Individual, social and structural factors underlying compliance to COVID-19 related self-isolation

Willem Kriens 6014690

Wordcount: 7817

Abstract:

In order to mitigate the current COVID-19 pandemic many countries including the Netherlands have put measures in place to curb the virus. Many of these measures however are mandatory but left unchecked, leaving it up to people to decide whether or not to comply to these measures. One of these measures is COVID-19 related self-isolation. When a person has contracted covid, they are supposed to stay at home. In the current study factors are discussed which influence compliance to such a measure. Using different levels of influence (individual, social and structural) and the theoretical domains framework a set of factors was found to possibly explain compliance behavior. Individual factors included in the model were gender(women comply more than men), age(The older the more compliant, up until 60+ when people become less compliant), educational level(The higher educated the more compliant), perceptions about health(The more negative perceptions, the more compliant) and worries about employment (The less worries the more compliant). Social factors were perceived social isolation (the more isolated the less compliant). Structural factors were beliefs about the current measures to mitigate the spread of covid (The more positive the more compliant). Using a logistical regression on the binary dependent variable did or did not break their COVID-19 related self-isolation compliance was predicted using the former variables. Results indicate age, gender, educational level and perceptions about health are significant predictors of compliance. Self-isolation was not. Beliefs about regulations and worries about employment had to be omitted due to concerns with the assumptions of a logistical regression. Gender, age and perceptions about health followed the hypothesized effect. Educational level did not. Explanations for this are given in the discussion, together with limitations, strengths and avenues for further research.

Kriens, W. (Willem Kriens)

Supervisor: Tracy Cheung

Introduction

The novel coronavirus (COVID-19) has been in the Netherlands for an extended amount of time since February 2020 (Antonides, & van Leeuwen, 2020; Rijksoverheid, n.d.). COVID-19 symptoms vary but often include a fever, runny nose, fatigue, loss of smell, headaches, sneezing, coughing and a sore throat. Usually older people or those with certain medical conditions are affected more heavily, as COVID-19 could affect their immune system thereby making the disease fatal (Rothan, & Byrareddy, 2020). The virus has led to over 12.000 deaths in the Netherlands alone, and has infected over 800.000 people (Kuijvenhoven, n.d.). The virus has shown to transmit itself via three main routes. Namely, larger respiratory droplets which usually expire close to those who emit them; touching contaminated surfaces; and smaller air droplets which tend to linger longer in indoor spaces (Morawska, et al., 2020). Those infected with the virus can be asymptomatic, or in their incubation period when they are contagious (Bai, et al., 2020; Tindale, et al., 2020), so not only those who feel they have symptoms are contagious.

Measures have been in place to curb the spread of the virus, which has shown to be impactful. For instance, measures in The Netherlands, referred to as an "Intelligent Lockdown", include measures to increase the physical distance between people and stay at home measures, but not with the intention to impose a strict lockdown forcing people to stay at home (Antonides, & van Leeuwen, 2020; Kuiper et al., 2020). During the first wave of the pandemic measures were set up to ensure a lesser amount of contact between citizens to curb the virus. These measures revolve around social distancing, a process where people physically distance themselves from others (Backer, et al., 2020). The measures the government has taken and to which citizens have complied have shown to curb the spread of the virus during the first wave (Backer, et al., 2020), and were eased during the summer of 2020 (Folmer, et al., 2020a). Individuals' behavior in order for these measures to take effect is important and therefore compliance to social distancing and stay at home measures is one of the most important factors when considering the spread of the virus (Anderson, Heesterbeek, Klinkenberg, & Hollingsworth, 2020; Sailer, Stadler, Botes, Fischer, & Greiff, 2020).

Compliance to these mitigation measures was high during the first lockdown in the Netherlands (Kuiper, et al., 2020), however compliance and support towards social distancing measures have decreased during the second wave in the Netherlands. Full compliance to social distancing measures was at 46,7% in early May and dropped down to 30.3% come late June (Folmer, et al., 2020a; Folmer et al., 2020b). The Netherlands, is not the only country

where compliance to social distancing measures seems to be decreasing over time (Folmer, et al., 2020a; Folmer et al., 2020b), as Norway reports a similar pattern. Research in Norway also indicated that compliance levels to self-isolation have decreased (Steens, et al., 2020).

Although the Netherlands seems to have a high compliance to self-isolation measures (Kuiper, et al., 2020) there is no data on the compliance to self-isolation measure specifically for individuals who have been tested positive (i.e. were told to stay home for at least 7 days). This measure entails a following number of rules. Firstly, one is to stay at home during the self-isolation period. This period will last at least 7 days from the moment when symptoms first arise, or will last until 24 hours after being symptom free if one has been sick for more than seven days (RIVM, n.d.)

. Understanding the factors facilitating or hindering compliance to the self-isolation after coming into contact with someone tested positive to COVID-19 therefore is an issue that must be addressed.

Considering the factors which underly compliance is important to sustain the effect of self-isolation measures on the spread of the coronavirus considering how currently it is showing a downward trend (Folmer, et al., 2020a; Folmer et al., 2020b; Steens, et al., 2020), . By understanding the factors that underlie people's compliance to the self-isolation measures new policies can be made to ensure more compliance and more effectively curb the spread of the coronavirus. Compliance to the self-isolation measure is important to stop the spread, even when someone is not showing symptoms as someone might not be aware they are contagious (Bai, et al., 2020; Tindale, et al., 2020). However not much research has been done to understand what factors explain adherence to this measure, and more specifically minimal research has been conducted in the Netherlands. In response to the aforementioned research gap, the current proposed research aims to generate insights to the following research question "What are the factors underlying people's compliance to self-isolation measure when tested positive for COVID-19 in The Netherlands?" Existing research has so far identified factors on the individual- social- and material/structural level that influence compliance behavior. However, a research gap remains as research up to date have not considered the factors from various levels simultaneously to provide a holistic picture of when compliance occurs. In researching this question, the Theoretical Domains Framework (Cane, O'Connor, & Michie, 2012; Michie, et al., 2005) will be employed as theoretical framework. However, some factors are added to complement the model in order to ensure different levels of influence on behaviour are taken into account.

In order to examine these factors, a review of existing research on compliance to self-isolation measures will be presented. After this overview, the theoretical domains framework (TDF) and social ecological theory will be presented and used to explain and predict how certain factors form the individual factors such as gender, age, health, employment worries and education, social factors such as perceived social support, perceived quality of social contact and structural policy factors measured by opinions on the regulations in place influence behavior, and thus compliance. These different levels influence behavior, yet current research has mostly only focused mostly on one of these levels. As an approach combining all these levels could be better in understanding which factors are important to compliance all levels will be considered in the current proposed research. Data to research the current question will be gathered in the context of an internship with the Veiligheids-en Gezondheidsregio Gelderland-Midden (VGGM). The current study thus aims to add to the body of research on compliance to COVID-19 measures, and as it is done within a specific region of the Netherlands it is possible to observe differences between the mean and a region.

Literature review

The literature review will first offer an overview of research done on compliance behavior during the current COVID-19 pandemic. In order to explain and understand behavior many levels and factors within someone's life should be taken into consideration. Ecological models have often stressed the importance of taking into account different levels of influence (Sallis, Owen, & Fisher, 2015). Factors will be considered which influence behavior from the Individual, Social and Structural level. Factors were grouped using the social-ecological model (Germain, & Glitterman, 2008), which distinguishes these factors. After this review, the Theoretical Domains Framework (TDF) will be presented as a framework to study the factors predicting compliance behavior. The TDF has domains which relate to some of the levels and factors, but doesn't explain all. In the current study levels and factors are thus added to complement the TDF. Finally, hypotheses regarding ways factors influence compliance will be presented.

Individual factors

When considering demographics women tend to be more likely to adhere to self-isolation measures than men do this effect has been found a plethora of countries in the EU, and also the Netherlands (Carlucci, D'Ambrosio, & Balsamo, 2020; Clark, Davila, Regis, & Kraus, 2020 Kuiper, et al., 2020; Nivette, et al., 2020; Smith, et al., 2020; Tomczyk, Rahn, &

Schmidt, 2020). Age also predicts compliance to self-isolation (Carlucci, D'Ambrosio, & Balsamo, 2020; Steens, et al., 2020; Tomczyk, Rahn, & Schmidt, 2020). However, two separate studies indicate that the effect age has on compliance is not just a linear effect (i.e. the older the more likely to comply) but that younger cohorts (18-29) comply less than older cohorts, yet people older than 60 coming in second last when considering compliance to self-isolation measures (Carlucci, D'Ambrosio, & Balsamo, 2020; Steens, et al., 2020). Notably, these results were not replicated in the Netherlands, nor found in a larger meta study (Clark, Davila, Regis, & Kraus, 2020; Folmer, et al., 2020a). Education was also a factor, with higher educated people showing higher levels of compliance to self-isolation measures (Carlucci, D'Ambrosio, & Balsamo, 2020). Those who are married also tend to comply more to self-isolation measures (Carlucci, D'Ambrosio, & Balsamo, 2020).

Furthermore perceptions about one's own health also influence compliance to self-isolation. The pattern is that those who feel they will suffer more from COVID-19 tend to comply more easily measures (Clark, Davila, Regis, & Kraus, 2020; Steens, et al., 2020; Webster, et al., 2020). Those who fear to lose their jobs as result of complying with measures imposed by government to curb the spread of the coronavirus tend to comply less (Bodas, & Peleg, 2020; Webster, et al., 2020). Those who are in a more precarious situation financially thus might be less compliant to self-isolation measures. Notably, these findings actually highlight how individuals' compliance behaviors are also under the influence of structural factors. Put differently, overarching structural differences influence people's capacity and ability on the individual level to comply to measures taken by the government to curb the spread of COVID-19.

Social factors

Moreover, more social factors are important to compliance to self-isolation measures. Those who live in high density areas might have a hard time effectively self-isolating, due to this density and might have less social capital (Thakur, Lovinsky-Desir, Bime, Wisnivesky, & Celedón, 2020). Social capital is defined as the willingness of a group of people around a person to supply them with help (Adler, & Kwon, 2002). Social capital has shown to be predictive factor considering compliance to COVID-19 measures, the more social capital is observed in a certain area, the more compliance behavior (Bartscher, Seitz, Slotwinski, Siegloch, & Wehrhöfer, 2020; Wu, 2020). Social capital in this instance influences support networks (one could for instance do groceries for the self-isolating person; picking up other supplies; calling for a quick conversation; checking in on someone) and the ways social

norms are embedded in the community. When social capital is considered, to ways of measuring said capital arise. One way is the networks themselves (i.e. do people have social networks around them), and the quality of those networks (i.e willingness to supply help) (Adler, & Kwon, 2002; Robison, Schmid, & Siles, 2002). Absence of the quality social networks (i.e family uninvolved and unwilling to help a person during self-isolation, or even no support networks at all) could lead to one breaking their isolation (Wu, 2020). Social support has thus shown to lead to an increase in effective isolation. However, social support can come from different sources. When social support comes from family, it is more likely to help people effectively quarantine. Different studies however show that support from someone outside of the household (friends or family) could help people adhere to self-isolation measures (Smith, et al., 2020). Social capital, defined as the social networks people have and the quality of those networks, is therefore a factor in explaining compliance to the COVID-19 related self-isolation measure.

Structural factors

Perceptions about the regulations set by the government and the trust in the government also seems to be a predictor of compliance to social isolation COVID-19 measures (Carlucci, D'Ambrosio, & Balsamo, 2020; Webster, et al., 2020; Wright, Steptoe, & Fancourt, 2020). Those who trust the governmental response to COVID-19 tend to comply with the measures in set in place by the government. Belief in the effectiveness of the regulations also predicts compliance with measures (Clark, Davila, Regis, & Kraus, 2020). However, this was researched in the context of general measures, and not much is known about how this effect influences self-isolation when one has tested positive. Moreover, another way to increase compliance could be by raising incentives to adhere to measures. In the context of measures such as fines, financial penalties for breaking self-isolation measures has however been shown not to increase compliance to quarantine measures (Ryu, Hwang, Yoon, & Chun, 2020). Similarly, penalties or punishment do not seem to add to compliancy with measures taken (Kooistra, et al., 2020; Folmer, et al., 2020a; Van Rooij, et al., 2020). Punishment therefore does not offer to be a solution to force people to comply.

Concluding

It is out of the scope of current research to take all factors mentioned into consideration as a survey created by the GGD is used. However, the factors gender, age,

educational level, perceptions about health, worries about employment, perceived social isolation and beliefs about the current regulations to mitigate COVID-19 were included.

Theoretical Framework

The aforementioned literature presents numerous factors which at different levels (individual, social and structural) effect compliance behavior to self-isolation measures taken by governments. However, existing literature has so far studied the different levels of factors affecting compliance to measures taken to curb the spread of COVID-19 separately, and up to date there is scarce research studying these factors' influence on compliance behavior simultaneously. Therefore, it is useful to make use of a validated theoretical framework to provide an overview of how factors of different levels can influence compliance behavior simultaneously in order to facilitate holistic understanding of when and why compliance behavior to self-isolation measures occur. This understanding would also allow for the said behavior to be predicted more accurately.

The theoretical domains framework (TDF) is a framework created and validated by a large number of those working in behavior change theory fields. It was created to combine and merge the insights from various theories which explain behavior change (Cane, O'Connor, & Michie, 2012; Michie, et al., 2005). The framework has already been used to explain changes in behavior in patients, and could thus be applicable to explain behavior of those who have tested positive for Covid-19 (Atkins, et al., 2017). The framework encompasses 14 domains, these are broader domains wherein constructs are grouped which influence behavior. Factors that arose from the literature review fall into certain domains, as they are linked to constructs within those domains. A complete overview of all domains and constructs within domains is given in appendix one, which is a replication of the table used by Cane, O'Connor, & Michie (2012)

In the following section, factors that arose from the literature review will be discussed in their relation to constructs and domains of the TDF.

The fifth domain, optimism, contains the construct belief. As shown by in the literature beliefs about the regulations influences adherence to COVID-19 regulations. The more someone does believe the regulations will work and rally behind them the more likely they are to self-isolate (Clark, Davila, Regis, & Kraus, 2020). The eleventh domain, environmental context and resources contains the constructs resources / material resources and barriers and facilitators of the behavioural outcome. In the current case economic reasons or fears to break self-isolation would make people less likely to adhere to the regulations. As

shown in the literature review fear of losing one's job could make people less likely to adhere to regulations (Bodas, & Peleg, 2020; Webster, et al., 2020). The twelfth domain, social influences contains the construct social support. People who have less social support and capital are more likely to break their quarantine because they have no network to fall back on (Bartscher, Seitz, Slotwinski, Siegloch, & Wehrhöfer, 2020; Wu, 2020). The thirteenth domain emotion, contains the domain fear. Perceptions about health and the fear of becoming sick due to COVID-19 could fall under this domain.

The TDF is a useful framework because it is both interdisciplinary and has been validated, which ensures that specific domains and construct are likely to actually have an effect on behavior, which allows for more accurate predictions. (Cane, O'Connor, & Michie, 2012). The framework allows for research to look at a multitude of factors from different levels, such that it acknowledges individual behavior (i.e., compliance to self-isolation measures) as a consequence of the additive contribution of individual, social, and structural factors. Hence this framework ensures that the current study is able to respond the research gap of the use of single levels in many previous studies to study compliance behavior towards self-isolation measures.

Although the framework offers insight in what factors might influence behavior it fails to incorporate all factors identified in the literature research. The TDF does not include the variables age, gender and education. In this current study however these variables will be added into the model, as they are believed to be of importance to explain compliance behavior.

Current study

The current study investigated the research question of "What are the factors underlying people's compliance to self-isolation measure when tested positive for COVID-19 in The Netherlands?" was conducted within the context of an internship with the VGGM and GGD NOG. Existing data (collected by the VGGM and GGD NOG during the weeks 43 through 53) on compliance to self-isolating when having been tested positive for COVID-19 regulations will be analyzed. The research question of the current study was "Why do people not comply to the self-isolating measure when testing positive for COVID-19?". Factors on different levels were identified and used to predict compliance to the self-isolating measures. Factors were included in the survey which the VGGM set out and were used during the current study. Factors at the micro/individual level were age, gender, worries about employment, knowledge about regulations, perceptions about health. Factors on the

meso/social level were perceived social support and quality of social relations. Factors on the macro/policy level were beliefs about the regulations taken.

Following from the literature review and theoretical perspectives the following hypothesis were made, and shown within the levels of influence they fit.

Individual level

H1. Age will have a positive effect on compliance, up until the age of 60, after which compliance is less (Carlucci, D'Ambrosio, & Balsamo, 2020; Steens, et al., 2020; Tomczyk, Rahn, & Schmidt, 2020).

H2. Educational level has a positive effect on compliance.

H3. Perceptions about health will have a negative effect on compliance behavior, those who believe to be healthier tend to comply less (Clark, Davila, Regis, & Kraus, 2020; Steens, et al., 2020; Webster, et al., 2020).

H4. Men are less likely to comply than women are Netherlands (Carlucci, D'Ambrosio, & Balsamo, 2020; Clark, Davila, Regis, & Kraus, 2020 Kuiper, et al., 2020; Nivette, et al., 2020; Tomczyk, Rahn, & Schmidt, 2020).

H5. Worries about employment has a negative effect on compliance (Bodas, & Peleg, 2020; Webster, et al., 2020).

Social level

H6. Perceived social support has a positive effect on compliance (Bartscher, Seitz, Slotwinski, Siegloch, & Wehrhöfer, 2020; Wu, 2020).

Structural level

H7. Beliefs about regulations taken to curb the spread of COVID-19 have a positive effect on compliance measures (Carlucci, D'Ambrosio, & Balsamo, 2020; Webster, et al., 2020; Wright, Steptoe, & Fancourt, 2020).

Figure 1 illustrates the hypothesized ways factors influence compliance behavior.

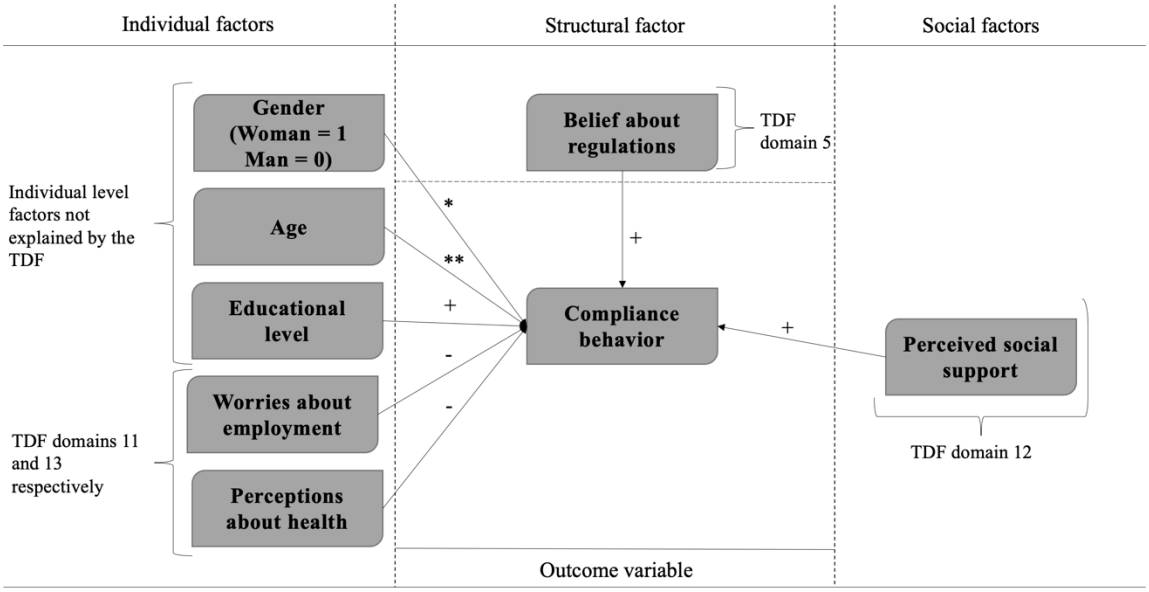

Figure 1 Factors and their hypothesized influence on compliance behaviour, their levels of influence and their theoretic domains.

Methods

Study design

The current study used a survey created by the GGD in order to measure all variables within the research population. A cross-sectional study design was used in order to answer the research question and predict compliance to the COVID-19 related self-isolation measure. As the dependent variable, complying or not complying, is binary a binary logistic regression analysis was used.

Participants

Participants only include those who have tested positive. Everyone who was tested positive by the VGGM or GGD NOG was eligible to participate in the current study. Total number of participants is not yet known. Data was collected from week 43 until week 53. Those who tested positive during this period received an email with information about the survey and instructions on how to participate if they chose to. 13135 people participated on the survey rolled out by the GGDs, of which 5359 (40.4%) male and 7767 (59.1%) female. The division of age groups can be found in table 1.

Table 1

Age groups, their count and percentage of total.

Age group	Count	Percentage of total
16-17	353	2.7%
18-24	1392	10.6%
25-39	2834	21.6%
40-45	4164	31.7%
55-69	3476	26.7%
70-81	880	6.7%
85+	36	0.3%
Total	13135	100%

Procedure

After testing positive someone in the target population could be invited via email to participate in the current study if they had left their email while making a test appointment. An email was sent out to all who tested positive for covid, containing information on the survey, stating it was to better understand the spread of covid. This email contained a link to the survey, clicking the link informed consent was given, and the survey started. If participants indicated they had not been tested positive or were below 15, they were told they couldn't partake in the survey. In order to reduce redundant questions certain elements where not shown. That is if someone indicated they were currently employed, questions related to unemployment were not shown. If someone indicted they had not broken their isolation, no questions were shown related to the reason why they broke their isolation. As a closing statement participants were thanked for participating and had the option to indicate whether or not they had questions or comments about the survey.

Measurements

All variables were measured by a survey which was designed by the VGGM. Questions were asked and answered in Dutch.

Compliance

For the variable, compliance with self-isolation, question posed was "It can be quite difficult not to head outside if suffering from mild symptoms, no one would be able to do your groceries or you'd like to get some fresh air. Have you, during the isolation period, gone outside to for instance go for a walk, do groceries of visit people?" Answer options were

"Yes, about (number of times)", "No" and "I don't know". Because the I don't know option offers no insight into compliance behavior, these values were seen as missing. Using a dummy coding compliance was coded as 0 = did not comply (Yes) and 1 = did comply (No).

Health perception

For the variable perceptions about health, the question "How is your health in general?". 5-point likert scale answers were offered, "Very good", "Good", "All right", "Bad", "Very bad". Codes for said answers ranged from one to five respectively, a higher score representing a worse perceived health.

Gender

For the variable Gender, participants were asked "What is your gender?" answer options being "Man" "Woman" and "Different". Using dummy coding men were coded zero and woman coded one. As the option different only had 2 participants they were removed from the dataset.

Educational attainment

Educational attainment was measured by asking participants what their highest completed education was. Answers were "No education", "basic education", "Lbo", "Vmbo/mavo", "Havo/vwo", "Mbo", "Hbo" and "University". Codes to these options ranged from one (no education) to seven (University). Meaning a higher score on this variable meant a higher level of educational attainment.

Age

For the variable age people were asked "What is your age?". Answer options were multiple choice, "15 or younger", "16-17 years old", "18-24 years old", "25-39 years old", "40-54 years old", "55-69 years old", "70-84 years old" and "85 years or older". Age groups were coded one to eight. All participants scoring 1 were removed from the dataset, as they were below the age of 15. A higher score on this variable meant a higher age.

Worries about employment

Worries about employment was measured by the following question "Have you worried about your employment in the last month?" Answer options were a 5-point likert scale with the options "Never", "Almost never", "Sometimes", "A lot", "Always". Options were coded one to five respectively, a higher score meaning more worries.

Belief about regulations

Belief about regulations was measured by asking respondents whether they agreed with 10 of the current measures taken to curb the spread of COVID-19. Measures included but are not limited to "Travel as little as possible", "Only a maximum of three visitors

allowed, and one group a day". A 4-point likert scale was offered per measure, options being "Not at all", "Neutral", "Fully" and "No opinion". Options were coded one to four respectively. A four was recoded as missing, and an average score of non-missing values was created. A higher score on this variable meant people overall tended to agree with the regulations in place.

Perceived social support

Considering perceived social support, participants were asked if 6 statements were applicable to their situation. Statements included but are not limited to "I often feel abandoned", "I have a lot of people I can depend on", "I miss people around me". Answer options were a 3-point likert scale for each individual question "Yes", "Kind of" and "No". Questions were coded to ensure a higher score meant less perceived social support. An average score was computed out of the six questions.

Data analysis

Data was analyzed using SPSS statistics. All variables will be added into a logistical regression model. Prior to any analysis assumptions of the logistical regression will be tested. Assumptions tested are linearity of the logit, lacking of multicollinearity and absence of influential values. Linearity of the logit will be tested by running a logistical regression on all variables, computing the logit of said variables, then subsequently an interaction term between the variable and the logit of a variable. If the computed interaction term is significant, linearity of the logit can not be assumed (Field, 2018). This Box-Tidwell test was performed with compliance as the dependent variable and all hypothesized predictors in the model, and their log computations. In order to test for multicollinearity of the variables a regular regression will be performed, off of which collinearity statistics will be attained. If values of tolerance are lower than 0.1 and VIF values above 10 will be seen as violations of the assumption of multicollinearity. Absence of influential values was measured using cooks distance, values above 1 will be considered as a violation. Dependent variable in the model is compliance behavior with the self-isolation measure. Independent variables are perceptions about health, gender, age, knowledge, worries about employment, belief about regulations, perceived social support and perceived quality of social relations. Finally intercorrelations between all significant predictors are presented.

Results

As a first step the assumptions of the logistical model were tested for all hypothesized predictors, gender, age, educational level, perceptions about health, worry about employment, perceived social support and belief about regulations. Linearity of the logit could not be assumed for two of the predictors, worry about employment *B = (-0.472), SE = 0.158, Wald = 8.876, p = .003* and belief about regulations *B = (-1.261), SE = 0.396, Wald = 10.131, p = .001*. Running another logistical regression after removing these two predictors proved no issues for the assumption of linearity of the logit for the remaining variables. For the assumptions of no multicollinearity a regular regression was run with all predictor variables, where no values of tolerance or VIF were observed that were close to or were above or below the threshold for the assumption multicollinearity to not be assumed. No Cooks distance values higher that 0.002 were observed. Worry about employment and belief about regulations were thus taken out of the current model as they could not meet the assumption of linearity of the logit.

The binary logistic regression indicates that gender, age, educational level and perceptions about health are significant predictors of compliance to the self-isolation measure when tested positive (*Chi-Square* = 179.905, *df* = 5, *Nagelkerke's* R^2 = 0.022, *p* = <.001). Perceived social support was not a significant predictor in the current model. Gender (coded female 0, male 1) *B* = 0.148, *SE* = 0.43, *Wald* = 18.355, *p* = <.001 has an odds ratio of 1.203, females were more likely to comply than males. Age (*M* = 4.93, *SD* = 1.177) *B* = 0.078, *SE* = 0.018, *Wald* = 18.277, *p* = <.001 has an odds ratio of 1.082, the older groups were more likely to comply than younger groups. Educational level (*M* = 5.81, *SD* = 1.547) *B* = -0.100, *SE* = 0.014, *Wald* = 48.931, *p* = <.001 has an odds ratio of 0.905, lower educated people are more likely to comply than higher educated people. Perceived health (*M* = 1.93, *SD* = 0.670) *B* = 0.265, *SE* = 0.033, *Wald* = 62.676, *p* = <.001 has an odds ratio of 1.303, the less healthy a person perceives themselves the more likely they are to comply. Finally, although not significant perceived social support (*M* = 2.614, *SD* = 0.379) *B* = 0.108, *SE* = 0.057, *Wald* = 3.603, *p* = 0.058 has an odds ratio of 1.114. This means that main effects were found for Gender, age, educational level and perceived health on compliance to the self-isolation measure when testing positive for Covid-19. All significant results are summarized in table 2.

Table 2

B coefficients, S.E., Wald statistic and odds ratio of significant predictors,

Predictor	*B*	*S.E.*	*Wald statistic*	Odds ratio
Gender	0.184	0.043	18.355	1.203
Age	0.078	0.018	18.277	1.082
Educational level	-0.100	0.014	48.931	0.905
Perceived health	0.265	0.033	62.676	1.303

All predictors in the current model are correlated to one another, as visible in table 3.

Table 3

Intercorrelations table for al significant predictors in the model, all correlations significant at the 0.05 level.

Predictor	Gender	Age.	Educational Level	Perceived Health
Gender	1	-0.132	-0.019	0.029
Age	-0.132	1	-0.065	0.109
Educational level	-0.019	-0.065	1	-0.143
Perceived health	0.029	0.109	-0.143	1

Discussion

The current study aimed to explain what factors underly compliance to the COVID-19 related self-isolation measure. This was attempted through a survey created by the VGGM and GGDNOG and people who tested positive in these regions were able to participate.

Following the literature review a set of hypothesis were made concerning which and how factors influence compliance to this measure. Concerning the first hypothesis, age was found to have a positive effect on compliance, however the hypothesized effect that after 60 this

people are less compliant was not found in the current dataset. The current study therefore argues that older people are more likely to comply to the covid-19 self-isolation mitigation measure. The first hypothesis can therefor not be accepted by the current study. This however is not extremely surprising, as other articles mentioned that age simply has a positive relation to compliance behavior (Tomczyk, Rahn, & Schmidt, 2020). Another cause that the effect was not witnessable in the current study was due to the age groups. As it was not possible to clearly cut off a group of 'above 60' using the data gathered by the current survey.

The second hypothesis, educational level has a positive effect on compliance behavior is not supported by the current study and has to be rejected. As the data clearly shows in the current study educational level has a negative effect on compliance behavior, meaning that the higher someone is educated the more likely they are to break their covid-19 related self-isolation. One of the possible reasons for this effect is that the region the survey took place in has a lot of neighborhoods which are close to or surrounded by nature. Higher educated individuals tend to have a higher socioeconomic status, which could mean they live in more affluent areas which are less populated. Which could in turn lead to them being able to break their isolation more safely.

The third hypothesis, stating perceptions about health have a negative effect on compliance is clearly supported by the current study, and is accepted. The current study shows that the healthier people tend to perceive themselves, the more likely they are to break their covid-19 related self-isolation. This is in line with theory mentioned earlier in this study, and follows the reasoning that those who feel they are more at risk are more likely to comply to covid-19 mitigation measures (Clark, Davila, Regis, & Kraus, 2020; Steens, et al., 2020; Webster, et al., 2020).

The fourth hypothesis, a main effect of gender on compliance behavior, was supported by the current study. Men tend to comply less than women do. This hypothesis is therefor accepted in the current study. This is also supported by nearly every study who takes gender into account when studying compliance to covid-19 self-isolation measures and follows the theory mentioned in the current study (Carlucci, D'Ambrosio, & Balsamo, 2020; Clark, Davila, Regis, & Kraus, 2020 Kuiper, et al., 2020; Nivette, et al., 2020; Smith, et al., 2020; Tomczyk, Rahn, & Schmidt, 2020).

The sixth hypothesis concerning the negative effect on compliance of perceived social support could not be supported by the current study and must therefore be rejected. It is however important to note that although not significant, the results are close to statistical

significance. This could in turn mean that results were acquired due to sampling errors, or that this could be one of the issues within certain groups, but not all.

Both the fifth hypothesis concerning the negative effect of worrying about employment and the seventh hypothesis stating beliefs about regulations have a positive effect on compliance could not be tested in the current study. Both variables were not able to meet the assumptions for a logistical regression and where therefor removed from the current model.

This violation of assumptions was however not the only limitation to the current study. As evident there is a bias in the current study where more women have answered the survey than men have. For instance, one bias could be that women tend to answer questions about their perceived health differently than men do (Barreto, & Figueiredo., 2009; Denton, & Walters., 1999). This could in turn have biased to current dataset to include a more skewed picture of perceived health. As visible in table 3, gender and perceptions about health are correlated. Males tend to view themselves as less healthy. Future studies could aim to control for gender when taking perceived health into account.

Another bias in the current study is that only those who are generally more likely to participate in research are likely to fill out the survey. This non response could possibly lead to a bias in the current study, as it can not be guaranteed that those in the sample who do not respond think alike with those who do. In many different settings this bias can be found in surveys distributed via mail, and it is unlikely the current study would be an exception (Culpepper, & Zimmerman., 2006; Mazor, Clauser, Field, Yood, & Gurwitz., 2002). Furthermore response bias isn't only limited to nonresponse. When considering sensitive topics such as health and welfare social desirability bias is likely to be present and participants tend to underreport these topics (Marquis, Marquis, & Pollich., 1986). As adherence to covid-19 regulations is pushed by media an government one could be less inclined to disclose their non-compliance to such measures when asked on a survey. Which could in turn lead to a bias in the data. Although anonymity is ensured, people were sent this survey to their personal email. Future research should look into ways to reach the whole population equally and try to minimize response bias. Furthermore, the current study only offers insight into predictors to people breaking their isolation. The reasoning people might have is neglected. The current survey however did contain questions regarding such reasoning. Although outside of the scope of the current study, a qualitative analysis was done which offered insight into this reasoning. A mixed method design could in the future offer a more clear picture of both who and why people break their isolation.

Because there was no control over the environment in which participants completed the survey it is possible that they were not fully engaged with the survey, which in turn could also have created a bias in the data affecting reliability. Another issue with the current survey is that not all questions were checked for validity, which might in turn create issues with the validity of the current study.

However, the current study does hold a large sample size, which is one of the prerequisites for a logistical regression. Having this large sample size makes it less likely that what has been observed in the current study is due to random errors. Findings are therefor more reliable (Field, 2018). Due to assumption testing it was made sure no assumptions of the statistical analysis were violated, which in turn ensures that the specific analysis was used right and therefor the results are more reliable.

When compared to earlier findings the current study shows that individual level predictors are, in line with theory, accurate predictors of compliance behavior regarding compliance behavior to covid-19 self-isolation regulations. In the current study it was not able to show whether or not the TDF is a framework which is applicable to this compliance behavior, as assumptions for most variables related to the framework were not met. Results from predictors included in the model are mixed, as social isolation is not a significant predictor, however perceptions about health is. Further research should thus investigate whether or not this framework is applicable. When the results are put in a societal context, a focus could be added on communicating towards different groups. As age and gender are predictors, policy should try to find a way to reach this groups with more appropriate communication.

Conclusion

In summary, the covid-19 pandemic has called for measures to mitigate the spread of the virus. One of these is self-isolating those who have tested positive, however this measure is not enforced by the government. It is therefor up to the compliance of those tested positive to stay in self-isolation. The aim of the current study was to understand factors underlying such compliance. Factors from micro, meso and macro levels influence such behavior. In the current study evidence was found for the acceptance of two out of seven hypothesis, namely hypothesis three and four. In conclusion, the study found significant results to support the notion that women comply more than men do and that the less healthy a person feels the more likely they are to comply to the self-isolation measure. Age was found to be a positive significant predictor of compliance behavior, but differed slightly from the hypothesis this effect would cease to exist after 60. Educational level had an opposite effect on compliance

as was hypothesized, and explanations for this are characteristics of the region. Perceived social support was found not to be a predictor of compliance with self-isolation measures.

Current research adds to the understanding of factors influencing compliance behavior to the self-isolation by adding onto research already done in this field, but taking a closer look at a different region within the Netherlands. Avenues for further research are taking a closer look at the relation between educational level and compliance to these measures in a more broad view, taking into account social or structural factors which might better explain this relation.

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Appendix 1. Domains of the TDF and the constructs as explained in the article by Cane, O'Connor, & Michie (2012)

Domains	Constructs
1. Knowledge (An awareness of the existence of something)	Knowledge (including knowledge of condition/scientific rationale) Procedural knowledge Knowledge of task environment
2. Skills (An ability or proficiency acquired through practice	Skills Skills development Competence Ability Interpersonal skills Practice Skill assessment
3. Social/Professional Role and Identity (A coherent set of behaviors and displayed personal qualities of an individual in a social or work setting)	Professional identity Professional role Social identity Professional boundaries Professional confidence Group identity Leadership Organizational commitment
4. Beliefs about Capabilities (Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use)	Perceived competence Self-efficacy Perceived behavioral control Beliefs Self-Esteem Empowerment Professional confidence
5. Optimism (The confidence that things will happen for the best or that desired goals will be attained)	Optimism Pessimism Unrealistic optimism Identity

6. Beliefs about Consequences (Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation)	Beliefs Outcome expectancies Characteristics of outcome expectancies Anticipated regret Consequents
7. Reinforcement (Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus)	Rewards (proximal / distal, valued / not valued, probable / improbable) Incentives Punishment Consequents Reinforcement Contingencies Sanctions
8. Intentions (A conscious decision to perform a behaviour or a resolve to act in a certain way)	Stability of intentions Stages of change in model Transtheoretical model and stages of change
9. Goals (Mental representations of outcomes or end states that an individual wants to achieve)	Goals (distal / proximal) Goal priority Goal / target setting Goals (autonomous / controlled) Action planning Implementation intention
10. Memory, Attentions and Decision processes (The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives)	Memory Attention Attention control Decision making Cognitive overload / tiredness
11. Environmental Context and Resources (Any circumstance of a person's situation or environment that	Environmental stressors Resources / material resources Organisational culture / climate Salient events / critical incidents

discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour)	Person x environment interaction Barriers and facilitators
12. Social influences (Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)	Social pressure Social norms Group conformity Social comparisons Group norms Social support Power Intergroup conflict Alienation Group identity Modelling
13. Emotion (A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event)	Fear Anxiety Affect Stress Depression Positive / negative affect Burn-out
14. Behavioral Regulation (Anything aimed at managing or changing objectively observed or measured actions)	Self-monitoring Breaking habit Action planning

Syntax of analysis performed

```
* Measures score, remove no opinion (4) SYSMIS.
RECODE MTR_2_1 MTR_2_12 MTR_2_2 MTR_2_10 MTR_2_11 MTR_2_3 MTR_2_4
MTR_2_5 MTR_2_6 MTR_2_7 MTR_2_9
   MTR_2_8 MTR_1_1 MTR_1_2 MTR_1_3 MTR_1_4 MTR_1_5 MTR_1_6 MTR_1_7
MTR_1_8 MTR_1_9 MTR_1_10 (4=SYSMIS).
EXECUTE.

COMPUTE
AVGMTR=MEAN(MTR_2_1,MTR_2_12,MTR_2_2,MTR_2_10,MTR_2_11,MTR_2_3,MTR_2_4,
MTR_2_5,MTR_2_6,

MTR_2_7,MTR_2_9,MTR_2_8,MTR_1_1,MTR_1_2,MTR_1_3,MTR_1_4,MTR_1_5,MTR_1_6,
MTR_1_7,MTR_1_8,MTR_1_9,
   MTR_1_10).
EXECUTE.

*average measures score

RECODE week (1 thru 6=0) (7 thru 10=1) INTO MTRPer.
VARIABLE LABELS  MTRPer 'Periodes met verschillende maatregelen'.
EXECUTE.

ONEWAY AVGMTR BY MTRPer
  /STATISTICS DESCRIPTIVES
  /PLOT MEANS
  /MISSING ANALYSIS.

* SI average score

RECODE SI_2 SI_3 SI_5 (1 = 3) (2 = 2) (3 = 1).

COMPUTE SI_GEM=MEAN(SI_1,SI_2 ,SI_3 ,SI_4 ,SI_5 ,SI_6).

VARIABLE LABELS SI_GEM 'Gemiddelde score op SI vragen'.

EXECUTE.

***Somscore MHI-5.
*Hercoderen negatieve items.
RECODE MHI5_1 MHI5_2 MHI5_4 (1=0) (2=1) (3=2) (4=3) (5=4) (6=5) (ELSE=copy) INTO
zenuwachtig opvrolijken somber.
EXECUTE.

*Recode positive items MHI5
RECODE MHI5_3 MHI5_5 (1=5) (2=4) (3=3) (4=2) (5=1) (6=0) (ELSE=copy) INTO kalm
gelukkig.
```

```
EXECUTE.

*Score MHI5
COMPUTE somscore_MHI5 = SUM (zenuwachtig, opvrolijken, somber, kalm, gelukkig).
EXECUTE.

*Score MHI5
COMPUTE MHI5_som = somscore_MHI5*4.
COMPUTE MHI5_2cat = 9.
IF (MHI5_som < 60) MHI5_2cat=1.
IF (MHI5_som GE 60) MHI5_2cat=2.
VARIABLE LABELS MHI5_2cat 'MHI-5 in 2 categorieen'.
VALUE LABELS MHI5_2cat 1 'psychisch ongezond' 2 'psychisch gezond' 9 'onbekend'.
MISSING VALUES MHI5_2cat (9).
EXECUTE.

* 6 is weet ik niet bij SK

RECODE SK_1 (6=SYSMIS).
EXECUTE.

* 4 is NVT

RECODE Financien (4=SYSMIS).
EXECUTE.

* Dummy Gender/isolatie
** 1 is man, 0 is vrouw, anders niet meegenomen
** 0 is isolatie niet breken of het niet weten, 1 is isolatie wel breken

DO IF(1-MISSING(change)).
RECODE Gender (2=0) (1 = 1) (3 = SYSMIS) (SYSMIS = SYSMIS) INTO GenderDummy.
RECODE IsolatieBreek (1=1) (2 = 0) (3 = 0) (SYSMIS = SYSMIS)  INTO IsolatieBreekDummy.
END IF.
VARIABLE LABELS GenderDummy 'Man vs. Vrouw'.
VARIABLE LABELS IsolatieBreekDummy 'Nietgebroken vs. Welgebroken'.
VARIABLE LEVEL GenderDummy IsolatieBreek (Nominal).
FORMATS GenderDummy IsolatieBreekDummy (F1.0).
EXECUTE.

** dummy low/middle/high educated
* Laag = 1tm4
midden 5tm6
hoog 7tm8

RECODE Opl (1 thru 4=1) (ELSE=0) INTO LaagOplVSrest.
RECODE Opl (5 thru 6=1) (ELSE=0) INTO MiddenOplVSrest.
```

```
RECODE Opl (7 thru 8=1) (ELSE=0) INTO HoogOplVSrest.
VARIABLE LABELS LaagOplVSrest 'Laag opleidingsniveau vs de rest'.
VARIABLE LABELS MiddenOplVSrest 'Midden opleidingsniveau vs de rest'.
VARIABLE LABELS HoogOplVSrest 'Hoog opleidings niveau vs de rest'.
EXECUTE.

* recofe living together

IF  (SamenKindtot3 = 1 OR SamenKind4tot12 = 1 OR SamenKind13tot17 = 1 OR
SamenKindtot18 = 1)
   SamenKinderen=1.
EXECUTE.

RECODE SamenKinderen (SYSMIS=0).
EXECUTE.
```

*Initial check of model

```
DATASET ACTIVATE DataSet1.
LOGISTIC REGRESSION VARIABLES IsolatieBreekDummy
  /METHOD=ENTER GenderDummy
  /METHOD=ENTER Leeftijd
  /METHOD=ENTER Opl
  /METHOD=ENTER WerkZorgen
  /METHOD=ENTER Gezondheid
  /METHOD=ENTER SI_GEM
  /METHOD=ENTER AVGMTR
  /SAVE=PRED PGROUP COOK LEVER DFBETA
  /CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).
```

*Computing logs

```
COMPUTE LnOpl=LN(Opl).
VARIABLE LABELS  LnOpl 'LogOPL'.
COMPUTE LnGenderDummy=LN(GenderDummy).
VARIABLE LABELS  LnGenderDummy 'LogGender'.
COMPUTE LnLeeftijd=LN(Leeftijd).
VARIABLE LABELS  LnLeeftijd 'LogLeeftijd'.
COMPUTE LnWerkZorgen=LN(WerkZorgen).
VARIABLE LABELS  LnWerkZorgen 'LogWerkZorgen'.
COMPUTE LnGezondheid=LN(Gezondheid).
VARIABLE LABELS  LnGezondheid 'LogGezondheid'.
COMPUTE LnSI_GEM=LN(SI_GEM).
VARIABLE LABELS  LnSI_GEM 'LogSI_GEM'.
COMPUTE LnAVGMTR=LN(AVGMTR).
VARIABLE LABELS  LnAVGMTR 'LogAVGMTR'.
EXECUTE.
```

```
*checking linearity of the log
LOGISTIC REGRESSION VARIABLES IsolatieBreekDummy
  /METHOD=ENTER SI_GEM GenderDummy AVGMTR Leeftijd Opl WerkZorgen Gezondheid
LnOpl*Opl
    Leeftijd*LnLeeftijd LnWerkZorgen*WerkZorgen Gezondheid*LnGezondheid
LnSI_GEM*SI_GEM AVGMTR*LnAVGMTR
    GenderDummy*LnGenderDummy
  /CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).

*Checking for multicolinearity
REGRESSION
  /MISSING LISTWISE
  /STATISTICS COEFF OUTS R ANOVA COLLIN TOL
  /CRITERIA=PIN(.05) POUT(.10)
  /NOORIGIN
  /DEPENDENT IsolatieBreekDummy
  /METHOD=ENTER GenderDummy AVGMTR Leeftijd Opl WerkZorgen Gezondheid.

* Execution of proposed model
LOGISTIC REGRESSION VARIABLES IsolatieBreekDummy
  /METHOD=ENTER GenderDummy Leeftijd Opl Gezondheid SI_GEM
  /CONTRAST (GenderDummy)=Indicator
  /CRITERIA=PIN(.05) POUT(.10) ITERATE(20) CUT(.5).

* Export Output.
OUTPUT EXPORT
  /CONTENTS  EXPORT=ALL  LAYERS=PRINTSETTING  MODELVIEWS=PRINTSETTING
  /PDF  DOCUMENTFILE='H:\output analyses.pdf'
     EMBEDBOOKMARKS=YES  EMBEDFONTS=YES.
```