Ph.D. thesis

Determinants of young people's responses to risk information: The role of personality, perceived life stress and message characteristics

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ABBREVIATIONS

BMI	Body Mass Index
FFM	Five Factor Model
ISIS	Islamic State of Iraq and Syria
PA	Physical activity
PSS	Perceived Stress Scale
T2D	Type 2 diabetes
TIPI	Ten Item Personality Inventory

LIST OF PAPERS

The present Ph.D. project is based on the following papers.

Paper 1

Skøt, L., Nielsen, J. B., & Leppin, A. (2018). Who perceives a higher personal risk of developing type 2 diabetes? A cross-sectional study on associations between personality traits, health-related behaviours and perceptions of susceptibility among university students in Denmark. *BMC Public Health, 18*(1), 972. doi:10.1186/s12889-018-5884-9

Paper 2

Skøt, L., Nielsen, J. B., & Leppin, A. Does psychological stress influence young adults' behavioural responses to gain- vs. loss-framed messeages promoting type 2 diabetes prevention? *2nd submission is in progress.*

Paper 3

Skøt, L., Nielsen, J. B., & Leppin, A. Risk perception and support for security measures: Interactive effects of media exposure to terrorism and psychological stress? *Journal of Risk Research,* https://doi.org/10.1080/13669877.2020.1750460

SUMMARY

Background

This Ph.D. project focuses on two major, but quite different public health threats: type 2 diabetes (T2D) and terrorism. Despite decades of research on what determines people's responses to
(health-) threatening messages, many knowledge gaps have remained regarding the relevance of message characteristics on the one hand and recipient/target group characteristics on the other.

Aims

The purpose of this Ph.D. project was to examine the role of specific determinants of young adults' responses to two types of threats, i.e. T2D and terrorism. Three papers are included in this thesis, which aimed to investigate:

1. direct associations between personality traits and perceived susceptibility to T2D as well as indirect pathways mediated via body mass index (BMI) and T2D-related behaviours (paper 1);
2. whether perceived life stress impacts behavioral responses to gain- vs. loss-framed health messages promoting T2D prevention (paper 2);
3. whether perceived life stress impacts cognitive and emotional responses to media exposure about a terrorism event vs. non-terrorism-related content (paper 3).

Methods

Two web-based experimental studies were conducted. Participants in both studies were university students in Denmark. In the first study, participants were recruited by sending an email to study directors at the targeted universities asking if they could forward a study announcement to students via email or upload it on E-learn, social media (Facebook, Twitter) or other relevant student platforms. The same method of recruitment was used in the second study, along with distribution of flyers in classrooms and on campus.

Study 1: Participants completed a baseline survey, after which they were randomly assigned to one of three groups (risk information only, gain-framed message, or loss-framed message). The 'risk- information-only' group was presented with information about T2D risk in young adults. The same risk information was presented to the other two groups. In addition, these

two groups received a message emphasizing either the health benefits of adopting three recommended actions (gain frame) or the health costs of failing to adopt them (loss frame). Participants also filled out a survey immediately after the intervention and at 3-months follow-up. Sociodemographic factors (age, sex, parental education and parental birthplace[1]), family history of T2D, T2D-related behaviours (physical activity [PA], consumption of sugar-rich foods and beverages and T2D screening), perceived susceptibility to T2D, Five Factor Model (FFM) personality traits (openness, conscientiousness, extraversion, agreeableness and emotional stability) and perceived life stress were assessed at baseline. A manipulation check was carried out at post-intervention, and participants also provided information about their height and weight (used to calculate BMI). T2D-related behaviours were again assessed at follow-up.

Study 2: Participants completed a baseline survey, after which they were randomly assigned to a terrorism or non-terrorism media exposure group. They were subsequently invited to attend an experimental session. At the session, participants in the terrorism media exposure group watched a real-life news clip about a recent terrorist event (London Bridge attack, 2017). The non-terrorism media exposure group watched a real-life news clip about a non-violent societal risk (robot revolution). Participants filled out a survey immediately before and after the intervention. Sociodemographic factors (age, sex, parental education and parental birthplace) and perceived life stress were assessed at baseline. A manipulation check was performed at post-intervention. Perceived susceptibility to terrorism, terrorism-related worry, and support for security measures against terrorism were assessed at pre- and post-intervention.

Results

Paper 1: The final sample included participants in study 1 who provided complete baseline data (n = 1205). A hierarchical multiple regression analysis showed that among the personality factors both conscientiousness and emotional stability were directly negatively associated with perceived susceptibility to T2D, after controlling for sociodemographic factors, family history of T2D, T2D-related behaviours (combined moderate and vigorous PA, sweets consumption and prior T2D screening) and BMI. Further, a series of binary logistic regression analyses, controlling for sociodemographic factors and family history of T2D, revealed that conscientiousness was associated with PA and BMI, extraversion with PA

[1] In Denmark or outside the country

and sweets consumption, emotional stability with PA, and openness with BMI and prior T2D screening. Sobel tests were conducted to test the significance of mediation effects. These tests revealed that conscientiousness was indirectly negatively associated with perceived susceptibility to T2D via PA and BMI. Furthermore, extraversion was indirectly negatively associated with perceived susceptibility to T2D via PA.

Paper 2: The final sample included participants allocated to the gain and loss frame groups in study 1 who provided complete data at baseline, immediately after the intervention and at 3-months follow-up (n = 645). Data were analyzed using binary logistic regression, controlling for sociodemographic factors, family history of T2D, BMI and baseline T2D-related behaviours. At follow-up, gain framing was associated with more frequent vigorous PA and less frequent sugary soda consumption. Furthermore, higher levels of perceived life stress were associated with less frequent vigorous PA as well as more frequent consumption of sweets and processed fruit juice. Subgroup analyses revealed that the effects of message framing did not differ as a function of perceived stress level (low vs. high).

Paper 3: The final sample included participants in study 2 who provided complete data at baseline as well as immediately before and after the intervention (n = 94). Data were analyzed using a series of two-way analyses of covariance (ANCOVA). All the models controlled for pre-test scores on the relevant outcome. In addition, the model for perceived susceptibility to terrorism controlled for sex and parental education, and the models for terrorism-related worry and support for security patrols at universities during the day controlled for sex. Neither media exposure nor perceived life stress alone affected post-test levels of perceived susceptibility to terrorism, terrorism-related worry or support for security measures. However, significant interaction effects were found between media exposure and perceived life stress on post-test levels of support for video surveillance, support for mandatory bag checks at universities as well as support for security patrols at universities during the day. Participants with lower levels of life stress scored similarly on these measures in the terrorism and non-terrorism media exposure groups, whereas among participants with higher stress levels, demand for security measures was greater in the terrorism than non-terrorism media exposure group.

Conclusions

Paper 1: The findings demonstrate the utility of FFM personality traits in understanding T2D risk perception among young adults.

Paper 2: The findings suggest that both perceived life stress and message characteristics (gain vs. loss frame of T2D risk messages) influence T2D-related behaviors in young adults. However, the absence of a moderator effect indicates that reactions to differently framed messages do not depend on prior levels of general life stress.

Paper 3: Young adults with elevated levels of perceived life stress are more responsive to terrorism-related media coverage than those with lesser life stress when it comes to a desire for security measures against terrorism. This suggests that higher levels of general life stress may sensitize young people towards the impact of threatening information.

SAMMENFATNING (Danish summary)

Baggrund

Dette Phd projekt fokuserer på to store, men meget forskellige trusler mod folkesundheden: type 2 diabetes (T2D) og terrorisme. På trods af at forskningen i årtier har undersøgt, hvad der er afgørende for folks reaktioner på (sundheds-) truende budskaber, er der fortsat manglende viden om relevansen af budskabernes karakter på den ene side og modtager/målgruppens egenskaber på den anden side.

Mål

Formålet med dette Ph.D.-projekt var at undersøge, hvilken rolle specifikke determinanter spiller for unge voksnes reaktioner på to typer trusler, T2D og terrorisme. Denne afhandling består af tre artikler, med det formål at undersøge:

1. om der er direkte sammenhænge mellem personlighedstræk og opfattet sårbarhed for T2D samt indirekte sammenhænge medieret via kropsmasse indeks og T2D relateret adfærd (artikel 1);
2. om opfattet livsstress påvirker adfærdsmæssige reaktioner på gevinst- versus tabs-betonede sundhedsbudskaber, der fremmer T2D forebyggelse (artikel 2);
3. om opfattet livsstress påvirker kognitive og følelsesmæssige reaktioner på medieeksponering ved en terrorbegivenhed versus ikke-terror relateret indhold (artikel 3).

Metoder

Der blev gennemført to webbaserede eksperimentelle undersøgelser. Deltagerne i begge studier var universitetsstuderende i Danmark. I den første undersøgelse blev deltagerne rekrutteret ved at sende en e-mail til studieledere på de universiteter, undersøgelsen var rettet mod, hvor der blev spurgt til, om de kunne videresende en annonce vedrørende undersøgelsen til de studerende via e-mail eller uploade den på E-Learn, sociale medier (Facebook, Twitter) eller andre relevante platforme. Den samme rekrutteringsmetode blev brugt i den anden undersøgelse, samt distribution af flyers i undervisningslokaler og på campusområde.

Undersøgelse 1: Deltagerne udfyldte et baseline spørgeskema, hvorefter de blev randomiseret til en af tre grupper (kun risikoinformation, gevinst-betonet sundhedsbudskab, eller tabs-

betonet sundhedsbudskab). Ved risikoinformation gruppen blev de studerende præsenteret for information om T2D risiko hos unge voksne. Den samme risikooplysning blev præsenteret for de to øvrige grupper. Derudover modtog disse to grupper et budskab, der betonede enten sundhedsfordelene ved at udøve tre anbefalede handlinger (gevinst-betonet sundhedsbudskab) eller sundhedsomkostningerne ved ikke at udøve dem (tabs-betonet sundhedsbudskab). Deltagerne udfyldte også et spørgeskema lige efter interventionen samt ved tre måneders opfølgning. Sociodemografiske faktorer (alder, køn, forældres uddannelse og forældres fødested[2]), familiær disposition til T2D, T2D-relateret adfærd (fysisk aktivitet, indtagelse af sukkerholdige fødevarer og T2D-screening), opfattet sårbarhed for T2D, Fem-Faktor Modellens (FFM) personlighedstræk (åbenhed, samvittighedsfuldhed, ekstroversion, venlighed og følelsesmæssig stabilitet) og opfattet livsstress blev indsamlet ved baseline. Et manipulationstjek blev udført efter interventionen, og deltagerne gav oplysninger om deres højde og vægt (blev brugt til at beregne kropsmasse indeks). Den T2D-relaterede adfærd blev vurderet igen ved tre måneders opfølgning.

Undersøgelse 2: Deltagerne udfyldte et baseline spørgeskema, hvorefter de blev randomiseret til at deltage i en terrorisme- eller ikke-terrorisme medie-eksponeringsgruppe. De blev efterfølgende inviteret til at deltage i en eksperimentel session. Ved denne session så deltagerne i terrorisme medie-eksponeringsgruppen et ægte nyhedsklip om en nylig terror begivenhed (London Bridge angrebet i 2017), og deltagerne i ikke-terrorisme medie-eksponeringsgruppen så et ægte nyhedsklip af en ikke voldelig samfundsmæssig risiko (robotrevolution). Deltagerne udfyldte et spørgeskema umiddelbart før og efter interventionen. Sociodemografiske faktorer (alder, køn, forældres uddannelse og forældres fødested) og opfattet livsstress blev vurderet ved baseline. Et manipulationstjek blev udført efter interventionen. Opfattet sårbarhed for terrorisme, terrorrelateret bekymring og efterspørgsel efter sikkerhedsforanstaltninger mod terrorisme blev vurderet inden og efter interventionen.

Resultater

Artikel 1: Den endelige stikprøve inkluderede respondenter i første undersøgelse, der gav komplette baseline data (n = 1205). En hierarkisk multiple regressionsanalyse viste, at blandt personlighedsfaktorerne var både samvittighedsfuldhed og følelsesmæssig stabilitet direkte negativt forbundet med opfattet sårbarhed for T2D efter justering for sociodemografiske

[2] I Denmark eller uden for landet

faktorer, familiær disposition til T2D, T2D-relateret adfærd (kombineret moderat og hård fysisk aktivitet, slikforbrug og forudgående T2D screening) og kropsmasse indeks. Endvidere afslørede en række binære logistiske regressionsanalyser, der justerede for sociodemografiske faktorer og familiær disposition til T2D, at samvittighedsfuldhed var forbundet med fysisk aktivitet og kropsmasse indeks, ekstroversion med fysisk aktivitet og slikforbrug, følelsesmæssig stabilitet med fysisk aktivitet, og åbenhed med kropsmasse indeks og forudgående T2D screening. Sobel tests blev udført for at teste om mediation effekter var signifikante. Disse tests afslørede, at samvittighedsfuldhed var indirekte negativt associeret med opfattet sårbarhed overfor T2D via fysisk aktivitet og BMI. Endvidere var ekstroversion indirekte negativt associeret med opfattet sårbarhed overfor T2D via fysisk aktivitet.

Artikel 2: Den endelige stikprøve indeholdte de respondenter, der var allokeret til enten den gevinst-eller tabs-betonede sundhedsbudskabsgruppe i den første undersøgelse, og som gav komplette data ved baseline, lige efter interventionen samt tre måneders opfølgning (n = 645). Data blev analyseret ved hjælp af binær logistisk regression, justeret for sociodemografiske faktorer, familiær disposition til T2D, kropsmasse indeks og baseline T2D-relateret adfærd. Gevinst-betoning var, ved opfølgning, forbundet med hyppigere hård fysisk aktivitet og mindre hyppigt sukkerholdigt sodavandbrug. Desuden var højere niveau af opfattet livsstress forbundet med mindre hyppigt hård fysisk aktivitet, og hyppigere forbrug af slik og forarbejdet frugtjuice. Analyser af undergrupper viste, at effekten af den måde budskaberne blev betonet, ikke afveg som en funktion af det opfattede stressniveau (lavt versus højt).

Artikel 3: Den endelige stikprøve inkluderede deltagere fra studie 2, som gav komplette data ved baseline samt lige inden og efter interventionen (n = 94). Data blev analyseret af en række to-vejs analyser af kovarians (ANCOVA). Alle modellerne blev justeret for præ-test scorer på den relevante udfaldsmål. Desuden blev modellen for opfattet sårbarhed for terrorisme justeret for køn og forældres uddannelse, og modellerne for terrorrelateret bekymring og efterspørgsel efter sikkerhedsvagter på universiteter i dagtimerne blev justeret for køn. Hverken medie eksponering eller opfattet livsstress påvirkede post-test scorer på opfattet sårbarhed for terrorisme, terrorrelateret bekymring eller efterspørgsel efter sikkerhedsforanstaltninger. Der var en signifikant interaktionseffekt mellem medie-eksponering og opfattet livsstress på post-test scorer på efterspørgsel efter videoovervågning, efterspørgsel efter obligatoriske visitation af tasker på universiteter samt efterspørgsel efter sikkerhedsvagter på universiteter i dagtimerne. Deltagere med et lavere niveau af livsstress

havde en tilsvarende score i disse tre mål i både terrorisme og ikke terrorisme medie-eksponerings gruppen, hvorimod deltagere med et højere niveau af livsstress havde en større efterspørgsel efter sikkerhedsforanstaltninger end i ikke-terrorisme medie-eksponeringsgruppen.

Konklusioner

Artikel 1: Fundene viser anvendeligheden af FFM personlighedstræk i forståelsen af T2D-risikoopfattelse blandt unge voksne.

Artikel 2: Fundene indikerer, at både opfattet livsstress og budskabets karakter (gevinst- vs. tabs-betonet sundhedsbudskab) påvirker T2D-relateret adfærd hos unge voksne. Dog indikerer fraværet af en moderator-effekt, at reaktioner på budskaberne ikke afhænger af forudgående niveau af general livsstress.

Artikel 3: Unge voksne med forhøjet niveau af opfattet livsstress er mere sårbare over for terrorrelateret mediedækning end dem med mindre livsstress, i forhold til et ønske om sikkerhedsforanstaltninger i terrorisme. Dette tyder på, at højere niveau af general livsstress kan gøre de unge mere sårbare (sensitive) overfor påvirkningen af truende information.

1. GENERAL INTRODUCTION

Why focus on young people's reactions to the threats of T2D and terrorism? T2D is becoming more common in young adults [1]. However, perceptions of T2D risk tend to be low in this group [2-5]. What has been a major concern in recent years among adults of all ages across Europe on the other hand are terrorist attacks – as shown by opinion polls across Europe and North America [6, 7]. While there actually has been an increase in the number of terrorist attacks in Europe, the likelihood of an individual becoming the victim of a terrorist attack is extremely small. In fact, statistically speaking, the chances of an individual developing T2D are much higher than being harmed in a terrorist attack, so why do perceptions of T2D and terrorism not reflect this?

Several decades of research have been devoted to investigating factors that determine people's responses to risk and information about risk. Early on, Slovic et al. with their 'psychometric paradigm' showed that lay people's perceptions of hazards differ greatly from those of experts. While experts view risks as the likelihood of harm based on mortality estimates, lay perceptions of risk are far more subjective and linked to specific qualitative features of hazards, in particular the two dimensions labelled as "dread risk" and "unknown risk" [8]. Seen from the perspective of this framework, lay people's perceptions of terrorism risk fill the criteria for high dread, defined by involuntariness, dread, catastrophic potential, fatal consequences as well as inequitable distribution of risks and benefits among other characteristics. Conversely, high dread does not typically characterize people's perceptions of lifestyle-related health risks, such as food intake or sedentariness, since these are mostly considered voluntary and controllable as well as comparatively well-known [9].

The psychometric paradigm challenged the notion that people base their judgements on purely rational deliberation of likelihoods, as did another approach trying to explain decision-making processes: Prospect Theory [10, 11]. With this theory, Tversky and Kahneman proposed among other things that under conditions of uncertainty people make choices based on values assigned to potential gains and losses and that they tend to assign higher weights to losses than gains, i.e. are generally loss-averse. Further work by Tversky and Kahneman has shown that people often use heuristics (mental short cuts) when making judgements and decisions as well as evaluating gains and losses. Perhaps the most prominent among those "rules of thumb" is the "availability heuristic" [12], which describes the phenomenon that people tend to rely on vivid examples that immediately come to mind when making

judgements about the likelihood of risks. Types of risks which are thus easily recalled because they have featured prominently in the mass media tend to be overestimated in terms of likelihood of occurrence.

More recently, Slovic et al. have proposed an "affect heuristic" [13] which guides decision making and risk evaluation, and in a similar vein Loewenstein et al. put forward the "risk as feelings" concept [14]. With these approaches, it has been suggested that people's judgments and decisions are not only or even mainly based on rational deliberations but rather on emotional processes. In other words, people may evaluate risk information based on their gut feelings [15]. They do this, as Slovic et al. have termed it by tapping into an "affect pool" of mental images and pictures related to the specific risk [13].

At present, there is general consensus that emotional processes are critical in risk perception as well as risk reactions. Thus, to be effective, risk communications need to not only target people's cognitions about risks, in particular their knowledge, but also the emotions related to them. However, the extent to which emotional processes are triggered may vary and depend on message characteristics on the one hand and underlying differential vulnerabilities on the other. As for the relevance of message characteristics for risk communication effects, prior research has particularly focused on factors influencing people's reactions to gain vs. loss framed health messages. Gain-framed messages emphasize the health benefits of adopting a recommended action, whereas loss-framed messages emphasize the health costs of not adopting the action.

Responses to a risk message are also likely to depend on characteristics of the recipient and the situational circumstances this person finds herself/himself in. One factor that so far has been mostly overlooked as a potential determinant of T2D risk perception is personality. Within psychology, personality is understood as being made up of stable traits that are unique to the individual [16]. Such traits are believed to affect people's behavioral choices and patterns across different situations. Prior research has documented associations between personality traits and perceptions of lifestyle-related health risks, such as lung cancer, alcohol dependency and venereal disease/AIDS [17]. Furthermore, personality traits have been linked to lifestyle factors, such as PA, dietary behaviour and overweight/obesity [18-21]. Thus, it might be expected that personality traits would be indirectly related to T2D risk perception via related health behaviours.

Beyond dispositional factors, the situational context a person finds him/herself in as well as person-environment transactions, that is, the specific way a person in general deals with environmental demands, might be relevant for how that person reacts to risks and specific risk messages in that he/she may be differentially sensitized and responsive towards risk information in comparison to other individuals. In line with this assumption, it has been shown that persons with high dispositional anxiety or anxiety disorder seem to be more likely to detect and process threat-related information [22]. Related to this, early experimental research by Bower on the role of emotion in information processing pointed out that people are sensitized towards information that is congruent with their current mood states [23-25]. Another factor in this context which, similar to anxiety, might specifically attune people towards threats to health and well-being, is perceived life stress. This could be of particular relevance since, particularly among young adults, stress seems to be on the rise. A recent nationwide study in Denmark, for instance, has shown that the prevalence of perceived stress among Danes aged 16 or over has increased by 4.3 percentage points in the period 2010-2017, and that young women aged 16 to 24 years were particularly affected [26]. However, research has yet to investigate the question of whether people with higher and lower levels of life stress differ in their responses to risk messages.

The above-mentioned gaps in knowledge are what have driven this Ph.D. project. Do personality traits play a role in determining T2D risk perception among young adults? Does perceived life stress influence young adults responses to (a) framed messages targeting T2D prevention and (b) media coverage of terrorism? These are the research questions that were addressed. Sections 2 and 3 describe the background for this Ph.D. project in more detail.

2. BACKGROUND: STUDY 1

2.1. Introduction to T2D

T2D is a chronic disease that occurs when the body can no longer effectively use insulin, a hormone made by the pancreas that absorbs glucose into cells for use as energy. This leads to a buildup of glucose in the bloodstream, known as hyperglycemia [27]. T2D has been linked with overweight and obesity, unhealthy diet, physical inactivity, prediabetes or impaired glucose tolerance, smoking and past history of gestational diabetes. These factors are all related to lifestyle and hence modifiable. Non-modifiable factors associated with T2D risk include older age, ethnicity and family history of T2D [27]. If left undiagnosed or untreated, T2D can have severe consequences for health and quality of life. Possible long-term physical consequences include coronary heart disease, kidney failure, leg amputation, vision loss, and nerve damage. The disease can increase the overall risk of dying prematurely. Furthermore, poorly controlled diabetes in pregnancy increases the risk of various complications, including fetal death [28].

T2D poses a major threat to public health in the 21st Century. The prevalence of T2D among adults in Europe alone has risen from 4.9% in 2000 to 8.8% in 2017 [27, 29]. The latest figures from the Danish Diabetes Association indicate that as of the start of 2017, there was approximately 260,750 people with diabetes (primarily T2D) in Denmark, corresponding to 4.5% of the population. This is more than twice the number in 2000 [30]. By 2030, the number of people with T2D in Denmark is expected to reach 430,000 [31]. Diabetes costs Danish society about 31.8 billion kroner a year [32].

Most people affected by T2D are middle-aged or elderly, but this does not mean that younger adults should not be targeted for preventive intervention. The rise in T2D is clearly associated with modifiable behavioural habits, such as increased consumption of energy-dense foods as well as sedentary lifestyles [28]. These habits are usually established and stabilized long before the onset of diabetic symptoms, i.e. in adolescence and young adulthood [1], and, therefore, early prevention is particularly important for T2D, as it is for many lifestyle diseases, such as cardiovascular disease.

In addition to this, recent developments indicate that T2D is becoming more common among young adults. Based on data from the International Diabetes Federation, it has been estimated that the percentage of young adults (aged 20-39 years) with T2D has risen from 13% to 16%

worldwide from 2000 to 2013 [1]. While this development seems most striking in the developing world, this trend has also been observed in industrialized Western countries. In the US, prevalence rates among 20-44 year olds have risen from 2.7% during the period 1988-2004 to 4.5% in 2011/2012 [33]. Furthermore, an increase in the incidence of T2D has been found in some European countries, such as the UK where the standardized incidence ratio for individuals under 40 years old was 598 per 100.000 in 2006-10 as compared to 217 in 1996-2000 [34]. Early onset T2D results in longer life course exposure to hyperglycemia and its potential consequences [1]. Furthermore, T2D is a more aggressive disease when it occurs at a younger age [1, 35]. For these reasons, T2D prevention efforts should consider involving younger adults, and efforts could start by raising awareness of the problem in this target group.

Communication about health risks is a major part of public health as well as medical practice. T2D risk communication is difficult when it comes to young people, since many in this group might simply not believe that such messages apply to them and as a result they may show little interest in or motivation for seriously considering the message content. However, as pointed out by influential health behaviour theories, such as the Health Belief Model [36] and Protection Motivation Theory [37], failure to recognize one's own health risks is likely to prevent the adoption of necessary protective behaviours. Research from the US has shown that there is a tendency among students to perceive a higher T2D risk for their peers than for themselves [2, 3, 5], and this tendency has been linked to lower levels of perceived susceptibility to T2D in this group [4]. This is concerning because – as mentioned above – this lack of awareness can lead to inactivity. To develop effective communications, it is therefore important to identify the factors that determine young adults' perceptions of T2D risk. Research is scarce in this area. Prior studies conducted on US college students have focused on the role of sociodemographic and medical risk factors, such as age, sex, birthplace, race/ethnicity, income, family history of T2D, pre-diabetes, awareness of blood glucose level and overweight/obesity – as well as perceptions about the causes of diabetes – for T2D risk perception [2, 3, 38, 39]. Of these factors, only family history of T2D has emerged as a consistent predictor [3, 38].

At present, even less is known about the role of psychological factors in this context. For example, it could be supposed that people's personality traits may have an have an impact on how they perceive personal health risks, not at least because personality traits also govern the choice of health-promoting or risky behaviors, such as smoking, alcohol consumption, PA

and healthy/unhealthy eating habits [18, 19, 40-43]. Research has yet to address potential relationships between personality traits and T2D risk perception. Thus, the focus of paper 1 was on examining the possible role of personality in T2D risk perception among young adults**.** Further background information is presented in section 2.2. Paper 1.

Furthermore, an important consideration in the communication of T2D risk is how the behavioural recommendations in messages are framed. Goal framing is frequently used in health persuasion. In goal framing, it is not the health behaviour itself that is framed, but rather its potential to provide a benefit (gain frame), or its potential to provide a loss (loss frame) [44]. No dominance of one approach can be claimed but generally message effectiveness may depend on moderating factors, including contextual and stable individual difference variables [45, 46]. To date, little evidence exists of how prior emotional states might interact with message framing. How young adults react to framed health messages might depend on the level at which they perceive their lives as stressful, independent of the threat targeted in the message. Stress is a common problem among young adults in Western countries [26, 47-49] and it has been linked to T2D-related behaviours, such as unhealthy eating and lack of PA, in this group [50-56]. Furthermore, there is evidence to suggest that such behaviours may more or less be intentionally used by young adults to cope with stress [57, 58]. However, there have been no studies examining whether people with low and high levels of perceived life stress differ in their responses to framed health messages. Therefore, the focus of paper 2 was on examining the impact of prior levels of perceived life stress on young adults' behavioural responses to gain- vs. loss-framed messages promoting T2D prevention. Further background information is presented in section 2.3. Paper 2.

2.2. Paper 1:

2.2.1. T2D risk perception in young adults

To date, few studies have investigated T2D risk perception in young adults, most of which are studies on US college students. Some studies have examined how students perceive their risk of developing T2D compared to their peers (comparative risk perception). Sealey-Potts and Reyes-Velazquez [5] found that significantly more participants (68%) perceived their peers to be at risk for developing T2D as compared to themselves (23%). Mongiello et al. [3] identified participants with three or more risk factors for T2D and found that 39% perceived themselves to be less likely to develop T2D than others. These individuals were subsequently characterized as underestimators as opposed to realistic estimators. Similarly, Amuta et al. [2]

found that 33% of overweight/obese participants perceived themselves to be at much lower or slightly lower T2D risk compared to people their age, which likely indicates an underestimation of actual risk. These findings suggest that there is a tendency among students to have an optimistic bias towards developing T2D. Furthermore, optimistic bias about T2D risk has been linked to lower levels of perceived lifetime susceptibility to T2D [4].

2.2.2. Factors associated with T2D risk perception in young adults

Little is known yet about potential determinants of young adults' perceptions of T2D risk. The above-mentioned study by Amuta et al. [2] examined gender differences in T2D risk perception and found that females had significantly higher levels of perceived lifetime susceptibility to T2D than males, and higher comparative risk perception concerning T2D. Other studies conducted on US college students have assessed multiple predictors of T2D risk perception. The above-mentioned study by Mongiello et al. [3] showed that participants identified as underestimators were more likely than realistic estimators to be male, have no family history of T2D, and to be born outside the US. Age, race/ethnicity, income, college type, and BMI were not significant predictors of comparative risk perception concerning T2D. Another study found that participants who identified themselves as being part of a race/ethnicity other than non-Hispanic white, and who had a greater number of family members with T2D, were more likely to have higher levels of perceived 10-year and lifetime susceptibility to T2D compared to their counterparts. [38]. Non-significant predictors included sex, having discussed family history of T2D with parents, and perceptions about the causes of T2D (behavioural, social, genetic, and environmental). Furthermore, Seo et al. [39] found that participants who were overweight/obese, had been told they were pre-diabetic, and who did not know their blood glucose level, were more likely than their counterparts to perceive themselves as being susceptible to developing T2D, after controlling for age, race/ethnicity and having a direct family member with T2D. Overall, only family history of T2D has consistently been found to increase students' perceived risk of T2D, whereas findings regarding the other factors are ambiguous.

2.2.3. The role of personality in health risk perception

2.2.3.1 The concept of personality

Aa previously mentioned, personality is made up of stable traits that are unique to the individual [16]. These traits have been defined as "dimensions of individual differences in

tendencies to show consistent patterns of thoughts, feelings and actions" (p. 25) [16]. Currently, the most popular taxonomy for personality traits is the Five Factor Model (FFM) [59], which comprises five basic dimensions: openness to experience (closed to experiences), conscientiousness (lack of conscientiousness), extraversion (introversion), agreeableness (disagreeableness) and neuroticism (emotional stability). These traits are present in varying degrees in all people [16]. People with high openness to experience tend to be imaginative, creative, original and curious, whereas those who score low on this trait are inclined to be down-to-earth, uncreative, unconventional and uncurious. People with high conscientiousness are generally conscientious, hardworking, well organized and punctual, while low scorers on this trait are prone to being negligent, lazy, disorganized and late. People with high extraversion tend to thrive in activities that involve large social gatherings and play an active role in them. In contrast, people who are more introverted are likely to enjoy spending time alone or with close friends and play a more passive role in large social gatherings. Furthermore, they tend to be less talkative and affectionate than extraverts. People with high agreeableness are generally trusting, lenient and good-natured, whereas those who are more disagreeable have a tendency to be suspicious, critical, ruthless and irritable. Lastly, people with high neuroticism are prone to experiencing negative emotions, such as nervousness, anxiety and anger, and to be self-conscious and temperamental. On the other hand, people who are more emotionally stable are typically calm, even-tempered, comfortable and unemotional [16]

2.2.3.2. Mechanisms of influence

Personality dispositions might either directly influence risk perception or indirectly work via health-related behaviours. In the first case, people who are, for instance, less open to new experiences or less emotionally stable may be more likely to perceive threat, while people high in extraversion and sensation-seeking might feel less easily threatened. An indirect effect could occur where a differential level of risky or protective health behaviours in persons with different personality traits leads to lesser or higher levels of risk perception. Thus, for instance, people with higher levels of conscientiousness may be more likely to adhere to health recommendations and avoid unhealthy behaviours, such as alcohol consumption, and accordingly – since they are aware they have a healthier lifestyle – also have lower risk perceptions regarding cancer or coronary heart disease.

2.2.3.3. Prior research

There is some evidence to suggest that direct and/or indirect relationships may exist between personality traits and perceptions of health risks. Sjöberg [60] examined associations between FFM personality traits and personal risk perceptions of 26 hazards in a sample of college applicants in Sweden. Regarding lifestyle-related health risks, it was found that higher emotional stability and conscientiousness were associated with lower risk perception of AIDS and unhealthy dietary habits. Higher emotional stability was also associated with lower risk perception of sunrays. Another study investigated associations between FFM personality traits, risky health behaviors and perceived susceptibility to lung cancer, alcohol dependency, driving accidents and venereal disease/AIDS among university students in Switzerland [17]. The results showed that particularly conscientiousness and agreeableness were more or less consistently negatively associated with perceived susceptibility to the investigated health risks, either directly or indirectly via related health behaviors or (mostly) both.

FFM personality traits have also been shown to influence factors associated with T2D risk in diverse samples of adults. A systematic review of the literature showed that higher conscientiousness and openness were associated with healthy dietary practices [20]. Another systematic review has linked higher neuroticism and lower conscientiousness to overweight/obesity [21]. Moreover, two meta-analyses found that lower neuroticism along with higher openness, extraversion and conscientiousness were associated with increased PA [18, 19]. Thus, it is possible that these factors may represent potential mediating mechanisms affecting associations between personality traits and T2D risk perception.

Considering the available evidence linking personality traits to health risk perception and factors associated with T2D risk, it is highly relevant to examine both direct and indirect pathways from personality traits to T2D risk perception via PA, dietary behaviour and BMI among young adults. Such research could help to identify reasons for low risk perception in this target group, which may stand in the way of preventive behavioural action.

2.3. Paper 2

2.3.1. Health persuasion

Deeply ingrained within public health communications is the popular notion that people have a considerable degree of control over their health, in particular when it comes to lifestyle diseases. Rather than using the straightforward method of reporting ‘facts’ it has become

increasingly popular for health communications to contain a persuasive content, that is, they attempt to influence people to adopt a particular belief or a particular course of action. For the past three decades, a major focus of research has been on the effects of goal framing. In goal framing, health behaviour can be framed in terms of its potential to provide a benefit (gain frame) or its potential to avoid a loss (loss frame) [44]. For instance, a brochure promoting regular PA can highlight the benefits of this practice (e.g. regular exercise helps to prevent or delay T2D) or the costs of avoiding it (e.g. failing to exercise regularly increases your risk of developing T2D).When people's responses to outcome information vary depending on how it is framed, this is known as a framing effect [44]. Numerous studies over the years have focused on investigating which frame, gain or loss, has the higher persuasive impact on protective behaviour change. Findings, however, have been discrepant, and in the meantime, there is some agreement that no general dominance of one approach can be claimed but that generally message effectiveness may depend on contextual and personal variables that moderate framing effects.

2.3.1. Moderators of goal framing effects – what do we know so far?

What has mostly been investigated so far are differences in the occurrence or direction of framing effects depending on the function of the recommended health behaviour. Drawing from Prospect Theory [10, 11], Rothman and Salovey [61] proposed that gain-framed messages would be more effective in promoting behaviours that have a relatively low risk of an unpleasant outcome (e.g. help prevent the onset of a health problem) because people tend to avoid risks when considering potential gains. Conversely, loss-framed messages were argued to be more effective for promoting behaviours that involve some risk of an unpleasant outcome (e.g. may detect a health problem) because people tend to become more risk-seeking when considering potential losses.

Inspired by this reasoning, many studies have investigated the effects of gain vs. loss framing for health messages recommending either a prevention- or detection-oriented behaviour. Gallagher and Updegraff [46] set out to provide an updated meta-analysis of these studies. The results for detection-oriented behaviours showed no differential effects of message framing on behavioural responses. For prevention-oriented behaviours, a small significant gain frame advantage was found for behavioural responses, however effects were only found in the areas of skin cancer prevention, smoking cessation and PA. No effects were found for dietary and obesity-related behaviours, oral health behaviours, safe sex or vaccination

behaviours. Thus, it is evident that Rothman and Salovey's predictions cannot explain the entire pattern of results reported in this meta-analysis.

Another approach considers the extent to which individual differences moderate the impact of framed health messages, and a sizable body of research already exists in the area. In a systematic review of the literature, Covey [45] reported consistent interactions of message framing with dispositional factors, such as ambivalence, approach-avoidance, regulatory focus, need for cognition and self-efficacy beliefs. Beyond stable individual differences, a limited number of studies have examined the role of experimentally induced mood in moderating framing effects, primarily in samples of US college students [62-66]. These studies operationalized the "persuasiveness" of framed health messages as intentions to adopt the recommended behaviour and/or actual behaviour change. However, the results have been inconclusive. One study showed that gain-framed messages were most effective when matched with positive mood, whereas loss-framed messages were most effective when matched with negative mood [62]. Similarly, Yan et al. found that such effects occurred when positive mood was coupled with action-oriented behaviour and negative mood was coupled with restraint-oriented behaviour [63]. In contrast, Keller et al. [64] reported that gain- and loss-framed messages produced the most persuasive effects when participants' mood did not align with the message frame. The remaining studies failed to find an interaction between mood and message framing [65, 66]. Other work has investigated whether discrete negative emotions interact with message framing. For example, Gerend and Maner [67] experimentally induced fear vs. anger in US college students before presenting them with a gain- or loss-framed message promoting fruit and vegetable consumption. Fruit and vegetable intake was assessed two weeks after message exposure. The results revealed that participants in the fear condition were most responsive to the loss-framed message, whereas those in the anger condition reacted more strongly to the gain-framed message.

2.3.2. Why is it relevant to look at psychological stress as a moderator?

2.3.2.1. The concept of stress

According to the cognitive-mediational approach, proposed by Lazarus [68], all negatively-valenced emotions (anger, envy, jealousy, anxiety, fear, guilt, shame and sadness) are caused by psychological stress. Stress arises when a person appraises a transaction with the environment as threatening, challenging, or harmful. Such appraisals, in turn, influence the coping process and resulting emotions. Stress is particularly powerful when a person

appraises a transaction with the environment as a threat (characterized by uncertainty) that is likely to exceed his/her ability to cope, and this may lead to anxiety.

2.3.2.2. Stress in young adults

Recent research suggests that stress is a common problem in Western countries, especially among young adults. The 2017 Stress in America™ survey found that stress levels were, on average, higher among Millenials (5.7 on a scale of 1 to 10) compared to Boomers (3.9), Gen Xers (5.3), and adults over 72 years old classified as Matures (3.3) [47]. A UK survey conducted in collaboration with YouGov reported that 60% of 18- to 24-year-olds have felt so stressed by the pressure to succeed in the past year that they felt overwhelmed or unable to cope [49]. Furthermore, in a nationwide survey conducted for the Danish Health Authority [26], 25.1% of Danes aged 16 years or over reported that they had experienced high levels of perceived life stress during the previous month, as measured by the 10-item Perceived Stress Scale (PSS-10) [69]. This represents an increase of 4.3 percentage points since 2010. Young women aged 16 to 24 years were particularly affected, with 40% reporting elevated stress levels. For further information about the PSS-10 see section 5.2.6. Measures.

2.3.2.1. Relationship between stress and T2D-related behaviours

A recent narrative review reported evidence for a positive association between stress and unhealthy dietary intake as well as a negative association between stress and healthy dietary intake in diverse samples of college students [50]. Other studies have documented a negative association between self-reported vigorous PA and perceived stress in this group [51-54], a finding that has been corroborated by studies that measured PA objectively [55, 56]. One possibility is that unhealthy eating and PA constitute efforts to cope with stress, and there is some evidence to support this notion. A longitudinal, population-based study in Finland found that adults (aged 31 years) who were classified as stress-driven eaters tended to eat sausages, hamburgers, pizza and chocolate more frequently than their counterparts [58]. Furthermore, Thome and Espelage [57] administered an "exercise as coping scale" to US college students, asking how often they engaged in various types of exercise when faced with a difficult or stressful situation. Higher scores on this measure were associated with higher levels of exercise and lower levels of anxiety.

In light of the above evidence, it could be speculated that the general level of stress experienced by people might moderate the effects of health messages, that is, those with

lower and higher stress levels may react differently to health messages including different frames of such messages. On the one hand, it might be expected that the often-negative emotions accompanying stress experiences could sensitize people towards "threat information" causing them to be more inclined to attune to loss-framed messages (mood congruency). Support for this assumption comes from the previously mentioned experimental research by Bower et al. indicating that people are sensitized towards mood congruent information [23-25]. Furthermore, persons with high dispositional anxiety or anxiety disorder have been found to be more likely to detect and process threat-related information [22]. On the other hand, Rothman and Salovey [61] have suggested that message framing effects may be restricted to people who process messages in a systematical (vs. heuristic) manner, i.e. they cognitively elaborate on the message content (see Petty & Cacioppo [70]). Given that a high level of stress may interfere with cognitive processing [71, 72], highly stressed people might in general be less responsive to message framing compared to those with lower stress levels. Research examining such effects is needed as it could help inform T2D risk communications by identifying specific groups that may be more or less responsive to such communications

3. BACKGROUND: STUDY 2

3.1. Concern about terrorism and demand for security measures in Europe

Since early 2015, Europe has witnessed an increasing number of terrorist attacks at the hands of the terrorist organization Islamic State of Iraq and Syria (ISIS). France and the UK have been critical targets. Terrorist attacks have also taken place in countries such as Belgium, Denmark, Finland, Germany, Netherlands, Spain, and Sweden. As a result, the threat of terrorism has become a major concern among adults of all ages across Europe, as indicated by recent opinion polls. In 2017, the Pew Research Center [6] conducted a survey in 30 countries asking about eight possible threats – including the threat posed by ISIS. Looking across the 10 European countries surveyed, a median of 74% of the respondents (aged 18 years or older) reported that ISIS is a major threat to their country. Furthermore, ISIS was named as the top threat in six of these countries: France, Italy, Germany, UK, Netherlands and Poland. Denmark was not included in this investigation. However, the Danish Foundation – "Trygfonden", conducted a survey in 2017 inquiring into Danes' sense of security [7]. It was found that more than half (55%) of the respondents (aged 18 years or more) agreed with the statement that Denmark would probably be hit by terrorism in the next

year. Regarding public demand for security against terrorism, a 2018 Eurobarometer survey of the 28 EU member states showed that 69% of the respondents (aged 15 years or over) found current EU action to be lacking and that 77% wanted more EU intervention in the future [73]. As previously mentioned, statistically speaking, the chances of an individual being harmed in a terrorist attack are negligible. So how can the high level of perceived risk and demand for security found among the European general public best be explained?

3.2. Determinants of reactions to terrorism risk – what do we know so far?

One of the earliest models of how lay people judge and react to risks is the psychometric paradigm developed by Slovic et al. [8] (for further information about the psychometric paradigm see section 1. General introduction).

Other research has demonstrated that closeness to a terrorist target in terms of temporal and/or geographical proximity increases public risk perceptions about terrorism [74-77]. One explanation for the effects is the previously mentioned "availability heuristic" which allows people to make judgments about the likelihood of risks based on how easy they are to imagine or recall [12]. Availability, however, mostly develops indirectly, that is, via exposure to media reporting. Media tend to feature and "feed on" dramatic events such as terrorist attacks, which is assumed to distort viewers perceptions of terrorism (or other dramatic events) likelihood, since the mental images linked to these events are extremely vivid, emotion-loaded and can easily be recalled. But what has so far been shown empirically regarding people's reactions to exposure to terrorism via the media?

3.3. Reactions to media coverage of terrorism

Prior experimental studies have indicated that exposure to terrorism-related media coverage actually increases estimates of terrorism risk [78] and negative emotional reactions [79-82]. People may thus respond to information about terrorism risk depending on their emotions rather than rational deliberation about likelihood, which is in line with the previously mentioned "affect heuristic" [13], and "risk-as-feelings" concept [14]. These approaches have suggested that judgements and evaluations are not always or mainly based on rational cognitive processes but that in making these evaluations people tap into an "affect pool" of mental images and pictures which offer mental-shortcuts to decision-making [13]. In an experimental study by Traczyk et al. [83] for instance, it was shown that when people experience negative consequences of risk they develop more stress as well as higher

perceptions of risk and – as a consequence – the preparedness to take risks is diminished. In a similar way, it can be expected that the very vivid horror images people connect with terrorist attacks are likely to influence people's risk estimates regarding terrorism on one hand, and their felt needs and demands for societal measures to limit and control such risk on the other [81].

However, it is well known that reactions to threatening events are not uniform across populations, and many factors can be assumed to have a moderating impact, such as for instance socio-economic background [84-86], cultural specificities and world views [82, 87, 88], personality [17, 60] or psycho-social resources [89]. Particularly relevant might be the initial emotional states which people find themselves in and which might influence the attention to and processing of risk-relevant information. This will be discussed in the next subsection.

3.4. The role of incidental affect in shaping risk reactions

As previously mentioned, early experimental research by Bower et al. suggested that people are sensitized to information that matches their current mood states [23-25]. Furthermore, there is evidence to suggest that being in a negative mood can lead to the formation of negative expectations (Forgas, 2003). In a similar vein, Loewenstein and Lerner [90] posited "carry-over-effects" in that decision making and judgement is not only influenced by issue-related but also by prior, incidental emotion. Moreover, Lerner and Keltner in their Appraisal Tendency Framework [91, 92] proposed that emotions and related cognitive appraisals create cognitive dispositions or "appraisal tendencies" which influence the perception and evaluation of future events. This could explain why, for example, Johnson and Tversky in their experimental study found that negative affect induced by newspaper reports of a tragic event led to higher estimations of the frequency of many different risks, independent of similarity with the initial story content [93]. Regarding the impact of prior emotional states on terrorism risk reactions, Lerner et al. [81] documented that naturally occurring fear increased estimates of terrorism risk among US adults. Furthermore, another US study found that negative affect increased adults' perceptions of terrorism risk – independently of experimental exposure to media coverage of terrorism [78].

Beyond prior acute emotional states, it might be expected that the broader level at which people perceive their lives as stressful could influence their reactions to terrorism risk (for

further information about the concept of stress see section 2.3.2.1. The concept of stress). As previously mentioned, persons with high dispositional anxiety or anxiety disorder have been found to be more likely to detect and process threat-related information. Thus, similar to people with anxiety, stressed people may already be sensitized to threats in their environment causing them to be more inclined to attune to threatening information [22]. Whether there is such differential susceptibility to terrorism-related information is not without relevance since stress seems to be a common problem in Western countries, especially among younger generations (see section 2.3.2.2. Stress young adults). Research in this area is needed as it could help identify specific groups of people that may be more or less susceptible to the effects of exposure to threatening information, which could inform the design and implementation of emergency information strategies.

4. AIMS AND OBJECTIVES

The purpose of this Ph.D. project was to examine the role of specific determinants of young adults' reactions to the threats of T2D and terrorism. In pursuit of this aim, two web-based experimental studies were conducted.

4.1. Study 1

The first study aimed to investigate: (a) cross-sectional associations between personality traits, T2D-related behaviours and T2D risk perception (paper 1) and (b) the impact of perceived life stress on behavioural responses to gain vs. loss-framed messages promoting T2D prevention (paper 2). The study was guided by the following objectives:

1) to examine direct associations between personality traits and perceived susceptibility to T2D as well as indirect pathways mediated via BMI and T2D-related behaviours (PA, sweets consumption and prior T2D screening) (paper 1);
2) to test (a) main effects of message framing (gain vs. loss) and perceived life stress (low vs. high) on follow-up T2D-related behaviours (PA, consumption of sugar-rich foods and beverages as well as T2D screening); and (b) whether perceive life stress interacts with message framing to explain follow-up T2D-related behaviours (paper 2).

4.2. Study 2

The second study aimed to investigate the impact of perceived life stress on immediate cognitive and emotional responses to media exposure about a terrorism event vs. non-

terrorism-related content. This aim was addressed in paper 3. The specific objectives were to assess: (a) main effects of media exposure (terrorism vs. non-terrorism) and perceived life stress (low vs. high) on posttest risk reactions (perceived personal susceptibility to terrorism, terrorism-related worry, and support for security measures against terrorism); and (b) whether perceived life stress interacts with media exposure to explain post-test risk reactions.

5. METHODS

5.1. Overview

Two web-based experimental studies were conducted for this Ph.D. thesis. Papers 1 and 2 are based on study 1, paper 3 is based on study 2. Table 1 below presents a brief overview of the three papers.

Table 1. Overview of the three papers

	STUDY 1		**STUDY 2**
	Paper 1	**Paper 2**	**Paper 3**
Aims	To investigate direct associations between personality traits and T2D risk perception as well as indirect pathways mediated via BMI and T2D-related behaviours	To investigate whether perceived life stress impacts behavioral responses to gain- vs. loss-framed health messages promoting T2D prevention	To investigate whether perceived life stress impacts immediate cognitive and emotional responses to media exposure about a terrorism event vs. non-terrorism-related content
Design	Cross-sectional: This paper reports on baseline data from study 1	Experiment with one follow-up measure	Experiment
Intervention	N/A	Exposure to gain- vs. loss-framed health messages promoting T2D prevention	Exposure to terrorism vs. non-terrorism media coverage
Measurement	Standardized questionnaire	Standardized questionnaire	Standardized questionnaire
Data analysis	Hierarchical multiple regression Binary logistic regression	Binary logistic regression	Analysis of covariance (ANCOVA)

	Sobel tests		
Population	University students	University students	University students
Study period	October 2016 – May 2017	October 2016 – May 2017	October 2017 – April 2018

5.2. Study 1

5.2.1.Design

This study utilized a 3 (message framing: gain frame, loss frame, risk information only) x 2 (perceived stress: low, high) factorial design.

5.2.2. Data collection

Data were collected via online surveys administered at baseline, immediately after the intervention, and at 3-months follow-up. Paper 1 examined the baseline data. In paper 2, follow-up data from the gain and loss frame groups were analyzed. All data were collected by and stored in REDCap[3]. Data collection began in October 2016 and ended in May 2017.

5.2.3. Eligibility criteria

Eligibility criteria for participation in this study were: (1) being an undergraduate or graduate student attending one of five major universities in Denmark[4]; (2) aged less than 40 years; (3) having more than three months left on study program; and (4) no diagnosis of type 1 or type 2 diabetes.

5.2.4. Recruitment

The author of this thesis sent an email to study directors at the targeted universities asking if they could forward a study announcement to students via email or upload it on E-learn, social media (Facebook, Twitter) or other relevant student platforms.

5.2.5. Procedure

The baseline survey could be accessed by clicking on the weblink provided in the study announcement. The introductory page presented information about the purpose of the study,

[3] Research Electronic Data Capture
[4] Aarhus University, University of Copenhagen, Aalborg University, University of Southern Denmark, Roskilde University

eligibility criteria, methods of data collection, and data protection. Furthermore, it emphasized that participation was voluntary and anonymous. Participants could indicate their consent by clicking on a radio button that stated, "I want to participate in this study". Once consent was provided, participants were guided to the survey questions. The final question asked participants to provide identifying information (email address), so that data from the other surveys could be linked.

After completing the baseline survey, participants were randomly assigned (via REDCap) to one of three groups (gain frame, loss frame, risk information only), and subsequently (within 2-3 days) sent an email with a weblink granting access to the intervention. The 'risk-information-only' group was presented with information about T2D risk in young adults. The same risk information was presented to the two framing groups. In addition, these two groups received a message emphasizing either the health benefits of adopting the recommended actions (gain frame) or the health costs of failing to adopt them (loss frame). For further information about the intervention see section 5.2.6.2. Intervention. Participants completed the post-test survey directly after reading the material. After three months, an email with a weblink granting access to the follow-up survey was sent to participants. Participants' email addresses were deleted from the database once data from all three surveys had been linked.

5.2.6. Measures

5.2.6.1. Baseline survey

The baseline survey covered the following areas: sociodemographic factors (age, sex, parental education, parental birthplace), family history of T2D, perceived susceptibility to T2D, T2D-related behaviours (PA, consumption of sugar-rich foods and beverages, prior T2D screening), personality traits, and perceived life stress.

Single items were used to probe age, sex, parental education (highest level of education attained by either parent), parental birthplace (within or outside Denmark)[5], and family history of T2D (immediate or extended family members).

Perceived susceptibility to T2D was assessed using a single Likert-type item: "How likely is it that you will develop T2D at some point in your life?" Responses were rated on a 7-point scale ranging from 1 (extremely unlikely) to 7 (almost certain).

[5] Proxy measure for having a Danish vs. foreign/immigrant background

Moderate and vigorous PA were assessed separately by asking: “In the last three months, how many times a week on average did you engage in moderate-intensity PA for at least 30 minutes a day/vigorous-intensity PA for at least 20-30 minutes a day?” The response options were: ‘less than once a week’, once a week’, ‘2 times a week’, ‘3-4 times a week’, ‘5-6 times a week’, and ‘7 times a week’.

Consumption of sugar-rich foods and beverages was assessed by asking, “In the last three months, how often on average did you eat/drink: (a) sweets (e.g. chocolate, cookies, winegums etc.) and/or ice cream? (b) ready-made fruit juice (e.g. orange juice, apple juice etc.) from the supermarket? (c) non-diet soda drinks (e.g. Coke, Pepsi, Sprite etc.)?” The response options were ‘less than once a month or never’, ‘once a month’, ‘several times a month’, ‘once a week’, ‘several times a week’, ‘once a day’, and ‘more than once a day’.

Prior T2D screening was assessed by asking, “Have you ever been tested for T2D?” (yes or no).

Personality traits were measured using the Ten-Item Personality Inventory (TIPI) [94]. The TIPI includes two items for each of the FFM personality dimensions (openness, conscientiousness, extraversion, agreeableness and emotional stability). Each item consists of pairs of descriptors tapping into the same pole of the dimension in question. Half of the items correspond to the positive pole of the dimensions, the other half the negative pole. Each item is evaluated on a 7-point Likert scale ranging from 1 (disagree strongly) to 7 (agree strongly). A total score for each dimension is generated by inversing the reverse scored items, and then computing the average of the two. Higher scores indicate higher levels of that particular personality trait.

Perceived life stress was measured using the previously mentioned PSS-10, which is a global assessment of the degree to which individuals appraise their lives as stressful in terms of unpredictability, uncontrollability and overload [69]. Respondents are asked to indicate how often they felt or thought a certain way during the previous month. Each items is rated on a 5-point scale ranging from 0 (never) to 4 (very often). Total scores range from 0-40, with higher scores indicating higher levels of perceived stress. Cronbach’s alpha for the PSS-10 was .90.

5.2.6.2. Intervention

Participants in the gain and loss frame groups were requested to read a health brochure. The first section of the brochure provided information about T2D risk in young adults. The second section included a message emphasizing either the health benefits of adopting three recommended behavioural actions (gain frame) or the health costs of failing to adopt them (loss frame). The recommended actions were to ‘get screened regularly for T2D’, ‘limit the amount of sugar in your diet’, and ‘be physically active on a regular basis’. The two versions of the brochure can be found in Appendix 1 (gain frame) and Appendix 2 (loss frame).

5.2.6.3. Post-test survey

First, participants rated how informative they thought the brochure was on a 7-point scale ranging from 1 (not at all) to 7 (very much). They also indicated on 7-point scales which mood the brochure created (mostly negative to mostly positive) and how threatened they felt by the information in the brochure (not threatened at all to very threatening). These questions were included as a manipulation check. Following this, participants reported their height and weight, which were used to calculate BMI (kg/m^2). In paper 1, BMI was treated as a baseline variable since it was not expected to undergo relevant changes between the baseline and post-test assessments.

5.2.6.4. Follow-up survey

Participants answered the same questions about PA as well as consumption of sugar-rich foods and beverages that were included in the baseline survey.

T2D screening was assessed by asking, “In the last three months, did you get tested for T2D?” (yes or no).

5.2.7. Survey translation

All surveys were available in English and Danish. The health brochures and single item measures were translated from English to Danish by the author of this thesis and then checked by a student intern. Regarding the multi-item measures, a validated Danish consensus version of the PSS-10 was used [95]. Cronbach’s alpha for the Danish PSS-10 in this study was .88. Since no Danish version of the TIPI exists, it was arranged for the scale to be translated to Danish and then back-translated to English. Two researchers who were knowledgeable of the English speaking culture but whose mother tongue was Danish

produced independent Danish translations of the original English version. The author and main supervisor of this thesis worked closely with them to produce a Danish consensus version. A third researcher, who was fluent in English and who had no knowledge of the TIP translated the Danish consensus version back to English. When compared with the original version, the back-translated version was found to be satisfactory. The final Danish version was prepared after reaching a common consensus between all the experts and subsequently pilot tested on five Ph.D. students.

5.2.8. Ethics and data protection

Procedures for data storage were approved by the Danish Data Protection Agency [96]. According to Danish law, studies that are questionnaire-based and do not include a clinical intervention are exempt from ethical approval [97]. All participants provided informed consent.

5.2.9. Data analysis

5.2.9.1. Data cleaning and preparation

All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 24.0 (Armonk, NY: IBM Corp). The significance level was set at $p < .05$. Data collected via REDCap were imported to SPSS, and variables were defined (name, type, label, values, missing etc.).

When summing up scores for the PSS-10 missing values were replaced by individual item means in cases where only one or two items were missing.

The following variables were collapsed into dichotomous formats: parental education (university vs. other), parental birthplace (both parents born in Denmark vs. other), family history of T2D (no/don't know vs. yes), moderate PA (below recommended level vs. at or above recommended level), vigorous PA (below recommended level vs. at or above recommended level), sweets consumption (less than once a day vs. once a day or more), fruit juice consumption (once a week or less vs. more than once a week), soda consumption (once a week or less vs. more than once a week), BMI (underweight/normal weight vs. pre-obese/obese), and perceived life stress (low vs. high).

The cut-off points for vigorous and moderate PA are based on the Danish Health Authority's recommendations for weekly physical activity for adults aged 18-64 years: '7 times a week' for moderate PA, and 'more than once a week' for vigorous PA [98]. In paper 1, scores on both indicators were combined to form a composite PA variable with two categories: 'below recommended level' (below cut-off on both moderate and vigorous PA) vs. 'at or above recommended level' (above or equal to the cut-off on either moderate or vigorous PA). In paper 2, only vigorous PA was assessed.

The cut-off for BMI was based on the World Health Organization's BMI classification [99]. Participants with a BMI of less than 25 were classified as underweight/normal weight, and those with a BMI of 25 or more were classified as pre-obese/obese.

As the PSS-10 is not a diagnostic instrument, there is no clinically justifiable cut-off score. The cut-off for perceived life stress was based on the logical mid-point of the scale differentiating between those who on average rarely or never experienced stress (low stress = scores between 0-19) and those who experienced stress more often (high stress = scores between 20 and 40).

Participants with missing data were excluded from subsequent analyses.

5.2.9.2. Descriptive statistics and bivariate analyses

In papers 1 and 2, continuous variables were described using the mean and standard deviation, categorical variables using frequency counts and percentages.

In paper 1, the independent sample's t-test or chi square test was used to examine whether participants with complete and incomplete baseline data differed with respect to sociodemographic factors and family history of T2D. Pearson correlation coefficients were computed to examine (two-tailed) bivariate associations between potential predictors and perceived susceptibility to T2D.

In paper 2, the independent sample's t-test or chi-square test was used to compare baseline characteristics (sociodemographic factors, family history of T2D, BMI, T2D-related behaviours) between the gain and loss frame groups, and between participants lost to follow-up and those in the final sample. The chi-square test was used to inspect whether the gain and loss frame groups differed with respect to drop-out rates after randomization. A series of

independent samples t-tests were conducted to determine whether participants' evaluations of the health brochure differed as a function of message framing (manipulation check).

5.2.9.3. Multivariable analyses

In paper 1, preliminary tests were conducted to check whether the assumptions for conducting multiple linear regression (linearity, multivariate normality, homoscedasticity, multicollinearity and outliers) had been met. One participant represented a multivariate outlier (standard residual > 3 standard deviations) and was subsequently deleted. Further, the assumptions for conducting binary logistic regression (observation independence, multicollinearity and large sample size) were checked. Following this, the Baron and Kenny approach was used to test for mediation [100]. First, it was investigated whether personality traits were associated with perceived susceptibility to T2D in the absence of potential mediators. Second, it was tested whether there were unique effects of personality traits, T2D related behaviours (composite PA, sweets consumption and prior T2D screening) and BMI on perceived susceptibility to T2D. These analyses were carried out using a two-step hierarchical multiple regression analysis controlling for sociodemographic factors and family history of T2D. Third, a series of binary logistic regression analyses, controlling for the same confounders as listed above, were performed to examine the effects of personality traits on BMI (model 1), composite PA (model 2), sweets consumption (model 3), and prior T2D screening (model 4). Lastly, the Sobel test [101] was used to test the significance of any mediation effects.

In paper 2, preliminary tests were conducted to test whether the assumptions for binary logistic regression had been met. Following this, a series of binary logistic regression analyses were performed to test the main effects of message framing (gain vs. loss) and perceived life stress (low vs. high) on follow up T2D-related behaviours (vigorous PA, sweets consumption, fruit juice consumption, soda consumption, and T2D screening), after controlling for sociodemographic factors, family history of T2D, BMI, and baseline T2D-related behaviours.

5.3. Study 2

5.3.1. Design

This study utilized a 2 (media exposure: terrorism vs. non-terrorism) X 2 (perceived life stress: low vs. high) factorial design.

5.3.2. Data collection

Participants filled out an initial baseline survey and attended an experimental session approximately 1-2 weeks later where they completed a survey immediately before and after the intervention. All data were collected by and stored in REDCap. Data collection began in October 2017 and ended in April 2018.

5.3.3. Eligibility criteria

Participants were eligible to participate in this study if they were an undergraduate or graduate student attending the University of Southern Denmark and under 40 years old. There were some additional eligibility criteria because part of this study (data not used here) involved measuring participants' heart rate at rest and while watching either a terrorism or non-terrorism news clip. These criteria included: no heart disease, no high blood pressure, not taking sedatives or pain medication prescribed by a doctor, and no psychiatric diagnosis (e.g. depression or anxiety).

5.3.4. Recruitment

The author of this thesis sent an email to study directors at the University of Southern Denmark asking if they could post a study announcement on E-learn, social media (Facebook, Twitter) or other relevant student platforms. In addition, flyers advertising the study were distributed in classrooms and on campus.

5.3.5. Procedure

The baseline survey could be accessed via the weblink provided in the flyer/online study announcement. The introductory page presented information about the purpose of the study, eligibility criteria, methods of data collection, and data protection. Furthermore, it emphasized that participation was voluntary and anonymous, and informed potential participants that they had the option of receiving a canteen voucher for completing the study. Participants could indicate their consent by clicking on a radio button that stated, "I want to participate in this study". Once consent was provided, they were immediately guided to the survey questions. The final question asked participants to provide identifying information (email address), so that data from the other surveys could be linked.

After completing the baseline survey, participants were randomly assigned (via REDCap) to either the terrorism or non-terrorism media exposure group, and subsequently (within 2-3 days) sent an email inviting them to attend a 60-minute experimental session at the

university. The experimental session was made with each participant separately and took place in quiet study rooms at the university. At the onset of the session, the investigator (author of this thesis) informed each participant that they would be watching a short real-life news clip about a contemporary societal risk and reminded them that participation was voluntary and anonymous. They were then sat down comfortably in front of a laptop computer and requested to fill out the pre-test survey. Following this, they were shown a 12-minute news clip about either a recent terrorist event (terrorism media exposure) or a non-violent societal risk (non-terrorism media exposure). Participants completed the post-test survey directly after watching the news clip. The investigator sat in the corner of the room reading a book during the entire session to reduce feelings of being monitored. All participants were fully debriefed after the session. Participants' email addresses were deleted from the database once data from all the surveys had been linked.

5.3.6. Measures

5.3.6.1. Baseline survey

The baseline survey covered sociodemographic factors (age, sex, parental education, parental birthplace) and perceived life stress.

Single items were used to measure age, sex, parental education (highest level of education attained by either parent) and parental birthplace (within or outside Denmark)[6].

Perceived life stress was assessed using the PSS-10 [69], which has been described in the methods section for study 1 (see section 5.2.6.1. Baseline survey). Cronbach's alpha for this scale was .91.

5.3.6.2. Pre-test survey

The pre-test survey included measures of perceived susceptibility to terrorism, terrorism-related worry, and support for security measures against terrorism.

Perceived susceptibility to terrorism was assessed using a single Likert-type item: "How likely is it that you will become a victim of a terrorist attack in the future? Responses were rated on a 7-point scale ranging from 1 (extremely unlikely) to 7 (almost certain).

[6] Proxy measure for having a Danish vs. foreign/immigrant background

Terrorism-related worry was assessed by asking: “How worried are you about becoming a victim of a terrorist attack in the future?” Responses were rated on a 7-point scale ranging from 1 (not worried at all) to 7 (extremely worried).

Support for security measures against terrorism was assessed by asking participants to indicate the extent to which they agreed or disagreed with the following statements: “For public safety there should be: (a) more video surveillance in Denmark in general; (b) video surveillance in all major pedestrian areas; (c) video surveillance on all public transport; (d) video surveillance at universities; (e) mandatory bag checks at big public events (e.g. music concert/festival, football match); (f) mandatory bag checks at universities; (g) more security patrols in public places; (h) security patrols at universities during the day.” Responses were rated on 7-point scales ranging from 1 (disagree strongly) to 7 (agree strongly).

Before filling out the above measures, participants completed comparable measures relating to the non-violent societal risk (not reported here).

5.3.6.3. Intervention

The terrorism media exposure group watched a real-life news clip about the terrorist attack that occurred in London Bridge, England, on the 3rd June 2017. A description of the terrorism news clip can be found in Appendix 3. The non-terrorism media exposure group watched a real-life news clip about a non-violent societal risk – the robot revolution. Both news clips were found on YouTube and made by Sky News. Furthermore, they were matched on parameters of length (12 min + 06 sec) and sex of the presenter (male).

5.3.6.4. Post-test survey

First, participants indicated how stressed they felt while watching the news clip on a 7-point scale ranging from 1 (not at all) to 7 (very much). This question served as a manipulation check. Following this, participants answered the same questions about perceived susceptibility to terrorism, terrorism-related worry, and support for security measures that were included in the pre-test survey. They also answered the comparable questions relating to the non-violent societal risk (not reported here). The order of presentation of these questions was counterbalanced across the media exposure groups. The terrorism media exposure group was presented with the questions about terrorism first, followed by the questions relating to the non-violent societal risk.

5.3.7. Survey translation

As in study 1, all surveys were available in English and Danish. Single items were translated from English to Danish by the author of this thesis and then checked by a Ph.D. student. Furthermore, the validated Danish consensus version of the PSS-10 was used [95]. Cronbach's alpha for this scale was .82. The video clips were only available in English.

5.3.8. Ethics and data protection

Procedures for data storage were approved by the Danish Data Protection Agency [96]. As with study 1, this study did not require ethical approval according to Danish law since the intervention was not a clinical one [97]. All participants provided informed consent. Before initiating the intervention, the investigator informed participants in the terrorism media exposure group that the news footage might be distressing to watch and then asked them if they still wanted to continue. Furthermore, participants who scored above or equal to the clinical cut-off (≥ 20) on the 10-item Kessler Psychological Distress Scale (administered at baseline) [102] received additional debriefing and were offered a contact number for the student counselling service. This was done in order to avoid any negative reactions to the threat induction.

5.3.9. Data analysis

5.3.9.1. Data cleaning and preparation

All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 24.0 (Armonk, NY: IBM Corp). The significance level was set at $p < .05$. Data collected via REDCap were imported to SPSS, and variables were defined (name, type, label, values, missing etc.).

When summing up scores for the PSS-10 missing values were replaced by individual item means in cases where only one or two items were missing.

The following variables were collapsed into dichotomous formats: parental education (higher education[7] vs. other), parental birthplace (both parents born in Denmark vs. other) and perceived life stress (low vs. high).

[7] Higher education of three years or more

As previously mentioned, there is no clinically justifiable cut-off point for the PSS-10. The cut-off point for perceived life stress was based on the median score (low stress = scores between 0-14; high stress = scores between 15 and 40).

Due to low endorsement of upper or lower categories, certain scores were collapsed on the following items: perceived susceptibility to terrorism (scores 5, 6, and 7; range = 1-5), terrorism-related worry (scores 5, 6 and 7; range 1-5), support for mandatory bag checks at big public events (scores 1 and 2; range = 2-7), support for mandatory bag checks at universities (scores 5, 6 and 7; range = 1-5), more security patrols in public places (scores 6 and 7; range = 1-6) and support for security patrols at universities during the day (scores 5, 6 and 7: range = 1-5).

The four remaining items assessing support for video surveillance (more video surveillance in Denmark in general, video surveillance in all major pedestrian areas, video surveillance on all public transport, and video surveillance at universities) were found to be highly correlated: Cronbach's alpha was .91 and .98 for pre- and post-test scores, respectively. Thus, a composite video surveillance variable was generated by combining all the scores (range = 4-28).

Participants with missing data were excluded from subsequent analyses.

5.3.9.2. Descriptive statistics and bivariate analyses

Continuous variables were described using the mean and standard deviation, categorical variables using frequency counts and percentages.

The independent samples t-test or chi-square test was used to compare baseline characteristics (socio-demographic factors and perceived life stress) between participants who remained in the study and those who dropped out, and between the terrorism and non-terrorism media exposure groups. A chi-square test was used inspect whether drop-out rates differed between the terrorism and non-terrorism media exposure groups. An independent samples t-test was used to determine whether the degree of stress experienced while watching the news clip differed between the terrorism and non-terrorism media exposure group (manipulation check). Pearson correlation coefficients or independent samples t-tests were computed to examine bivariate associations between sociodemographic factors and each of the outcome variables. Factors found to be associated with outcome variables were controlled for in the respective models.

5.3.9.3. Multivariable analyses

Preliminary tests were conducted to check whether the assumptions for conducting a two-way Analysis of Covariance (ANCOVA) had been met (observation independence, normality, outliers, homogeneity of variances, linear relationship between the covariates and outcome variables, homogeneity of regression slopes). The assumption of homogeneity of variance was not met in the model for security patrols at universities during the day (p = .005). However, since ANOCOVA is known to be robust to violations of this assumption when group sizes are roughly equal [103], the decision was made to proceed with the multivariable analysis for this outcome. The assumption of homogeneity of regression slopes was violated in the model for perceived susceptibility to terrorism. A custom model revealed a significant interaction effect between parental education and media exposure (p = .024). Since parental education was found to be significantly associated with perceived susceptibility to T2D (see section 6.3. Paper 3), the decision was made to test this model both with and without this covariate to determine whether it made a difference to the results. Following this, a series of two-way ANCOVAs, controlling for pretest scores and relevant sociodemographic factors, were conducted to test the main effects of media exposure (terrorism vs. non-terrorism) and perceived life stress (low vs, high) on post-test risk reactions (perceived susceptibility to terrorism, terrorism-related worry, and support for security measures against terrorism), and whether there was an interaction effect between media exposure and perceived life stress on post-test risk reactions.

6. RESULTS

6.1. Paper 1

Paper 1 investigated direct associations between personality traits and perceived susceptibility to T2D as well as indirect pathways mediated by BMI and T2D-related behaviours. The paper was based on baseline data collected in study 1. The final sample size was n = 1205.

The results of the bivariate analyses showed that parental birthplace was significantly different between participants with complete and incomplete (n = 697) baseline data. Compared to participants with incomplete data, a higher proportion of those with complete data reported that both parents were born in Denmark. The results of the correlational

analyses revealed a number of significant associations between potential predictors and T2D risk perception (not reported here).

The hierarchical multiple regression analysis showed that the personality traits of conscientiousness and emotional stability were directly negatively associated with perceived susceptibility to T2D, after controlling for sociodemographic factors, family history of T2D, T2D-related behaviours (combined moderate and vigorous PA, sweets consumption, and prior T2D screening) and BMI.

A series of binary logistic regression analyses revealed a number of significant associations between personality traits and T2D-related behaviours, after controlling for sociodemographic factors and family history of T2D. These are summarized below.

- Openness was negatively associated with BMI and positively associated with prior T2D screening.
- Conscientiousness was positively associated with PA and negatively associated with BMI.
- Extraversion was positively associated with PA and negatively associated with sweets consumption.
- Emotional stability was positively associated with PA.

Finally, the results of the Sobel tests indicated that both PA and BMI partially mediated the negative association between conscientiousness and perceived susceptibility to T2D. Furthermore, the negative association found between extraversion and perceived susceptibility to T2D in step 1 of the hierarchical multiple regression model was fully mediated by PA.

6.2. Paper 2

Paper 2 investigated whether perceived life stress impacts behavioral responses to gain- vs. loss-framed health messages promoting T2D prevention. The paper was based on follow-up data collected in study 1. Only data from the gain and loss frame groups were analyzed. The final sample size was n = 645 (gain frame: n = 317; loss frame: n = 328).

The results of the bivariate analyses showed that family history of T2D was significantly different between participants in the final sample and those who dropped out after

randomization (n = 390). Participants in the final sample were more likely to have a family history of T2D compared to those who dropped out after randomization. Regarding the manipulation check, a significant effect of message framing was found on the extent to which the brochure was perceived as threatening and perceptions of the mood created by the brochure. Gain frame participants rated the brochure as less threatening and more positive than loss frame participants, indicating that the framing manipulation was effective.

The results of the binary logistic regression analyses predicting follow-up T2D-related behaviours are summarized below. Each model controlled for sociodemographic factors, family history of T2D, BMI, and baseline T2D-related behaviours.

- There was a main effect of message framing on vigorous PA and soda consumption. Compared to loss frame participants, gain frame participants were significantly more likely to adhere to the recommended vigorous PA level and less likely to drink sugary soda more than once a week. A non-significant trend was observed suggesting that gain frame participants were more likely than loss frame participants to consume sweets and/or ice cream once a day or more.
- There was a main effect of perceived life stress on vigorous PA as well as sweets and fruit juice consumption. Compared to participants with low stress levels, highly stressed participants were less likely to adhere to the recommended vigorous PA level, more likely to consume sweets and/or ice cream once and day or more, and more likely to consume processed fruit juice more than once a week.
- Separate analyses of the low and high stress groups revealed that perceived stress did not moderate the effect of message framing on any of the outcome variables.

Regarding T2D screening, only 12 participants reported that they had been screened for T2D during the follow-up period. Due to this very small number and the resulting small cell counts for the separate groups, logistic regression analyses could not be conducted for this outcome. Univariate tests indicated that there were no differences in choosing to be screened between participants with low and high stress levels or between gain and loss frame participants.

6.3. Paper 3

Paper 3 investigated whether perceived life stress impacts immediate cognitive and emotional responses to media exposure about a terrorism event vs. non-terrorism-related content. The

paper was based on data collected in study 2. The final sample size was n = 94 (terrorism media exposure: n = 47; non-terrorism media exposure: n = 47).

The results of the bivariate analyses showed that parental education was significantly different between the terrorism and non-terrorism media exposure groups. Participants in the terrorism media exposure group were more likely to have at least one parent with a higher education compared to those in the non-terrorism media exposure group. Sex was significantly associated with post-test levels of perceived susceptibility to terrorism, terrorism-related worry, and support for security patrols at universities during the day. In each case, females had higher scores than males. Furthermore, there was a significant association between parental education and post-test levels of perceived susceptibility to terrorism. Scores were higher for participants who had at least one parent with a higher education compared to those whose parents had other types of education. Thus, these factors were controlled for in the respective multivariable models. As for the manipulation check, there was a significant effect of media exposure on the degree of stress experienced while watching the news clip. Stress levels were higher in the terrorism compared to non-terrorism media exposure group, indicating that the threat induction was effective.

A series of ANCOVA's predicting post-test cognitive and emotional reactions while controlling for pre-test scores and relevant sociodemographic factors revealed the following results.

- There was a main effect of media exposure on levels of support for video surveillance (composite variable) such that scores were significantly higher in the terrorism than non-terrorism media exposure group.
- No main effects of perceived life stress were observed.
- Significant interaction effects were found between media exposure and perceived life stress on post-test levels of support for video surveillance, support for mandatory bag checks at universities and support for security patrols at universities during the day. Participants with lower levels of life stress scored similarly on these measures in the terrorism and non-terrorism media exposure groups. However, participants with higher stress levels scored higher on these measures in the terrorism than non-terrorism media exposure group.

As previously mentioned, a significant interaction effect was found between parental education and media exposure in the custom model for perceived susceptibility to terrorism, indicating that the assumption of homogeneity of regression slopes had been violated. When the model was tested without including parental education as a covariate this made no difference to the results.

7. DISCUSSION

7.1. Main findings

The results of paper 1 showed that the personality traits of conscientiousness and emotional stability were directly negatively associated with perceived susceptibility to T2D. Furthermore, conscientiousness was indirectly negatively associated with perceived susceptibility to T2D via PA (combined moderate and vigorous) and BMI. In addition, extraversion was indirectly negatively associated with perceived susceptibility to T2D via PA.

In paper 2, it was found that gain framing was associated with more frequent vigorous PA and less frequent soda consumption at 3-months follow-up. Moreover, higher levels of perceived life stress were associated with less frequent vigorous PA as well as more frequent consumption of sweets and/or ice cream and processed fruit juice at follow-up. However, the effects of message framing did not differ as a function of perceived stress level.

Lastly, the results of paper 3 indicated that neither media exposure nor perceived life stress alone affected post-test levels of perceived susceptibility to T2D, terrorism-related worry or support for more security measures. However, significant interaction effects were found between media exposure and perceived life stress on post-test levels of support for video surveillance, support for mandatory bag checks at universities and support for security patrols at universities during the day. Specifically, scores on these measures were similar among participants with lower levels of life stress in the terrorism and non-terrorism media exposure groups, whereas among participants with higher stress levels demand for security measures was greater in the terrorism than non-terrorism media exposure group.

7.2. Paper 1

In accordance with previous cross-sectional studies [2-5], this research showed that estimates of personal susceptibility to T2D tended to be low among students (mean = 2.72 on a scale from 1 to 7).

Regarding the role of FFM personality traits in T2D risk perception, it was found that conscientiousness and emotional stability were directly negatively associated with perceived susceptibility to T2D. Similarly, Vollrath et al. [17] reported that conscientiousness had a direct negative effect on risk perception of lung cancer, alcohol dependency and venereal disease/AIDS in a sample of university students in Switzerland. In addition, neuroticism (polar opposite to emotional stability) had a direct positive effect on risk perception of alcohol dependency and driving accidents. Why do students with higher levels of conscientiousness or emotional stability tend to be more optimistic regarding future health risks? People with high conscientiousness usually have a high level of self-discipline and as a result they may be better equipped to handle life and less likely to take risks that affect their health. Moreover, people who are more emotionally stable are usually calm and even tempered which may make them less likely to ruminate about things that could go wrong.

When examining associations between personality traits and T2D-related behaviours, it was found that higher levels of conscientiousness, extraversion and emotional stability were associated with increased PA. Similar findings have been reported in two prior meta-analyses [18, 19]. These meta-analyses also reported a positive association between openness and PA. However, the present research found no evidence for such an association. The discrepancy in findings might be attributed to the fact that participants included in the meta-analyses were generally older than the students in the present research. Given that younger adults are more likely to partake in PA compared to older generations [104], it is possible that being open to new experiences is not a necessary requirement for students to be exposed to PA, or conversely they may view PA as being noticeably less novel than older adults.

In the present research, higher levels of extraversion were associated with lesser sweets consumption. This finding stands in contrast to a previous Swiss population study in which higher extraversion was found to be associated with increased sweets consumption through the tendency to eat in response to cues from the environment [41]. One possible explanation for the discrepancy in findings is that the types of social activities that attract students (e.g.

sports activities, visiting pubs/night clubs) may not involve eating as much sugary foods as the kinds of activities that older adults in the general population tend to seek out (e.g. family gatherings). Furthermore, taking into consideration that the majority of students in the present research were females under the age of 30, it is possible that weight concerns may in general be highly pertinent for them and that this tendency is heightened among those with high extraversion since they are inclined to be especially interested in promoting favourable social impressions or images.

In line with the results of a previous systematic review [21], it was found that higher levels of conscientious were associated with lower BMIs. However, while the review documented a positive relationship between neuroticism (emotional stability) and overweight/obesity, no such association was found in the present research. Furthermore, this research found that higher levels of openness were associated with lower BMIs, whereas the review reported no relationship between this particular personality trait and body weight. The inconsistent findings might reflect age differences between samples given that the average age of participants included in the review was between 40-50 years. Obesity status is likely to have stabilized considerably by the time a person reaches middle age. Thus, it could be that personality traits show different patterns with body weight during midlife compared to young adulthood.

Regarding the role of personality traits in T2D screening, the present research found that higher levels of openness were associated with increased screening rates. Although no prior studies have investigated relationships between personality traits and T2D screening, this finding suggests that students with high openness may also be more curious to partake in health screenings.

Lastly, the negative association between conscientiousness and perceived susceptibility to T2D was found to be partially mediated by both PA and BMI. Similarly, the study by Vollrath et al. [17] reported that conscientiousness had a negative indirect effect on perceived susceptibility to lung cancer, alcohol dependency and venereal disease/AIDS via related health behaviours (smoking, getting drunk, and risky sexual behaviour). A previous prospective longitudinal cohort study of 1235 Americans reported that personality traits, particularly conscientiousness, negatively predicted health-related behaviours (alcohol use and smoking) across seven decades (1930-2000) [105]. This suggests that people with high conscientiousness are aware of the importance of adopting health promoting behaviours and

act accordingly. Consistent with this assumption, the present research suggests that highly conscientious students may in general be more likely to reach recommended levels of PA and maintain healthy BMIs because they know that such behaviours help to prevent adverse health outcomes and this may in turn have lessened their perceptions of susceptibility to T2D. Contrary to Vollrath et al. [17] who reported no relationships between extraversion and health risk perceptions, the present research found that the negative association between extraversion and perceived susceptibility to T2D was fully mediated by PA. One reason for this could be that students with high extraversion may be part of a social group which expects its members to be physically active, and since promoting favourable social impressions or images tends to be particularly important for the highly extraverted, this may have motivated them to partake in PA on a regular basis. Furthermore, students with high extraversion may also be aware that engaging in regular PA helps to prevent T2D, which could possibly have lessened their perceptions of susceptibility to T2D.

7.3. Paper 2

This research found a significant main effect of message framing on follow-up vigorous PA. Participants in the gain frame group were more likely than their loss frame counterparts to adhere to the recommended vigorous PA level at follow-up. This finding supports the results of a previous meta-analysis [46]. But why would gain frames work better than loss frames when it comes to convincing people to be more physically active? Rothman and Salovey [61] have argued that in regard to lifestyle behaviors such as physical activity, which promote health or prevent disease long-term, gain frames are generally more persuasive, since they basically involve no or little risk, and according to Prospect Theory [10, 11], most people are inclined to avoid risks when gains are at stake. A further possibility is that gain frames may put people into a more positive mood which is likely to create optimism regarding the implementation of the behavior, and optimism has been linked to engaging in preventive lifestyles, among them healthy nutrition and PA [106].

In addition, the present research found a significant main effect of message framing on follow-up soda consumption. Participants in the gain frame group were less likely than their loss frame counterparts to drink sugary soda more than once a week. Furthermore, a non-significant trend was observed suggesting that participants in the gain frame group were also less likely than their loss frame counterparts to consume sweets and/or ice cream once a day or more. Finding overall weaker benefits for gain than loss frames is in line with other

studies. Thus, the meta-analytic review by Gallagher and Updegraff [46] based on seven studies which investigated choices regarding various types of food and drink similarly identified only an overall weak advantage of gain frames. However, no further studies on nutrition-related behavior and gain/loss framing have been published in recent years, so the evidence-base is limited.

A very low uptake rate of T2D-screening at follow-up (1.9%) prevented any multivariable analyses. Univariate analyses did not suggest significant differences in uptake depending on frames but given the extremely small subsample of screening users any comparison might be invalid. One reason for this low uptake rate is that students simply do not see a need to get tested for T2D at their age but that this is something they might do in the future. Another possible explanation is that the follow-up period in this study was not long enough to adequately assess changes in screening behaviour.

This research also showed that perceived life stress had a significant main effect on follow-up vigorous PA. Participants with higher levels of life stress were less likely than their low stress counterparts to adhere to the recommended vigorous PA level. This finding is similar to that reported by Steptoe et al. [53] in a longitudinal, quasi-experimental study examining the impact of upcoming exams (applied as a naturalistic stress model) on PA (moderate and vigorous combined). The finding is also consistent with several cross-sectional studies reporting a significant inverse association between perceived stress and vigorous PA among university students [51, 52, 54, 56]. According to Transactional Stress Theory [68], people may use vigorous PA as explicit emotion as well as problem-focused strategies to cope with stress, thereby reducing negative emotion as well as increasing energy levels in order to be able to better deal with demands. Alternatively, it has been suggested that people who experience high stress levels, for instance due to work, study or family demands, are likely to cut time for "non-essential activities", among them leisure time PA. In particular, students who are largely sedentary are unliley to start engaing in PA when they experience stress, while those who are physically active may temporarily cut these activities from their time budgets in order to invest more time into work or other demands – which also would explain the findings of the present research.

Regarding consumption of sugar-rich foods and beverages, a significant main effect of perceived life stress on follow-up sweets consumption was found. Participants with higher levels of perceived life stress were more likely than their low stress counterparts to eat sweets

and/or ice cream once a day or more. Some other studies – though all cross-sectional – have also reported that higher levels of stress experienced among university students were related with more sweets consumption [107-109]. Also, it has been shown in experimental studies that female students under conditions of high induced stress were consuming more sweet and high-fat food items compared to students in the control condition [110, 111]. Since sweets are rich in carbohydrates they may induce at least a temporary stress reduction and therefore be employed as a way to cope with stress. In addition, students who are stressed may perceive that they do not have sufficient time or energy to cook healthy meals or even prepare a salad and hence fall back on quickly available convenience foods.

Furthermore, this research found a significant main effect of perceived life stress on follow-up fruit juice consumption. Participants with higher levels of life stress were more likely than their loss frame counterpart to drink processed fruit juice more than once a week. While no previous studies have examined the relationship between perceived life stress and fruit juice consumption in university students, one case-control study found a significant positive association between perceived stress and fruit juice consumption among non-obese (vs. obese) Tehrani women (mean age = 30 years) [112]. Over the years, there has been a lot of media coverage in Denmark about the negative effects of consuming sweet foods and sugary soft drinks but not processed fruit juice. Thus, it is possible that many students may be unaware that fruit juice is just as high in calories as soft drinks, and as the sugar rush from fruit juice may provide temporary relief from stress, it might reinforce consumption behaviour under stress.

Lastly, the present research showed that perceived life stress had no effect on soda consumption or T2D screening at follow-up.

A main focus of the present research was to investigate whether behavioural responses to gain vs. loss-framed messages differ according to prior levels of perceived life stress. Separate analyses of the low and high stress groups indicated that perceived life stress did not differentially affect the impact of message framing on any of the follow-up T2D-related behaviours, that is, incidental stress might not affect students' behavioural responses to framed health messages promoting T2D prevention. One explanation for these findings is that students may not perceive the issue of T2D as a sufficiently prevalent or serious future threat for prior levels of perceived life stress to have an effect on how they process and subsequently react to framed health messages. This means that it is possible that incidental

stress may influence peoples' responses to gain- vs. loss-framed messages targeting other - subjectively more relevant - risks for young people and/or diabetes-related risk in older populations. Another explanation could be that general stress levels among students were not high enough to have an impact on their responses to message framing. This is unlikely, however, since the stress levels found in the present study were not particularly low but in fact higher than those reported for a comparable age group from a recent national Danish sample [26], and they were also higher than those found in the second study conducted for this Ph.D. thesis.

7.4. Paper 3

This research found no main effect of media exposure on terrorism risk perception. The fact that only perceived personal susceptibility to terrorism was measured might explain this finding. Similar to the present research, Breckenridge et al. [78] found that exposure to a video news report about terrorism (vs. no video) had no effect on personal susceptibility to terrorism across four time frames (three months, six months, one year and five years) in a nationally representative sample of US adults. However, exposure to the terrorism video significantly increased perceptions of terrorism risk against the nation within three months and a year as well as the one-year perceived risk for someone participants knew well. Given that people tend to be more optimistic when judging their own personal risk from terrorism as compared to risk to others and the nation [78, 81, 113], it is possible that this makes perceptions of personal vulnerability more robust to the effects of exposure to terrorism risk information. Regarding the other outcome measures, no main effects were found for media exposure apart from in the model predicting support for video surveillance (composite variable). In this model, participants scored significantly higher in the terrorism than non-terrorism media exposure group. However, this main effect was qualified by a significant interaction with perceived life stress and will thus not be discussed further. Furthermore, no main effects were found for perceived life stress. Overall, the above findings suggest that exposure to terrorism-related media coverage in and of itself as well as incidental stress might not affect students' risk reactions to terrorism.

A main focus of the present research was to investigate whether reactions to terrorism-related media coverage depend on prior levels of perceived life stress. A significant interaction effect was found between perceived life stress and media exposure in three of the models: support for video surveillance, support for security patrols at universities during the day, and support

for mandatory bag checks at universities. For participants with lower levels of life stress, reactions did not differ depending on whether they were in the terrorism or non-terrorism media exposure group. However, for participants with higher stress levels demand for security measures was greater in the terrorism than non-terrorism media exposure group. Thus, it is possible that information which is compatible with pre-existing frames of mind might be more believable or persuasive [114]. In agreement with the affect heuristic and risk-as-feelings hypothesis [13, 14], this implies that actualization of prior and more general strain experience or of lack of control by acute threat triggers may cause people to be more likely to perceive the world as a "dangerous place" which needs societal control and defense measures.

While no prior studies have examined the moderating role of percived life stress on the relationship between acute threat induction and preference for control measures, other factors which might be conceived of as being related to stress have previously been investigated. Rubaltelli et al. [79] found a significant interaction effect between exposure to terrorism-related pictures (vs. neutral pictures) and scores on the Highly Sensitive Person Scale, an explicit measure of sensory processing [115], on willingness to trade off one's privacy in a sample of Italian students. The direction of the interaction was similar to that found in the present research. Highly sensitive participants were more willing to trade off their privacy in the terrorism pictures condition than when they were confronted with neutral pictures. No differences were observed between the conditions for participants with lowere levels of sensitivity.

The findings of the present research point to a contradiction since no differential – or, in fact, any type of – effects were found for perceived risk and worry about terrorism. Why would students with higher stress levels who were confronted with media coverage of terrorism demand stricter security measures if they did not perceive a higher personal risk from terrorism or worry about the threat? Since secruity measures against terrorism are aimed at protecting society as a whole, one explanation could be that demand for such measures may reflect perceived national risk from terrorism. Thus, asking students to provide likelihood estimates of future terrorist attacks in the country may have provided more consistent results. Support for this explanation has been provided by Rubaltelli et al. (2018). Although the predictor variables investigated in their study are not directly comparable to the ones in the present research, it was found that Italian students with higher stress reactivity (assessed via heart rate variability) perceived a higher risk of future attacks in Europe/Italy/their home

town consequent to viewing terrorism-related vs. neutral pictures. Participants with lower levels of stress reactivity did not react differently depending on whether they viewed the terrorism-related or neutral pictures.

Another explanation for the largely unchanged and non-differential perception of personal risk and worry might be that students' responses to the questions about perceived risk reflect a defiant attitude in terms of not giving way to terrorists' attempts to make people live in fear, an attitide which has been promoted by many traditional media outlets as well as in social media in many Western European countries, including Denmark, in the wake of the recent terrorist attacks in Europe. Conversely, reactions towards protective measures might allow for potentially underlying fear to manifest itself, reflecting a desire to protect the country, including onseself and loved ones, against any "residual risk".

8. METHODOLOGICAL CONSIDERATIONS

Two web-based experimental studies were conducted for this Ph.D. project, which is a major strength, as it allowed for a comparison of the determinants of young adults' reactions to risk information across two major, but quite different public health threats: T2D and terrorism. Study 1 is unique in its examination of (a) the role of personality traits in T2D risk perception (paper 1) and (b) the impact of prior levels of general life stress on behavioural responses to experimentally-delivered gain vs. loss-framed messages promoting T2D prevention (paper 2). Other strengths of study 1 include its longitudinal design and large samples of students recruited from five major universities in Denmark (paper 1: n = 1205; paper 2: n = 645). Study 2 is the first to investigate the impact of prior levels of general life stress on reactions (cognitive and emotional) to media coverage of terrorism vs. non-terrorism-related content (paper 3). Furthermore, it used a real-life stressor (online news clip) to induce acute threat, which strengthens external validity. However, this Ph.D. project also has some limitations.

Caution is warranted in making inferences about the generalizability of this research because convenience sampling was used in both studies. This did not allow for true response rates to be calculated and is likely to have introduced sampling bias. Females were overrepresented in the samples, as is common in student surveys [116]. Given that students are more likely to participate in online surveys when they have a vested interest in the research topic [117], this gender imbalance likely reflects a higher interest in and concern about health-related (study

1)[8] and societal (study 2)[9] issues among women. In general, it must be assumed that it was mainly students interested in these topics who were willing to participate in the first place and who were also less likely to drop out. Another factor affecting generalizability is that university students are not representative of young adults in general but represent the higher educated segment of the population in that age group. Furthermore, it is possible that some recall bias and social desirability may have occurred since all variables were assessed by means of self-report. A further limitation relevant to both studies is that single items were used to measure risk reactions. Using such brief measures may have contributed to avoiding responder tiredness thereby preventing more, and in all likelihood more selective, drop-out, but this may have come at the expense of the measurement precision provided by more elaborate instruments. The following text addresses the limitations that are specific to each study in more detail.

Study 1

In study 1, the BMI data may have been imprecise given that males tend to overestimate their height while females tend to underestimate their weight [118]. Furthermore, the fact that BMI data were collected after the intervention, and not at baseline, may have increased sampling bias towards persons interested in health-related issues. Regarding the assessment of consumption of sugar-rich foods and beverages, only frequency of consumption was measured because it is more demanding for participants to provide information about portion sizes. Having information about portion sizes may have resulted in more differentiation and possibly also stronger associations for these variables. Due to time constraints, the decision was made to use a very brief measure of personality traits (TIPI: paper 1) rather than the comprehensive gold standard (NEO-PI-3) [119]. On the other hand, favourable outcomes in terms of factor structure [120], for temporal stability, i.e. test-retest reliability as well as convergent and discriminant validity have been demonstrated for the TIPI [94, 120].

Furthermore, one cannot infer causality regarding the associations found between personality traits and T2D risk perception because the data were cross-sectional (paper 1). However, it seems unlikely or implausible that causality is reversed, i.e. that perceived risk regarding T2D would have an effect on stable and broad personality dispositions. Disentangling direction of

[8] Study 1 was advertised as an investigation into stress and health in young people
[9] Study 2 was advertised as an investigation into how young people react to news coverage of contemporary societal risks.

causality is, however, more challenging when it comes to T2D risk perception and T2D-related lifestyle behaviors. Prominent health behavior models, such as the Health Belief Model [36] or Protection Motivation Theory [37] focus on the effects that people's perceptions, among them those about health risks, have on health-protective or endangering behaviors. However, depending on the time perspective chosen, the association can definitely also be reversed, since people to some extent factor in their prior or current behaviors when assessing their risks, particularly when they consider their health-protective actions [121-124]. A further limitation is that it was not possible to establish congruence between students' actual and perceived risk of T2D (paper 1). However, findings were adjusted for some of the relevant T2D risk factors including socio-demographic characteristics, family history of T2D and BMI. Lastly, the fact that this study did not control for seasonal variations may have affected the results given that seasonal variations have been found to effect nutritional status, body weights and compositions as well as daily energy expenditure among university students [125].

Study 2

In study 2, the sample size was small (n = 94) resulting in a lack of power for some analyses which, had the sample been larger, might have yielded significant effects for smaller differences. Having to physically attend an experimental session may have decreased motivation to take part as it requires more time, energy and planning than participating in an intervention conducted entirely online. Finally, it is possible that the timing of the study may have influenced reactions to media coverage of terrorism. Students were surveyed towards the end of a series of terrorist attacks in Europe and may therefore already have been desensitized to a certain degree.

9. CONCLUSIONS

Overall, the findings of this Ph.D. project point to the role that personality traits play in shaping T2D risk perception in young adults. Furthermore, they indicate that prior levels of general life stress may impact young adults' reactions to media coverage of terrorism (vs. non-terrorism-related content), but not their responses to framed messages (gain vs. loss) promoting T2D prevention. The following sections describe the conclusions in more detail.

9.1. Study 1

In paper 1 (based on cross-sectional data), the findings confirm those from previous research – that students tend to have low T2D risk perception – and extend them by revealing direct and indirect (via T2D-related behaviours and BMI) associations between personality traits and T2D risk perception. Although the findings need confirmation by longitudinal studies, this research suggests that personality testing has the potential to be a useful tool for understanding reasons for low risk perception in this group. One practical implication of these findings for health risk communication is that it may be beneficial to tailor messages to match recipients' personality characteristics instead of using the one size fits all approach. Previous research has shown that survey respondents evaluated tailored advertisements for a single product more positively when they cohered with their personality characteristics [126]. Furthermore, there is evidence to suggest that relating messages to personality dispositions could be a promising method for adapting health-promoting mobile applications to better fit the needs of target audiences [127]. Thus, it would be interesting to investigate the effectiveness of using this technique in health risk communications targeting early onset T2D.

In paper 2, the findings showed that message framing and prior levels of general life stress elicited independent, direct effects on students' T2D-related behaviours at 3-months follow-up, but there was no indication that stress led to different reactions to gain or loss framing. Thus, this research suggests that gain framing may be useful for promoting sufficient vigorous PA and limited sugary soda consumption among young adults. Furthermore, the initiation of health behaviour change, such as increasing vigorous PA and limiting intake of foods or drinks, may be more difficult for those who are experiencing elevated stress levels. Successfully tackling stress in young people may move them into a position in which they are better able to respond to health risk communications. A promising option in this context could be to specifically target stress as a trigger of food intake and/or integrate techniques for stress management within health communication strategies. On the other hand, the results did not indicate a relevant differentiating role for general stress experience for participants' behavioral reactions to gain or loss framing, that is vigorous PA and food or drink intake. Future research should consider the potential effects of incidental stress on reactions to gain vs. loss-framed messages targeting other - subjectively more relevant – risks for young people and/or diabetes-related risk in older populations.

9.2. Study 2

In paper 3, the findings showed that neither exposure to terrorism (vs. non-terrorism) media coverage nor prior levels of general life stress affected students' personal risk perceptions regarding terrorism, terrorism-related worry or demand for security measures. Furthermore, it was shown that students with higher levels of stress were more responsive to terrorism-related media exposure than those with lesser life stress when it comes to a desire for a variety of increased security measures.

Although the findings need confirmation in larger samples, this research suggests that exposure to terrorism-related media coverage and incidental stress in and of themselves are not sufficient to elicit immediate changes in young adults' risk reactions to terrorism. However, it illustrates the power of the media to immediately affect demand for security measures in vulnerable subgroups. Terrorist attacks are massively amplified by the traditional as well as the social media and thereby may lead to demands for immediate regulatory action, particularly among population segments who are already sensitized by prior stress experience and therefore more vulnerable. The question of whether to introduce such measures puts decision-makers in a difficult position, not at least within contexts such as universities. Security measures may temporarily calm down concerns in some people, but they are not unproblematic since they are potentially disruptive and may themselves cause concerns about the possibility of attacks as well as about infringements of civil rights while being expensive and without guaranteed effectiveness. Also, it may be argued that while there is some evidence showing that immediate reactions to many terrorist threats tend to be strong, such responses vary over time, not at least depending on a continuous or waning media coverage [75]. However, there is a need for more research investigating how reactions to terrorism risk information develop over time.

REFERENCES

1. Lascar N, Brown J, Pattison H, Barnett AH, Bailey CJ, Bellary S. Type 2 diabetes in adolescents and young adults. Lancet Diabetes Endocrinol 2018, 6(1):69-80.
2. Amuta AO, Jacobs W, Barry AE, Popoola OA, Crosslin K. Gender differences in type 2 risk perception, attitude, and prrotective health behaviors: A study of overweight and obese college students. Am J Health Educ 2016, 47(5):315-323.
3. Mongiello LL, Freudenberg N, Jones H, Spark A. Many college students underestimate diabetes risk. J Allied Health 2016, 45(2):81.
4. Reyes-Velazquez W, Sealey-Potts C. Unrealistic optimism, sex, and risk perception of type 2 diabetes onset: Implications for education programs. Diabetes Spectr 2015, 28(1):5-9.
5. Sealey-Potts C, Reyes-Velazquez W. Perceived and actual risks of college students for developing type 2 diabetes. Austin J Nutr Metab 2014, 1(2).
6. Pew Research Center. "Globally, People Point to ISIS and Climate Change as Leading Security Threats". Washington, D.C: Pew Research Center 2017. Retrieved from https://www.pewglobal.org/2017/08/01/globally-people-point-to-isis-and-climate-change-as-leading-security-threats/
7. Trygfonden: Tryghedsmåling 2017. Trygdonden 2017. Retrieved from https://www.trygfonden.dk/viden-og-materialer/publikationer/tryghedsmaalinger/tryghedsmaaling-2017
8. Slovic P: Perception of risk. Science 1987, 236(4799):280-285.
9. Slovic P, Fischhoff B, Lichtenstein S. Facts and fears: Understanding perceived risk. In: Societal Risk Assessment: How Safe is Safe Enough? , edn. Edited by Schwing RC, Albers WA. Boston, MA: Springer US 1980, pp 181-216.
10. Kahneman D, Tversky A. Prospect Theory: An Analysis of Decision under Risk. Econometrica 1979, 47(2):263-291.
11. Tversky A, Kahneman D. The framing of decisions and the psychology of choice. Science 1981, 211(4481):453-458.
12. Tversky A, Kahneman D. Availability: A heuristic for judging frequency and probability. Cogn Psychol 1973, 5(2):207-232.
13. Finucane ML, Alhakami A, Slovic P, Johnson SM. The affect heuristic in judgments of risks and benefits. J Behav Decis Mak 2000, 13(1):1-17.

14. Loewenstein GF, Weber EU, Hsee CK, Welch N. Risk as feelings. Psychol Bull 2001, 127(2):267-286.
15. Slovic P, Finucane ML, Peters E, MacGregor DG. Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. Risk Anal 2004, 24(2):311-322.
16. McCrae RR, Costa PT, Jr. Personality in adulthood: A Five Factor theory perspective, 2nd edn. New York, London: The Guilford Press 2006.
17. Vollrath M, Knoch D, Cassano L. Personality, risky health behaviour, and perceived susceptibility to health risks. Eur J Pers 1999, 13(1):39-50.
18. Wilson KE, Dishman RK. Personality and physical activity: A systematic review and meta-analysis. Pers Individ Dif 2015, 72(Supplement C):230-242.
19. Sutin AR, Stephan Y, Luchetti M, Artese A, Oshio A, Terracciano A. The five-factor model of personality and physical inactivity: A meta-analysis of 16 samples. J Res Pers 2016, 63:22-28.
20. Lunn TE, Nowson CA, Worsley A, Torres SJ. Does personality affect dietary intake? Nutrition 2014, 30(4):403-409.
21. Gerlach G, Herpertz S, Loeber S. Personality traits and obesity: A systematic review. Obes Rev 2015, 16(1):32-63
22. Robinson OJ, Vytal K, Cornwell BR, Grillon C. The impact of anxiety upon cognition: Perspectives from human threat of shock studies. Front Hum Neurosci 2013, 7:203.
23. Bower GH. Mood and memory. Am Psychol 1981, 36(2):129-148.
24. Bower GH, Sahgal A, Routh DA. Affect and Cognition [and Discussion]. Philos Trans R Soc Lond B Biol Sci 1983, 302(1110):387-402.
25. Forgas JP, Bower GH. Mood effects on person-perception judgments. J Pers Social Psychol 1987, 53(1):53-60.
26. Jensen HAR, Davidsen M, Ekholm O, Christensen AI. Danskernes sundhed: Den Nationale Sundhedsprofil 2017 (1.0 udg.). København: Sundhedsstyrrelsen 2017.
27. International Diabetes Federation. IDF Diabetes Atlas, 8th edn. Brussels, Belgium: International Diabetes Federation 2017.
28. World Health Organization. Global report on diabetes. Geneva, Switzerland: World Health Organization 2016.
29. International Diabetes Federation. IDF Diabetes Atlas, 1st edn. Brussels, Belgium: International Diabetes Federation 2000.

30. Danish Diabetes Association. Diabetes i Danmark 2019. Retreived from https://diabetes.dk/presse/diabetes-i-tal/diabetes-i-danmark.aspx
31. Jensen HAR, Thygesen LC, Davidsen M. Sygdomsudviklingen i Danmark fremkrevet til 2030. KOL og type 2-diabetes. København: Statens Institut for Folkesundhed, Syddansk Universitet 2017.
32. Sortso C, Green A, Jensen PB, Emneus M. Societal costs of diabetes mellitus in Denmark. Diabetes Med 2016, 33(7):877-885.
33. Menke A, Casagrande S, Geiss L, Cowie CC. Prevalence of and trends in diabetes among adults in the United States, 1988-2012. Jama 2015, 314(10):1021-1029.
34. Holden SH, Barnett AH, Peters JR, Jenkins-Jones S, Poole CD, Morgan CL, Currie CJ. The incidence of type 2 diabetes in the United Kingdom from 1991 to 2010. Diabetes Obes Metab 2013, 15(9):844-852.
35. Song SH, Hardisty CA. Early-onset Type 2 diabetes mellitus: An increasing phenomenon of elevated cardiovascular risk. Expert Rev Cardiovasc 2008, 6(3):315-322.
36. Janz NK, Becker MH. The Health Belief Model: A decade later. Health Edu Q 1984, 11(1):1-47.
37. Rogers RW. Cognitive and physiological processes in fear appeals and attitude change: A revised theory of Protection Motivation. In: Social Psychophysiology, edn. Edited by Cacioppo J, Petty R. New York: Guilford Press 1983.
38. Dickerson JB, Smith ML, Sosa E, McKyer EL, Ory MG. Perceived risk of developing diabetes in early adulthood: Beliefs about inherited and behavioral risk factors across the life course. J Health Psychol 2012, 17(2):285-296.
39. Seo D-C, Torabi MR, Kaigang L, John PM, Woodcox SG, Perera B. Perceived susceptibility to diabetes and attitudes towards preventing diabetes among college students at a large midwestern university. Am J Health Stud 2008, 23(3):143-150.
40. Hakulinen C, Hintsanen M, Munafò MR, Virtanen M, Kivimäki M, Batty GD, Jokela M. Personality and smoking: Individual-participant meta-analysis of nine cohort studies. Addiction 2015, 110(11):1844-1852.
41. Keller C, Siegrist M. Does personality influence eating styles and food choices? Direct and indirect effects. Appetite 2015, 84:128-138.
42. Hakulinen C, Elovainio M, Batty GD, Virtanen M, Kivimäki M, Jokela M. Personality and alcohol consumption: Pooled analysis of 72,949 adults from eight cohort studies. Drug Alcohol Depend 2015, 151:110-114.

43. Adan A, Forero DA, Navarro JF. Personality traits related to binge drinking: A systematic review. Front Psychiatry 2017, 8:134-134.
44. Levin IP, Schneider SL, Gaeth GJ. All frames are not created equal: A typology and critical analysis of framing effects. Organ Behav Hum Dec Process 1998, 76(2):149-188.
45. Covey J. The role of dispositional factors in moderating message framing effects. Health Psychol 2014, 33(1):52-65.
46. Gallagher KM, Updegraff JA. Health message framing effects on attitudes, intentions, and behavior: A meta-analytic review. Ann Behav Med 2012, 43(1):101-116.
47. American Psychological Association. Stress in America: The state of our nation. Stress in AmericaTM Survey 2017. Retrived from https://www.apa.org/images/state-nation_tcm7-225609.pdf
48. Australian Psychological Society. How Australians are coping with life: The findings from the Australian Psychological Society Stress and Wellbeing in Australia survey 2015. Melbourne, Victoria: Australian Psychological Society 2015.
49. Mental Health Foundation. 60% of young people unable to cope due to pressure to succeed 2018, Retrived from https://www.mentalhealth.org.uk/news/60-young-peopleunable-cope-due-pressure-succeed
50. Lyzwinski LN, Caffery L, Bambling M, Edirippulige S. The relationship between stress and maladaptive weight-related behaviors in college students: A review of the literature. Am J Health Educ 2018, 49(3):166.
51. VanKim NA, Nelson TF. Vigorous physical activity, mental health, perceived stress, and socializing among college students. Am J Health Promot 2013, 28(1):7-15.
52. Pengpid S, Peltzer K. Vigorous physical activity, perceived stress, sleep and mental health among university students from 23 low- and middle-income countries. Int J Adolesc Med Health 2018.
53. Steptoe A, Wardle J, Pollard TM, Canaan L, Davies GJ. Stress, social support and health-related behavior: A study of smoking, alcohol consumption and physical exercise. J Psychosom Res 1996, 41(2):171-180.
54. Nelson MC, Story M, Larson NI, Neumark-Sztainer D, Lytle LA. Emerging adulthood and college-aged youth: An overlooked age for weight-related behavior change. Obes 2008, 16(10):2205-2211.
55. Van Berkel K, Reeves B. Stress among graduate students in relation to health behaviors. Coll Stud J 2017, 51(4):498.

56. Gerber M, Brand S, Herrmann C, Colledge F, Holsboer-Trachsler E, Pühse U. Increased objectively assessed vigorous-intensity exercise is associated with reduced stress, increased mental health and good objective and subjective sleep in young adults. Physiol Behav 2014, 135:17-24.
57. Thome J, Espelage DL. Relations among exercise, coping, disordered eating, and psychological health among college students. Eat Behav 2004, 5(4):337-351.
58. Laitinen J, Ek E, Sovio U. Stress-related eating and drinking behavior and body mass index and predictors of this behavior. Prev Med 2002, 34(1):29-39.
59. McCrae RR, Costa PT, Jr. Personality trait structure as a human universal. American Psychol 1997, 52(5):509-516.
60. Sjöberg L. Distal factors in risk perception. J Risk Res 2003, 6(3):187-211.
61. Rothman AJ, Salovey P. Shaping perceptions to motivate healthy behavior: The role of message framing. Psychol Bull 1997, 121(1):3-19.
62. Anghelcev G, Sar S. In the mood for [the right kind of] social marketing communication: How congruity between consumer mood and message framing influences intentions to recycle. J Soc Mark 2014, 4(1):38.
63. Yan C, Dillard JP, Shen F. The effects of mood, message framing, and behavioral advocacy on persuasion. J Commun 2010, 60(2):344-363.
64. Keller PA, Lipkus IM, Rimer BK. Affect, framing, and persuasion. J Mark Res 2003, 40(1):54-64.
65. Mitchell MM. Risk, threat, and information seeking about genital herpes: The effects of mood and message framing. Commun Stud 2001, 52(2):141-152.
66. Nan X. Influence of incidental affect and message framing on persuasion: The case of promoting sun protection behaviors. Int Public Health J 2011, 3(1):111.
67. Gerend MA, Maner JK. Fear, anger, fruits, and veggies: Interactive effects of emotion and message framing on health behavior. Health Psychol 2011, 30(4):420-423.
68. Lazarus RS. Stress and emotion: A new synthesis. London: Free Association Books 1999.
69. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. J Health Soc Behav 1983, 24(4):385-396.
70. Petty RE, Cacioppo JT. The elaboration likelihood model of persuasion. In: Advances in experimental social pychology. Volume 19, edn. Edited by Berkowitz, L. New York: Academic Press 1986, pp. 123-205.

71. Vogel S, Schwabe L. Learning and memory under stress: Implications for the classroom. Npj Sci Learn 2016, 1:16011.
72. Sandi C. Stress and cognition. Wiley Interdiscip Rev Cog Sci 2013, 4(3):245-261.
73. European Parliament. Eurobarometer Survey 89.2 of the European Parliament: A Public Opinion Monitoring Study. Brussels: European Union 2018.
74. Fischhoff B, Gonzalez RM, Small DA, Lerner JS. Judged terror risk and proximity to the World Trade Center. J Risk Uncertain 2003, 26(2/3):137-151.
75. McArdle SC, Rosoff H, John RS: The dynamics of evolving beliefs, concerns emotions, and behavioral avoidance following 9/11: A longitudinal analysis of representative archival samples. Risk Anal 2012, 32(4):744-761.
76. Rubin GJ, Brewin CR, Greenberg N, Hughes JH, Simpson J, Wessely S. Enduring consequences of terrorism: 7-month follow-up survey of reactions to the bombings in London on 7 July 2005. Br J Psychiatry 2007, 190(4):350-356.
77. Woods J, Eyck T, Kaplowitz S, Shlapentokh V. Terrorism risk perceptions and proximity to primary terrorist targets: How close is too close? Hum Ecol Rev 2008, 15(1):63-70.
78. Breckenridge JN, Zimbardo PG, Sweeton JL. After years of media coverage, can one more video report trigger heuristic judgments? A national study of American terrorism risk perceptions. Behav Sci Terrorism Polit Aggres 2010, 2(3):163-178.
79. Rubaltelli E, Scrimin S, Moscardino U, Priolo G, Buodo G. Media exposure to terrorism and people's risk perception: The role of environmental sensitivity and psychophysiological response to stress. Br J Psychol 2018, 109(4):656-673.
80. Shoshani A, Slone M. The drama of media coverage of terrorism: Emotional and attitudinal impact on the audience. Stud Confl Terror 2008, 31(7):627-6.40.
81. Lerner JS, Gonzalez RM, Small DA, Fischhoff B. Effects of fear and anger on perceived risks of terrorism: A National field experiment. Psychol Sci 2003, 14(2):144-150.
82. Fischhoff B, Gonzalez RM, Lerner JS, Small DA. Evolving judgments of terror risks: Foresight, hindsight, and emotion. J Exp Psychol-App 2005, 11(2):124-139.
83. Traczyk J, Sobkow A, Zaleskiewicz T. Affect-laden imagery and risk taking: The mediating role of stress and risk perception. PLOS ONE 2015, 10(3):e0122226.
84. Stevens G, Agho K, Taylor M, Barr M, Raphael B, Jorm L. Terrorism in Australia: Factors associated with perceived threat and incident-critical behaviours. BMC Public Health 2009, 9:91-91.

85. Botzen WJW, Aerts JCJH, van den Bergh JCJM. Dependence of flood risk perceptions on socioeconomic and objective risk factors. Water Resour Res 2009, 45(10).
86. Peretti-Watel P, Seror V, Verger P, Guignard R, Legleye S, Beck F. Smokers' risk perception, socioeconomic status and source of information on cancer. Addict Behav 2014, 39(9):1304-1310.
87. Peters E, Slovic P. The role of affect and worldviews as orienting dispositions in the perception and acceptance of nuclear power. J Appl Soc Psychol 1996, 26(16):1427.
88. Sjöberg L. Explaining risk perception: An empirical evaluation of cultural theory. Risk Decis Pol 1997, 2(2):113-130.
89. Cohen-Louck K, Levy I. Risk perception of a chronic threat of terrorism: Differences based on coping types, gender and exposure. Int J Psychol 2018.
90. Loewenstein GF, Lerner JS. The role of affect in decision making. In: Handbook of affective sciences, edn. Edited by Davidson R, Goldsmith H, Scherer K. Oxford: Oxford University Press 2003, pp. 619-642.
91. Lerner JS, Keltner D. Fear, anger, and risk. J Pers Soc Psychol 2001, 81(1):146-159.
92. Lerner JS, Keltner D. Beyond valence: Toward a model of emotion-specific influences on judgement and choice. Cogn Emot 2000, 14(4):473-493.
93. Johnson EJ, Tversky A. Affect, generalization, and the perception of risk. J Pers Soc Psychol 1983, 45(1):20-31.
94. Gosling SD, Rentfrow PJ, Swann WB. A very brief measure of the Big-Five personality domains. J Res Pers 2003, 37(6):504-528.
95. Eskildsen A, Dalgaard VL, Nielsen KJ, Andersen JH, Zachariae R, Olsen LR, Jorgensen A, Christiansen DH. Cross-cultural adaptation and validation of the Danish consensus version of the 10-item Perceived Stress Scale. Scand J Work Environ Health 2015, 41(5):486-490.
96. Lov om supplerende bestemmelser til forordning om beskyttelse af fysiske personer i forbindelse med behandling af personoplysninger og om fri udveksling af sådanne oplysninger (databeskyttelsesloven) 2018. Retrieved from https://www.retsinformation.dk/Forms/r0710.aspx?id=201319
97. Vejledning om anmeldelse, inberetningspligt mv. (sundhedsvidenskabelige forskningsprojekter) 2014. Retrieved from http://www.nvk.dk/~/media/NVK/Dokumenter/Vejledning-om-anmeldelse-6-januar-2014.pdf?la=da

98. Pedersen BK, Andersen LB. Fysisk aktivitet - håndbog om forebyggelse og behandling (3.1 udg.). København: Sundhedsstyrelsen 2011.
99. World Health Organization. Body mass index – BMI 2019. Retrieved from http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi
100. Baron RM, Kenny DA. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. J Pers and Soc Psychol 1986, 51(6):1173-1182.
101. Sobel ME. Asymptotic confidence intervals for indirect effects in structural equation models. Sociol Methodol 1982, 13:290-312.
102. Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SL, Walters EE, Zaslavsky AM. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol Med 2002, 32(6):959-976.
103. Tabachnick BG, Fidell LG. Using multivariate statistics, 2. edn. New York: Harper Collins Publishers 1989.
104. Bauman AE, Reis RS, Sallis JF, Wells JC, Loos RJ, Martin BW. Correlates of physical activity: Why are some people physically active and others not? Lancet 2012, 380(9838):258-271.
105. Martin LR, Friedman HS, Schwartz JE. Personality and mortality risk across the life span: The importance of conscientiousness as a biopsychosocial attribute. Health Psychol 2007, 26(4):428-436.
106. Boehm JK, Chen Y, Koga H, Mathur MB, Vie LL, Kubzansky LD. Is optimism associated with healthier cardiovascular-related behavior?: Meta-analyses of 3 health behaviors. Circ Res 2018, 122(8):1119-1134.
107. El Ansari W, Adetunji H, Oskrochi R. Food and mental health: Relationship between food and perceived stress and depressive symptoms among university students in the United Kingdom. Cent Eur J Public Health 2014, 22(2):90-97.
108. Mikolajczyk RT, El Ansari W, Maxwell AE. Food consumption frequency and perceived stress and depressive symptoms among students in three European countries. Nutr J 2009, 8(1):31-31.
109. Papier K, Ahmed F, Lee P, Wiseman J. Stress and dietary behaviour among first-year university students in Australia: Sex differences. Nutrition 2015, 31(2):324-330.
110. Grunberg NE, Straub RO. The role of gender and taste class in the effects of stress on eating. Health Psychol 1992, 11(2):97-100.

111. Habhab S, Sheldon JP, Loeb RC. The relationship between stress, dietary restraint, and food preferences in women. Appetite 2009, 52(2):437-444.
112. Sedequat F, Rabiei S, Faria S, Rastmanesh R. Correlates of snacking with stress and depression in obese and non-obese women. J Obes & Weight Loss Ther 2013, 3:161.
113. Sjöberg L. The perceived risk of terrorism. Risk Manag 2005, 7(1):43-61.
114. DeSteno D, Petty RE, Rucker DD, Wegener DT, Braverman J. Discrete emotions and persuasion: The role of emotion-induced expectancies. J Pers Social Psychol 2004, 86(1):43-56.
115. Aron EN, Aron A. Sensory-processing sensitivity and its relation to introversion and emotionality. J Perso Soc Psychol 1997, 73(2):345-368.
116. Porter SR, Whitcomb ME. Non-response in student surveys: The role of demographics, engagement and personality. Res High Educ 2005, 46(2):127-152.
117. Saleh A, Bista K. Examining factors impacting online survey response rates in educational research: Perceptions of graduate students. J Multidiscip Eval 2017, 13(29):63-74.
118. Stommel M, Schoenborn CA. Accuracy and usefulness of BMI measures based on self-reported weight and height: Findings from the NHANES & NHIS 2001-2006. BMC Public Health 2009, 9(1):421.
119. McCrae RR, Costa Jr PT, Martin TA. The NEO-PI-3: A more readable revised NEO Personality Inventory. J Pers Assess 2005, 84(3):261-270.
120. Ehrhart MG, Ehrhart KH, Roesch SC, Chung-Herrera BG, Nadler K, Bradshaw K. Testing the latent factor structure and construct validity of the Ten-Item Personality Inventory. Pers Individ Differ 2009, 47(8):900-905.
121. Leppin A, Aro AR. Risk perceptions related to SARS and avian influenza: Theoretical foundations of current empirical research. Int J Behav Med 2009, 16(1):7-29.
122. Brewer NT, Chapman GB, Gibbons FX, Gerrard M, McCaul KD, Weinstein ND. Meta-analysis of the relationship between risk perception and health behavior: The example of vaccination. Health Psychol 2007, 26(2):136-145.
123. Brewer NT, Weinstein ND, Cuite CL, Herrington JE. Risk perceptions and their relation to risk behavior. Ann Behav Med 2004, 27(2):125-130.
124. Siegrist M. The necessity for longitudinal studies in risk perception research. Risk Anal 2013, 33(1):50-51.

125. Kucukerdonmez O, Rakıcıoglu N. The effect of seasonal variations on food consumption, dietary habits, anthropometric measurements and serum vitamin levels of university students. Prog Nutr 2018, 20(2):165-175.
126. Hirsh JB, Kang SK, Bodenhausen GV. Personalized persuasion: Tailoring persuasive appeals to recipients' personality traits. Psychol Sci 2012, 23(6):578-581.
126. Halko S, Kientz JA. Personality and persuasive technology: An exploratory study on health-promoting mobile applications. In: Persuasive Technology. Berlin: Springer Berlin Heidelberg 2010 pp 150-161.

APPENDIX 1: GAIN FRAME BROCHURE

Do you know YOUR risk of developing type 2-diabetes?

An alarming epidemic

Today, more and more young people are getting type 2-diabetes. The disease used to be called adult-onset diabetes, as it mostly affected elderly people. Today, this term is misleading, since type 2-diabetes affects adults of ALL ages as well as adolescents and even children.

- In Europe, ca. **55 million** adults have type 2-diabetes.
- By 2030, this figure is estimated to rise to **66 million.**
- The number of people with type 2-diabetes has risen the most among adults aged **30-40 years.**

What is diabetes?

In people with type 2-diabetes, the body can no longer effectively use the hormone insulin. Glucose (sugar) builds up in the bloodstream instead of being converted to energy.

What are the consequences?

Type 2-diabetes is a serious disease. It reduces your quality of life and interferes with your daily functioning. Possible long-term physical consequences include heart attack, stroke, kidney failure, leg amputation and vision loss. The disease can increase your overall risk of dying prematurely. In pregnancy, poorly controlled diabetes increases the risk of various complications, including fetal death.

You are at RISK for getting diabetes if you:

Eat an unhealthy diet high in sugar
Are overweight or obese
Do not get enough physical activity
Have a parent or sibling with type 2-diabetes

Stay healthy – take action!

There is not yet a cure for type 2-diabetes. Once you have the disease, you must live with it the rest of your life. The good news is that it can be prevented or delayed greatly in people who are at risk.

There are certain things that YOU yourself can do to stay healthy.

ACTION 1: Get screened regularly for type 2-diabetes

Many people do not know that they have type 2-diabetes. It is therefore very important that you visit your doctor every three years to have your blood sugar levels tested.

If you get screened regularly for type 2-diabetes it is MORE LIKELY that you will:

- Find out whether you already have the disease or are at risk of developing it.
- Receive effective treatment and prevent future health complications.

ACTION 2: Limit the amount of sugar in your diet

The maximum amount of sugar you should eat in a day is:

- Men: 150 calories (37.5 grams or 9 teaspoons)
- Women: 100 calories (25 grams or 6 teaspoons)

If you limit the amount of sugar in your diet it is LESS LIKELY that you will develop type 2-diabetes.

Stay healthy – take action!

ACTION 3: Be physically active on a regular basis

It is recommended that you are physically active for at least:

- 30 minutes every day of the week at a moderate level of intensity (you become out of breath but can still hold a conversation)

  OR

- 20-30 minutes, 2 times a week, at a vigorous level of intensity (you become out of breath and are unable to hold a conversation).

If you are physically active on a regular basis it is LESS LIKELY that you will develop type 2-diabetes.

Stay healthy!
The more of these goals you achieve, the LOWER your risk will be for developing type 2-diabetes.

APPENDIX 2: LOSS FRAME BROCHURE

Do you know YOUR risk of developing type 2-diabetes?

An alarming epidemic

Today, more and more young people are getting type 2-diabetes. The disease used to be called adult-onset diabetes, as it mostly affected elderly people. Today, this term is misleading, since type 2-diabetes affects adults of ALL ages as well as adolescents and even children.

- In Europe, ca. **55 million** adults have type 2-diabetes.
- By 2030, this figure is estimated to rise to **66 million.**
- The number of people with type 2-diabetes has risen the most among adults aged **30-40 years.**

What is diabetes?

In people with type 2-diabetes, the body can no longer effectively use the hormone insulin. Glucose (sugar) builds up in the bloodstream instead of being converted to energy.

What are the consequences?

Type 2-diabetes is a serious disease. It reduces your quality of life and interferes with your daily functioning. Possible long-term physical consequences include heart attack, stroke, kidney failure, leg amputation and vision loss. The disease can increase your overall risk of dying prematurely. In pregnancy, poorly controlled diabetes increases the risk of various complications, including fetal death.

You are at RISK for getting diabetes if you:

Eat an unhealthy diet high in sugar
Are overweight or obese
Do not get enough physical activity
Have a parent or sibling with type 2-diabetes

Don't get sick – take action!

There is not yet a cure for type 2-diabetes. Once you have the disease, you must live with it the rest of your life. The good news is that it can be prevented or delayed greatly in people who are at risk.

There are certain things that YOU yourself can do to avoid getting sick.

ACTION 1: Get screened regularly for type 2-diabetes

Many people do not know that they have type 2-diabetes. It is therefore very important that you visit your doctor every three years to have your blood sugar levels tested.

If you do *not* get screened regularly for type 2-diabetes it is MORE LIKELY that you will:

- Not find out whether you already have the disease or are at risk of developing it.
- Not receive effective treatment and not be able to prevent future health complications.

ACTION 2: Limit the amount of sugar in your diet

The maximum amount of sugar you should eat in a day is:

- Men: 150 calories (37.5 grams or 9 teaspoons)
- Women: 100 calories (25 grams or 6 teaspoons)

If you do *not* limit the amount of sugar in your diet it is MORE LIKELY that you will develop type 2-diabetes.

Don't get sick – take action!

ACTION 3: Be physically active on a regular basis

It is recommended that you are physically active for at least:

- 30 minutes every day of the week at a moderate level of intensity (you become out of breath but can still hold a conversation)

  OR

- 20-30 minutes, 2 times a week, at a vigorous level of intensity (you become out of breath and are unable to hold a conversation).

If you are *not* physically active on a regular basis it is MORE LIKELY that you will develop type 2-diabetes.

Don't get sick!
The fewer of these goals you achieve, the HIGHER your risk will be for developing type 2-diabetes.

APPENDIX 3: DESCRIPTION OF TERRORISM NEW CLIP

Title – Special Report: London Bridge Terror Attack (Edited)

Duration – 12.06

A special news report on the London terror attacks. The report contains a mixture of footage of the attack, eyewitness accounts, and other related footage. It is presented by a male reporter who provides a voice over commentary throughout the report.

Timeline

0.00 - Introductory video footage of incident in progress

0.21 - Eye witness interview, description of attack

0.30 - Eye witness interview, description of attack

0.34 - Voice over of eye witness, description of attack, a mixture of video footage of incident is shown

0.45 – Voice over of presenter begins to speak, a mixture of video footage of the incident is shown

1.00 – Eye witness interview, description of attack

1.05 – Eye witness interview, description of attack

1.12 – Voice over of presenter, video footage of incident shown

1.19 – Victim interview from the scene of incident, description of attack

1.38 – Eye Witness interview, description of attack

2.00 – Voice over of presenter, video footage of incident shown

2.07 – Eye witness interview, description of attack

2.12 – Eye witness interview, description of attack

2.47 – Voice over of presenter, a mixture of video footage of incident is shown

4.00 – Eye witness interview, description of attack

4.21 – Voice over of presenter, video footage of incident

4.36 – Eye witness interview, description of attack

4.50 – Voice over of presenter, mixture of video footage of incident shown

5.22 – Eye witness interview, description of attack

5.54 – Video footage of incident shown

6.04 – Eye witness interview, description of attack

6.18 – Mixture of video footage of incident shown

6.39 – Voice over of presenter, footage of incident continues

6.45 – Eye witness interview, description of attack

6.50 – Video footage of incident shown

6.55 – Voice over of presenter, video footage continues

7.00 – Still images of dead attackers shown

7.10 – Police commissioner statement on police operations and tactics

7.37 – Voice over of presenter, a mixture of video footage of the incident is shown

7.57 – Eye witness interview, description of attack

8.28 – Voice over of presenter, still images of victims shown

8.42 – Statement made by family of victim

9.12 – Family member of missing person shown appealing to member of the public for information

9.30 – Interview with family member of missing person, appeal for information

9.42 – Voice over of presenter, footage of attacker's family detained by police

10.00 – Interview with attacker's neighbour, description of attackers

10.09 – Voice over of presenter, still image of attackers shown

10.16 – Voice over of presenter, footage from Channel 4 documentary, attacker is in the footage

10.31 – Voice over of presenter, video footage of crime scene shown

10.39 – Interview with neighbour of attacker, description of suspicious activity prior to incident

10.48 – Voice over of presenter, video footage of police operations post attack is shown

11.04 – Statement by Prime minister

11.09 – Voice over of presenter, video footage of police operations post attack is shown

11.17 – Statement by opposition leader

11.23 – Voice over of presenter, video footage of vigil in progress

11.35 – Speech by Mayor of London at vigil

11.55 – Voice over of presenter, video footage of vigil continues, the presenter makes closing statement.