

## The tsunami, then and three years after.

PTSD symptoms in Dutch tsunami victims in relationship to exposure.



Drs. S.J.M.A. Matthijssen & I.H. van Oosterom Bsc.

Supervisors:

Prof.dr. R.J. Kleber

Kol-arts dr. E. Vermetten

July, 2008

Masterthesis Clinical & Health Psychology, University Utrecht

**Photo front page:**  
**Source: [www.worldpressphoto.org](http://www.worldpressphoto.org), 2004**

Mommy! A tsunami! You heard your young child say.  
But when you reached to take his hand, your son was washed away.  
Mommy! A tsunami! You heard his sister scream.  
You tried to run, but couldn't move. You woke. It was a dream.

For us, a figment of our minds while blanketed in bed.  
But for those who were swept to sea, this nightmare left them dead.  
Did panic fill their final thoughts? I pray they sensed God near.  
I hope their death was swift so that they had no time to fear.

So why should we be spared such grief? Do we deserve to live?  
But since we dream what others saw, can we do less than give?

For mummies robbed of babies, for husbands who lost wives,  
For kids without their moms and dads, for all who have survived,  
Let's give help to the homeless, let's fund the food they need,  
Let's pray for people we don't know who claim a different creed.

Regardless of religion, let's act on what we see, for God is pleased when we reach out. We  
are one family.

**Source: [http://www.funlol.com/1220/Tsunami\\_Poem!.html](http://www.funlol.com/1220/Tsunami_Poem!.html)**

## Summary

---

**Introduction.** December the 26th 2004 a massive undersea earthquake northwest of Sumatra, Indonesia, with a Richter-scale magnitude of 9.3, caused a giant shockwave or tsunami that devastated the shorelines of Indonesia, Sri Lanka, India, Thailand, and many other countries (van Griensven et al., 2006). Thousands of people from all over the world were reported missing or dead. Besides the enormous death toll, other far-reaching consequences followed. It is important to raise the awareness of psychological consequences resulting from major trauma. With insight in these consequences there can be anticipated upon obstacles in psychological aid. **Theoretical background.** Psychological consequences of natural disasters have been studied extensively. The most notably measured psychological problem was posttraumatic stress disorder (PTSD). Exposure, seen as one of the most influencing factors in developing PTSD is investigated. The central question raised in the research is: *Do individuals who are exposed more severely to the tsunami have more PTSD-symptoms and how strong is the possible relationship between exposure and symptoms after three years?* **Method.** Starting the study first qualitative research was done. With use of TISEI-internetquestionnaires ([www.tisei.org](http://www.tisei.org)) the focus of the study was on PTSD-symptoms among Dutch survivors who were present in one of the affected regions at the time of the tsunami or were indirectly influenced by it. Participants at T1 were 28 Dutch males (38,4%) and 45 Dutch females (61,6%). At T2 (three years after the tsunami) participants were 15 Dutch males (40,1%) and 22 Dutch females (59,6%). For measuring exposure, questions that revealed a form of exposure to the tsunami on the TISEI-website were used. A factoranalysis was conducted which revealed at T1 two factors, which were not replicated at T2. Davidson Trauma Scale (DTS) was used to assess PTSD symptoms cross-sectionally. Regressionanalysis were used to assess the relationship between exposure and the DTS. **Results.** DTS scores differed significantly at T1 (M= 72,2055) and T2 (M= 57,2432). Cluster D of PTSD revealed the highest mean, at T1 and at T2. At T1 (N= 73) 30 persons scored above 80, the cut-off score for diagnosing PTSD. This was 41,1% of the sample. At T2 (N=37) 5 persons or 13,5% of the sample could be diagnosed with PTSD. **Discussion.** The recent study has found no significant difference in levels of exposure to the tsunami and its relationship with PTSD symptoms. This outcome applies for the T1-group, as well as for the T2-group. An appreciable descending trend is visible in PTSD symptoms over time, although the groups cannot be compared. Participants at T1 had a mean score of 72.21 on the DTS. 41.1% had PTSD symptoms. Three years after the disaster - at T2 – the mean score was 57.24. 13.5% of the individuals showed PTSD symptoms.

## Preface

---

With finishing this research we are one step closer to becoming psychologists. The research was for us an interesting project, with impressing experiences and intimate moments with those who actually experienced the tsunami. Not only doing research and learning more about the statistics, but most of all the subject of the research had a grip on us. We remembered our first meeting with Kol-arts dr. Eric Vermetten, with whom we explored several ideas and options for doing research. It didn't take long after he told us about an option of doing research about the impact of the tsunami, to decide this was what really interested us.

Not only we did quantitative research, we also interviewed survivors. We were touched by the stories and by the openness of those who spoke with us. We would like to thank Simone and Xander who took us on a mental journey by telling us their story of the end of their normal life on Koh PhiPhi. Also, Patricia who experienced hurricane Katrina showed us what the impact of a traumatic event can be. We also would like to thank Karin and Luc and their children for sharing with us their terrifying moments during the tsunami. It is hard to put down in words the respect we have for their dedication to create the tsunami-monument. We think this is an amazing initiative for those who lost their lives during the tsunami, but also for their loved ones, who can come there to remember and honor them.

We are honored that we could be part of this special project and that we got a chance to help, together with Kol-arts dr. Eric Vermetten, dr. Tom van der Schoot, Cap. Dick Ross and Cap. John van der Eijk, with giving the painting tsunami-survivors made a place in the Calamiteitenhospitaal in Utrecht.

In doing our research we could rely on each other but also on our supervisors. We would like to thank our supervisors: Prof. dr. Rolf Kleber and Kol-arts dr. Eric Vermetten for their helpful criticism that inspired us to look further for better explanations and a more analytic approach, for their confidence in us, their overwhelming enthusiasm and their inspiring ideas to look beyond the normal expected. They not only encouraged us to grow scientifically but also personally. Furthermore, we would like to thank Rens van der Schoot Msc. for his dedication in helping us through the difficult bumps we had to take statistically. Without his help we could not have succeeded in the way we can do now. Then of course our parents, sisters and our beloved partners, Valerio and Mark who were there to support us. Thank you!

## Contents

---

<b>Introduction</b>	<b>8</b>
<b>Theoretical background</b>	<b>10</b>
§ 2.1 Psychological consequences	10
§ 2.2 Stress Model	11
§ 2.3 PTSD	12
§ 2.4 Risk factors	14
§ 2.5 Exposure	15
§ 2.6 Development of PTSD symptoms	17
<b>Methods</b>	<b>18</b>
§ 3.1 Preparations	18
§ 3.2 TISEI	18
§ 3.3 Methods	19
<i>A. Directly after the tsunami</i>	19
Participants	19
Measures, instruments and data collection	22
Procedure	23
Design and statistical analysis	23
<i>B. Three years after the tsunami</i>	25
Participants	25
Measures, instruments and data collection	25
Design and statistical analysis	26
Procedure	26
<b>Results</b>	<b>27</b>
§4.1 PTSD-symptoms	27
§4.2 The relationship between exposure and PTSD-symptoms	28
A. Directly after the tsunami	29
B. Three years after the tsunami	30
§4.3 Subanalysis	30
A. Directly after the tsunami	30

B. Three years after the tsunami	32
<b>Discussion</b>	<b>34</b>
§5.1 PTSD-symptoms	34
§5.2 Exposure	37
§5.3 The central question	39
§5.4 Strength of the study	40
§5.5 Limitations of the study	41
§ 5.6 Future recommendations	42
<b>Literature</b>	<b>44</b>
Appendix 1	50
Appendix 2	51

## Chapter 1: Introduction

---

*'I felt so guilty new life started in me, while the world around us died.'*

**(Interview survivor tsunami)**

December the 26th 2004 one of the most devastating natural disasters of the last few years occurred. A massive undersea earthquake northwest of Sumatra, Indonesia, with a Richter-scale magnitude of 9.3, caused a giant shockwave or tsunami that devastated the shorelines of Indonesia, Sri Lanka, India, Thailand, and many other countries (van Griensven et al., 2006). The death rate was estimated at 300.000 (World Health Organization, 2005 in So-Kum Tang, 2007). Most effected countries in terms of deaths were Indonesia (131.029), Sri Lanka (31.229), India (10.749), Thailand (5.395), Malaysia (74), the Maldives (108), Myanmar (90) and Somalia (176) (United Nations (UN), 2006). Many tsunami victims were not native citizens of the affected regions, but were citizens from abroad working in the area or were on holiday. Thousands of people from all over the world were reported missing or dead. Affected countries were the Scandinavian countries (851), Germany (552), Great-Britain (150), Switzerland (112), France (95), Austria (86), Italy (40), Hong Kong (38), Japan (37), the Netherlands (36), the United States of America (33) and Australia (26) (UN, 2006).

During the days and weeks following the tsunami, the intensive global media coverage vividly documented the physical consequences of the tsunami's destructive power (Davidson & McFarlane, 2006). As each day passed, many lives were claimed by disease and untreated injuries (Szegedy-Maszak, 2005). Besides the enormous death toll, other far-reaching consequences followed. Economic consequences were apparent, not only for those who lost everything. Furthermore, there were those who had no physical injuries but who suffered from the burden of coping with grief, terror and loss.

It is important to raise the awareness of psychological consequences resulting from major trauma. With insight in these consequences there can be anticipated upon obstacles in psychological aid. There are many risk factors which determine mental health outcome after experiencing a major traumatic event. In chapter two risk factors will be mentioned and a theoretical background for stress symptomatology and the development of Posttraumatic Stress Disorder (PTSD) will be discussed by looking at earlier research. PTSD is the most notably measured psychological disturbance after traumatic experiences (Norris et al. 2002a, Norris, Friedman & Watson, 2002b). One of the risk factors - exposure to the disaster - will be explored. Secondly, awareness will be raised for longitudinal research in the trauma field.

The central question of the research is the following:

- ***Do individuals who are exposed more severely to the tsunami have more PTSD symptoms and how strong is the possible relationship between exposure and symptoms after three years?***

In chapter three the used methods will be outlined. Chapter four discusses the results of the analysis, concluding with a discussion in chapter five. Besides the social importance of the research for better understanding consequences of traumatic experiences and anticipation on this in psychological aid, also theoretically this research raises interesting questions about the validity and reliability of internet research and about the problems with conceptualising 'exposure'.

## Chapter 2: Theoretical background

---

*'When the tsunami came, everybody fled for his life!  
No human being was safe anymore!  
Most had to give their life!  
The day before the tsunami came everybody was still happy!  
Until the tsunami came!  
Then the tsunami was over!  
No human being was then still himself!*

**(de Ruijter, van der Schoot, Vermetten, 2005)**

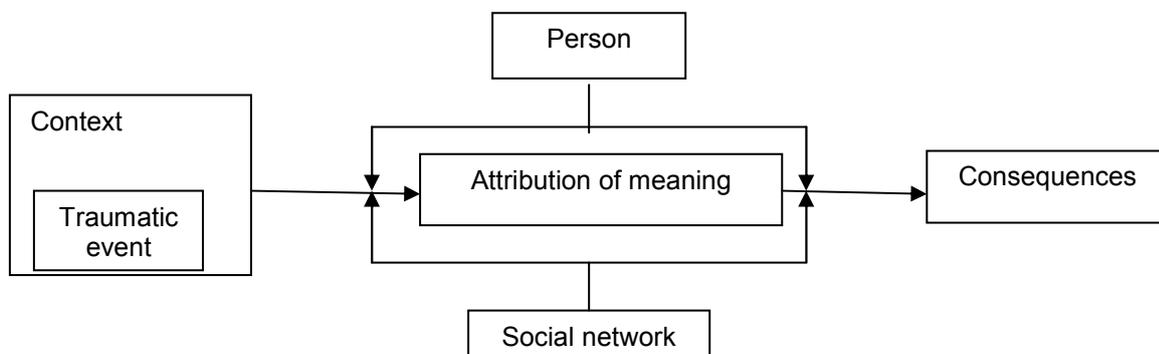
### § 2.1 Psychological consequences

What have we learned from disaster research in the past? Psychological consequences of natural disasters have been studied extensively (see Norris 2002a; Norris 2002b; Norris 2004). There is a variety of mental health problems reported in research and the prevalence rates of these problems vary drastically. Though variation in research exists, there are distinct trends visible. In a review of Norris et al., the most notably measured psychological disturbance was posttraumatic stress disorder (PTSD) (2002a, 2002b). Depression was the second most commonly observed disorder, followed by anxiety (Shalev, 2001). Acute stress reactions, such as anxieties, are a normal and expected response to a traumatic event, seen in the majority of cases (Foa et al., 2006). Nevertheless, prevalence rates of pathologic persistence of symptoms vary considerably.

A number of studies have demonstrated a low prevalence of PTSD in populations of trauma victims. On the other hand, some studies have found a high prevalence of PTSD after trauma. Basoglu, Kilic, Salcioglu and Livanou (2004) and Lopes Cardozo, Vergara, Agani, and Gotway (2000) point out that this is possibly due to variation in study methods, disaster type, magnitude and cultural differences in somatisation and coping with disaster. Barlow (Keane & Barlow, 2002; D.W. King, King, Foy, & Gudanowski, 1996) says that this discrepancy can be explained by close exposure to the trauma, which seems necessary in the development of this disorder. But this is not the whole story. Some people experience the most horrifying trauma and emerge psychologically healthy. For others, even relatively mild stressful events are sufficient to produce a full-blown disorder. To understand how this can happen, we must consider the etiology of PTSD (Barlow & Durand, 2005).

## § 2.2 Stress Model

A traumatic event leads to different kinds of reactions. How can we look at the relationship between the event and its effect? There are different perspectives on the connection between psychological and social phenomena (stressors) on the one hand and illnesses and emotional disturbances on the other hand. The modern specificity perspective defines a relationship between psychosocial variables and effects. It rejects a monocausal explanation for symptoms as well as their frequency and severity. A stressor is associated with a variety of mental health problems and a variety in severity of problems. The perception of the stressor, as well as the nature of the stress reactions, personal factors and social relationships, determine the ultimate effects of an extreme event (Kleber & Brom, 2003). Figure 1 shows the stress model derived from the modern specificity perspective.



**Figure 1. Stress model (Source: Kleber & Brom, 2003)**

A crucial aspect in this model is attribution of meaning. The way people perceive an event - consciously or unconsciously - differs. The event acquires a meaning that can differ substantially according to the individual and the group. Furthermore, the event does take place in a context. This context, such as the culture of a country where an event takes place, or the group people are experiencing the events with, is contributing to a variety of consequences. This is important in attributing meaning to disaster (Kleber & Brom, 2003). Not only the context plays an important role in determining the consequences. Also individual characteristics and the social network of an individual influence the consequences. Thus, following this model, consequences are not determined only by exposure in itself.

The described model is a guideline. Interpretations should be done with caution. This model also has limitations, for example time is not included as a factor. A cognitive model presented by Ehlers and Clark (2000) explains the causes of the possible persistence of symptoms of PTSD. Two main factors for the maintenance are mentioned: The excessively negative

appraisals of the trauma and/or its sequelae, and a disturbance of autobiographically memory characterized by poor elaboration and contextualization, strong associative memory and strong perceptual priming.

Negative appraisals of the trauma and/or its sequelae occurs when individuals are unable to see the trauma as a time-limited event that does not have global negative implications for their future. This has the common effect of creating a sense of serious current threat. Appraisals of the traumatic event can occur through overgeneralization. For example in the case of the tsunami, it is possible that individuals have difficulties by being close the sea because they can be afraid that another tsunami will occur. Secondly, appraisals of the way one felt or behaved during the event can have long-term threatening implications. For example, the discovery of a pregnancy during the tsunami, can be expressed in feelings of guilt and anger, which can lead to thoughts like 'why can I bring new life into this world while so many people died?'

Appraisal of trauma sequelae includes: interpretation of ones initial PTSD symptoms, interpretations of other peoples reactions in the aftermath of the event and appraisal of the consequences that the trauma has in other life domains. In case of the tsunami this can be physical pain due to injury or loss of a home or a job.

Furthermore, the disturbance of autobiographical memory is that trauma memory is inadequately integrated into autobiographical memories, but also into its context in time, place, subsequent and previous information. For instance, during the qualitative research a common phenomenon was the inability of looking at photos which led to problematic intentional recall.

## **§ 2.3 PTSD**

In 1980, PTSD was first introduced in DSM III and was slightly revised in the DSM-III-R as well as in the DSM-IV (APA, 1994). In the DSM-IV, PTSD is classified as an anxiety disorder and is characterized by the coexistence of three clusters of symptoms, namely reexperiencing, avoidance and hyperarousal (American Psychological Association, 1994). Acute PTSD can be diagnosed one month after the event occurs. When PTSD continues longer than three months, it is considered chronic. Chronic PTSD is usually associated with more prominent avoidance behaviors (Davidson, Hughes, Blazer, & George, 1991).

Another concept is delayed PTSD. There are researchers who debate this delayed-onset category. Blanchard and Hickling (2004) state that a delayed-onset is extremely unlikely,

because those with so called delayed-onset are not symptom free in earlier phases (van der Velden, van Loon, Ijzermans, Kleber, 2006b).

A specific model for the development for PTSD comes from Barlow (2004) (see Figure 3). The model states that there is a generalized psychological and biological vulnerability. Experiencing a traumatic event is an essential condition for the development of PTSD. This event, like experiencing the tsunami, coincides with experiencing a true alarm. Intense basic emotions, such as true alarms - thus experiencing the actual threat - lead to learned alarms. In PTSD, the initial alarm is true in that real danger is present. If the alarm is severe enough, we may develop a conditioned or learned alarm reaction to stimuli that reminds us of the trauma (Barlow & Durand, 2005).

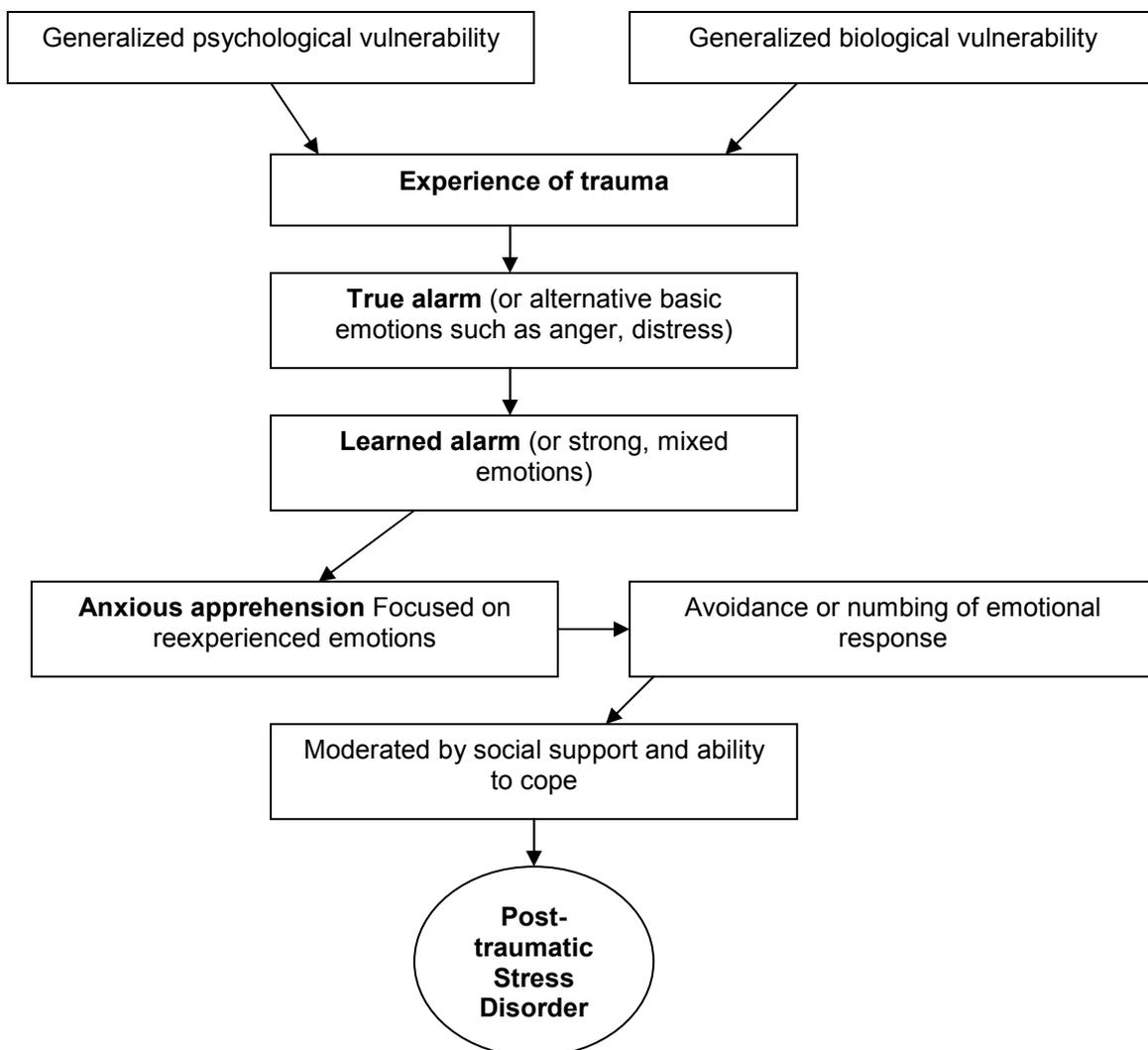


Figure 3. A model of causes of posttraumatic stress disorder. (Source: Barlow, 2004)

Learned alarms occur during exposure to situations that symbolize or resemble an aspect of the traumatic event. The experience of an alarm or other intense emotions is not sufficient for

the development of PTSD. One must develop anxiety in the sense that these events, including one's own emotional reactions to them, are proceeding in an unpredictable, uncontrollable manner. When negative affect develops, one enters the vicious cycle of anxious apprehension. Finally, anxiety is always moderated to some extent by variables such as the presence of adequate coping skills and social support. In PTSD, evidence already exists that these moderating variables play a role in determining whether the disorder develops or not (Barlow, 2004).

## §2.4 Risk factors

The DSM-IV describes the setting event for PTSD as exposure to a traumatic event during which one feels fear, helplessness or horror (Barlow & Durand, 2005). Confrontation with a traumatic experience is a necessary but not sufficient cause for the development of the disorder. Understanding risk factors is essential for identifying vulnerable populations and developing culturally specific mental health interventions. But what is known about risk factors today? The nature of the event, but also the personality of the victim, his condition and his social system stipulate the consequences of the traumatic event (Meijer & de Vries, 2001). The risk of developing PTSD among women is approximately twice that of men, even when types of traumatic events are taken into account (Breslau, Chilcoat, Kessler, Peterson & Lucia, 1999). In addition to gender, age has been examined as a risk factor for exposure to traumatic events and to developing PTSD. Kessler (1995) states that prevalence was elevated among widowed, separated or divorced. Armenian et al. (2000) found a higher level of education compared to lowest was protective for PTSD, an outcome we would like to investigate. Foa et al. (2006) summarise ten risk factors for PTSD from a review of Norris et al. (2002a) (Table 1).

**Table 1. Risk Factors for Posttraumatic Stress Disorder after a Major Disaster**

---

Severe exposure to the trauma
Living in highly disrupted community
Female gender
Belonging to an ethnic minority group
Middle age
Poverty or low socioeconomic status
Presence of children in the home
Presence of a distressed spouse
Psychiatric history
Impoverished support

---

**Source: Based on Norris et al. 2002 in Foa et al. 2006**

A meta-analysis by Brewin, Andrews and Valentine (2000 in Foa et al., 2006) examined the impact of 14 risk factors for generalized PTSD. The size of the effects varied markedly, but the largest effects were seen with factors operating during or after trauma: trauma severity, lack of social support, and post trauma stress. Although Ozer and Weiss (2004) acknowledge this, they found in their meta-analysis that, besides the named risk factors by Brewin et al. (2000 in Foa et al., 2006), peritraumatic dissociation was the strongest predictor for PTSD. This phenomenon refers to unusual experiences during and immediately after the traumatic event. Nevertheless, peritraumatic dissociation and other predictors categorized as (a) historical or static characteristics (b) trauma severity; (c) psychological processes during and immediately after the trauma; and (d) social support and life stress after the traumatic event were neither necessary nor sufficient for developing PTSD. The explanation for the fact that peritraumatic dissociation is a predictor requires the considering of differences in people who are exposed to the traumatic event, as well as the nature of the exposure. Also the severity of the traumatic event influences the likelihood of peritraumatic dissociation. Recent prospective studies though show that peritraumatic dissociation appears not to be an independent risk factor for long-term symptoms (Van der Velden et al., 2006 in van der Velden, van Loon, IJzermans & Kleber, 2006b). Furthermore, the level of social support following the trauma is also a strong predictor, with more social support associated with lower likelihood of later PTSD symptoms. An individual's level of social support likely relates to his or her history and functioning prior to the trauma, factors that Ozer and Weiss (2004) have not investigated in their own analysis. Though, in general, factors that were present before the trauma had relatively little effect on the risk of PTSD (Foa et al., 2006). This conclusion is not unequivocal for all researchers. Some personality traits, especially neuroticism appears to be a risk factor for developing PTSD (Bramsen, Dirkzwager & Van der Ploeg, 2000 in Schnurr, Friedman & Rosenberg, 1993).

## **§2.5 Exposure**

Exposure can be conceptualized as the intensity of the contact with the trauma. It is a gradual measure of the level of experiencing or witnessing the traumatic event and consists of a variety of factors (distance, physical contact etc.) which can differ depending on the type of traumatic event. There are several studies conducted on the relationship between exposure and mental functioning. A number of investigators have found severity of exposure to be the primary etiological factor in individual differences in response to stress (e.g., Davidson & Foa, 1991; Frye & Stockton, 1982; Green, Lindy, & Grace, 1985), with high exposure leading to a higher rate of prevalence of PTSD (Goenjian et al., 1994 in Elal &

Slade, 2005). Survivors with the lowest level of exposure to the earthquake-tsunami tend to maintain a relatively stable emotional functioning (So-Kum Tang, 2007). Another disaster study has also found that PTSD symptoms are often related to greater traumatic exposure (Carr et al., 1997 in So-Kum Tang, 2007). Dewaraja and Kawamura (2006) assessed the relationship between exposure to the tsunami and the resulting psychological dysfunctions. They compared a tsunami-group (people who were exposed to the tsunami) with a control group (people who lived 5 kilometres from the coast and were not affected by the tsunami). The results were that the tsunami-group had significantly higher PTSD scores than the control group.

Despite of the great importance of exposure in developing PTSD as mentioned above, there is little consistency in the way that this factor is defined and measured in survivors of traumatic events. A systematic approach to measuring severity of traumatic exposure seems essential in the debate concerning the importance of trauma intensity and its relation to other risk factors in the development of PTSD. For instance, Elal and Slade (2005) have developed an instrument to measure the degree of exposure to an earthquake disaster. In this, they incorporated both the range of stressor exposure and the perceived distress associated with various aspects of the trauma experienced. This Traumatic Exposure Severity Scale (TESS) consisted of two parts: the (a) a measure of the occurrence of a range of traumatic experiences and (b) a measure of the amount of distress generated by each of those experiences (Elal & Slade, 2005).

Confrontation with the tsunami can be very diverse. While doing qualitative research we were confronted with the stories of some survivors. Some were in the sea while the quake started and felt a strange current while others were at land running away from the water. One little girl was taken by the water and saw everything turning black, while suddenly a strange hand pulled her out of the water. Experiencing the tsunami was also different depending on the country. In some countries a high 'wall' of water was witnessed, while in other countries this was not the case. This shows that trauma severity, even having experienced the same event like the tsunami in 2004, can differ drastically between persons. Even having gathered all exposure-items for a questionnaire, it still remains the question how to get a balance between the difference in severity of exposure in the items. Assessing these differences could give more grip on differences in PTSD symptoms and its scope. Once again, those who experienced the disaster most personally and directly seemed to be the ones most affected (Barlow & Durand, 2005).

This leads to the following hypothesis:

- *More severe exposure to the tsunami leads to more PTSD symptoms.*

## **§ 2.6 Development of PTSD symptoms**

There is a small amount of disaster research done longitudinally. Therefore, our knowledge concerning the development of trauma related symptoms as a result of a disaster is restricted. This information is crucial when it comes to psychological aid. The review of Norris (2002a, 2002b) showed that the effects of disasters may be quite enduring. Furthermore, duration cannot be totally separated from magnitude and stronger effects are also more likely to persist.

Longitudinal studies on Western survivors (Carr et al., 1997, Groenjian et al., 2000 in Ko-Sum Tang, 2007) have found that initial earthquake experiences have an enduring mental health effect that is only partially ameliorated over time, and PTSD symptoms tend to persist for an extended period of time following extreme earthquake trauma (Ko-Sum Tang, 2007). In general, the first year was the time of peak symptoms and effects, and people did improve over time. Yet in many studies symptoms lingered for months, even years, for a significant minority of participants (Norris, 2002b).

This leads to the following hypothesis:

- *Symptoms of PTSD will decrease over time: there will be fewer symptoms years after the tsunami than directly after the tsunami.*

## Chapter 3: Methods

---

*'The romantic view I had, even in the paradise, is completely vanished.'*

(de Ruijter, van der Schoot, Vermetten, 2005)

### § 3.1 Preparations

Many questions raised during the first phase of the research. How can the impact of a disaster like the tsunami on mental health be defined? What are main issues dominating the lives of those who survived? Trying to get an image surrounding these questions, we conducted qualitative interviews with survivors of the tsunami and a survivor of hurricane Katrina. We prepared ourselves by looking at documentaries and news material. Also we read the book 'Overleven' which gave us grip on individual stories of those who survived the tsunami. We got into contact with the survivors through our supervisor Kol-arts dr. E. Vermetten. In these interviews the survivors were unreserved in their disclosure. They shared their experiences and feelings with us. Some of them we spoke several times. We got grip on experiencing a traumatic event and its impact by detailed stories, photo's and films. People told about the dreadful panic that took place during the tsunami. Also the days after the tsunami, the vision of dead people and their smell was a horrific remembrance. Houses were devastated and hours and days after the tsunami people were screaming and looking for each other.

The impact of such a traumatic experience, three years after occurrence (and two for hurricane Katrina), was tremendous. This made us realize that it is impossible to grasp the totality of mental health problems after experiencing a traumatic event in this research. The current research just focuses on one particular facet of this totality.

It was impressive how precise the retrieved memories were. People could still smell the specific odor, hear the sounds and see the horrific images. Not only reading about the tsunami or other disasters, but actually hearing the detailed experiences of those interviewed made us realize the need for further research and the need for initiatives such as TISEI.

### § 3.2 TISEI

The initiative for TISEI is supported by the Calamity Hospital, Central Military Hospital and is carried out via the University Medical Center Utrecht, in collaboration with the department of Social Sciences of the University of Utrecht ([www.tisei.org](http://www.tisei.org)). These institutions started a

research effort in which the medical and psychological impact of the tsunami on the survivors was longitudinally assessed. They developed a multilingual web-based concept using the internet for multiple purposes: establish contact with other survivors, participate in standardized questionnaires on the emotional impact of the disaster, seek help in their geographic region and find information on relevant news items (Vermetten, van Middelkoop, Taal & Carll, 2007). This web-initiative is realized by the foundation ECHOES ONLINE, which is founded in 2005. In the first year, this initiative was supported by the Ministry of VWS, RIVM/CGOR, Foundation Impact, the Child psychotrauma Centre Utrecht, the University Medical Centre Utrecht and the Central Militair Hospital Utrecht. The project still runs, even without any financial support ([www.tisei.org](http://www.tisei.org)). January 14<sup>th</sup> 2005 the website of TISEI (Tsunami International Survey on Emotional Impact) ([www.tisei.org](http://www.tisei.org)) went live.

Approximately 500 Dutch civilians were present in tsunami-affected areas, 36 did not survive. By using the TISEI-questionnaires the focus of this study was on PTSD-symptoms among Dutch survivors who were present in one of the affected regions at the time of the tsunami or were indirectly influenced by it. The relationship between exposure and PTSD-symptoms, as well as the difference in PTSD-symptoms directly after the tsunami and after three years were investigated. Methods of these parts will be described separately.

### **§ 3.3 Methods**

#### **A. Directly after the tsunami**

##### **Measures, instruments and data collection**

Approximately two weeks after the disaster, the first survey was carried out. Traumatic stress symptoms and other symptoms in the aftermath of the earthquake-tsunami were assessed with self-report questionnaires. The subject recruitment took place via the media. In this manner, people heard about the TISEI website and they self-selected to participate in the research. People voluntarily filled in the questionnaires as described before. They were made aware that these data would be used for research purposes.

The questionnaires on the TISEI-website consisted of 12 sections and were a compilation of validated existing questionnaires and non-validated questionnaires who could reveal valuable information surrounding mental health problems, such as a questionnaire about sleeping problems. (Table 1 in the appendix shows all sections). Participants filled in the questionnaires online ([www.tisei.org](http://www.tisei.org)) in Dutch. Answer possibilities varied depending on the

specific questions and questionnaires. Some used dichotome variables, some categorical and there were open questions. For this research a time-span of two months was used, so all participants who filled in the questionnaire between January, 14<sup>th</sup> 2005 and March, 13<sup>th</sup> 2005 were taken into account. Table 2 shows the sections used in this research.

**Table 2. Used sections on the TISEI-website**

<b>Section &amp; Title</b>	<b>Information</b>
1. Information on stay in Asia	Information about the reason of the stay, the country they were in and what and with whom they experienced the event
3. Personal information	Questions about demographic characteristics, such as age, gender, marital status, educational attainment, and employment status before the tsunami
5. Davidson Trauma Scale	(Dutch translation of the questionnaire) Questions about how often and how strong participants had to do with the consequences of the tsunami in the last 7 days. This survey focuses on the frequency and seriousness of the impact of the tsunami disaster during the past seven days. Participants have to think of the past week when they fill in this list and click on the option that applies to them. Source: JRT Davidson, Davidson Trauma Scale

Source: [www.tisei.org](http://www.tisei.org)

**Exposure-items** For severity of exposure there was no single combined measure used, but different solitary questions. These questions were part of section 1 and developed through the delphi method. Questions that could reveal a form of exposure to the tsunami were used. Only categorical or dichotome variables were taken into account. The questions selected are shown in Table 3.

**Table 3. Severity of exposure questions**

<b>Nr</b>	<b>Question</b>	<b>Answer 1</b>	<b>Answer 2</b>
1	Did you notice that the sea pulled back?	Yes	No
2	How far were you from the sea when the seaquake started?	Close= Beach, 50 mtrs., 100 mtrs.	Far= inland
3	Did the water hit you?	Yes	No
4	Were you injured by the seaquake?	Yes	No
5	Did you need medical attention?	Yes	No
6	Was there someone from your direct family/friends/ travel companions injured?	Yes= father (in law), mother (in law), children, partner, friend, travel companion	No = no one, or insignificant other
7	Did you have any negative experience during or	Yes	No

---

	after the disaster?		
8	Was there someone from your direct family- /friends/travel companions missing?	Yes= father (in law), mother (in law), children, partner, friend, travel companion	No = no one or insignificant other
9	Is there someone from your direct family- /friends/travel companions deceased?	Yes= father (in law), mother (in law), children, partner, friend, travel companion	No = no one or insignificant other
10	How long was your life in danger?	Yes= several minutes, half an hour, an hour, several hours, a day, several days	No = no life danger

---

**Source:** [www.tisei.org](http://www.tisei.org)

All answers were dichotomized for analyses. In some cases there was an extra possibility to choose the category, for example 'Other, namely...'. In these cases the answers were individually examined and recoded into the most fitting category. In the case of question 2, the choice was made between persons who could actually see the sea or were very close and people who were further distanced from the sea. This was done to make a clear distinction in exposure. In the case of question 7, 8 and 9 the answer 'no' was assumed as meaning 'not lost anyone', because this actual option was not available in the questionnaire. Answer possibilities were limited to indicate who was lost, not if anyone was lost. Furthermore, 'local population', 'persons just met', 'persons close to another person but never met' and 'insignificant others', were stated as 'not lost anyone.' This is done because it was thought that this would not differentiate between participants. In the case of question 10 no difference was made in the duration of life-danger. This was due to the question whether the estimations made by participants are objective and reliable. Table 4 shows the way in which answers were dichotomized.

**PTSD symptoms** The Davidson Trauma Scale (DTS) ([www.ncptsd.va.gov](http://www.ncptsd.va.gov)) is a 17-item self-report measure that assesses the 17 DSM-IV symptoms of PTSD. Items are normally rated on 5-point frequency (0 = "not at all" to 4 = "every day") and severity scales (0 = "not at all distressing" to 4 = "extremely distressing"). Respondents were asked to identify the traumatic experience that is most disturbing to them and to rate, in the past week, how much trouble they have had with each symptom. The DTS yields a frequency score (normally ranging from 0 to 68), a severity score (normally ranging from 0 to 68), and a total score (normally ranging from 0 to 136). It can be used to make a preliminary determination about whether the symptoms meet DSM-criteria for PTSD. Scores can also be calculated for each of the 3

PTSD symptom clusters (i.e., B, C, and D) ([www.ncptsd.va.gov](http://www.ncptsd.va.gov)). In this research the DTS was used with a 4-point frequency, rating from 1 (= “not at all”) to 4 (= “often”) on the frequency scale and 1 (= “not at all”) to 4 (= “extremely distressing”) on the severity scale leading to a frequency score of 17- 68 and a severity score with the same range. The total score ranges from 34 to 168. Therefore, in this research, the cut-off score - which is normally at 40 (Meltzer-Brody, Churchill, Davidson, 1999) - was set at 80.

**Demographic variables** Subvariables age, gender, marital status and educational level were taken into account, because those categories were also present on the TISEI-website. Also psychiatric history, as mentioned by Foa et al. (2006), was present on the TISEI-website, but this was an open question, which led to a large range of answers. For this reason, this category was not taken into account in our analyses.

## Participants

A total of 81 surveys were filled in via the TISEI website. Eight surveys were unusable as the respondents had not completed the questionnaires. The final sample for this study consisted of 73 completely filled in surveys. Participants were 28 Dutch males (38,4%) and 45 Dutch females (61,6%) who were affected by the tsunami and filled in the questionnaire in the first two months the website went live. There were three age categories: 18-25 (9,6%), 25-40 (53,4%) and 40-60 (37%). Of the participants 50,7% was married or long lasting living together. 17,8% was single, 20,5% had a relationship, 5,5% was engaged, 2,7% was divorced and 1,4% was widow(-er). 1,4% was missing. Percentages of educational level can be seen in Table 4.

**Table 4. Educational level**

<b>Educational level</b>	<b>Percentage</b>
None	3
Lager Beroepsonderwijs, HH-school, LHNO	1
HAVO	11
VWO, atheneum, gymnasium, 5jr HBS, MMS	7
MBO	12
HBO	38
Universiteit	22
Different	6

Due to anonymity it was not known how many victims who visited the website, actually filled in the questionnaires and who did not. Also it was impossible to say whether some of the

victims did not know about the existence of the questionnaires. This made it hard to say something about an actual number of nonresponse. It was only possible to conclude something about non-response in the sense of uncompleted questionnaires. Whether the participants were representative for all the Dutch tsunami victims was even so not clear. Compared to the Dutch population the percentage of persons highly educated (HBO, WO) was much higher in the sample, 26% respectively 60% (CBS Statline, 2008), which made representability of the sample not credible, though there should actually be compared with data on all Dutch tsunami victims and not the Dutch population. Maybe the sample was representative for tsunami victims, because those who can financially afford it to travel to Asia, were probably also the ones most educated.

## **Procedure**

Participants had to register themselves on [www.tisei.org](http://www.tisei.org) before access was provided to the websurvey. After registration, a password was send to a personal email-address. Participants had access to the questionnaires with a self-selected name and a password. The questionnaires were placed in a standard order. The questionnaires were filled in online and participants could decide when, where and with whom to fill them in.

## **Design and statistical analysis**

This part of the research had a within group between subject design. Statistical analyses were conducted using the SPSS 15.0 software (Chicago, SPSS Inc). There were only six missing answers in the exposure-items of which three were found in the question 'Did you hit the water?' and three in the question 'How long was your life in danger?' To deal with these missing data and to observe unidentified variables, missing values were imputed with the help of the Expectation-maximization algorithm (EM) (Dempster, Laird & Rubin, 1977). This was done only for the exposure items. Missing values in the demographic variables were left untouched.

Missing values were imputed, preceding a factoranalysis with regard to the exposure items. In spite of the small sample size we conducted this factoranalysis in order to comprehend the structure in the main exposure items. In this factor analysis all exposure-items as seen in Table 3 were taken into account. This resulted in two factors, shown in Table 5. Only loadings above 0.3 are shown here. The factor analysis resulted in exclusion of the items 'Did you notice that the sea pulled back?' and 'Did you have any negative experience during or after the disaster?'. Analysis of these items did not reveal any strange matters.

The item 'Was there someone from your direct family/friends/travel companions injured?' was assigned to component 2, due to higher loading on this component. The Cronbach's  $\alpha$  for component 1 was 0.748 and for component 2 this was 0.788. Though exclusion of the item 'Was there someone from your direct family/friends/travel companions injured?' resulted in a higher Cronbach's  $\alpha$  (= 0.890), the item was not deleted due to the resulting small amount of items that would be left to constitute the component and due to the fact that the Cronbach's alpha was already high. See appendix 2 for the reliability-results.

**Table 5 Factor analysis**

	<b>Component 1</b>	<b>Component 2</b>
Were you injured by the seaquake?	<b>,764</b>	
Did the water hit you?	<b>,758</b>	
Did you need medical attention?	<b>,744</b>	
How long was your life in danger?	<b>,666</b>	
How far were you from the sea when the seaquake started?	<b>,548</b>	
Is there someone from your direct family-/friends/travel companions deceased?		<b>,911</b>
Was there someone from your direct family-/friends/travel companions missing?		<b>,911</b>
Was there someone from your direct family/friends/travel companions injured?	<b>,526</b>	<b>,620</b>

To measure the relationship between the severity of exposure-factors and the symptoms of PTSD a multiple regression analysis has been done. This analysis was not focussed on PTSD as a construct but on symptoms as a dimensional measure. Symptoms measured by the Davidson Trauma Scale (DTS) were put off against the questions of severity of exposure participants experienced.

Subanalyses were done for gender, marital status, educational level and age. The subanalysis for gender was measured by an independent T-test. For marital status, educational level and age a one-way independent ANOVA has been done.

## **B. Three years after the tsunami**

### **Measures, instruments and data collection**

Because longitudinal research was not possible due to anonymity, a cross-sectional design was used to measure PTSD-symptoms. This anonymity makes it difficult to tell whether the group of participants consisted mostly of new participants, participants who filled in the questionnaires earlier but not during the first two months, or participants who filled in the questionnaires during the first two months. Three years after the tsunami participants were recruited. They consisted of the participants who filled in the questionnaire during the first two months and other visitors of the website who filled in the questionnaire later on or did not fill in the questionnaire, but visited the website. Participants were again asked to fill in the questionnaires which were available on the TISEI-website. They were approached via email and informed about the anonymity and use of the data. The first email was sent the 8<sup>th</sup> of December 2007, to contact tsunami-survivors, but at that time the question was not raised to fill in the questionnaires again. The 24<sup>th</sup> of December 2007 a second email with the question to fill in the questionnaires was sent. A reminder-email was sent January, 29 2008 and a final reminder the 21<sup>st</sup> of February. A time span of 2 months of measurement was retained. The time-span was from the 24<sup>th</sup> of December 2007 until the 23<sup>rd</sup> of March 2008.

Measures and instruments used were the same as in described in part A.

### **Participants**

Three years after the tsunami, a total of 39 surveys were filled in via the TISEI website. The final sample for this study consisted of 37 usable questionnaires, which means they were filled in completely. Participants were 15 Dutch males (40,5%) and 22 Dutch females (59,5%) who were affected by the tsunami. They were divided in three age categories: 18-25 (10,8%), 25-40 (37,8%) and 40-60 (51,4%). 73% of the participants was married or lasting living together. 18,9% was single, 2,7% had a relationship, 2,7% was engaged, 2,7% was divorced and 2,7% was widow(er). Due to the same reasons mentioned by section A. it is not possible to say something about non-response. Furthermore, in this case it is hard to tell whether email addresses overlapped, whether they were checked and whether they were still in use.

**Table 6. Educational level**

<b>Educational level</b>	<b>Percentage</b>
None	0
Lager Beroepsonderwijs, HH-school, LHNO	0
HAVO	16
VWO, atheneum, gymnasium, 5jr HBS, MMS	8
MBO	14
HBO	32
Universiteit	24
Different	5

### **Procedure**

People were approached via email to fill in the questionnaire again via the TISEI website. The rest of the procedure was the same as described in part A.

### **Design and statistical analysis**

A cross-sectional analysis is used here with a within group between subject design. Statistical analyses were conducted using the SPSS 15.0 software (Chicago, SPSS Inc). There were no missing data. Again a factor analysis was conducted with the exposure-items, which resulted in two factors. The two factors differed from the factors found at T1.

Furthermore, a multiple regression analysis was conducted. The subanalyses were done as mentioned above, with an independent T-test for the gender-category, and the others were measured with a one way ANOVA.

## Chapter 4: Results

*'The sea is different and will never be as before.'*

([www.tisei.org](http://www.tisei.org))

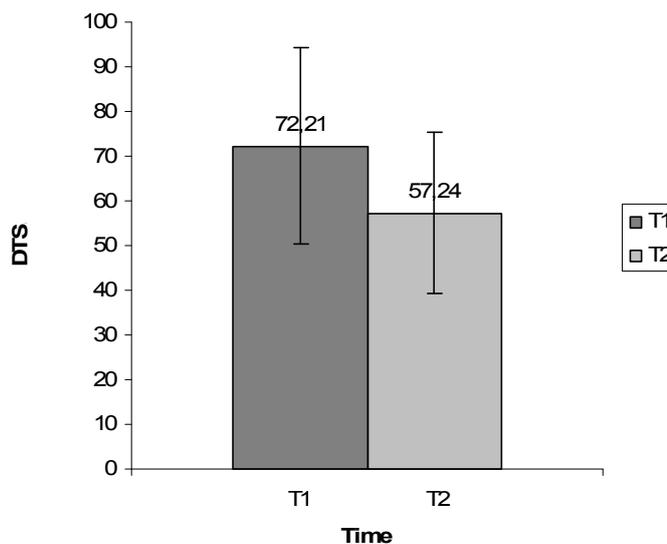
### §4.1 PTSD-symptoms

PTSD symptoms were measured with the Davidson Trauma Scale (DTS). In this research the minimum score was 34 and the maximum score was 168. In Table 7 descriptive statistics are mentioned.

**Table 7. Descriptive statistics PTSD scores**

	<i>N</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>T Mean Upper</i>	<i>Sig. (2-tailed) Error Mean, Upper</i>	<i>Std. Upper</i>
DTS T1	73	34,00	118,00	72,21	21,90			
DTS T2	37	34,00	98,00	57,24	18,18			
						-3,04		,004

PTSD-symptoms at T1 measured with the DTS had a mean score of 72.21 (S.D. = 21.90) and were normally distributed. PTSD-symptoms at T2 were measured with the DTS had a mean score of 57.24 (S.D. = 18.18) and were normally distributed.



**Figure 4. Mean DTS-scores on T1 and T2**

The following hypothesis was posed:

- *More severe exposure to the tsunami leads to more PTSD symptoms.*

This difference between T1 and T2 was assessed with a paired samples T-test, which indicated a significant result. The difference in DTS-scores thus is significant (Table 7).

With the DTS the opportunity exists to divide the total scores in clusters and look at those differences. In Table 8 it is shown that frequency items had a slightly higher mean than severity items, although this was not analysed on significance. Also all separate clusters, whether measured in frequency or severity had a higher mean at T1 than at T2. Especially cluster D at frequency level was high at T1. These are items which measure symptoms of hyperarousal and are mentioned in the DSM-IV-TR (APA, 1994). At T2 this category still has the highest score.

**Table 8. Differences in means on the DTS separated to DSM-cluster.**

		<i>T1 (N=73)</i>	<i>T2 (N=37)</i>
Frequency	Cluster B (reexperiencing)	2.13	1.70
	Cluster C (avoidance)	2.19	1.83
	Cluster D (hyperarousal)	2.62	1.92
Severity	Cluster B (reexperiencing)	1.93	1.50
	Cluster C (avoidance)	1.79	1.56
	Cluster D (hyperarousal)	2.19	1.60

Different to the normal cut-off score of 40 a cut-off score of 80 is used here to diagnose PTSD (see Chapter 3). In the sample at T1 (N= 73) 30 persons scored above 80. This is 41,1% of the sample. At T2 (N=37) 5 persons scored above the cut-off score. This is 13,5% of the sample.

#### **§4.2 The relationship between exposure and PTSD-symptoms**

Exposure was measured with the ten selected items shown in Table 3. Items were dichotomized. Percentages of answers in the categories are shown in Table 9. The scores at T1 and T2 did not show large differences, which means that answers on the exposure-items did not differ drastically between the two measure points.

**Table 9. Answers exposure at T1 and T2**

	<b>T1:</b>	<b>T2:</b>
	<b>Yes/ nearby</b>	<b>Yes/ nearby</b>
Did you notice that the sea pulled back?	34.2%	37.8%
How far were you from the sea when the seaquake started?	74%	81.1%
Did the water hit you?	45.2%	64.9%
Were you injured by the seaquake?	26%	45.9%
Did you need medical attention?	21.9%	43.2%
Did you have any negative experience during or after the disaster?	71.2%	86.5%
How long was your life in danger?	72.6%	83.8%
Was there someone from your direct family/friends/ travel companions injured?	21.9%	29.7%
Was there someone from your direct family-/friends/travel companions missing?	12.3%	10.8%
Is there someone from your direct family-/friends/travel companions deceased?	11.0%	24.3%

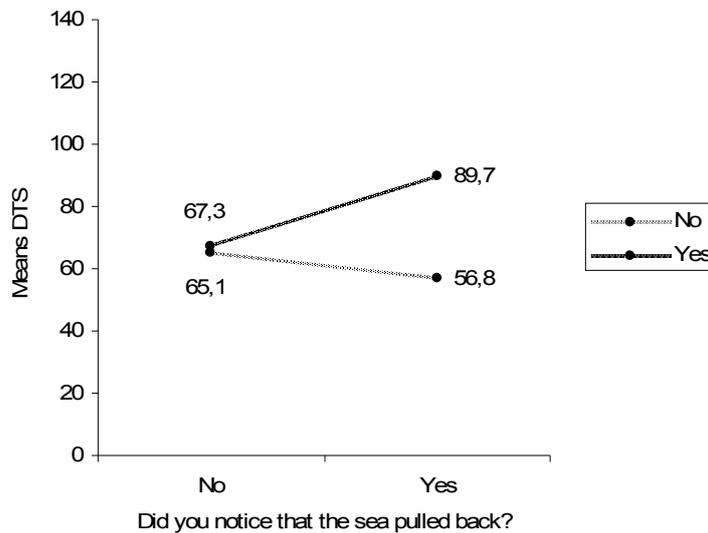
The hypothesis concerning exposure was the following:

- *Symptoms of PTSD will decrease over time: there will be fewer symptoms years after the tsunami than directly after the tsunami.*

### **A. Directly after the tsunami**

With a factor analysis in Part A, two factors were found, as shown in table 5. With these factors a multiple regression analysis with the DTS as dependent variable was done. These factors did not show significance, factor 1 ( $t(72) = -.001, p > .05$ ), factor 2 ( $t(72) = .504, p > .05$ ). After this, multiple regression analysis with three factors and were used in multiple regression analysis with the DTS, but none were significant. This was done to explore a possibility of replicating factors at T2. Because none were significant, the single exposure-items were used in a multiple regression analysis. Here, two single items were significant. Those were 'Did you notice that the sea pulled back?' and 'Did you have any negative experience during or after the disaster?' ( $t(72) = 2.341, p < .05$ ), ( $t(72) = 2.363, p < .05$ ). When a new interaction variable was created and added to the regression analysis, this interaction variable was significant. The interaction variable was the only variable in the new regression analysis which is coherent with the DTS. This means that participants who both had a negative experience during or after the disaster and noticed that the sea pulled back

had significantly higher scores on the DTS, than persons experiences either one or none of the two items (see Figure 5).



**Figure 5. Interaction effect**

### **B. Three years after the tsunami**

A factoranalysis was conducted. Regressionanalysis with conducted factoranalysis was not significant ( $F(36)= 1.632, p > .05$ ). The single exposure-items were used in a multiple regressionanalysis. Here, one item was significant. This was 'Did you need medical attention?' ( $t(36)= 2.387, p < .05$ ). Participants who needed medical attention had significantly higher scores on the DTS. As shown in table 9 a larger percentage of the participants also needed medical attention (43.2%), which is different from T1 (21.9%).

## **§4.3 Demographic variables**

### **A. Directly after the tsunami**

The sample characteristics of the Dutch tsunami victims at T1 are presented in Table 10. The DTS-scores did solely differ when the group was divided according to gender. The other demographic characteristics in relation to the DTS did not prove to be significant. The sample characteristics will be shortly discussed. For gender, an independent T-test was used. For the other demographic variables, a one-way independent ANOVA has been done.

### **Gender**

The majority of the participants were women (N = 45), with a mean score of 76.51 (S.D. = 20.73) on the DTS. The men (N = 28) had a lower average score; they had a mean score of 65.29 (S.D. = 22.31) on the DTS. This difference in PTSD-symptoms was significant ( $t(71) = -2.185, p < .05$ ). The effect size was 0.25 with a power of 0.59. This is in line with the theory that women have a higher prevalence of PTSD.

### **Marital status**

The groups had very small N's and the results were non-significant ( $F(4,66) = 2.080, p > .05$ ). Even though the effect ( $r = 0.37$ ) was non-significant, it still represented a fairly substantial effect (Field, 2005). The highest score on the DTS were found in the group 'long lasting living together/married' (N = 37), with a mean of 79.22 (S.D. = 21.38), which was opposite to the expectation assessed in earlier research (see Vermetten, 2003). Vermetten (2003) states that being separated, divorced or widowed proved to be a risk factor for higher PTSD-scores. Though in this sample these groups were very small.

### **Educational level**

An interesting aspect is that the substantial part of the participants existed from higher educated people (HBO and Universiteit). There seems no trend visible in DTS scores divided according to educational level. The results were not significant ( $F(6,65) = 2.7, p = >.05$ ), though the effect size was high ( $r = 0.47$ ).

### **Age**

It is worth mentioning that there seems to be a trend: the older the participant, the higher the average DTS score. Although this upward trend is visible, no significant relationship was found with the DTS ( $F(2,70) = 1.44, p > .05$ ), ( $r = 0.2$ ). This trend is also visible in other research, like the risk factors explored in Foa et al. (2006), which shows that individuals of middle age are at higher risk of developing PTSD.

**Table 10. Demographic variables directly after the tsunami (T1)**

	<i>Dutch tsunami victims N</i>	<i>Mean DTS score</i>	<i>df</i>	<i>p</i>
Gender				
Female	45	76.51	71	< .05
Male	28	65.29		
Marital Status				
Single	13	62.38	71	ns.
Relationship	15	70.4		

Engaged	4	60.75		
Long lasting living together/married	37	79.22		
Divorced	2	55.5		
Widow(-er)	1	50.0		
Educational level				
None	2	35.5	72	ns.
Lager Beroepsonderwijs, HH-school, LHNO	1	55.0		
HAVO	8	85.37		
VWO, atheneum, gymnasium, 5jr HBS, MMS	5	68.0		
MBO	9	79.11		
HBO	28	68.11		
Universiteit	16	80.44		
Different	4	54.0		
Age				
18-25	7	60.29	72	ns.
25-40	39	71.79		
40-60	27	75.89		

Ns, Not significant

### **B. Three years after the tsunami**

The sample characteristics of the Dutch tsunami victims, groups at T2 are presented in Table 11. The sample characteristics will again be shortly discussed. Like mentioned before, for gender, an independent T-test was used. For the other demographic variables, a one-way independent ANOVA has been done.

#### **Gender**

Again, the majority of participants were women (N = 22). The men (N = 15) showed a slightly higher score on the DTS (58.53) compared to the women (56.36). Contrarily to the sample at T1, at this time point the relationship between age and PTSD-symptoms was nonsignificant ( $t(35) = 0.352, p > .05$ ) with an effect size of  $r=0.06$ .

#### **Marital status**

The majority in this group participants consisted of 'Long lasting living together/married' (N = 27). Compared to the mean scores of the DTS, marital status did not have a relationship with the strength of PTSD-scores ( $F(1,32) = 2.69, p > .05$ ). However, it represented a fairly substantial effect ( $r = 0.50$ ) (Field, 2005).

#### **Educational level**

No individuals with an educational level of 'none' or 'Lager Beroepsonderwijs, HH-school, LHNO' participated at T2. Results were not significant ( $F(5,31) = 1.3, p > .05$ ), though the effect size was relatively large ( $r = 0.42$ ).

### Age

The trend which was visible at T1 is not replicated at T2. The highest mean DTS score is found in the 25-40 group (DTS score of 60.21), but differences between groups are small. No significant relationship was found between age and the DTS  $F(2,34) = 0.32$   $p > .05$  ( $r = 0.14$ ).

**Table 11. Demographic variables three years after the tsunami (T2)**

	<i>Dutch tsunami victims N</i>	<i>Mean DTS score</i>	<i>df</i>	<i>p</i>
Gender				
Female	22	56.36	35	ns.
Male	15	58.53		
Marital Status				
Single	7	53.0	33	ns.
Relationship	1	89.0		
Engaged	1	98.0		
Long lasting living together/married	27	55.3		
Divorced	0	-		
Widow(-er)	1	67.0		
Educational level				
None	0	-	36	ns.
Lager Beroepsonderwijs, HH-school, LHNO	0	-		
HAVO	6	63.5	36	ns.
VWO, atheneum,gymnasium, 5jr HBS, MMS	3	52.33		
MBO	5	60.2		
HBO	12	47.5		
Universiteit	9	64.44		
Different	2	64.5		
Age				
18-25	4	57.5	36	ns.
25-40	14	60.21		
40-60	19	55.0		

Ns, Not significant

## Chapter 5: Discussion

---

*'Even after three years it is still going with ups and downs.'*

**(Interview survivor tsunami)**

More than three years have past since the tsunami on December 26, 2004. In the mean time several other tsunamis took place, but the disaster in 2004 is in its extent the largest. For those who witnessed the disaster and survived, the emotional impact of the disaster is tangible even after three years. For many the disaster got under the skin and they do not experience life as it was before. Others luckily do not experience these reactions.

To assess the emotional impact qualitative preparation research was done. Several interviews with tsunami survivors took place. With these insights about experiences surrounding the tsunami, we got a clearer view on the impact and its preceding factors. Smells, sounds, sights and feelings at the time of the tsunami could be recalled precisely. This made us realize the importance of exposure to a disaster. Exposure appeared to be an important factor determining the psychological consequences. Scientific studies confirmed a relationship between exposure and PTSD symptoms (Goenjian et al., 1994 in Elal & Slade, 2005). Considering the exiguous research about the concept exposure and its effects on psychological impact after a disaster, it was interesting to investigate this subject.

In this research the magnitude of PTSD-symptoms both directly after the tsunami and after three years was assessed cross-sectionally. Also the relationship between exposure and PTSD-symptoms was assessed, both directly after the tsunami (January 14, 2005- March 13, 2005) (T1) as well as three years after the tsunami (24 December 2007 – 23 February 2008) (T2).

### **§5.1 PTSD-symptoms**

In the aftermath of disasters, victims suffer from symptoms such as anxiety, depression, fatigue, intrusions, and avoidance reactions in the short, intermediate, or long term. A considerable minority of the victims will develop posttraumatic stress disorder (PTSD) or other mental disorders (Norris et. al., 2002b). With regard to the recent study concerning PTSD symptoms the following hypothesis was formulated:

- *Symptoms of PTSD will decrease over time: there will be fewer symptoms years after the tsunami than directly after the tsunami.*

Looking at this study 41,1% of the sample could be diagnosed with PTSD at T1 (N=73), which was directly (up to 2,5 months) after the tsunami. Kleber and Brom (1992) estimated that in general approximately 20% to 30% of victims develop PTSD after a disaster (see also Lundin, 1995; Smith & North, 1993). This would lead to the conclusion that the prevalence of PTSD among Dutch survivors of the tsunami was very high. Although a study of the Buffalo Creek Dam disaster also found a prevalence-rate of PTSD to be 44% soon after the incident (Briere & Elliott, 2000). Interpreting the data we should take into account that symptoms in this study were measured shortly after the tsunami took place, while PTSD can not be diagnosed until one month after the disaster. A high level of symptoms is a normal reaction immediately after a disaster. Shortly after a disaster, most people show acute stress reactions (Blanchard et. al, 1996).

There is also considerable evidence that the typical course of adaptation is to recover in the following months after trauma exposure. In a study from Blanchard et. al (1996), one half of a sample meeting criteria for PTSD shortly after a motor vehicle accident had remitted by 6 months and two thirds had remitted by 1-year post trauma. There is considerable evidence for this phenomenon and patterns indicate that the normative response following trauma is to initially experience a range of symptoms but the majority of these reactions will remit in the following months (Bryant, 2003). This can explain the high level of symptoms at T1 found in this, and the lower level at T2. At T2 - three years after the tsunami (N=37) - 13,5% of the sample could be diagnosed with PTSD, which is strikingly different from the 41,1% at T1. A critical note has to be made here: due to the cross-sectional character of the study this is only a trend we can take into consideration.

The same trend is visible in research about the firework disaster in Enschede. This study concluded that, measured three weeks after, and 18 months after the disaster the prevalence of all health problems declined. Of the affected residents, 19-47% had health problems only at the first time point and not at the second time point; 21-34% had health problems in both time points of the study and 4-10% reported health problems 18 months after the disaster for the first time. Eighteen months after the disaster, 19% of the affected residents had symptoms of PTSD (Grievink et. al, 2007). These findings make it plausible to consider the found trend as believable.

The numbers in the study of Grievink et al. (2007) do make us aware of chronic and delayed PTSD (though these numbers are for mental health problems in general and not PTSD.) There is a need for longitudinal research in the trauma-field to assess the natural course of PTSD-symptoms and the course of other mental health problems.

Another interesting aspect is the influence of the western society on PTSD. Summerfield (2006) argues that we are as resilient as the society we live in expects us to be. He states PTSD is a self-fulfilling prophecy caused by prediction about psychological damage that dominates the Western society at this moment. There seems to be some logic in his argument if we look at PTSD symptoms after the tsunami in the Thai population. In research among adults in tsunami-affected areas in southern Thailand, symptoms of PTSD were reported by 12% of displaced and 7% of nondisplaced persons in Phang Nga and 3% of nondisplaced persons in Krabi and Phuket (Griensven et. al). Moreover, in a study among adult Thais, So-kum Tang (2007) concludes that at 2 weeks following the earthquake tsunami, 22% of all participants met the criteria for DSM-IV Acute Stress Disorder, which is remarkably lower than in our study or the Buffalo-creek study (Briere & Elliott, 2000).

Nevertheless, 30% of all participants in the study met the criteria for DSM-IV PTSD at 6 months postdisaster, measured by a questionnaire about the occurrence of 17 symptoms for DSM-IV PTSD (So-kum Tang, 2007). This was not so different from studies conducted in Western societies like a study after the Bijlmer flight-disaster, in which was found that 6 months after the plane crash 26% of the respondents were suffering from PTSD (Carlier & Gersons, 1997).

Yet, it is best to compare our study with a study that also used the same measurement instrument. A study on PTSD symptoms among quake victims of the Chi-chi quake in Taiwan in 1999 used the Chinese version of the DTS and interviewed victims one year after the quake. They found in their study (N = 272) that 9.2% Of the men and 22.2% of the women could be diagnosed with PTSD (Wen Kuo, Jen Wu, Ching Ma, Chiu, & Chou, 2007). These data are difficult to compare with the current study due to a different measurement point (one year after the disaster instead of up to 2,5 months) and due to a different participant group, but appear to be lower than results found in this study if we take a hypothetical gradual decline of symptoms into account. Though, these prevalences cannot be neglected and are of substantial height.

Taking all together, the conclusion can be made that PTSD can be a chronic condition. Besides symptoms directly after the event, it can be still apparent years after, though a decrease of symptoms is found in most studies.

## §5.2 Exposure

The extent of exposure during or immediately after a traumatic event has been considered to be an important risk factor for the development of posttraumatic stress symptoms and PTSD. Studies found that a high level of exposure leads to a higher rate of prevalence of PTSD (Goenjian et al., 1994), and that PTSD symptoms are often related to greater traumatic exposure (Carr et al., 1997 in So-Kum Tang, 2007). Keeping this in mind, in the recent study it was interesting to focus on the concept of exposure and its consequences in the aftermath of the tsunami. This led to the following hypothesis:

- *More severe exposure to the tsunami leads to more PTSD symptoms.*

To quantify the concept exposure is not easy, particularly because a validated and standardized questionnaire of exposure useful for the tsunami did not exist. Data about exposure and risks for psychopathology are abundant, and the assessment of disaster exposure is a specific and challenging research area.

Although complicated, there are some studies which attempted to measure exposure. For instance, in a former internet based survey research about exposure to the tsunami, PTSD symptoms and increased substance use, used a 7 made-up statements with yes/no-answers, like 'witnessed the tsunami wave oneself' and 'lost any family members (parents, siblings, children, partners etc.) to measure exposure (Vetter, Rossegger, Rossler, Bisson & Endrass, 2008). An other study of war veterans measured trauma exposure using self-ratings of frequency and subjective intensity: Combat exposure was measured using a 21-item scale published by Wilson and Krauss (1985 in O'Toole & Catts, 2008), which asked the frequency of experiencing each of 21 specified events such as direct enemy contact, firing weapons at the enemy, and being under fire, seeing Australians killed or be wounded.

The construct of exposure is thus not unequivocal, though research shows it is of influence on PTSD symptoms. For example, the psychological impact of exposure to the Bijlmermeer plane crash is evident from the fact that some tenants of neighbouring buildings with a view of the disaster area (eyewitnesses) were suffering from PTSD as well (Carlier & Gersons, 1997).

Both at T1 and T2, two identified factors in the exposure items were not significant in a multiple regression analysis with the DTS, which measures PTSD-symptoms. The non-significant result in the multiple regression could be due to several factors. First of all, the

study was based on existing questionnaires which were available on the TISEI-website. This could implicate that these questions did not fully contain the construct exposure. Secondly, due to the fact that the research was conducted through internet-questionnaires, it is not easy for participants to pose questions about the questionnaires. Possibly some questions were multi-interpretable or subjective. For example, the question 'Did you have any negative experience during or after the disaster?' could be interpreted in different manners. Some would refer to the tsunami as a negative experience, others would only account for negative experiences besides the tsunami. Thirdly, to interpret the outcome, items were dichotomized and this could lead to loss of information. In future research other analyses could be used to overcome this. Finally, all items had the same weighting in this research. This could work confounding and may be is not a realistic reproduction of reality.

Though the importance of exposure is irrefutable, in this study only single items had a significant relationship on PTSD symptoms. In the group of participants at T1, two exposure-items ('Did you notice that the sea pulled back?' and 'Did you have any negative experience during or after the disaster?') were significantly correlated with the DTS, which means that those items showed a correlation with the outcome on the DTS. An interaction effect of the two factors appeared significant. This means that seeing the sea pulling back, combined with experiencing a negative event had an enlarged effect. No specific explanation can be found to clarify this interaction effect. At T2 another item (Did you need medical attention?) was significant.

It could be the case that earlier exposure-questionnaires who did find a significant relationship between exposure and PTSD also measured the psychological impact and not purely exposure. This can be seen in the research of Elal and Slade (2005) who have developed an instrument to measure the degree of exposure to an earthquake disaster. This Traumatic Exposure Severity Scale (TESS) consisted of two parts: (a) a measure of the occurrence of a range of traumatic experiences and (b) a measure of the amount of distress generated by each of those experiences. The authors stated that the second part (b) is not really part of exposure in itself. It is a consequence. In the current research this confounding component was not taken into account. Only items measuring the range of traumatic experiences were included, which resulted in more objective picture. Due to the variation in measuring exposure it is difficult to compare the outcome of the current study with earlier research on exposure.

Thus another conclusion could be that exposure in itself is less important in developing PTSD-symptoms. It could also be that peritraumatic dissociation, as mentioned by Ozer and

Weiss (2004) is a more predictive factor. This factor could in its turn be influenced by exposure. Even so attribution of meaning, as mentioned by Kleber and Brom (2003) could be more important than exposure by itself. This could implicate that not just experiencing the event or the extent of the exposure, but the way in which a person perceives the event is important. Looking at the other model mentioned in chapter two, the crux is maybe in the way in which an individual perceives a learned alarm (Barlow, 2004). This model implicated that the experience of an alarm or other intense emotions is not sufficient in and of itself for the development of PTSD (Barlow, 2004). In this way exposure may be less influential than previously thought. The model states that one must develop anxiety in the sense that these events, including one's own emotional reactions to them, are proceeding in an unpredictable, uncontrollable manner. When negative affect develops, one enters the vicious cycle of anxious apprehension. This is showing overlap with the concept 'attribution of meaning' mentioned by Kleber and Brom (2003) in their stress model, who also state that the way in which one perceives is determining. Finally Barlow states evidence already exists that moderating variables play a role in determining whether PTSD develops or not, because anxiety is always moderated to some extent by variables such as the presence of adequate coping skills and social support (Barlow, 2004). These coping skills or social support and their relationship to PTSD should be further addressed. Maybe a non-pathological 'attribution of meaning' is a way of successful coping with a traumatic experience.

### **§ 5.3 The central question**

The central question in the research was the following:

- ***Do individuals who are exposed more severely to the tsunami have more PTSD symptoms and how strong is the possible relationship between exposure and symptoms after three years?***

The recent study has found a significant difference in levels of exposure to the tsunami and its relationship with PTSD symptoms, but not for all exposure-items. Individuals more exposed in some ways do have more PTSD symptoms, but other forms of exposure did not resulted in experiencing more symptoms. This was the case directly after the tsunami and three years after the tsunami. The items which appeared of influence directly after the tsunami were not the same as three years after. Two single exposure items directly after the tsunami ('Did you notice that the sea pulled back?' and 'Did you have any negative experience during or after the disaster?') were significantly correlated with the DTS. Three years after the tsunami another item ('Did you need medical attention?') was significant.

#### **§5.4 Strengths of the study**

This study revealed some interesting aspects. The establishments of different components in exposure at T1 showed a physical and a psychological component. These two factors could have implications on the development of PTSD or even other mental health outcome, leading to better affiliation in practical psychological aid. Psychological exposure could for example be of more influence on PTSD symptoms or physical exposure could be more important directly after disasters. This knowledge should be gained to identify which persons could benefit from help and more specific what kind of help. The outcome is theoretically an interesting outcome, because this could lead to a further development of the exiguous 'exposure'- field. Further research with larger groups of participants should be done, to investigate the tenability of the factors.

Most importantly, the study is a pioneer study. Before the current study no research was done with the data of TISEI. This left a still unexplored field, which we are currently beginning to assess. The TISEI-project is not only very helpful for those who want to get in contact with each other or read something about events surrounding the tsunami, but is a new form of doing internet research. This format could be used in future disaster situations. There remain some limitations, most of all because its relatively young existence in the research field. The challenges are to draw representative samples of the general population, to deal with the issue of people without internet access, and to minimize the potential for nonresponse bias in web surveys.

These disadvantages and other barriers can be overcome by recognizing them and exploring this field more extensively. And most importantly, there are many strengths of e-health surveys. The costs of web surveys relative to the alternative model, the speed with which they can be conducted, and the ability to combine the power of computerized survey instruments with the advantages of self-administration makes this a valuable research tool. But much work remains to identify barriers to broader use of this method, and to overcome potential disadvantages (Couper, 2007). Emerging evidence provides support for the beneficial effects of online interactive eHealth programs, although many challenges remain with respect to research approaches to methodology, implementation, and evaluation (Ahern, 2007).

## **§5.5 Limitations of the study**

Besides the strengths of the study, also some limitations are present. First of all, the strengths that the use of TISEI and its method brought also has its limitations. The design of the TISEI questionnaires was relatively disorderly. The major reason for this was because the website had to be developed in a short period of time. In this way, it functioned very well for victims of the tsunami who needed support, but for research purposes it had its shortcomings. For example, during the research we discovered that the original DTS uses a five-point scale for its questionnaires (Davidson, Tharwani, & Connor, 2002). The DTS-questionnaires at the TISEI website contain a 4-point scale. Furthermore, because the participants could not be linked to each other at T1 and T2 (due to anonymity reasons), a longitudinal analysis was made impossible to carry out. This was unfortunate, because it would be interesting to do this measurement and look for the chronicity of PTSD or even explore the concept of delayed onset.

Secondly, the number of subjects was small. Approximately 500 Dutch tsunami survivors exist, of which only 73 at T1 and 37 at T2 were part of the study.

Thirdly, the danger of using an online questionnaire is the self-selecting effect and this results in being careful with generalizations, because this can endanger the reliability. It is a challenge to draw representative samples of the general population - in this case all Dutch tsunami survivors - and of dealing with the issue of people without internet access. The sample in this study is relatively young. This could be due to the destination in which the tsunami took place - young persons perhaps go on vacations with further destinations - and not so much to the access to internet, though this is hard to tell. Also challenging is minimizing the potential for non-response bias in web surveys or even knowing the non-response. In the case of this specific research it should also be taken into account that priming, due to answering other questionnaires before the DTS, can be a blurring factor, though for every participant the same order of questionnaires was used. This makes it on the one hand difficult to test such a hypothesis, but on the other hand submits all the participants to the same research-condition, in this way facilitating interpretation.

An other limitation of this study is the second measurement point. This was in the time the anniversary of the tsunami took place, though it could be questioned whether this was a suitable time. Hull, Alexander and Klein (2002) avoid the anniversary of the disaster because this could lead to temporary intensification of symptoms.

## §5.6 Future recommendations

Recommendations for future research are threefold. The first recommendation for future research should be to extend research surrounding the construct exposure. The authors believe that a step has been taken, though adaptations should be made. An improved questionnaire is central for future disaster research. Though we should keep in mind that a standardized exposure list may not be useful, as it remains the question whether it is possible to develop a questionnaire which measures exposure in general. No disaster is the same and the nature of exposure differs among events. Disasters can occur with a warning or unexpected and exposure to an earthquake would not contain the same exposure as exposure to a terrorist attack or a tsunami. All have different kinds of exposure, which in its turn can lead to diverse reactions. For example, being a survivor from a disaster with fire captures different forms of exposure than surviving a flood. Maybe a list with some themes and/or a list of psychological exposure without specific items of physical exposure can be a valuable tool. Psychological exposure could be for example loosing a family member, a friend being missing or your children getting injured. These questions could be (partly) standardized so they can be used for different kinds of disaster. This makes comparison on psychological exposure of disasters possible.

The second recommendation is extension into the area of internet research. It is possible that websites who offer psychological help and/or are used for research purposes use internet questionnaires. Even if validated questionnaires are used, validity in the case of e-research should be assessed, because this is a new form of doing research. For example, what is the role of disturbing factors such as or the impact of different research settings on participants? Also there is – though this is also the case for face-to-face research – no evidence that participants filled in the questionnaires honestly. And what about the influence of drugs and alcohol for which can be more or less controlled in face-to-face research?

The third recommendation for future research would be the use of a longitudinal design for measuring PTSD symptoms and other mental health problems. Not only should there be more measurement points in time, also individual scores at different time points should be coupled to each other, like the research of van der Velden et al. (2006a). Hull, Alexander en Klein (2002) reported even though the majority of trauma victims will improve, symptom rises are also reported. If only mean scores would be used and for some, symptoms would aggravate and for others diminish, the total score could be not so different from an earlier measurement point, weighing out individuals differences and pathways. Also multiple measurement points should be included. This to better understand delayed onset PTSD for

example and to see possible fluctuations in symptoms. If only two measurement points are taken those with persistent PTSD and those with fluctuations resulting in the same symptom-level at T2 can not be disconnected from each other. Hull, Alexander and Klein (2002) also point out that the majority of those exposed to traumatic events identified something positive to have come from the tragedy, whether personal or situational. This study does not focus on positive aspects, which was not the focus either, but would be interesting for future research.

It is important to note that the survivors of major disasters will have other problems in addition to their medical needs. Many have lost their homes and livelihoods and faced major difficulties in re-establishing a normal lifestyle as a result. Therefore, the successful treatment of PTSD after mass trauma will require a holistic approach, with attention to both the medical and psychological as well as the social needs to the survivors (Otero, Njenga & Psych, 2006). Fortunately, there is currently more attention for resilience in survivors. Resilience is more common than previously thought. Although there has been relatively little research on the absence of trauma symptoms, the available evidence suggests that resilience following such events may be more prevalent than previously believed (Bonanno, Galea, Bucciarelli, & Vlahov, 2006). For this study it could implicate that the 86,5% of the participants three years after the tsunami were resilient. Though further research should investigate this speculation. This will provide us with insight in the strengths of human beings to overcome and protect themselves from the horrifying experiences of disasters.

## Literature

---

- Ahern, D.K. (2007). Challenges and Opportunities of eHealth Research. *American Journal of Preventive Medicine, 32, 5S, 75-82.*
- American Psychological Association (1994). *Diagnostic and statistical manual of mental disorders, fourth edition.* Washington, DC: American Psychiatric Association.
- Armenian, H.K., Morikawa, M., Melkonian, A.K., Hovanesian, A.P., Haroutunian, N., Saigh, P.A., Akiskal, K., & Akiskal, H.S. (2000). Loss as a determinant of PTSD in a cohort of adult survivors of the 1988 earthquake in Armenia: implications for policy. *Acta Psychiatrica Scandinavica, 102 (1), 58-64.*
- Barlow, D.H. (2004). *Anxiety and its Disorders. The nature and treatment of anxiety and Panic.* New York: The Guilford Press.
- Barlow, D.H., & Durand, V.M. (2005). *Abnormal Psychology: an Integrative Approach.* Belmont: Wadsworth, Thomson Learning Inc.
- Basoglu, M., Kilic, C., Salcioglu, E., & Livanou, M. (2004). Prevalence of posttraumatic stress disorder and comorbid depression in earthquake survivors in Turkey: an epidemiological study. *Journal of Traumatic Stress, 17, 133-141.*
- Blanchard, E.B., Hickling, E.J., Barton, K.A., Taylor, A.E., Loos, W.R., & Jones-Alexander, J. (1996). One-year prospective follow-up of motor vehicle accident victims. *Behavior Research and Therapy, 34, 775-786.*
- Blanchard, E.B. & Hickling, E.J. (2004). In E.B. Blanchard & E.J. Hickling (Eds.), *After the crash: psychological assessment and treatment of survivors of motor vehicle accident*, 161-174. American Psychological Association, Washington, DC
- Bonanno, G.A., Galea, S., Bucciarelli, A., & Vlahov, D. (2006). Psychological Resilience After Disaster. New York City in the Aftermath of the September 11th Terrorist Attack. *Association for Psychological Science, 17, 3, 181-186.*

- Bramsen, I., Dirkzwager, A.J.E. & Van der Ploeg, H.M. (2000). Pre-deployment personality traits and exposure to trauma as predictors of post-traumatic stress symptoms: a prospective study of former peacekeepers. *American Journal of Psychiatry*, *157*, 1115-1119.
- Breslau, N., Chilcoat, H.D., Kessler, R.C., Peterson, E.L., & Lucia, V.C. (1999). Vulnerability to assaultive violence: Further specification of the sex difference in post-traumatic stress disorder. *Psychological Medicine*, *29*, 813-821.
- Briere, J. & Elliott, D. (2000). Prevalence, characteristics, and long-term sequelae of natural disaster exposure in the general population. *Journal of Traumatic Stress*, *13*, 661-679.
- Bryant, R.A. (2003). Early predictors of posttraumatic stress disorder. *Biological Psychiatry*, *53*, 789-795.
- Carlier, I.V.E., & Gersons, B.P.R. (1997). Stress Reactions in Disaster Victims Following the Bijlmermeer Plane Crash. *Journal of Traumatic Stress*, *10*, 2, 329-335.
- CBS Statline. Retrieved in July 2008 from the World Wide Web: <http://www.cbs.nl>
- Couper, M.P. (2007). Issues of representation in ehealth research (with a focus on web surveys). *American Journal of Preventive Medicine*, *32*, 5S, 83-89. Elsevier.
- Davidson, J.R.T., Tharwani, H.M., & Conner, K.M. (2002). Davidson trauma scale (DTS): Normative scores in the general population and effect sizes in placebo-controlled SSRI trials. *Depression and Anxiety*, *15*, 75-78.
- Davidson, J.R.T., Hughes, D.L., Blazer, D.G., & George, L.K. (1991). Posttraumatic stress in the community. An epidemiological study. *Journal of Psychological Medicine*, *21*, 713-721.
- Davidson, J.R.T., & McFarlane, A.C. (2006). The extent and impact of mental health problems after disaster. *Journal of Clinical Psychiatry*, *67*, suppl 2.
- Dempster, A., Laird, N., & Rubin, D. (1977). Maximum likelihood from incomplete data via the EM algorithm. *Journal of the Royal Statistical Society*, *39*, 1-38.

- Dewaraja, R., & Kawamura, N. (2006). Trauma intensity and posttraumatic stress: Implications of the tsunami experience in Sri Lanka for the management of future disasters. *International Congress Series 1287*, 287, 69-73.
- DTS-Davidson Trauma Scale. Retrieved in January 2008 from the World Wide Web <http://www.hogrefe.co.uk/?/test/show/149/>
- Ehlers, A., & Clark, D.M. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy*, 38, 319-345.
- Elal, G., & Slade, P. (2005). Traumatic Exposure Severity Scale (TESS): A measure of exposure to major disasters. *Journal of Traumatic Stress*, 18, 3, 213-220.
- Field, 2005. *Discovering Statistics Using SPSS*. Sage Publications Ltd; Second Edition.
- Foa, E.B., Stein, D.J., & McFarlane, A.C. (2006). Symptomatology and psychopathology of mental health problems after disaster. *Journal of Clinical Psychiatry*, 67, 2, 15-25.
- Gray, M.J., Bolton, E.E., & Litz, B.T. (2004). A Longitudinal Analysis of PTSD Symptom Course: Delayed-Onset PTSD in Somalia Peacekeepers. *Journal of Consulting and Clinical Psychology* 72, 5, 909–913.
- Griensven, F. van, Chakkraband, M.L.S., Thienkrua, W., Pengjuntr, W., Lopes Cardozo, B., Tantipiwatanaskul, P., Mock, P.A., Ekassawin, S., Varangrat, A., Gotway, C., Sabin, M., & Tappero, J.W. (2006). Mental health problems among adults in Tsunami affected areas in southern Thailand. *American Medical Association*, 296, 5, 537-548.
- Grievink, L., Velden, P.G. van der, Stellato, R.K., Dusseldorp, A., Gersons, B.P.R., Kleber, R.J., & Lebet, E. (2007). A longitudinal comparative study of the physical and mental health problems of affected residents of the firework disaster Enschede, The Netherlands. *Public Health*, 121, 367–374.
- Goenjian, A.K., Najarian, L.M., Pynoos, R.S., Steinberg, A.M., Manoukian, G., Tavosian, A., & Fairbanks, L.A. (1994). Posttraumatic stress disorder in elderly and younger adults after the 1988 earthquake in Armenia. *American Journal of Psychiatry*, 151, 895–901.

- Instrument Review Davidson Trauma Scale (DTS). Retrieved in January 2008 from the World Wide Web:[http://www.hsrd.research.va.gov/for\\_researchers/measurement/instrument/instrumentreviews2.cfm?detail=85](http://www.hsrd.research.va.gov/for_researchers/measurement/instrument/instrumentreviews2.cfm?detail=85)
- Keane, T.M., & Barlow, D.H. (2002). Posttraumatic stress disorder. In D.H. Barlow, *Anxiety and its disorders: the nature and treatment of anxiety and panic*. (2nd ed.) New York: Guilford Press.
- Kessler R.C., Sonnega, A., Bromet, E. Hughes, M., & Nelson, C.B. (1995). Posttraumatic stress disorder in the National Comorbidity Survey. *Archives of General Psychiatry*, 52, 12, 1048-1060.
- King, D.W., King, L.A., Foy, D.W., & Gudanowski, D.M. (1996). Prewar factors in combat related post traumatic stress disorder: Structural equation modeling with a national sample of female and male Vietnam Veterans. *Journal of Consulting and Clinical Psychology*, 64, 520-531.
- Kleber, R., & Brom, D. (2003). *Coping with trauma. Theory, prevention and treatment*. Swets & Zeitlinger publishers, the Netherlands.
- Lopes Cardozo, B., Vergara, A., Agani, F., & Gotway, C.A. (2000). Mental health, social functioning, and attitudes of Kosovar Albanians following the war in Kosovo. *JAMA*, 284, 569-577.
- Lundlin, T. (1995). Transportation disasters-a review. *Journal of Traumatic Stress*, 8, 381-389.
- Meijer, M., & Vries, R. de (2001). Schokkende gebeurtenissen: gevolgen, verwerking en begeleiding. *Marineblad*, 140-147.
- Meltzer-Brody, S., Churchill, E., & Davidson, J.R.T. (1999). Derivation of the SPAN, a brief diagnostic screening test for post-traumatic stress disorder. *Psychiatry Research* 88, 63-70.
- Norris, F.H., Friedman, M.J., Watson, P.J., Byrne, C.M., Diaz, E., & Kaniasty, K. (2002a). 60,000 Disaster victims speak: part I. An empirical review of the empirical literature, 1981-2001. *Psychiatry*, 65, 3, 207-239.

- Norris, F.H., Friedman, M.J., & Watson, P.J. (2002b). 60.000 Disaster victims speak: part II. Summary and implications of the disaster mental health research. *Psychiatry*, 65, 3, 240-260.
- Norris, F.H., Murphy, A.D., Baker, C.K, & Perilla, J.L. (2004). Postdisaster PTSD over four waves of a panel study of Mexico's 1999 flood. *Journal of Traumatic Stress*, 17,4, 283-292.
- Otero, J.C., Njenga, F.G., & Psych, F.R.C. (2006). Lessons in posttraumatic stress disorder from the past: Venezuela floods and Nairobi bombing. *Journal of Clinical Psychiatry*, 67, suppl. 2, 56-63.
- O'Toole, B.I., & Catts, S.V. (2008). Trauma, PTSD, and physical health: An epidemiological study of Australian Vietnam veterans. *Journal of Psychosomatic Research*, 64, 33-40.
- Ozer, E.J., & Weiss, D.S. (2004). Who develops posttraumatic stress disorder? *American Psychological Society*, 13, 4, 169-172.
- Ruijter, de, A., van der Schoot, T., & Vermetten, E. (2005). *OVERJ[LEVEN, over het jaar van de Tsunami*. Utrecht: Uitgeverij de Tijdstroom.
- Schnurr, P.P., Friedman, M.J., & Rosenberg, S.D. (1993). Preliminary MMPI scores as predictors of combat-related PTSD symptoms. *American Journal of Psychiatry*, 150, 479-483.
- Shalev, A.Y. (2001). What is posttraumatic stress disorder? *Journal of Clinical Psychiatry*, 62, suppl. 17, 4-10.
- Smith, E.M., & North, C S. (1993). Posttraumatic stress disorder in natural disasters and technological accidents. In Wilson, J. P., & Raphael B. (Eds.) *International handbook of traumatic stress syndromes*. New York: Plenum Press.
- So-Kum Tang, C. (2007). Trajectory of traumatic stress symptoms in the aftermath of extreme natural disaster. A study of Adult Thai Survivors of the 2004 Southeast Asian Earthquake and Tsunami. *The Journal of Nervous and Mental Disease*. 195, 1, 54-59.

SPSS 15.0 software. SPSS Inc. Chicago.

Summerfield, D. (2006). Survivors of the Tsunami: dealing with disaster. *Psychiatry*, 5, 7, 255-256.

Szegedy-Maszak, M. (2005). The Borders of Healing. *U.S. News & World Report*, 138, 2.

United Nations. UN Office of of the Special Envoy for Tsunami Recovery. Retrieved December, 21, 2006, from <http://www.tsunamispecialenvoy.org/default.aspx>

Velden, P.G. van der, Grievink, L., Kleber, R.J., Drogendijk, A.N. Roskam, A.R., Marcelissen, F.G.H., Olf, M., Meewisse, M.L., & Gersons, B.P.R. (2006a). Post-disaster mental health problems and the utilization of mental health services: A four-year longitudinal comparative study. *Administration and Policy in Mental Health and Mental Health Services Research*, 33, 3, 279-288.

Velden, P. van der, Loon, P. van, IJzermans, J., & Kleber, R. (2006b). *Psychosociale zorg direct na een ramp*. De psycholoog, 658-663.

Vermetten, E. (2003). *Posttraumatic stress disorder. Neurobiological studies in the aftermath of traumatic stress*. Utrecht: Drukkerij Zuidam & Uithof B.V.

Vermetten, E., Middelkoop, C.J. van, Taal, L., & Carll, K. (2007). Online Psychotrauma Intervention in the Aftermath of the Tsunami: A Community-Building Effort, 255-271 in Carll, E.K., (Eds.) (2007) *Trauma Psychology: Issues in Violence, Disaster, Health, and Illness*. Westport, CT: Praeger Publishers.

Vetter, S., Rossegger, A., Rossler, W., Bisson, J.I., & Endrass, J. (2008). Exposure to the tsunami disaster, PTSD symptoms and increased substance use – an internet based survey of male and female residents of Switzerland. *BMC Public Health*, 8, 92, 1-6.

Wen Kuo, H., Jen Wu, S., Ching Ma, T., Chiu, M., & Chou, S. (2007). Posttraumatic symptoms were worst among quake victims with injuries following the Chi-chi quake in Taiwan. *Journal of Psychosomatic Research* 62, 495– 500.

World Press Photo. Retrieved in May 2008 from the World Wide Web: <http://www.worldpressphoto.org/>

## Appendix 1

**Table 1. Sections on the TISEI-website**

<b>Section &amp; Title</b>	<b>Information</b>
1. Information on stay in Asia	Information about the reason of the stay, the country they were in and what and with whom they experienced the event
2. Physical health	Questions about the physical health before the tsunami
3. Personal information	Questions about demographic characteristics, such as age, gender, marital status, educational attainment, and employment status before the tsunami
4. Impact of Events Scale	(Dutch translation of the questionnaire) Participants had to think of the tsunami disaster, read each statement and indicate how often a certain statement applied on them in the past seven days. The list consisted of statements that people may express after an extremely traumatic experience, like the tsunami disaster. Source: M.J. Horowitz, Impact of Events Scale.
5. Davidson Trauma Scale	(Dutch translation of the questionnaire) Questions about how often and how strong participants had to do with the consequences of the tsunami in the last 7 days. This survey focuses on the frequency and seriousness of the impact of the tsunami disaster during the past seven days. Participants have to think of the past week when they fill in this list and click on the option that applies to them. Source: JRT Davidson, Davidson Trauma Scale
6. The peritraumatic dissociative experiences questionnaire	(Dutch translation of the questionnaire) This questionnaire focuses on the phenomena that may occur in the period around a disaster, so in this case the tsunami disaster. Source: CR Marmar, DS Weiss, TJ Metzler, The peritraumatic dissociative experiences questionnaire
7. Complaints	(Dutch translation of the questionnaire) Questionnaire about the extent to which participants are suffering from physical and psychological complaints. Answers have to refer to how they felt during the past seven days. Source: SCL, LR Derogatis, SCL-90
8. The Beck Depression Inventory-II	(Dutch translation of the questionnaire) 21 questions accompanied by various statements. Participants have to select one statement that best reflects how they have felt during the past week including today. If several statements apply equally, they have to select the most serious one. Source: Beck Depression Inventory II, AT Beck
9. Emotions	Indication of the extent to which emotions occurred. Participants have to think of the moment the disaster took place or when you were confronted with the events around the disaster for the first time. Source: P Van der Velden and R Kleber, 2001
10. The Rouw Vragen Lijst (RVL)	Different responses, that can occur after the loss of a loved one in relation to the tsunami for which the participants have to fill in how each statement applies to them since the disaster. Note: read 'death' as 'missing' in case the participant misses someone who is lost after the tsunami. Source: Rouw Vragen Lijst (RVL) P.A. Boelen, Jos de Keijser, Jan van den Bout
11. Remaining questions	Manier en kwaliteit van de hulp direct na de ramp.
12. Sleeping habits	Questions about the sleeping habits in the past month.

## aAppendix 2

---

Table 1. Reliability Statistics: component 1

Cronbach's Alpha	Cronbach's Alpha Based on	N of Items
,749	Standardized Items	5
	,748	

Table 2. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Rgeraakt	2,06	1,52	,58	,36	,68
Rgewond	2,26	1,63	,57	,47	,69
Rverzorging	2,31	1,68	,57	,50	,69
Rlevensgevaar	1,78	1,76	,49	,29	,72
Rafstand	1,77	1,88	,38	,28	,75

Table 3. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on	N of Items
,764	Standardized Items	3
	,788	

Table 4. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Romgevinggewond	,23	,38	,45	,21	,89
Romgevingvermist	,33	,39	,67	,65	,60
Romgevingoverleden	,34	,40	,7	,66	,57