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Navigating the Mental Health of Seafarers on Dutch-Flagged Ships: The Impact of Time Onboard, Having a Family Ashore and the Lifeline of Social Relations at Sea.

Master thesis

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Abstract

Seafarers play a vital role in global transportation while working under unique conditions that sets them apart from other professions. They live on board with their crew for extended periods of time, separated from family and friends. The time that seafarers spent on board has been linked to mental health, but the nature of this relationship is unclear, particularly how factors like social relationships on board and having a partner or children at home might influence it. This study aims to investigate these dynamics and explore the factors that could influence seafarers' mental health. The research question is: "*What is the effect of the number of consecutive weeks spent onboard on the mental health of seafarers, and how do having a family ashore and social relations onboard influence this effect?".*

A quantitative analysis was conducted using survey data from 304 seafarers working on Dutch-flagged vessels. The survey was distributed through networks and with help of the KVNR and the Dutch branch of Nautilus International. The survey included questions regarding mental health, the on-board stay, social relations and family structure. The analysis was done using regression models in SPSS.

The results show that a longer period on board leads to a lower mental health among seafarers. Better social relationships on board seem to worsen the relationship between time on board and mental health. However, while significant, this negative moderating effect is marginal. Social relations on board do have a strong direct positive effect on mental health scores. When social relations on board are better, the mental health of seafarers increases. Having a partner or children ashore does not seem to influence the mental health of seafarers or the relationship between time on board and mental health.

These findings highlight the importance of creating opportunities for seafarers to improve their social relations on board. Further research should focus on identifying strategies to strengthen social relationships on board.

Preface

Dear reader,

I am pleased to present my master's thesis, written for my master's program in Sociology, with a specialization in Labour Relations and Life Cycle, at the University of Groningen. Over the past few months, I have dedicated myself to exploring the mental health of seafarers on Dutch-flagged ships. This research has resulted in the thesis you are about to read. This topic is of personal interest to me, as my father was a seafarer, and I know "the way of life". I feel closely connected to the industry, especially to the people who work in it.

I would like to express my gratitude to all those who contributed to this research. First and foremost: I want to thank all the seafarers who participated. I truly appreciate the time you took to participate and the trust that you placed in me by sharing your experiences. I would also like to thank all the seafarers who shared the survey with others and those who approached me to express their support for my research. For the seafarers who know me personally via my father: thank you for your devotion, trust, ideas and your kind words of support. This made this experience especially meaningful to me.

I would also like to thank Nautilus (NL), trade union for seafarers, and the Koninklijke Vereniging van Nederlandse Reders (KVNR) [Royal Association of Netherlands Shipowners], for sharing the survey on their social media. I really appreciate your support for my thesis. I would also like to thank all the other people who shared my survey and helped me to reach seafarers. Besides, I want to thank my supervisor Dr. Wike Been and the second assessor, Dr Mark Huisman, for their feedback and guidance over the past few months. Wike, thank you for your support and your encouragement to pursue my personal interests and do my own research. This was an incredible journey from which I have learned a lot.

Finally, I want to thank my family and friends for their support. To my friends from Groningen: thank you for the shared writing sessions, coffee breaks and feedback. This kept me motivated and helped me improve my writing. I would also like to express my deepest gratitude to my mother, for her constant support and her faith in my abilities. And a special tribute goes to my father, whose love, kindness, support and unwavering belief in me have always inspired and motivated me, even now that he is no longer with us.

I hope you enjoy reading my work and that you find it both insightful and enjoyable.

Teddy Kroon

Groningen, 23rd of October 2024.

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1. Introduction

Seafaring has been important in connecting the world and sustaining economies for centuries. For the Netherlands this is no different, and seafaring and life at sea have profoundly influenced the nation's development. The Dutch history was shaped by some of the key players from the 16th and 17th century, such as explorers Willem Barentsz and Abel Tasman, and admiral Michiel de Ruyter. Furthermore, the Dutch East Indian Company (VOC), active from 1602 until 1799, was the first multinational company in the world and had a significant influence on worldwide trade and the Dutch economy and culture (Kuipers, 2024). Nowadays, the Netherlands continues to hold an important position in seafaring and maritime trade. For example, in 2022, nearly 622 million tons of cargo from seagoing vessels were processed in Dutch ports. 475 million tons entered via the Port of Rotterdam, which is the largest port of Europe (Centraal Bureau voor de Statistiek, n.d.). Besides, nearly 24 thousand seafarers work on Dutch-flagged vessels, of which around 5,250 hold the Dutch nationality (Koninklijke Vereniging van Nederlandse Reders, 2024).

The life of seafarers is very different than that of people with regular (office) jobs: seafarers, often with different nationalities, live together on a ship for consecutive days, weeks or even months, away from their loved ones, with the ship being their second home. Even with technological improvements like WIFI on board and better mobile internet connections in ports, seafarers are still physically isolated from their friends and family while on board. This could potentially influence the mental health of seafarers.

Despite this atypical way of life, the effects of these working conditions on the mental health of seafarers were not often attracting attention of labour sociologists for a long time. During the COVID-19 pandemic, however, the mental health of seafarers gained interest among researchers and policy makers. Due to the special circumstances, the vital role of seafarers became evident: they transport important products like medication and medical devices all over the world (International Maritime Organization, 2020). This was empathized by the Dutch government among others, who classified the nautical sector as vital (Nautilus International, 2021). However, seafarers often faced challenges such as travel restrictions, resulting in being stranded on board for longer periods than usual (Tan, 2020). This caused feelings of insecurity, worries for the family at home and feeling trapped on board, showing a negative effect on the mental health of seafarers (Slišković, 2020). These results shows that certain work characteristics of seafaring during the COVID-19 pandemic had an impact seafarers' mental health. While these insights are valuable and seem to show that being on

board for a longer period of time and worrying about family influences mental health, it is important to recognize that the COVID-19 pandemic was a challenging time. The research towards the sector in that period might therefore not accurately reflect the current state of seafarers' mental health and the influence of the length of the on-board stay in normal circumstances, now that the pandemic has subsided.

The importance of researching the mental health of seafarers becomes evident from the Seafarers Happiness Index (SHI) which has been compiled quarterly since 2015 based on a survey among seafarers (Mission for Seafarers, 2024). In 2023, the SHI revealed a notable decline in seafarers' happiness, dropping from a 7.1 in the first quarter of the year to a 6.4 by the last quarter. Additionally, the survey indicated that seafarers' happiness decreases as their time spent onboard increases. For example, trips lasting between one and three months received a rating of 7.2, while trips longer than twelve months were rated at 5.2. The survey also underscores the importance of social relationships on board, with factors such as camaraderie with colleagues and good crew relationships identified as key contributors to happiness. This could mean that good social relationships on board might weaken a potential negative relationship between the time spend on board and the mental health of seafarers. Furthermore, one of the main reasons for depression is feeling isolated from the family ashore, both while at sea and at home (Sampson & Ellis, 2019). This might enhance the relationship between the time on board and mental health, since seafarers who have longer on-board stays miss their family for a longer period of time.

While the SHI suggests that the length of the on-board stay may influence mental health, there is a lack of studies directly examining this relationship. As a result, evidence supporting this link remains limited, and the impact of working conditions, such as separation from family and the quality of social relationships on board, on this potential relationship is still unknown. Therefore, it is important to investigate whether time spent on board has a direct relationship with mental health, as well as identifying factors that strengthen or weaken this relationship. Understanding these dynamics could be used to improve mental health of seafarers and stimulate further research in this area. This study focuses specifically on seafarers on Dutch-flagged ships, a population that has not yet been researched.

The aim of this study is therefore to further investigate whether the length of time spent on board affects the general mental health of seafarers on Dutch-flagged ships, and whether this relationship is influenced by having a family ashore and/or social relationships on board. This adds to the current, still limited, literature on the mental health of seafarers. The lack of research is mostly explained by the fact that seafarers work remote, making it

challenging reach seafarers and obtain a good random sample (Sampson & Ellis, 2019). It is important to clarify that mental health in this research is seen as a broad concept, aiming to form a general understanding of the mental well-being of seafarers: it does not aim to determine or name any specific mental issues. The World Health Organization (WHO) defines mental health as "a state of mental well-being that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their community" (2022). When mental health is low, it can cause distress, hinder functioning, and increase the risk of self-harm. Therefore, it is important to identify important factors in seafarers' mental health.

The findings of this study offer the potential to enhance the mental health of seafarers on Dutch-flagged vessels. Seafarers spend long periods in an isolated environment, away from their families, where the crew often relies heavily on each other. If it is found that the time spent on board affects the mental health of seafarers, this can be considered in regulations regarding the length of on-board stays. Research indicates that employers often do not feel the need to invest in proactive ways to improve the mental health of seafarers, even though the seafarers themselves recognize measures as shorter periods on board, better ways to communicate with home and better social relations on board as ways to improve their mental health (Sampson & Ellis, 2021). The results of this research will contribute to the current knowledge of what factors influence the mental health, containing the factors that seafarers themselves see as important. These insights may encourage employers to adapt their policies regarding time on board, social relations on board and the family life of seafarers, thereby improving working conditions and helping seafarers to increase their mental health.

Finally, this research provides insights into human behavior in an isolated work environment, which can have broader implications beyond maritime settings. By investigating whether social relationships and having a family ashore also play a role in the relation between time away from home and mental health, these findings can be used in various sectors. For example, policies could encourage social contacts with colleagues and provide more opportunities for employees to structure their work periods around family circumstances. This could be relevant for any profession where employees are away from home for extended periods.

For this purpose, a survey was conducted on Dutch flagged vessels. The reason for focusing on a single flag in this research is based on EU legislation regarding seafarers. Article 11.4 of Regulation 883/2004 of the European Parliament and European Council states that the social security for EU-seafarers on board is determined by the flag state of the ship, in

this case The Netherlands[1]. Therefore, the social security among the EU-crewmembers is the same on these ships. This is important, since social security can influence mental health (Simpson, et al, 2021). Besides, Dutch-flagged ships have not been researched before, which makes this an interesting new research population, especially considering the rich maritime history of the Netherlands. The research question is: "*What is the effect of the number of consecutive weeks spent onboard on the mental health of seafarers, and how do having a family ashore and social relations onboard influence this effect?".* In this study, the effects of age, the location of participation and the amount of co-workers on board are controlled for, as these factors may influence mental health outcomes.

First, the theoretical framework is discussed. This chapter will explain the expected relationships between the different concepts and the possible influence of the control variables. The hypotheses of this thesis are also described in this chapter. Next, the methods chapter outlines how this research is conducted, describing the survey and operationalization of the variables, followed by an analysis plan. This is followed by the results chapter, which shows the results from the regression analysis in which the hypotheses are tested. Based on these findings, the conclusion and discussion chapter are written. Lastly, the reference list and appendices are provided.

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A02004R0883-20140101

2. Theoretical Framework

The theoretical framework describes the different concepts that will be studied in the thesis. This consists of current knowledge and explanations for the possible relationships between the concepts.

2.1 General mental health of seafarers

Even though little research has been done on the mental health of seafarers, there are some important findings. These are presented below, showing possible mental health issues among seafarers.

Research from Lefkowitz and Slade (2019) shows that 25 percent of the seafarers that completed their health survey showed signs of depression. This is a significantly higher number then in any other working population. Also, 17 percent who completed an anxiety disorder questionnaire showed signs of anxiety and 20 percent had suicidal thoughts in the two weeks before the survey. The depression, anxiety and suicidal thoughts increase the chance of an injury or illness on board and decrease the chance of staying at the company or that seafarers remain seafarer in general. Besides, as mentioned before, the Seafarers Happiness Index (SHI) shows that the mental health of seafarers seems to have declined in 2023, dropping from 7.1 in the first quarter to a 6.4 in the last (Mission for Seafarers, 2024).

2.2 Mechanisms and sociological theories

To understand mental health, it is important to understand which mechanisms are important for seafarers and what theories can help understand mental health in general. These are described below.

2.2.1 Loneliness and social isolation

It is important to understand underlying reasons that might be responsible for lower mental health of seafarers compared to other working population. One of the important indicators for a lower mental health in general, that also applies to seafarers due to their unusual working conditions, is social isolation (Evans & Fisher, 2021). Research shows that people who are socially isolated have higher levels of depression and anxiety, compared to people who are not socially isolated, therefore having a significant effect on mental health. A study from

Smith and Victor (2019) shows similar outcomes, concluding that an increase in feeling isolated and/or lonely caused a decrease in mental health.

Loneliness is also an important indicator for mental health and is often linked with social isolation. Research from Beutel et al. (2017) shows that loneliness is connected to depression, anxiety, panic attacks and suicidal thoughts and therefore decreases general mental health. This is interesting, since seafarers spent a lot of time at sea and are therefore partially isolated from society for prolonged periods of time. The study also shows that the effect of loneliness on feelings of depression and low life satisfaction seem particularly strong for men, which is an interesting insight, since most seafarers are male, with an estimate of only 1.2 percent of seafarers being female (International Transport Workers' Federation, 2023).

Both social isolation and loneliness are typical for the working life of seafarers, who are often away from family, friends and their community for long consecutive periods. Research specified to seafarers' mental health from Sampson & Ellis (2019) seems supports this statement. Their study shows that seafarers report being significantly less happy when on board in comparison to when they are at home. This is mainly caused by feelings of isolation, loneliness and the separation from their family, which negatively contribute to the mental health of seafarers.

2.2.2 Sociological theories on mental health

Sociological research provides valuable insights into the relationship between the length of the on-board stay and the mental health of seafarers. It also helps to explain how being separated from the family ashore and the social relationships on board can influence this relationship. Two main theories are relevant in this context: the Social Support Theory and the Social Capital Theory.

The Social Support Theory emphasizes the importance of social networks and social support they provide in buffering the negative effects of stress on mental health (Cohen & Wills, 1985). As stated in 2.2.1, seafarers often experience physiological stress on board such as feelings of loneliness and social isolation, and social support could help to buffer these negative effects. However, seafarers are physically separated from their primary social networks like family and friends while they are on board. Even though they may have access to WIFI or mobile networks, their connection to these networks is more limited compared to those with regular jobs. This disconnection reduces the amount of social support they receive,

potentially leading to a decline in their mental health over time. The length of the on-board stay between seafarers varies, which means that some seafarers experience this isolation from their social network for longer periods of time than others. This can cause a negative relation between the time on board and the mental health of seafarers. However, good social relationships on board can act as a buffer against this negative effect, since this can reduce the feelings of loneliness and social isolation. Conversely, bad social relations on board can increase feelings of loneliness and social isolation, as this adds to the lack of social support they experience due to being separated from family and friends.

Another social theory is the theory of Social Capital by Putnam (2000). This theory emphasizes the importance of "strong ties" on mental health, which refers to close personal relationships that stimulate trust and emotional support. As stated, seafarers are often relatively isolated from their strong ties like family and close friends. As the length of the on-board stay increases, the negative effects of this isolation from their strong ties might increase. However, forming stronger relationships with crew members on board can enhance the strong ties on board, creating more feelings of trust and emotional support. This shows, just like the social support theory, that increasing social relations might buffer the negative effects from the longer period at sea, separated from family and friends ashore. On the other hand, having a partner and/or children at home might worsen the effect of a longer period at sea, since seafarers who have a family at home miss their emotional support while on board. In contrast, seafarers without a partner or children may not feel this absence as strongly, as they do not experience the social support of a partner or children when at home. This might make a longer on-board stay less difficult for seafarers without a partner and/or children.

2.3 Key relations: time on board, family and social life.

The literature above shows the mechanisms of loneliness and social isolation, along with sociological theories that could be important in this research. Below, existing research that shows the relations between mental health and the length of time on board and the influence on this relationship of having a family ashore and social relations on board are described. These all have a link with social isolation and/or loneliness and might therefore influence the mental health of seafarers.

2.3.1 Time on board and mental health

As stated in the introduction, the SHI shows that the length of time on board has a negative effect on the happiness of seafarers, since it decreases from 7.2 for trips of one to three months to a 5.2 for trips longer than 12 months (Mission for Seafarers, 2024). This seems to be in line with studies who have investigated this relationship (Slišković & Penezić, 2016; Sampson & Ellis, 2019). According to Sampson and Ellis (2019), seafarers usually experience their time on board as lonely and isolated, therefore a longer stay on board can be expected to decrease the mental health of seafarers since these are both important indicators for mental health. Research on seafarers during the Covid-19 pandemic also shows that, even though seafarers are used to working in social isolation, prolonging the time on board and therefore longer period of social isolation, significantly negatively affected their mental health (Slišković, 2020). This was caused by an increase in feeling lonely and missing family more. Research from Agterberg and Passchier (1998), who interviewed three harbor physicians in Rotterdam, shows that long periods away from home are the most prominent reasons for feelings of loneliness and homesickness. Seafarers themselves point out that reducing the time on board would help to improve their mental health, which seems to be in line with the outcomes of the SHI (Sampson & Ellis, 2021).

Seafarers are not the only group of workers that are away from home for a longer period of time. Research about so-called fly-in-fly-out (FIFO) work also shows a relationship between being away from home for work and mental health. This type of work is often used when there is a large distance between work and home, creating the need for workers to stay away from home for a longer period, like days or weeks (Fruhen et al., 2022). The employees are housed and fed by the employer and have a schedule with predetermined times for work and time at home, therefore being similar in some ways to the life of a seafarer. There are a few important factors that impact the mental health of FIFO workers. The psychological demands that this way of working brings, where you constantly need to switch between work and home life, causes emotional stress and impacts the mental health of the workers (Parker et al., 2018). The fact that they are either at home or at work for prolonged periods of time, makes that the employee constantly needs to redefine their place when they return home or at work. FIFO workers with shorter or even-time rosters reported significantly better outcomes on mental health, indicating that the time away from home impacts the mental health. Loneliness during their time away from home, also significantly impacts the mental health of the FIFO workers, since the fractured way of life makes it harder to feel connected with

friends and loved ones (Watts, 2004). This creates feelings of loneliness and isolation, decreasing the workers' mental health.

The Covid-19 pandemic showed that prolonged periods on board also led to increased feelings of isolation and loneliness, therefore decreasing their mental health (Baygi et al., 2022) (Slišković, 2020). In combination with the impact of transitioning from work to home life and the length of the roster, the lifestyle of the seafarer seems to have great impact on his mental health. They are also separated from important social networks and their strong ties, which can have negative influences on their mental health, since they experience less social/emotional support and trust. The Social Support and Social Capital theory show that these are of great importance for mental health. This could show that a longer time on board and therefore a longer separation from these important connections could lead to decreasing mental health scores. These findings lead to the first hypotheses of this thesis: "*The mental health of seafarers decreases as the time on board increases*".

2.3.2 The influence of having a family ashore

Since seafarers spend a lot of time away from home, the role of having a family ashore on feelings of loneliness and isolation are also interesting to explore. Research from Beutel et al. (2017) shows that feelings of loneliness are significantly higher in people who live alone, do not have a partner and do not have children. This relationship was already found by Stack (1998), whose research pointed out that when people are married, the feelings of loneliness are lower than when unmarried. It also shows that being a parent was also an important factor in decreasing feelings loneliness. The positive effects of marriage and having children on feeling lonely were stronger among men than women.

However, the life of a seafarer also contains being away from the family for a long time. Although the communication with people ashore has increased in comparison with 20 years ago due to better internet connections etc., missing the family remains a big part of the seafarer's life. Different studies show that being away from the family seems to have a negative impact on the feelings of loneliness and stress, and therefor on mental health. For example, a study on army soldiers who were deployed shows that married soldiers more often gave negative consequences of their deployment than single soldiers (Newby et al., 2005). One of the main negative deployment results for married soldiers was that they were away from their family and missed important family related events. The negative effect of deployment on their relationship was also often mentioned.

Similar effects like the ones among soldiers regarding being from home for work and family life are found among FIFO workers. FIFO-families experience more work-to-family conflicts and have more concern over their partners wellbeing than the regular community (control) families (Dittman et al, 2016). Research from Parker et al. (2018) shows that work and home conflicts increase the chances of depression, anxiety and burnout among FIFO workers. They also experience increased feelings of loneliness and isolation since they are separated from their family and miss out on family events.

Studies on seafarers also show that family related problems and a feeling of isolation from the family are some of the most prominent reasons for feeling depressed while on board (Chowdhury et al. 2016). They also experience a form of isolation from the family when they are home, having to redefine their position in the family and being away from their spouse and children for a long time (Sampson & Ellis, 2019). Seafarers often feel like strangers in their own home or town after a long period at sea. An example of this is missing seeing their own children grow up, coming home to a different child each time. When asked what makes seafarers happiest, most answers relate spending time with their family. During the Covid-19 pandemic, it was found that the longer periods on board increased depressive symptoms among seafarers, mostly among married officers, decreasing their mental health (Baygi et al., 2022). The worries about the family at home during this period increased the feeling of loneliness among seafarers, decreasing their mental health (Slišković, 2020).

These findings show that having a family at home can increase the feelings of loneliness and isolation for seafarers during their time on board. The research of Newby et. al. (2005) shows that married army personnel noted more negative consequences than single personnel, which indicates there might be a difference for seafarers as well. Since the positive effect of being married on loneliness seems to be reversed for people in working in jobs that demand being away from home for a longer period of time, it can also be expected that the positive effects having children are also reversed. Besides, the Social Capital theory explained in 2.2.2 states that strong ties, such as relationships with family, are important to enhance someone's mental health. Having a family at home like a partner and children, and therefore having to miss these strong ties, can therefore have a negative effect on the relationship between time on board and mental health. Seafarers with a family ashore might miss the emotional support a partner or children offer during their time on board, while seafarers without a partner or children may not feel the absence of emotional support as strongly. This leads to the second hypotheses of this thesis: *"Having a family at home increases the negative effect between length of time on board and mental health"*.

2.3.3 The influence of social relations on board

Though social isolation and loneliness can cause depression and anxiety, it appears that social support on board can lower these levels (Evans & Fisher, 2021; Pauksztat, Grench, et al. 2022). The more isolated someone feels, the stronger the effect of social support is on lowering depression and anxiety. Research from Brooks and Greenberg (2022) shows that good relationships contribute to job satisfaction, and that crews that change frequently were more stressful than having a stable crew. This is also found in the SHI of Mission for Seafarers (2024), which shows that having a regular roster is an advantage for the happiness on board. This allows for trust and respect to grow among crew members, creating stronger social bonds. Seafarers themselves also see increasing social relations and camaraderie as a good way to fight isolation and loneliness and find it important to create spaces where people can come together and bond. The importance of the social relations on board are also shown in the study of Sampson and Ellis (2019), in which they find that isolation, boredom and loneliness, among other things, have a negative effect on the mental health of seafarers. When asked what makes seafarers the happiest on board, most responses were linked to their social life on board like talking with colleagues. Problems with the relationships on board on the other hand were important indicators for a depression. One of the strategies that seafarers use to battle feelings of depression seem to be to interact with others on board. Engaging in social activities as talking to colleagues, watching movies or playing a game together, etc., is a common way for seafarers to make themselves feel better.

The importance of social relations on mental health in general has been researched before. For example, the mental health in deprived communities, where there are barriers to social engagement due to low income, fear of crime, etc., was mainly negatively associated with feeling lonely (Kearns et al., 2014). Loneliness was strongly associated with both social contacts and social support, both decreasing loneliness and helping to form a social buffer for stressors of poor mental health. In these communities, it was important to be familiar with the neighbors in an active way and not just by merely recognizing each other. Feeling lonely was decreased by having contact with neighbors on most days, therefore increasing mental health. Research from Kuczynski et al. (2021) also shows the importance of social contact. They find that more social interactions decrease feelings of loneliness and depression. The quality of the interactions is also important. The perceived responsiveness of people that a person interacts with also influences the feelings of loneliness and depression. Social support is also seen as a good way to reduce loneliness, since research shows that people who have higher levels of social support show lower levels of loneliness (Zhang & Dong, 2022). In an overview on

literature on mental health and social support, Turner & Brown (2010) conclude that social support matters in situations of psychological distress, especially in cases where stress exposures are high. For seafarers, the separation from family and friends can cause psychological distress in the forms of loneliness and feelings of social isolation. The longer the on-board stay of a seafarer, the longer they experience these forms of psychological distress. Their findings indicate that support on board could help to buffer this effect, similar to the Social Support theory from Cohen and Wills (1985). Besides, the Social Capital theory from Putnam (2000) also indicates that enhancing social relationships and with that, creating strong ties on board, can improve feelings of trust and emotional support. Any negative effect that might occur due to a longer stay on board might therefore be buffered by increasing social relations.

Social relationships and social support seem to be important in fighting loneliness, both in general and specifically for seafarers. Good social relationships on board may mitigate the negative effect of length on board on mental health. Though the specific influence of social relationships on the relationship between length of time on board on mental health has not been researched yet, the third hypotheses of this thesis can be formulated as followed based on the current literature on social relationships and loneliness: *"When social relationships on board are better, the negative effect of length of time on board on mental health decreases"*.

2.4 Control variables

To test our hypotheses, it is important control for the effects of certain other variables, which have a strong effect on mental health in general. By doing this, the conclusions are more precise, since the effect of important factors for mental health are eliminated.

2.4.1 Age

Age has been chosen as a control variable since this seems to have a direct effect on the mental health of a person, also among seafarers. Most of the seafarers reporting mental health issues were younger than 40 years old (Lefkowitz et al., 2019). This was also found by Seyle et al., (2018), who concluded that a younger age is a significant predictor for symptoms of depression in seafarers. Doyle et al., (2016) show that the age of seafarers negatively correlates with perceived stress, therefore showing that younger seafarers have higher stress levels, lowering their mental health. Besides, the age seems to play a big role in the feelings

of loneliness, which is also an important indicator for the mental health of seafarers. Research from Beudel et al. (2017) shows that in their research population of 35- to 74-year-olds, the loneliness declined with age. Since they also found that the feelings of loneliness were associated with depression, anxiety and suicidal thoughts, the negative impact of loneliness on mental health was stronger among younger people.

2.4.2 Location while participating in the study

Seafarers are significantly less happy while on board compared to when they are at home (Sampson & Ellis, 2019). This is caused by the feelings of loneliness, isolation and the separation for their family. This might influence the response on surveys of the seafarers who participate while being on board. Therefore, it is expected that people who are on board will have overall lower outcomes on mental health than people who participate while being at home with their family.

Research from Hartoyo (2022) among cadets at the Djadajat Maritime Academy shows that the reasons from the students for becoming a seafarer mostly come from intrinsic motivation, they therefore seem to have a passion for life at sea. Even though the questions focus on how they feel while on board, being at home might influence their answers. While at home, they do not experience the negative effects of working at sea. Seafarers are at home with their family, with whom they can spent a lot of time during their time off. This might influence their perception of seafaring and lead to higher mental health scores.

2.4.3 Amount of people on board

The size of the crew might be an important factor to use as a control variable. This can be explained by the fact that this might partially overlap with the social relations on board. Larger groups, and in this case larger crews, offer more opportunities for social interactions, which might have an influence on the personal network (Hawkley et al., 2008). For seafarers, this could mean that they have more opportunities to meet individuals with whom they connect, thereby enhancing their social relationships in an otherwise fairly isolated environment. However, larger groups can also have a negative impact and make people feel more alone in a crowd (Cacioppo et al., 2009). Interactions are often less profound and the bonds between individuals tend to be weaker, which can lead to feelings of loneliness (Putnam, 2000). This could mean that seafarers on ships with larger crews may experience

greater feelings of loneliness, even though they have more opportunities for social relations. As a result, their mental health could be negatively influenced.

Smaller groups seem to achieve that the relationships that are formed might be more meaningful (Putnam, 2000). This creates more social cohesion, since members of the group, and in this case the crew, are more involved in each other's lives. For seafarers this means that a smaller crew might create more intimate relations and enhanced feelings of trust and camaraderie.

This shows that the effect of the size of the crew might have an influence on the mental health of seafarers, since influences the feelings of loneliness and social isolation in either a negative or positive manner. This makes it important to ensure that the possible effect is controlled for.

3. Methods

In the methods section, data collection, the operationalization and the analysis plan are discussed.

3.1 Data collection

The data for this study is collected with an online survey among seafarers on Dutch-flagged ships. The reason for an online survey is that it allows for collecting a large amount of data in a short amount of time. Besides, it is the best way of collecting data to answer the research question and gives the opportunity to formulate conclusions that can be generalized to the population. An online survey can also be sent to seafarers who are on board at the time of the data collection since seafarers usually have access to a WIFI/internet connection on board. The survey is written in English, since this is the working language on board of ships with crews from different countries (Oldenburg, et al., 2012). A captain in the personal network of the researcher, with many years of experience in working with international crews, was asked to read the questions and determine if they would be understandable for an international crew. The online survey was tested by the supervisor of this thesis. The survey was made in Qualtrics, and the data stored at the local environment of the University of Groningen.

3.1.1 Ethics

This study was ethically assessed and approved by the ethics board of the Sociology department, Faculty of Behavioral and Social Sciences from the University of Groningen before collecting the data. Before participating, respondents were informed about the possible risks and the way their data would be handled and stored. They were informed that their data would be used for this thesis and might possibly be used for further research on this topic. Participation was fully voluntary. Respondents needed to give consent before participating in the survey.

3.1.2 Survey

The survey was developed for this specific research and conducted in June and July of 2024 and the survey questions can be found in Appendix I of this document. The survey contains a few demographic questions, like age, nationality and EU-citizenship of the respondents in order to map the population and to cover control variables. The respondents were also asked

about their work-characteristics, like their roster to determine the length of time on board, and questions regarding work experience, work pressure, etc. After this, there are multiple statements that give an impression of the general mental health of seafarers. This is followed with questions about the family situation and questions about the social relations on board, in order to get the information needed to test the hypotheses from this research. Seafarers could also share anything they like about the topics in the survey in an open question at the end. The answers to this question are considered when interpreting the results if relevant.

3.1.3 Population and distribution

The population in this research is seafarers on Dutch-flagged ships. This total population consists of nearly 24 thousand seafarers who work on Dutch-flagged vessels, of which around 5,250 hold the Dutch nationality (Koninklijke Vereniging van Nederlandse Reders, 2024). The minimum desired sample size was set around 150 participants. This was based on two factors. First, the k*15=n rule, in advance it was known that there would be at least 5 variables in the model (time on board, family ashore, social relations and at least two control variables), resulting in a desired sample size of 75. However, it was assumed that there might be more interesting control variables. So, in the case of 7-10 variables, the desired sample size would be around 105 to 150. Second, a power analysis was done to determine the desired sample size. While assuming 7 predictors, an expected R^2 of 0,1, power of 80 and an alpha of a = 0,05, the sample size should be around 137. Since the number of predictors was not completely certain yet, the minimum sample size was set at 150. In total, 527 individuals began the survey, but 359 gave consent and met the criteria of working on a Dutch-flagged vessel and were between the ages of 18 and 67 years old. This is well over the minimum of 150 participants and therefore the desired minimum sample size was achieved.

The survey was distributed in multiple ways, in order to reach as many seafarers on Dutch-flagged ships from as many different shipping companies and ships as possible. The survey was shared in a (private) Facebook group "Vrienden van voorheen GB", this is a close community with around 350 seafarers who used to work for a Dutch shipping company, Gebr. Broere B.V., which does not exist anymore. The members are now spread out over multiple (Dutch-flagged) ships and were therefore relevant for the survey. It was also encouraged and possible for the seafarers in this group to share the link to the survey with their crewmembers or other seafarers they might know outside of this group. We also used snowball sampling to reach our population. The survey was sent to seafarers on Dutch-flagged ships in the personal

network of the researchers via WhatsApp or email and were also asked to share the survey with their crew and other seafarers they might know. It was also posted on the personal Facebook profile of the researcher as a public post, as another way to reach seafarers in the personal network and to enable them to share it on their profiles.

Besides, the survey was posted on the LinkedIn profiles of the researchers, since the Koninklijke Vereniging van Nederlandse Reders (KVNR) [Royal Association of Netherlands Shipowners] stated that they've had positive experiences with this way of reaching seafarers. Also, LinkedIn posts are public and gives people the opportunity to like/share the post and the link to the survey, making it visible for a larger network than just personal connections. Besides, the KVNR shared the survey on their LinkedIn page as well. They find it important to stimulate research in this field and, according to the KVNR, a lot of seafarers follow them on LinkedIn, which made this a good way to reach the target population. Nautilus International (NL), the Dutch branch of an international trade union for seafarers, also shared the survey to their members via WhatsApp groups and by sharing the survey on Facebook and LinkedIn. They also find it important to help students who are researching the sector and were therefore willing to spread the survey to their members.

Due to the nature of the data collection through networks, snowball sampling and public posts, it is unknown who and how many seafarers saw the survey.

3.1.4 General information of the participants

As mentioned before, there were 359 participants in this research. Before further explaining the variables in the model, this paragraph will give a general impression of the participants (See appendix III). Of the participants, 95.5 percent were male, and 4.5 percent were female. This is a similar percentage as the estimate percentage of females who are seafarers, which is around 1.2 percent (International Transport Workers' Federation, 2023). The average age of the participants was 41 years old.

Looking at the nationalities, most participants have the Dutch nationality. This group is 88.9 percent of the total amount of participants. The remaining 11.1 percent consist of Indonesian, Belgian, Filipino, Ukrainian, British, Latvian, Polish, Bulgarian, German, Indian, Lithuanian, Romanian and Russian seafarers. This means that the percentage of Dutch participants is higher than anticipated, since around 21.9 percent of the seafarers on Dutch-flagged vessels are Dutch. This overrepresentation can introduce bias and affect the generalizability of the results to seafarers on Dutch-flagged ships in general.

It is also interesting to note that 51 percent of the participants was on board while participating, and the other 49 percent was at home. Showing that the survey reached seafarers on board just as well as seafarers who were at home.

3.2 Operationalization

The survey consisted of multiple questions to map the sample, control variables and the main variables of the study. Below, each variable is clarified, including the phrasing of the questions and how the variables were recoded to ensure that it could be used in the model (see Appendix VII for the syntax).

3.2.1 Mental health

Mental health was measured on the Short Depression-Happiness Scale (Josepth et al., 2004). This is a shorter version of the depression-happiness scale, only using 6 statements. Respondents could choose from four answer options: 0) never, 1) rarely, 2) sometimes and 3) often. The questions are both formulated in a positive and negative way. The statements can be found below, these were slightly altered by adding "on board", to ensure that they reflect the life on board (see Appendix). The aim of mixing positive and negative statements was to prevent response bias from the respondents. This way the risk of respondents falling into a patterns of answering can be prevented. The statements from the original scale are as follows:

1. I felt dissatisfied with life
2. I felt happy
3. I felt cheerless
4. I felt pleased with the way I am
5. I felt that life was enjoyable
6. I felt that life was meaningless

There were also two additions, since two important factors for the mental health of seafarers seem to be the loneliness and social isolation aspect of working at sea (Sampson & Ellis, 2019). One of these was be formulated as positive, and one as negative, to keep mixing the statements and prevent response bias. The statements that were added are as follows:

7. I felt connected to others on board
8. I felt lonely on board

To analyze the data, the negative statements are recoded, to ensure that a lower score means a lower mental health and all the statements measure mental health in the same way. The scores are added up to a total with a minimum of 0 and a maximum of 24 (3*8) in which a higher score means a better mental health. This score can be found in one variable called "mental health". The Cronbachs Alpha, which indicates if the statements have a good internal consistency, was 0.82. This is above the ideal minimum of 0.7, which indicates that these statements can be used to measure one variable: mental health (See appendix II and III).

3.2.2 Time on board

The variable time on board is measured in an open question where seafarers are asked how many consecutive weeks they are at sea. This was inspired by the survey from Slišković and Penezić (2016) on the job- and life satisfaction of seafarers. They formulated their question as followed:

- On-board stay according to contract: 1, 2, 3, 4, 5, 6, more than 6 months.

However, personal experience shows that the time in board in contracts can also be formulated in weeks, especially for shorter periods of time (like 2, 3 or 6 weeks). To measure the time on board more precisely, this was an open question asking for the number of weeks.

- On board stay according to contract, in weeks: (number of weeks)

The time on board is used as a continues variable. A value of 175 was coded as a missing value, since this seems highly unlikely considering all other values are between 1 and 34. Since this variable is used to test a moderating effect, it is also centered. The centered variable is used in the model to look at direct effects and to create interaction terms with Partner, Children and Social relations. By doing this, it becomes clear how these factors might affect the relationship between time on board and mental health.

3.2.3 Family ashore

To measure the family ashore, it is important to look at the current household situation of the seafarer. This was determined by two questions. The first asked the seafarers whether they were single or in a relationship. In case of the latter, they had two possible answers, one where they are not living together and one where they are. This gave them three possible answers: 1) "Single", 2) Relationship, not living together, 3) relationship, living together. Next, they were asked to state the number of children they had in an open question.

The scores for Partner will be recoded to a dummy, where 0 means single and 1 means that they are in a relationship. This will make it possible to see if having a partner at home has any effect their mental health while on board. The same will be done with the number of children: 0 will mean that they have no children and 1 that they do have children (See Appendix II and III). These do not need to be centered and will be added to the model as they are. Together, these two variables will give an impression of the effect of family ashore on the mental health of the seafarer.

3.2.4 Social relations on board

To measure the social relations on board, it is important to look at existing research on seafarers. Social relations can be measured by asking about the perceived social support on board. Pauksztat et al (2022) measure the onboard peer support by giving three statements, in which each can be answered with the categories strongly disagree (0) to strongly agree (6).

1. When I need help from other crew members, I get it.
2. I can rely on other crew members when things get stressful.
3. There is at least one person on board with whom I can talk about private things or problems at home.

There were a few additions to this survey, based on what was found in the literature on social relationships of seafarers. This showed that the trust and respect that a regular roster creates increased happiness on board (Mission for Seafarers, 2024). Also, spending time with crew members by watching movies, talking, playing games etc. decreased feelings of loneliness and depression (Sampson & Ellis, 2019). These were also be measured on a scale from 0 to 6, like the statements before.

4. I experience trust and respect among the crew.
5. I have enough opportunities on board to spent time together with the crew (watching a movie/tv, playing a game, having a cup of coffee, etc.).

Just like mental health, this will be converted to one variable called social relations (See Appendix II and III). The scores for a respondent are added together, giving a score between 0 and (5*6) 30. A higher score means that people have better social relationships on board, while a low score stands for low social relations on board. The Cronbach's Alpha in this case is 0.75, which is also above the minimum of 0.7. This indicates that there is a high internal

consistency between the statements and that they can be used to make one variable. To use this variable in the model, it will be centered just like time on board. This centered variable will be entered in the model and will also be used in the interaction between social relations and time on board.

3.2.5 Control variables

There are also a few questions to cover, and check for possible other, control variables (see Appendix I). The control variables for this research are age, the location of participation and the amount of people on board. Age will be treated as a continuous variable and was measured with an open question where respondents could answer with a number. Respondents aged below 18 and over 67 were excluded from the analyses, since seafarers outside this age range are not part of the current working population and are therefore not within the population of this study. The location of participation is a dummy variable where 0 means that they were on board and 1 means that they were at home while responding to the survey.

The amount of people on board was asked with an open question where they could answer in numbers. Due to the large variability in the data, this variable is recoded (See Appendix II and III). Originally, the values vary between 0 co-workers and 1200 co-workers. However, 75 percent of the crews consist of 19 crewmembers or less. In order to use this variable, new categories are made. 0 up to and including 20 will remain the same, meaning the exact number of co-workers on the ship. After this, 21-50 will be counted in groups of 10. This means that 21-30 will be labeled as 21, 31-40 as 22 and 41-50 as 23. After this the steps increase further, since the data is more spread out. 24 will contain 51 up and including 75 and 25 will contain 76 up to and including 100. The last two categories will consist of 26: 101 up to and including 500, and 27: 501 up to and including 1200. This recoding is necessary because, although the higher values are relevant, they represent rare cases that could distort the results if they are left ungrouped. By categorizing the higher values in the data in these groups, it ensures that both lower and higher values can be used in the analysis. The variable is treated as continuous to capture as much variation in the data as possible.

3.2.6 Missing values

After recoding the variables necessary and determining which values count as missing, the missing values were filtered from the data. The output from the original variables with missing values, including a descriptives table, can be found in Appendix III. After filtering the

missing values for all the variables, the total sample size decreased by 15.3 percent from 359 to 304. This means that 304 people answered all the questions necessary to make the models. The descriptives after filtering the missing values can be found in Appendix IV.

3.3 Analysis plan

There are multiple steps in analyzing the data and formulating an answer to the research question. The conceptual model for this research can be seen in Figure 1. The data will be analyzed in a regression analysis, using SPSS. First, there will be a univariate and a bivariate analysis. This will allow for the assessment of variable distributions and examining the correlation between the different variables.

Next, the model of mental health of seafarers is estimated in several steps. In the first model, only the control variables are added, so the effects in the models after this are always controlled for these variables. Then, in model 2, the centered variable of time on board is added and this model will be used to test the first hypotheses, which states that a longer time on board decreases mental health. Model 3 will also contain the partner and children to resemble the family ashore and the centered variable of social relations. No hypotheses are tested with this model, but it makes it possible to see the individual effects of the variables on the mental health. In model 4, the interactions of the moderators with time on board will be added. Meaning there will be three interactions in this model: time on board with partner, time on board with children and time on board with social relations. This model will be used to test the second and third hypotheses of this thesis, regarding the moderating effects of family ashore and social relationships. By adding the moderators at the same time, the effects will be controlled for each other, showing the unique effect of each moderator.

After interpreting the models and testing the hypotheses, the model assumptions are checked, multicollinearity is examined, and influential points and outliers are identified.

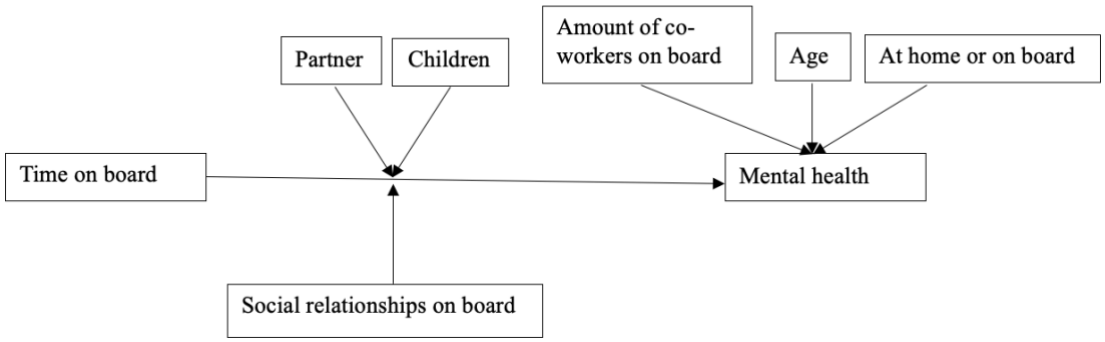

Figure 1: Conceptual model

Results

This chapter contains the results of this research. First, the descriptive statistics of the variables in the model is discussed, followed by a bivariate analyses. After this, the results of the multivariate analyses are described. Lastly, the quality of the models is inspected. The syntax can be found in Appendix VII.

4.1 Descriptive statistics

The descriptive statistics show the means, standard deviations, minimum, maximum of the different variables in the model. Table 1 shows these descriptive statistics, see Appendix IV for more details. Filtering the missing values does not seem to have a strong impact on any of the descriptive statistics and will therefore not be discussed any further (Appendix III).

Table 1: Descriptive statistics[1]

Variable	Mean	Standard Deviation	Minimum	Maximum
Mental health	17.53	3.94	6	24
Time on board	8.00	5.24	1	34
Partner* (0=single; 1=relationship)	21.4% single 78.6% relationship	-	0	1
Children*(0=no children; 1= children)	43.1% no children 56.9% has children	-	0	1
Social relations	22.41	4.75	2	30
Age	41.25	13.26	20	67
Location* (0=on board; 1=at home)	54.3% on board 45.7% at home	-	0	1
Number of co-workers**	13.30	6.59	1	27

[1] *N = 304. *Dummy variables are shown in percentages instead of a mean, and do not have a standard deviation. ** See 3.2.5 for the categorisation of this variable.*

An important finding that Table 1 shows is that the general mental health of seafarers seems to be good, since a mean of 17.53 on a scale that measures from 0 to 24 is quite high. This is also backed up by the fact that no seafarer scored the lowest possible scores of 0-5, while there were seafarers who scored the maximum score of 24. The results also show the number of weeks seafarers are on board. This is an average of 8 weeks, with a standard deviation of 5. We also see that the range is large: seafarers on Dutch-flagged vessels are at sea for a

minimum of 1 week, and a maximum of 34. Table 1 also tells us that 21.4 percent of the respondents is single, while the other 78.6 percent are in a relationship, 43.1 percent is childless, while 56.9 percent has one or more children. The seafarers in general also have good social relations, with a mean of 22.41 on a scale from 0 to 30.

The control variables do not show any special results. The ages are 19 to 67, with an average of 41, and the division in participating while on board or at home is almost equal. Due to the categorization of the number of co-workers, the mean and standard deviation do must be interpreted with care. The mean of 13.3 coworkers shows that most of the seafarers have a relatively small crew. The number of seafarers with 21 or more co-workers, which are coded within the values of 21-27, seems to be relatively small since the mean stays within the first 20 values. As stated before, the number of co-workers on board varies from 1 up to 1200, with 50 percent of the seafarers having 12 co-workers or less on board (Appendix II). Most of the seafarers (75 percent) have 19 coworkers or less.

4.2 Bivariate analysis

Table 2 shows the correlations between the different variables. A score between -1 and 0 means that there is a negative relationship between the two variables, and between 0 and +1 shows a positive relationship. The further the score is from 0, whether negative or positive, the stronger the relationship between the variables.

Table 2: Correlation between the variables[1]

Variable	Mental health	Time on board	Partner	Children	Social relations	Age	Location	Co-workers
Mental health	-							
Time on board	-0.15*	-						
Partner	0.08	-0.18**	-					
Children	0.01	-0.04	0.39**	-				
Social relations	0.60**	-0.22**	0.06	-0.08	-			
Age	0.03	0.02	0.21**	0.52**	-0.09	-		
Location	0.05	-0.02	0.01	-0.07	0.01	0.09	-	
Co-workers	-0.01	0.07	0.05	-0.05	0.06	-0.04	0.00	-

[1]*N = 304 for al variables *The correlation is significant at a=0.05 (two-tailed test); **Correlation is significant at a=0.01 (two-tailed test).*

The analyses show a small but significant correlation between the number of weeks seafarers consecutively spend on board and the mental health of the seafarers (r = -0.15 ; $p < 0.05$). This indicates that longer on-board stays are associated with lower mental health among seafarers. This also works the other way around: shorter on-board are associated with a better mental health.

Looking at the family ashore, the findings indicate that seafarers who are in a relationship are more often associated with shorter on-board stays compared to those who are single (r =-0.18 ; $p < 0.01$), but it is not associated with a higher or lower mental health (r = 0.08 ; $p > 0.05$). Also, seafarers who are in a relationship are more often linked to having children than seafarers who are not in a relationship (r = 0.39 ; $p < 0.01$). However, having children does not seem to be connected to the mental health of seafarers (r = 0.01 ; $p > 0.05$) or the on-board stay (r = -0.04 ; $p > 0.05$).

The degree of social relationships on board shows a strong positive correlation with the mental health of seafarers (r = 0.60 ; $p < 0.01$). This indicates that seafarers who have better social relationships on board are often associated with a higher mental health. Interestingly, the social relations and the on-board stay have a negative relationship (r = 0.22 ; $p < 0.01$), which indicates that seafarers who have shorter on-board stays tend to report better social relations on board.

The control variables do not show any significant effects, except age, which is associated with having a partner (r = 0.21 ; $p < 0.01$) and children (r = 0.52 ; $p < 0.01$), indication that older seafarers are more often associated with having partners and children than younger seafarers.

4.3 Multivariate analyses

To see the effects of the variables on the mental health of seafarers, four different models are estimated. These are shown in Table 3. The full output from SPSS can be found in Appendix V of this document. Table 3 is used to test the different hypotheses of this research and to determine the effects on mental health. The time on board and social relations were centered in order to make the interactions. This was not necessary for partner and children, since these are dummy variables.

Table 3: Models for estimating the mental health of seafarers[1]

	Model 1		Model 2		Model 3		Model 4		VIF*	Model 5**	
	B (SE)	*p*	*B (SE)*	*p*	*B (SE)*	*p*	*B (SE)*	*p*		*B (SE)*	*p*
Constant	17.04 (0.90)	<0.001	16.91 (0.89)	<0.001	16.55 (0.76)	<0.001	16.51 (0.77)	<0.001		17.05 (0.75)	<0.001
Age	0.01 (0.02)	0.61	0.01 (0.02)	0.55	0.02 (0.02)	0.15	0.02 (0.02)	0.20	1.43	0.02 (0.02)	0.32
Location	0.34 (0.46)	0.46	0.31 (0.45)	0.50	0.24 (0.37)	0.51	0.23 (0.37)	0.54	1.04	0.02 (0.35)	0.95
Amount of co-workers	-0.00 (0.03)	0.95	0.00 (0.03)	0.90	-0.02 (0.03)	0.38	-0.02 (0.03)	0.40	1.03	-0.04 (0.03)	0.17
Time on board			-0.11 (0.04)	0.01	-0.00 (0.04)	0.91	0.05 (0.07)	0.50	4.55	0.06 (0.07)	0.43
Partner					0.25 (0.49)	0.61	0.29 (0.50)	0.56	1.29	0.33 (0.48)	0.50
Children					0.01 (0.46)	0.97	0.03 (0.46)	0.95	1.61	-0.07 (0.44)	0.87
Social relations					0.50 (0.04)	<0.001	0.51 (0.04)	<0.001	1.10	0.55 (0.04)	<0.001
Time on board * Partner							-0.05 (0.10)	0.60	6.06	0.02 (0.10)	0.98
Time on board * Children							-0.04 (0.09)	0.61	3.20	-0.08 (0.08)	0.33
Time on board * Social relations							-0.01 (0.01)	0.05	1.12	-0.02 (0.01)	0.02
R^2	0.00		0.03		0.38		0.39			0.43	
R^2 Change	0.00		0.02		0.35		0.01				
R^2 *adjusted*	-0.01		0.01		0.36		0.36			0.41	
F Change	0.30	0.83	6.62	0.01	55.55	<0.001	1.47	0.22			

[1]*N = 304 *VIF is noted for model 4. **After filtering influential cases and outliers, N=300 (see 4.4.3)*

4.3.1 Model fit

The model fit for the regression analyses can be assessed by looking at the R^2, as shown in Table 3. The R^2 is the amount of explained variance in mental health scores. It shows how well the model can explain the mental health of seafarers with the variables used in that model. Model 4, the final model containing all the variables and interactions, has an R^2 of 0.39. This means that the variables in the model are able to explain 39 percent of the variance in scores on mental health.

Looking at the other models, it can be concluded that age, location of participation and the amount of co-workers on board do not explain any variance since the R^2 of model 1 is 0, implying that they do not have an effect on mental health scores. Model 2 however, in which

the time on board is added to the model, shows an R^2 of 0.03, which is a significant increase in explained variance ($F(1,299) = 6.62$; $p < 0.05$). The model can explain 3 percent of the variance in mental health, compared to 0 percent in model 1. This indicates that adding the time spend on board significantly improves the model and is able to better explain mental health scores compared to model 1.

The third model, where partner, children and social relations were added, show a large and significant increase in the explained variance ($F(3,296) = 55.55$; $p = <0.001$). The R^2 is 0.38, showing that 38 percent of the variance in mental health scores can be explained by the model. This is a large increase and shows that at least one of the added variables is a good predictor for mental health scores. Adding the interactions of these variables with time on board in the fourth model does not seem to increase the explained variance in mental health scores ($F(3,293) = 1.47$; $p = 0.22$).

The adjusted R^2 is a more accurate way to assess the fit of a model. Unlike the regular R^2, the adjusted R^2 takes the number of variables in the model into account. This means that the R^2 value can decrease, which is not possible with the regular R^2, making it possible to see if a model is actually performing worse. The adjusted R^2 values in Table 3 do not show very different results than the regular R^2. The only interesting finding is that the control variables, which are added in model one, do show a negative R^2, indicating that these seem to worsen the prediction of mental health scores compared to the "model 0", in which the average of mental health is used to predict the mental health scores.

4.3.2 Estimated coefficients

The coefficients of the different models show some interesting results. In model 2, the negative slope of the time on board is significant ($b = -0.11$; $p < 0.05$). This indicates that for every additional week on board, the mental health score decreases with 0.11, controlled for all other variables in the model. This seems to support the first hypothesis of the research, which assumed that longer on-board stays decrease mental health.

The interactions in model 4 between the time on board and the variables partner ($b = -0.05$; $p = 0.60$) and children ($b = -0.04$; $p = 0.61$) are not significant, controlled for all other variables. The slopes show that having a child or partner at home negatively effects the effect of time on board on mental health, but this effect is very small. Since both having a partner and having children are not significant, there is no evidence for the second hypothesis. This

suggests that neither having a partner nor having children moderates the relationship between time on board and mental health.

While not significant at a=0.05, it should be noted that the interaction between time on board and the social relationships in model 4 is almost significant, showing a negative relationship (b = -0.01 ; p = 0.05). This does give an indication that there might be a moderating effect of social relations on the relationship between time on board and mental health. The negative slope indicates that if social relationships are higher, the effect of time on board on mental health will become worse, though this effect is only marginal.

However, after filtering the outliers and influential points in model 5 (see paragraph 4.4.3), the negative interaction between time on board and social relations becomes significant (b = -0.02 ; p < 0.05). Rather than having a buffering effect, better social relationships seem to worsen the effect of time on board on mental health, which is the opposite of the third hypothesis. This means that people with better social relationships on board experience a more negative effect of the length of their on-board stay on their mental health. However, while significant, the slope of the interaction is very small (b = -0.02 ; p < 0.05). While there is evidence for a moderating effect of social relations on board in a negative way, this is only marginal compared to the positive direct effect that social relations have on mental health of seafarers (b = 0.55; p < 0.001). The rest of the conclusions do not change in model 5.

Furthermore, the slope of social relations in both model 3 and 4 is significant, controlled for all other variables in the models (b = 0.50 ; p <0.001) (b = 0.51 ; p <0.001). This shows that the social relations on board have a strong positive effect on the mental health of seafarers. If seafarers experience better social relations on board, their mental health will increase. This is also backed by the answers to the open-ended question at the end of the survey: many of the seafarers that answered this question related to the importance of social relations on board. This shows that they find this an important topic, which they want to stress more after the survey. One of the participants states: "*During my [sic] time at sea I experienced how important it is to get along with the crew. When the atmosphere [sic] on board is negative [sic], in can easily affect you in a negative [sic] way. It is hard to escape because you spend both your working hours as well as free hours together. When you have a crew where you fit in well and the atmosphere is good, to affects your mental health in a positive [sic] way. For me, this is what I don't like about working at sea. I often shift between ships, so I sail with many different people. You really have to be lucky with the colleagues [sic] you get.*"

Besides general notes that social relations are important for their mental health or happiness on board, they also often related to either the difficulties of a multinational crew or the increased use of internet by crewmembers, which seems to decrease social bonding on board. Regarding the nationalities on board, one of the participants states: "*I think in a lot of cases the nationality of the crew on board is of influence for how we feel on board, social interaction is always easier [sic] with people who speak our language*". Regarding the increased use of internet, one of the participants states: "*The impact of good internet on board is very double faced: it makes contact with home and the world much easier thus making most seafarers happier [sic] but also, as in "real" society, lowers the level of social bonding and coherence amongst the crew on board.*". These statements seem to emphasize the important of social relations, which seems to be in line with the results of this study.

4.4 Model inspections

To ensure that this is a good model to estimate the mental health of seafarers and that the results are reliable, multiple model inspections were done. First the assumptions of linear regression were checked. This is followed by checking for possible multicollinearity between the variables. Outliers and influential points are also identified.

4.4.1 Assumptions of linear regression

Linear regression has four assumptions: independent observations, linearity, homoscedasticity and normality. For the first assumption of independent observations, it is important that there was a random sample of participants. As stated in the methods section of this research, the survey was shared on multiple platforms to ensure that as many seafarers on Dutch-flagged ships as possible were reached. The data shows that both people on board as people at home participated. However, the survey was spread using networks, which might hinder part of the population to participate. While the intention was to reach as many, it is always possible that not everyone in the population had the same chance to participate. This must be taken into consideration while making conclusions about the results.

The second assumption looks at the linearity of the model, to determine if the relationships are correctly specified. This is the case when the average of the residuals of every set of x-values is 0. This assumption can be checked with a residual plot with a loess line, which can be found in Appendix VI. The loess line, which shows the average of the

residuals for all sets of x-values, runs close to the zero line throughout, which indicates that this assumption is also met.

The homoscedasticity is also checked with the residual plot (Appendix VI). For this assumption it is important that the standard deviation of the residuals is constant for all sets of x-values. This means that there are no clear patterns in the data and that the data points are scattered equally around the zero line. The residual plot shows that there are no clear patterns, and that the data is scattered equal around the zero line, therefor this assumption is also met.

The last assumption is normality, which means that the residuals of mental health have a normal distribution. This assumption is checked by looking at the histogram and pp-plot of the residuals of mental health (Appendix VI). The histogram shows a small deviation between 0 and 1, and between 3 and 4, but these are minor and do not seem problematic. The pp-plot also shows some deviation from the line, but this is also only minor and not problematic.

The data shows that there are no violated assumptions in this model. This means that the results are quite reliable, and that linear regression was a good way to estimate the mental health.

4.4.2 Multicollinearity

To further investigate the trustworthiness of the model, possible multicollinearity will be checked by VIF-scores (Appendix VI). These scores indicate if there is a high correlation between two or more of the independent variable in the model. VIF-scores generally require attention when they are above 4. The VIF-scores for model 4 can be found in Table 3. It shows two values that are interesting. Time on board had a VIF of 4.55, which, while not problematic, can indicate that the results could be less robust. The VIF score suggests a moderate level of multicollinearity, indicating that the relationship between time on board and mental health might be influenced by social relations, since time on board and social relations have a relatively strong correlation (Table 2). Another interesting VIF-score comes up for the interaction between time on board and having a partner. However, since this is an interaction, a higher VIF-score is not surprising since interactions usually have higher VIF-scores.

4.4.3 Outliers and influential points

Now that the assumptions and the multicollinearity are checked, the possible outliers and influential points are identified. These will be identified by looking at the residuals, leverage, DFFIT and the Cook's Distance (Appendix VI). Possible outliers and influential points might

heavily influence the results of the regression and are therefore important to identify. To achieve this an extra column with case numbers was added to the dataset, containing case numbers. Making it possible to identify specific cases (see syntax in Appendix VII).

The outliers can be identified using the residual plot that was also used for the assumptions of linearity and homoscedasticity. Outliers are cases that have a residual lower than -3 or higher than 3. There seem to be two outliers in the data: case number 267 and 268, these are also added in Table 4 below.

Table 4 shows the most important cases that have high scores on the leverage, DFFIT and Cook's Distance. The maximum leverage is calculated by the following formula: (3*p)/n. In this case there are 11 parameters (including the constant) with an n of 304. This makes the average leverage value (3*11)/304 = 0.109. In total, six cases exceed this leverage value, which means that these values have a large influence on (some of) the estimated model parameters, pulling their value in the direction of the respondent.

The Cook's Distance determines which cases have an effect on the outcome of all other estimated values of the model. The maximum for the Cook's Distance is calculated with the following formula: 4/n, which in this case is 4/304 = 0.013. In total there were 18 cases which exceeded this value, of which the six highest are shown in Table 4.

The DFFIT shows the effect of a case on the model fit if you exclude this one case. These can both be negative or positive. There is no rule for the DFFIT, but no values except one exceed -1 and 1. This is case 301.

Table 4: Diagnostics outliers and influential points

	Residuals	Leverage > 0.109	Cook's Distance >0.013	DFFIT
Case number (value)	268 (3.597)	301 (0.370)	301 (0.103)	301 (-2.037)
Case number (value)	267 (3.416)	184 (0.384)	268 (0.046)	-
Case number (value)	-	161 (0.208)	278 (0.043)	-
Case number (value)	-	278 (0.197)	267 (0.042)	-
Case number (value)	-	287 (0.134)	282 (0.039)	-
Case number (value)	-	288 (0.117)	291 (0.028)	-

There are a few cases that are considered influential based on all (or multiple of) the indices. These are the cases 267, 268. 278 and 301. To check the influence of these cases on the model, they are filtered out of the data (Appendix VI). The coefficients of the model after

filtering can be found in Table 3 as 'model 5'. Model 5 shows a 4 percent increase in explained variance in mental health from 39 percent to 43 percent. This means that the model seems to estimate mental health scores better than model 4, and that the respondents that are seen as influential did have a strong effect on the amount of explained variance.

Another change that is worth mentioning is the significance of the interaction between time on board and social relations. The interaction was almost significant in model 4 (b = -0.01 ; p = 0.05) and is significant in model 5 (b = -0.02 ; $p < 0.05$). This seems to confirm an interactive effect between social relations and time on board, however, it seems to be negative instead of positive. That means that better social relations worsen the effect of time on board on mental health. The p-values of other variables also changed in model 5, only they did not make a difference in significance and are therefore not relevant to mention.

Beside the two notable changes before, the changes seem to be minor. The outliers and influential cases seem to have had an effect on the reliability of the model, but it is not problematic.

Conclusion and discussion

The aim of this study was to investigate if there is a relationship between the length of an on-board stay of seafarers on Dutch-Flagged ships and their mental health. Additionally, the influence of having a family ashore and social relations on board on this relationship was also examined. The main question was: "*What is the effect of number of consecutive weeks spent onboard on the mental health of seafarers, and how do having a family ashore and social relations onboard influence this effect?".* To answer this question, a survey was conducted among seafarers on Dutch-flagged ships, followed by a regression analysis to investigate the relationships between the variables. This contributes to the gap in the literature regarding the relationship between the length of the on-board stay and the mental health of seafarers.

This study shows that if the on-board stay of a seafarer is longer, the mental health scores of a seafarer will be lower. This is in line with the results of the Seafarers Happiness Index (SHI), which indicated that a longer on board has a negative effect on mental health (Mission for Seafarers, 2024). This was also seen in literature on FIFO-workers, where workers with shorter rosters reported higher mental health scores (Fruhen et al., 2022). The relationship can be explained based on the mechanisms of loneliness and social isolation, which are important indicators for mental health in general (Evans & Fisher, 2021) (Smith & Victor, 2019) (Beutel, et al., 2017). Research points out that seafarers experience loneliness and social isolation on board, decreasing their mental health. A longer on board stay also means that seafarers experience these feelings of loneliness and social isolation for a longer period of time, which makes this a possible explanation for the relationship found in this study (Sampson & Ellis, 2019).

Having a family ashore, consisting of having a partner or children, does not seem to influence the relationship between time on board and the mental health of seafarers. These factors also do not seem to have a direct effect on the mental health of a seafarer. A possible explanation for this might be that seafarers and their families are used to this way of life. One of the participants states the following: " *The question about the combination of work and family will not give you a correct answer. A sailor and his family are flexible and adjust [sic] their schedule and the activities to the schedule of the seafarer. If you think that work and social life at home conflict than being a seafarer will chew you out and it would be best to find a shore-based [sic] job*.".

Interestingly, the quality of social relations on board did seem to influence the relationship between time on board and mental health, but instead of a positive moderating

effect which buffers negative effects of the time spend on board, it seems to worsen this relationship. This is an interesting finding since the expectation, based on existing literature and the Social Capital theory and Social Support theory, was that social relationships would buffer a negative relation between time on board and mental health.

However, this negative effect is marginal in comparison to the strong positive direct effect of social relations on mental health. The quality of the social relationships on board has a strong direct positive effect on the mental health of seafarers, showing higher mental health scores when social relations are better. This is in line with earlier research from Sampson & Ellis (2021), which shows similar results. The results of the survey corroborate this notion, since many respondents commented on the importance of social relations on board in the open-ended question at the end of the survey. This is also backed by the Social Support theory (Cohen & Wills, 1985) and the Social Capital theory (Putnam, 2000), which both emphasize the importance of social relations in improving mental health. The strong effect of social relations on the mental health of seafarers is an important finding, showing that improving social relations can help to improve mental health on board.

It's important to note the limitations of this study as well. One of the limitations was the reduction of the sample size due to the excluding cases with missing data. The total sample size of 359 dropped with 15.3 percent to 304 after filtering out the missing responses, meaning that all participants that did not respond to the questions used for this analyses were eliminated from the data. However, this is still above the minimum of 150, which means that the statistical power of the study was preserved, ensuring that the results are still reliable.

A further limitation is the overrepresentation of Dutch participants. While approximately 21.9 percent of the seafarers on Dutch-flagged vessels is Dutch, they comprised 88.9 percent of the sample. This can be the result of the snowball and network sampling used to recruit participants. It is possible that this way of data collection did not reach the non-Dutch seafarers well enough, or it could indicate that they are less willing to participate. The first option is the most likely, since the networks that were used to spread the survey mostly consisted of Dutch seafarers. While it seems that the results can be generalized to the Dutch seafarers on Dutch-flagged vessels, this limits the extent to which the result of the study can be generalized to the more diverse population of seafarers on Dutch-flagged vessels in general. Future studies could therefore aim for a more representative sample, for example, by reaching out more directly to non-Dutch seafarers.

Another limitation was that the variable used for time on board was not normally distributed, but right skewed with a mean of 8 and a maximum of 34. This suggests that most of the seafarers in the sample had relatively shorter on-board stays, with fewer participants experiencing longer periods at sea. This could limit the generalizability of the findings to the seafarers who have longer on-board stays.

Lastly, it is important to note that there was a small positive correlation between time on board and the moderator social relations. This indicates that a longer on-board stay of a seafarer is associated higher ratings of social relations on board. This might be the cause of the high VIF-score of time on board, influencing the reliability of the results. It also makes it harder to conclude whether the impact on mental health is caused by the time on board or the social relations on board. This makes it harder to make conclusions about the independent effects of these variables.

This study contributes to the sparse research to the mental health of seafarers, among seafarers on Dutch-flagged vessels in particular. It suggests that time on board plays a negative role in the mental health of seafarers. This shows that if the on-board stay is longer, the mental health of seafarers decreases. Interestingly, the results showed that better social relations on board seem to worsen the relationship between time on board and mental health, but that this influence is marginal. Another interesting finding is that, while this was not the main topic of this study, social relationships have a strong positive direct impact on the mental health of seafarers. Better social relations on board result in a higher mental health. This underscores the need for and importance of enhancing social relationships among the crew members as a way to improve the mental health on board.

Given the strong direct impact that social relations seem to have on the mental health of seafarers, further research to social relationships on board is strongly recommended. It is important to further explore factors that can positively influence the social relations on board in order to increase mental health on board. In this research, social relations are defined as feelings of trust, getting help if needed and the opportunities to spend time with crewmembers in activities such as watching a movie or drinking a coffee together. It can be assumed that these are important for crewmembers, but the individual effects of the statements were not tested. Further research is therefore needed to identify which are the most important factors, in order to determine strategies to improve social relations on board, which in turn enhances mental health on board.

In conclusion, this study serves as an important step towards understanding the factors that influence seafarers' mental health. It highlights the importance of social relationships on board and provides a basis for future research and interventions aimed at improving the mental health of those who work at sea.

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Appendices

Appendix I: Questionnaire

To ensure that you are a part of our research population, we would like to ask you to confirm if you work on a Dutch-flagged ship.

- Is the ship that you work on registered as Dutch-flagged? 0) no, 1) yes

Now, we would like to ask you a few general questions about your demographical and work-characteristics.

Demographics:

- Gender: 0) male, 1) female
- Age: (years)
- Nationality: (open)
- EU or non-EU resident: 0) EU, 1) Non-EU
- What is the highest level of education or training you have successfully completed? (open)
- Location while filling in this questionnaire: 0) On board, 1) At home

Work-characteristics

- How many years of experience do you have working at sea: (years)
- How many co-workers are approximately on board during your current (or most recent) stay on board: (number)
- What kind of employment contract do you have? 1) Contract of unlimited duration, 2) Contract of limited duration, 3) Temporary employment agency contract, 4) Apprenticeship or other training scheme, 4) Self-employed, 5) Other, 6) Don't know
- How much work pressure did you experience on board in the last six months, with one being very low and 10 being very high: (scale from 1-10).
- How many hours are you expected to work in a usual week on board according to your contract? (number)
- During a stay on-board, how often do you have to work over-time? 0) Never, 1) once a month or less, 2) Several times a month, 3) Several times a week, 4) Daily

The next two questions will ask you about your roster. Please state how many consecutive weeks you (normally) are at sea and at home in a full number (so "6" for example, if you are at sea for six weeks at a time). If this is flexible, please give an average of the last year.

- On board stay according to contract, in weeks: (number of weeks)
- Home stay according to contract, in weeks: (number of weeks).

The following questions will be about how you feel while on board. It is important that you answer the questions based on how you feel while you are on board, so please think how you've been feeling the time you were on board in the last six months. So, if you're answering the questionnaire at home, think about how you feel while at sea.

- I felt dissatisfied with life on board
- I felt happy on board
- I felt cheerless on board
- I felt pleased with the way I am on board
- I felt that life on board was enjoyable
- I felt that life on board was meaningless
- I felt connected to others on board
- I felt lonely on board

As mentioned before, this research also investigates the effects of having a family or not. Therefore, the following questions will ask you about your current household situation.

- Marital status: 1) single, 2) relationship, not living together 3) relationship, living together
- Number of children: (open)
- Age of the child(ren): (open)
- Do your children still live in your household? 1) no, 2) partly, 3) yes.
- How often (on average) do you have contact with your family at home? 0) every day, 1) few times a week, 2) once a week, 3) once every two weeks, 4) few times a month, 5) once a month, 6) less than once a month
- How would you rate the quality of the relationship with your family in general? (Scale from 1 to 10).
- In general, how does your work fit in with your family or social commitments outside work? 1) Not at all well, 2) not very well, 3) neutral, 4) well, 5) very well

The following statements all say something about the social relationships that you experience on board. Please indicate on the scale to what degree you agree or disagree with the following statements. While answering these statements, think about the crew on the vessel you are currently working on. If you rotate often or just changed vessels, then think about your experiences from the past 6 months. A score of 1 means that you strongly disagree, a score of 7 means that you strongly agree.

- When I need help from other crew members, I get it.
- I can rely on other crew members when things get stressful.
- There is at least one person on board with whom I can talk about private things or problems at home.
- I experience trust and respect among the crew.
- I have enough opportunities on board to spent time together with the crew (watching a movie/tv, playing a game, having a cup of coffee, etc.).

Closing question:

- Is there anything you would like to share about the subjects that you answered questions about?

Appendix II: Data before recoding, Cronbach's Alpha

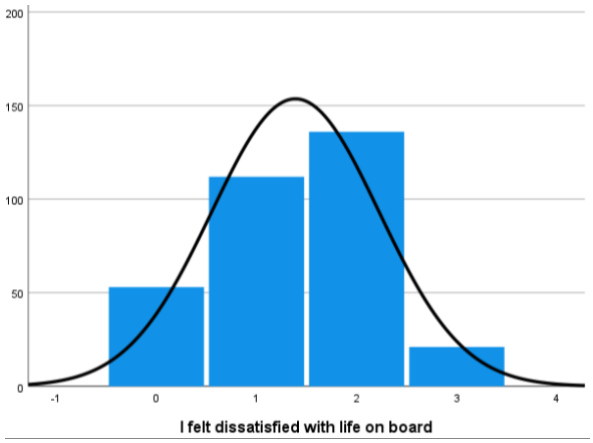
This Appendix shows the data of variables that will be recoded: mental health, partner, children, social relations and co-workers on board. The Cronbach's Alpha is shown if relevant. The descriptives of the new and all other variables can be found in Appendix III.

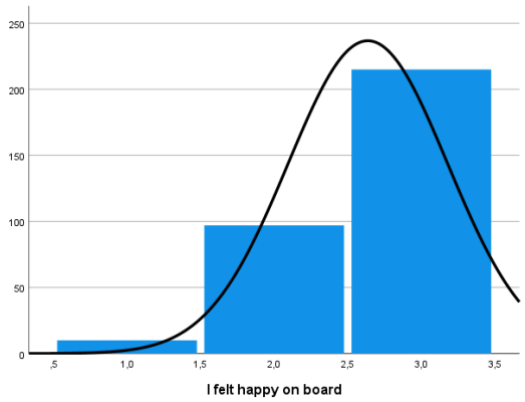
Mental Health:

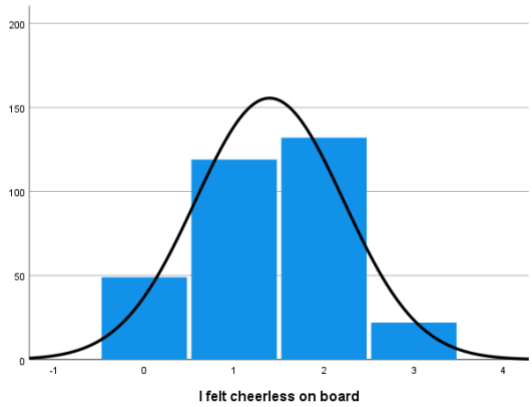
Original statements: The descriptives and histograms of the original statements.

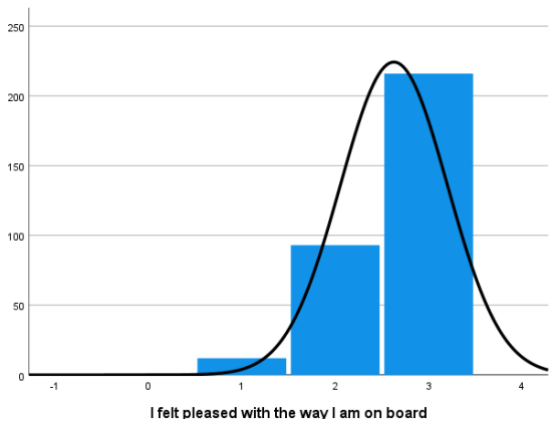
Descriptive Statistics

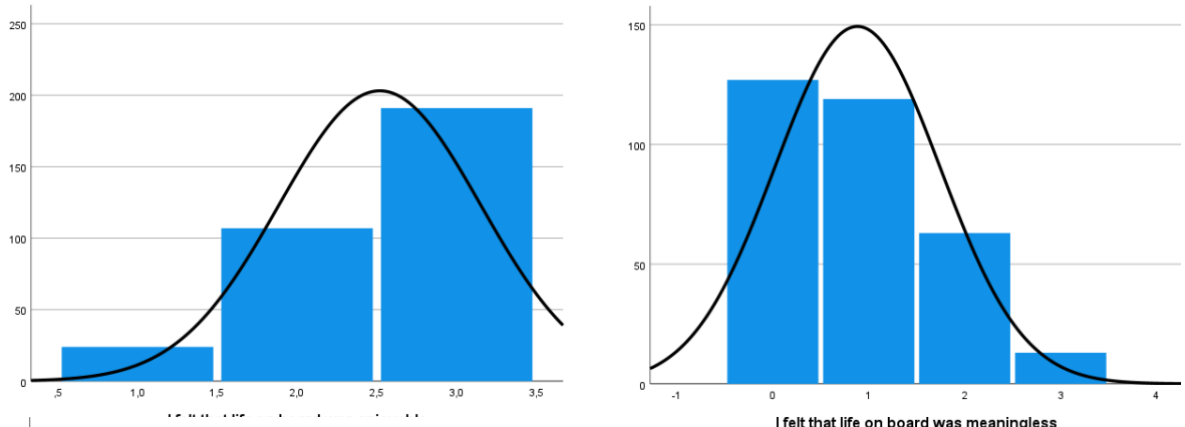
	N	Minimum	Maximum	Mean	Std. Deviation
I felt dissatisfied with life on board	322	0	3	1,39	,836
I felt happy on board	322	1	3	2,64	,543
I felt cheerless on board	322	0	3	1,39	,826
I felt pleased with the way I am on board	322	0	3	2,63	,573
I felt that life on board was enjoyable	322	1	3	2,52	,632
I felt that life on board was meaningless	322	0	3	,88	,860
I felt connected to others on board	322	0	3	2,53	,651
I felt lonely on board	322	0	3	1,17	,895
Valid N (listwise)	322				



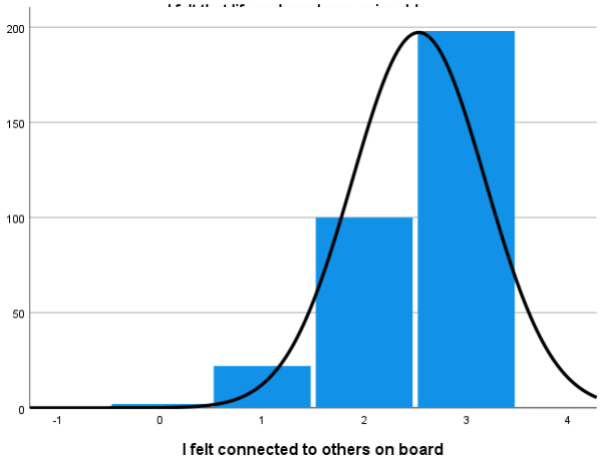








I felt that life on board was meaningless

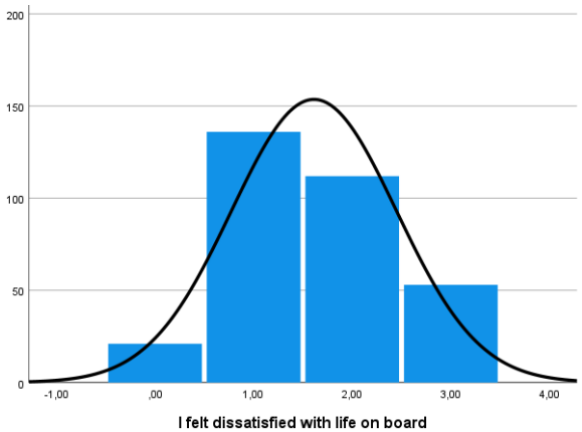


I felt connected to others on board

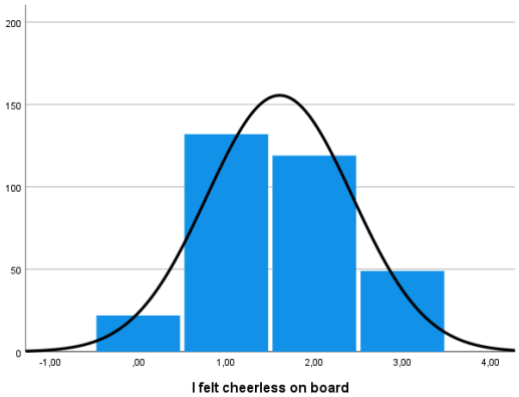
New recoded statements: The statements that were negative were recoded. Before recoding: a higher score meant a worse mental health. This was switched so all the statements will be interpreted the same: a higher score is a higher mental health.

Descriptive Statistics

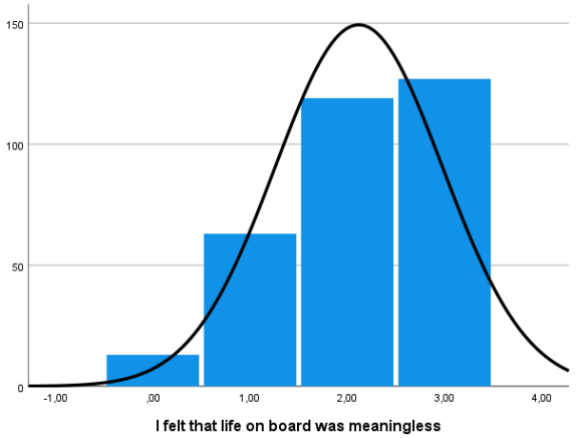
	N	Minimum	Maximum	Mean	Std. Deviation
I felt dissatisfied with life on board	322	,00	3,00	1,6118	,83624
I felt cheerless on board	322	,00	3,00	1,6056	,82581
I felt that life on board was meaningless	322	,00	3,00	2,1180	,86019
I felt lonely on board	322	,00	3,00	1,8323	,89468
Valid N (listwise)	322				

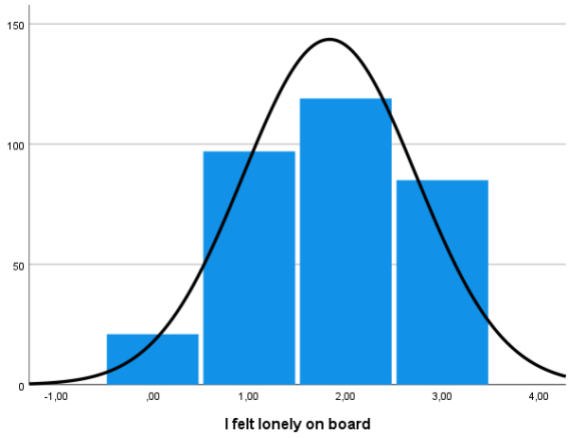


I felt dissatisfied with life on board



I felt cheerless on board





Cronbach's Alpha: The Cronbach's Alpha indicates the internal consistency of the different statements that are used to measure mental health. A score of 0,7 is seen as minimum in order to use statements to measure one concept. In this case, the score is 0,823. This is well above the minimum and shows that these statements can recoded into one variable, mental health. Looking at the item-total statistics, leaving out any of the statements will only slightly decrease the Cronbach's Alpha, therefor we will use all the statements.

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	322	89,7
	Excluded[a]	37	10,3
	Total	359	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,823	,835	8

Item Statistics

	Mean	Std. Deviation	N
I felt happy on board	2,6366	,54254	322
I felt pleased with the way I am on board	2,6273	,57269	322
I felt that life on board was enjoyable	2,5186	,63243	322
I felt connected to others on board	2,5342	,65120	322
I felt dissatisfied with life on board	1,6118	,83624	322
I felt cheerless on board	1,6056	,82581	322
I felt that life on board was meaningless	2,1180	,86019	322
I felt lonely on board	1,8323	,89468	322

Inter-Item Correlation Matrix

	I felt happy on board	I felt pleased with the way I am on board	I felt that life on board was enjoyable	I felt connected to others on board	I felt dissatisfied with life on board	I felt cheerless on board	I felt that life on board was meaningless	I felt lonely on board
I felt happy on board	1,000	,616	,614	,419	,423	,263	,306	,298
I felt pleased with the way I am on board	,616	1,000	,630	,327	,432	,307	,343	,340
I felt that life on board was enjoyable	,614	,630	1,000	,399	,482	,363	,351	,385
I felt connected to others on board	,419	,327	,399	1,000	,290	,144	,215	,363
I felt dissatisfied with life on board	,423	,432	,482	,290	1,000	,504	,371	,446
I felt cheerless on board	,263	,307	,363	,144	,504	1,000	,430	,391
I felt that life on board was meaningless	,306	,343	,351	,215	,371	,430	1,000	,382
I felt lonely on board	,298	,340	,385	,363	,446	,391	,382	1,000

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
I felt happy on board	14,8478	13,008	,586	,497	,801
I felt pleased with the way I am on board	14,8571	12,796	,604	,497	,798
I felt that life on board was enjoyable	14,9658	12,282	,657	,533	,790
I felt connected to others on board	14,9503	13,169	,424	,259	,817
I felt dissatisfied with life on board	15,8727	11,376	,624	,416	,790
I felt cheerless on board	15,8789	11,970	,515	,349	,807
I felt that life on board was meaningless	15,3665	11,878	,502	,277	,810
I felt lonely on board	15,6522	11,467	,549	,327	,804

The output below shows the old frequencies of the partner status of a seafarer, before recoding this into a variable with only single and relationship as options.

Marital status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	70	19,5	21,7	21,7
	Relationship, not living together	25	7,0	7,8	29,5
	Relationship, living together	227	63,2	70,5	100,0
	Total	322	89,7	100,0	
Missing	System	37	10,3		
Total		359	100,0		

Children:
The output below shows the frequencies of the number of children that seafarers have. This will be recoded into a variable meaning 0 = no children and 1 = children.

Number of children

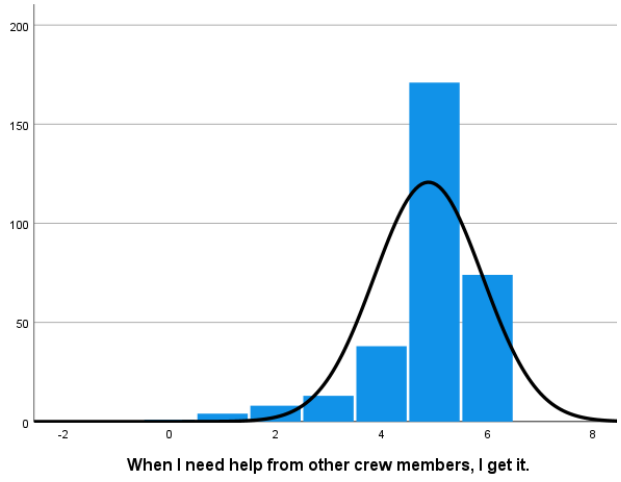
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	,00	138	38,4	43,1	43,1
	1,00	62	17,3	19,4	62,5
	2,00	69	19,2	21,6	84,1
	3,00	37	10,3	11,6	95,6
	4,00	8	2,2	2,5	98,1
	5,00	4	1,1	1,3	99,4
	6,00	2	,6	,6	100,0
	Total	320	89,1	100,0	
Missing	System	39	10,9		
Total		359	100,0		

Social relations:

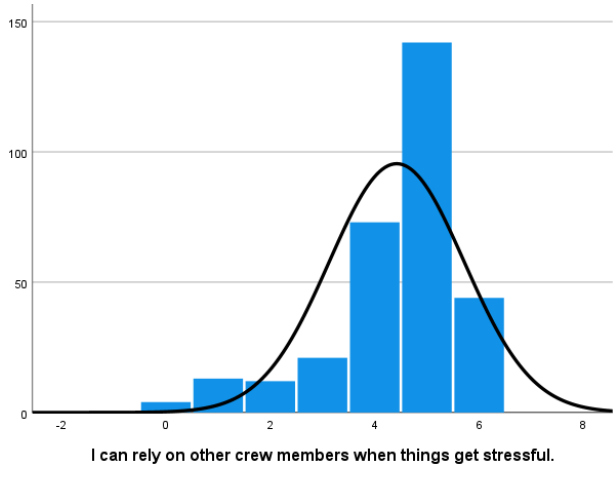
This shows the descriptives and histograms of the statements that were used to create the variable "social relations".

Descriptive Statistics

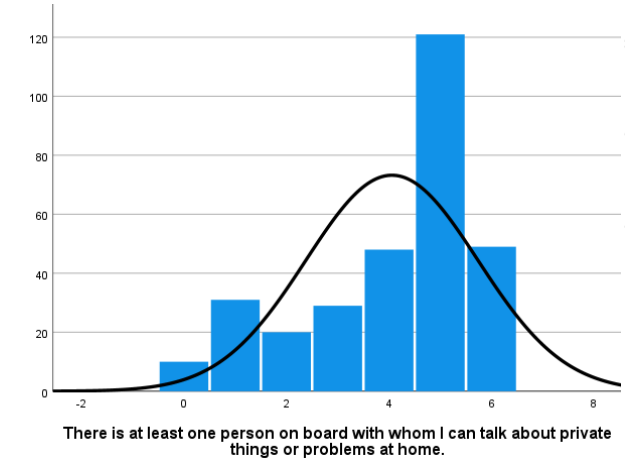
	N	Minimum	Maximum	Mean	Std. Deviation
When I need help from other crew members, I get it.	309	0	6	4,89	1,021
I can rely on other crew members when things get stressful.	309	0	6	4,42	1,291
There is at least one person on board with whom I can talk about private things or problems at home.	308	0	6	4,06	1,678
I experience trust and respect among the crew.	309	0	6	4,81	1,045
I have enough opportunities on board to spent time together with the crew (watching a movie/tv, playing a game, having a cup of coffee, etc.).	309	0	6	4,21	1,574
Valid N (listwise)	308				

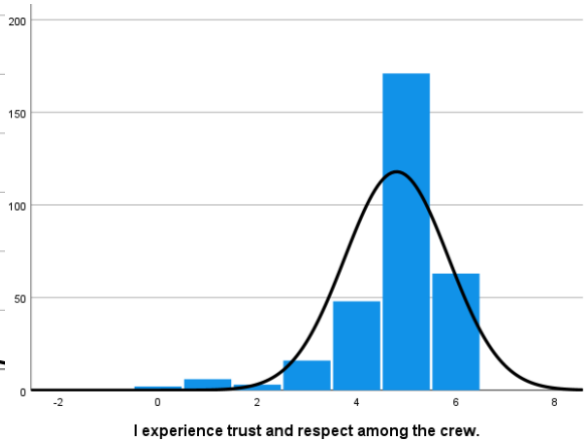


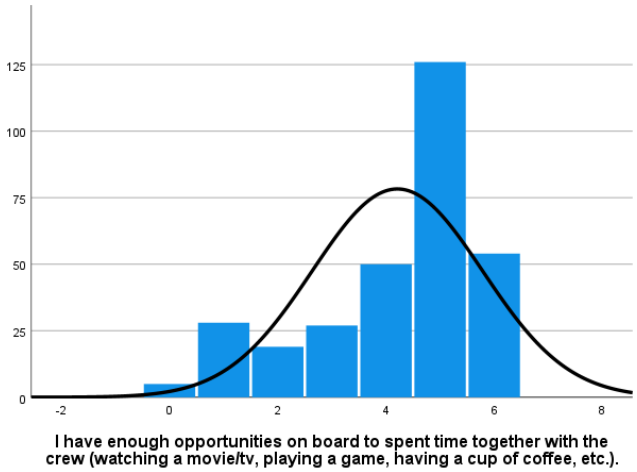
When I need help from other crew members, I get it.



I can rely on other crew members when things get stressful.







Cronbach's Alpha: As seen below, the Cronbach's Alpha for the different statements is 0,746. Just as with mental health, the Cronbach's Alpha will only decrease when leaving out any of the statements. This is why all statements will be used to create the variable that measures the social relationships of seafarers.

Inter-Item Correlation Matrix

	When I need help from other crew members, I get it.	I can rely on other crew members when things get stressful.	There is at least one person on board with whom I can talk about private things or problems at home.	I experience trust and respect among the crew.	I have enough opportunities on board to spent time together with the crew (watching a movie/tv, playing a game, having a cup of coffee, etc.).
When I need help from other crew members, I get it.	1,000	,492	,317	,423	,262
I can rely on other crew members when things get stressful.	,492	1,000	,363	,526	,341
There is at least one person on board with whom I can talk about private things or problems at home.	,317	,363	1,000	,394	,433
I experience trust and respect among the crew.	,423	,526	,394	1,000	,386
I have enough opportunities on board to spent time together with the crew (watching a movie/tv, playing a game, having a cup of coffee, etc.).	,262	,341	,433	,386	1,000

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	308	85,8
	Excluded[a]	51	14,2
	Total	359	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,746	,765	5

Item Statistics

	Mean	Std. Deviation	N
When I need help from other crew members, I get it.	4,89	1,023	308
I can rely on other crew members when things get stressful.	4,42	1,293	308
There is at least one person on board with whom I can talk about private things or problems at home.	4,06	1,678	308
I experience trust and respect among the crew.	4,81	1,042	308
I have enough opportunities on board to spent time together with the crew (watching a movie/tv, playing a game, having a cup of coffee, etc.).	4,21	1,575	308

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
When I need help from other crew members, I get it.	17,50	17,365	,485	,291	,715
I can rely on other crew members when things get stressful.	17,97	15,191	,564	,386	,681
There is at least one person on board with whom I can talk about private things or problems at home.	18,33	13,402	,515	,274	,708
I experience trust and respect among the crew.	17,58	16,499	,586	,368	,686
I have enough opportunities on board to spent time together with the crew (watching a movie/tv, playing a game, having a cup of coffee, etc.).	18,18	14,275	,486	,254	,715

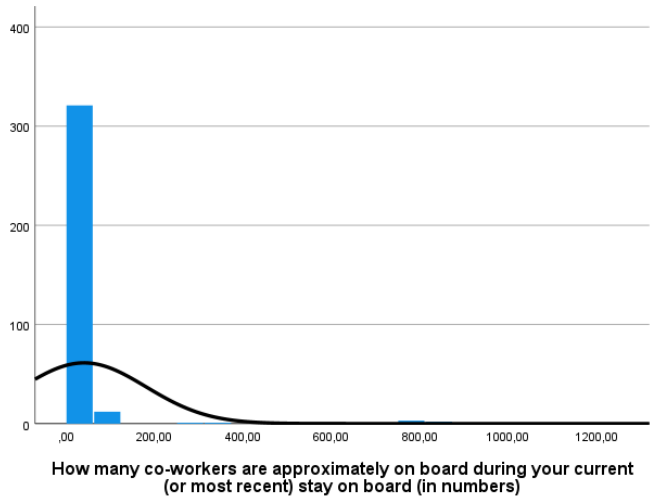
Co-workers: Original distribution

How many co-workers are approximately on board during your current (or most recent) stay on board

N	Valid	344
	Missing	15
Mean		41,3576
Median		12,5000
Std. Deviation		139,89547
Minimum		,00
Maximum		1200,00

How many co-workers are approximately on board during your current (or most recent) stay on board (in numbers)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	,00	1	,3	,3	,3
	1,00	3	,8	,9	1,2
	2,00	2	,6	,6	1,7
	3,00	3	,8	,9	2,6
	4,00	9	2,5	2,6	5,2
	5,00	16	4,5	4,7	9,9
	6,00	14	3,9	4,1	14,0
	7,00	23	6,4	6,7	20,6
	8,00	30	8,4	8,7	29,4
	9,00	19	5,3	5,5	34,9
	10,00	18	5,0	5,2	40,1
	11,00	15	4,2	4,4	44,5
	12,00	19	5,3	5,5	50,0
	13,00	23	6,4	6,7	56,7
	14,00	15	4,2	4,4	61,0
	15,00	15	4,2	4,4	65,4
	16,00	11	3,1	3,2	68,6
	17,00	10	2,8	2,9	71,5
	18,00	8	2,2	2,3	73,8
	19,00	5	1,4	1,5	75,3
	20,00	7	1,9	2,0	77,3
	21,00	1	,3	,3	77,6
	22,00	5	1,4	1,5	79,1
	23,00	1	,3	,3	79,4
	24,00	1	,3	,3	79,7
	25,00	6	1,7	1,7	81,4
	26,00	1	,3	,3	81,7
	27,00	2	,6	,6	82,3
	28,00	1	,3	,3	82,6
	29,00	4	1,1	1,2	83,7
	30,00	5	1,4	1,5	85,2
	31,00	2	,6	,6	85,8
	32,00	3	,8	,9	86,6
	35,00	2	,6	,6	87,2
	36,00	1	,3	,3	87,5
	40,00	7	1,9	2,0	89,5
	42,00	2	,6	,6	90,1
	45,00	3	,8	,9	91,0
	49,00	1	,3	,3	91,3
	50,00	3	,8	,9	92,2
	52,00	1	,3	,3	92,4
	58,00	1	,3	,3	92,7
	60,00	2	,6	,6	93,3
	70,00	2	,6	,6	93,9
	80,00	1	,3	,3	94,2
	90,00	1	,3	,3	94,5
	93,00	1	,3	,3	94,8
	99,00	3	,8	,9	95,6
	100,00	3	,8	,9	96,5
	120,00	1	,3	,3	96,8
	263,00	1	,3	,3	97,1
	350,00	1	,3	,3	97,4
	700,00	1	,3	,3	97,7
	750,00	1	,3	,3	98,0
	800,00	2	,6	,6	98,5
	830,00	1	,3	,3	98,8
	850,00	1	,3	,3	99,1
	900,00	1	,3	,3	99,4
	950,00	1	,3	,3	99,7
	1200,00	1	,3	,3	100,0
	Total	344	95,8	100,0	
Missing	System	15	4,2		
Total		359	100,0		



How many co-workers are approximately on board during your current (or most recent) stay on board (in numbers)

Appendix III: Descriptive statistics (before filtering missing values)

Below you can see the descriptives of the variables in the model, with the missing values, and (where relevant) after recoding. The missing values have not been filtered out yet. Some of these (Age, Gender, Nationality and Location) were also used in the methods chapter of this thesis.

Only used in Methods for general descriptions:

Frequencies Gender:

Statistics

Gender

N	Valid	359
	Missing	0
Mean		,04

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	343	95,5	95,5	95,5
	Female	16	4,5	4,5	100,0
	Total	359	100,0	100,0	

Frequencies Nationality:

Statistics

Nationality

N	Valid	359
	Missing	0

Nationality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	,3	,3	,3
	Belgian	5	1,4	1,4	1,7
	British	3	,8	,8	2,5
	Bulgarian	1	,3	,3	2,8
	Dutch	319	88,9	88,9	91,6
	Filipino	5	1,4	1,4	93,0
	German	1	,3	,3	93,3
	Indian	1	,3	,3	93,6
	Indonesian	10	2,8	2,8	96,4
	Latvian	3	,8	,8	97,2
	Lithuanian	1	,3	,3	97,5
	Polish	3	,8	,8	98,3
	Romanian	1	,3	,3	98,6
	Russian	1	,3	,3	98,9
	Ukrainian	4	1,1	1,1	100,0
	Total	359	100,0	100,0	

Variables used in models

Table:

Table: Descriptive statistics including missing values

Variable	Mean	Standard Deviation	Minimum	Maximum	*N***
Mental health	17,48	3,95	6	24	322
Time on board	8,04	5,33	1	34	322
Partner* (0=single; 1=relationship)	21,7% single 78,3% relationship	-	0	1	322
Children*(0=no children; 1= children)	43,1% no children 56,9% has children	-	0	1	320
Social relations	22,39	4,75	2	30	308
Age	41,03	13,26	19	67	359
Location* (0=on board; 1=at home)	51% on board 49% at home	-	0	1	359
Amount of co-workers***	13,41	6,57	0	27	344

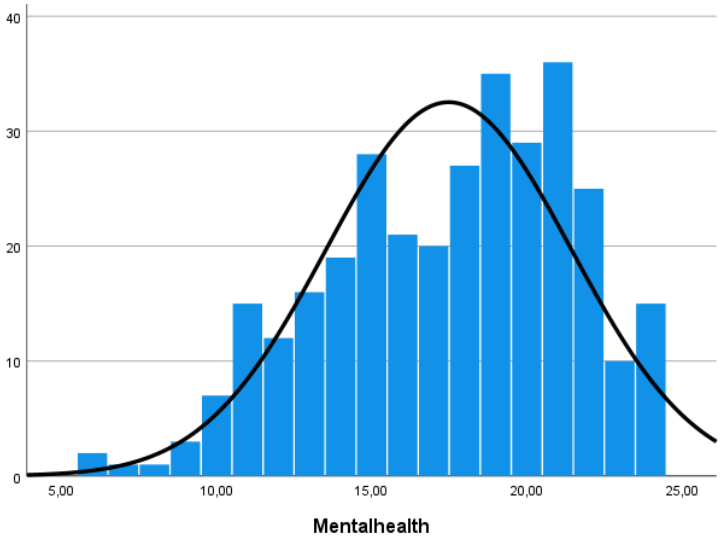
**Dummy variables are shown in percentages instead of a mean, and do not have a standard deviation.*
*** The N of the variables may differ due to missing values. The total N was 359. ***careful interpretation regarding that the variable is coded in groups after 20.*

Output:

Descriptives Mental Health after creating the variable.

Descriptive Statistics

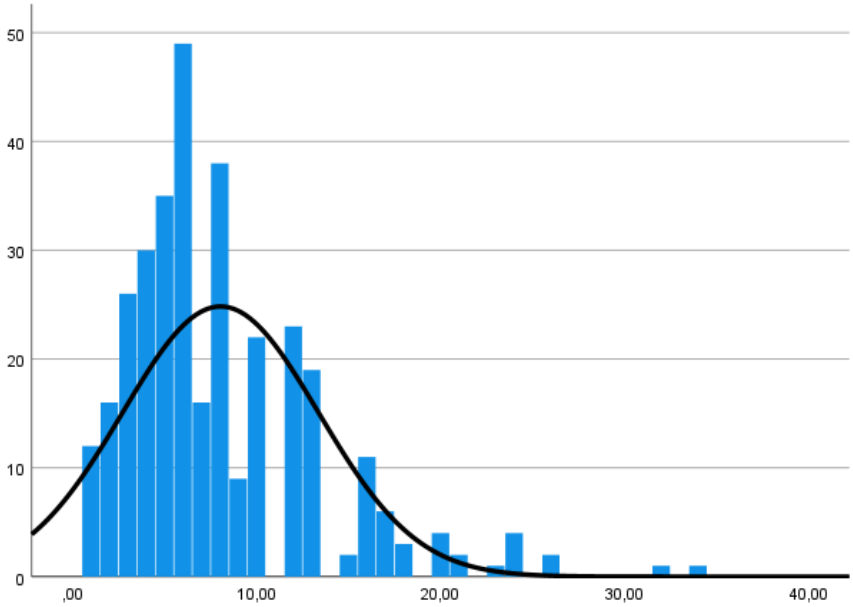
	N	Minimum	Maximum	Mean	Std. Deviation
Mentalhealth	322	6,00	24,00	17,4845	3,94922
Valid N (listwise)	322				



Descriptives Weeks on Board

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
On board stay (one period) according to contract, in weeks:	332	1,00	34,00	8,0437	5,33277
Valid N (listwise)	332				



Descriptives Partner (frequencies and descriptives)

Statistics

Single or relationship

N	Valid	322
	Missing	37
Mean		,78

Single or relationship

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	70	19,5	21,7	21,7
	Relationship	252	70,2	78,3	100,0
	Total	322	89,7	100,0	
Missing	System	37	10,3		
Total		359	100,0		

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Single or relationship	322	0	1	,78	,413
Valid N (listwise)	322				

Descriptives Children (frequencies and descriptives)

Statistics

No children or has children

N	Valid	320
	Missing	39

No children or has children

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No children	138	38,4	43,1	43,1
	Children	182	50,7	56,9	100,0
	Total	320	89,1	100,0	
Missing	System	39	10,9		
Total		359	100,0		

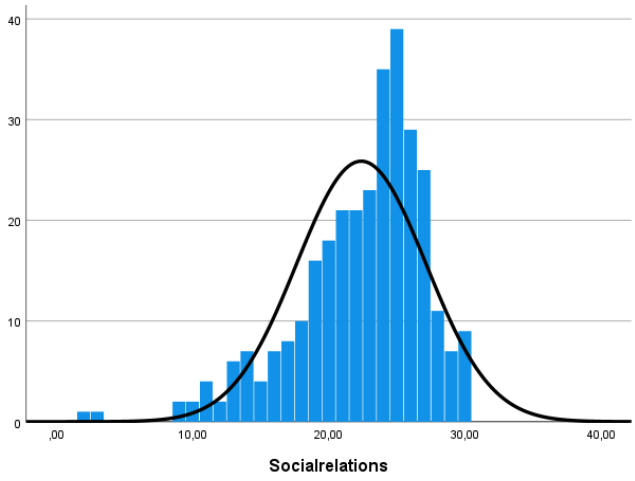
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
No children or has children	320	0	1	,57	,496
Valid N (listwise)	320				

Descriptives Social relations

Descriptive Statistics

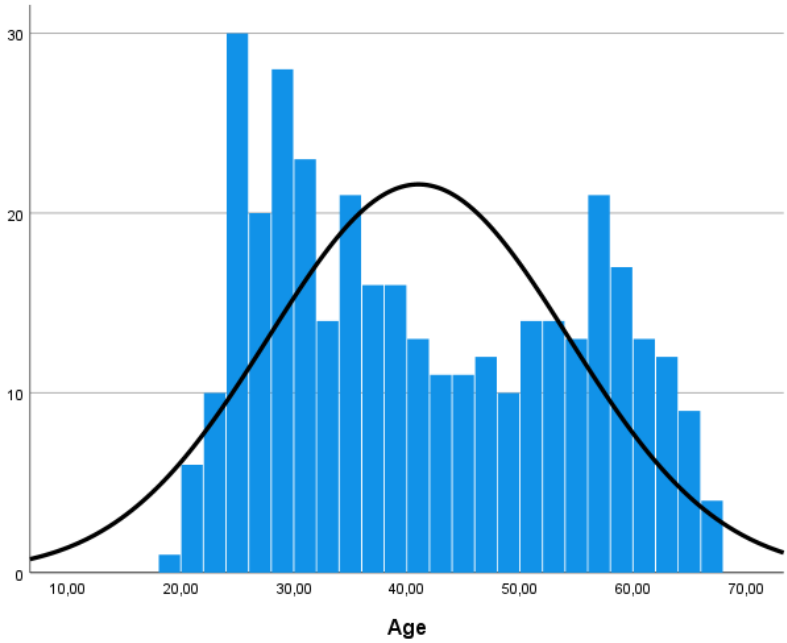
	N	Minimum	Maximum	Mean	Std. Deviation
Socialrelations	308	2,00	30,00	22,3896	4,74813
Valid N (listwise)	308				



Descriptives Age

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	359	19,00	67,00	41,0279	13,26120
Valid N (listwise)	359				



Descriptives Location (frequencies and descriptives)

Statistics

Location while filling in this questionnaire

N	Valid	359
	Missing	0

Location while filling in this questionnaire

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	On board	183	51,0	51,0	51,0
	At home	176	49,0	49,0	100,0
	Total	359	100,0	100,0	

Descriptive Statistics

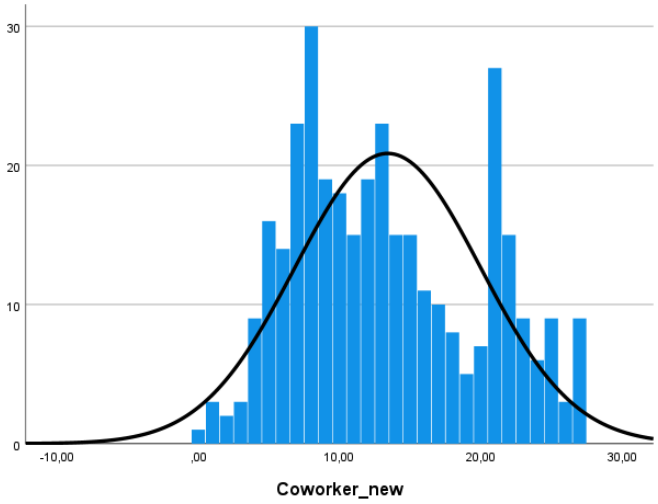
	N	Minimum	Maximum	Mean	Std. Deviation
Location while filling in this questionnaire	359	0	1	,49	,501
Valid N (listwise)	359				

Descriptives Coworkers

Statistics

Coworker_new

N	Valid	344
	Missing	15
Mean		13,4128
Median		12,5000
Std. Deviation		6,57750
Minimum		,00
Maximum		27,00



Appendix IV: Output Descriptives and Correlations

Output descriptives and correlations after deleting the missing values. Histograms of the variables (mental health, weeks on board, social relations, age, coworkers) after deleting the missing values are on the next page.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Mentalhealth	304	6,00	24,00	17,5263	3,93587
On board stay (one period) according to contract, in weeks:	304	1,00	34,00	7,9951	5,23562
Single or relationship	304	0	1	,79	,411
No children or has children	304	0	1	,57	,496
Socialrelations	304	2,00	30,00	22,4145	4,76849
Age	304	20,00	67,00	41,2467	13,26109
Location while filling in this questionnaire	304	0	1	,46	,499
Coworker_new	304	1,00	27,00	13,3026	6,58736
Valid N (listwise)	304				

Single or relationship

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	65	21,4	21,4	21,4
	Relationship	239	78,6	78,6	100,0
	Total	304	100,0	100,0	

No children or has children

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No children	131	43,1	43,1	43,1
	Children	173	56,9	56,9	100,0
	Total	304	100,0	100,0	

Location while filling in this questionnaire

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	On board	165	54,3	54,3	54,3
	At home	139	45,7	45,7	100,0
	Total	304	100,0	100,0	

Correlations[c]

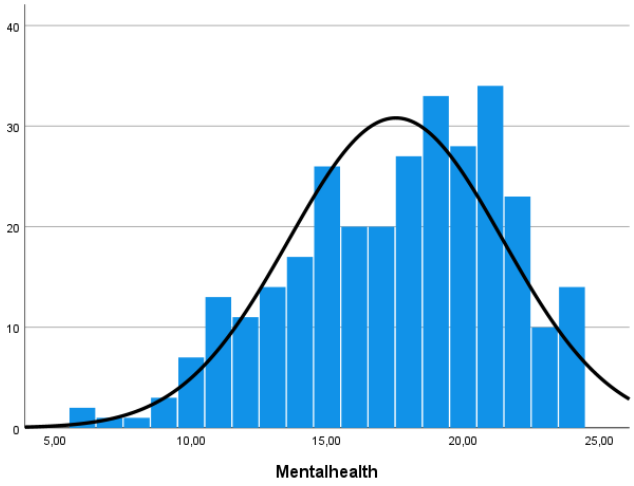
		Mentalhealth	On board stay (one period) according to contract, in weeks:	Single or relationship	No children or has children	Socialrelations	Age	Location while filling in this questionnaire	Coworker_new
Mentalhealth	Pearson Correlation	1	-,147*	,078	,007	,604**	,034	,045	-,005
	Sig. (2-tailed)		,010	,175	,908	<,001	,558	,433	,931
On board stay (one period) according to contract, in weeks:	Pearson Correlation	-,147*	1	-,183**	-,044	-,221**	,024	-,023	,072
	Sig. (2-tailed)	,010		,001	,444	<,001	,677	,688	,211
Single or relationship	Pearson Correlation	,078	-,183**	1	,389**	,057	,208**	,012	,047
	Sig. (2-tailed)	,175	,001		<,001	,320	<,001	,840	,412
No children or has children	Pearson Correlation	,007	-,044	,389**	1	-,078	,521**	-,068	-,054
	Sig. (2-tailed)	,908	,444	<,001		,176	<,001	,237	,349
Socialrelations	Pearson Correlation	,604**	-,221**	,057	-,078	1	-,092	,012	,063
	Sig. (2-tailed)	<,001	<,001	,320	,176		,109	,840	,276
Age	Pearson Correlation	,034	,024	,208**	,521**	-,092	1	,089	-,040
	Sig. (2-tailed)	,558	,677	<,001	<,001	,109		,123	,485
Location while filling in this questionnaire	Pearson Correlation	,045	-,023	,012	-,068	,012	,089	1	,000
	Sig. (2-tailed)	,433	,688	,840	,237	,840	,123		,999
Coworker_new	Pearson Correlation	-,005	,072	,047	-,054	,063	-,040	,000	1
	Sig. (2-tailed)	,931	,211	,412	,349	,276	,485	,999	

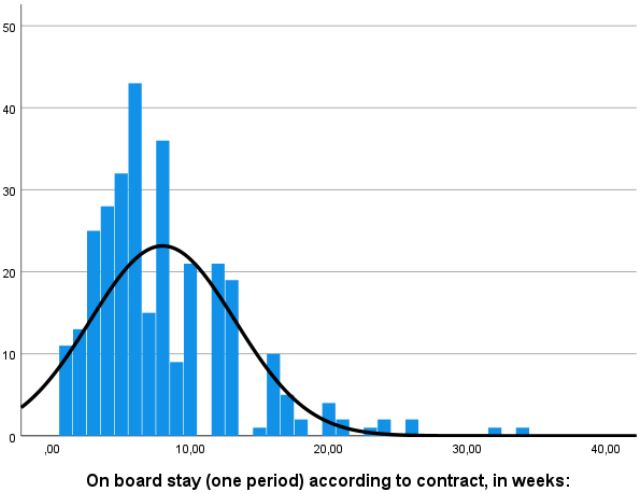
*. Correlation is significant at the 0.05 level (2-tailed).

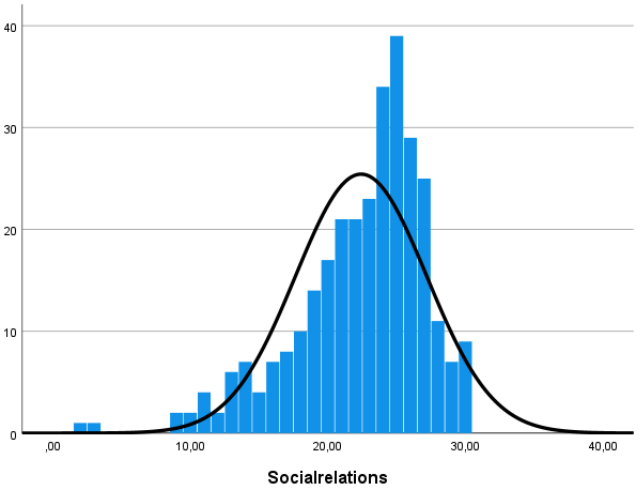
**. Correlation is significant at the 0.01 level (2-tailed).

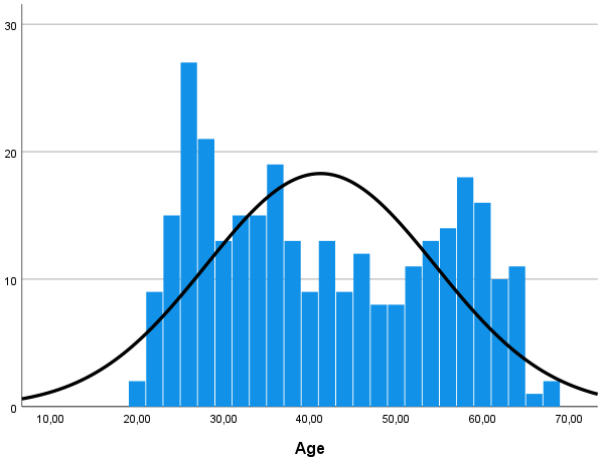
c. Listwise N=304

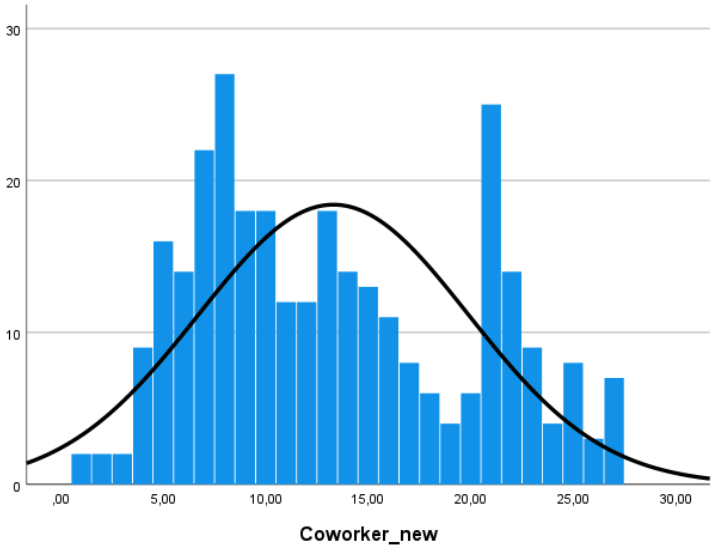
Histograms of Mental health, weeks on board, social relations, age, co-workers after deleting the missing values.











Appendix V: Output regression models

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,054[a]	,003	-,007	3,94968	,003	,295	3	300	,829
2	,157[b]	,025	,012	3,91317	,022	6,624	1	299	,011
3	,613[c]	,376	,361	3,14584	,351	55,551	3	296	<,001
4	,621[d]	,385	,364	3,13832	,009	1,473	3	293	,222

a. Predictors: (Constant), Coworker_new, Location while filling in this questionnaire, Age

b. Predictors: (Constant), Coworker_new, Location while filling in this questionnaire, Age, c_Weeksonboard

c. Predictors: (Constant), Coworker_new, Location while filling in this questionnaire, Age, c_Weeksonboard, c_Socialrelations, Single or relationship, No children or has children

d. Predictors: (Constant), Coworker_new, Location while filling in this questionnaire, Age, c_Weeksonboard, c_Socialrelations, Single or relationship, No children or has children, WEEKSxSOCIAL, WEEKSxCHILDREN, WEEKSxPARTNER

Coefficients[a]

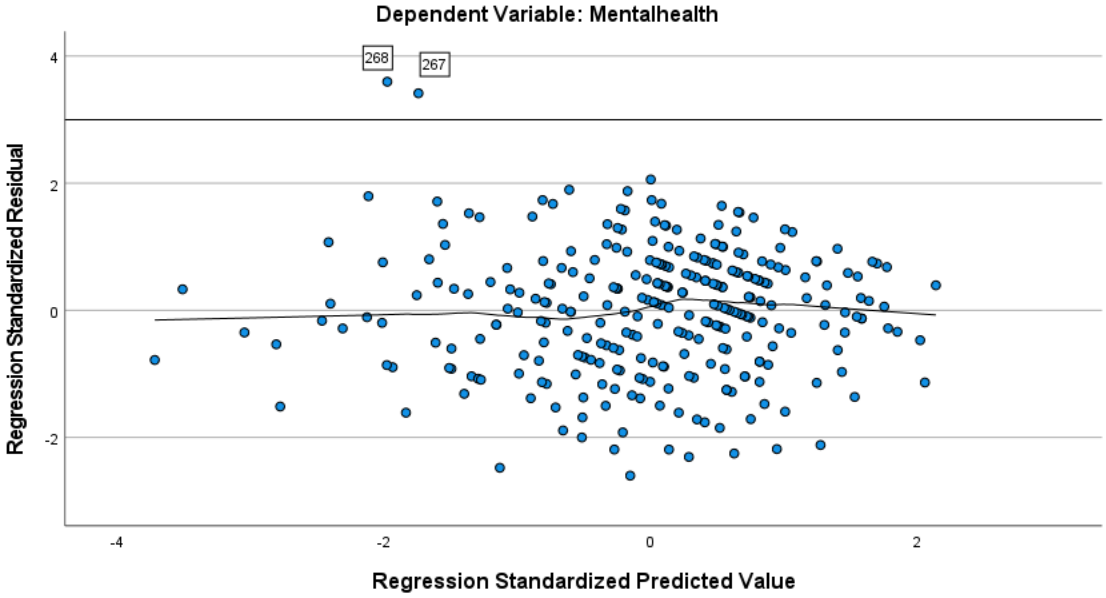
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	17,038	,899		18,962	<,001	15,270	18,807
	Age	,009	,017	,030	,515	,607	-,025	,043
	Location while filling in this questionnaire	,335	,457	,042	,734	,464	-,563	1,233
	Coworker_new	-,002	,034	-,004	-,066	,947	-,070	,066
2	(Constant)	16,908	,892		18,962	<,001	15,153	18,663
	Age	,010	,017	,034	,594	,553	-,023	,044
	Location while filling in this questionnaire	,305	,452	,039	,674	,501	-,585	1,195
	Coworker_new	,004	,034	,007	,122	,903	-,063	,072
	c_Weeksonboard	-,111	,043	-,147	-2,574	,011	-,196	-,026
3	(Constant)	16,550	,762		21,718	<,001	15,051	18,050
	Age	,023	,016	,079	1,450	,148	-,008	,055
	Location while filling in this questionnaire	,242	,367	,031	,660	,510	-,481	,965
	Coworker_new	-,024	,028	-,041	-,881	,379	-,079	,030
	c_Weeksonboard	-,004	,036	-,005	-,111	,911	-,075	,067
	Single or relationship	,252	,489	,026	,515	,607	-,710	1,213
	No children or has children	,019	,459	,002	,041	,967	-,885	,923
	c_Socialrelations	,504	,039	,611	12,850	<,001	,427	,581
4	(Constant)	16,511	,773		21,369	<,001	14,991	18,032
	Age	,021	,016	,071	1,295	,196	-,011	,053
	Location while filling in this questionnaire	,227	,368	,029	,617	,538	-,498	,952
	Coworker_new	-,024	,028	-,039	-,850	,396	-,078	,031
	c_Weeksonboard	,049	,073	,066	,674	,501	-,095	,194
	Single or relationship	,290	,499	,030	,580	,562	-,692	1,271
	No children or has children	,028	,460	,004	,062	,951	-,878	,935
	c_Socialrelations	,511	,040	,619	12,895	<,001	,433	,589
	WEEKSxPARTNER	-,051	,098	-,059	-,519	,604	-,244	,142
	WEEKSxCHILDREN	-,043	,085	-,042	-,510	,610	-,210	,123
	WEEKSxSOCIAL	-,013	,007	-,094	-1,938	,054	-,027	,000

a. Dependent Variable: Mentalhealth

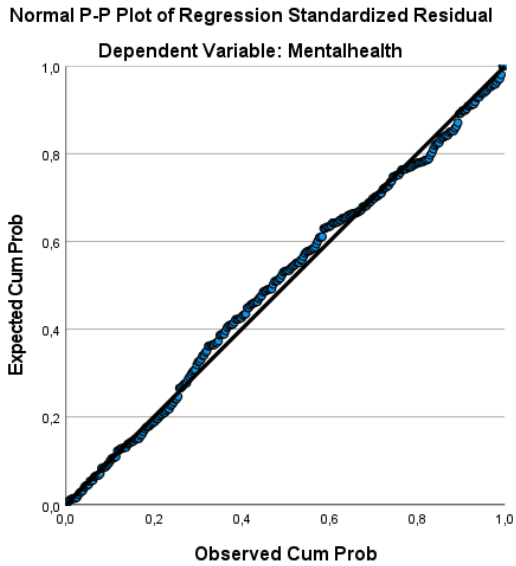
Appendix VI: Model inspections

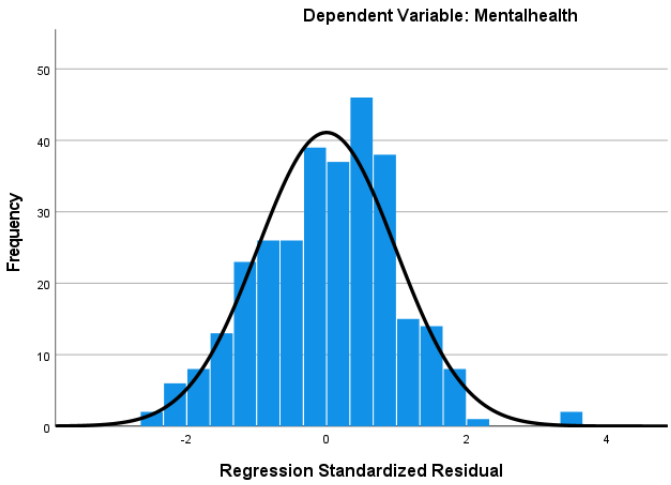
Assumptions of linear regression and outliers based on residuals

Residual plot: Assumptions linearity and homoscedasticity AND outliers based on residuals.



Histogram and PP-plot: assumption normality.





Multicollinearity: VIF

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	95,0% Confidence Interval for B Lower Bound	95,0% Confidence Interval for B Upper Bound	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	17,038	,899		18,962	<,001	15,270	18,807		
	Age	,009	,017	,030	,515	,607	-,025	,043	,991	1,010
	Location while filling in this questionnaire	,335	,457	,042	,734	,464	-,563	1,233	,992	1,008
	Coworker_new	-,002	,034	-,004	-,066	,947	-,070	,066	,998	1,002
2	(Constant)	16,908	,892		18,962	<,001	15,153	18,663		
	Age	,010	,017	,034	,594	,553	-,023	,044	,990	1,010
	Location while filling in this questionnaire	,305	,452	,039	,674	,501	-,585	1,195	,991	1,009
	Coworker_new	,004	,034	,007	,122	,903	-,063	,072	,993	1,007
	c_Weeksonboard	-,111	,043	-,147	-2,574	,011	-,196	-,026	,993	1,007
3	(Constant)	16,550	,762		21,718	<,001	15,051	18,050		
	Age	,023	,016	,079	1,450	,148	-,008	,055	,708	1,412
	Location while filling in this questionnaire	,242	,367	,031	,660	,510	-,481	,965	,972	1,029
	Coworker_new	-,024	,028	-,041	-,881	,379	-,079	,030	,979	1,021
	c_Weeksonboard	-,004	,036	-,005	-,111	,911	-,075	,067	,910	1,098
	Single or relationship	,252	,489	,026	,515	,607	-,710	1,213	,811	1,232
	No children or has children	,019	,459	,002	,041	,967	-,885	,923	,629	1,589
	c_Socialrelations	,504	,039	,611	12,850	<,001	,427	,581	,933	1,072
4	(Constant)	16,511	,773		21,369	<,001	14,991	18,032		
	Age	,021	,016	,071	1,295	,196	-,011	,053	,699	1,430
	Location while filling in this questionnaire	,227	,368	,029	,617	,538	-,498	,952	,963	1,039
	Coworker_new	-,024	,028	-,039	-,850	,396	-,078	,031	,974	1,027
	c_Weeksonboard	,049	,073	,066	,674	,501	-,095	,194	,220	4,550
	Single or relationship	,290	,499	,030	,580	,562	-,692	1,271	,775	1,291
	No children or has children	,028	,460	,004	,062	,951	-,878	,935	,623	1,605
	c_Socialrelations	,511	,040	,619	12,895	<,001	,433	,589	,910	1,099
	WEEKSxPARTNER	-,051	,098	-,059	-,519	,604	-,244	,142	,165	6,063
	WEEKSxCHILDREN	-,043	,085	-,042	-,510	,610	-,210	,123	,312	3,204
	WEEKSxSOCIAL	-,013	,007	-,094	-1,938	,054	-,027	,000	,890	1,124

a. Dependent Variable: Mentalhealth

Output after filtering for cases 267, 268, 278 and 301.

Descriptives: First, the descriptives are calculated again in order to make new centered variables for time on board and social relations.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
On board stay (one period) according to contract, in weeks:	300	1,00	34,00	7,8450	4,96460
Socialrelations	300	2,00	30,00	22,5133	4,68290

Coefficients: the new coefficients after filtering the outliers and influential points.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics R Square Change	Change Statistics F Change	Change Statistics df1	Change Statistics df2	Change Statistics Sig. F Change
1	,037[a]	,001	-,009	3,92015	,001	,133	3	296	,940
2	,129[b]	,017	,003	3,89674	,015	4,566	1	295	,033
3	,646[c]	,418	,404	3,01428	,401	67,004	3	292	<,001
4	,656[d]	,431	,411	2,99574	,013	2,208	3	289	,087

a. Predictors: (Constant), Coworker_new, Location while filling in this questionnaire, Age

b. Predictors: (Constant), Coworker_new, Location while filling in this questionnaire, Age, NEWc_Weeksonboard

c. Predictors: (Constant), Coworker_new, Location while filling in this questionnaire, Age, NEWc_Weeksonboard, NEWc_Socialrelations, Single or relationship, No children or has children

d. Predictors: (Constant), Coworker_new, Location while filling in this questionnaire, Age, NEWc_Weeksonboard, NEWc_Socialrelations, Single or relationship, No children or has children, NEWWEEKSxSOCIAL, NEWWEEKSxCHILDREN, NEWWEEKSxPARTNER

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6,123	3	2,041	,133	,940[b]
	Residual	4548,794	296	15,368		
	Total	4554,917	299			
2	Regression	75,462	4	18,865	1,242	,293[c]
	Residual	4479,455	295	15,185		
	Total	4554,917	299			
3	Regression	1901,832	7	271,690	29,902	<,001[d]
	Residual	2653,085	292	9,086		
	Total	4554,917	299			
4	Regression	1961,292	10	196,129	21,854	<,001[e]
	Residual	2593,625	289	8,974		
	Total	4554,917	299			

a. Dependent Variable: Mentalhealth

b. Predictors: (Constant), Coworker_new, Location while filling in this questionnaire, Age

c. Predictors: (Constant), Coworker_new, Location while filling in this questionnaire, Age, NEWc_Weeksonboard

d. Predictors: (Constant), Coworker_new, Location while filling in this questionnaire, Age, NEWc_Weeksonboard, NEWc_Socialrelations, Single or relationship, No children or has children

e. Predictors: (Constant), Coworker_new, Location while filling in this questionnaire, Age, NEWc_Weeksonboard, NEWc_Socialrelations, Single or relationship, No children or has children, NEWWEEKSxSOCIAL, NEWWEEKSxCHILDREN, NEWWEEKSxPARTNER

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	17,275	,899		19,224	<,001		
	Age	,006	,017	,021	,368	,713	,991	1,009
	Location while filling in this questionnaire	,190	,456	,024	,416	,677	,993	1,007
	Coworker_new	-,008	,034	-,013	-,229	,819	,998	1,002
2	(Constant)	17,168	,895		19,190	<,001		
	Age	,007	,017	,023	,397	,692	,991	1,009
	Location while filling in this questionnaire	,188	,453	,024	,416	,678	,993	1,007
	Coworker_new	-,001	,034	-,002	-,035	,972	,990	1,010
	NEWc_Weeksonboard	-,097	,046	-,124	-2,137	,033	,992	1,008
3	(Constant)	17,032	,734		23,190	<,001		
	Age	,019	,016	,064	1,217	,225	,715	1,398
	Location while filling in this questionnaire	,044	,354	,006	,125	,901	,972	1,029
	Coworker_new	-,037	,027	-,062	-1,375	,170	,972	1,029
	NEWc_Weeksonboard	,013	,037	,017	,355	,723	,906	1,103
	Single or relationship	,284	,472	,030	,601	,548	,800	1,250
	No children or has children	-,082	,442	-,010	-,185	,853	,630	1,587
	NEWc_Socialrelations	,541	,038	,649	14,106	<,001	,943	1,060
4	(Constant)	17,054	,745		22,879	<,001		
	Age	,015	,016	,052	,989	,323	,706	1,416
	Location while filling in this questionnaire	,021	,354	,003	,059	,953	,964	1,037
	Coworker_new	-,037	,027	-,063	-1,384	,167	,962	1,040
	NEWc_Weeksonboard	,055	,070	,070	,787	,432	,247	4,045
	Single or relationship	,329	,482	,035	,683	,495	,760	1,316
	No children or has children	-,071	,443	-,009	-,160	,873	,622	1,608
	NEWc_Socialrelations	,552	,039	,662	14,288	<,001	,918	1,090
	NEWWEEKSxPARTNER	,002	,098	,002	,021	,983	,179	5,597
	NEWWEEKSxCHILDREN	-,084	,086	-,077	-,976	,330	,318	3,143
	NEWWEEKSxSOCIAL	-,019	,008	-,109	-2,386	,018	,948	1,055

a. Dependent Variable: Mentalhealth

Appendix VII: Syntax

```
* Encoding: UTF-8.
RENAME VARIABLES (Q5=Consent).
RENAME VARIABLES (Q6=Population).
RENAME VARIABLES (Q8=Gender).
RENAME VARIABLES (Q9=Age).
RENAME VARIABLES (Q10=Nationality).
RENAME VARIABLES (Q11=EU).
RENAME VARIABLES (Q13=Location).
RENAME VARIABLES (Q14=Experience).
RENAME VARIABLES (Q15=Coworkers).
RENAME VARIABLES (Q21=Weeksonboard).
RENAME VARIABLES (Q23_1=MH1).
RENAME VARIABLES (Q23_2=MH2).
RENAME VARIABLES (Q23_3=MH3).
RENAME VARIABLES (Q23_4=MH4).
RENAME VARIABLES (Q23_5=MH5).
RENAME VARIABLES (Q23_6=MH6).
RENAME VARIABLES (Q23_7=MH7).
RENAME VARIABLES (Q23_8=MH8).
RENAME VARIABLES (Q25=Partner).
RENAME VARIABLES (Q26=Children).
RENAME VARIABLES (Q27=Agechild).
RENAME VARIABLES (Q33_1=SR1).
RENAME VARIABLES (Q33_2=SR2).
RENAME VARIABLES (Q33_3=SR3).
RENAME VARIABLES (Q33_4=SR4).
RENAME VARIABLES (Q33_5=SR5).

*Filter consent and population, and age.
SELECT IF (Consent = 1 AND Population = 1).
EXECUTE.
SELECT IF (Age >= 18 AND Age <=67).
EXECUTE.
*filtering 175 weeks in the time on board.
RECODE Weeksonboard (175=SYSMIS).
EXECUTE.
*Changes the nationalities by hand. So all the variations on "Dutch', like Nederlands" etc were changed to
"Dutch", checked this by hand for all the nationalities.

*DESCRIPTIVES/FREQUENCIES ETC WITH ALL THE MISSINGS ETC for the methods chapter.
*Gender, Age, Nationality and Location were also used in methods chapter.
*Descriptives Gender.
FREQUENCIES VARIABLES=Gender
  /STATISTICS=MEAN
  /ORDER=ANALYSIS.
*Descriptives Nationality.
FREQUENCIES VARIABLES=Nationality
  /STATISTICS=MEAN
  /ORDER=ANALYSIS.
*control variable: Age.
DESCRIPTIVES VARIABLES=Age
  /STATISTICS=MEAN STDDEV MIN MAX.
GRAPH
  /HISTOGRAM(NORMAL)=Age.
*Control variable: Location while participating.
FREQUENCIES VARIABLES=Location
  /ORDER=ANALYSIS.
*Old descriptives for mental health, social relations, co-workers.
```

```
DESCRIPTIVES VARIABLES=MH1 MH2 MH3 MH4 MH5 MH6 MH7 MH8
  /STATISTICS=MEAN STDDEV MIN MAX.
FREQUENCIES VARIABLES=MH1 MH2 MH3 MH4 MH5 MH6 MH7 MH8
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
DESCRIPTIVES VARIABLES=SR1 SR2 SR3 SR4 SR5
  /STATISTICS=MEAN STDDEV MIN MAX.
FREQUENCIES VARIABLES=SR1 SR2 SR3 SR4 SR5
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
FREQUENCIES VARIABLES=Coworkers
  /STATISTICS=STDDEV MINIMUM MAXIMUM MEAN MEDIAN
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.

*Recoding Mental health, Social relations, Partner, Children, Co-workers.
*Mental health: recoding the negative statements (MH1, MH3, MH6, MH8) so a higher score is a higher mental
health, checking Cronbachs alpha, making 1 variable.
RECODE MH1 (3=0) (2=1) (1=2) (0=3) INTO New_MH1.
EXECUTE.
RECODE MH3 (3=0) (2=1) (1=2) (0=3) INTO New_MH3.
EXECUTE.
RECODE MH6 (3=0) (2=1) (1=2) (0=3) INTO New_MH6.
EXECUTE.
RECODE MH8 (3=0) (2=1) (1=2) (0=3) INTO New_MH8.
EXECUTE.
*Descriptives and histograms.
DESCRIPTIVES VARIABLES=New_MH1 New_MH3 New_MH6 New_MH8
  /STATISTICS=MEAN STDDEV MIN MAX.
FREQUENCIES VARIABLES=New_MH1 New_MH3 New_MH6 New_MH8
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
*Cronbach's Alpha.
RELIABILITY
  /VARIABLES=MH2 MH4 MH5 MH7 New_MH1 New_MH3 New_MH6 New_MH8
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /SUMMARY=TOTAL
  /STATISTICS=DESCRIPTIVE CORR.
COMPUTE Mentalhealth=MH2 + MH4 + MH5 + MH7 + New_MH1 + New_MH3 + New_MH6 + New_MH8.
EXECUTE.
*Check variable.
FREQUENCIES VARIABLES=Mentalhealth
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
DESCRIPTIVES VARIABLES=Mentalhealth
  /STATISTICS=MEAN STDDEV MIN MAX.
*Social relations: checking the cronbachs alpha, making 1 variable.
RELIABILITY
  /VARIABLES=SR1 SR2 SR3 SR4 SR5
  /SCALE('ALL VARIABLES') ALL
  /MODEL=ALPHA
  /SUMMARY=TOTAL
  /STATISTICS=DESCRIPTIVE CORR.
COMPUTE Socialrelations=SR1 + SR2 + SR3 + SR4 + SR5.
EXECUTE.
*Check variable.
FREQUENCIES VARIABLES=Socialrelations
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
```

```
DESCRIPTIVES VARIABLES=Socialrelations
  /STATISTICS=MEAN STDDEV MIN MAX.
*Partner: was 1-3, now 0 means single and 1 means in a relationship.
RECODE Partner (1=0) (2=1) (3=1) (ELSE=SYSMIS) INTO Partner_new.
VARIABLE LABELS  Partner_new 'Single or relationship'.
EXECUTE.
*check variable.
FREQUENCIES VARIABLES=Partner_new Partner
  /STATISTICS=MEAN
  /ORDER=ANALYSIS.
*Children: recoding: instead of number of children, it will be a dummy. 0 = no children (so value 0), and the rest
will be 1 = has children (1 or more).
RECODE Children (0=0) (SYSMIS=SYSMIS) (ELSE=1) INTO Children_new.
VARIABLE LABELS  Children_new 'No children or has children'.
EXECUTE.
*check variable.
FREQUENCIES VARIABLES=Children Children_new
  /ORDER=ANALYSIS.
*Co-worker: recoding.
RECODE Coworkers (0=0) (1=1) (2=2) (3=3) (4=4) (5=5) (6=6) (7=7) (8=8) (9=9) (10=10) (11=11) (12=12)
    (13=13) (14=14) (15=15) (16=16) (17=17) (18=18) (19=19) (20=20) (SYSMIS=SYSMIS) (21 thru 30=21)
(31
    thru 40=22) (41 thru 50=23) (51 thru 75=24) (76 thru 100=25) (101 thru 500=26) (501 thru 1200=27)
    INTO Coworker_new.
EXECUTE.
*Check variable.
FREQUENCIES VARIABLES=Coworkers Coworker_new
  /STATISTICS=STDDEV MINIMUM MAXIMUM MEAN MEDIAN
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.

*DESCRIPTIVES DIFFERENT N'S BEFORE FILTERING MISSINGS.
DESCRIPTIVES VARIABLES=Mentalhealth
  /STATISTICS=MEAN STDDEV MIN MAX.
DESCRIPTIVES VARIABLES=Weeksonboard
  /STATISTICS=MEAN STDDEV MIN MAX.
FREQUENCIES VARIABLES=Weeksonboard
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
FREQUENCIES VARIABLES=Partner_new
  /STATISTICS=MEAN
  /ORDER=ANALYSIS.
DESCRIPTIVES VARIABLES=Partner_new
  /STATISTICS=MEAN STDDEV MIN MAX.
FREQUENCIES VARIABLES=Children_new
  /ORDER=ANALYSIS.
DESCRIPTIVES VARIABLES=Children_new
  /STATISTICS=MEAN STDDEV MIN MAX.
DESCRIPTIVES VARIABLES=Socialrelations
  /STATISTICS=MEAN STDDEV MIN MAX.
DESCRIPTIVES VARIABLES=Age
  /STATISTICS=MEAN STDDEV MIN MAX.
FREQUENCIES VARIABLES=Location
  /ORDER=ANALYSIS.
DESCRIPTIVES VARIABLES=Location
  /STATISTICS=MEAN STDDEV MIN MAX.
FREQUENCIES VARIABLES=Coworker_new
  /STATISTICS=STDDEV MINIMUM MAXIMUM MEAN MEDIAN
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
```

```
*Filtering out all missing values for the variables used in this model.
SELECT IF NOT MISSING (Mentalhealth) AND NOT MISSING (Weeksonboard) AND NOT MISSING
(Partner_new) AND NOT MISSING (Children_new) AND NOT MISSING (Socialrelations) AND NOT
MISSING  (Age)
    AND NOT MISSING (Location) AND NOT MISSING (Coworker_new).
Execute.

*Used the following for the five number summaries of Mental health, time on board, social relations, family
ashore (partner + children), age, location, amount of coworkers.
DESCRIPTIVES VARIABLES=Mentalhealth Weeksonboard Partner_new Children_new Socialrelations Age
Location Coworker_new
  /STATISTICS=MEAN STDDEV MIN MAX.
FREQUENCIES VARIABLES=Partner_new
  /STATISTICS=MEAN
  /ORDER=ANALYSIS.
FREQUENCIES VARIABLES=Children_new
  /ORDER=ANALYSIS.
FREQUENCIES VARIABLES=Location
  /ORDER=ANALYSIS.
*Histograms of mental health, weeks on board, social relations, age and co-workers after deleting the missing
values (=304).
FREQUENCIES VARIABLES=Mentalhealth
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
FREQUENCIES VARIABLES=Weeksonboard
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
FREQUENCIES VARIABLES=Socialrelations
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
FREQUENCIES VARIABLES=Age
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
FREQUENCIES VARIABLES=Coworker_new
  /HISTOGRAM NORMAL
  /ORDER=ANALYSIS.
*Correlations, pearson, "exclude cases listwise" for missing values, so N is the same for all variables.
*N didn't change after adding coworkers, not planning on recoding anything as missing, so already made the
table.
CORRELATIONS
  /VARIABLES=Mentalhealth Weeksonboard Partner_new Children_new Socialrelations Age Location
Coworker_new
  /PRINT=TWOTAIL NOSIG FULL
  /MISSING=LISTWISE.

*Centering Time on board and social relations.
COMPUTE c_Weeksonboard=Weeksonboard - 8.0437.
EXECUTE.
COMPUTE c_Socialrelations=Socialrelations - 22.3896.
EXECUTE.

*Interactions between time on board with: partner, children and social relations.
COMPUTE WEEKSxPARTNER=c_Weeksonboard * Partner_new.
EXECUTE.
COMPUTE WEEKSxCHILDREN=c_Weeksonboard * Children_new.
EXECUTE.
COMPUTE WEEKSxSOCIAL=c_Weeksonboard *c_Socialrelations.
EXECUTE.
```

```
*Regression.
REGRESSION
  /DESCRIPTIVES MEAN STDDEV CORR SIG N
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS CI(95) R ANOVA CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT Mentalhealth
  /METHOD=ENTER Age Location Coworker_new
  /METHOD=ENTER c_Weeksonboard
  /METHOD=ENTER Partner_new Children_new c_Socialrelations
  /METHOD=ENTER WEEKSxPARTNER WEEKSxCHILDREN WEEKSxSOCIAL.
*Assumptions of linear regression + VIF.
REGRESSION
  /DESCRIPTIVES MEAN STDDEV CORR SIG N
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT Mentalhealth
  /METHOD=ENTER Age Location Coworker_new
  /METHOD=ENTER c_Weeksonboard
  /METHOD=ENTER Partner_new Children_new c_Socialrelations
  /METHOD=ENTER WEEKSxPARTNER WEEKSxCHILDREN WEEKSxSOCIAL
  /SCATTERPLOT=(*ZRESID ,*ZPRED)
  /RESIDUALS HISTOGRAM(ZRESID) NORMPROB(ZRESID).
*Leverage, DFFIT, Cook's Distance.
REGRESSION
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS R ANOVA
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT Mentalhealth
  /METHOD=ENTER Age Location Coworker_new
  /METHOD=ENTER c_Weeksonboard
  /METHOD=ENTER Partner_new Children_new c_Socialrelations
  /METHOD=ENTER WEEKSxPARTNER WEEKSxCHILDREN WEEKSxSOCIAL
  /SAVE COOK LEVER ZRESID DFFIT.
*Adding casenumbers > with nationality descending (starting with an empty cel, followed by Belgian etc).
COMPUTE Casenumber=$CASENUM.
EXECUTE.
*Filtering influential cases number 268, 268, 278 and 301.
USE ALL.
COMPUTE filter_$=(Casenumber ~= 267 & Casenumber ~= 268 & Casenumber ~= 278 & Casenumber ~=
301).
VARIABLE LABELS filter_$ 'Casenumber ~= 267 & Casenumber ~= 268 & Casenumber ~= 278 &
Casenumber ~= 301 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMATS filter_$ (f1.0).
FILTER BY filter_$.
EXECUTE.
*New descriptives for time on board and social relations.
DESCRIPTIVES VARIABLES=Weeksonboard Socialrelations
  /STATISTICS=MEAN STDDEV MIN MAX.
*New centered variables and interactions.
COMPUTE NEWc_Weeksonboard=Weeksonboard - 7.8450.
EXECUTE.
COMPUTE NEWc_Socialrelations=Socialrelations - 22.5133.
EXECUTE.
COMPUTE NEWWEEKSxPARTNER=NEWc_Weeksonboard * Partner_new.
```

```
EXECUTE.
COMPUTE NEWWEEKSxCHILDREN=NEWc_Weeksonboard * Children_new.
EXECUTE.
COMPUTE NEWWEEKSxSOCIAL=NEWc_Weeksonboard *NEWc_Socialrelations.
EXECUTE.
*New regression.
REGRESSION
  /DESCRIPTIVES MEAN STDDEV CORR SIG N
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS R ANOVA COLLIN TOL CHANGE
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT Mentalhealth
  /METHOD=ENTER Age Location Coworker_new
  /METHOD=ENTER NEWc_Weeksonboard
  /METHOD=ENTER Partner_new Children_new NEWc_Socialrelations
  /METHOD=ENTER NEWWEEKSxPARTNER NEWWEEKSxCHILDREN NEWWEEKSxSOCIAL.
```