

**Doomscrolling through Climate Change:
The Mental Health Impact of Excessive Climate News Consumption**

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Abstract

As climate change has become one of the most salient topics of the 21st century, news reports about the issue and its overall coverage are increasing. However, the effect excessive climate news consumption has on mental health is still understudied. So called “doomscrolling” through climate news is the central variable this study aims to investigate, particularly with respect to its impact on individual’s anxiety levels. It was hypothesized that doomscrolling climate change information would increase anxiety levels within participants. Furthermore, after considering data from prior research, a stronger effect for younger individuals was expected. A mixed methods approach was employed that consisted of a qualitative interview study as well as a quantitative survey study. With regards to the former, a total of 15 interviews were conducted, with 7 female and 8 male participants. The mean age was 35.6. Each interview was analyzed via a thematic analysis and different themes were formed. Subsequently, these insights were used to create a novel instrument measuring climate change doomscrolling, which was added to the already established doomscrolling scale. The quantitative study consisted of 208 total participants while 89 were female and 40 males. Mean age was 27.6. Both hypotheses were tested through generalized linear model analyses. Results of the first test were significant, thus confirming that climate change doomscrolling indeed increased the participant’s anxiety levels. Contrary to that, the second analysis didn’t show any significant effects of the age moderator variable, hence, hypothesis number two was rejected. Considering the ubiquity of climate change news, additional research into doomscrolling with regards to climate change should be conducted to expand on the currently small body of research.

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Introduction:

“How do you feel about climate change?” This rather generic yet ubiquitous question is one that many of those living in the year 2023 have likely been asked about at least a few times. The increased level of interest in the topic within the population partly stems from a broad media adoption, as coverage has shown a 90% surge since 2015 (Boykoff, et al., 2022). Exposure to climate change also grew on social media networks, with 40% of users claiming to have come across a climate change related post at least once (Statista, 2022). While the impact changing temperatures ultimately have on human lives around the globe are becoming more evident, partially due to the previously mentioned media presence, there still seems to exist a lack of commonly shared definition for the term climate change (Schulz, Konrath & Schwarz, 2011). Oftentimes, the term is used interchangeably with other nomenclatures such as “global warming”, or “climate crisis”, thereby already implying severe negative effects of shifting environmental conditions. Abbass et al. (2022) defines the term as changes in global temperature and precipitation levels causing environmental events such as extreme weather, sea level rise and melting ice sheets.

Effects of Climate Change. Impact of climate change on humans encompasses a myriad of factors, including its influence on the world economy, infrastructure, energy, and health (Di Napoli, et al., 2022). One of the most pressing concerns is the current death toll caused by climate change and its associated extreme weather events. Zhao et al. (2021) presents data indicating approximately five million deaths worldwide can be attributed to changing climate conditions. Moreover, the World Health Organization expects 250,000 additional deaths per calendar year between 2030 and 2050 (WHO, 2021). While the majority of negative health outcomes discussed in news media related to the pertinent environmental changes are often referring to physical symptoms, psychological factors play a large role as well in the societal health impact of climate change. However, these specific effects are often overlooked within the media landscape but also in the scientific literature, as emphasis is mostly put on the environmental and economic ramifications of global warming (Lawrence et al, 2021).

Mental Health Impact of Climate Change. The expression of mental health related symptoms associated with climate change can vary greatly depending on the population studied as well as individual differences. Nevertheless, some overarching themes can be identified from the scientific literature. According to Doherty & Clayton (2011), climate change can cause the onset of insomnia and intense states of worry due to environmental anxiety, a concept that refers to the heightened perception of health risks stemming from

changing climate and temperatures. Moreover, the authors expound on personal guilt associated with man-made climate change, as well as the accompanying prospect of existential risk for the planet and the human species which can create increased levels of stress and provokes anxious thoughts (Doherty & Clayton, 2011). Other manifestations that underline the negative effect of climate change on mental health are more directly attributable to natural disasters. Those are personal trauma and posttraumatic stress disorder (PTSD), among individuals who have directly experienced environmental catastrophes and are suffering from their repercussions (Lawrence et al., 2021). Besides that, according to a systematic review by Cianconi, et al., (2020) the persistent exposure to negative news about climate change can evoke feelings of helplessness and may even trigger symptoms of depression. This is especially salient, as the overall reportage of climate change in news and social media has surged significantly over the past years. To further explore the concept, it is also valuable to look into prior research of “eco-anxiety”, a term that was coined in order give a name to the anxiety people feel upon pondering the potentially existential threat climate change poses to them (Coffey et al., 2021). The authors also show in their literature review that especially adolescents and young adults seem to be affected by the climate change related anxiety, which manifests physiologically in the form of sleeplessness, increased stress and emotions of fear and increased irritability (Coffey et al., 2021).

Doomscrolling. One phenomenon that has emerged specifically because of the previously described increased negative news consumption is so called “doomscrolling.” This term refers to the practice of browsing the web and social media channels with the intention of proactively searching for negative news and information (Anand et al., 2022). While smartphones are the central and most widely used technological tool for doomscrolling, a constant consumption of negative news stories on television can also be included in the broader spectrum that the term encompasses (Ytre-Arne and Moe, 2021). This tendency to continuously look for “doom and gloom” on social media and news channels has only been studied for a few years as of now, especially in light of the recent COVID19 pandemic. Price et al. (2022) demonstrated a relationship between the intake of negative information related to the pandemic on social media and depressive symptoms in adolescents. Related to that, another study illustrates a positive association between doomscrolling through COVID19 news and anxiety in participants (Sharma, Lee & Johnson, 2022). Similar findings solidify the correlation of unfavorable mental health outcomes and doomscrolling, as shown in a study from turkey that investigated the effects of doomscrolling on life satisfaction. It was found that individuals’ well-being in particular was impacted negatively by exposure to negative

news (Satici et al, 2022). Two potential explanatory factors for both the onset of doomscrolling behavior as well as the duration of each iteration of pertinent browsing sessions, low levels of self-control and higher degrees of neuroticism have shown to be directly associated (Sharma, Lee & Johnson, 2022). On top of that, cognitive biases can attribute to the behavior pattern as well. For example, the tendency to look for confirmatory information of one's own beliefs may cause a susceptible individual to fall into a downward spiral evoking prolonged doomscrolling about a particular pressing and emotionally salient topic (Anand et al., 2022). Despite existing studies such as those previously mentioned, the effects of compulsively checking pessimistic news on mental health have not yet been explored to a significant extent with regard to climate change information.

Age differences. A variable that is important to look at when researching the effects of doomscrolling is age differences. As established prior, the substrate on which negative information are usually consumed are smartphones (Ytre-Arne and Moe, 2021), whose age distribution per adult user is strongly leaning towards those in their late teens until their early thirties (Statista, 2021). However, doomscrolling, or rather the compulsive consumption of negative information may also be mediated through TV news channels for example, with a much older consumer base (Statista, 2021). But which of these cohorts is more affected by it? To specify the questions and put it into context of climate change and anxiety, it can be helpful to refer once more to eco-anxiety and research conducted within the realm of the topic. Coffey et al. (2021) point out that those between 18- and 35-years old exhibit stronger levels of anxiety related to climate change than those of older cohorts. Further adding to these tendencies of young people being especially affected by the phenomenon is a paper by Hickmann et al. (2021) in which the authors delineate the psychological burden this age cohort (16-25) is afflicted by. According to this paper, 84% claim to be moderately worried about climate change while 50% cite negative emotions including anxiety due to climate change related fear. With respect to research looking into doomscrolling, Sharma, Lee & Johnson (2022) point out that younger adults are more likely to doomscroll than older individuals.

So far, based on previously mentioned research, it was established that climate change has expressed itself in the form of mental health issues and psychological distress in the population. Moreover, other research findings show the negative effects of doomscrolling on individuals' mental health, which can cause lower well-being, depressive symptoms and anxiety. For the latter specifically, the term eco-anxiety was formed which describes symptoms of anxiety particularly considering climate change and its accompanying effects on

people. As of now, studies investigating the effect of doomscrolling on anxiety have mostly focused on the recent COVID19 pandemic, however, barely any scientific paper has investigated its association with the consumption of climate change related information and news. To provide more insight into that, this paper aims to answer the following research question: *What is the effect of doomscrolling on climate change information on individuals' levels of anxiety, depending on age?* Based on this research question, two hypotheses were developed.

Hypotheses

Hypothesis 1: Doomscrolling on climate change information increases the anxiety levels in individuals

Hypothesis 2: The impact of doomscrolling on climate change information on anxiety levels will differ depending on age, with younger individuals experiencing a stronger effect than older individuals.

In order to answer the research question and test the two hypotheses, a mixed methods approach is employed that consists of a qualitative and a quantitative study. These studies are outlined in the following sections.

Study 1

Methods

This study investigates the effect of doomscrolling climate change information has on the anxiety levels of individuals, taking into account their age. Thereby, a mixed methods approach was chosen that includes both qualitative and quantitative research methods. First, qualitative data collection was conducted, and was subsequently followed up with quantitative data collection. The method section of the first study was composed in accordance with the *Consolidated Criteria for Reporting Qualitative Research (COREQ)* checklist as shown in the research paper by Tong et al. (2007). A comprehensive list of each item can be found in Appendix A.

Research Team & Reflexivity

Personal Characteristics. Multiple interviews were conducted to gather qualitative data from the participants. In total, four researchers took part in the interview process and every one of them were Bachelor of Psychology students from the University of Twente. Two of them were female and two were male. All of them had previous experience with conducting and analyzing interviews, as well as writing and comprehending scientific papers

which is part of the education each participant received while having partaken in their Bachelor of Psychology studies.

Relationship with participants. A relationship with each participant was established before the start of the interview process through email and text message exchanges by which appointments were made and it was ensured that time and date were suitable for both researchers and participant. The interview subject's awareness of the researcher's goals and motivation for undertaking the study was encompassed by the informed consent form which informed the participants about the background and the process of the study. With regards to interviewer characteristics, it can be stated that the study is salient to all four researchers as it will be part of their Bachelor's degree. Potential biases could arise from the fact that climate change is a sensitive topic and may hold differing opinions for each individual researcher which may affect interview question selection and follow-up questions posed to the participants.

Study Design

Theoretical Framework. The theoretical framework of this study with respect to collecting and analyzing gathered data was thematic analysis. This approach is in accordance with an article by Braun and Clarke (2006), in which an emerging theory is established by accruing data. Before conducting the thematic analysis, all researchers discussed the exact steps in which the analysis will be executed. Thereby, it was decided that an inductive approach would be employed with emphasis on semantic themes.

Participant selection. Participants were selected based a mix of convenience sampling and snowball sampling. This was carried out through advertisements posted on the researcher's private social media accounts (see Appendix C), as well as approaching acquaintances, relatives and work contacts of the researchers in order to facilitate acquiring candidates for the interviews. Selection was exclusively focused on Dutch and German participants. The method of approach was mostly email, but also text messages and sometimes phone calls if necessary. The exclusion of participants was done if (1) they were below 18 years old, (2) were currently receiving treatment for a mental disorder, or (3) attempted suicide within 2 years of the study commencement. Hence, the inclusion of participants occurred if they were (1) adults over 18 years old and (2) currently residing in Germany or the Netherlands. Whilst the research team was in touch with 18 potential targets, a total of 15 participants were eventually recruited for the interviews. Non-participation did not occur, however, with some potential participants no viable date and time slots were found and thus the interviews weren't pursued further.

Setting. Data was collected in form of online video calls and phone calls. These were recorded in accordance with the agreement of the participants in the informed consent forms. All interviews were conducted from home via online meetings on *Microsoft Teams* (version 1.6.00.7354). Nobody else apart from interviewers and interviewees were present in the procedure. The sample included 8 male and 7 female participants. Age distribution ranged from 20- to 59-year-olds yielding a mean age of 35.6 years. 12 interviewees were German and 3 of them were Dutch.

Data collection. The interviews were semi-structured interviews with a total set of ten questions which was developed by the researchers before (see Appendix D). These questions were informed by scientific literature covering the topics of doomscrolling, climate change and the mental health constructs *depression, helplessness, social support and anxiety* which were relevant to each of the researcher's individual research questions. Prompts were used to pose follow-up questions to the participants. The interviews were not pilot-tested, and no repeat interviews were carried out. In terms of procedure, each interview began with the interviewer briefly describing the topic and context of the interview to the interviewee, as well as asking for consent to record. Audio recordings were conducted in agreement with the participants which were subsequently transcribed. The length of each individual interview varied. The shortest one lasted 14.47 minutes while the longest interview had a duration of 44.29 minutes. The average runtime was 24.49 minutes. Data saturation was not discussed, and no transcripts were given back to the participants for additional comments.

Analysis and Findings

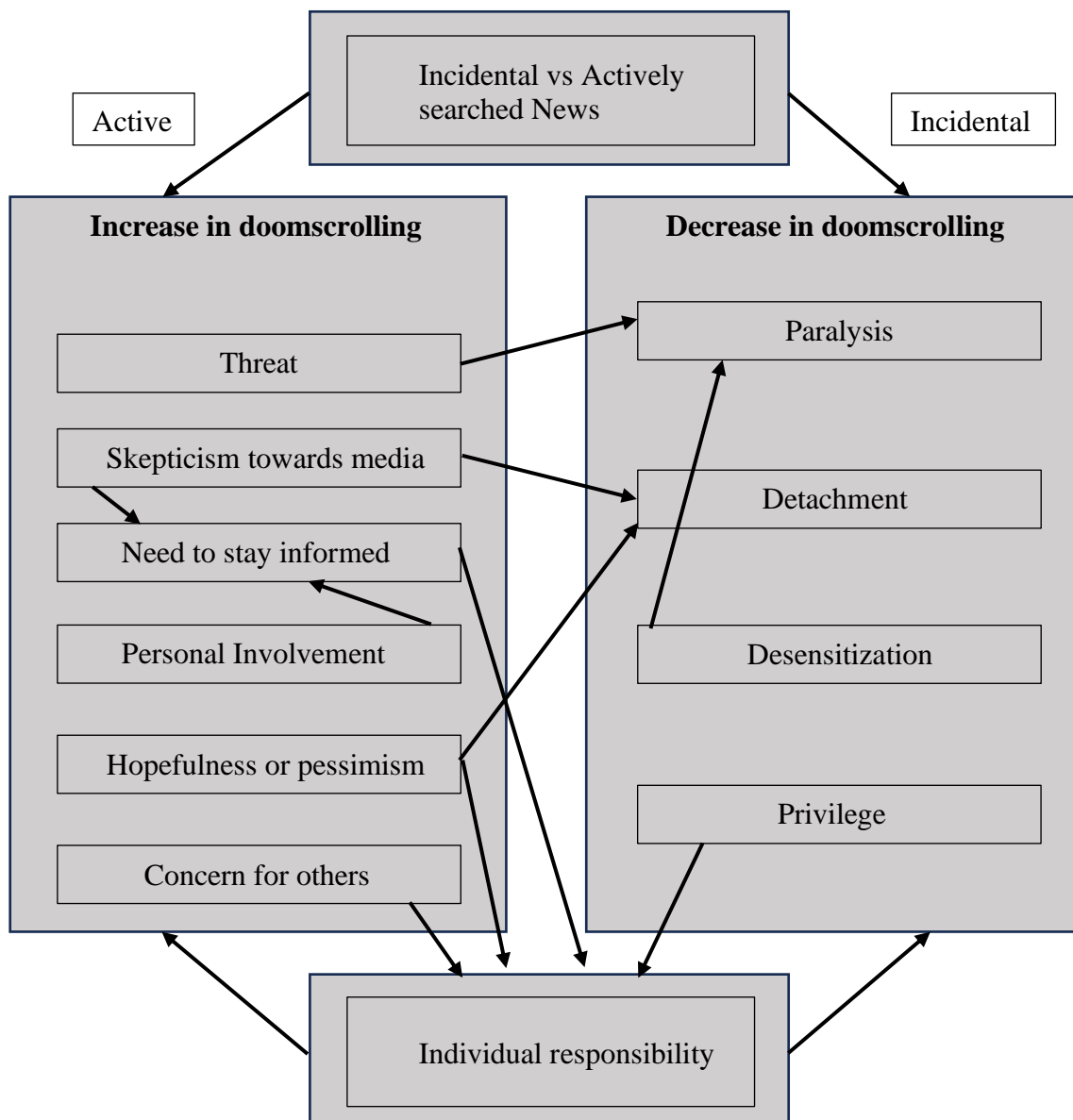
Data Analysis. Each participant coded every interview, hence a total of four coders were present. The initial transcripts were uploaded to *ATLAS.ti* (Mac Version 23.1.1, 2023) and an analysis with each transcript was conducted in the principles of the thematic analysis approach. An inductive coding approach was used to determine the themes, meaning that themes were derived based on the data from the interviews. For this individual thesis 29 codes were identified and a total of 14 themes were agreed upon collectively between researchers. These were then arranged in a coding tree (Figure 1). Different software was applied for data analysis purposes. With regards to interview transcription, *Microsoft Teams*' (Version 1.6.00.7354) internal transcription software was used as well as *Otter.Ai* and *Happyscribe*. Furthermore, inter-rater-reliability was not calculated as no previously established framework of codes existed.

Reporting. Quotations indicative for each theme were provided and assigned to a participant number. Findings were consistent with the presented data and themes were derived

collaboratively by all researchers. These themes were defined and are presented in the results section of the research paper. Furthermore, insights gained from the existing themes informed the subsequent development of survey questions in the quantitative part of the research. No further minor themes were discussed.

Figure 1

Relationship between relevant themes



The coding tree depicted above explains the relationship between all themes obtained from the thematic analysis. Arrows portray a positive relationship between two themes. Those are based on insights from the interview process and expressions by the interviewees. The subsequent paragraph will briefly explain the different connections while each theme will be

analyzed more detailed in the results section including provided quotations solidifying the prevalent relationships.

Overarching are Incidental vs Actively searched News and Individual responsibility are the most influential themes. They affect both an increase and decrease in doomscrolling behavior. News that are deliberately searched for seem to increase doomscrolling behavior, while those inadvertently come across decrease it. On the other hand, Individual responsibility can cause both a higher and lower doomscrolling rate. With regards to the association between individual themes, various connections can be established. Those who perceive climate change as a threat, tend to engage in more doomscrolling, however, others may also be paralyzed by the impending danger. Skeptics of the media's climate change portrayal may detach themselves from the information presented and either search for other sources or lower their media consumption due to their skepticism. Individuals who perceive a need to stay informed, also feel the personal responsibility to stay engaged with the topic. If personal involvement plays a role, those affected perceive a greater need to stay informed about the relevant topic. Those hopeful with respect to climate change also have a personal responsibility, while pessimistic people lean towards detachment from the subject matter. Concern for others aligns with individual responsibility. Individuals desensitized by climate change news, tend to be in a state of discouraging paralysis as caused by the overwhelming amount of negative media coverage. Finally, those privileged by their geographical location and thus not as strongly affected by climate catastrophes, feel a strong personal responsibility not to negatively affect others by their behavior who live in more endangered areas.

Results

The results of the qualitative study consist of 13 overarching themes that were derived from the interview process. Out of those, 12 were eventually selected and deemed to be relevant with respect to the topic of climate change doomscrolling. The themes thus reflect insights gained from the interviewee's responses to questions about the topic. All themes resulted from a collaborative effort of all four researchers who agreed on each one of them as a joint decision. In order to benefit the conciseness of this report, no individual codes are discussed but rather the frequency of quotes associated to each respective theme which is exhibited in *Table 1*. A list of the codes can instead be found in Appendix D. As demonstrated, the most prominent theme was *Paralysis* with 95 quotes, followed by *Individual Responsibility* with 91 quotes and *Skepticism towards media* with 68. The subsequent sub-section describes each theme in detail and explains its association to the codes

that were informing it. Moreover, excerpts from the interviews are utilized to underline the meaning of each theme.

Table 1

Frequency Table of each Theme with respective Number of Quotes

Theme	Quotes
Paralysis	95
Individual Responsibility	91
Skepticism towards media	68
Optimism/Pessimism	63
Concern for Others	58
Threat	53
Detachment	48
Incidental vs. Actively Searched News	45
Desensitization	43
Need to stay informed	41
Privilege	29
Personal Involvement	23
(Resentment towards System)	87

Paralysis

Paralysis is a theme that encompasses feelings such as being overwhelmed and feeling a lack of agency or power with regards to dealing with the issue of climate change. This is due to the limited level of perceived capacity to effectively act against climate related problems as an individual. A behavioral manifestation of this theme is the felt discouragement that emanates from consuming climate change related news. *“Um, I believe it is discouraging. To be honest, I think that for me, it is really more of a bit annoying when I do something, then it comes more from my personal motivation”* (Participant_15). Moreover, delving more into the emotional side of the theme, it coincides with the feelings of powerlessness. An example is the description of Participant_2 *“So first of all a feeling of powerlessness because you know, well I for one, I know I'm 58 years old now. I have lived in the last decades guaranteed not so that to prevent climate change. Just the powerlessness to change it now. I alone can change nothing, but I can do my part.”* In terms of codes, *feeling overwhelmed because of climate change*, *pessimism* and *emotional expression based on news coverage* are relevant to the theme.

Individual responsibility

The previous quote is a great segue into the theme of personal responsibility. The perception of agency and also moral obligation to act with the goal of alleviating the burden of global warming, many participants utilize available information about the topic to implement their own strategies to fight climate change. *“So, one reaction is really to clean up your own doorstep and say we throw away as little as possible. We try to keep it in circulation. As I already said, we don't buy plastic bags, we try to dispose of waste properly and act as sustainably as possible. From a mental or psychological point of view, it certainly also involves repression of this global situation”* (Participant_14). This statement is strongly bound to codes *measures against climate change and awareness of carbon footprint*. Another excerpt delineates the encouraging nature of news to take personal responsibility *“I would even say that it encourages me because even the bad news, in the sense of okay, that motivates me more towards action or towards creating or towards active involvement, rather than negativity that brings me down”* (Participant_14).

Skepticism towards media

Being skeptical about the media's portrayal of the facts concerning climate change can be understood as a spectrum. On the one hand people may believe that events are displayed as more egregious and devastating than they in fact are, whilst on the other hand another subset of the viewership may claim it to be underreported and not given enough importance. An example for the latter is a statement by Participant_17. *“Well, I'd say sometimes it just depends on which media you consume. But I, I would say that sometimes it's not enough... climate change isn't taken into consideration enough when it comes to issues like this.”* In this case, the skepticism towards media is attributed to the fact that not enough importance is given to the topic of climate change. An example for the sensationalistic type of news coverage comes from an excerpt of the interview with Participant_14. *“And yes, in the tabloid press or something, it is of course much more sensationalist or perhaps also more negative or formulated inconsistently. We are losing the earth, for example, such very generalized statements and sometimes even threatening.”* In this statement, the participant's critical position towards inflated and non-factual statements by the media can be observed. Codes involved in devising this theme are *criticism of media, criticism of political institutions, type of media*.

Motivation: Hopefulness or Pessimism/ Overwhelming

Media coverage about climate related issues can invoke a binary response in people. They either feel hopeful and encouraged by it or find themselves pessimistic about the

prospect of climate change and discouraged to act against it. The code *feeling overwhelmed because of climate change* also plays an important role in this theme as it suggests the emotional burden climate change imposes on individuals. This can in turn result in a paralyzed and hopeless state and lead to inaction. A good example of this from the interview process is visible in Participant_16 “*So, I feel... discouraged, insofar as I notice that you feel like you’re on your own, so of course you get that a little... a little is happening. But that’s all very, very sluggish and it all takes years before something gets done and so I...*” In this case there is the additional factor of feeling alone and limited in one’s personal force to enact change. Opposed to that, others find news about climate change to be rather encouraging. *Measures against climate change* is a code that contributes to that, as tangible measures often convey a feeling of personal agency and effective creation of change. For example “*Yes, encouraged can be seen in the fact that the climate movement is getting stronger. Fridays for Future. Last generation. They have an influx. And even if you oppose the conservative forces in Germany as much as they might, they have a following and they have already achieved a lot. If you think about what Greta started, what parliament, laws around school strike the school has struck and what a worldwide movement has become from it. That’s quite something. Well, and in my generation there are also enough people who say no, we can’t go on like this, we have to do something. They don’t take to the streets, of course, but they do what they can. They build photovoltaic systems or heat pumps, pump in the basement, etc. pp. Are more conscious about driving*” as stated by Participant_2.

Concern for others

Concern for others, or compassion for those suffering from climate related catastrophes refers to the participants who expressed their empathy with victims of previous or future issues and thereby an increased level of interest and exposure to the topic. For example, as Participant_11 points out “*We have friends in America, for example... if, there... if I read about someone there, for example a snowstorm or something similar, and I mean America is big, then of course I go deeper and ask myself where is that what’s happening there right now and so forth?*” The indication that an emotional relation to the catastrophe or the victims causes a growing need for more information becomes evident. Besides that, concern about geographical migration due to increased temperature is expressed. “*I have a very specific fear or concern. Those are climate refugees. That we will have a lot of movement from people who will no longer be able to live in climatic zones in the future, and we will have to consider how we divide the world, where one can live for how long*” (Participant_14). Becoming empathetic with victims thus appears to create an increased level

of interest and hence consumption of climate related news. In terms of codes, the theme was supported by *empathy towards victims of climate catastrophes, consequences of climate change, concern for future generations, anxious thoughts about the future.*

Threat

The extent to which people perceive climate change to be a threat differs greatly. Those who are more afflicted by its threatening nature tend to perceive *negative emotions due to climate change* and display *anxious thoughts about the future*. Those codes align very well with the theme of threat, as an excerpt from the interview with Participant_17 suggests. “Yes, so anxious because. I'm just worried about what could happen to me. What else could I experience. Also, because I... tend to be afraid for my fellow human beings and also, of course, if, well..., the next generations, of course I'm also afraid when I, somehow, I don't know... see friends who are having a child or something. And then I think okay, oh dear, hopefully they will still have such a nice, carefree life as we are right now. And exactly that, with worrying it's actually exactly the same.” Here, personal fear is combined with anxiety about the life on earth of future generations. Others describe their fear from the threat of climate change even akin to the fear of death. “So worried, I would say very much. Anxious, I can imagine this fear goes hand in hand with the knowledge that you might not live to be 100 years old. In view of the fact that this will not be possible. So, a certain ... not fear of death, but a fear that you just won't be able to live such a long life” (Participant_16). A connection to *increased consumption due to salient cc event* and the theme of concern for others is apparent too, as Participant_16 stated that “Um, yeah... now for example now in Turkey where the earthquake happened. If you just get a breaking news on your phone now there was an earthquake in Turkey, then some people notice it, and then they swipe it away... And I want it, so I'm interested, I read... and I read into it and follow a little over the next few days what happens, how? Yes... how people are doing, what... what kind of measures are being taken, and... somehow being a little bit up to date. Yes.” The threatening nature of climate change related catastrophes creates an urgent increase in acquiring more information about it.

Detachment

Detachment, or as in this case specifically, detachment from news related to climate change can be understood as a coping mechanism that aids individuals with the emotional burden that arises from the persistent exposure to negative news. This pattern is observable within the statement of Participant_12 “I don't worry about it that long though, as soon as I put my phone away I can ‘distance’ myself from it and realize there is not really anything that can be done about it.” The physical distance that the participant takes from the news in form

of putting away their phone serves as a metaphor for the coping mechanism of detachment. Another example is *“Mhm yes, that's quite funny because I have to say, I stopped watching the news somehow. It's just for these reasons that there are only negative reports, whether it's climate change or whatever ... during Corona, I only saw Corona [incidence] numbers”* as stated by Participant_3. This theme was especially informed by the code *coping mechanisms to deal with climate change*. These adjustments in behavior can take different shapes, and detachment was one of the most prominent ones detected within the interview process.

Incidental vs actively searched news

This theme serves as a distinction between incidental exposure to climate change news, which may be due to an urgent event, and the type of news the participant actively looked up. The latter led more often to doomscrolling within the interviewees than the former. As an example, Participant_2 describes that news about climate change one is coming across randomly tend to be forgotten quite fast. *“Yes, then it has three days in the media attention, it is then hyped and yes, the sack of rice fell over somewhere in China and that is then more important and the topic is then already out of the heads again.”* This statement coincides with the code *lack of genuine interest in climate cc news* and serves as an emphasis to show that the large amount of media attention climate change receives has a desensitizing effect. On the other hand, it also relates to the code *increased consumption due to salient cc event* and underlines that if something pertinent is communicated in the media, people tend to pay more attention. However only for a short duration, as mentioned before.

Opposite to that, news that are searched for proactively seem to induce a different effect in individuals. Participant_11 states *“We have friends in America, for example... if, there... if I read about someone there, for example a snowstorm or something similar, and I mean America is big, then of course I go deeper and ask myself where is that, what's happening there right now and so forth? But there has to be a personal connection. Otherwise, I won't go deeper into this whole topic.”* Here, a clear difference in attitude is visible if climate change news is of personal importance and are actively searched for because of that. This is again associated to the code *increased consumption due to salient cc event* and underlines that if a devastating climate event occurs, as in this case the hurricane, people tend to lean into the topic more.

Desensitization

The theme desensitization expresses the inverse relationship between sheer amount of news related to climate change and perceived severity. It is closely connected to the very first theme incidental vs actively searched news, as oftentimes the ubiquitously present news one

encounters randomly seem to make viewers forget faster and reduce the perceived importance. Codes serving this theme are *lack of genuine interest in cc news* and also *reduced perceived importance of cc* as participants seemed to be slightly annoyed by the presence of constant news related to climate change. Interviewer: “Okay, so you don’t feel the urge to look at it all the time.” Participant_15: “No, quite the opposite. It even bothers me a little, maybe you can understand that.” Subsequently, the interviewee addresses the fact that they feel the news coverage to be rather discouraging “Um, I believe it is discouraging. To be honest, I think that for me, it is really more of a bit annoying when I do something, then it comes more from my personal motivation. Yes, not from outside, not from the media or television.” Moreover, it can be mentioned that the negative undertones of news coverage regarding climate change seem to reduce the individual’s interest. “I think when climate change pops up in the media, I think it is mostly negative, because it mainly shows something ‘bad’. But I don’t necessarily connect that to climate change to be honest” (Participant_6).

Need to stay informed

The need to stay informed can arise from a myriad of factors. First, it can be related to emotional involvement in the topic due to *empathy towards victims of climate catastrophes*. Similarly, this is also the case if friends and family are involved. “We have friends in America, for example... if, there... if I read about someone there, for example a snowstorm or something similar, and I mean America is big, then of course I go deeper and ask myself where is that, what's happening there right now and so forth? But there has to be a personal connection. Otherwise, I won't go deeper into this whole topic” (Participant_11). Other than that, the need to stay up to date with climate news may also emerge due to the emotionally salient nature of the news and specific emotions that are evoked. “(...) because I often had the feeling that when I was busy with these topics, I then... yes, I then ruminated in my head a lot more and then I kind of get in a bad mood and um... sometimes also a bit like, well, not hate... but such a discomfort because I know that there is people who not care about it and somehow have not understood by now that... we really have a problem now and also... also in the future” (Participant 17). Hereby it is apparent that the interviewee was sucked into a vicious cycle in which busying themselves with the topic brought about negative emotions which in turn evoke the desire for more news consumption.

Privilege

Privilege as a theme refers to the privileged geographical position some people live in and the reduced impact of climate change related events that come with it. For example, people in Northern Europe are less affected by global warming than groups living in the Sub-

Saharan zone for example. The fact that some individuals are less impacted may result in a reduced interest in climate change related news. A quote encompassing this feeling of personal privilege comes from Participant_3 *“Again, not so much. Maybe also because I don’t really feel or experience the climate change, like I don’t see it happening really. Maybe also because I live in the Netherlands. I probably see the big changes more in countries further away from us. Maybe if those big changes would happen here I would be more touched by it, but now I just experience empathy for the people in other countries instead of worrying for myself. So, I do not think negatively about the future in regarding to climate change. If the world would end, then so be it, I could probably not really change it.”* Important codes are *lack of genuine interest in cc news* and *less fear due to location*.

Personal involvement

As the theme title suggest, personal involvement encompasses the level of personal connection one has to people living in an area that may be affected by climate change or even be ground zero for a climate catastrophe. Hence, this increased affection for potentially afflicted friends or family may evoke a need for additional information in order to stay informed and involved with these groups or individuals. This becomes evident in a quote associated to Participant_11 who stated in their interview *“We have friends in America, for example... if, there... if I read about someone there, for example a snowstorm or something similar, and I mean America is big, then of course I go deeper and ask myself where is that, what's happening there right now and so forth? But there has to be a personal connection. Otherwise, I won't go deeper into this whole topic.”* They point out a clear distinction between personal involvement and the lack thereof and indicate this to be a major reason to delve deeper into news surrounding the cause of the event that is affecting their friends. Another interviewee describes their personal involvement to be bound to their own family and its specific interest in the topic of climate change. *“Well, I've been dealing with the topic for a little longer now and... in my family too, so my sister and my mother too and well, that's somehow... climate change in general is always such a omnipresent topic somehow and I have, there's also a lot of input... also a lot of emotional input, which I get from my sister first and foremost. And that's exactly why it's definitely the case”* (Participant_17). Codes being linked to the theme of personal involvement are *discussions with friends and family*, *empathy towards victims of climate catastrophes* and *increased consumption due to salient event*.

Resentment towards the system

This theme was excluded from the final list of themes, because it didn’t significantly contribute to the topic of doomscrolling. However, it is still worthwhile mentioning as it was

part of various interviews and strongly expressed by a few participants. It encompasses the perception of some interviewees that the overarching levels of society which hold responsibility for the response to the crisis of climate change are not competent and acting in the most effective ways. Thus, a resentment towards these structures is evoked in the participants.

Study 2

Methods

The method section of the second study was written in accordance with the *Strengthening the Reporting of Observational Studies in Epidemiology* (STROBE) checklist for the description of quantitative method sections (Vandenbroucke et al., 2007). A comprehensive list of each criterion can be found in Appendix B.

Study Design

The study design is best described as cross-sectional correlation. This means that data is collected at a single point in time. Different variables were used. The independent variable was *doomscrolling on climate change* and was investigated with a scale and items that were developed by the researchers. The dependent variable was a mental health construct which was relevant for each researcher's individual research question and measured by means of a respective questionnaire. This research made use of the variable dependent variable *anxiety*, the predictor variable *doomscrolling on climate change* and the moderator variable *age*. The first two variables *anxiety* and *doomscrolling on climate change* are numerical variables and *age* is a dichotomous variable. As alluded to in the introduction, *age* was separated into two categories, *younger individuals* and *older*.

Participants and Recruitment

Recruitment of the participants was carried out in form of a convenience sampling via social media advertisement (see Appendix C) and word of mouth for non-students, and SONA which is a system by the *University of Twente* that enables recruitment of students as research participants. The survey was hosted on *Qualtrics*. A few criteria were established that excluded potential respondents from participating. Those were (1) being below 18 years old, (2) having insufficient English skills, (3) currently being treated or receiving medication for a mental disorder, and (4) a suicide attempt within the last two years.

Overall, 208 participants partook in the study. 78 (37.5%) participants were removed from the data set due to missing responses. Thus, the final sample contained of 130 participants (response rate = 62.5%). Within this set of subjects, 40 (30.77%) were male, 89 (68.46%) of the respondents were female and 1 (.77%) person was not specified/third gender.

The age range lied between 19 and 62. Besides that, 81 (62.31%) of the respondents were German, and 17 (13.08%) of the respondents were Dutch. Overall, 16 recruited respondents came from the SONA system of the *University of Twente* whereas the remainder of the sample was engaged through social networks and word of mouth. The dominant educational level was high school diploma qualifying for universities of applied sciences with 59 participants (45.38%), whereas only one respondent stated less than a high school diploma as their educational status (.77%).

Table 2*Participant Demographics and Educational Level*

Demographic	Mean (SD)	n (%)
Sex	-	
Male		40 (30.77)
Female	-	89 (68.46)
Age	27.68 (10.42)	130 (100)
Nationality		
Germany	-	81 (62.31)
Netherlands	-	17 (13.08)
France	-	6 (4.62)
Romania	-	3 (2.31)
Portugal	-	2 (1.54)
United Kingdom	-	2 (1.54)
United States	-	2 (1.54)
Indonesia	-	1 (.77)
Japan	-	1 (.77)
Malaysia	-	1 (.77)
Mexico	-	1 (.77)
Poland	-	1 (.77)
Switzerland	-	1 (.77)
Taiwan	-	1 (.77)
Vietnam	-	1 (.77)
Other		2
Educational Level		
Highschool (qualified for university of applied sciences)	-	59 (45.38)

High school diploma (qualified for regular university)	-	33 (25.38)
Bachelor's degree	-	21 (16.15)
Master's degree	-	4 (3.08)
PhD / doctorate	-	4 (3.08)
Less than high school diploma	-	1 (.77)
Other	-	8 (6.15)

Materials

The study's participation required a device that connects to the internet from the participants in order to access and fill in the survey online. This could either be laptop or smartphone. The final questionnaire was developed by the researchers in *Qualtrics* and comprised of a variety of scales that were based on variables of interest for the study and each researcher respectively. The following scales were utilized.

Climate Change Doomscrolling Scale (CCDS)

Firstly, based on insights gained from the thematic analysis of the interviews in the qualitative part, in which themes were first named and defined more specifically, the 12 question *Climate Change Doomscrolling Scale (CCDS)* was developed. This measurement tool was used to evaluate the test subject's doomscrolling behavior within the context of climate change specifically. Items were formulated in form of statements, such as "I am actively searching for news when a climate change related catastrophe occurs in my proximity". This is arranged as a 7-point Likert scale with answers ranging from "strongly disagree" (1) to "strongly agree" (7). Items 3, 4, and 10 were coded in reverse (see Appendix E). Cronbach's alpha for the self-developed scale showed an acceptable reliability level ($\alpha = .75$).

Doomscrolling Scale (DSS)

Furthermore, the already established *Doomscrolling Scale (DSS)* was used to measure doomscrolling behavior in participants. Again, this scale has a 7-point Likert scale and contains 15 items. Items are presented as statements and answers from respondents encompass a range from "strongly disagree" (1) to "strongly agree" (7). Sharma, Lee & Johnson (2022) have shown the *Doomscrolling Scale* to hold high discriminative power which was demonstrated through factor analysis and item-response-theory (IRT). The strongest item in their test was Item 9: "Even if my newsfeed says I am all caught up, I just keep scrolling for negative news" with an item-total correlation of .813. Besides, the weakest

one was Item 12: “I feel like I am addicted to negative news” with an item-total correlation of .666.

Hamilton Rating Scale for Anxiety (HAM-A)

In addition to that, to investigate the variable “*levels of anxiety*”, the *Hamilton Rating Scale for Anxiety (HAM-A)* was included. It usually consists of 14 items which display psychological and physiological symptoms. For the use case of this study specifically, item 14 “*Behavior at interview*” was removed due to the fact that no interview was conducted but rather did participants fill in the questionnaire themselves. The item is thus obsolete. Participants rate themselves on a 5-point Likert scale which ranges from “not present” (0) to “severe” (4). With regards to reliability and validity of the scale, both were shown to be sufficient (Thompson, 2015). Additionally, the questionnaire made use of the *Coping Competence Questionnaire (CCQ)* to measure helplessness, *Beck’s Depression Inventory (BDI)* assessing depressive symptoms, and finally the *Perceived Social Support Questionnaire (F-SozU K-6)* to appraise social support.

Procedure

Upon accessing the study via link on their device or through SONA, participants were shown a welcome page which includes general information about the topic of doomscrolling in relation to climate change, as well as an overview of the study and which measurement tools were used. Additionally, they were informed about the data handling and made aware of the deletion of all data pertaining to the study after 2025. The setting in which participants pursued filling in the survey was unknown. Subsequently, the informed consent sheet (see Appendix F) had to be filled in and signed by all participants. Thereby, participants with certain mental health and medical conditions could be excluded from the study before proceeding. Finally, demographics such as gender, educational level, age and nationality were asked of the respondents. Those who chose to participate through SONA were required to present their SONA ID. For each person partaking, the questions were posed in a randomized order, to avoid bias due to order effects. The survey duration was estimated at around 20-25 minutes. After completing the survey, respondents were thanked for participating and they could leave the website.

Data Analysis

Before beginning the data analysis, the dataset was downloaded from Qualtrics when the survey was finished and enough answers by participants were recorded. The format of the dataset was Excel, and the cleaning process commenced with removing all rows that were obsolete with regards to analyzing the data. In terms of participants, from a total of 210

recorded responses, 80 (38,10%) participants were excluded, 2 (0,95%) participants withdrew from the study, and 78 (37,14%) participants were unable to fully complete the survey. Hence, the final size of the sample was 130. After this procedure was completed, the dataset was uploaded into the programming language for statistics “R” (version 4.3.0). Within the R environment, various packages were loaded, and the analysis of the data could commence. The exact steps that were performed can be found in form of the R code in Appendix H. Firstly, descriptive statistics and correlations were calculated, before the data was checked through the employment of linear assumptions testing. Furthermore, a G*Power test was applied in order to evaluate whether the present sample size could be deemed sufficient for further statistical analyses. The results of these operations including tables and graphs can be found in within the subsequent results section of this report.

In terms of testing the hypotheses, each of them was separated into two individual hypotheses. This was done as the doomscrolling (DS) was measured with a scale already established whereas climate change doomscrolling (CCD) was measured with self-developed questions. This may decrease the validity of the individual scales and thus two separate analyses were conducted for each hypothesis.

Hypothesis *H1.1* states that Doomscrolling increases anxiety levels in individuals. Hypothesis *H1.2* states that Climate Change Doomscrolling increases anxiety levels in individuals. Hypothesis *H2.1* states the impact of Doomscrolling on individuals’ anxiety levels will differ depending on age, with younger individuals experiencing a stronger effect. Finally, Hypothesis *H2.2* states the impact of Climate Change Doomscrolling on individuals’ anxiety levels will differ depending on age, with younger individuals experiencing a stronger effect than older ones.

In order to test these four hypotheses, different linear models were created. To assess *H1.1*, a linear model with *Anxiety* as the independent variable and *Doomscrolling (DS)* as the dependent variable was created. *Anxiety* was measured using the total scores of the *HAM-A*. *DS* was made of the mean scores from the doomscrolling scale. With respect to testing *H1.2*, a linear model with *anxiety* as the independent variable and *Climate Change Doomscrolling (CCD)* as the dependent variable was developed. *CCD* was made of the mean scores on the self-developed questions.

To test *H2.1* and *H2.2*, *age* was introduced as a moderation effect and inserted into a linear regression model. The main effects in these models were *HAM-A* score and *anxiety*. The independent variables were *DS* in the first model and *CCD* in the second model.

Results

Descriptive Statistics

First of all, the mean scores and standard deviations of all scales were computed. The mean score on the DSS was 2.19 (SD = .99), while the mean score for CCD was 4.01 (SD = .93). The mean score on the HAM-A was 1.67 (SD =.54). Table 3 shows all aforementioned values. Besides that, skewness of data from all different scales was measured. The HAM-A data was clearly skewed (skewness = 1.25), while the CCD was also skewed to the left (skewness = -1.03). The DSS seemed to strong skewness (skewness = 1.35).

Table 3

Variable	<i>n</i>	<i>Mean</i>	<i>SD</i>
1. CCDS	130	4.01	.93
2. DSS	130	2.19	.99
3. HAM-A	130	1.67	.54

Note. *SD* = Standard Deviation. * Indicates $p < .05$. ** indicates $p < .01$.

CCDS = Climate change doomscrolling scale

DSS = Doomscrolling scale

HAM-A = Hamilton anxiety rating scale

Correlations.

Subsequently, the Pearson Correlations between all variables was calculated. Correlations between the variables showed no conspicuous effects, as is depicted on Table 4.

Table 4

Correlations between all Relevant Variables

Variable	DS	CCD	HAM-A	AGE
DSS	-	-	-	-
CCDS	.329	-	-	-
HAM-A	.432	.233	-	-
Age	-.096	-.152	-.208	-

G*Power Analysis

To determine a viable sample size, the G*Power software v3.1.9.6 (Faul et al., 2009) was used. Applied was an a priori power analysis with power = .80 and $\alpha = .05$, and two tails in the distribution. The minimal sample size required according to the analysis was $N = 55$ (see Appendix G) for three predictors. Thus, $N = 130$ which was the sample size for this study proved to be sufficient for hypotheses testing.

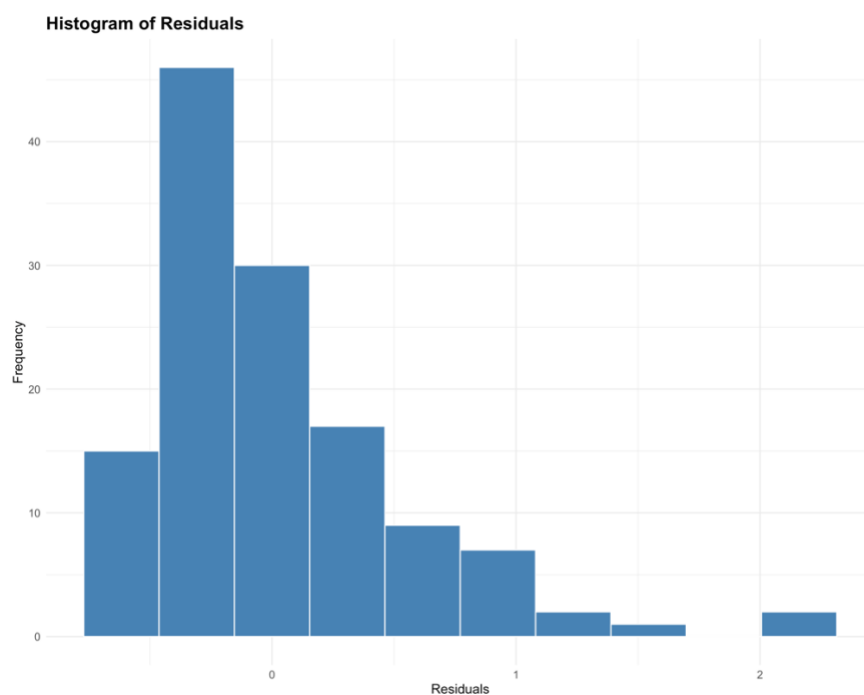
Linear Assumptions

Linear assumptions were checked before the hypotheses were investigated. Thereby, four linear models were developed and a regression analysis for each model was conducted. Model 1 consisted of DS and age, Model 2 consisted of DS and HAM-A, Model 3 consisted of CCD and age, whereas Model 4 consisted of CCD and HAM-A. Considering the small size of the sample, and to ensure validity and reliability of the results of the subsequent analyses, assumptions of *Normality, Linearity, Homoscedasticity and Independence* were investigated.

Normality. Normality of the residuals was checked by creating histograms of the residuals for all four assumption models. Model 1 was skewed to the left ($skewness_A = 1.31$) (Figure 2). Model 2 was also skewed to the left ($skewness_B = 1.61$). The skew of Model 3 was to the right ($skewness_C = -1.06$). Finally, Model 4 was also skewed to the left ($skewness_D = 1.41$). The assumption of normality was not met for these models (see Appendix G for histograms of models 2, 3 and 4).

Figure 2

Model A



Linearity. To test the assumption of linearity, the Harvey-Collier test was used. Results for Model A were not significant ($p = .966$) which means that the assumption of linearity was not violated. With regards to Model 2, similar non-significant results were shown as the Harvey-Collier yielded a p-value of .778. For Model 3 it was a p-value of .284,

thus not violating the linearity assumption either. Finally, Model 4 was not in violation of the assumption either ($p = .479$). Hence, the linearity assumption was met for all models.

Homoscedasticity. To test the assumption of homoscedasticity, the Breusch-Pagan test was applied. Once more, if the p-value for a model proves to be significant, the assumption of homoscedasticity would be violated. This was not the case for Model 1 ($p = .246$), Model 2 ($p = .844$), Model 3 ($p = .914$) and Model 4 ($p = .756$). Thus, the assumption of homoscedasticity was met for all four models.

Independence. The Durbin-Watson tests were performed to check the assumption of independence. The tests do not indicate any statistical significance for Model 1 ($p = .936$), for Model 2 ($p = .523$), for Model 3 ($p = .697$), and for Model 4 ($p = .157$). The assumption of independence was therefore met.

As the assumption of normality was violated, but all other parametric assumptions were met, a generalized linear model (GLM) approach was chosen to proceed with the hypothesis testing. This is in accordance with the recommendation by van Berg (2021) which suggests that GLMs can be used when dealing with especially skewed and non-normally distributed data. All linear models relevant for hypothesis testing were thus transformed into a GLM.

Hypothesis 1

H1.1. The first GLM suggests a significant relationship between DS and Anxiety with a p-value of $<.001$. H1.1 was thus accepted. There is a significant effect of doomscrolling on anxiety levels.

Table 5

Relationship: Doomscrolling and Anxiety

Variable	Estimate	SE	95% CI		p
			LL	UL	
(Intercept)	.224	.062	.009	.035	$<.001$
Doomscrolling (DS)	.134	.002	.008	.187	$<.001$

Note. Total N = 130. Degrees of Freedom = 130. CI = confidence interval; LL = lower limit; UL = upper limit.

H1.2. The second GLM suggests a significant relationship between CCD and Anxiety with a p-value of $<.001$. H1.2 was thus accepted. There is thus a significant effect of climate change doomscrolling on anxiety levels.

Table 6*Relationship: Climate Change Doomscrolling and Anxiety*

Variable	Estimate	SE	95% CI		p
			LL	UL	
(Intercept)	.193	.123	-.043	.438	.118
Climate Change Doomscrolling (CCD)	.082	.030	.023	.140	.006

Note. Total N = 130. Degrees of Freedom = 130. CI = confidence interval; LL = lower limit; UL = upper limit.

Hypothesis 2

H2.1. In the third GLM, age was used as a moderator. The moderation effect of age on DS and anxiety was not significant ($p = .745$). H2.1 was thus not accepted. The effect of doomscrolling on anxiety levels is not moderated by age.

Table 7*Moderation Analysis: Doomscrolling x Age*

Variable	Estimate	SE	95% CI		p
			LL	UL	
(Intercept)	.443	.207	.002	.852	.034
Doomscrolling (DS)	.099	.094	-.087	.285	.296
Age	-.007	.007	-.022	.007	.308
DS x Age	.001	.003	-.005	.008	.745

Note. Total N = 130. Degrees of Freedom = 130. CI = confidence interval; LL = lower limit; UL = upper limit.

H2.2. In the last GLM, age was used as a moderator once more. The moderation effect of age on CCD and anxiety was again insignificant ($p = .625$). H2.2 was thus not accepted either. The effect of climate change doomscrolling on anxiety levels is not moderated by age.

Table 8*Moderation Analysis: Climate Change Doomscrolling x Age*

Variable	Estimate	SE	95% CI		p
			LL	UL	
(Intercept)	.563	.397	-.214	1.33	.159

Table 8*Moderation Analysis: Climate Change Doomscrolling x Age*

Variable	Estimate	SE	95% CI		p
			LL	UL	
Climate Change Doomscrolling (CCD)	.027	.099	-.166	.223	.780
Age	-.012	.013	-.003	.014	.365
CCD x Age	.001	.003	-.005	.008	.625

Note. Total N = 130. Degrees of Freedom = 130. CI = confidence interval; LL = lower limit; UL = upper limit.

General Discussion

The purpose of this study was to gain a better understanding of the novel phenomenon called doomscrolling in relation to climate change. The topic has thus far been examined within the scientific literature mostly in the context of COVID-19, hence, this research paper dealt not only with a very new construct but also investigated its relation to a variable that had not been studied before such as climate change. Besides *doomscrolling on climate change information*, the other important variable in this study was *anxiety*, a mental health construct defined by states of worrying and tension including somatic symptoms such as high blood pressure (APA, 2023). Lastly, *age* was considered as an interaction variable to assess whether it plays a relationship in moderating doomscrolling and anxiety. Data collection employed a mixed methods approach, thus implementing both qualitative and quantitative research. An interview study was used to further gain an enhanced understanding of doomscrolling behavior in light of climate change news, as prior research was limited.

Results of the qualitative study

When taking a look into the findings of this study, it is valuable to properly contextualize information from the qualitative interview study in conjunction with the results from the quantitative survey approach. As mentioned before, the concept of doomscrolling is novel, meaning that prior studies are limited. The inclusion of an interview study was therefore of importance and provided comprehensive insights of how participants describe specific behavior patterns while consuming news concerning the topic of climate change as a whole. In the introduction, it was hypothesized that younger individual's anxiety levels would be more significantly affected than those of older ones. Even though this hypothesis was not confirmed by the quantitative study, it was supported by the interview study. Young

interviewees tended to be especially worried about the negative environmental changes the planet is undergoing. A potential explanation for this tendency may be that younger individuals will be affected by climate change for a longer time, as their remaining lifespan is greater. Besides, another curious fact from the qualitative analysis was the tendency of many participants to speak of pro-environmental actions to combat climate change. Considering this behavior through the lens of one of this study's variables, *anxiety*, a research paper by Ogunbode et al. (2022) may provide more insights. Their study examined actions against climate change and behaviors supportive of the environment in relation to anxiety revolving around climate change. They found that increased climate anxiety is positively associated with pro-environmental actions. This real-world implication is obviously not exclusively positive, as climate anxiety in itself is clearly a negative aspect of mental health, and associated with reduced well-being (Ogunbode et al., 2022). However, a positive tendency can be found when it comes to proactive behaviors stemming from this instance, as supported both by the qualitative research of this article as well as other published literature.

Results of the quantitative study

The results of the quantitative study underline the negative effect of doomscrolling climate change information on the anxiety levels of individuals. The analysis revealed a significant association between doomscrolling and anxiety levels, however, a moderation effect of age on the strength of the relationship was not found. When putting these findings into context of previous research, it becomes evident that they are partly in support of prior outcomes. Before directly comparing this study to previous ones, it should be mentioned that the aforementioned studies were mostly conducted in light of COVID-19 doomscrolling. Firstly, it can be stated that a relationship between doomscrolling and negative mental health outcomes was established in previous scientific articles (Price et al., 2022; Sharma, Lee & Johnson, 2022; Satici et al, 2022). Those included reduced levels of well-being, depressive symptoms and anxiety. Especially the negative impact on the latter mental health marker, anxiety, is of importance to this research article. Studies by Doherty & Clayton (2011); Lawrence et al. (2021); Coffey et al. (2021) and Cianconi et al. (2020) all delineate the negative effects of doomscrolling on anxiety. These research outcomes align with results from this study, as a significant relationship between doomscrolling climate change information and anxiety was established through data analysis of the quantitative study (see Table 6). Moreover, of particular interest to this paper is the concept of eco-anxiety. This construct encompasses the variables *doomscrolling on climate change information* and *anxiety* as it investigates the psychological distress that results from negative climate change related

events. Research by Coffey et al. (2021) outlined the negative detrimental mental health effects that the changing global climate has caused in individuals

Age

Moreover, an additional facet this study carries into the broader landscape of related literature is the incorporation of the variable *age*, for which prior research was sparse. Even though some previously published studies hinted at the fact that younger individuals may be more starkly affected by climate change than older ones (Coffey et al., 2021; Hickmann et al., 2021), a deeper dive into this specific variable had not been carried out yet, especially with regards to doomscrolling. The statistical analysis of the sample however didn't indicate any significant moderation effect of age on climate change doomscrolling (see Table 8). Despite this outcome, further researching the psychological distress climate change exerts on young individuals may be very important. As mentioned before, insights from the qualitative research of this study show that especially the younger cohort seems to be struggling with this particular burden climate change anxiety.

Limitations

Despite its results and the valuable insights this study could establish, some limitations should be addressed. Firstly, with respect to the qualitative study, again, a major limitation is the sampling method of interviewees, as participants were selected from a pool of potential candidates close to the researchers, such as relatives and acquaintances. This decreases the diversity of participants as people within this sample are likely very similar to each other with respect to their socio-economic status and cultural understandings. Given this instance, the discrepancies between individual opinions and insights from the interviews was reduced, thus, rendering the data more homogenous. Besides that, another limitation related to the interview study is the researcher's proficiency. At the point of data collection, all four researchers were Bachelor students and experience in conducting scientific interviews was quite limited.

With regards to the quantitative study, the most evident factor limiting the study is its sample size. 130 total responses were recorded in the quantitative study, which is considered low (Martinez-Mesa et al., 2014). In order to have greater statistical power and more significant results, a larger sample would be beneficial. Moreover, the sample used for this study can be categorized as white, educated, industrialized rich and democratic (*WEIRD*). The problem emanating from such a dataset is that drawing universal inferences that apply to diverse groups of people is difficult, as it is not representative for broad segments of the world's population (APA, 2010). Adding to this issue, the sample displayed an unequal gender distribution as approximately two thirds of all participants were women, while only

one third were men. Furthermore, it should be mentioned that participants were primarily Dutch and German which further reduces the generalizability of the findings to other countries and cultures. Hence, a different sampling method could prove to be helpful when conducting similar research in the future, especially when considering the ubiquity and global scale of the issue of climate change. Besides that, not all linear assumptions were met which renders drawing accurate inferences from the data more difficult.

Strengths

As opposed to the limiting aspects of this study, some strengths can be pointed out as well. First of all, the mixed method approach enabled gaining a deeper look into the topic and could thus inform the development of items used for the questionnaire later on. The CCDS was developed based on these insights obtained from the qualitative interview study, in which a newly gained comprehension of the interplay between *doomscrolling on climate change information* and various mental health constructs was shown. With respect to the reliability of the CCDS, the Cronbach's Alpha score proved to be acceptable. Thus, a new instrument could be established and may be aiding future researchers. Finally, as referred to before, this study addressed a large gap in the existing landscape of research conducted about doomscrolling. This is a considerable strength, as it adds to the established body of scientific knowledge, aids future researchers who conduct studies on the same topic and may uncover important practical implications.

Future Directions

Considering future research, it would be beneficial for the field if more studies would be conducted, and further valuable data can be added to the topic of doomscrolling in particular, as it has thus been mostly investigated during COVID-19. An approach targeting a more diverse set of topics could be valuable. Climate change as a topic may seem to be studied quite extensive in the literature, but this pertains mostly to environmental factors impacting the planet directly, as well as economic troubles arising from it. Contrary to that, climate change's association to mental health outcomes is still understudied (Lawrence et al, 2021) and therefore necessitates further research investigating its psychological impact. As results from this study suggest, people seem to be affected psychologically by the burden of an ongoing climate catastrophe. This means that not only additional studies are necessary to further deepen the understanding of this problem, but also that emotional support is required, helping humanity to prepare for a potentially difficult future in which climate change continues to play a very central role in everyone's lives. Kurth and Pihkala (2022) point out climate anxiety's universal nature and that initiatives are already on their way aiming to help

individuals to transform their eco-anxiety into proactive measures to fight the challenge of climate change. These insights align well with the previously described proactive actions against climate change found in the interview study of this research paper.

Conclusion

In conclusion, this study elucidates the phenomenon of doomscrolling in relation to climate change. The results of this research suggest that climate change doomscrolling increases individual's anxiety levels, whereas age doesn't seem to affect this association. Given the negative mental health effects of doomscrolling, additional studies have to be conducted in order to gain a better perspective of the scope of the problem, especially within the realm of a wider range of settings in which the behavior occurs. In aid of future studies, integrating insights from the interview study contributed to the first development of a scale measuring climate change doomscrolling. This scale may contribute to upcoming research as it shows acceptable reliability. Besides, when it comes to an outlook into the future, climate change anxiety seems to be a problem especially concerning the younger generation, but at the same time fueling a proactive approach to enact pro-environmental behaviors. Hopefully, solutions will be found to help individuals suffering from eco-anxiety and interventions can be developed to reduce doomscrolling behaviors that serve as a catalyst for anxiety related to climate change news. In terms of future research, it is recommended that further studies examining the topic be conducted to add to a relatively small body of research that exists as of now.

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Appendices

Appendix A

COREQ Criteria and Corresponding Pages

Criterion	Description	Page
Interviewer/facilitator	Which author/s conducted the interview or focus group?	8
Credentials	What were the researcher's credentials?	8
Occupation	What was their occupation at the time of the study?	8
Gender	What was the researcher's gender?	8
Experience and training	What experience or training did the researcher have?	8
Relationship established	Was a relationship established prior to study commencement?	8
Participant knowledge of the interviewer	What did the participants know about the researcher?	8
Interviewer characteristics	What characteristics were reported about the interviewer/facilitator?	8
Methodological orientation and theory	What methodological orientation was stated to underpin the study?	9
Sampling	How were participants selected?	9
Method of approach	How were participants approached?	9
Sample size	How many participants were in the study?	9
Non-participation	How many people refused to participate or dropped out? Reasons?	9
Setting of data collection	Where was the data collected?	9
Presence of non-participants	Was anyone else present besides the participants and researchers?	9
Description of sample	What are the important characteristics of the sample?	10
Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	10

Repeat interviews	Were repeat interviews carried out? If yes, how many?	N/A
Audio/visual recording	Did the research use audio or visual recording to collect the data?	10
Field notes	Were field notes made during and/or after the interview or focus group?	N/A
Duration	What was the duration of the interviews or focus group?	10
Data saturation	Was data saturation discussed?	N/A
Transcripts returned	Were transcripts returned to participants for comment and/or correction?	10
Number of data coders	How many data coders coded the data?	10
Description of the coding tree	Did authors provide a description of the coding tree?	11
Derivation of themes	Were themes identified in advance or derived from the data?	11
Software	What software, if applicable, was used to manage the data?	10
Participant checking	Did participants provide feedback on the findings?	10
Quotations presented	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified?	13
Data and findings consistent	Was there consistency between the data presented and the findings?	12
Clarity of major themes	Were major themes clearly presented in the findings?	13
Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	13

Appendix B*STROBE Checklist for Quantitative Method Sections and Corresponding Pages*

Criterion	Description	Page
Study design	Present key elements of study design.	20
Setting	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection.	20
Participants	Give the eligibility criteria, and the sources and methods of selection of participants.	20
Variables	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	23
Data sources/measurement	For each variable of interest, give sources of data and details of methods of assessment. Describe comparability of assessment methods if there is more than one group.	23
Bias	Describe any efforts to address potential sources of bias.	24
Study size	Explain how the study size was arrived at.	21
Quantitative variables	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why.	24
Statistical methods	a) Describe all statistical methods, including those used to control for confounding.	23
	(b) Describe any methods used to examine subgroups and interactions.	23
	(c) Explain how missing data were addressed.	N/A
	(d) If applicable, describe analytical methods taking account of sampling strategy.	N/A
	(e) Describe any sensitivity analyses.	N/A

Appendix C

Advertisement for the Interview Study – German (A)

**WIRD DIE MENTALE GESUNDHEIT DURCH
NACHRICHTEN ÜBER DEN KLIMAWANDEL
BEEINTRÄCHTIGT?**

Wir führen eine Studie zum Thema „Medienkonsum im Bezug auf den Klimawandel und Auswirkungen auf die mentale Gesundheit“ durch und suchen nach Teilnehmern für ein **anonymes online Interview**.

Das Interview dauert voraussichtlich **30 bis 40 Minuten**. Alle Daten die zu Identifizierung führen können, werden **anonymisiert**. Die Identität der Teilnehmer wird geschützt.


Bei Interesse, bitte die unten stehende E-Mail Adresse kontaktieren!

Voraussetzungen für Teilnehmer

- ▶ 18+
- ▶ Deutsch oder Niederländisch
- ▶ Zurzeit nicht in Behandlung wegen einer mentalen Erkrankung

**FRAGEN BEZÜGLICH DER
TEILNAHME?**

Bitte kontaktiere
l.grossekemper@student.utwente.nl



Advertisement for the Interview Study – German (B)

**NEGATIVE NACHRICHTEN
UND KLIMAWANDEL**

Möchten Sie dazu beitragen, dass Forscher verstehen, wie sich negative Nachrichten über den Klimawandel auf die psychische Gesundheit auswirken?

Möchten Sie Ihre Erfahrungen zum Konsum von Nachrichten über den Klimawandel teilen?

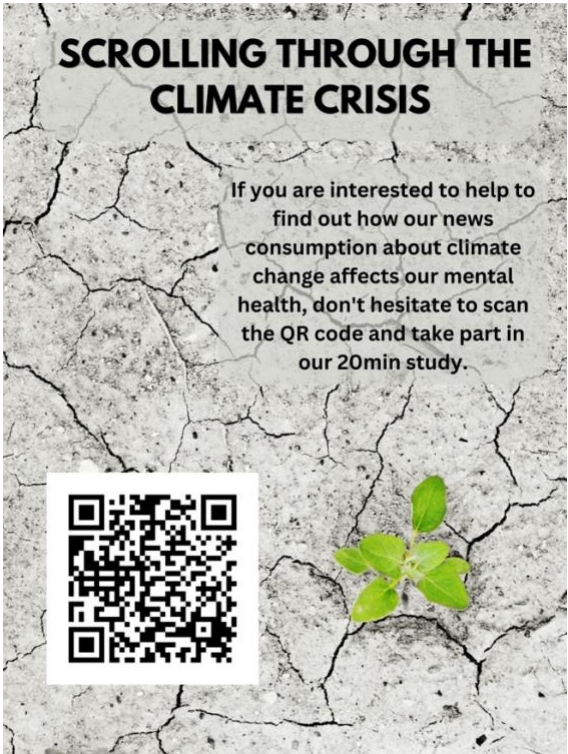
Dann nehmen Sie bitte an einem anonymisierten Online-Interview teil!
Für weitere Informationen kontaktieren Sie bitte:
n.f.a.apprich@utwente.student.nl

Anforderungen:

- Mindestalter 18 Jahre
- fließende Deutsch- oder Niederländischkenntnisse
- keine laufende Behandlung einer psychischen Erkrankung.



Advertisement for the Qualtrics Survey - English



Appendix D

Interview Questions

Questionnaire Items

1. What patterns of news checking have you noticed in yourself when reading something negative about climate change?
 - a. Do you think that this behaviour of reading climate change news is excessive and compulsive? Can you elaborate?
 2. How – in your opinion – is climate change displayed in the news media if there is a current climate event, (such as the flooding in Germany)?
 - a. What feelings are evoked when you read climate change news online in news media or social media?
 - b. Do you find yourself reading climate-related news more often if there is a catastrophe? Can you elaborate?
 3. When you think about the way you are feeling when you see negative news regarding climate change, what words come to your mind?
 4. If such feelings occur; what do you do to counteract feelings of helplessness when reading news about climate change?
 5. In what way do climate change news make you feel discouraged or encouraged to take action against it?
 - a. Do you believe, people feel motivated to take action against climate change when reading about it in the news?
 6. Can you describe what effect climate change has on your mental state of well-being?
 7. When reading news about climate change, do you turn to others to discuss what you read, or for emotional comfort and understanding?
 8. Do you share your attitude towards climate change and the news about it with friends, family, and colleagues?
 - a. Do you see differences between generations?
 9. Does news consumption about climate change increase negative thoughts about the future (with regards to the environment)?
 - a. Follow-up question: Can you describe what negative thoughts about the future arise when you watch/ read about news on climate change?
 10. Do you feel anxious (and stressed/ afraid) when thinking about climate change and its negative ramifications for humanity (and the environment)?
-

-
- a. Can you describe your feelings further and explain what causes them in particular?
-

List of codes used to derive themes

Codes

climate change news consumption
feeling overwhelmed because of climate change
discussions with family and friends
emotional expression based on news coverage
negative emotions due to climate change
anxious thoughts about future
anger
political opinion
incomprehension
measures against climate change
generational differences
pessimism
reduced perceived importance of cc
lack of genuine interest in cc news
Awareness of carbon footprint
type of media
coping mechanisms to deal with climate change
criticism of media
criticism of political institutions
generational differences in opinion about climate change
generational differences in news consumption (climate)
less fear due to remaining lifespan
less fear due to location
concern for future generations
consequences of climate change
empathy towards victims of climate catastrophes
cynicism about news media

feeling blamed for cc by media

increased consumption due to salient cc event

Note: CC = Climate Change

Appendix E*Items of the self-developed Climate Change Doomscrolling Scale (CCDS)*

Item	Theme
1. I am actively searching for news when a climate-change related catastrophe occurs in my proximity.	Incidental versus actively searched news
2. I feel the need to avoid climate change news because I feel overwhelmed when reading them.	Detachment
3. RE: The climate change topic is too pervasive; therefore, I pay less attention to it.	Desensitization
4. RE: Uncertainty in the media about the impact of climate change in the future makes me refrain from engaging with the topic.	Paralysis
5. My concern for other people makes me check news more frequently when a climate-catastrophe is presented in the media.	Concern for others
6. If a climate-catastrophe would occur near me or near people who are close to me, I would feel the urge to look up more news about the event.	Personal involvement
7. Negative news about climate change makes me want to assess the truthfulness of the information. Therefore, I actively search for more information.	Skepticism towards media Optimism/Pessimism
8. I feel it's my duty to keep up to date with climate change news and be knowledgeable about the topic.	Individual responsibility
9. My concern about the threat climate change poses to the environment makes me consume news more frequently about the topic.	Threat
10. RE: Given my location on the planet, I am less urged to consume news about the changing climate and its consequences.	Privilege
11. Consuming news about the environment urges me to stay informed and up to date with the topic of climate change.	Need to stay informed

RE = Items need to be coded in reverse

Appendix F*Informed Consent Form of the Qualtrics Survey*

By clicking **YES** below, I agree to the following:

I understand that my participation is voluntary. I also understand that I have the right to withdraw my consent at any time without needing to give a reason, if I experience any discomfort or distress.

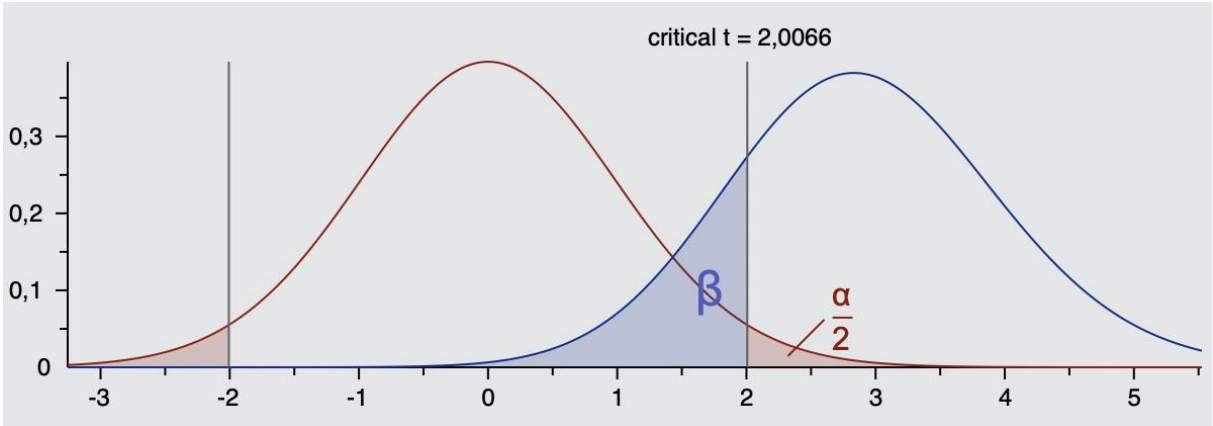
Furthermore, the following points are clear to me:

- All data that are collected by the researcher are treated completely anonymously and cannot and will not be traced back to my identity.
- I understand that information I provide will be used for research reports that aim to investigate the impact of doom scrolling on the topic of climate change impacts mental health.
- I am currently NOT receiving any kind of treatment (medical or therapy) for a mental disorder
- I have NOT had a suicide attempt in the last two years
- I am NOT currently suffering from suicidal ideation / thoughts
- I understand that taking part in the study involves the following risks: mental discomfort by talking about a sensitive topic such as climate change.
- I agree to keep the procedures and explanation of this study to myself and will not pass this information on to others because this might negatively influence the study results.
- I give permission for the answers that I provide to be archived in survey database so it can be used for future research and learning.

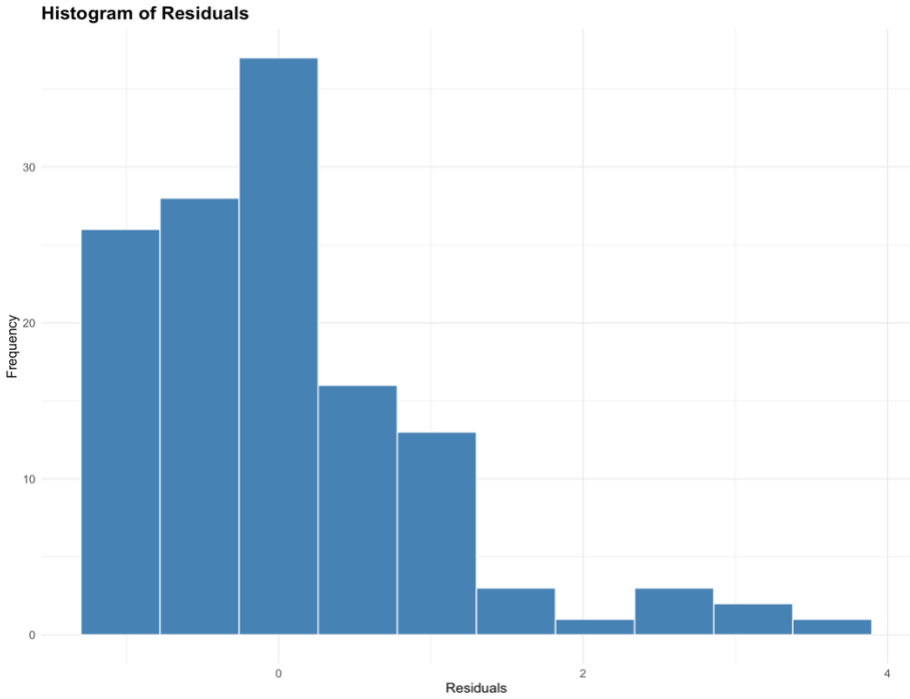
I agree to participate in the study:

- YES**, I fully understand the contents of this consent form and agree to participate in this study. I also agree not to disclose the details of the study to other parties.
- NO** (you will be directed to the end of the study)

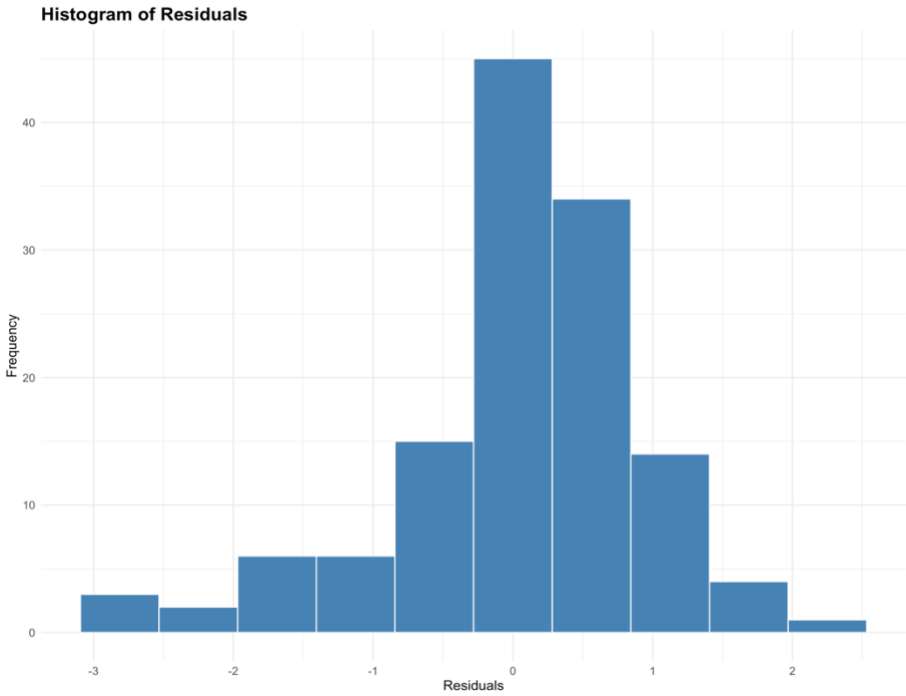
Appendix G
*G*Power Analysis*



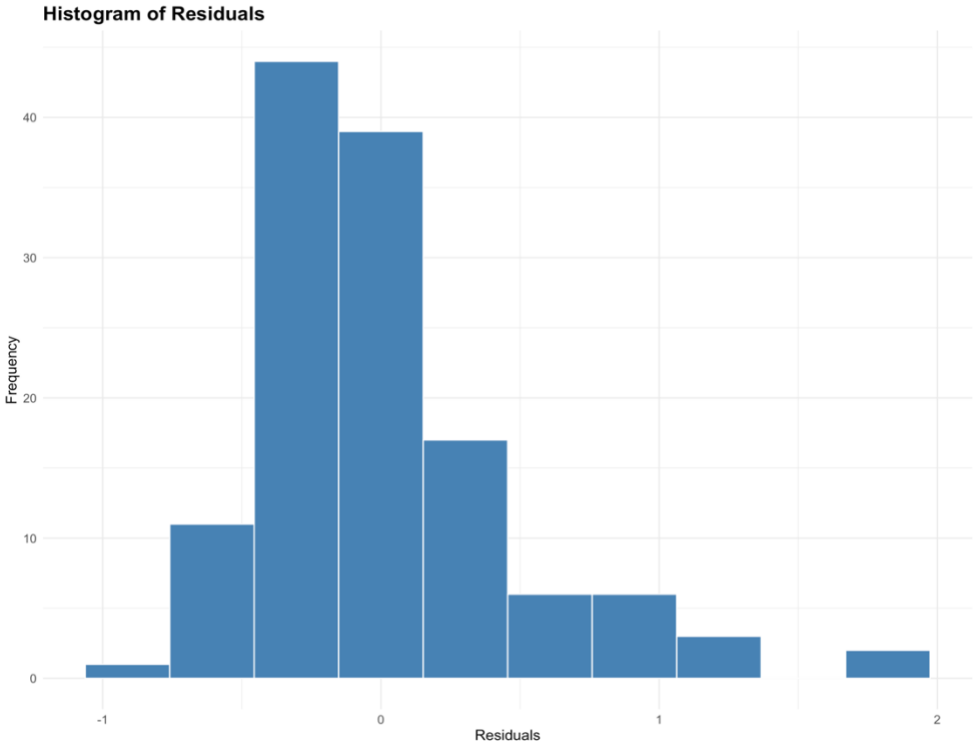
Model 2



Model 3



Model 4



Appendix H

R Script

```

#IMPORT NEW DATASET
newdf <- read_excel("Bachelor_Thesis_Survey_Cleaned.xls")
# Re-code CCD and CCQ Scales ----
newdf <-newdf %>%
  mutate_at(c("CCD_Q3","CCD_Q4","CCD_Q10"), # CCD recode negative items
    ~recode(., "1" = "7", "2" = "6", "3" = "5", "4" = "4", "5" = "3",
      "6" = "2", "7" = "1"), # recode reversed items
    c("CCQ_1", "CCQ_2", "CCQ_3","CCQ_4", "CCQ_5", "CCQ_6",
"CCQ_7","CCQ_8",
    "CCQ_9", "CCQ_10", "CCQ_11","CCQ_12"), # CCQ recode negative items
    ~recode(., "1" = "6", "2" = "5", "3" = "4", "4" = "3", "5" = "2",
      "6" = "1") # reverse code all items
  # safe data as numeric
newdf <- mutate_all(newdf,function(x) as.numeric(as.character(x)))
# calculate total scores for surveys
newdf <- newdf %>%
  mutate(
    CCD = rowSums(across(contains("CCD"))), # sum score
    DS = rowMeans(across(contains("DS"))), # mean score
    CCQ = rowSums(across(contains("CCQ"))), # sum score
    F_SozU = rowMeans(across(contains("F-SozU"))) # mean score

#CREATE NEW VARIABLE CCD
newdf$CCD <-
(newdf$CCD_Q1+newdf$CCD_Q2+newdf$CCD_Q3+newdf$CCD_Q4+newdf$CCD_Q5+n
ewdf$CCD_Q6+newdf$CCD_Q7+newdf$CCD_Q8+newdf$CCD_Q9+newdf$CCD_Q10+n
ewdf$CCD_Q11)/11
#RELIABILITY OF CCD SCALE
install.packages("psych")
library(psych)
#CREATE NEW VARIABLE HAM
newdf$HAM <- (newdf$'HAM-A_Q1'+newdf$'HAM-A_Q2'+newdf$'HAM-
A_Q3'+newdf$'HAM-A_Q4'+newdf$'HAM-A_Q5'+newdf$'HAM-A_Q6'+newdf$'HAM-
A_Q7'+newdf$'HAM-A_Q8'+newdf$'HAM-A_Q9'+newdf$'HAM-A_Q10'+newdf$'HAM-
A_Q11'+newdf$'HAM-A_Q12'+newdf$'HAM-A_Q13')/13
#RUN REGRESSION MODEL CCD+HAM -> HYPOTHESIS 1.1
modellccd <- lm(HAM~CCD,data = newdf)
summary(modellccd)
plot(modellccd)
residualsmodellccd <- residuals(modellccd)
ggplot() +
  geom_histogram(aes(x = residualsmodellccd, fill = "steelblue", color = "white", bins = 10)
+
  labs(title = "Histogram of Residuals",
    x = "Residuals",
    y = "Frequency") +
  theme_minimal() +
  theme(text = element_text(family = "Arial"),

```

```

    plot.title = element_text(size = 16, face = "bold"),
    axis.title = element_text(size = 12),
    axis.text = element_text(size = 10))
#CHECK ASSUMPTIONS NEW TESTS MODEL D
# Harvey-Collier test for linearity on UNC
harv_test <- harvtest(model1ccd, data=newdf)
summary(harv_test)
# Print the test results: not significant thus linearity confirmed
print(harv_test)
# 2. Homoscedasticity assumption -> assumption met
plot(modelA, which = 1)
# Breusch-Pagan test for homoscedasticity
bp_test <- bptest(model1ccd)
summary(bp_test)
print(bp_test)
# 3. Normality assumption
qqPlot(residualsmodelA, main = "Normal Q-Q Plot")
# Create histogram for SDG1
hist(residualsmodelA, breaks = 15, col = "lightgreen", main = "Histogram of Res")
# Shapiro-Wilk test for normality
shapiro_test <- shapiro.test(residualsmodelA)
summary(shapiro_test)
print(shapiro_test)
# 4. Independence assumption
durbinWatsonTest(modelA)
# 5. Multicollinearity assumption
vif(modelA)
#CREATE NEW VARIABLE AGE
newdf$age <- newdf$`Q3 Age`
#RUN MODERATION ANALYSIS -> HYPOTHESIS 2.1
model1ccdage <- lm(HAM~CCD*age,data = newdf)
summary(model1ccdage)
residualsmodel1ccdage <- residuals(model1ccdage)
hist(residualsmodel1ccdage)
plot(model1ccdage)
#CHANGE model1ccdage to GLM
GLMccdage <- glm(HAM ~ CCD*age, data = newdf, family = Gamma(link = "log"))
confint(GLMccdage, level = 0.95)
summary(GLMccdage)
#CHANGE MODEL TO GLM
GLM1ccd <- glm(HAM ~ CCD, data = newdf, family = Gamma(link = "log"))
summary(GLM1ccd)
confint(GLM1ccd, level = 0.95)
#CHECK ASSUMPTIONS VIA PLOTS
plot(modelA)
plot(model2ds)
plot(modelC)
plot(model1ccd)
#CHECK NORMALITY OF RESIDUALS
#CREATE NEW MODEL DS AND AGE
#MODEL A

```

```

modelA <- lm(DS~age,data = newdf)
residualsmodelA <- residuals(modelA)
ggplot() +
  geom_histogram(aes(x = residualsmodelA), fill = "steelblue", color = "white", bins = 10) +
  labs(title = "Histogram of Residuals",
        x = "Residuals",
        y = "Frequency") +
  theme_minimal() +
  theme(text = element_text(family = "Arial"),
        plot.title = element_text(size = 16, face = "bold"),
        axis.title = element_text(size = 12),
        axis.text = element_text(size = 10))
#CHECK ASSUMPTIONS NEW TESTS MODEL A
# Harvey-Collier test for linearity on UNC
harv_test <- harvtest(modelA, data=newdf)
summary(harv_test)
# Print the test results: not significant thus linearity confirmed
print(harv_test)
# 2. Homoscedasticity assumption -> assumption met
plot(modelA, which = 1)
# Breusch-Pagan test for homoscedasticity
bp_test <- bptest(modelA)
summary(bp_test)
print(bp_test)
# 3. Normality assumption
qqPlot(residualsmodelA, main = "Normal Q-Q Plot")
# Create histogram for SDG1
hist(residualsmodelA, breaks = 15, col = "lightgreen", main = "Histogram of Res")
# Shapiro-Wilk test for normality
shapiro_test <- shapiro.test(residualsmodelA)
summary(shapiro_test)
print(shapiro_test)
# 4. Independence assumption
durbinWatsonTest(modelA)
# 5. Multicollinearity assumption
vif(modelA)
#CREATE NEW MODEL CCD AND AGE
#MODEL C
modelC <- lm(CCD~age,data = newdf)
residualsmodelC <- residuals(modelC)
ggplot() +
  geom_histogram(aes(x = residualsmodelC), fill = "steelblue", color = "white", bins = 10) +
  labs(title = "Histogram of Residuals",
        x = "Residuals",
        y = "Frequency") +
  theme_minimal() +
  theme(text = element_text(family = "Arial"),
        plot.title = element_text(size = 16, face = "bold"),
        axis.title = element_text(size = 12),
        axis.text = element_text(size = 10))
#CHECK ASSUMPTIONS NEW TESTS MODEL C

```

```

# Harvey-Collier test for linearity on UNC
harv_test <- harvtest(modelC, data=newdf)
summary(harv_test)
# Print the test results: not significant thus linearity confirmed
print(harv_test)
# 2. Homoscedasticity assumption -> assumption met
plot(modelA, which = 1)
# Breusch-Pagan test for homoscedasticity
bp_test <- bptest(modelC)
summary(bp_test)
print(bp_test)
# 3. Normality assumption
qqPlot(residualsmodelA, main = "Normal Q-Q Plot")
# Create histogram for SDG1
hist(residualsmodelA, breaks = 15, col = "lightgreen", main = "Histogram of Res")
# Shapiro-Wilk test for normality
shapiro_test <- shapiro.test(residualsmodelA)
summary(shapiro_test)
print(shapiro_test)
# 4. Independence assumption
durbinWatsonTest(modelA)
# 5. Multicollinearity assumption
vif(modelA)
#CHECK NORMALITY OF RESIDUALS
residualsmodelA <- residuals(modelA)
hist(residualsmodelA)
skewness(residualsmodelA)
residualsmodelC <- residuals(modelC)
hist(residualsmodelC)
skewness(residualsmodelC)
hist(residualsccd)
skewness(residualsccd)
residualsccdage <- residuals(model1ccdage)
hist(residualsccdage)
residualsds <- residuals(model2ds)
hist(residualsds)
skewness(residualsds)
residualsdsage <- residuals(model2dsage)
hist(residualsdsage)
#CORRELATIONS
cor.test(newdf$DS,newdf$`Q3 Age`)
cor.test(newdf$HAM,newdf$`Q3 Age`)
cor.test(newdf$CCD,newdf$HAM)
#CHECK ASSUMPTION INDEPENDENCE
install.packages("zoo")
install.packages("lmtest")
library(lmtest)
dwtest(model1ccd)
#CREATE NEW VARIABLE DS
newdf$DS <-
(newdf$DS_Q1+newdf$DS_Q2+newdf$DS_Q3+newdf$DS_Q4+newdf$DS_Q5+newdf$DS

```

```

_Q6+newdf$DS_Q7+newdf$DS_Q8+newdf$DS_Q9+newdf$DS_Q10+newdf$DS_Q11+ne
wdf$DS_Q12+newdf$DS_Q13+newdf$DS_Q14+newdf$DS_Q15)/15
#RUN REGRESSION MODEL DS+HAM -> HYPOTHESIS 1.2
model2ds <- lm(HAM~DS,data = newdf)
summary(model2ds)
residualsmodel2ds <- residuals(model2ds)
ggplot() +
  geom_histogram(aes(x = residualsmodel2ds, fill = "steelblue", color = "white", bins = 10) +
  labs(title = "Histogram of Residuals",
    x = "Residuals",
    y = "Frequency") +
  theme_minimal() +
  theme(text = element_text(family = "Arial"),
    plot.title = element_text(size = 16, face = "bold"),
    axis.title = element_text(size = 12),
    axis.text = element_text(size = 10))
plot(model2ds)
#RUN MODERATION ANALYSIS -> HYPOTHESIS 2.2
model2dsage <- lm(HAM~DS*age,data = newdf)
summary(model2dsage)
residualsmodel2dsage <- residuals(model2dsage)
hist(residualsmodel2dsage)
plot(model2dsage)
#CHECK ASSUMPTIONS NEW TESTS MODEL B
# Harvey-Collier test for linearity on UNC
harv_test <- harvtest(model2ds, data=newdf)
summary(harv_test)
# Print the test results: not significant thus linearity confirmed
print(harv_test)
# 2. Homoscedasticity assumption -> assumption met
plot(modelA, which = 1)
# Breusch-Pagan test for homoscedasticity
bp_test <- bptest(model2ds)
summary(bp_test)
print(bp_test)
# 3. Normality assumption
qqPlot(residualsmodelA, main = "Normal Q-Q Plot")
# Create histogram for SDG1
hist(residualsmodelA, breaks = 15, col = "lightgreen", main = "Histogram of Res")
# Shapiro-Wilk test for normality
shapiro_test <- shapiro.test(residualsmodelA)
summary(shapiro_test)
print(shapiro_test)
# 4. Independence assumption
durbinWatsonTest(modelA)
# 5. Multicollinearity assumption
vif(modelA)
#DESCRIPTIVE STATISTICS
summary(newdf$CCD)
summary(newdf$DS)
summary(newdf$HAM)

```

```
sd(newdf$DS)
sd(newdf$CCD)
sd(newdf$HAM, na.rm = TRUE)
install.packages("moments")
install.packages("e1071")
skewness(newdf$HAM, na.rm = TRUE)
skewness(newdf$DS, na.rm = TRUE)
skewness(newdf$CCD)
#HYPOTHESIS TESTING WITH GENERALIZED LINEAR MODELS
#hypothesis 1 DS and HAM
GLM1 <- glm(HAM~DS,data = newdf, Gamma(link = "log"))
summary(GLM1)
confint(GLM1, level = 0.95)
#hypothesis 2 CCD and HAM
GLM2 <- glm(HAM~CCD,data = newdf, Gamma(link = "log"))
summary(GLM2)
confint(GLM2, level = 0.95)
#Hypothesis 3 DS and Ham * Age
GLM3 <- glm(HAM~DS*age,data = newdf, Gamma(link = "log"))
summary(GLM3)
confint(GLM3, level = 0.95)
#Hypothesis 4 CCD and Ham * Age
GLM4 <- glm(HAM~CCD*age,data = newdf, Gamma(link = "log"))
summary(GLM4)
confint(GLM4, level = 0.95)
#HYPOTHESIS 2 - IS MODERATION EFFECT STRONGER FOR YOUNGER
INDIVIDUALS
interaction.plot(newdf$age, newdf$DS, newdf$HAM, xlab = "Age", ylab = "HAM", legend =
TRUE)
interaction.plot(newdf$age, newdf$CCD, newdf$HAM, xlab = "Age", ylab = "HAM", legend
= TRUE)
```