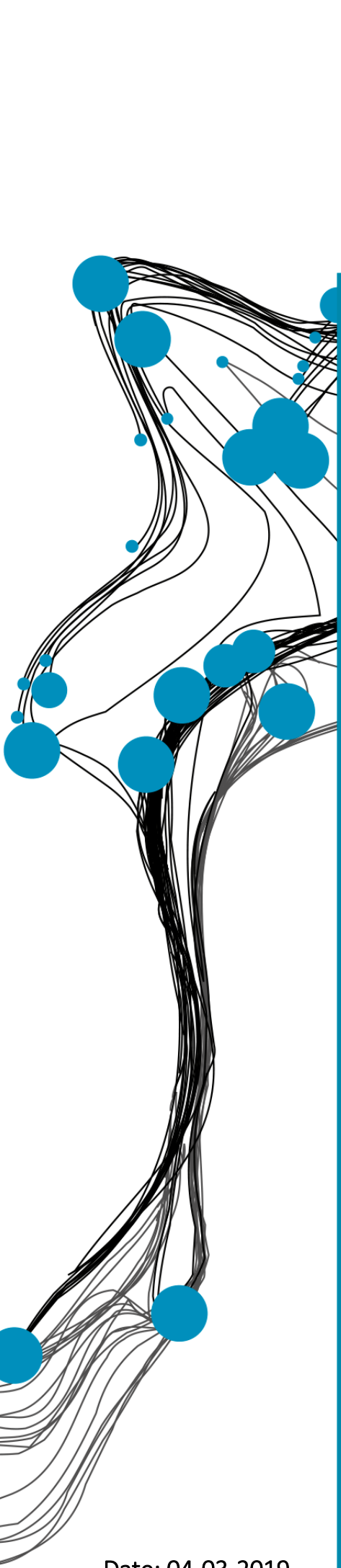

# Fire-safety at home and self-reliance of older adults

Masterthesis

W. A. Eendebak

S1338269

Supervisors:

Dr. M.W.M. Kuttschreuter

Dr. M. Stel

Psychology of Conflict, Risk and Safety

Faculty: Behavioral Management and Social Sciences

University of Twente

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UNIVERSITY OF TWENTE.

**Samenvatting**

Door fysieke en psychologische beperkingen zijn oudere volwassenen kwetsbaar bij woningbrand. Het resultaat is dat ouderen vaker slachtoffer zijn van woningbrand dan andere leeftijdsgroepen. Omdat oudere volwassenen langer zelfstandig thuis wonen, wordt van hen verwacht dat ze zichzelf voorbereiden op woningbrand. De onderzoeksvraag luidt: 'Hoe zelfredzaam zijn oudere volwassenen en wat beïnvloedt de mate van zelfredzaamheid?' Gebaseerd op onder andere de Protectie Motivatie Theorie zijn verschillende factoren geïdentificeerd en geanalyseerd die mogelijk een relatie hebben met zelfredzaam gedrag ten opzichte van woningbrand. Via een vragenlijst zijn volwassenen van 65 jaar en ouder gevraagd naar hun mening en hun gedrag wat betreft woningbrand. Resultaten tonen aan dat de perceptie van hun eigen kunnen verklaart of oudere volwassenen maatregelen nemen en zich voorbereiden op woningbrand. Andere resultaten geven aan dat perceptie van kennis, perceptie van responseffectiviteit en perceptie van zelfeffectiviteit positief gerelateerd zijn aan zelfredzaam gedrag, wat betekent dat bij een hoge perceptie van kennis, responseffectiviteit en zelfeffectiviteit ook een hoge mate van zelfredzaamheid kan worden verwacht. Er zijn meerdere redenen waarom oudere volwassenen zich niet voorbereiden, bijvoorbeeld vanwege responskosten, die negatief zijn gerelateerd aan zelfredzaam gedrag. Meer onderzoek is nodig om deze resultaten te gebruiken voor effectieve risicocommunicatie richting ouderen. Ook zou er kunnen worden gekeken naar de invloed van andere factoren, zoals eerdere ervaringen met woningbrand of de invloed van familie en vrienden.

**Abstract**

Because of psychological or physical impairments, older adults form a vulnerable group regarding residential fire. This results in the fact that older adults are more often a victim of fire than other age groups. Because older adults live independently longer, they are expected to prepare for residential fire themselves. The research question is: 'How self-reliant are older adults regarding residential fire and what influences the degree of self-reliance?' Based on the Protection Motivation Theory and other literature several factors are identified and analyzed that are possibly related with self-reliant behavior regarding residential fire. Via a survey, adults of 65 years and older are asked about their opinions and their actual behavior regarding fire prevention and preparation. Results indicate that the perception of their own abilities predict whether older adults take preventive measures and prepare for residential fire. Other results indicate that perceived knowledge, perceived response-efficacy and perceived self-efficacy are positively related to self-reliant behavior, which means that with a high perception of knowledge, response efficacy and self-efficacy, highly self-reliant behavior can be expected. There are several reasons why older adults might not prepare for fire, for example protective response costs, which are negatively related to self-reliant behavior. More research is needed to use these results for effective risk communication toward older adults. Future research could also focus on the influence of other factors, such as previous experiences with residential fire or the influence of family and friends.

## Contents

## 1. Introduction

Worldwide the population is ageing. According to the United Nations, virtually every country in the world is experiencing growth in the number and proportion of older persons in their population (United Nations, 2017). There are several reasons why the population is ageing, among which is the increase in life expectancy. On a national level the process of population ageing is visible too. The prognosis is that in 2040, 25% of the Dutch population is 65 years or older. This was 18% in 2016. (Nederlandse Zorgautoriteit, 2018; Volksgezondheidenzorg.info, n.d.). There are regional differences within the Netherlands. According to the Dutch Bureau of Statistics (Centraal Bureau voor Statistiek/CBS), population ageing is especially happening 'on the edges' of the Netherlands, which is near the borders in the south, north and east (De Jong & Van Duin, 2010; Garssen 2011). In Twente, specifically in rural areas, the ageing process is prominent (GGD Twente, 2017).

The increase in the number of older adults has several consequences. For example, healthcare costs rise when this group becomes larger (De Jong & Van Duin, 2010). To decrease these costs, the government has increased the physical threshold to be admitted to nursing homes. This means that only older adults who need a lot of care are allowed to nursing homes. This has the consequence that older adults live independently longer instead of in a nursing home (Nederlandse Zorgautoriteit, 2018). When people live independently longer, their self-reliance becomes more important. This becomes important because of the possible decline in physical capabilities and psychological impairments when someone gets older, such as a decrease in hearing performance (Fernandez, Byard, Lin, Benson & Barbera, 2002). When there is no help immediately possible and there is less support present and/or available for older adults in emergency situations, they need to prepare themselves. To increase their self-reliance, older adults must be motivated to protect and prepare for risks.

Residential fires are specifically situations in which self-reliance of older adults is important. Because of the possible physical impairments, they are more vulnerable in case of fire. For example, consequences of hearing impairments are that older adults do not hear the smoke alarm in case of a fire. They are also often impaired in terms of mobility, which means they cannot escape quickly or cannot escape at all (Warda, Tenenbein & Moffatt, 1999). Older adults are slow in detecting heat because of a diminished sensitivity for pain, which can result in a late detection of fire (Brandweer, n.d.). Besides impairments, older adults often use older appliances, such as heating blankets, which have an increased chance to cause fire (Warda et al., 1999). This results in the fact that older adults are 2,7 times more often victim

of a fatal house fire than the average citizen of the Netherlands (Brandweeracademie, 2015). For this reason, it is important for older adults to have a high self-reliance and to increase their self-reliance when necessary. In order to increase this, two things are of importance, what is their degree of self-reliance and what influences this degree.

### 1.1 Goal and purpose of the study

This study focuses on the underlying factors of self-reliance that influence older adults to take or not take protective measures regarding fire. The behavior that needs to be changed is their self-protective behavior: only when older adults have the intention to perform self-protective behavior, their self-reliance can increase. With high self-reliant behavior, older adults can improve their safety at home when they live independently and increase their safety in case of emergency. Also important is the current degree of self-reliance and how various determinants that predict self-protective behavior are related to self-reliance.

When it is clear what the main barriers are for older adults, which prevent them from being self-protective and self-reliant, strategies can be developed to motivate this behavior and increase their self-reliance. The goal of the study is to map what predicts the degree of self-reliance amongst older adults in Twente and how they are related to self-reliance.

### 1.2 Self-reliance

The goal of self-reliance is, according to Kolen (2010), to make it easier and possible for citizens to save themselves or to survive until they are saved. This is the case because emergency services can take some time to arrive at the place of the incident, or help is not immediately available because of the nature of the disaster.

Several definitions of self-reliance are provided by different organizations and/or literature. For example, the Veiligheidsberaad defines self-reliance as:
*'The measures that citizens take for prevention, during and after crises to help themselves and to limit the consequences'* (Veiligheidsberaad, 2014, p. 22).

The Institution Physical Safety (Instituut Fysieke Veiligheid /IFV) defines self-reliance as:
*'Self-reliance includes the capabilities and measures taken of citizens to prevent and control incidents and the aftermath of incidents independently or with help of others.'* (IFV, 2012, p. 3).

When combining these definitions, some aspects become clear. Firstly, according to these definitions, self-reliance focuses on the capabilities of people to take preventive measures. This means whether someone has the capabilities to deal with the threat. Secondly, self-reliance encompasses measures. This is about whether someone has the means to deal with the threat. This can be for example knowledge, but also more practical costs such as time or money (Grothmann & Reusswig, 2006). However, these definitions are not the only definitions of self-reliance. What self-reliance encompasses is not always clear, which can make the concept unclear and difficult to study.

Self-reliance can be both perceived self-reliance of an individual or the self-reliant behavior of an individual. Perceived self-reliance is the subjective view of older adults of their self-reliance. For example, whether they think they are prepared for an emergency or living safely at home. This is different from self-efficacy because self-efficacy focuses on whether they feel able to perform a certain behavior. This study focuses on self-reliant behavior and not the perception of older adults of their behavior. Behavior is chosen because perception of self-reliance can be different from the actual behavior. For example, older adults can think they are self-reliant, but in reality, they are not self-reliant because they do not prepare themselves.

Self-reliance in this study is defined as following: Someone is self-reliant when he or she prepares for a threat, takes preventive measures and thinks about what to do in case of a threat. Especially, preparing for the future is important, when someone may become less self-reliant. Self-reliant behavior, in this study, are the concrete measures that older adults take to prevent fire and prepare for residential fire.

Being self-reliant requires that you are motivated to take precautionary measures to deal with an incident or threat. Only when you recognize the threat and are able to take measures to prevent the threat, your self-reliance can increase (Ruitenberg & Helsloot, 2004). Becoming motivated to protect yourself is therefore related to being self-reliant. The Protection Motivation Theory provides a framework for whether someone is motivated to protect him or herself.

### 1.3 Protection Motivation Theory

The Protection Motivation Theory is about the motivation for people to adopt protective behaviors. According to this theory, there are two processes that underlie the intention for protective behavior when faced with a threat. The two processes in the Protection motivation theory are threat appraisal and coping appraisal (Neuwirth, Dunwoody & Griffin, 2000).

Threat appraisal is the first process and is about whether people feel that the threat applies to them and is threatening to them. This includes the perceived severity of the hazard and the perceived probability of the threat to the individual. High perceived severity of the hazard means that someone thinks the threat is severe and threatening to him or herself. Perceived probability is about the likelihood of a threat for an individual. Does an individual think that it is likely that the incident/threat personally affects him or her? When the threat appraisal is high, people do think it is a threat and they are more likely to be motivated to do something about the threat, resulting in protective behavior. Threat appraisal can be decreased by both extrinsic as intrinsic rewards, such as pleasure for current behavior (Neuwirth et al., 2000).

The second process is coping appraisal. Coping appraisal is about whether someone thinks he or she can cope with the threat. Coping appraisal exists of both perceived response efficacy and perceived self-efficacy. Perceived response efficacy is whether someone thinks the preventive behavior (which is the response) is adequate for dealing with the threat. If the response efficacy is low, a person thinks that a response does not help in preventing the threat or dealing with the threat. Perceived self-efficacy is about whether someone thinks he or she is able to prevent the threat or deal with the threat. If someone does not think that he or she is able to deal with the threat, self-efficacy is perceived as low (Neuwirth et al., 2000). In both cases someone will not be motivated to protect oneself.

Fear can be aroused when someone thinks that a threat is likely to occur and the consequences of the threat are perceived as severe combined with the perception that he or she can nothing do to prevent the threat or deal with the consequences. Fear causes people to perform maladaptive behaviors such as denial, when these high levels of threat perception are not accompanied by information on how to deal with the threat or positive efficacy beliefs (Bubeck, Botzen & Aerts 2012; Witte & Allen, 2000).

### *1.3.1 Protective response costs*

There can also be costs that can influence the intention to perform protective behavior (Neuwirth et al., 2000). These costs are reflected in the definition of self-reliance as resources. Self-reliance includes that someone has (the idea that he or she has) enough time and money to deal with the threat. Also, the effort that it takes can be seen as costs. In previous research, specifically effort and time were found as holdbacks (Gutteling, Baan, Kievik & Stone, 2010). In the study done by Grothmann and Reusswig (2006), a third variable was added that reflects these costs: protective response costs. Protective response costs is part of the coping process

as described in the Protection Motivation Theory and is the assumed costs of performing the preventive response.

### 1.4 Perceived responsibility

A fourth part of the definition of self-reliance is the perceived responsibility. It might be that older adults rely on others to take protective measures, for example the government or the housing foundation. The perceived efficacy of others can decrease the likelihood of individuals taking private preventive measures (Grothmann & Reusswig, 2006).

A reason for this decreased likelihood to take preventive measures can be that they do not think it is their responsibility to deal with the threat. This 'responsibility attribution' is about who an individual thinks is responsible for taking preventive measures against a threat (Terpstra & Gutteling, 2008). If people perceive others responsible for their safety, they are less motivated to take preventive measures (Paton, 2003). They can think (wrongly) that others take precautionary measures because of this attributed responsibility. The study of Lalwani and Duval (2000) found that when there is no obvious personal responsibility, individuals fail to take their personal responsibility even when there is a high perceived threat and a high perceived self-efficacy.

### 1.5 Perceived knowledge and risk perception

When assessing the self-reliant behavior of older adults, perceived knowledge can influence whether someone takes protective measures. Besides having the perception that you are able to take protective measures and thinking that it is necessary to take protective measures, you also need to know which measures you can take. People often overestimate their knowledge or expertise (Ballantyne, Paton, Johnston, Kozuch & Daly, 2000). If they do overestimate it or estimate it as high, they are less likely to be attentive to new information and less likely to perceive need for additional preparation. This can also lead to the overestimation of their own safety (Paton, Smith, Daly & Johnston, 2008)

According to Paton (2003; 2013), research has consistently found that levels of preparedness are low. People find it difficult to clarify the uncertainties associated with a hazard. Also, people find it difficult to make clear what the most effective measures are that they can implement to protect themselves (Paton, 2013).

People make a distinction between personal risk and general risk. They estimate their own risk often lower than the risk to other people, for example family. Optimistic bias means

that people often claim to be less vulnerable than others. This is also related to unrealistic optimism. Individuals can therefore estimate personal risk as low, but they can claim that it is higher for others in general. The sense of control over the risk, which is the extent to which they could protect themselves, is an important variable accounting for this underestimation of the personal risk. This can mean, for example, that people do find it a risk, but think that others are more vulnerable to it (Sjöberg, 2000).

### 1.6 Current study

This study is about the self-reliant behavior of older adults regarding residential fire. It is important to know what predicts their self-reliance, because only when that is known, risk communicators can tackle those factors by incorporating and emphasizing them in risk communication. The main research question is therefore:

*'How self-reliant are older adults regarding residential fire and what influences the degree of self-reliance?'*

By answering this question, firstly, self-reliant behavior of older adults is mapped and secondly, the main determinants of the low or high degree of self-reliance regarding residential fire are identified. Also, a sub research question is formulated. This question focuses on the main determinant of self-reliance and is formulated as following:

*'What predicts the degree of self-reliance most strongly?'*

The research questions are answered using surveys. Older adults, of 65 years or older, who live independently in Twente are the subjects of this study.

Linking self-reliance and protection motivation by using the Protection Motivation is not often done explicitly in scientific literature. Therefore, this study adds to scientific literature that is about self-reliant behavior, which consists of preparing for a threat and taking preventive measures (preventive behavior). The Protection Motivation Theory focuses on the intention to perform protective behavior, this study focuses on the actual behavior while using the Protection Motivation Theory. That this theory can also be used to explain actual behavior can be seen in for example the study of Grothmann and Reusswig (2006). However, this study is different from research done by Grothmann and Reusswig (2006) in several ways. Firstly, this study focuses on residential fire, instead of flooding. Also, surveys are used as data collection

method, instead of telephone interviews. A last main difference are the participants included, this study focuses on people of 65-years or older. The study of Grothmann and Reusswig (2006) included ages from 16 till 83. Therefore, this study has a different approach than previous research and can add in explaining and analyzing actual behavior instead of intention.

Many studies focus on adults or adolescents, therefore this study is a valuable addition to literature about protective behaviors of older adults. Also, many studies focus on the causes of fire and the amount of risk older adults are exposed to regarding fire, not on the prevention of fire in relation to self-reliance and protection motivation.

### 1.7 Hypotheses

Following from the Protection Motivation Theory and the scientific literature as described, five hypotheses are formulated. The first hypothesis focuses on the correlation between self-reliance and perceived threat: perceived probability and perceived severity. Within the Protection Motivation Theory, threat appraisal leads to higher degrees of intention to protective behavior, which in turn can lead to actual protective behavior. Based on the Protection Motivation Theory it is hypothesized that high perceived probability of the threat and high perceived severity of the threat is related to high levels of self-reliance.

H1: The more someone perceives the threat as severe and likely, the more someone takes preventive measures or prepares for fire (self-reliance).

Based on the Protection Motivation Theory (Neuwirth et al., 2000, Grothmann & Reusswig, 2006), it is expected that perceived response efficacy and perceived self-efficacy positively correlate with self-reliance.

H2a: The more perceived self-efficacy and perceived response efficacy, the more someone takes preventive measures or prepares for fire (self-reliance).

Protective response costs are expected to correlate negatively with perceived response efficacy and perceived self-efficacy.

H2b: The more perceived protective response costs, the less perceived response efficacy and perceived self-efficacy.

Based on the study of Grothmann and Reusswig (2006), it is expected that high perceived responsibility is related to low degrees of self-reliance. This is expected because people are less inclined to take measures when they do not feel it is their responsibility (Beringer, 2000).

H3: The more perceived responsibility is attributed to others, the less someone takes preventive measures or prepares for fire (self-reliance).

Based on Paton et al. (2008), it is hypothesized that perceived knowledge is positively correlated with self-reliance. Only when people perceive having knowledge about taking preventive measures, about how to prepare for fire and about how to act in case of fire, they will act self-reliant. Therefore hypothesis 4 is:

H4: The more perceived knowledge someone has about taking preventive measures, about preparation for fire and about how to act in case of fire, the more someone prepares for fire or takes preventive measures.

## 2. Method

### 2.1 Participants

The participants of this study were older adults. Through convenience sampling, older adults of 65 years or older, who live in Twente and live independently were recruited. Living independently means that the older adults do not live in a nursing home or live with other persons, except for possibly their partner. Older adults who live in a nursing home or with other persons than their partner are excluded because their own self-reliance is possibly influenced by other people taking care of them. The age of 65 years and older was chosen because for this group self-reliance is especially important because of an increased chance on physical and psychological impairments (Zantinge, Van der Wilk, Van Wieren, & Schoemaker, 2011). Respondents who did not agree with the informed consent, respondents younger than 65 years or respondents who did not fill in the survey for at least 50%, were excluded. Participants were recruited from the social environment of the employees of the Safety Region Twente (Veiligheidsregio Twente), from known addresses of older adults and via elderly unions and other organizations that focus on older adults.

In total 104 respondents participated in the study of which 21 participants were excluded. Six participants were excluded because they did not met the age criteria, five participants were excluded because they did not fill in their age and 10 participants were excluded because they did not complete at least 50% of the survey. After excluding the participants who did not meet the criteria, 83 participants remained. Among the 83 participants, 54% was male and 45% was female. One person did not fill in their gender. Age ranged from 65 till 92 and the mean age was 75.88. Village/town ratio was almost equally distributed: 54% of the older adults lived in a village compared to 43% of the older adults that lived in a town. Out of 83 participants 37% lived alone, 63% lived together, 54% lived in a house and 46% lived in an apartment. Stairs or an elevator to leave their bedroom was needed for 71% of the participants.

*2.1.1 Representativeness of the sample*

Nationally seen, there are large differences between older adults dependent on age in the Netherlands. For example, 70% of the older adults aged from 65 years till 75 years live together. This percentage decreases to 37% of older adults aged 85 years and older (CBS, 2018). In this study, the mean age of older adults living alone is higher ($M$ = 77.94) than of older adults who live together ($M$ = 74.65).

More than 50% of the older adults that are 85 years or older live in an apartment, compared to 25% of the (older) adults from 55 years to 65 years lives in an apartment (De Groot, Van Dam & Daalhuizen, 2013). In this sample, the mean age of older adults living in an apartment is also higher ($M$ = 77.36) compared to older adults living in a house ($M$ = 74.13).

There is almost an equal distribution of older adults that live in either a town or in a village in the Netherlands. However, it is expected that the number of older adults in small municipalities will increase (Kooiman, De Jong, Husiman, Van Duin & Stoeldraijer, 2016). The sample resembles this trend.

There are more women at older age than men, because women tend to become older than men. The distribution was 46% male against 54% female in 2016 for older adults of 65 years or older, but the percentage increases to 63% female among older adults who are 80 years or older (Garssen, 2011). The sample does not exactly resemble that.

## 2.2 Design

A survey was conducted to answer the research question. Measured in this study are: perceived probability, perceived severity, perceived response efficacy, perceived self-efficacy, protective response costs, perceived knowledge of preventive measures, perceived responsibility and self-reliant behavior of older adults. As is described in the definition of self-reliance, self-reliance is about preventing and controlling incidents. Self-reliance focuses on the actual behavior of older adults.

## 2.3 Measures

The questions are based on questions used in various studies: a study about perceptions regarding threat and efficacy towards a company working with high doses of chemicals, a study about citizens and floods and a study about fire safety (Ter Huurne, 2017; Grothmann & Reusswig, 2006; Brandweer Limburg-Noord & Brandweer Zuid-Limburg, 2017). All items were asked following a 5-point Likert scale. The questions about perceptions were asked following a 5-point scale ranging from 'strongly disagree' till 'strongly agree'. The questions about self-reliant behavior were asked following a 5-point scale ranging from 'never' till 'always'.

Additionally, questions about (socio-)demographics were asked. These questions focused on the age of the participant; the gender of the participant; the housing situation of the participant (living in a house or apartment; needing a stairs or elevator to leave their bedroom or not), living situation (alone or not alone) and whether they live in a village or a town. These questions were asked to check whether there are differences in self-reliant behavior and differences in perceptions of fire, measures, ability, costs responsibility and knowledge between older adults. The questions of the survey are in Appendix A.

### *2.3.1 Perceived probability and perceived severity*

Perception of threat was divided into perceived probability and perceived severity (Grothmann & Reusswig, 2006; Neuwirth et al., 2000). In total 3 items measured perceived probability and 2 items measured perceived severity.

Cronbach's alpha was performed. The inter-reliability of the items of perceived probability is $\alpha = .70$, which means that the reliability is good.

Cronbach's alpha was not performed for measuring reliability of the items of perceived severity because it only contained two items. Therefore, the correlation between the

items was calculated. The correlation test showed that there is a significant positive correlation between the items of perceived severity ($r$ = .36, $p$ < .001). This means that the items of perceived severity are in the same direction.

*2.3.2 Perceived response-efficacy, perceived self-efficacy and protective response costs*

The items of perceived response efficacy, perceived self-efficacy and protective response costs are based on the study of Grothmann and Reusswig (2000). Perceived response efficacy was measured with 4 statements, perceived self-efficacy was measured with 5 statements and protective response costs consisted of 6 items.

Cronbach's alpha was performed for perceived response efficacy: α = .76. This means that the interitem-reliability is good. The Cronbach's alpha of perceived self-efficacy α = .82, which also indicates a good reliability of the items. Lastly, Cronbach's alpha of the items of protective response costs is α = .87, which is high.

*2.3.3 Perceived responsibility*

Perceived responsibility for protection and preparation was measured with 6 statements: Again, Cronbach's alpha was performed to check the inter-reliability of the items. Cronbach's alpha was α = .70, indicating a good reliability.

*2.3.4 Perceived knowledge*

Whether someone thinks he or she has knowledge about measures and what to do in case of fire was measured via 6 statements. Cronbach's alpha was performed, the inter-reliability of the items is α = .72., which indicates a good reliability.

*2.3.5 Self-reliance*

Self-reliance was measured to indicate whether older adults take preventive measures, prepare for a fire and test their smoke alarm. Self-reliance was measured via statements which focus on the actual behavior of older adults. The questions were based on research done by fire brigade Limburg-Noord and Limburg-Zuid (2017). The self-reliance measures were divided into three different types of behavior: preventing fire, signaling fire and preparation for fire. Each category consisted of one or more topics regarding fire. Preventing fire consisted of items about smoking in house, cooking, electric devises and candles; signaling was about

smoke alarms; and what to do in case of fire (preparation) was about an escape plan, flight route and agreements with neighbors.

Cronbach's alpha was $\alpha = .48$, which is a poor reliability. Four items (both candle items, the item about smoking and the presence-when-cooking-item) were removed to increase the reliability. Cronbach's alpha increased to $\alpha = .58$, which is still a low reliability.

### 2.4 Procedure

Older adults were asked via various channels whether they wanted to participate in a study about self-reliance and fire prevention at home. If they wanted to participate, they received the survey. The survey consisted of a description of the goal of the survey and information about the topic of the study. An instruction about how to fill in the survey and a section about the informed consent was also included. The survey topic was complemented with some examples of preventive measures people can take for preventing and signaling fire. The language of the survey was Dutch, because of possible difficulties for older adults to understand and read English. The survey was either personally handed, was sent via a website link or was sent as a document via e-mail. Based on the preference of the participant, the option was given to fill in the survey online or on paper.

Respondents had to agree with the informed consent to participate in the study. They started with answering questions about (socio-)demographics. After they had filled in the survey, the researcher collected the paper surveys personally or via other contacts. The participants who filled in the online survey could just close the survey in their browser. The respondents could e-mail the researcher in case of questions. The e-mail address of the responsible organization of the researcher (Veiligheidsregio Twente) was provided in the survey.

Before distributing the survey, the proposal of this study was submitted to the Ethics Board of the University of Twente. The Ethics Board approved the study.

The survey (paper and online survey) was first piloted among 4 participants. The feedback of the participants was used to improve the survey. Also, before analyzing the data, some items were recoded. Three items were recoded from 'perceived responsibility' ('others taking measures' and 'responsibility of the government for both saving in case of fire and preventing for fire'). All the items of 'protective response costs' were recoded and three items from 'self-reliance' (both 'candle' items and the 'smoking' item) were recoded. The final survey is in appendix B.

### 2.5 Data-analysis

Data was gathered via online surveys distributed via Qualtrics and via paper surveys. Data was analyzed using the statistics program SPSS. Cronbach's alpha was performed to check for reliability of the items. Whether there are significant differences in (socio-)demographics, correlation tests and independent t-tests were performed. A correlation test was performed to test the hypotheses and hierarchical multiple regression was done to answer the second research question.

## 3. Results

The mean of self-reliance ($M$ = 3.72, $SD$ = 0.45) is higher than the middle of the scale, which means that the older adults act self-reliant. Self-reliance can be divided into three types of self-reliant behavior: self-reliance at home, self-reliance regarding smoke alarms and self-reliance as preparation for fire. Self-reliance at home has a mean of 4.53 ($SD$ = 0.48), which is above the middle of the scale and indicates highly self-reliant behavior. 93% Of the older adults have a smoke alarm, but they do not act highly self-reliant in terms of testing smoke alarms ($M$ = 2.77, $SD$ = 1.19). Older adults mean for preparation for fire is above the middle of the scale ($M$ = 3.26, $SD$ = 0.62), which indicates that older adults act self-reliant in terms of preparation (Table 1).

There are some differences between the individual items of self-reliance regarding preparation for a fire. Two items scored below the middle of the scale ($M < 2.5$) and three items scored above the middle of the scale ($M > 2.5$). Not often are agreements made with neighbors ($M$ = 1.93, $SD$ = 1.18), but, on the other hand escape routes are often free of obstacles ($M$ = 4.38, $SD$ = 0.99). In general, older adults act on average slightly more self-reliant at home compared to testing smoke alarms and compared to self-reliance as preparation for a possible fire (Table 1).

Mean calculations showed that response efficacy is perceived as high ($M$ = 4.05, $SD$ = 0.56). This means that the respondents perceive measures for preventing or signaling fire as useful in preventing the threat. Perceived probability is perceived a little below the middle of the scale ($M$ = 2.41, $SD$ = 0.69), which indicates that the respondents perceive the likelihood that a fire occurs as not likely nor unlikely. Older adults do think that the consequences of fire are severe ($M$ = 4.01, $SD$ = 0.72) and they think it is their own responsibility to evacuate and to take measures ($M$ = 3.92, $SD$ = 0.58). Older adults perceive themselves being able to find

information about fire and they perceive themselves being able to use this information in case of fire (*M* = 3.78, *SD* = 0.50) (Table 1).

Table 1

*Means and standard deviations (n = 77-83)*

| **Measures** | **M** | **SD** | **N** |
|---|---|---|---|
| Self-reliance[1] | 3.72 | 0.45 | 83 |
| Self-reliance at home[1] | 4.53 | 0.48 | 83 |
| Materials away from fire when cooking[1] | 4.61 | 0.88 | 83 |
| Dust free appliances[1] | 4.26 | 0.81 | 82 |
| Damage free cords[1] | 4.67 | 0.82 | 81 |
| Damage free appliances[1] | 4.58 | 0.86 | 83 |
| Self-reliance: smoke alarm[1] | 2.77 | 1.19 | 77 |
| Self-reliance: preparation[1] | 3.26 | 0.62 | 83 |
| Flight route[1] | 3.49 | 1.00 | 83 |
| Agreements neighbors[1] | 1.93 | 1.18 | 83 |
| Flight route free from obstacles[1] | 4.38 | 0.99 | 82 |
| Trial flight route[1] | 2.14 | 1.26 | 81 |
| Flight key[1] | 4.37 | 1.20 | 83 |
| Perceived probability[2] | 2.41 | 0.69 | 82 |
| Perceived severity[2] | 4.01 | 0.72 | 82 |
| Perceived response efficacy[2] | 4.05 | 0.56 | 83 |
| Perceived self-efficacy[2] | 3.72 | 0.59 | 83 |
| Protective response costs[2] | 2.49 | 0.80 | 82 |
| Perceived responsibility[2] | 3.92 | 0.58 | 83 |
| Perceived knowledge[2] | 3.78 | 0.50 | 82 |

[1]*Range from 1=never till 5=always.*

[2]*Range from 1=strongly disagree till 5=strongly agree.*

The self-reliance: smoke alarm item has a lower number of respondents (77) compared to the other items, because only older adults who possessed a smoke alarm were asked to answer the question about testing their smoke alarms.

### 3.1 Correlations

Correlational analysis (Table 2) showed that older adults' perception of their ability to take measures is positively related to their perception about the usefulness of measures (response efficacy) ($r = .55$, $p < .001$).

Secondly, a high correlation was found between perceived response efficacy and perceived responsibility ($r = .45$, $p < .001$). This means thinking that it is your own responsibility to take measures is positively related with the perception that measures as useful in preventing or signaling fire.

Correlational analysis also showed that there is a high correlation between perceived response efficacy and perceived knowledge, meaning that older adults' perceptions of knowledge are positively related with their perceptions about the usefulness of measures ($r = .49$, $p < .001$).

Lastly, perceived knowledge correlated highly with older adults' perception of being able to take measures (self-efficacy) ($r = .66$, $p < .001$).

There were no significant correlations found between protective response costs and the other perceptions of older adults (Table 2).

Table 2

*Correlational analysis (r) self-reliance, perceptions and (socio-)demographics*

| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
|---|---|---|---|---|---|---|---|---|
| 1. Self-reliance | - | -.24* | -.10 | .32** | .34* | .18 | .12 | .36** |
| 2. Perceived probability | -.24* | - | | | | | | |
| 3. Perceived severity | -.10 | .23* | - | | | | | |
| 4. Perceived response efficacy | .32** | -.27** | .09 | - | | | | |
| 5. Perceived self-efficacy | .34** | -.00 | .04 | .55** | - | | | |
| 6. Protective response costs | .18 | -.15 | .12 | .13 | -.08 | - | | |
| 7. Perceived responsibility | .12 | -.26* | -.01 | .45** | .28** | .22* | - | |
| 8. Perceived knowledge | .36** | -.06 | .06 | .49** | .66** | .21* | .37** | - |
| Age | -.27*** | .18 | .13 | -.26*** | -.13 | -.12 | -.21 | -.21 |
| Gender | .04 | -.11 | .03 | .09 | -.01 | -.08 | -.07 | -.19 |
| Living alone/together | .09 | -.17 | -.05 | .12 | -.01 | .26* | .29**** | .19 |
| Town/village | -.05 | .18 | -.30**** | -.18 | .12 | -.23*** | -.05 | .09 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Apartment/house | .01 | -.17 | -.11 | -.00 | -.02 | .20 | .25*** | .05 |
| Presence of elevator/stairs | .18 | -.11 | .09 | -.05 | .22*** | -.00 | -.01 | .10 |

*$p < .05$ one-sided

**$p < .01$ one-sided

***$p < .05$ two-sided

****$P < .01$ two-sided

### 3.2 Hypothesis testing

*3.2.1 Perceived probability and perceived severity*

Only perceived probability was significantly correlated with self-reliance ($r = -.24$, $p = .03$) (Table 2). Perceived severity was not significantly correlated ($r = -.10$, $p = .38$). The correlation between perceived probability and self-reliance was negative, while it was hypothesized that the correlation would be positive. This means higher degrees of perceived probability are related with lower degrees of self-reliant behavior. It was hypothesized that higher degrees of perceived probability was related with higher degrees of self-reliance, therefore hypothesis 1 is rejected.

*3.2.2 Perceived response efficacy and perceived self-efficacy*

Perceived response efficacy ($r = .32$, $p < .001$) and self-reliance were significantly correlated, meaning that older adults' (positive) perception about the usefulness of measures is positively related to acting self-reliant (i.e. taking measures, testing smoke alarms, preparing for fire) (Table 2). Correlation between self-reliance and perceived self-efficacy ($r = .34$, $p < .001$) was also significant (Table 2). This indicates that older adults' perception of their ability to prepare for fire and recognize fire is positively related to self-reliant behavior. Both findings were as hypothesized, therefore hypothesis 2a is confirmed.

It was expected that protective response costs correlates negatively with both perceived response efficacy and perceived self-efficacy (H2b). However, protective response costs did not significantly correlate with perceived response efficacy and perceived self-efficacy (Table 2). Therefore, hypothesis 2b is rejected.

*3.2.3 Perceived responsibility*

There was no significant correlation found between self-reliance and perceived responsibility ($r = .12$ $p = .30$) (Table 2). It was hypothesized that there would be a significant positive correlation between self-reliance and perceived responsibility. This means that hypothesis 3 is

rejected. Being reliant on others and attribute responsibility to others is not significantly related to self-reliant behavior of older adults.

*3.2.4 Perceived knowledge*

Correlational analysis (Table 2) showed a positive correlation between perceived knowledge and self-reliance ($r = .36$, $p < .001$). This means that the perceptions of older adults regarding their knowledge are related to their self-reliant behavior. Hypothesis 4 is therefore confirmed.

**3.3 Differences in (socio-)demographics**

*3.3.1 Age*

According to a Pearson's correlation test, age is significantly correlated with self-reliance ($r = -.27$, $p = .01$). Because it is a negative correlation, 'younger' older adults act less self-reliant compared to older adults at a higher age. The results of the correlation tests are presented in Table 2.

Correlation between age and perceived response efficacy was also significant ($r = -.26$, $p = .02$), this means that at a higher age, older adults perceive measures less useful than older adults at a lower age.

*3.3.2 Gender*

An independent t-test was performed to analyze whether there are differences between male and female older adults. There were no significant results, meaning that being either male or female does not result in different perceptions or different degrees of self-reliant behavior.

*3.3.3 Living alone/together*

An independent t-test showed that older adults living alone significantly perceive less personal responsibility to take measures ($M = 3.70$, $SD = 0.71$) than older adults who live together ($M = 4.04$, $SD = 0.46$), $t(81) = -2.68$, $p = 0.01$. This finding indicates that older adults who live together rely less on others, besides their partner, than older adults who live alone.

The independent t-test of living alone/together and protective response costs was also significant, $t(49) = -2.74$, $p = .03$. People who live together perceive protective response costs as lower ($M = 2.33$, $SD = 0.70$) compared to people who live alone ($M = 2.77$, $SD = 0.90$).

To see which protective costs are perceived as low, additional independent t-tests were performed. Results showed that there is only a statistical significant difference between older

adults living alone or together in the perceived amount of effort of taking measures, $t(79) = 5.50$, $p = .04$). Older adults living alone perceive effort for taking measures as higher ($M = 2.74$, $SD = 1.17$) compared than older adults who do not live alone ($M = 2.27$, $SD = 0.85$).

### *3.3.4 Town/village*

An independent t-test showed that older adults living in a town perceive the threat of fire as more severe ($M = 4.24$, $SD = 0.60$) than older adults living in a village ($M = 3.81$, $SD = 0.75$), $t(78) = 2.84$, $p = .01$.

The independent t-test between living in a town or village and protective response costs was also significant, $t(76) = 2.12$, $p = .04$. Older adults living in a town perceive protective response costs as lower (M = 2.27, $SD = 0.77$) compared to older adults living in a village ($M = 2.65$, $SD = 0.80$). To specify which costs are specifically perceived lower, again an independent t-test was performed. The analysis showed that older adults living in a town perceive effort significantly lower ($M = 2.15$, $SD = 0.91$) than older adults living in a village ($M = 2.65$, $SD = 1.04$), $t(77) = 2.28$, $p = .03$).

### *3.3.5 Apartment/house*

Following from an independent t-test, older adults who live in an apartment perceive less personal responsibility for taking measures (besides their partner) ($M = 3.79$, $SD = 0.66$) than older adults who live in a house ($M = 4.07$, $SD = 0.44$), $t(77) = -2.35$, $p = .02$).

There was a significant negative correlation between age and whether someone lives in either an apartment or a house ($r = -.25$, $p = .02$), which means older adults living in an apartment are on average older compared to older adults living in a house. Age does not significantly correlate with perceived responsibility and an ANOVA of age and perceived responsibility was also not significant, $F(58, 24) = .86$, $p = .65$. Therefore, age has no direct role in older adults' perceived responsibility. but does have a role in whether older adults live in either an apartment or a house.

### *3.3.6 Presence of elevator/stairs*

The independent t-test showed that older adults who need stairs or an elevator to leave their bedroom perceive themselves as being less able to take measures or find information ($M = 3.64$, $SD = 0.60$) than older adults who do not need stairs or an elevator ($M = 3.92$, $SD = 0.52$), $t(48) = -2.14$, $p = .04$. Mean age for older adults that need or do not need stairs/elevator

was both 76 (*M* = 75.92, *SD* = 6.76; *M* = 75.79, *SD* = 5.87). There was no significant correlation between age and presence of stairs/elevator and neither between age and self-efficacy. Age has therefore no role on the relationship between needing stairs/elevator and self-efficacy.

### 3.4 Multiple regression analysis

A hierarchical multiple regression analysis was done to check whether one of the determinants explained the degree of self-reliance the most and to see whether the determinants can explain the degree of self-reliance.

#### *3.4.1 Hierarchical regression determinants self-reliance*

The determinants of self-reliance are included in the first model of the multiple regression analysis. A significant regression equation was found for being self-reliant, $F(7,73) = 3.58$, $p < .001$, with a $R^2$ of .26 (Table 3, model 1).

The determinants were stepwise included in the second model (Table 3, model 2). The second model was also significant $F(3,77) = 6.99$, $p < 001$, with an $R^2$ of .21, with only two significant determinants included. The analysis showed that perceived probability and perceived self-efficacy are statistically significant predictors of self-reliance. This means that when older adults perceive fire occurring as likely, they act less self-reliant compared to when they think fire is unlikely to occur. Also, older adults perceiving themselves being able to take measures predicts for a small part self-reliant behavior. These findings indicate that perceived self-efficacy predicts the degree of self-reliance most strongly (Table 3, model 2).

Table 3

*Hierarchical regression analysis self-reliance*

| | **Model 1** | | **Model 2** | |
|---|---|---|---|---|
| | β | SE | β | SE |
| Perceived probability | -.19 | .07 | -.21* | .07 |
| Perceives self-efficacy | .24 | .07 | .37** | .08 |
| Protective response costs | .17 | .11 | .18 | .18 |
| Perceived severity | -.11 | .12 | | |
| Perceived response efficacy | .11 | .06 | | |
| Perceived knowledge | .13 | .09 | | |
| Perceived responsibility | -.16 | .13 | | |

| | | |
|---|---|---|
| $R^2$ | .26** | .21** |

*p-value < .05

**p-value < .01

*3.4.2 Hierarchical regression (socio-)demographics and determinants*

In the second analysis, the three most important determinants from the previous analysis and the (socio-)demographics were included (Table 4). The first model was found to be significant, $F$ (9,69) = 2.31, $p$ =.02, with explanatory value of $R^2$ = .23 (Table 4, model 1).

In the second model, the (socio-)demographics and determinants were included stepwise, see Table 4, model 2. Model 2 was significant in explaining self-reliance, $F$(2.76) = 6.74, $p$ < .005. In model 2 only perceived self-efficacy was significant. This means that when older adults perceive themselves able to take measures or to recognize fire, their self-reliant behavior increases. Again, these findings indicate that perceived self-efficacy predicts the degree of self-reliance most strongly.

Table 4

*Hierarchical regression analysis self-reliance including (socio-)demographics*

| | **Model 1** | | **Model 2** | |
|---|---|---|---|---|
| | β | SE | β | SE |
| Perceived probability | -.11 | .08 | | |
| Perceived self-efficacy | .30** | .08 | .35** | .08 |
| Protective response costs | .19 | .06 | .20 | .06 |
| Age | -.18 | .01 | | |
| Gender | .10 | .12 | | |
| Living together/alone | .03 | .13 | | |
| Living village/town | -.02 | .10 | | |
| Apartment/house | -.14 | .10 | | |
| Stairs/elevator | .09 | .10 | | |
| $R^2$ | .23* | | .15** | |

*p-value < .05

**p-value < .01

*3.4.3 Hierarchical regression (socio-)demographics*

A third analysis was done to check whether (socio-)demographics can explain the degree of self-reliance. The first model, including all the (socio-)demographics was not significant, $F(6, 73) = 1.51$, $p = .19$ (Table 5, model 1). This means that (socio-)demographics do not explain the degree of self-reliance.

In the second step, the (socio-)demographics were entered stepwise (Table 5, model 2). This model is significant, $F(1, 78) = 4.74$, $p = .03$, but it only explains a small part of self-reliance ($R^2 = .06$). The only significant (socio-)demographic is age, but it is not a strong predictor (Table 5, model 2).

Table 5

*Hierarchical regression analysis of (socio-)demographics*

| | **Model 1** | | **Model 2** | |
|---|---|---|---|---|
| | β | SE | β | SE |
| Age | -.24 | .01 | -.24* | .01 |
| Gender | .11 | .12 | | |
| Living together/alone | .09 | .13 | | |
| Living village/town | -.05 | .10 | | |
| Apartment/house | -.11 | .10 | | |
| Stairs/elevator | .17 | .10 | | |
| $R^2$ | .11 | | .06* | |

**p-value < .05*

***p-value < .01*

*3.4.4 Multiple regression perceived self-efficacy*

A fourth analysis was done to analyze if (socio-)demographics can explain the degree of perceived self-efficacy. The results indicate that the model is not significant, $F(73,6) = .82$, $p = .56$. The degree of perceived self-efficacy cannot be not explained by any of the (socio-)demographics that were measured in this study (Table 6).

Table 6

*Multiple regression analysis perceived self-efficacy*

| | **β** | **SE** |
|---|---|---|
| Age | -.14 | .01 |

| | | |
|---|---|---|
| Gender | -.05 | .16 |
| Living together/alone | -.04 | .14 |
| Living village/town | .12 | .13 |
| Apartment/house | -.03 | .14 |
| Stairs/elevator | .17 | .14 |
| $R^2$ | .06 | |

*$^{*}$p-value < .05*

*$^{**}$p-value < .01*

## 4. Discussion

The model, existing of: perceived probability, perceived severity, perceived response efficacy, perceived self-efficacy, protective response costs, perceived responsibility and perceived knowledge, was found significant in predicting self-reliance. However, the model explained only a small part ($R^2$ = .26) of the degree of self-reliance. This means that self-reliance cannot fully be explained by these determinants. These results indicate that self-reliant behavior of older adults can be explained for a small part by the Protection Motivation Theory. This means that self-reliant behavior is related to perceptions about threat and measures. Because only a small part can be explained by self-reliance, a comparison between protective behavior and self-reliant behavior should be done with caution.

Perceived self-efficacy predicts the self-reliant behavior of older adults most strongly. This result indicates that older adults' perception of being able take preventive measures and to act in case of fire most strongly predicts self-reliant behavior. None of the (socio-)demographics measured in this study explain the degree of perceived self-efficacy. Therefore, a reason for the explanatory value of the degree of self-efficacy remains unknown. It is possible that the perception of older adults being able to take measures or to act in case of fire can be influenced by their physical or psychological impairments. Impairments, which can be barriers for self-reliant behavior, can decrease the perceived ability of older adults (Neuwirth, 2000).

Contrary to what was expected, older adults perceiving fire as likely to occur is negatively related to self-reliant behavior. This means that older adults act less self-reliant when they perceive probability of a fire as likely. A possible explanation for this surprising result is older adults having low response- and self-efficacy beliefs in combination with high perceptions about the likelihood of the threat. This can result in the belief that older adults think it is likely that a fire occurs, but do not think they can do anything about it to prevent a fire from happening. Also, they do not think measures are useful in preventing fire. This

arouses fear, because they think nothing can reduce the probability of fire. It is possible that older adults, in that case, are not motivated to improve their self-reliance or to remain self-reliant. Fear can result in maladaptive behavior, such as risk denial. In case of denial, older adults deny the threat of fire. This can negatively influence their motivation to protect themselves and become self-reliant (Bubeck et al., 2012; Witte & Allen, 2000).

Another possible reason for the surprising result is that older adults who act more self-reliant estimate the chance of fire lower because they are more prepared. Older adults who have prepared themselves for a fire can think that residential fire is less likely to occur because of these preparations. In that case, adoption of measures decreases the risk perception of older adults.

Perceived responsibility was not related with self-reliance. This means that whether older adults rely on, or attribute responsibility to others for preparation or evacuation, is not related to the degree of self-reliance. A possible explanation is that residential fire is a familiar threat for older adults. When a threat is familiar, people are less likely to be reliant on others for measures and information (Paton, 2013).

Perceived knowledge is, as expected, positively related with self-reliant behavior. Previous research found that people do not take measures when they do not have enough knowledge to deal with a threat (Bird, Gisladottir & Domney-Howes, 2010). On the other hand, increased understanding can result in increased enthusiasm for fire prevention. Residents who have more fire-related knowledge are more likely to own fire prevention equipment (Beringer, 2000). The results also indicate that, in line with the study of Beringer (2000), increased knowledge is related to increased trust in the usefulness of the measures. Behaving self-reliant also requires knowledge about what measures to take. Therefore, it is likely that highly self-reliant older adults also have high perceptions of knowledge (Beringer, 2000).

#### *4.0.1 (Socio-)demographics*

Within the sample of older adults, there were also some differences between older adults based on (socio-)demographics. From this study it became clear that self-reliance correlates negatively with age, meaning that older adults at higher age are less self-reliant compared to older adults at a younger age. This is in line with previous research. As found by Fernandez et al. (2000), and Crew and Zavotka (2006), at an increasing age, older adults are more likely to have physical or psychological impairments that can make them frailer or feel frailer (Zantinge et al., 2011). Therefore, they can think they are less able to take measures or to find

information (CBS, 2014; Crew & Zavotka, 2006). Older adults at a higher age perceive measures to prevent fire as less useful than older adults that are younger. A possible explanation for this result was not found.

There were no statistical differences found between men and women regarding perceptions of fire, measures, responsibility and knowledge, nor were there found any differences in self-reliant behavior.

This study found that older adults who live alone are more reliant on others than older adults that live together. A possible explanation could be that they do not have a partner to rely on and therefore must turn to others for help and support. According to research done by Rosenkoetter, Covan, Cobb, Bunting and Weinrich (2007), an important reason for older adults not preparing for leaving their homes in case of emergency is that older adults need assistance and are not able to evacuate themselves.

Protective response costs were perceived lower by older adults who live together compared to older adults who live alone. A possible explanation can be that protective response costs can be divided among residents when living together. What becomes clear from the results is that older adults living together specifically perceive effort to take measures lower than older adults living alone. When living alone, the workload resides with only one person. When living with a partner, tasks could be divided, which decreases the amount of effort per resident. There is no evidence of older adults living together perceiving time or money differently than older adults living alone. These results are in line with the study of Zhang et al. (2006), which study also found higher fire prevention rates among older adults living with others.

Older adults living in a town, perceive the probability of a threat higher and perceive protective response costs as higher, than older adults living in a village. A reason for this relationship was not be found.

Older adults living in a house rely less on others or attribute less responsibility to others for taking measures than older adults living in an apartment. A possible reason for this result is that people living in a house more often live together and rely on each other instead of others. In this sample older adults living in a house live indeed more often together than alone: 73% of the older adults lived together compared to 27% who lived alone in a house. Partners living together can help each other with preparing for fire and can help each other in case of fire. For example, when evacuating, older adults can help each other to leave the house safely. This can be especially important when older adults are dependent on assistance when evacuating (Rosenkoetter et al., 2007).

A last difference is found between older adults who need stairs or an elevator to leave their bedroom and older adults who do not need stairs or an elevator. Older adults who need stairs or an elevator perceive less self-efficacy than older adults who do not need stairs or an elevator. Whether these results are reliable is not clear. Within the pilot, the question about stairs/elevators was difficult to answer for some of the respondents. It is possible that even after changing the question after the pilot, some older adults still had difficulties with understanding this question.

### 4.1 Limitations

There are several limitations. Firstly, a limitation is the generalizability of the study. This study cannot be used to make conclusions about the whole population of older adults in Twente. The reason is that with 83 participants the sample is too small to be able to make such conclusions. Mainly due to time constraints it was not possible to increase the number of participants. The sample is (mostly) representative for older adults in the Netherlands in terms of (socio-)demographics.

The reliability of the scale of self-reliance was quite low. This could have affected the study and its results. This low reliability of the items could have led to a lower reliability of the model(s) that explain self-reliance.

There are several limitations of using surveys as data collection method. Firstly, it is possible that older adults give socially desirable answers. This threat is limited by ensuring the participants that the survey is anonymous. Secondly, it is possible that the survey itself increases awareness about fire, which in turn can change their perceptions about, for example, the probability that a fire occurs or the severity of a possible fire. Lastly, by using surveys and distributing them online, it is possible that the more engaged and active older adult is reached for whom it is possibly easier to act self-reliant.

### 4.2 Future research

In this study, self-reliance is researched as motivation to protect oneself and is based on the Protection Motivation Theory. Within this study, the Protection Motivation Theory, including perceived responsibility and perceived knowledge, was for a small part applicable to predict self-reliance. Future research could focus on other determinants that also possibly can explain the degree of self-reliance, such as previous experience with residential fire, which has been found to influence risk perception (Bubeck et al., 2012). Also, whether someone is the owner

of the house or property can be of influence on the degree of preparedness or on the intention to prepare for fire (Grothmann & Reusswig, 2006; Beringer 2000). Other models, such as the Theory of Planned Behavior could be used to explain the behavior of older adults (Ajzen, 2002). The Theory of Planned Behavior includes subjective norm that leads to the formation of behavioral intention (Ajzen, 2002). Subjective norm reflects the opinions of others and the degree to which you value these opinions. This can result in either social pressure or social support for taking measures and preparation. Social support or pressure can therefore increase or decrease self-reliant behavior. Lastly, future research could include the perception of the family of older adults as predictor of self-reliance, which is in line with the Theory of Planned Behavior and subjective norm. Previous research has indicated that taking and implementing measures is influenced by the family's perception of the hazard (Beringer, 2000).

Self-reliance encompasses various aspects, it has been defined as not only being about taking measures, but also thinking about taking measures, estimating own limitations, knowing possible risks and know how to act on them. Self-reliance, in this study, is measured as the actual behavior of older adults. However, perceived self-reliance can also be of influence on older adults' actual self-reliant behavior. For future research it would be interesting to analyze to what degree actual self-reliant behavior is related to perceived self-reliance.

Future research could focus on explanations of the correlations between several (socio-)demographics and perceptions of older adults. In this study, several relationships were found, but an explanation of these relationships was not always found. For example, the question: 'Why is there a relationship between age and perceived response efficacy?' could be interesting for research. Also, in previous academic literature (for example Neuwirth, et al. 2000 or Paton et al., 2008), the focus was often not on housing situation and living situation, but such (socio-)demographics could also be of interest. These could be especially interesting for risk communicators who want to focus on a specific target group.

Another interesting area for future research is the relationship between new technology and the degree of self-reliance of older adults. The past years, more technology has become available to support older adults living independently longer. An example is a smoke alarm that flashes light or that trembles instead of only making sound (Brandweer, n.d.). This is specifically useful for older adults with hearing impairments. Remaining self-reliant when living independently can become easier with such new technologies. Future research could examine the influence of new technology on the degree of self-reliance of older adults. Or it could focus on questions such as: Is there a difference in self-reliance between older adults

who use such technology and older adults who do not? A different focus could be on the willingness of older adults to adopt such new technology and if this willingness influences their self-reliant behavior.

Lastly, future research could focus on different age groups. In this study the focus was on older adults of 65 years and older. Future research could test whether the model that is used is also applicable to predict self-reliant behavior of other age groups. For example, the focus could be on parents with young children, because this group also has an increased chance to become victim of a fire in house. Young parents are more distracted by their children compared to parents with older children or parents with no children. It is easy for them to forget, for example, the stove when they are busy with their children. Also, young parents use the dryer more often and are less likely to clean the filter. Dust in the dryer can increase the likelihood of fire to occur (Verbond van Verzekeringen & Brandweer, 2018; IFV, 2018).

### *4.2.1 Recommendations risk communication*

For risk communicators it is important to take these results into account when communicating with older adults to increase their self-reliance regarding residential fire. Self-efficacy is an important determinant for explaining the self-reliant behavior of older adults. Older adults need to think they are able to take measures to prevent fire or to find useful information. Risk communicators could focus on the perceived self-efficacy of older adults. This means focusing on their perception of being able to prepare for a fire, recognizing fire, finding usable information and applying this information in practice.

The focus for risk communicators should be on the two areas of self-reliance on which older adults score low on. Older adults act less self-reliant regarding fire preparation and testing smoke alarms compared to self-reliant behavior at home. Risk communicators should therefore focus on improving preparation for a fire. The focus should specifically be on the items of preparation older adults score low on: making agreements with neighbors and testing the escape route.

Additionally, risk communicators should focus on research about communicating with older adults. In order to increase self-reliant behavior of older adults, risk communicators should focus on which communication channel is preferred by older adults and has the intended effect. An important question remains unanswered: How can older adults best be reached in order to increase their self-reliance? Risk communicators could focus for example on their children or other family members. Previous research showed that especially family

can be highly influential in changing the behavior of older adults (Beringer, 2000). More research is needed to answer this question.

Risk communication can take into account the different (socio-)demographics that correlate with self-reliant behavior and other perceptions. This study provides valuable information about differences between older adults in terms of self-reliant behavior and perceptions of fire, measures, knowledge and responsibility. The ‘oldest’ older adults are less self-reliant than ‘younger’ older adults. Older adults living alone perceive more protective costs (specifically effort) and perceive less personal responsibility than older adults living together. Older adults living in a village perceive fire as more severe and perceive more protective costs (specifically effort) than older adults living in a town. Older adults living in an apartment perceive less personal responsibility to take measures than older adults living in a house. Lastly, older adults who need stairs or an elevator to leave their bedroom perceive being less able to take measures than older adults who don’t need stairs or an elevator. Taking together, the focus should be on the ‘oldest’ older adults, older adults who live alone, older adults who live in an apartment, older adults who live in a village and older adults who need stairs or an elevator to leave the bedroom.

### 4.3 Conclusion

With older adults being a high-risk group to become victim of residential fire, it is crucial to for adults to act self-reliant to prevent them from becoming victims of residential fire. This study showed that the Protection Motivation Theory can be used to predict self-reliance. However, not much of self-reliant behavior can be explained. With only a small part of self-reliance explained by the determinants, self-reliant behavior cannot completely be compared with intention to perform protective behavior. This study indicates that self-reliant behavior is predicted most strongly by whether older adults feel capable to prevent and signal fire. Also, the results of this study indicate that older adults take preventive measures, but do not test smoke alarms or prepare themselves for a possible fire, meaning that self-reliant behavior of older adults can be improved. Lastly, there are differences between older adults in terms of perceptions and self-reliant behavior dependent on (socio-)demographics. Additional research is needed to develop and analyze effective communication towards older adults and to explain a larger degree of self-reliant behavior of older adults.

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# Appendix

## A. Survey questions

**(Socio-)demographic questions:**

- What is your age?
- What is your gender?
- What is your living situation?
- What is your housing situation?
- Do you live in an apartment or a house?
- Do you need stairs or an elevator to leave your house or building from the bedroom?

**Items perceived probability:**

- I think that there is a high chance that fire occurs in my house.
- I think chances are high that I will become wounded because of residential fire.
- I think chances are high that I will become wounded because of fire caused by someone else.

**Items perceived severity:**

- If there is a fire, the consequences for me are severe.
- I think that residential fire is a serious danger for me.

**Items perceived response efficacy:**

- I have sufficient confidence in the measures I took to prevent residential fire.
- When fire breaks out at home, I have influence on my safety.
- Taking measures is useful in preventing fire.
- Installing smoke alarms is useful for detecting fire on time.

**Items perceived self-efficacy:**

- I am capable to prepare myself for a possible residential fire.
- In case of fire, I can act in the right way.
- I can recognize fire in time.
- I can find usable information about the causes of fire.
- I can also apply the information I have practically.

**Items protective response costs:**

- Taking measures to prevent fire are expensive.
- It costs a lot of money to buy smoke alarms.
- Taking measures to prevent fire cost a lot of time.
- It costs a lot of time to buy and install smoke alarms.
- Taking measures to prevent fire cost a lot of effort.
- It takes a lot of effort to buy and install smoke alarms.

**Items perceived responsibility:**

- Because others already have taken enough measures to prevent fire, I do not have to do that.
- It is the responsibility of the government to save me when there is a fire at my home.
- It is my own responsibility to escape from my house in case of fire.
- It is the responsibility of the government to take measures that prevent fire at my home.
- It is my own responsibility to take measures that prevent fire.
- It is my responsibility to install smoke alarms.

**Items of perceived knowledge**

- I know where I can find information about fire prevention.
- I can use the information I have in case of fire.
- I know what I must do in case of fire.
- I know what to do when the smoke alarm goes off.
- I know how I can evacuate from my house in case of a fire.
- I know how I can test a smoke alarm.

**Items self-reliance**

Questions about fire safety at home:

- Do you smoke, or someone else in your household, at the couch, in bed or in a chair?
- Do you stay, or someone else, in the kitchen during cooking?
- Do you keep flammable materials, like tea towels or bath towels etc. at distance from the stove?
- Are electrical appliances free from dust at your home?

- Are electrical appliances with defects being left unused, repaired or thrown out?
- Do you sometimes have candles or tea lights burning when there is no one else present in the room?
- Do you sometimes have candles or tea lights burning nearby flammable materials such as curtains?

Questions about smoke alarms:

- Do you have one or more smoke alarms in your house?
- Do you test your smoke alarms?

Questions about what to do in case of fire:

- Do you think about the fastest way to escape in case of fire?
- Do you make agreements with people who are close to your, such as neighbors, in case of fire?
- Are your escape routes free from obstacles, for example, there are no shoes or cabinets that may stand in your way?
- Do you practice/try your escape routes?
- Do you have a key ready next to your front- or backdoor in case you have to flee?

# B. Zelfredzaamheid en brandveiligheid van oudere volwassenen in Twente

Beste meneer, mevrouw,

Graag wil ik u vragen om een enquête in te vullen over woningbrand. Veiligheidsregio Twente wil graag weten wat uw mening is over brandveiligheid. Door middel van een vragenlijst probeert de Veiligheidsregio Twente in kaart te brengen of oudere volwassenen zichzelf zouden kunnen redden in geval van brand. Ook willen we graag weten waarom oudere volwassenen zich wel of niet voorbereiden op brand. Met deze informatie kan Veiligheidsregio Twente informatie aanpassen op de behoefte van oudere volwassenen in Twente. Deze enquête is daarnaast onderdeel van een master afstudeeronderzoek.

Deelname aan het onderzoek is volledig vrijwillig en anoniem. Er worden geen persoonlijke gegevens van u opgeslagen. U kunt op elk moment stoppen met de enquête zonder opgave van reden. De antwoorden worden alleen gebruikt voor het doel van het onderzoek.

Als u vragen hebt kunt u deze mailen naar w.eendebak@vrtwente.nl.

Willemijn Eendebak

Student Psychologie Universiteit Twente en stagiaire bij Veiligheidsregio Twente

**Gaat u akkoord en wilt u meedoen aan het onderzoek?**

- ○ Ja
- ○ Nee

*Aanwijzingen voor het invullen van de vragenlijst:*

- Wij zijn geïnteresseerd in UW mening. Er zijn geen goede of foute antwoorden. Als u twijfelt over een antwoord, probeer dan toch de antwoordmogelijkheid te kiezen die het beste bij u past. U bent vrij om een vraag niet te beantwoorden als u dat niet wilt.

- Bij de vragen in deze vragenlijst kunt u telkens maar voor één antwoord kiezen.

- U kunt antwoorden door het rondje voor het door u gekozen antwoord aan te kruisen of door het antwoord in de aangegeven ruimte in te vullen.

- Het invullen van de vragenlijst duurt ongeveer 20 minuten en u kunt op elk moment stoppen of later doorgaan.

# Achtergrondkenmerken

Als eerste zouden we graag enkele achtergrondgegevens van u willen weten.

**Wat is uw leeftijd? _____**

**Wat is uw geslacht?**

- ○ Man
- ○ Vrouw

**Wat is uw leefsituatie?**

- ○ Ik woon alleen
- ○ Ik woon samen

**Wat is uw woonsituatie?**

- ○ Ik woon in een stad
- ○ Ik woon in een dorp
- ○ Geen antwoord

**Woont u in een appartement of in een huis?**

- ○ Appartement
- ○ Huis
- ○ Geen antwoord

**Heeft u een trap of lift nodig om vanuit uw slaapkamer uw woning of gebouw te verlaten?**

- ○ Ja
- ○ Nee

**Wilt u per stelling aangeven in hoeverre u het er mee oneens of mee eens bent. Hierbij is links 'helemaal mee oneens' en rechts 'helemaal mee eens'. Als u niet wilt antwoorden is dat ook mogelijk.**

**1. De volgende stellingen gaan over uw mening ten opzichte van brand.**

| | Zeer mee oneens | Mee oneens | Niet mee oneens/niet mee eens | Mee eens | Zeer mee eens |
|---|---|---|---|---|---|
| Er is een grote kans dat er bij mij in huis brand ontstaat | ○ | ○ | ○ | ○ | ○ |
| Er is een grote kans dat ik gewond raak door een brand in mijn woning | ○ | ○ | ○ | ○ | ○ |
| Er is een grote kans dat ik gewond raak door een brand veroorzaakt door een ander | ○ | ○ | ○ | ○ | ○ |
| Als er brand uitbreekt in huis heeft dat grote gevolgen voor mij | ○ | ○ | ○ | ○ | ○ |
| Ik vind woningbrand een ernstig gevaar | ○ | ○ | ○ | ○ | ○ |

Er zijn verschillende maatregelen die mensen nemen om zichzelf voor te bereiden op brand. Sommige mensen hebben bijvoorbeeld een vluchtplan of hebben rookmelders opgehangen. Het kan per persoon verschillen hoeveel voorbereiding zinvol is.

**2. De volgende stellingen gaan over hoe u denkt over het nemen van maatregelen.**

| | Zeer mee oneens | Mee oneens | Niet mee oneens/niet mee eens | Mee eens | Zeer mee eens |
|---|---|---|---|---|---|
| Ik heb vertrouwen in de maatregelen die ik heb genomen om thuis brand te voorkomen | ○ | ○ | ○ | ○ | ○ |
| Mocht er brand uitbreken, dan heb ik invloed op mijn eigen veiligheid | ○ | ○ | ○ | ○ | ○ |
| Het nemen van maatregelen is nuttig om brand te voorkomen | ○ | ○ | ○ | ○ | ○ |
| Het ophangen van rookmelders is nuttig om brand op tijd te kunnen herkennen | ○ | ○ | ○ | ○ | ○ |
| Ik ben in staat om mij voor te bereiden op een mogelijke brand in huis | ○ | ○ | ○ | ○ | ○ |
| In geval van brand kan ik op de juiste manier handelen | ○ | ○ | ○ | ○ | ○ |
| Ik kan brand tijdig herkennen | ○ | ○ | ○ | ○ | ○ |

| | Zeer mee oneens | Mee oneens | Niet mee oneens/niet mee eens | Mee eens | Zeer mee eens |
|---|---|---|---|---|---|
| Ik kan bruikbare informatie vinden over de oorzaken van brand | ○ | ○ | ○ | ○ | ○ |
| Ik kan de informatie die ik heb ook toepassen in de praktijk | ○ | ○ | ○ | ○ | ○ |
| Maatregelen nemen om brand te voorkomen zijn duur | ○ | ○ | ○ | ○ | ○ |
| Het kost veel geld om rookmelders aan te schaffen | ○ | ○ | ○ | ○ | ○ |
| Maatregelen nemen om brand te voorkomen kost veel tijd | ○ | ○ | ○ | ○ | ○ |
| Het kost veel tijd om rookmelders te kopen en op te hangen | ○ | ○ | ○ | ○ | ○ |
| Maatregelen nemen om brand te voorkomen kost veel moeite | ○ | ○ | ○ | ○ | ○ |
| Het kost veel moeite om rookmelders te kopen en op te hangen | ○ | ○ | ○ | ○ | ○ |

**3. De volgende stellingen gaan over wie er maatregelen neemt of moet nemen.**

| | Zeer mee oneens | Mee oneens | Niet mee oneens/niet mee eens | Mee eens | Zeer mee eens |
|---|---|---|---|---|---|
| Omdat anderen al genoeg maatregelen hebben genomen om brand te voorkomen, hoef ik dat niet meer te doen | ○ | ○ | ○ | ○ | ○ |
| Het is de verantwoordelijkheid van de overheid om mij te redden als er brand uitbreekt | ○ | ○ | ○ | ○ | ○ |
| Het is mijn eigen verantwoordelijkheid om mijn huis te ontvluchten bij brand | ○ | ○ | ○ | ○ | ○ |
| Het is de verantwoordelijkheid van de overheid om brand te voorkomen in huis | ○ | ○ | ○ | ○ | ○ |
| Het is mijn verantwoordelijkheid om maatregelen te nemen om brand te voorkomen | ○ | ○ | ○ | ○ | ○ |
| Het is mijn verantwoordelijkheid om rookmelders op te hangen | ○ | ○ | ○ | ○ | ○ |

**4. De volgende stellingen gaan over informatie over brand.**

| | Zeer mee oneens | Mee oneens | Niet mee oneens/niet mee eens | Mee eens | Zeer mee eens |
|---|---|---|---|---|---|
| Ik weet waar ik informatie kan vinden over brandpreventie | ○ | ○ | ○ | ○ | ○ |
| Ik kan de informatie die ik heb, gebruiken als er brand uitbreekt | ○ | ○ | ○ | ○ | ○ |
| Ik weet hoe ik moet handelen als er brand uitbreekt | ○ | ○ | ○ | ○ | ○ |
| Ik weet wat ik moet doen als het brandalarm afgaat | ○ | ○ | ○ | ○ | ○ |
| Ik weet hoe ik mijn woning moet ontvluchten als er brand is | ○ | ○ | ○ | ○ | ○ |
| Ik weet hoe ik een rookmelder kan testen | ○ | ○ | ○ | ○ | ○ |

**Wilt u per stelling aangeven hoe vaak de volgende situaties voorkomen. Hierbij is helemaal links 'nooit' en rechts 'altijd'. Als u niet wil antwoorden is dat ook mogelijk.**

**5. De volgende vragen gaan over brandveiligheid in huis.**

| | Nooit | Zelden | Soms | Vaak | Altijd |
|---|---|---|---|---|---|
| Rookt u, of iemand in uw huishouden, op de bank, in bed of in een stoel? | ○ | ○ | ○ | ○ | ○ |
| Blijft u, of iemand anders, in de keuken als er gekookt wordt? | ○ | ○ | ○ | ○ | ○ |
| Houdt u brandbare materialen als theedoeken, handdoeken etc. op afstand van het fornuis? | ○ | ○ | ○ | ○ | ○ |
| Zijn elektrische apparaten bij u thuis vrij van stof? | ○ | ○ | ○ | ○ | ○ |
| Zijn de snoeren van uw elektrische apparaten onbeschadigd? | ○ | ○ | ○ | ○ | ○ |
| Worden elektrische apparaten met mankementen niet meer gebruikt, gerepareerd of weggegooid? | ○ | ○ | ○ | ○ | ○ |
| Branden er weleens kaarsen of waxinelichtjes terwijl er niemand in de ruimte aanwezig is? | ○ | ○ | ○ | ○ | ○ |
| Branden er weleens kaarsen of waxinelichtjes in de buurt van brandbare materialen, zoals gordijnen? | ○ | ○ | ○ | ○ | ○ |

**De volgende vragen gaan over rookmelders.**

| | Ja | Nee | Weet ik niet |
|---|---|---|---|
| Heeft u één of meerdere rookmelders in uw woning? | ○ | ○ | ○ |

| | Nooit | Zelden | Soms | Vaak | Altijd |
|---|---|---|---|---|---|
| Test u uw rook-melders? | ○ | ○ | ○ | ○ | ○ |

**De volgende vragen gaan over het handelen in geval van brand.**

| | Nooit | Zelden | Soms | Vaak | Altijd |
|---|---|---|---|---|---|
| Denkt u weleens na over wat de snelste weg is om uw huis te ontvluchten bij brand? | ○ | ○ | ○ | ○ | ○ |
| Maakt u weleens afspraken met naasten, zoals uw buren, voor als er brand uitbreekt? | ○ | ○ | ○ | ○ | ○ |
| Zijn uw vluchtroutes vrij van obstakels, bijvoorbeeld geen schoenen of kasten die in de weg staan? | ○ | ○ | ○ | ○ | ○ |
| Probeert u uw vluchtroute weleens uit? | ○ | ○ | ○ | ○ | ○ |
| Heeft u een sleutel klaarliggen bij uw voor- of achterdeur voor als u moet vluchten? | ○ | ○ | ○ | ○ | ○ |

**Ten slotte heeft Veiligheidsregio Twente nog twee vragen over hoe en wanneer ze u het beste kan bereiken.**

**Zou u willen aangeven hoe u het liefste zou willen worden aangesproken?**

- ○ Senior
- ○ Bejaarde
- ○ Oudere
- ○ Oudere volwassene
- ○ 65-plusser
- ○ Geen voorkeur
- ○ Anders, namelijk _____

**Heeft u naar aanleiding van deze vragenlijst nog opmerkingen of suggesties, dan kunt u deze hieronder kwijt.**

_____

_____

_____

_____

_____

**Hartelijk dank voor uw medewerking!**