Fear Appeal Message as an Intervention to Increase Risk Awareness, Attitude Change and Promote Self-Protective Action to Prevent Future Zoonoses

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Abstract

A previous study concerning zoonoses demonstrated that Dutch participants were not aware of the risks of zoonoses developing in intensive livestock farming. The present study widens this scope by focusing on zoonoses in general and investigates the effectiveness of two intervention conditions. The awareness condition is targeted at increasing awareness by providing information, the fear appeal condition focuses at increasing awareness and fear by presenting information and a picture. The two hypotheses were separated into parts. The first hypothesis was that a) participants in the intervention conditions have higher risk awareness towards zoonoses compared to the control condition. b) Participants have a higher attitude towards the prevention of future zoonoses in the intervention conditions compared to the control condition. And c) Participants' intentions for changing behaviour towards zoonoses are higher in the intervention conditions compared to the control condition without information. The second hypothesis was that a) participants in the fear appeal condition have higher risk perception towards zoonoses compared to the awareness condition. b) Participants' attitude is higher in the fear appeal condition compared to the awareness condition. c) Participants' intentions towards changing behaviour are higher in the fear appeal condition compared to the control condition. And d) Participants' fear towards zoonoses is higher in the fear appeal condition compared to the awareness condition. Participants (N = 191) were randomly assigned to either the control condition, the fear appeal condition, or the awareness condition in a survey questionnaire about risks of zoonoses. In the survey participants' demographic, risk perception before and after, attitude, attitude towards government's action, intentions for changing behaviour and fear were measured. Findings showed that participants who received the two intervention conditions had a more positive attitude towards the future prevention of zoonoses. Furthermore, those who received the fear appeal condition would be more inclined to change their behaviour to prevent future zoonoses. In addition, findings indicate that participants who were assigned to the fear appeal condition were more compelled to change their behaviour and had a more positive attitude towards the prevention of future zoonoses compared to participants in the awareness condition. Given these results, there is a necessity to inform people about the risks of zoonoses. Lastly, further experiments should be done on an intervention towards the prevention of zoonoses to find out if there is the possibility to raise respondent's awareness.

Keywords: zoonoses, fear appeal, intervention, attitude, behaviour, awareness, perception, risk, fear

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Pathogens that derive from animals or animal products are the sources of many new, evolving and re-emerging human diseases. A large range of domestic and wild animal species serve as repositories for these diseases, which are called zoonoses. Zoonoses (Greek "zoon" = animal) can be defined as "diseases and infections which are naturally transmitted between vertebrate animals and man" (Hubálek, 2003). Effective detection, prevention and control of zoonoses pose a major challenge, given the wide range of the animal species affected. Furthermore, infections can be induced by all types of possible pathogens such as viruses, bacteria or parasites (Bueno-Marí et al., 2015; Meslin et al., 2020). A currently familiar zoonosis is for example COVID-19, likely of bat origin which resulted in a global pandemic and an economic and social disruption (Rahman et al., 2020). Given these issues, this study investigates the effectiveness of two intervention conditions to raise awareness of the risks of zoonoses, change the attitude positively towards the prevention of future zoonoses and induce intentions towards changing behaviour to prevent future zoonoses.

Zoonoses can emerge in different environments and simultaneously in different ways of transmission. To start with the environments, one classification is synanthropic zoonoses which occur in the urban environment (Hubálek, 2003). Those animals affected are residential animals and non-domestic animals that are kept domestic. For example, pets such as dogs and cats are reservoirs for zoonotic pathogens. They live together with their owner in a home, sometimes sleep together in one bed, often get into physical contact for example by stroking the pet or also being licked by their pet. These circumstances seem to be harmless, however, could lead to zoonotic diseases such as urban rabies transmitted by dogs or cat scratch diseases (Paul, King, & Carlin, 2010). Furthermore, non-domestic animals such as wild animals in zoos are also possible vectors for the transmission of zoonotic diseases (Conrad et al., 2017; Panayotova-Pencheva, 2013).

Another example of synanthropic zoonoses is livestock that is kept domestic for food production such as eggs, dairy and meat and can infect both workers in that area and consumers. Intensive livestock farming uses high stocking densities at a large scale which leads to genetic proximity and weakening the animals' immune systems and in turn, increases the risk of developing infectious diseases (Espinosa et al., 2020). Without outside contact they might have a lower chance for zoonotic transmissions caused by wild animals compared to organic farming, however, the change of zoonosis is higher (Espinosa et al., 2020). Besides, due to the expansion of agricultural land use, animals lose their habitats which increases the

likelihood of the spread of pathogenic agents. Also, there is a risk in organic food production (Garcia, & Teixeira, 2017; Hovi et al., 2003). Since there is a lack of chemical treatments, animals are more vulnerable to pathogenic microorganism from zoonoses. In addition, even though organic farming systems have the goal to maintain biodiversity and freedom of natural behaviour in their livestock, these free-range systems for animals could lead to an increased risk of zoonotic infections due to exposure to possible zoonotic pathogens carried by rats, birds or other wild animals which leads to the next categorization, wildlife (Garcia, & Teixeira, 2017; Hovi et al., 2003).

The second classification, exoanthropic zoonoses, develop in the natural environments and circulate outside of the human environment (Hubálek, 2003). It was estimated that 72% of zoonoses arise from wildlife (Jones et al., 2008). There is a generally increased use of wildlife habitats for farming which in turn increased the contact between wild animals and both livestock and humans (Coker et al., 2011) As a result, the possibility of transmission of infections is higher. Another instance is the hunting, butchering and consumption of wild animals (Wolfe et al., 2005). Hunters get into direct contact and increase the exposure to pathogens due to scratches or bites (Espinosa et al., 2020). Besides, butchering leads hunters to be exposed to bodily fluids, bodily tissue or faeces, also spreading pathogenic agents. In addition, the consumption or trade of meat could lead to zoonotic transmissions (Espinosa et al., 2020).

Lastly, there are also zoonotic agents which spread in both urban and natural cycles, for example, the transmission of yellow fever (Hubálek, 2003). Examples of transmissions were already mentioned but to 5be more specific, transmission can occur by direct contact, aerosol (sneezing/coughing), or orally for example by food consumption (Hubálek, 2003). Now that it is clear where and how zoonoses occur the question is how often they arise.

Not all zoonotic diseases are capable of inducing major outbreaks (Hubálek, 2003). Still, in general, 75% of all bacteria and viruses that result in diseases come from animals (Bueno-Marí et al., 2015; Karesh et al., 2012). There is minimal need for mutation for animal viruses to make the jump from animal to human, thus posing a high risk to humans (Warren & Sawyer, 2019). Additionally, different factors induce the spread of new mutations in zoonotic diseases.

As an example, factors such as population growth and global changes result in new emerging zoonotic diseases (Karesh et al., 2012). Due to a globally expanding population, there is an increased requirement for food products such as from intensive animal production systems (Coker et al., 2011; Graham et al., 2008; Rohr et al., 2019). Rohr et al. (2019)

mention that there has been a positive association between agricultural drivers and zoonotic infections in people of at least 50 percent, since 1940. Furthermore, Rohr et al. (2019) assume that those numbers presumably grow as agriculture develops and intensifies. Domestic animals raised for human consumption led to a growth in human to animal contact and resulted in emerging zoonotic infections (Coker et al., 2011; Leibner et al., 2009; Wolfe et al., 2007). Finally, these changes in food production caused ancient zoonoses like rabies to re-emerge due to an increased risk of transmission of pathogens from wild species to domestic animals (Coker et al., 2011).

A question that needs to be raised is whether people are aware of the general characteristics of zoonoses, where and how they can be infected as well as the consequences of infection. A study by Stel, Eggers, and Nagelmann (2021) showed that in the Netherlands, while most participants indicated to be aware that zoonoses could develop in the Dutch intensive livestock industry, the biggest group did not regard this as very likely. In addition, results showed that many participants did not know that the meat they ate is derived from those intensive livestock industries. Since their study focused on zoonoses regarding intensive livestock industries, this current study aims to focus on general zoonoses in different environments to widen the scope. Thus, the goal is to create an experiment in the form of an intervention to raise awareness of the risks that zoonoses induce in general and adjust participants' behaviour to prevent future zoonoses. An effective method to communicate risk to raise awareness and change behaviour is by using fear appeals (Witte et al., 2001).

Fear Appeal to Gain Attitudes towards Behaviour Change

Health risk messages most of the time use *fear appeals* which are “a persuasive communication that attempts to arouse fear to promote precautionary motivation and self-protective action” (Ruiter et al., 2014; Witte et al., 2001). This arousal should then lead to a cognitive, affective and behavioural response to decrease or remove the fear. Fear appeals are prevailing in health campaigns (Witte et al., 2001). Some common examples are anti-smoking campaigns, driving and drinking campaigns and safe sex campaigns.

Various theoretical frameworks and models exist to interpret fear appeals which focus on behaviour, message, and the audience. First, the study by Tannenbaum et al. (2015) showed that in general, a moderate amount of fear is more effective than less amounts of fear, and there is no benefit to increasing the amount of fear from a moderate level on.

Self-efficacy and response efficacy are important elements to a fear appeal message which is suggested by the stage model (Ruiter et al., 2015; Tannenbaum et al., 2015). Response efficacy refers to a person’s belief whether the proposed action in the message is

efficient (Ruiter et al., 2015). Generally, a fear appeal message includes a recommendation for health-protective action to change risky behaviour. Thus, for the receiver to be approving, it is needed to present the action as efficient such as, “quitting smoking can decrease heart risks”. Self-efficacy concerns a person’s perception of their own ability to reach a goal (Ruiter et al., 2015). Therefore, receivers should be informed that the action is easy to accomplish, for instance: "relaxation techniques to reduce the stress of not smoking are easy to execute at home". Results showed that messages are effective without both, however, more effective when they are included (Ruiter et al., 2015).

The stage model also proposes the inclusion of depicted severity and susceptibility. For the health risk message to be effective it is necessary to mention how severe the threat is with consideration of the susceptibility of the receiver (Ruiter et al., 2014). The anti-smoke example mentioned before could be threatening to smokers but not so much to non-smokers. The research demonstrated that a high level of depicted severity and susceptibility correlated positively with the effectiveness of the fear appeal message towards change in behaviour, attitude, and intentions (Tannenbaum et al., 2015).

Besides, research suggests that pictorial warnings led recipients to be more susceptible to the threat compared to text-only warnings (Cantrell et al., 2013). The reason for that is that the threat in the picture-based message seems to be more likely to the recipient to occur and therefore more credible. Furthermore, pictorial warnings seem to be more effective in informing, raising awareness and motivating to change their behaviour, as mentioned in a study by Cantrell et al. (2013) concerning tobacco-related health warning labels. In addition to being effective, researchers also found downsides such as defensive reactions (towards graphic warning labels concerning tobacco) and an increase of undesired behaviour (concerning the consumption of sugar) (Gupta et al., 2018; McQueen et al., 2015).

Taking all that into consideration, two fear appeal interventions within a survey will be designed including the factors mentioned above. First, the threat needs to be high enough to the participants to which they should be also susceptible to. Second, the message will include information about zoonoses in general, consequences of infection and health-protective actions. Self-efficacy and response-efficacy will be evoked by presenting the action as simple and effective. To measure the effectiveness of the intervention, general questions will be asked in regard to participants’ risk perception of zoonoses before and after the manipulation, and questions about participants' attitudes towards risky behaviour as well as government’s action, their current intentions for changing behaviour and their perceived fear will be asked after the manipulation. Given the factors which increase the emergence of

zoonoses, behaviour changes that could be effective are preventing general contact with other animals (domestic animals, animals from the zoo, etc.) as much as possible, avoiding eating animal products (meat, eggs, milk, etc.) and for pet owners, visiting the veterinary for health checks regularly. Furthermore, a control condition will be used to test whether there is a difference with and without the interventions. Lastly, it will be tested whether a pictorial message with text will be more effective than only textual information concerning risk-awareness, attitudes, intentions for changing behaviour, and eliciting fear. Due to the several aspects, the hypotheses will be divided into parts. The first hypothesis was that a) participants who received the intervention conditions have higher risk awareness towards zoonoses compared to the control condition. b) Participants' attitude towards the prevention of future zoonoses is higher in the intervention conditions compared to the control condition. And c) Participants' intentions for changing behaviour towards zoonoses are higher in the intervention conditions compared to the control condition. The second hypothesis was that a) participants in the fear appeal condition (with picture and text) have a higher risk perception towards zoonoses compared to the awareness condition with a text-only message. b) Participants have a higher attitude towards zoonoses if they received the fear appeal condition compared to the awareness condition. c) Participants' intentions towards changing behaviour to prevent future zoonoses are higher in the fear appeal condition compared to the control condition. And d) Participants who received the fear appeal condition have a higher fear towards zoonoses compared to the awareness condition. The methods section will describe the experiment in more detail.

Methods

Participants and Design

For this study, a non-probability sampling method was employed. Participants in this study included University of Twente students and others recruited by convenience and snowball sampling. For the analysis of the results, 34 participants that did not finish the survey were excluded from the data, leaving 157 out of 191 respondents. Out of 157 participants were 52 male and 103 female, one indicated non-binary, or a third gender and one indicated that they preferred not to say. The age range was between 18 and 51 years, with a residence in the Netherlands, Germany or other. All of them were volunteers. The research

was approved by the BMS Ethics Committee. Participants could also decide whether they want to take part in a raffle for the chance of winning a 50 Euro gift card.

The experiment used a between-subject design with three conditions. The control condition, the fear appeal condition, and the awareness condition. The dependent variables were fear, perception before manipulation, perception after manipulation, attitude, attitude towards government's action and intentions to change behaviour for preventing future zoonoses. The independent variable was risk communication with three levels (control condition, fear appeal condition, and awareness condition).

Materials and Procedure

The Psychology test subject pool BMS, Facebook, LinkedIn, Instagram, Whatsapp and Pollpool (a website to recruit participants) were used to collect participants for the survey. With a link, participants were led to Qualtrics, an online survey tool to conduct the experiment. Before the start of the experiment, participants were given informed consent following the guidelines of the BMS Ethics Committee (see Appendix for full survey questionnaire).

During the survey, participants' demographics and different animal food consumption, as well as their possession concerning pets and veterinary visits were asked first. The questionnaire started with participants' demographics concerning their age, gender, and residence and a choice to not disclose them. After that, they were asked to indicate their animal food consumption consisting of 6 items and an 8-point Likert scale ranging from "never" to "every day in a week". An example is: "How often do you consume non-organic meat per week?". Next, participants were asked if they had a pet. They could choose between "yes", "no" or "prefer not to say". Then, a four-point Likert scale was presented where they were asked how often per year, they visit the veterinarian with their pet for health checks. The scale ranged from "never" to "more than once a year". Afterwards, 12 items regarding the risk perception of zoonoses were asked. More specifically items about risks in different domains concerning wildlife or urban environments were presented. Participants could choose between 7 answers ranging from "strongly disagree" to "strongly agree". For example: "There is a risk of domestic animals transmitting zoonotic diseases to humans.". After that, the survey varied according to the three conditions (see Appendix for all conditions).

The intervention conditions were composed of a fake Facebook post which had general information about zoonoses, the consequences, and recommended action to prevent getting infected. The information about zoonoses and the consequences included susceptibility and severity for the intervention to be effective. For example, information about

the transmission and mentioning the global pandemic due to COVID-19 demonstrated the severity of the issue and that it can affect everyone. In addition, self-efficacy and response-efficacy was ensured by displaying the recommendations as effective and simple. For instance, one recommendation is to prevent contact with animals as much as possible. Furthermore, interventions included a sentence about the risks of hospitals being full. The sentence was chosen as a fear factor out of a Dutch research report concerning Corona (van't Veld et al., 2020) because it had the highest percentage. Concerning the fear appeal condition, the picture was chosen to be suitable for the fear factor and to induce a moderate amount of fear, thus displaying a situation with many patients lying in beds. To increase the possibility that participants read the information carefully, the intervention conditions had a timer of 75 seconds so that they could only proceed after the time ran out.

The second part of the questionnaire consisted of five themes for the intervention conditions and four for the control condition since there was no intervention in between and thus no items concerning risk perception were presented again. For the manipulated conditions, the first one was again risk perception with an additional 7-point Likert scale item of whether they read the information carefully. Secondly, participants were presented with 10 items concerning intentions in behaviours concerning consumption of animal products, veterinary visits for pets, contact with domestic and non-domestic animals, and hunting. The choices consisted of a 5-point Likert scale ranging from "doing that more than currently" to "I do not do that and would stick to that". The choices were adjusted to the items. An example item is: "With regards to consuming non-organic meat I would…". Third, 10 items regarding their attitude towards zoonoses in general were presented and participants had again seven choices between "strongly disagree" to "strongly agree", for instance: "Hunting animals is bad for hunters since it increases the risk for them of getting zoonoses.". The fourth theme was attitude towards governments' action consisting of seven items and a 4-point Likert scale with the choices "ban it", "reduce the amount", "keep it as it is", and "increase the amount". An example is: "With regards to the government action towards veterinary visits for health checks they should…". Lastly, participants were asked about their current fear and their fear of hospitals being full since it was used in the health risk message. Also, control fear aspects were tested by asking participants about their fear of an economic crisis. The last theme consisted of six items and a 7-point Likert scale ranging from "strongly disagree" to "strongly agree". At the end of the survey, participants were asked whether they wanted to participate in a raffle for the chance to win a 50-euro gift card. If yes, they were led to a separate survey by

which they needed to write down their email address for the raffle. If not, they completed the survey there.

Results

Perception

Before the start of the analyses, all negative items were recoded. A factor analysis with the items of mean of perception before manipulation was performed to check whether the items all reflect one factor of perception before manipulation. The factor analysis showed a solution that did not theoretically or logically fit clear factors. As Cronbach's alpha of all times together was .76, - a coefficient above .65 was seen as high enough - perception before the manipulation was the mean of all items together. An ANOVA with mean of perception before manipulation as dependent variable and risk communication with three levels as the independent variable was conducted. The results indicated that there was no statistically significant difference between the three conditional groups as determined, $F(2,154) = 1.35$, $p = .263$ (Overall: $M = 4.55$, $SD = 0.68$) (see Table 1, for a summary of all the means and standard deviations).

Same as before, a factor analysis with the mean of perception after manipulation items was conducted to check for the factor loadings. Results showed a solution that did not theoretically or logically fit clear factors. Cronbach's alpha with all the items was high ($\alpha = .90$) and therefore perception after the manipulation was the mean for all items. An ANOVA with mean of perception after manipulation as dependent variable and risk communication with three levels as the independent variable was performed. The test revealed no statistically significant difference between the three groups as well, $F(1,102) = 0.91$, $p = .342$ (Overall: $M = 5.35$, $SD = 0.94$).

Repeated measures ANOVA with mean of perception before manipulation and mean of perception after manipulation as dependent variables and risk communication with two levels as independent variable was conducted. As perception after the manipulation was measured only in the two intervention conditions, the ANOVA regarded testing differences of before and after for the two intervention conditions only. The test showed a significant main effect for mean of perception before manipulation and mean of perception after manipulation, $F(1,102) = 98.75$, $p = .000$, partial $\eta 2 = .492$. Participants had a higher awareness after an intervention ($M = 5.35$; $SD = 0.94$) than before ($M = 4.60$; $SD = 0.69$). There was a statistically non-significant interaction between the mean of perception before and after, and

risk communication, $F(1,102) = 0.08$, $p = .773$, partial $\eta 2 = .001$. Lastly, the scale of participants' careful reading averaged 5.77 (SD = 1.15).

Changing behaviour

Factor analysis was performed with all mean of intentions for changing behaviour items. Results showed a solution that did not theoretically or logically fit clear factors. Since Cronbach's alpha of all times together was .82, intentions for changing behaviour was the mean of all items together. Univariate analysis of variance tested the effects of risk communication with three levels on mean of intentions for changing behaviour. Results showed a significant main effect for risk communication, $F(2,154) = 4.34$, $p = .015$, partial $\eta 2 = .053$. Participants who received the fear appeal intervention indicated to want to change their behaviour that prevents them from getting a zoonosis more ($M = 3.38$, $SD = 0.08$) compared to the awareness condition ($M = 3.04$, $SD = 0.08$), $p = .005$ and the control condition ($M = 3.15$, $SD = 0.59$), $p = .049$. There was no difference between the control condition and the awareness condition, $p = .363$.

Attitude

The factor analysis for attitude in general showed a solution that did not theoretically or logically fit clear factors. Cronbach's alpha of all items demonstrated a coefficient of .84, and thus, attitude in general was the mean of all items together. Regarding ANOVA, Levene's test revealed that equal variances cannot be expected ($p = .040$). Thus, a Kruskal-Wallis H test with the mean of attitude in general as a dependent variable and risk communication with three levels as independent variable was carried out. The test showed that there was a statistically significant difference in mean of attitude in general between the conditions, $x^2(2) = 9.38$, $p = .009$. Participants who received the control condition indicated a weaker attitude (rank score 63.49; $M = 4.42$, $SD = 0.65$) than in the fear appeal condition (rank score: 87.92; $M = 4.84$, $SD = 0.89$), and than in the awareness condition (rank score: 85.88; $M = 4.84$, $SD = 0.89$).

Concerning attitude towards government's action, the factor analysis revealed a solution that did not match clear factors conceptually or logically. Cronbach's alpha for all items was .68, indicating that attitude towards government's action was the mean of all items taken together. An ANOVA with mean of attitude towards government's action as dependent variable and risk communication with three levels as independent variable was carried out. The analysis demonstrated statistically non-significant results considering differences between groups, $F(2,154) = 0.53$, $p = .587$ (Overall: $M = 2.39$, $SD = 0.47$).

Fear

A factor analysis with the mean of fear items was conducted for checking whether the fear item related to the fear appeal message and societal fear belong to different constructs as hypothesized. The factor analysis revealed that items related to general fear and the item concerning the fear towards hospitals being full - which is related to the fear appeal message - , are loaded strongly on one factor termed general fear (α = .84), and the two societal items are more strongly loaded on a second factor, which was termed societal fear (α = .76). An ANOVA with mean of general fear as dependent variable and risk communication with three levels as the independent variable demonstrated statistically non-significant results considering the difference between the groups, $F(2,154) = 0.22$, $p = .804$ (Overall: $M = 3.31$, $SD = 1.33$). An ANOVA with the mean of societal fear as the dependent variable and risk communication with three levels as an independent variable showed no statistically significant difference between the risk communication, $F(2,154) = 0.19$, $p = .904$ (Overall: $M = 4.57$, $SD = 1.39$).[1]

[1] Analyses in which participants from other countries than the Netherlands or Germany were excluded showed similar results.

Table 1

Means, Standard Deviations in Conditions and Likert-scale Themes

Conditions	Perception before Manipulation		Perception after Manipulation		Mean of Intentions for Changing Behaviour		Mean of Attitude in General		Mean of Attitude towards Government's Action		Mean of Fear	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Control Condition	4.45	0.66			3.15	0.59	4.42	0.65	2.44	0.51	3.77	1.09
Awareness Condition	4.53	0.68	5.27	0.94	3.04	0.52	4.84	0.89	2.37	0.45	3.64	1.15
Fear Appeal Condition	4.66	0.69	5.44	0.94	3.38	0.65	4.84	0.89	2.35	0.46	3.79	1.16
Total	4.55	0.68	5.35	0.94	3.19	0.60	4.70	0.83	2.38	0.47	3.73	1.13

Note. A higher score means higher perception, attitude, attitude towards government's action, intentions towards changing behaviour and fear.

Discussion

The aim of the study was to investigate whether an intervention in the form of a fake Facebook post would raise awareness, change the attitude towards the prevention of zoonoses positively and promote self-protective action to prevent future zoonoses. The first hypothesis was that a) participants who received the intervention conditions have higher risk awareness towards zoonoses compared to the control condition. b) Participants' attitude towards the prevention of future zoonoses is higher in the intervention conditions compared to the control condition. And c) Participants' intentions for changing behaviour towards zoonoses are higher in the intervention conditions compared to the control condition. The first hypothesis was rejected since only part b) concerning attitude in general and c) intentions for changing behaviour was supported by the results. The results showed that participants in the intervention conditions had a more positive attitude towards the prevention of future

zoonoses. Additionally, those who were in the fear appeal condition would change their behaviour more to prevent them from receiving zoonoses.

The second hypothesis was that a) participants who received the fear appeal condition (with picture and text) have a higher risk perception towards zoonoses compared to the awareness condition with a text-only message. b) Participants' attitude towards zoonoses is higher if they received the fear appeal condition compared to the awareness condition. c) Participants have higher intentions towards changing behaviour to prevent future zoonoses in the fear appeal condition compared to the control condition. And d) Participants in the fear appeal condition have a higher fear towards zoonoses compared to the awareness condition. The second hypothesis was also rejected. The hypothesis only holds for c) intentions for changing behaviour and b) attitude in general. The results indicate that participants are more inclined to change their behaviour and have a positive attitude towards the prevention of future zoonoses when they have received the fear appeal condition with a picture compared to participants in the awareness condition.

In a past study concerning zoonoses, the focus was on intensive livestock industries whereas our study showed significant results towards general risks of zoonoses. Results concerning attitudinal and behavioural change are in line with Ruiter et al. (2014) and Witte et al. (2001) who described that fear appeal messages lead to self-protective action and the arousal due to the message which should cause a cognitive and behavioural response. Furthermore, results of intentions to change their behaviour are also in congruence with Cantrell and his colleagues (2013) who mentioned that pictorial messages have stronger and more positive effects on behaviour changes, attitude and awareness compared to text-only interventions. Apart from that, McQueen and his colleagues (2015) also mentioned downsides such as defensive actions or an increase of undesired behaviour. Based on these findings, a plausible explanation for the non-significant results could be the outcome of negative reactions towards the messages. Rimal (2001) found that self-efficacy and risk perception positively influenced participants' motivation to think about the risk. Furthermore, Kok et al. (2018) believe that only a high level of self-efficacy results in an effective fear appeal. If self-efficacy is too low, participants will respond defensively. Thus, a reason for the non-significant results of awareness could be that self-efficacy and risk perception of both interventions was not high enough to induce a significant result. Those two aspects as well as depicted severity and susceptibility refer to the individual (Ruiter et al., 2014) which could be the cause for the non-significant results of attitude towards government's action. The intervention was targeted at the individuals personally and since the government refers to an

organization not connected to the participants, the intervention might not have influenced their attitude towards that. Contradicting with the view of the importance of susceptibility (Ruiter et al., 2014), a study by Kessels et al. (2014) found that if the threat was self-relevant, participants engaged in an attentional avoidance reaction towards the fear appeal message. Thus, another explanation for the non-significant results could be that participants did not attend to the information because it was self-relevant. Furthermore, the fear appeal messages showed no significant differences between the two conditions leading to the possibility that the fear appeal intervention did not arouse a moderate level of fear as suggested by Tannenbaum et al. (2015), or the items did not measure the fear of the interventions as intended to. Lastly, participants' answers towards their careful reading of the interventions ranged from strongly disagree to strongly agree. Not all of them strongly agreed to read the information carefully which is another factor that could have led to non-significant results.

However, in general, it was found that awareness of participants was low in all conditions before the manipulation, suggesting that there is a necessity to increase awareness so that people are aware of the risks of zoonoses. Lastly, while previous research has focused on the risks of tobacco, these results demonstrate that people also need to be informed about the risks of zoonoses and that it also leads to behavioural and attitude change.

Limitations and Recommendations

The generalizability of the results is limited by the residence of the participants which was restricted to Germany and the Netherlands. In addition, participants were only able to be recruited via a specific test subject pool and by convenience sampling. Thus, this type of sampling cannot be generalized to the population and the inferences can be made only about the sample itself. Some of the recommended self-protective actions required money as for example the advice to visit the veterinarian for health checks regularly with respect to pet owners. This could be a financial hurdle for pet owners and thus might have influenced the results. Furthermore, conditions did not differ regarding fear so that there is a possibility that the arousal level was not high enough to induce fear. Another limitation is that due to the current circumstances all participants had to conduct the study at home. Therefore, we had no control over the participants regarding their attention and environment. They could use another person to help them so that their decisions are perchance not completely their own. Furthermore, their environment could have distracted them and thus, for instance, they could have been influenced in their decision in some way.

Taking the limitations into consideration, it would be interesting to see the results of a random sample selection in different countries to test whether the effects obtained in this

study could be replicated. Further research should implement a more controlled environment where participants conduct the study in the presence of the researcher. It would also be beneficial to test the fear appeal message by measuring self-efficacy, risk perception and arousal level beforehand to ensure that the message is indeed effective. Furthermore, the effect of leaving out threat information which is self-relevant should be tested since some researchers found out that otherwise it leads to defensive reactions. Lastly, it is recommended to improve the items of fear since there is a possibility that they do not measure the fear level of the interventions.

Conclusion

Zoonoses are infectious diseases leading to death, global pandemics and social disruption. This study demonstrates that it is important to raise awareness to prevent future zoonoses as well as the possibility of attitude and behavioural change to help fight against zoonoses.

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Appendix

Survey Questionnaire

Information sheet

Welcome and thank you for participating in this study! In the following, you will be presented with Information about the study by which you are asked to read carefully.

Research purpose
You are being invited to participate in a research study titled Risks of Zoonoses. This study is being done by Nicole Banach.

The purpose of this research study is to investigate people's experience, perception, and intentions towards zoonoses (an infectious disease jumping from animals to humans) and will take you approximately 20 minutes to complete. The data will be used for a report.

Taking part in the study
Your participation in this study is entirely out of free will and you can withdraw at any time. You are free to omit any question. If you withdraw your consent, your data will be deleted from the data set.

Your data is handled with utmost confidentiality. Personal or confidential data is not issued forth in such a manner that it could be traced back to you. Research results are therefore solely issued as a summation of all gathered data. We will minimize any risks

by not asking for any personal information which could be used to identify you (e.g. your name, your home address, etc.).

At the end of the survey you can decide whether you want to participate in a raffle for the chance to win a 50 euro gift card. For that you will be asked for your email adress which will be stored seperately from the rest of the data and cannot be linked to the data.

For any questions feel free to contact me at any time: Nicole Banach, n.banach@student.utwente.nl

Risks associated with participating in the study
Taking part in the study involves a risk of mental discomfort. You are not obligated to answer questions or read information that cause any discomfort.

Hereby I declare that I

- ◯ Read the Information above and agree to partake in this study
- ◯ Do not consent

For SONA participants, please write down your User ID

Demographics

What is your gender?

- ◯ Male
- ◯ Female
- ◯ Non-binary / third gender

- ○ Prefer not to say

What is your age? (Please enter only numbers, not letters)

Where do you live?

- ○ Germany
- ○ Netherlands
- ○ Other
- ○ Prefer not to say

Animal Food Consumption

Please indicate below how often you consume the animal food products per week. Please take into account breakfast, lunch as well as dinner. (For clarification: Organic food = fresh or processed food produced by organic farming methods. Organic food is grown without the use of synthetic chemicals)

	Never	Once a week	Two times a week	Three times a week	Four times a week	Five times a week	Six times a week	Every day
Non-organic meat	○	○	○	○	○	○	○	○
Organic meat	○	○	○	○	○	○	○	○
non-organic dairy food (e.g. milk, eggs, etc.)	○	○	○	○	○	○	○	○
Organic Dairy food (e.g. milk, eggs, etc.)	○	○	○	○	○	○	○	○
Other non-organic animal food products (e.g. gelatin in gummy bears)	○	○	○	○	○	○	○	○
Other organic animal food products (e.g. gelatin in gummy bears)	○	○	○	○	○	○	○	○

Questions regarding Pets

Do you have a pet?

- ○ Yes
- ○ No
- ○ Do not prefer to say

How often do you visit the veterinarian for health checks?

Never	Less than once per year	Once per year	More than once per year
○	○	○	○

Risk perception (before manipulation)

We are interested in your perception towards zoonoses. For the statements below, please indicate to what extent you agree or disagree.

There is a risk of domestic animals transmitting zoonotic diseases to humans.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

It is **not** possible for meat to transmit zoonotic diseases to humans.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Zoonotic diseases can be transmitted by eating organic meat.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Humans can be infected with zoonoses by eating non-organic animal food.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

There is a risk due intensive livestock farming (intensive = large numbers of farm animals) for developing infectious diseases in those animals.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

There is **no** risk for biological animal food to infect humans with zoonoses.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

There is a risk for other types of organic animal food products (e.g. gelatin in gummy bears) to infect humans with zoonoses.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

There is a risk for other types of non-organic animal food products (e.g. gelatin in gummy bears) to infect humans with zoonoses.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Scratches or bites from domestic animals (e.g. dogs, cats, etc.) increase the risk for zoonotic infections.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Humans can be infected with zoonoses by getting into contact with animals outside the human environment (e.g. horses, rats, birds, etc.).

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

There is **no** risk for humans of getting a zoonotic infection by animals from the zoo.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Zoonotic diseases **cannot** be transmitted by eating dairy food (like for example milk, eggs, etc.).

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

There is a risk for people getting a zoonotic disease by hunting animals.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

The coronavirus is a zoonotic disease.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Condition with Facebook post

Below, a Facebook post with a picture is presented. Please look at the post and read the information carefully. You will have **at least** 75 seconds to do so. When you finished reading, please continue (after 75 seconds, the button to proceed will appear).

Risks of Zoonoses

#zoonoses

ZOONOSES

Key Facts

- **Zoonosis** = infectious disease jumping from animals to humans (or other animals)
- Which animals? **Domesticated animals** (e.g. pets, farm animals, animals from the zoo) & **wild animals** (e.g. rats, birds + by hunting)
- Transmission:

Consequences

- Zoonoses comprise a large percentage of all **newly identified** infectious diseases as well as many existing ones
- The global pandemic Covid-19 resulted in **economic and social disruption**
- Another global problem is the **capacity levels in**

Prevention

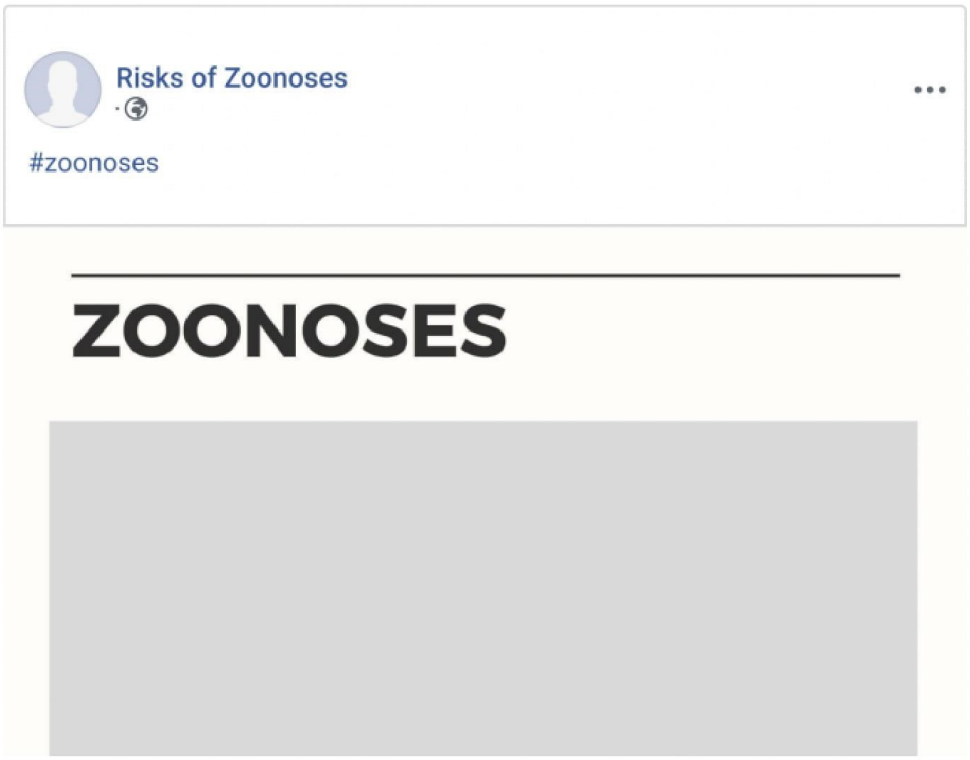
- **how to prevent zoonoses effectively?**

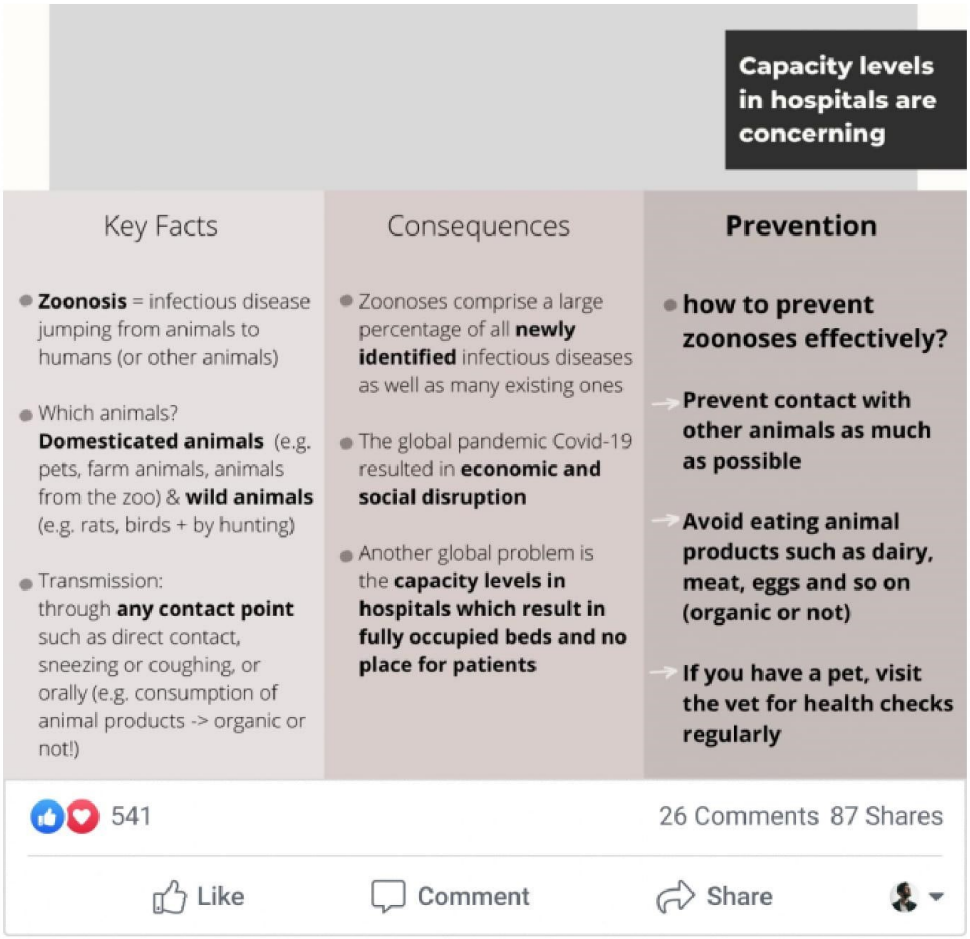
→ **Prevent contact with other animals as much as possible**

→ **Avoid eating animal products such as dairy, meat, eggs and so on**

Condition without picture

Below, a Facebook post is presented. Please look at the post and read the information carefully. You will have **at least** 75 seconds to do so. When you finished reading, please continue (after 75 seconds, the button to proceed will appear).





Control Condition

In the following, questions concerning your behaviour, attitude, and fear will be asked. Please continue.

Risk perception (after the manipulation)

Now that you have read the information, please indicate again for the statements below to what extent you agree or disagree.

I read the information carefully.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

There is a risk of domestic animals transmitting zoonotic diseases to humans.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

It is **not** possible for meat to transmit zoonotic diseases to humans.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Zoonotic diseases can be transmitted by eating organic meat.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Humans can be infected with zoonoses by eating non-organic animal food.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

There is a risk due intensive livestock farming for developing infectious diseases in those animals.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

There is **no** risk for biological animal food to infect humans with zoonoses.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

There is a risk for other types of organic animal food products (e.g. gelatin in gummy bears) to infect humans with zoonoses.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

There is a risk for other types of non-organic animal food products (e.g. gelatin in gummy bears) to infect humans with zoonoses.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Scratches or bites from domestic animals (e.g. dogs, cats, etc.) increase the risk for zoonotic infections.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Humans can be infected with zoonoses by getting into contact with animals outside the human environment (e.g. horses, rats, birds, etc.).

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

There is **no** risk for humans of getting a zoonotic infection by animals from the zoo.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Zoonotic diseases **cannot** be transmitted by eating dairy food (like for example milk, eggs, etc.).

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

There is a risk for people getting a zoonotic disease by hunting animals.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

The coronavirus is a zoonotic disease.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Changing behaviour

Now that you received more information about zoonoses, their causes, consequences and how you can reduce the risk of zoonoses, do you intend to change your behaviour? Please indicate this for the behaviours below (For clarification: Organic food = fresh or processed food produced by organic farming methods. Organic food is grown without the use of synthetic chemicals).

With regards to consuming non-organic meat I would…

consume more than I currently do	consume less than I currently do	consume just as much as I currently do	not consume at all	I do not consume non-organic meat and would stick to that
○	○	○	○	○

With regards to consuming organic meat I would…

consume more than I currently do	consume less than I currently do	consume just as much as I currently do	not consume at all	I do not consume organic meat and would stick to that
○	○	○	○	○

With regards to consuming non-organic dairy products (e.g. eggs, milk, etc.) I would…

consume more than I currently do	consume less than I currently do	consume just as much as I currently do	not consume at all	I do not consume non-organic dairy
○	○		○	

				products and would stick to that

With regards to consuming organic dairy products I would…

consume more than I currently do	consume less than I currently do	consume just as much as I currently do	not consume at all	I do not consume organic dairy products and would stick to that

With regards to consuming other non-organic animal food products (e.g. gelatin in gummy bears) I would…

consume more than I currently do	consume less than I currently do	consume just as much as I currently do	not consume at all	I do not consume other non-organic animal food products and would stick to that

With regards to consuming other organic animal food products (e.g. gelatin in gummy bears) I would…

consume more than I currently do	consume less than I currently do	consume just as much as I currently do	not consume at all	I do not consume other organic animal food products and would stick to that

With regards to consuming meat from hunters I would…

consume more than I currently do	consume less than I currently do	consume just as much as I currently do	not consume at all	I do not consume meat from hunters and would stick to that

With regards to getting into contact with zoo animals I would…

do that more than I currently do	do that less than I currently do	do that just as much as I currently do	not do it at all	I do not get into contact with zoo

○				animals and would stick to that ○

With regards to getting into contact with wild animals (e.g. rats, birds, mice, etc.) I would…

do that more than I currently do	do that less than I currently do	do that just as much as I currently do	not do it at all	I do not get into contact with zoo animals and would stick to that
○	○	○	○	○

With regards to visiting the veterinarian with my pets for health checks I would…

visit more than I currently do	visit less than I currently do	visit as just as much as I currently do	not visit at all	I do not visit the veterinarian and would stick to that
○	○	○	○	○

With regards to getting contact with domestic animals which are not mine I would…

do that more than I currently do	do that less than I currently do	do that as just as much as I currently do	not do it at all	I do not get into contact with domestic animals and would stick to that
○	○	○	○	○

Attitude General

Now we are interested in your ideas about zoonoses. Please indicate below to what extent you agree or disagree.

Consuming meat is bad for my health since I could get and zoonotic infection.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Eating dairy products such as eggs and milk are good since they do not increase the risk for me of getting zoonoses.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Organic food products are bad for increasing my risk of getting zoonoses when consuming them.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Vet visits are good for decreasing the risk for a pet to get a zoonotic disease.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Consuming animal food from intensive livestock farming industries is bad because they increase the risk of me getting zoonoses.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Livestock farming is bad because deforestation leads wild animals such as rats or birds to infect the livestock with zoonoses.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Getting into contact with domestic animals is good because there is not risk for me of getting a zoonotic infection from them.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Getting into contact with animals from the zoo is bad since they could infect me with a zoonotic disease.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Getting into contact with wild animals (e.g. rats, birds, mice, etc.) is bad since they could infect me with a zoonotic disease.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Hunting animals is bad for hunters since it increases the risk for them of getting zoonoses.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Hunting animals is bad for me since the meat could infect me with zoonoses.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Attitude towards Government's Action

Now, we are interested in your ideas about what the government should do in regards to zoonoses. Please choose one out of the four options for each statement.

With regards to the government's action towards animal markets they should…

Ban it	Reduce the amount	Keep it as it is	Increase the amount
○	○	○	○

With regards to the government's action towards intensive livestock farming they should…

Ban it	Reduce the amount	Keep it as it is	Increase the amount
○	○	○	○

With regards to the government's action towards livestock farming in general they should…

Ban it	Reduce the amount	Keep it as it is	Increase the amount
○	○	○	○

With regards to the government's action towards organic livestock farming they should…

Ban it	Reduce the amount	Keep it as it is	Increase the amount
○	○	○	○

With regards to the government's action towards hunting they should…

Ban it	Reduce the amount	Keep it as it is	Increase the amount
○	○	○	○

With regards to the government's action towards keeping animals in zoos they should…

Ban it	Reduce the amount	Keep it as it is	Increase the amount
○	○	○	○

With regards to the government's action towards veterinarian visits for health checks they should…

Ban it	Reduce the amount	Keep it as it is	Increase the amount
○	○	○	○

Fear

Lastly, we are also interested in your level of fear. For the statements below, please indicate to what extent you agree or disagree.

I feel fearful.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

I feel anxious.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

I feel frightened.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

I fear the hospitals being full.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

I fear an economic crisis.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

I fear a social disruption.

Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
○	○	○	○	○	○	○

Raffle Sign Up

Thank you for participating! This is the end of the experiment. Are you interested in a raffle for the chance of winning a 50 Euro gift card?

- ○ Yes
- ○ No