



Utrecht University

## The effect of social integration on the severity of the symptoms of the common cold

*Bachelor Thesis Sociology*

**Abstract.** Multiple studies found a relationship between social integration and various physical health outcomes. However, previous studies seem to lack in providing an explanation for this relationship. Therefore, the aim of this study is to introduce an approach where psychological health and physical health are more integrated by studying the effect of social integration on the severity of the symptoms of the common cold, mediated by social support and purpose in life. This study uses the Aggregate Data (1986-2011) from the Common Cold Project to examine whether there is an effect of social integration on symptom severity, mediated by social support and purpose in life by using multiple linear regressions. The results show that this study does not find any evidence to support the hypothesized effects. However, the results show that social integration does affect social support and purpose in life.

**Keywords:** Social integration • Social support • Purpose in life • Symptom severity of the common cold • Common Cold Project

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## **Introduction**

Since the mid 1970's, the impact of social conditions on mortality and morbidity are more studied within the epidemiologic research (Berkman et al., 2000; Moore, 2017; Seeman, 1996). Throughout the 1970s and 1980s, several studies suggested that the lack of social ties predicted mortality from almost every cause of death (Berkman et al., 2000). The association between higher social integration and lower mortality risk is one of the most reported health outcomes which is related to social integration (Seeman, 1996; Ell et al., 1992). Social integration is defined as having a diverse network and therefore having multiple social roles in different social contexts (Cohen, 2000). Thus, a higher level of social integration means that the individual has a larger and more diverse society in which he/she lives in (Cohen, 2000; Seeman 1996). Multiple studies found that social isolation (the opposite of social integration) is a risk factor in life-threatening illnesses such as cardiovascular diseases and multiple types of cancer (Berman et al., 2000, Chandra et al., 1983, Ell et al., 1992, Orth-Gomér et al, 1993, Seeman, 1996; Wiklund et al., 1988).

However, social integration appears to be linked to more common and less life-threatening diseases as well, such as the common cold. Cohen and colleagues studied the link between social relationships and the susceptibility of the common cold (Cohen, 1997; 2000). The results of this study suggested that there is a significant correlation between social integration and the susceptibility of the common cold. However, via which specific mechanisms social integration affects the susceptibility of the common cold is not clear. For example, smoking and the amount of exercise in a week were associated with both social integration and the susceptibility of the common cold. However, the mediating effect of these variables accounted for too little of the relationship to act as primary explanation linking social integration and the common cold in this study (Cohen, 1997; 2000).

In addition, other studies which linked social integration to physical diseases seem to struggle with explaining *how* social integration affects physical health as well. For example, Orth-Gomér and colleagues (1993) hypothesized that men who lack social support and social integration have an unhealthy lifestyle (measured as smoking and lack of physical exercise). An unhealthy lifestyle was assumed to increase the risk of an acute myocardial infarction and death from coronary heart disease. The results of this study showed that there is a relationship between the lack of social support and social integration and higher risks of an acute myocardial infarction and death from coronary heart disease. However, they could not find

unequivocal results that could support that this relationship was mediated by an unhealthy lifestyle (Orth-Gomér et al., 1993).

Another study that struggled with explaining the link between social integration and physical health is the research by Ell and colleagues (1992). The results showed that there is a association between social relationships, social support and cancer survival. However, it seems that emotional support is a critical factor in explaining the link between social relationships and cancer survival, the mechanisms of how supportive relationships may influence cancer survival are still quite indistinct.

The problem is that despite all the previous findings over the past 30 years which provided evidence to argue that social ties are beneficial for psychological and physical health, it seems still unknown *how* social ties influence psychological and physical health (Thoits, 2011). Apparently, previous research focused more on confirming the positive influence of social relationships on various health outcomes, than on the primary intervening mechanisms (Thoits, 2011). Many previous studies lack in providing a theoretical framework which is able to explain the beneficial influence of social relationships on health outcomes and therefore, it is hard to understand the mechanisms between social ties and health (Thoits, 2011). The few studies which did provide a theoretical framework, focused exclusively on physical health or exclusively on psychological health, although it is possible these are perhaps related to each other (Thoits, 2011).

This study aims to narrow down this gap of knowledge by introducing a more integrated perspective involving psychological well-being and physical health. In order to achieve this aim, this research will study the effect of social integration on the symptoms of the common cold and will take various mediators in consideration which are linked to the psychological well-being. Cohen and colleagues studied the susceptibility of the common cold (Cohen, 1997; 2000), but the severity of the symptoms of the common cold is not studied yet, although it is quite relevant looking at the societal impact. Therefore, this study will focus on the severity of the symptoms of the common cold.

Fendrik and colleagues (2001) showed that on average an employee loses nearly 9 hours of work per cold episode in the United States. This study also indicated that 67% of the adults experience a cold at least once a year and those who suffer annually from a cold, experience on average 2.2 cold episodes per year (Fendrik et al., 2001). A more recent study showed that an even higher percentage of the American population (85%) experience a cold episode at least once a year (Dicpinigaitis et al, 2015). The impact of the absence of employees with an average of 1.09(8-hour workday) workday lost per cold episode, was

estimated by Bramley, Lerner & Sarnes (2002) as 214 million lost workdays per year due to the common cold (Bramley, Lerner & Sarnes, 2002). It is likely that the severity of the common cold symptoms will impact the absence of employees. Coping with more severe symptoms, employees are more likely to stay home from work than when they face less severe symptoms, such as only having a runny nose. Furthermore, employees with more severe symptoms are likely to be absent for a larger amount of time than when facing less severe symptoms. Thus, more severe symptoms of the common cold can result in a large amount of absence and therefore has a big societal impact.

In addition, more severe common cold symptoms can affect the productivity and the daily activities due to the fact that a cold episode can cause reduction of subjective alertness and impaired cognitive and psychomotor functioning (Smith et al., 1998; Dicipinigitis, 2015).

Furthermore, what makes the common cold an interesting disease, especially when taking the psychological well-being into account, is that it is often self-diagnosed due to its commonality and due the fact that there is often no need for medication or visiting a physician (Eccles, 2005). Thus, the perception of being ill does play an important role. Therefore, it is more related to the psychological well-being compared to other diseases.

This study aims to contribute to the knowledge derived from previous studies on *how* social integration influences health outcomes. Therefore, the main question of this study is: *“How does social integration affect the severity of the symptoms of the common cold?”* In order to answer this research question and to understand the relationship between social integration and the severity of the common cold, various mediators which are related to psychological well-being are taken into consideration.

## Theory

The first theory which linked social conditions to health outcomes was the theory of Durkheim about multiple types of suicide in his book *Le Suicide* (1897) (Berkman, 2000; Cohen, 2000). Its contribution to the link between society and health is immense due to its general explanation for behavioral patterns, where the main explanation does not rest on individual psychological factors, but on social conditions (Berkman et al., 2000; Cohen, 2000; Johnson, 1965). Therefore, Durkheim's theory (1897) is not limited to the patterns of suicide, but is wider applicable to other behavioral patterns, from homicides to cardiovascular diseases (Berkman, 2000; Cohen, 2000).

Durkheim (1897) made a distinction between four types of suicide, where all four were based on the imbalance of social integration and the regulation of morality (Thompson, 1982). High or low levels of social integration and moral regulation can disrupt individual behavior patterns by affecting their stability. Low levels of integration can lead to the absence of having a purpose in life, little social support and social control (Thompson, 1982). High levels of integration can lead to being overwhelmed and in the feeling that the importance of the individual subordinate to society (Thompson, 1982).

Many scholars are critical on Durkheim's work, and find his work too limited and not applicable for modern society (Kushner & Sterk, 2005). Despite the critiques on Durkheim's theory, it is still relevant to mention for two reasons. First, even with all the received criticism, the fundamental aspects of Durkheim's work are still the most used explanations in studies linking social capital to physical health (Cohen, 2000; Kusher & Sterk, 2005; Thoits, 2011). Therefore, it is relevant to mention this theory as a starting point for the theoretical framework. Second, Durkheim's work is considered for linking social conditions to health instead of psychological characteristics. But looking at this theory more closely, it has a social psychological perspective due to the fact that these social conditions (social control, social support and purpose in life) seem to be related to the psychological well-being. Due to its general approach, there is enough space for further additions in the field of psychological well-being. Therefore, this theory is in line with the aim of incorporating the psychological- and physical well-being.

Thus, this study will use Durkheim's theory (1897) as a starting point but will move beyond this theory by adding more detailed theories, with respect to the psychological aspects.

## Social support

Social support was mentioned in Durkheim's (1897) theory as one of the social conditions which are linked to social integration. To consider social support as a possible explanation for the link between social integration and symptom severity of the common cold, the possible effects of social support should be analyzed more extensively.

Social support is defined as the fulfillment of the individual's social needs (approval, esteem, encouragement) (Kaplan et al., 1977). These needs can be fulfilled by having social interactions (Kaplan et al., 1977). The beneficial effects of social support on psychological and physical health were shown in various studies over time (Thoits, 2011). Social support is normally performed by the individual's significant others. Therefore, the focus is on the primary group of social network members, which is a small and enduring group with more formal interactions (Thoits, 2011). Normally this group is consisted of family members and close relatives and friends (Thoits, 2011). Individuals are emotionally tied to this group, causing this group to have a significant influence on the individual's life. Social support is divided in three different types of support: emotional, informational and instrumental support (Lin & Wescott, 1991; Thoits, 2011). Emotional support is love, esteem and encouragement received from significant others. Informational support refers to informational assistance, and instrumental support refers to the material or behavioral assistance by solving problems (Lin & Wescott, 1991; Thoits, 2011).

Social support that affects physical health as a more direct way, underline the importance of social support by adopting promoted healthy behavioral patterns (Shumaker & Hill, 1991). This is usually done by providing informational support or by providing resources (instrumental support), which are beneficial for health promoting behavior (Shumaker & Hill, 1991). In the case of severity of common cold symptoms, social network members can provide additional information about what to do and what not to do when facing severe common cold symptoms. For example, significant others can encourage to stay at home by providing information of the negative consequences when going outside and going to work while being ill. Another example, which links instrumental support to symptom severity, is when a social network member will provide transport, such as offering a drive, and therefore prevents being exposed to weather conditions that have the ability of aggravating the symptoms of the common cold.

Social support that affects physical health in a more indirect way, is primary psychological based. Social support is associated with positive psychological states, such as

feeling of belonging and self-esteem (emotional support). These positive psychological states are associated with bodily changes which enhance the ability of the immune system (Cohen, 2000). The immune system is the defense mechanism that provides protection against foreign agents and infectious diseases, such as the common cold (Kaplan, 1991). Therefore, the enhanced ability of the immune system, as a result of having social support, can prevent severe symptoms of the common cold. Moreover, positive psychological states can lead to a more positive assessment of situations. With a positive psychological state, individuals are more likely to have a more positive perception of a situation. (Shumaker & Hill, 1991). This is especially relevant considering the fact that the common cold is often self-diagnosed due to its commonality (Eccles, 2005). Therefore, it is expected that the symptoms of the common cold will be perceived as less severe when having a positive psychological state.

A research by Hann and colleagues (2002) studied to impact of social support, as a result of social integration, on a depression by cancer patients. This study showed that more social support is related to less severe symptoms of depression. This confirms the assumption that more social support can lead to more positive psychological states. Although, the relationship is significant for all ages and both genders, there seem to be some differences. It is logical that the composition and size of the social network changes over time when getting older. This study confirms these changes. But interesting enough, these changes do not affect the satisfaction with the social support by showing no significant differences in social support satisfaction between younger and older cancer patients. Furthermore, the differences in gender were also quite remarkable in this study. It appears that there were no differences in the relationship between social support and the severity of the symptoms of a depression. But a larger social network was associated with less depression symptoms for females and was unrelated for males.

In conclusion, this study assumes that all three types of social support (informational, instrumental and emotional support) as a result of social integration, can affect symptom severity in a positive manner. Informational and instrumental support can be beneficial for adopting health promoting behavior and therefore preventing more severe symptoms when facing a common cold. Emotional support as a result of social integration, can lead to a positive psychological state which means that the immune system is more able to fight the common cold and prevent more severe symptoms. Also, a positive psychological state can cause a less severe perception of the symptoms while facing a common cold.



## Purpose in life

Durkheim (1897) argued that social integration can lead to having a purpose in life. Moving beyond Durkheim's theory (1897), the definition and effects of having a purpose in life should be considered in more depth.

Purpose in life is also described as a direction in life or having existential meaning (Thoits, 1983, Cohen, 2000; Reker, Peacock & Wong, 1987). Having a purpose in life refers to the intention of striving towards achieving goals and therefore making sense of one's existence (Reker, Peacock & Wong, 1987). The opposite of purpose in life, meaninglessness, can lead to negative psychological consequences, such as depressions or anxiety. It could also cause a decline in physical health (Reker, Peacock & Wong, 1987; Thompson et al., 2003).

Research showed that purpose in life is important in for every age but the perception of purpose in life differs among older and younger/middle-aged individuals. Younger and middle-aged respondents perceive purpose in life as striving towards achieving goals (in the future) and older individuals perceive purpose in life based on their achieved goals earlier in life. In addition, it seems that women are more willing to find purpose in life compared to men. (Reker, Peacock & Wong, 1987).

The 'Identity Accumulation Hypothesis' of Thoits (1983) is a theory that links purpose in life to psychological well-being (Thoits, 1983). Later on, Cohen and colleagues (2000) applied this theory to link purpose in life to the susceptibility of the common cold (Cohen, 2000). The Identity Accumulation Hypothesis (1983) focusses on social identities derived from the social roles. As earlier mentioned, the primary group of social network members is a small and enduring group with high levels of informal interaction (Thoits, 1983; 2011). Due to the longevity and high frequency of interaction, Thoits (1983; 2011) argues that these social roles contain social expectations and responsibilities. Responsibilities towards significant others will lead to avoiding risky behavior and engaging in selfcare (Thoits, 2011). Linking this to severity of the symptoms of the common cold, for example, it is likely that caregivers with responsibilities to their children or others they care for, will avoid risks of getting more ill in order to be get well as soon as possible, so that they continue their responsibilities.

Meeting the social expectations and responsibilities by doing what is expected by others, will give a satisfied feeling of belonging and will improve the self-esteem (Thoits, 1983; Cohen, 2000). As earlier mentioned, the feeling of belonging and self-esteem are associated with positive psychological states, which are associated with an enhanced ability of

the immune system to fight infectious diseases like the common cold and a more positive assessment of situations.

In conclusion, having a purpose in life derived from social roles can encourage the individual to avoid risky behavior and to engage in selfcare due to their responsibilities towards significant others. Therefore, it is expected that more social integrated individuals will face less severe symptoms when facing a common cold due to their engagement in selfcare and avoidance in risky behavior.

Furthermore, it is expected that purpose in life will have a positive effect on the psychological state. Therefore, it is assumed that purpose in life can affect symptom severity of the common cold in the same way as social support. Purpose in life will increase positive psychological states and therefore will result in less severe symptoms due to an enhanced ability of the immune system. It will also result in a less severe perception of the symptoms of the common cold, due to a more positive perspective.

### Social control theory

Social control is considered as a primary explanation by most theorists for the link between social integration and various health outcomes (Thoits, 2011). In basic terms, social control refers to the capacity of the regulation of desired norms and values in society (Janowitz, 1975). In this case, it is applied as the capacity of the social network members to monitor, control and encourage or discourage certain behavior which affects physical health. It could encourage individuals to adopt behavior that is beneficial for their physical health and it could discourage an unhealthy lifestyle. However, social control can have a negative influence as well when risky or unhealthy behaviors are promoted and encouraged by social network members, such as smoking or drinking alcohol (Thoits, 2011).

Although, social control is the most considered explanation for the link between social integration and various physical health outcomes (Thoits, 2011), multiple studies found that healthy/unhealthy behaviors, such as smoking, drinking alcohol and physical exercise, are only partially responsible for the link between social integration and physical health (Cohen, 1997, 2000; Orth-Gomér, 1993). In studying the link between social integration and susceptibility of the common cold by Cohen and colleagues (1997; 2000), the mediating effect of smoking and physical exercise was too little to be the primary explanation. In the study between social integration and coronary heart disease by Orth-Gomér & Willhelmsen

(1993), there were no unequivocal results to support the mediating effect of an unhealthy lifestyle (smoking and lack of physical exercise).

However, social control as a mediating effect via healthy/unhealthy lifestyle is too little to be the primary explanation, the effect cannot be ignored. Also, other studies showed that unhealthy behaviors such as smoking cigarettes, drinking alcohol and obesity are factors that reduce the defense ability of the immune system (MacGregor, 1989; Nieman et al, 1999; Sopori, 2002). Moreover, healthy behavior such as physical exercise has a positive effect on the immune function (Pedersen & Hoffman-Goetz, 2000).

Therefore, it is worth to mention and to take in consideration by performing the analyzes in this study.

### Deriving hypotheses

In conclusion, it is expected that higher levels of social integration can lead to higher levels of social support, purpose in life and social control. Due to the knowledge that social control via healthy/unhealthy behavioral patterns cannot be the primary explanation, this study focusses on the mediating effects of social support and purpose in life. Social support and purpose in life are both expected to be beneficial for positive psychological states. These positive psychological states are not only assumed to enhance the ability of the immune system and therefore will lead to less severe common cold symptoms but are also assumed to results in a more positive assessment of situations. Therefore, in respect to the commonality of self-diagnosing a common cold, it is assumed that the symptoms of the common cold are perceived as less severe.

Thus, this leads to the following hypothesis:

*H1: Social integration has a negative effect on the severity of the symptoms of the common cold*

*H2: Social integration has a negative effect on the severity of the symptoms of the common cold mediated by receiving social support*

*H3: Social integration has a negative effect on the severity of the symptoms of the common cold, mediated by purpose in life.*

Figure 1: Scheme of the hypothesized effects of H2, where the plus and minus indicate the expected the statistical direction of the effect.

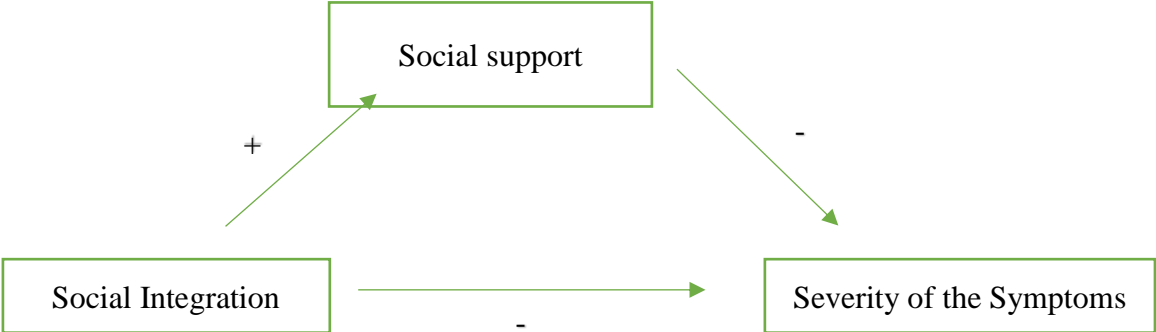
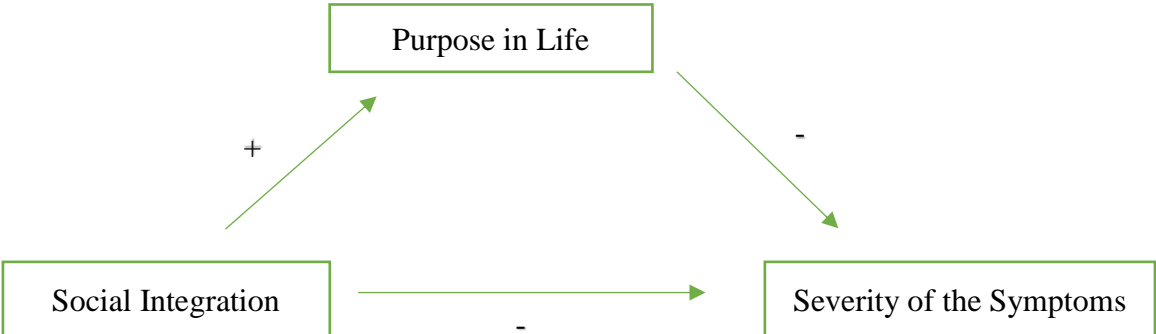


Figure 2: Scheme of the hypothesized effects of H3, where the plus and minus indicate the expected the statistical direction of the effect.



## Methodology

This study uses the Aggregate Data (1986-2011) from the Common Cold Project: 5 Studies of Behavior, Biology and the Common Cold. This project started in 2011 with the aim of creating a database which combines the research data from 5 prospective viral-challenge studies (The British Cold Study (BCS); the three Pittsburgh Cold studies (PCS1, PCS2 and PCS3); and the Pittsburgh Mind-Body Center Cold Study (PMBC)). The sample consisted of healthy adults between the age of 18 and 55 years old. The participants were experimentally exposed to a virus which could result in the common cold. After being exposed to the virus, the participants were monitored while being in quarantine for 6 days, in order to analyze the development of the infection. The number of participants was 1415 whereof 46% male and 54% female.

Due to the high non-response rate for some of the studied variables (see Table 1), the missing data was disregarded. This results in a loss of response of 61.62% (872) of the total number of participants (1415).

**Table 1. Number of valid and missing values of studies variables**

Variable	Valid	Missing
Social integration	1415	
Purpose in Life	544	871
Social support	1134	281
Severity of symptoms	1016	399
Sex	1415	
Age	1415	
Body mass	1413	2
Smoking	1412	3
Alcohol	739	676
Exercise	1015	400

After dismissing the non-response data, the descriptive statistics are presented for the total sample for this study of 543 participants. Further descriptive information about the studied variables is given in the result section.

## Variables

**The severity of the symptoms** is measured by the self-reported severity of the symptoms. As earlier mentioned, the perception of the severity of the symptoms is relevant due to the commonality of self-diagnosing the common cold and therefore being related to the psychological well-being. For this reason, the self-reported symptom severity of the common cold is used in this study. Every day in quarantine after being exposed to the virus, the participants rated the severity of the symptoms in the past 24 hours. The participants were measured 5 days in quarantine in total. The scale of the severity rating was from 0 (none) to 4 (very severe). The eight self-reported symptoms were nasal congestion, sneezing, runny nose, sore throat, cough, headache, chills, malaise and reporting having a cold or flu. The scores of all the symptoms were summed up together of each day in quarantine. To adjust the rating of the severity of the symptoms, the score of the day before the experiment was subtracted from each rating per day in quarantine. The scores per day in quarantine were summed up together, where all 5 days (the total days in quarantine) should contain a valid value. This resulted in a variable with a possible range between 0 and 160. The higher scores are associated more severe symptoms and lower scores are associated with less severe symptoms of the common cold.

**Social integration** is having a diverse social network and therefore having multiple social roles (Cohen, 2000). In order to measure the social integration, participants were given 13 social roles by questionnaire. These roles were labeled as high contact roles, assuming that the given social roles contain a high frequency of interaction. Per role, they had to answer whether they hold this role or did not hold this role. The roles that the participants answered as holding this role, were summed up together. The measured high contact social roles were being married/having a relationship like marriage, having a parent, having a child, having a child-in-law, having close relatives, having close friends, being a church/temple member, being a student, being a neighbor, being a volunteer, being another group member, being a coworker, being supervisor at work. The summed-up high contact roles have a discrete score with a possible range between 0 and 13. A lower score means that the individual has lower levels of social integration and higher scores means that the individual has higher levels of social integration.

**Social support** is measured by the Interpersonal Support Evaluation List. As earlier mentioned, social support can be divided in three types of social support: informational, instrumental and emotional support (Lin & Wescott, 1991; Thoits, 2011). The Interpersonal Support Evaluation List is made out of twelve statements that takes into consideration all three types of social support (see Appendix A.). An example of a statement that takes into account the informational support is *“There is someone I can turn to for advice about problems with family.”*. An example of a statement that takes the instrumental support into account is *“If I get sick, I could easily find someone to help with daily chores.”*. An example of a statement that takes the emotional support into account is: *“There is no one I can share my most private worries and fears with.”*. The answers were organized in a four-point scale, where the participants had to answer per statement to what extent they agreed or disagreed with the given statement (definitely false, probably false, probably true, definitely true). Before taking the average score of all twelve items, six items were scored in reverse, in order to measure the items in the same direction. For example, the statement *“There is no one I can share my most private worries and fears with.”* was scored in reverse. The scores of all twelve items were summed up together, where all 12 statements must contain valid values. This resulted in a possible range between 0 and 48. Lower scores are associated with lower levels of social support and higher scores are associated with greater levels of social support.

**Purpose in life** is measured in the Purpose in Life Scale, where participants got nine statements related to purpose in life (see Appendix B.). An example is *“I enjoy making plans for the future”*. The answers were organized in a six-point Likert scale, where the participants had to answer how strongly they agreed or disagreed with the statements. Before taking the average score from all nine items, the six negative worded items were scored in reverse, in order to measure the statements in the same direction. For example, the statement *“My daily activities seem trivial/unimportant”* was scored in reverse (see Appendix B.). The mean of the scores of the nine items, were at least seven variables must contain valid values, was multiplied by nine which resulted in a variable with a possible range between 9 and 54. Lower scores are related to poorer levels of purpose in life and higher scores are related to greater levels of purpose in life.

Six **control variables** were used which possibly provide an alternative explanation for the association between social integration and the severity of the symptoms (age, sex, body mass index, smoking, drinking alcohol and exercise). In previous cited studies, differences were mentioned for age and gender related to social support, purpose in life and the importance of social integration. Therefore, both variables are relevant to take in consideration as control variables. The age of the participants is the age they were at the screening of the research. This variable has a possible range between 18 and 55 years. Sex is a dichotomous variable (male or female). As mentioned in the theoretical framework, social control was used in previous studies as a primary explanation for the link between social integration and various health outcomes via the adoption of health promoting behaviors and health compromising behaviors. Despite the fact that the mediating effect was too small to be the primary explanation, the effect of health promoting/compromising behaviors cannot be ignored. Therefore, four variables associated with health promoting/compromising behavioral patterns are taken into consideration as control variables: Body Mass Index, smoking, drinking alcohol and exercising. Body Mass Index is measured by dividing the weight in kilograms by the height in meters as a continuous variable. Smoking (are you a current smoker: yes/no), drinking alcohol (drinking alcohol at least once a week: yes/no) and exercising (engaging in regular physical activity at least once a week: yes/no) were arranged as dichotomous variables.

## Procedure

In this study, a multiple linear regression is used in order to test the three hypotheses. With a multiple linear regression, it is possible to analyze whether various independent variables (in this study: social integration, purpose in life, age, sex, body mass, smoking, consuming alcohol and physical exercise) can predict the value of the dependent variable (the severity of the symptoms of the common cold). Moreover, a multiple linear regression is appropriate due to the fact that it allows to resolve the overall fit of the regression model by the explained variance. Due to the fact that this study focuses on detecting the specific pathways between social integration and the severity of the symptoms, a multiple linear regression is also useful due to its capacity to determine the relative contribution of each independent variable of the total explained variance.



## Results

**Table 2: Descriptive statistics of the studied variables**

	Minimum	Maximum	Mean	SD
Severity of symptoms	0	104.00	11.43	13.02
Social integration	1	11	5.48	1.84
Social support	6.00	36.00	29.65	5.65
Purpose in life	16.88	54.00	41.23	7.35
Sex	0	1	.49	.50
Age	18	55	29.36	10.57
Body Mass Index	16.25	52.54	26.80	6.12
Smoking	0	1	.39	.49
Alcohol	0	1	.46	.50
Exercise	0	1	.81	.39

When looking at the descriptive statistics of all variables (Table 2), there are a few things that stand out. Looking at the dependent variable (symptom severity), the mean is remarkably low when taking the total range (0-104) into consideration. In addition, social support and purpose in life have a remarkably high mean (Social support: 29.65; Purpose in life: 41.23) compared to the total range (Social support: 6.00-32.00; Purpose in life: 16.88-54.00).

In the attempt to answer the research question: “*How does social integration affect the severity of the symptoms of the common cold?*”, this study uses multiple linear regressions. In order to test the hypothesis derived from the theoretical framework, different regression models were made. Before using the multiple linear regression analysis, the key assumptions of normality, no multicollinearity, linearity and homoscedasticity were tested.

Before using the multiple linear regressions, the variables were tested for normality, with a normality test (see Table 3). The Skewness and Kurtosis are used to determine the shape of the distribution of the variables. Skewness measures the asymmetry of the distribution of the variable and Kurtosis measures the extremity of values which are outliers. To test for normality, the closer the Skewness is to zero (which indicate a normal distribution), the more normal the distribution of the variable is. If it is skewed to the left (mean is below the median), there is a negative skewness and vice versa for skewed to the right (mean more than median).

It seems that the dependent variable (severity of the symptoms) might not be normally distributed. Due to the high and positive value of Skewness ( $S=1.978$ ), it is likely that severity of the symptoms is skewed to the right.

**Table 3: Testing for normality by Skewness and Kurtosis.**

	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error
Severity of symptoms	1.978	.105	6.456	.209
Social Integration	.148	.105	-.135	.209
Social support	-1.148	.105	1.265	.209
Purpose in Life	-.528	.105	.123	.209

To test the linearity of the relationship between the dependent (severity of the symptoms) and de independent variable (social integration), a scatterplot was used (see Appendix C.). When linearity is at place, the values within the scatterplot should show a pattern of linearity. Looking at the scatterplot seems there is no linear relationship between social integration and the severity of the symptoms.

In order to test there is no multicollinearity, matrix of Pearson's correlation was used among all independent variables to ensure there is the correlation between the independent variables is not higher than .800. Looking at the Pearson's correlations among all independent variables, there seems to be no multicollinearity (see Appendix D.).

Furthermore, there seems to be a significant correlation between social integration and social support (Pearson's correlation = .229,  $p < .005$ ) as well as between social integration and purpose in life (Pearson's correlation = .236,  $p < .005$ ).

The last assumption is homoscedasticity. Homoscedasticity means that the error term of the residuals is the same across the regression line. Taking the scatterplot of the relationship between the independent variable (social integration) and dependent variable (severity of the symptoms of the common cold) (see Appendix C.), the error term of the residuals seems to differ across the regression line. Therefore, it is likely that there is no homoscedasticity.

To test the first hypothesis (*Social integration has a negative effect on the severity of the symptoms of the common cold*), the first regression model (see Table 6, Model 1) was computed between the independent variable (social integration) and the dependent variable (severity of the symptoms). The results show that there is a negative significant effect which is not significant of social integration on symptom severity of the common cold ( $B = -.317, t = -1.041, p = .298$ ). The R-Square measures the proportion of the explained variance of the symptom severity from social integration. In this model the R-Square is .002. These results do not provide any support to for the first hypothesis (*Social integration has a negative effect on severity of the symptoms of the common cold*). Therefore, the first hypothesis is rejected.

To test the second hypothesis (*Social integration has a negative effect on the severity of the symptoms of the common cold, mediated by social support*), the effect of social integration on symptom severity mediated by social support, was estimated by using two regression models. The estimated effect of social integration on social support (see Table 4), seems to be a significant positive effect ( $B = .632, t = 4.883, p < 0.005$ ). Looking at effect of social integration on symptom severity mediated by social support (Table 6, Model 2), adding social support results in a smaller and less significant effect of social integration on symptom severity ( $B = -.159, t = -.513, p = .608$ ). The effect of social support on symptom severity ( $B = -.250, t = -2.485, p = .013$ ) is not significant as well, but is close to significance. Furthermore, the R-square of this model is higher compared to R-square of the first regression model ( $R^2 = .015$ ). Despite the fact that the effect of social support on severity of the symptoms is almost significant, it is the second hypothesis must nevertheless be rejected.

To test the third hypothesis (*Social integration has a negative effect on the severity of the symptoms of the common cold, mediated by purpose in life*), the effect of social integration on severity of the symptoms mediated by purpose in life, was estimated by using two regression models. Looking at the effect of social integration on purpose in life (see Table 5), it appears that there is a positive significant effect ( $B = .944, t = 5.645, p < 0.005$ ). Looking at the effect of social integration on symptom severity, mediated by purpose in life (see Table 6, Model 3), the effect of social integration on symptom severity is still negative and not significant ( $B = -.244, t = -.716, p = .474$ ). The effect of purpose in life on symptom severity appears to be a negative effect ( $B = -.098, t = -1.252, p = .211$ ). This effect is not significant as well. Therefore, the third hypothesis of this study is rejected.

In order to exclude alternative explanations for the relationship between social integration and the severity of the symptoms of the common cold, the control variables (sex, age, body mass index, smoking, drinking alcohol and exercise) were added to the fourth regression model (see Table 6, Model 4). Age has a small positive effect which is not significant ( $B = .009$ ,  $t = .156$ ,  $p = .876$ ) Sex has positive effect which comes close to significance ( $B = 3.128$ ,  $t = 2.726$ ,  $p = .007$ ). All control variables related to an unhealthy lifestyle do not seem to have a significant effect either. Body Mass Index has a negative effect which is not significant ( $B = -.034$ ,  $t = -.351$ ,  $p = .726$ ). Smoking ( $B = 1.1048$ ,  $t = .891$ ,  $p = .373$ ), drinking alcohol ( $B = .239$ ,  $t = .206$ ,  $p = .837$ ) and physical exercise ( $B = .644$ ,  $t = .451$ ,  $p = .652$ ) have a positive effect which are not significant as well.

**Table 4. Regression analysis of the estimated effect of social integration on social support.**

	B	S.E.
Constant	26.185	.748*
Social integration	.632	.129*

\* $p < 0.001$

**Table 5. Regression analysis of the estimated effect of social integration on purpose in life.**

	B	S.E.
Constant	36.057	.966*
Social integration	.944	.167*

\* $p < 0.001$

**Table 6: Multiple linear regression analyses with severity of the symptoms of the common cold as the dependent variable.**

	<u>Model 1</u>			<u>Model 2</u>			<u>Model 3</u>			<u>Model 4</u>		
	B	S.E.	P	B	S.E.	P	B	S.E.	p	B	S.E.	p
Constant	13.169	1.799	.000	19.718	3.164	.000	16.704	3.324	.000	19.728	4.850	.000
Social integration	-.317	.304	.298	-.159	.310	.608	-.224	.313	.474	-.189	.315	.548
Social support				-.250	.101	.013				-.260	.113	.021
Purpose in life							-.098	.078	.211	-.035	.087	.687
Age										.009	.057	.876
Sex										3.128	1.148	.007
Body mass										-.034	.097	.726
Smoking										1.048	1.176	.373
Drinking alcohol										.239	1.163	.837
Exercise										.644	1.428	.652
R2	.002			.015			.005			.028		

## **Discussion**

Looking at the statistical analyzes of this study, it appears that the results do not provide any evidence to support the hypotheses. However, there are some interesting parts of the results from which possible new insights can arise.

It appears that social integration does not have an effect on the severity of the symptoms of a common cold. However, social integration does affect social support and purpose in life.

Furthermore, results imply that when adding social support to the multiple linear regression model, the relationship between social integration and severity of the symptoms of the common cold becomes less significant and the effect of social support is close to significance. This could imply that there is some kind of a mediating effect. However, more research is needed get more grip on this possible mediating effect, before conclusions can be drawn.

### *Limitations*

The first limitation encountered by this study is that previous studies seem to agree on the fact that there is a link between social integration and physical health due to the numerous findings that links social integration to physical diseases. The essence of the study is based on the assumption that this relationship does exist. Looking back on the findings of this study, it seems that going beyond this relationship, is still too far-fetched. Before settling on the idea of an established association between social integration and physical health, the complexity of the relationship must to be understood in a more detailed manner before applying it to a more specific context, such as the severity of the symptoms of the common cold. Further research should consider taking a step back and putting more emphasis on unraveling the intervening mechanisms between social integration and physical health by studying the intermediate steps before looking at the relationship in a broader perspective. To get a better understanding of the complexity of the relationship between social integration and physical health, a more interdisciplinary approach is needed.

Second, the results seem to confirm the assumption that social integration can lead to social support and purpose in life. In the theoretical framework, a positive psychological state was assumed to be influenced by social support as well as purpose in life. The positive psychological state will eventually have an impact on the severity of symptoms. This study did not take the intervention of the psychological well-being into account due to the fact that this study has a sociological approach. Therefore, further research should consider a more interdisciplinary approach where psychological and medical expertise allows to consider the

intervention of the psychological well-being in more depth as well as the exact impact of the psychological well-being on the immune system.

Third, this study focused on the effect of social integration on the physical health, by analyzing the association between social integration and symptom severity of the common cold mediated by social support and purpose in life. Therefore, this study overlooked the possibility of reverse causality. The physical and psychological well-being can presumably affect the level of social integration, as well as the received social support and the purpose in life. This study partially tackled the issue of reverse causality by using an experimental design. Therefore, the reversed causality of the symptom severity was excluded. However, to exclude the possible reversed causality of the psychological well-being, further research should consider a longitudinal research design to study the mutual causality in more depth.

Fourth, it is appropriate to mention that the operationalizing and analyzing procedure possibly limited the results of this study. Severity of the symptoms of the common cold was measured by eight different self-reported symptoms, which were valued equally. However, it is likely, with respect to the perception of the severity of the symptoms, that a runny nose for instance is perceived as less severe than coping with a headache. Therefore, further research should consider that not all symptoms are perceived as equally severe when measuring the self-reported severity in general. For example, this could be done by first determining which symptoms are considered as more or less severe and ranking them according to their perceived severity.

Final, taking the multiple linear regression assumptions into account, it appears that this study violates three out of the four assumptions. Looking at normality tests, it seems that the dependent variable 'severity of the symptoms of the common cold' is not normally distributed but skewed to the right. Besides, the symptom severity scored high on the Kurtosis as well, which measures the extremity of the values of the variable (outliers). This suggests that the used dependent variable was not suited for a multiple linear regression. In addition, this was also confirmed by the linearity and homoscedasticity test with a scatterplot. Due to the lack of statistical expertise and time pressure, this study was not able to consider a different analytical approach. For further research, another analytical approach must be considered when studying variables similar to this study. For example, using logarithmic transformations with appropriate caution. Otherwise, for using a multiple linear regression, a different dataset must be considered that contains more normal distributed variables.

## Conclusion

Findings of studies over the past 30 years suggest there is a link between social integration and various physical health outcomes. The lack of social ties seems to be a risk factor in almost every cause of death. The results are impressive; social integration has a protective effect on life-threatening diseases, such as different types of cancer and cardiovascular diseases. Also, on more common and less life-threatening cases, such as the susceptibility of common cold. Thoits (2011) brought up the questionable situation, where scholars seem to be willing to underline the importance of social ties but are not able to provide an appropriate theoretical framework, nor seem to be able to analyze the complexity of the link between social ties and physical health. In addition, previous studies focused exclusively on psychological health or exclusively on physical health. Therefore, this study aimed to introduce an approach where psychological health and physical health are more integrated by studying the effect of social integration on the severity of the symptoms of the common cold. This led to the following research question: “*How does social integration affect severity of the symptoms of the common cold?*”. Taking psychological aspects into consideration, the following three hypotheses were derived: *H1: Social integration has a negative effect on the severity of the symptoms of the common cold; H2: Social integration has a negative effect on the severity of the symptoms of the common cold mediated by receiving social support; H3: Social integration has a negative effect on the severity of the symptoms of the common cold, mediated by purpose in life.*

This study used the Aggregate Data (1986-2011) from the Common Cold Project: 5 Studies of Behavior, Biology and the Common Cold. The results of this study did not provide any support to confirm the derived hypotheses. However, this study did find a significant relationship between social integration and social support as well as between social integration and purpose in life. In addition, it is relevant to mention that despite the fact that the results were not significant, the mediating effect of social support came close to significance.

The encountered limitations of this study suggest that future research should consider putting more emphasis on unraveling the complexity of the link between social integration and physical health. Therefore, a more interdisciplinary approach must be considered due to the fact that it seems that the link between social integration and physical health goes beyond the boundaries of one single approach.



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## Appendix A.

The twelve statements of the Interpersonal Support Evaluation List (Social support)

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Statements of the Interpersonal Support Evaluation List	
1.	If I go on a trip, I have a hard time finding someone to go with me.
2.	There is no one I can share my most private worries and fears with.
3.	If I am sick, I could easily find someone to help with daily chores.
4.	There is someone I can turn to for advice about problems with family.
5.	If I go to a movie, I could easily find someone to go with me.
6.	If I need suggestions on personal problems, there is someone I can turn to.
7.	I don't often get invited to do thing with others.
8.	If I had to go out of town, it is difficult to find someone to look after my place
9.	If I want to have lunch with someone, I could easily find someone.
10.	If I am stranded 10 miles from home, there is someone I could call to get me.
11.	If there is a family crisis, it is difficult to find someone to give me good advice.
12.	If I need help moving, I am having a hard time finding someone to help.

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The six statements of the Interpersonal Support Evaluation List, which are measured in reversed direction.

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Reversed statements	
1.	If I go on a trip, I have a hard time finding someone to go with me.
2.	There is no one I can share my most private worries and fears with.
3.	I don't often get invited to do thing with others.
4.	If I had to go out of town, it is difficult to find someone to look after my place
5.	If there is a family crisis, it is difficult to find someone to give me good advice.
6.	If I need help moving, I am having a hard time finding someone to help.

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## Appendix B.

The nine statements of the Purpose in Life Scale (Purpose in life)

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Statements of Purpose in Life Scale	
1.	I live life one day at a time, I don't think about the future
2.	I enjoy making plans for the future
3.	I tend to focus on the present, because the future brings me problems.
4.	My daily activities seem trivial/unimportant
5.	I don't have any sense of what I am trying to accomplish in life.
6.	I am active in carrying out plans
7.	I was used setting goals, but now it seems like a waste of time.
8.	Some people wander aimlessly. I am not one of them.
9.	I feel like I've done all there is to do in life.

---

The six statements of the Purpose in Life Scale which are measured in the reversed direction.

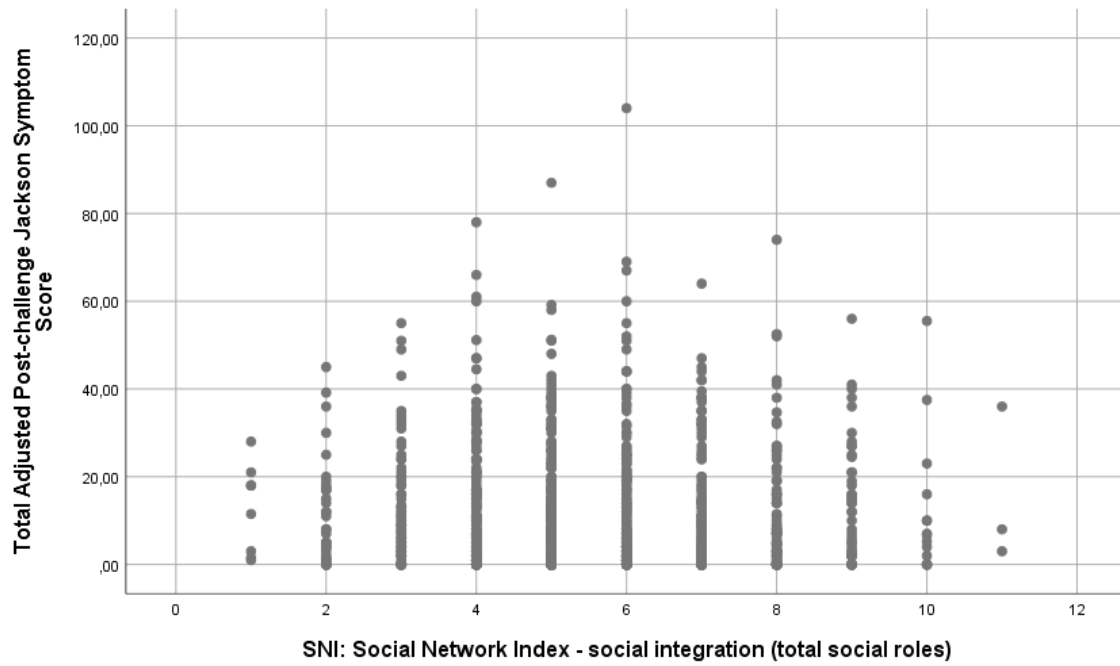
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Reversed statements	
1.	I live life one day at a time, I don't think about the future
2.	I tend to focus on the present, because the future brings me problems.
3.	My daily activities seem trivial/unimportant
4.	I don't have any sense of what I am trying to accomplish in life.
5.	I was used setting goals, but now it seems like a waste of time.
6.	I feel like I've done all there is to do in life.

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## Appendix C.

Figure x: Scatterplot Social integration and Severity of the Symptoms



## Appendix D.

Pearson's correlations between all independent variables

	Social integration	Social support	Purpose in life	Age	Sex	Body Mass Index	Smoking	Drinking alcohol	Physical exercise
Social integration	1	.229**	.236**	.119**	.187**	.017 (.514)	-.118**	-.037 (.312)	.102**
Social support	.229**	1	.432**	-.028 (.350)	.096**	.061*	.039 (.195)	.108**	.059 (.109)
Purpose in life	.236**	.432**	1	-.106*	.131**	-.016 (.703)	-.108*	-.066 (.126)	.089*
Age	.119**	-.028 (.350)	-.106*	1	.040 (.131)	.206**	.079**	-.050 (.172)	-.072*
Sex	.187**	.096**	.131**	.040 (.131)	1	.027 (.309)	-.134**	-.182**	-.013 (.684)
Body Mass Index	.017 (.514)	.061*	-.016 (.703)	.206**	.027 (.309)	1	-.006 (.824)	-.091*	-.079*
Smoking	-.118**	.039 (.195)	-.108*	.079**	-.134**	-.006 (.824)	1	.185**	-.097**
Drinking alcohol	-.037 (.312)	.108**	-.066 (.126)	-.050 (.172)	-.182**	-.091*	.185**	1	.026 (.485)
Physical exercise	.102**	.059 (.109)	.089*	-.072*	-.013 (.684)	-.079*	-.097**	.026 (.485)	1

\* p<.05

\* p<.005