UNIVERSITY OF TWENTE.

Psychology

Bachelor thesis

The changes in and impact of social support on COPD patients who participated in the REDUQ study and their readiness-to-quit smoking

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Abstract

Introduction. Smoking cessation has shown to be the most effective treatment for COPD, slowing down the progress in the decline of the lung function. Therefore, smoking cessation programs have been developed to aid COPD patients with to stop or reduce smoking. The REDUQ study was an intervention that aimed to help Dutch, smoking COPD patients to reduce their smoking behavior. A successful reduction was hoped to motivate the participants to make a quit attempt. However, the REDUQ study showed no significant improvement of smoking reduction over an eighteen month span between the intervention and the control group. Therefore, interest has grown to examine the cognitive and behavioral processes that potentially aid or hinder smoking cessation among the target group. The main focus of this paper are the questions whether social support changed significantly among the participants during the REDUQ intervention and whether social support predicts readiness-to-quit over time.

Methods. A 26 week SCED study was introduced before and during the active reduction phase of the REDUQ (II) study. Telephone questionnaires were obtained weekly. For each of the four participants included, multiple linear regression analyses were applied while controlling for autocorrelation.

Results. Social support did not change significantly over time in three participants but showed a weak but significant decline for one participant in the control group. Furthermore, it was not indicated that there is a different pattern in the change of social support among participants in the intervention group and those in the control group. Social support did not predict readiness-to-quit significantly for any participant. Moreover, autocorrelation was shown to have a strong, significant impact on social support as well as readiness-to-quit.

Discussion. Taken together the results indicated that social support does not change significantly during the course of the REDUQ study. Furthermore, social support does not influence the change of readiness-to-quit significantly among the participants. These findings are in contrast to previous research. They also contradict the ASE – model which claims that social support is a significant predictor for smoking cessation. Future research should examine various sub-variables of social support and their correlation to smoking cessation.

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1. Introduction

1.1 COPD & Smoking

Chronic obstructive pulmonary disease (COPD) is an illness that causes a progressive decline in the lung function (GOLD, 2016). The patient's airflow is usually limited as a result of an inflammation of the pulmonary system (GOLD, 2016). COPD is prevalent in developed as well as developing countries (GOLD, 2016). In the Netherlands there was a yearly prevalence of 323.600 diagnosed cases as of 2007 (Gommer & Poos, 2011). As formulated by the Global initiative for chronic obstructive lung disease (GOLD, 2016), it is a preventable and also treatable but not fully reversible disease. The severity is determined along a scale from mild (1) to very severe (4) (GOLD, 2016). Hansell, Walk and Soriano (2003) showed that COPD is highly prevalent as underlying as well as contributing cause of death. That is also indicated by the notion that in the Netherlands 5.984 persons died of COPD in 2010 (Gommer & Poos, 2011). There are various reasons that can lead to the development of COPD. However, by far the most common factor is smoking (Fletcher & Peto, 1977). Not only is smoking cessation a way to prevent COPD but it also has a mitigating effect when the illness is already prevalent. The abstinence of cigarette smoking slows the decline of lung function (Comstock, Brownlow, Stone, & Sartwell, 2008). That is the reason why the first and most important step of treatment for COPD is smoking cessation (GOLD, 2016). Nevertheless, most smoking COPD patients do not quit even after taking part in a smoking cessation intervention (Jiménez-Ruiz et al, 2001). Moreover, COPD patients seem to be even more resistant towards smoking cessation interventions than smokers without the illness (Jiménez-Ruiz et al, 2001). Still, there are some interventions that show at least some promise in smoking cessation among COPD patients (Tønnesen, Mikkelsen & Bremann, 2006). Among others Tønnesen et al. (2007) indicated that especially cessation interventions consisting of a combination of pharmacological and psychotherapeutic treatment are more successful to aid smoking cessation in COPD patients than either one alone. However, in order for those interventions to be effective smokers must be willing to stop smoking in the first place. According to the Continu Onderzoek Rookgewonten (COR) just 65 % of the Dutch smokers of 15 years or older have ever made a serious quit attempt as of 2014 (Van Laar et al., 2015). For those not interested in quitting or those who feel not capable to quit smoking, smoking reduction could potentially be an alternative (Batra et al., 2005). The goals for smoking reduction can be one of two possible natures: Either the reduction itself is the goal or the reduction is seen as a step towards complete smoking cessation (Chan et al., 2011). The former can be problematic because the effects of smoking reduction on health and specifically COPD are not clear. Simmons et al. (2005) found that a large reduction of the number of smoked cigarettes has somewhat of a mitigating effect on the decline of respiratory functions in COPD patients. However, they did not find a linear effect and the

effects detected were minimal. Furthermore, Hughes and Carpenter (2005) reported that the possible smoking reduction effects on health are limited due to compensation behavior. That means smokers who consciously reduce smoking tend to compensate their nicotine intake, by for instance smoking cigarettes with a higher nicotine content.

The danger of smoking reduction as a step towards cessation is that a successful reduction can cause the respective individual to feel that he 'has done enough for his health' which would be counterproductive to motivate him for engaging in smoking cessation (Chan et al., 2011). On the other hand there are also reasons supporting the appliance of smoking reduction interventions. For example Bandura's self-efficacy theory (1977) can be used to argue that the experience of successful reduction of the smoking habit causes a greater feeling of self-efficacy for the smoker. The smoker feels capable to quit smoking and is thus more motivated to do it. Also research indicates that a smoker is less dependent on nicotine after successful reducing which makes it easier for him to quit altogether (Wennike, Danielsson, Landfeldt, Westin, & Tønnesen, 2003). This is further supported by Le Houezec and Säwe (2003) who found in their review that smokers not willing to quit at baseline are more likely to be abstinent at four months, one and two years follow-up after undergoing a smoking reduction program. Therefore the focus of the so-called REDUQ study lays on smoking reduction as a step towards complete cessation.

1.2 The REDUQ studies

The REDUQ study targeted COPD patients that did not want or did not feel capable to quit smoking. The study includes active treatment to aid the participants reduce their smoking behavior. The ideal outcome, however, is that the participants create enough motivation to try to quit smoking completely. The study was implemented with Dutch, smoking COPD patients who were either not willing or did not feel capable to quit smoking within the next month. They were randomly assign to one of two conditions. Condition one was a group smoking reduction program combined with Nicotine Replacement Therapy (NRT) (intervention group). The second condition was a self-help program consisting of an information meeting and a self-help manual to reduce smoking (control group). The participants completed questionnaires at baseline and follow-ups until eighteen months after treatment start. Contrary to the research hypothesis the findings showed no significant differences in the reduction and cessation rates between the conditions. An additional study (REDUQ II) was developed to gather more in-depth information on the cognitive and behavioral determinants and predictors that indicate the success of such a smoking reduction intervention and subsequent cessation. 22 smoking COPD patients were successfully included in the study. The two interventions remained the same as in the REDUQ I study. To survey the cognitive and behavioral determinants

and possible changes within the participants a 'Single Case Experimental Design' (SCED) part was added to the REDUQ II study. Single case means one unit which can be a person, a neighborhood or in general a group. A major difference between the so-called SCED studies and cross-sectional group comparisons is that the latter are applied to compare between groups at a single time slot while the former is focused on the change within an individual over different time slots (Vandenbos et al., 2006). During the SCED study the participants completed weekly questionnaires five to eight weeks before the treatment, throughout the 13 weeks of active smoking reduction treatment as well as five to eight weeks after the active reduction treatment.

1.3 Social influence

Over the years different cognitive determinants and potential predictors of successful smoking cessation have been examined (Hymowitz et al., 1997). Among others, the potential effects of different social aspects gain attention such as marital status, social class determined by occupation and social support (Chandola, Head, & Bartley, 2004). A theoretical framework that includes social constructs as predictors for behavioral change is the attention – social influence – self-efficacy (ASE) model provided by De Vries, Dijkstra and Kuhlman (1988), a model that has been proven to effectively evaluate and predict health behaviors in cross-sectional studies (De Vries & Backbier, 1994) as well as longitudinal studies (De Vries & Mudde, 1998). In their work of De Vries and Backbier (1994) demonstrate the predictive value of social support for pregnant women who try to stop smoking. In the present study the focus lies on the construct social support and its change over time in COPD patients during the REDUQ II study:

1. (How) does social support change over time among smoking COPD patients participating in the REDUQ II study?
2. Does social support change differently among participants in the intervention group (SRT) and those in the control group (self-help program)?

De Vries and Mudde (1998) adjusted another feature of the ASE model, the inclusion of the transtheoretical model (TTM) of change to smoking cessation behavior. They picked up the research of Prochaska et al. (1988) who had applied the transtheoretical model to smoking cessation processes. According to Prochaska, Velicer, DiClemente and Fava (1988) five stages of change can be defined and applied to smoking cessation. Precontemplation labels smokers who do not intend or make plans to quit smoking. The contemplation phase refers to smokers who intend to quit within six months. Smokers in the action phase are actively stopping or have stopped smoking within the past six months while individuals in the maintenance phase have stopped for more than six months.

Those in the relapse phase are participants who had stopped within the last six months but have started smoking again. De Vet, Brug, Nooijer, Dijkstra and de Vries (2005) added another one of Prachaska's stages, the preparation phase. They formulated that individuals in the preparation phase plan to change their behavior within the next month. In their Delphi study De Vet, Brug, Nooijer, Dijkstra and De Vries (2005) indicated that different variables influence the transition from one phase to another. Many variables have an stage-related impact. For instance, the awareness for an unhealthy behavior and the own consequences of it are particular important for the transition from the precontemplation to the contemplation stage but not as much for the transition from preparation to action stage. Very few variables were shown to have an impact throughout all stages of the transtheoretical model. One variable that indicated to influence the transition throughout all was social support. Therefore, the relation between social support and 'readiness-to-quit' (which is comparable to Prochaska's stage of change) is examined in the present study.

3. Is there a relation between social support and readiness-to-quit smoking over time in COPD patients participating in the REDUQ II study?

2. Methods

2.1 Design & Procedure

For the REDUQ study a randomized single case experimental ABA' design with multiple baseline conditions was used. Thus participants underwent a baseline phase (A) with various measurement moments, a thirteen week treatment phase (B) and a follow-up phase (A'). It was not expected that the participant's behavior and cognitions would return to baseline conditions during this phase. Additionally, participants were allocated to four different baseline conditions starting from eight to five weeks before the intervention start. The participants were randomly assigned by minimization. The participants' groups and conditions were labelled openly.

To recruit COPD patients for the study explanations about the study, its goals and rough content were given to potential participants. Short telephone interviews were conducted to check preliminary eligibility for the study. If fulfilling the requirements, the patient was invited to an information meeting. Furthermore, the patient received an informed consent form. After providing informed consent the participant was seen by a lung physician to check for the final inclusion criteria. Then he filled in an extended questionnaire regarding demographics, smoking habits and history, motivation to change his or her smoking habit, nicotine dependence, social influences, depressive and anxiety symptoms and health conditions. Subsequently the participants were allocated to either the control group or the intervention group.

The participants in the control group met for a general information event of one hour where they received a self-help manual on how to reduce smoking. In the intervention group participants took part in a treatment consisting of behavioral counseling and use of Nicotine replacement therapy (NRT). The latter was offered for free during a twelve week span. The therapeutic part consisted of eight group session (one and a half hour per session) plus four check-in phone calls over 18 months. However, the SCED study and this research paper focus on a 26 week span which includes the thirteen weeks of active smoking reduction. If any participant in either condition declared to be ready to quit smoking he or she would be stimulated to enter an intensive cessation intervention. The study and treatment took place at the pulmonary outpatient clinic of the "Medisch Spectrum Twente" hospital Enschede. Furthermore, patients were allowed to apply their usual medication intake.

2.2 Sample

In total 22 participants were included in the REDUQ II study which were enlisted through the "Medisch Spectrum Twente" hospital Enschede. All participants needed to fulfill a variety of requirements that were the clinical diagnosis of COPD according to the GOLD standards, the consumption of at least ten cigarettes daily, motivation to reduce daily cigarette consumption, having tried to quit smoking unsuccessfully two or more times and being between forty and eighty years of age at the start of the study. Criteria for exclusion from the study were pregnancy or breast feeding, language barriers (not understanding or speaking Dutch), serious psychiatric morbidity and contra-indications of NRT's. Furthermore, only participants were included that did not intend to quit smoking within one month after baseline.

2.3 Measurements

For the REDUQ II study participants filled in a questionnaire about the topics current smoking behavior, their smoking history and quit attempts, attitude, self-efficacy, social influence and motivation to change their smoking behavior. In addition, questionnaires about anxiety and depression (HADS) (Spinhoven et al., 1997) and health status (EQ5D [The EuroQol Group, 1990] and COPD questionnaire CCQ [Van der Molen, 2003]) were administered. Additionally, a lung function test was taken at baseline. At the start and end of the thirteen week treatment phase there were also salivary cotinine and expired-air CO measurements obtained from the participants.

Depending on the research condition participants started eight to five weeks before the beginning of treatment to answer weekly a short telephone questionnaire. The questionnaire was

administered 26 weeks throughout the treatment phase until five to eight weeks after the active reduction to measure readiness to quit, smoking consumption, adherence to treatment/ NRT's or other cessation medication, social influences, self-efficacy and urges to smoke. Those questionnaires were administered by assistant researchers who did not know which condition and group the participants were allocated to.

For the present study *social support* was measured by the item 'Do people in your environment stimulate you to quit smoking/ stay abstinent?'. The respondent was asked to answer on a 5-point Likert scale with either 'Not applicable', 'No', 'A little bit', 'Average' or 'A lot'. The participant's answers were converted into numeric scores. 'Not applicable' was scored as a 0, 'No' as a 1, 'A little bit' as a 2, 'Average' as a 3 and 'A lot' as a 4.

Readiness-to-quit smoking was measured by the item 'Do you plan to stop smoking?' with the possible answers 'No, I do not plan to stop smoking and I do not plan to reduce smoking', 'No, I do not plan to stop smoking but I plan to reduce smoking', 'Yes but not within five years', 'Yes within five years', 'Yes, within a year but not within the upcoming six months', 'Yes, within six months but not within the upcoming three months', 'Yes within three months but not within the upcoming month', 'Yes within a month but not within the upcoming week', 'Yes within a week' and 'I have quit already on [date of quitting]'. These scores were converted as well. 'No, I do not plan to stop smoking and I do not plan to reduce smoking' was scored as a 1, 'No, I do not plan to stop smoking but I plan to reduce smoking' as a 2, 'Yes but not within five years' as a 3, 'Yes within five years' as a 4, 'Yes, within a year but not within the upcoming six months' as a 5, 'Yes, within six months but not within the upcoming three months' as a 6, 'Yes within three months but not within the upcoming month' as a 7, 'Yes within a month but not within the upcoming week' as a 8, 'Yes within a week' as a 9 and 'I have quit already at [date of quitting]' as a 10.

2.4 Data analysis

2.4.1 Selection of participants, missing values and descriptives

For the data analysis four participants were chosen, two from the control group and two from the intervention group. In order to be included in the analysis the data set of a participant was required to have at most two missing values for each relevant variable (social support, readiness-to-quit). Furthermore, no data sets were included of participants who were allocated to the same group (control/intervention) and condition (starting at eight weeks, seven, six, five before treatment) at the same time. Two participants were selected from condition D. However, they were not allocated to the same group. Additionally, a balanced spreading between male and female participants was

emphasized as far as possible (one female and three male participants were included because there were 15 male participants in the REDUQ II sample against seven female). In total two missing values had to be imputed using the average of the directly preceding and the directly following score.

Table 1 – Participants' characteristics

	Gender	Age	Group	Condition	Missing values
Participant 1	Male	50	Control	D (starting 5 weeks before treatment)	1
Participant 2	Male	77	Intervention	D (starting 5 weeks before treatment)	1
Participant 3	Male	56	Intervention	A (starting 8 weeks before treatment)	-
Participant 4	Female	56	Control	B (starting 7 weeks before treatment)	-

For all analyses participants' data was analyzed in separate data sets of SPSS. In order to make a general assessment descriptives including mean, median, standard deviation, variance, minimum and maximum and thus frequencies of the relevant variables of each participant were analyzed. Graphs were created to visualize the development of the participants' scores on the two relevant variables. Furthermore, for each participant the autocorrelation of the social support and readiness-to-quit variable was controlled for.

2.4.2 Research question 1

In order to answer research question one, '(How) does social support change over time among smoking COPD patients participating in the REDUQ II study?', a multiple linear regression analysis was applied. The independent variables included in the model were 'time' and a lag 1 variable of social support. This way the model takes into account the potential autocorrelation of the dependent variable social support (IBM, 2012). For time there was no need to create a lag variable as the original variable is directly time-bounded.

2.4.3 Research question 2

To answer the second research question, 'Does social support develop differently among participants in the intervention group (SRT) and those in the control group (self-help kit)?' a multiple linear

regression analysis was applied. Similar to the previous regression, time and 'social support lag 1' were used as independent variables and 'social support' as dependent variable. In contrast, this analysis was restricted to the thirteen measurement moments during the treatment phase thus using an n = 13 frame.

2.4.4 Research question 3

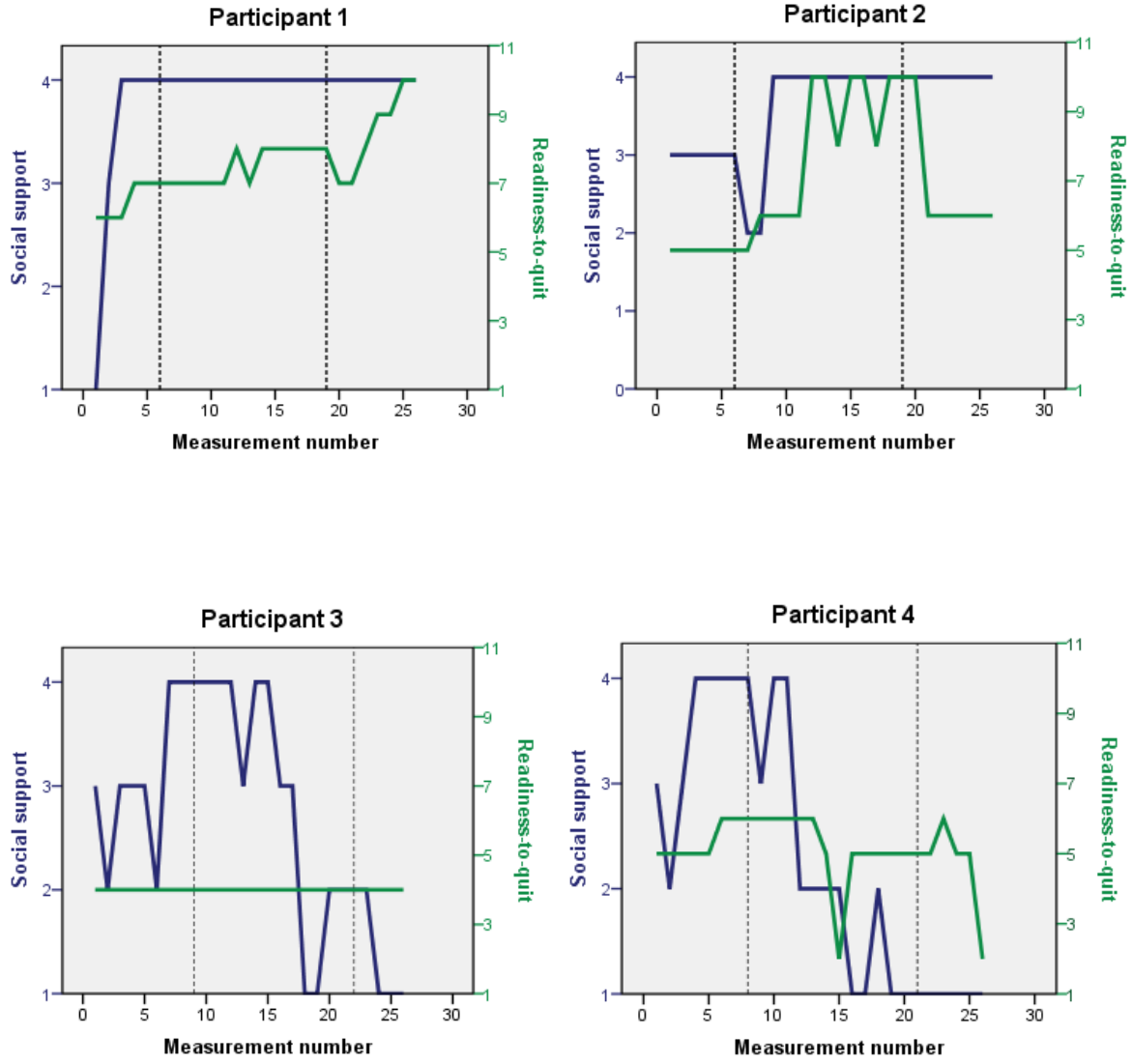
For the third research question 'Is there a relation between social support and readiness to quit smoking over time in COPD patients participating in the REDUQ II study?' a multiple linear regression was applied which included the independent variables 'social support', 'social support lag 1', 'readiness-to-quit lag 1' and the dependent variable 'readiness-to-quit'. By involving the two lag variables autocorrelation was taken into account both on X and on the Y axis (IBM, 2012).

3. Results

3.1 Descriptive values

For social support the mean score reached from $\bar{x}_4 = 2.27$ ($SD_4 = 1.251$) over $\bar{x}_3 = 2.69$ ($SD_3 = 1.123$) and $\bar{x}_2 = 3.62$ ($SD_2 = .635$) to $\bar{x}_1 = 3.85$ ($SD_1 = .613$). Thereby the higher the average was for social support the lower was its standard deviation. There was a noticeable gap between the mean scores as well as standard deviations of participant 1 and 2 (high mean score, low standard deviation) and participant 3 and 4 (lower mean score, higher standard deviation). Except for participant 2 the minimum-maximum range was 1 (= no support) to 4 (= a lot of support). For participant 2 the range was 2 (= little support) to 4. For readiness-to-quit the mean scores and respective standard deviations were $\bar{x}_1 = 7.58$ ($SD_1 = 1.065$), $\bar{x}_2 = 6.96$ ($SD_2 = 2.029$), $\bar{x}_4 = 5.12$ ($SD_4 = 1.033$). For participant 3 the score averaged $\bar{x}_3 = 4$ with no standard deviation $SD_3 = 0$. Thus there was no variability at all. Subsequently participant 3 was excluded from further analysis involving the variable readiness-to-quit as the constant value makes a regression analysis impossible.

In the following there is a visual analysis to gather indications and trends among the participants' scores. Still, the statistical analyses have much more decisive weight. Thus the visual analysis can merely be seen as indications. An explanation therefore is given in the 'Discussion' section.



Figures 1-4. Participants' scores on social support and readiness-to-quit over the examined 26 week span. The dotted lines mark the transition to the following phase (ABA').

The scores of social support for participant 1 and participant 2 increase quickly and remain high throughout the rest of the study. The increase is stronger for participant 1 than participant 2. Also participant 3 and participant 4 show a similar pattern in their social support score. Both scores start at an average level decline shortly and rise subsequently before the start of the active treatment phase. During the treatment phase both scores decline strongly and remain low. Both participant 1 and participant 2 quit smoking at a given point throughout the course of the study. Overall their readiness-to-quit scores are higher than those of participant 3 and participant 4. Still, participant 1 shows some kind of gradual increase while participant 2 reaches the peak score (stopped smoking) several times during the reduction phase but the scores decline during the follow up. For most of the 26 weeks participant 4's score stays between five and six but two times (including

the last score) it declines to two (not wanting to quit but to reduce smoking). As previously mentioned participant 3 shows no change in his readiness-to-quit score throughout the whole 26 week span.

3.2 Autocorrelation

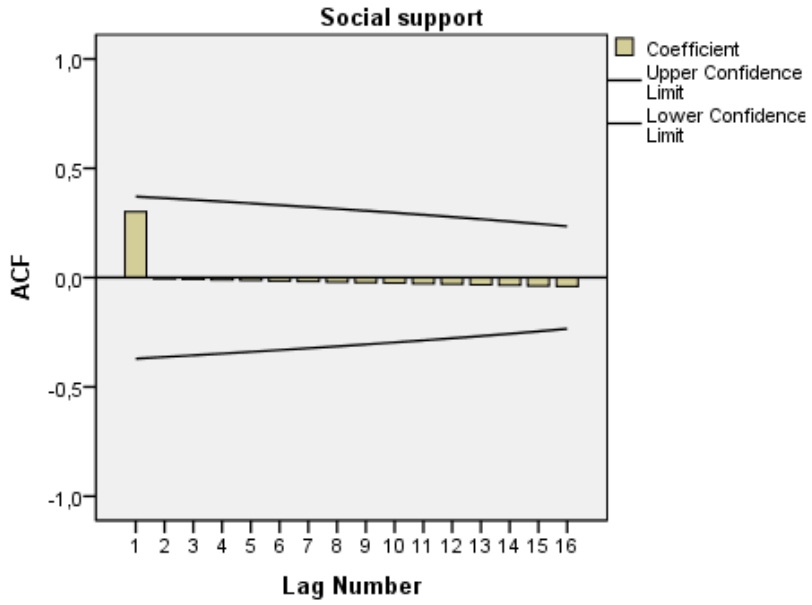


Figure 5. Autocorrelation of the social support score of participant 1.

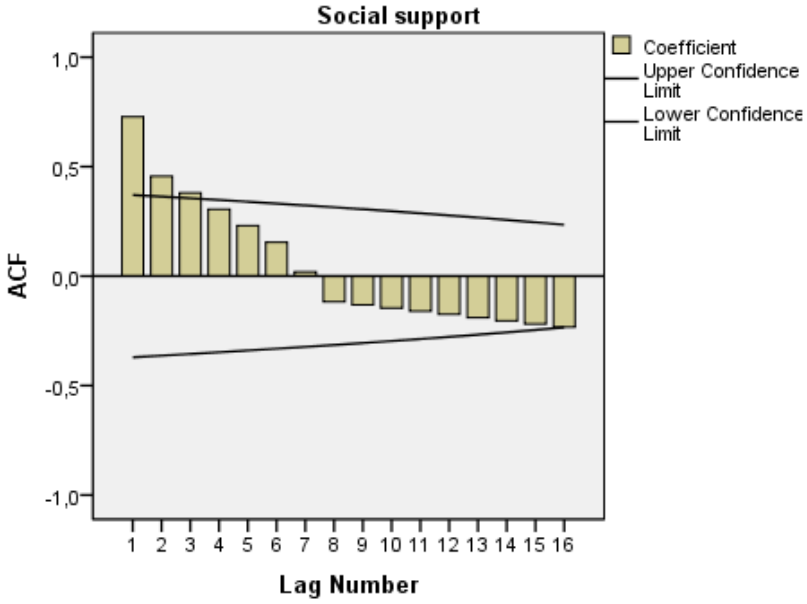


Figure 6. Autocorrelation of the social support score of participant 2.

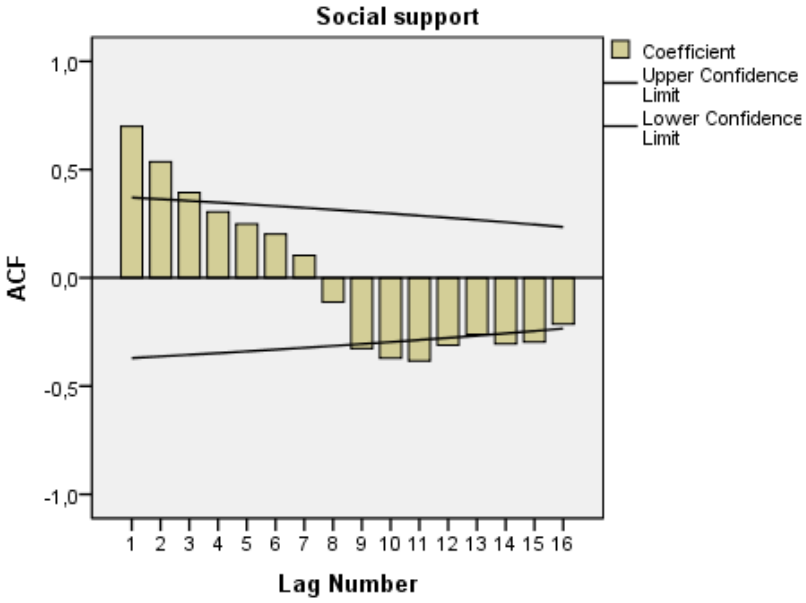


Figure 7. Autocorrelation of the social support score of participant 3.

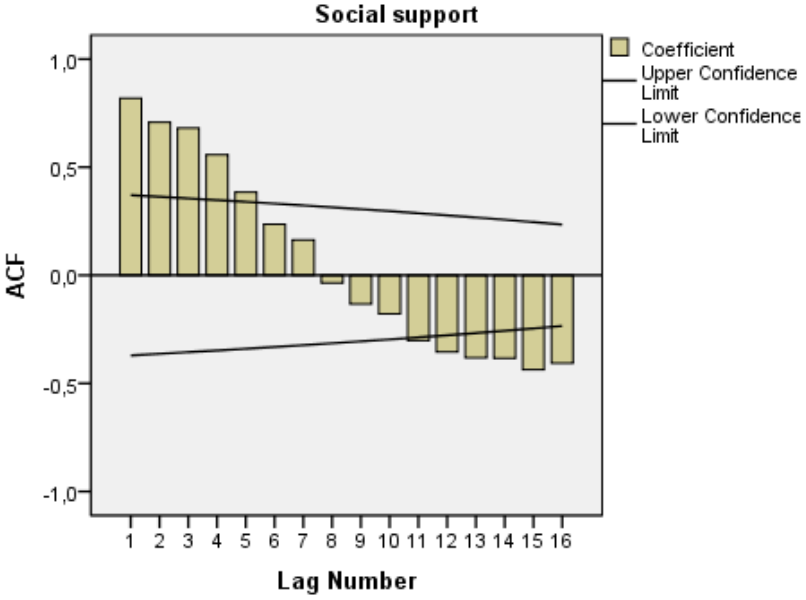


Figure 8. Autocorrelation of the social support score of participant 4.

For participant 1 there is no indication of a significant autocorrelation in the social support score (Appendix A). For all other participants the social support score shows significant autocorrelation for all 16 lags as well as strong significant autocorrelation for at least the first three lag scores (Appendix A). For those participants especially lag1 shows a noticeable strong autocorrelation. Since the measurement intervals used were one-week intervals (n=26) the lag1 output remains the most relevant output for this research. Thus autocorrelation shows a high correlation between consecutive scores on social support.

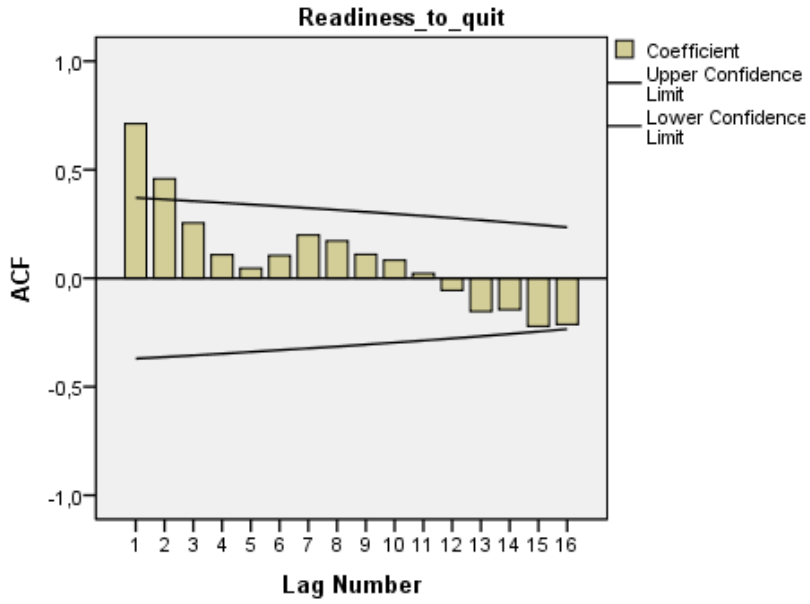


Figure 9. Autocorrelation of the social support score of participant 1.

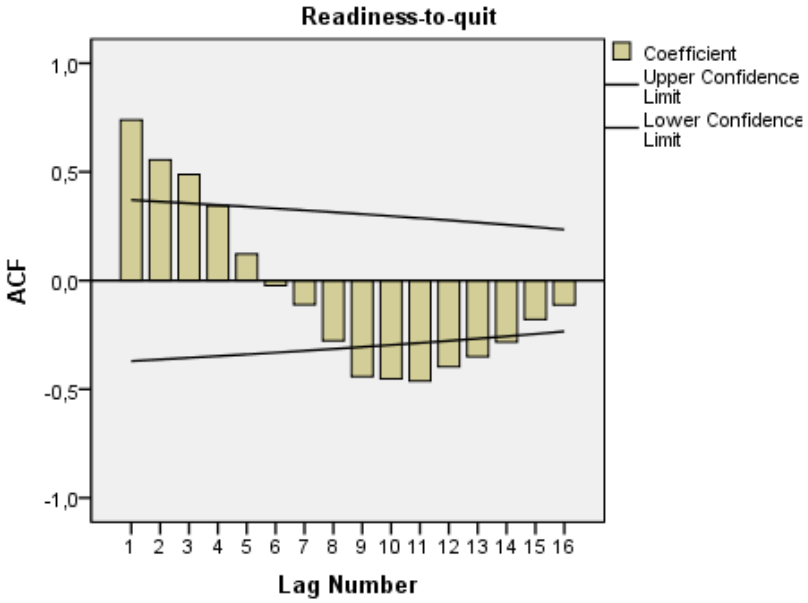


Figure 10. Autocorrelation of the social support score of participant 2.

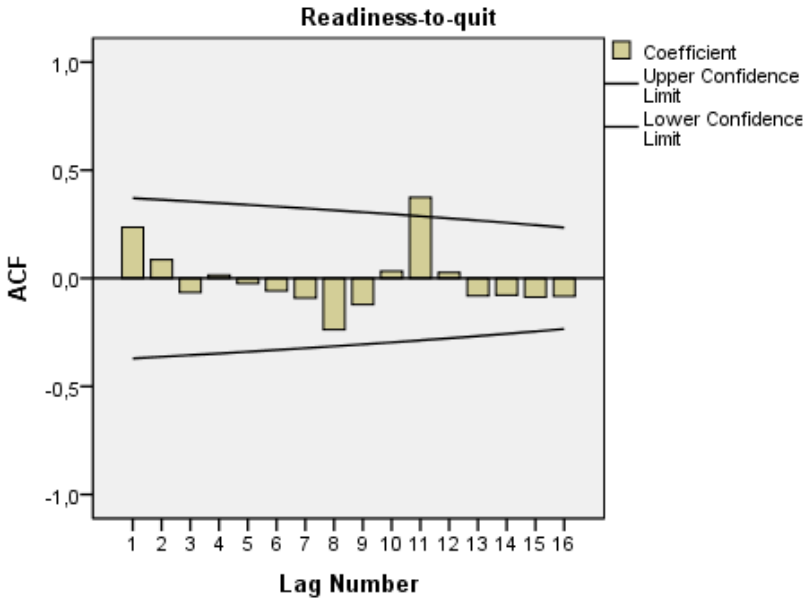


Figure 11. Autocorrelation of the social support score of participant 4.

For participant 1 and 2 significant autocorrelation was shown to be present for all sixteen lags (Appendix B) and for at least lag1 and lag2 the autocorrelation was strong. Especially lag1 showed noticeable strong autocorrelation and thus it shows a high correlation between consecutive scores on readiness-to-quit. For participant 4 lag11 showed a strong autocorrelation. However, none of the 16 lags showed significant autocorrelation (Appendix B).

3.3 (How) does social support change over time among smoking COPD patients participating in the REDUQ II study?

The multiple regression analyses showed that time and autocorrelation account for a big amount of the variability in the development of social support in all of the participants. The adjusted R squared reached from $\overline{R}^2_3 = .56$, $F_3(2, 22) = 16.53$, $p_3 < .001$, over $\overline{R}^2_2 = .57$, $F_2(2, 22) = 17.04$, $p_2 < .001$ and $\overline{R}^2_4 = .75$, $F_4(2, 22) = 36.77$, $p_4 < .001$ to $\overline{R}^2_1 = .89$, $F_1(2, 22) = 101{,}96$, $p_1 < .001$. All of the models were significant for a $\alpha = .01$ level. Time as independent variable did not reach significance as a predictor for social support for pp1, pp2 and pp3. For participant 4 time did not predict social support significantly for a $\alpha = .01$ level but for $\alpha = .05$. Still, its power with $ß_4 = -.4$ remained relatively weak. That means within this model time accounts for a decline of .4 SD per week. To put it in a different way B_4 is -.07 which means that per week moving forward time accounts for a decline of .07 scores on social support. The positive correlation of the autocorrelation is much stronger with $B_4 = .54$ and $ß_4 = .53$. Therefore, the results do not indicate a significant pattern of the change of social support over time during the REDUQ II study in the four examined participants.

Table 2 – ***Multiple linear regression analysis participant 1***

Changes in social support while controlling for autocorrelation

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.78	.08		33.33	.000
	Time	-.002	.002	-.08	-1.06	.299
	Social support lag1	.31	.02	.98	13.34	.000

a. Dependent Variable: Social support

Table 3 – *Multiple linear regression analysis participant 2*

Changes in social support while controlling for autocorrelation

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.35	.54		2.53	.019
	Time	.03	.02	.3	1.62	.120
	Social support lag1	.54	.18	.54	2.92	.008

a. Dependent Variable: Social support

Table 4 – *Multiple linear regression analysis participant 3*

Changes in social support while controlling for autocorrelation

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.6	.72		2.21	.038
	Time	-.04	.03	-.28	-1.78	.089
	Social support lag1	.62	.17	.59	3.7	.001

a. Dependent Variable: Social support

Table 5 – *Multiple linear regression analysis participant 4*

Changes in social support while controlling for autocorrelation

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.95	.78		2.50	.020
	Time	-.07	.03	-.4	-2.33	.029
	Social support lag1	.54	.17	.53	3.12	.005

a. Dependent Variable: Social support

3.4 Does social support develop differently among participants in the intervention group (SRT) and those in the control group (self-help program)?

For three participants results were obtained after applying the multiple linear regression only to the data gathered during the treatment phase. The 'social support' score of participant 1 remained constant for all thirteen measures. Therefore, no regression could have been applied. The remaining regression analyses showed significant results with $\overline{R^2}_2 = .42$, $F_2(2, 10) = 5.41$, $p_2 = .026$; $\overline{R^2}_3 = .63$, $F_3(2, 10) = 11.34$, $p_3 = .003$; $\overline{R^2}_4 = .69$, $F_4(2, 10) = 14.55$, $p_4 = .001$. For participants 2 and 3 none of the independent variables ('time, 'social support lag 1') were a significant predictor alone. For participant 4 'measurement number' was a significant negative predictor at an $\alpha = .05$ level while 'social support lag 1' remained insignificant. When comparing, participant 4 (control group) was the only participant showing a significant development of his social support score over time during the B phase. Both participants in the intervention group showed no significant development while participant 1, also in the control group, did not display any variability of social support during the B phase. Thus the results indicate no clearly distinctive pattern between participants in the control and intervention group.

Table 6 – *Multiple linear regression analysis (B phase) participant 2 (intervention group)*

Changes in social support while controlling for autocorrelation

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.34	.78		1.71	.119
	Time	.08	.06	.41	1.36	.202
	Social support lag1	.37	.3	.37	1.23	.247

a. Dependent Variable: Social support

Table 7 – *Multiple linear regression analysis (B phase) participant 3 (intervention group)*

Changes in social support while controlling for autocorrelation

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	4.68	2.15		2.18	.054

	Time	-.17	.09	-.58	-1.98	.075
	Social support lag1	.29	.3	.29	.98	.353

a. Dependent Variable: Social support

Table 8 – *Multiple linear regression analysis (B phase) participant 4 (control group)*

Changes in social support while controlling for autocorrelation

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	5.90	2.12		2.79	.019
	Time	-.26	.10	-.87	-2.64	.025
	Social support lag1	-.01	.32	-.01	-.03	.977

a. Dependent Variable: Social support

3.5 Is there a relation between of social support and readiness-to-quit smoking over time in COPD patients participating in the REDUQ II study?

Two of the three regression analyses showed that the model significantly explained variance for the 'readiness-to-quit' variable with $\overline{R}^2_1 = .69$, $F_1(3, 21) = 18.89$, $p_1 < .001$ and $\overline{R}^2_2 = .53$, $F_2(3, 21) = 10.01$, $p_2 < .001$. For both models 'readiness-to-quit lag 1' was the only significant predictor within the model. 'Social support' and 'social support lag 1' did not reach significance for either case.

Table 9 – *Multiple linear regression analysis participant 1*

Changes in readiness-to-quit while controlling for autocorrelation

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.83	5.54		.51	.615
	Social support	-.8	1.89	-.15	-.42	.678
	Social support lag1	.4	.63	.24	.63	.533
	Readiness-to-quit lag1	.86	.14	.80	6.25	.000

a. Dependent Variable: Readiness-to-quit

Table 10 – *Multiple linear regression analysis participant 2*

Changes in readiness-to-quit while controlling for autocorrelation

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	.53	1.74		.30	.765
	Social support	.28	.7	.09	.4	.696
	Social support lag1	.27	.69	.09	.39	.702
	Readiness-to-quit lag1	.65	.17	.66	3.74	.001

a. Dependent Variable: Readiness-to-quit

Table 11 – *Multiple linear regression analysis participant 4*

Changes in readiness-to-quit while controlling for autocorrelation

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.19	1.31		2.45	.023
	Social support	-.03	.31	-.04	-.10	.920
	Social support lag1	.35	.30	.42	1.17	.256
	Readiness-to-quit lag1	.23	.26	.18	.85	.403

a. Dependent Variable: Readiness-to-quit

The third multiple linear regression analysis was not significant as a model for predicting 'readiness-to-quit' displaying $\overline{R}^2_3 = .11$, $F_3(3, 21) = 2.03$, $p_3 = .141$. The results suggest that social support was not a significant predictor for readiness-to-quit within the examined participants during the REDUQ II study.

4. Discussion

Taken together there was no indication that the intervention had any impact on the level of social support experienced by the participants. Their level of social support did not increase significantly. That was true for the participants in the control as well as the intervention group. One out of four

participants (allocated to the control group) showed even a significant decline of social support over the 26 weeks examined. However, the decline was not very strong after controlling for autocorrelation. Therefore, it can be concluded that there was no significant pattern in the change of social support over time. There was also no distinctive pattern distinguishing the change of social support of the control and the change of the intervention group.

There was a noticeable similarity between the scores on social support of participants 1 and 2 respectively participants 3 and 4. The graphs possibly suggest some kind of change over time. Still, visual interpretation was not used to draw conclusions in this research due to its lack of reliability described by Jones, Weinrott and Vaught (1978). Their findings suggest that the compliance between statistical and visual analysis is especially low if a high degree of autocorrelation is present. The influence of autocorrelation was shown to be strongly apparent in the data sets for social support as well as for readiness-to-quit. For all participants except for one participant autocorrelation appeared to be significant and strong regarding social support. The reason for a lack of autocorrelation in one participant might be a potential ceiling effect in the social support score. Nevertheless, the multiple regression analysis showed that autocorrelation still had an influence on the change of social support for that participant. For all other participants the regression analysis confirmed that autocorrelation accounted for a lot of variability in the change of social support.

Lastly social support did not show a significant correlation with readiness-to-quit among the participants. Autocorrelation accounted for the variability explained by the regression analyses of both variables, social support and readiness-to-quit. The findings contradict the ASE – model (De Vries et al., 1988) that incorporates social support as predictor for readiness-to-quit. The present study does not only contradict cross-sectional studies but also other time-series research such as the study of Chandola et al. (2004) who indicated that social support very well might be a significant predictor for smoking cessation. Burns, Rothman, Fu, Lindgren and Joseph (2014) indicated that research examining the effects of social support on smoking cessation might be contradicting because social support is a complex construct that includes different sub-variables. They argue that the impact of social support on smoking cessation must be examined more differentiated, using more variables. This argument fits by one of the most pressing limitations regarding the present study's methodology. Just one item was used for each variable measured (social support and readiness-to-quit) which could have impacted the content validity of those measures. The Likert scale for the item social support only included five possible answers which might have also caused a ceiling effect. This is further supported by the high mean score of two participants and their low standard deviation. This could also explain the lack of variability in the social support score of one participant during the treatment phase. Another possible reason for the discrepancy between the results of the

present study and others might be that in this case readiness-to-quit was used as outcome whereas most studies relate to other measures of smoking cessation (such as number of cigarettes smoked daily).

The item of readiness-to-quit was scored along a continuum which included 'I do not intend to stop but I intend to diminish my smoking behavior' for one participant (the others did not score on this rank therefore it is negligible for them). It is possible that this score does not represent a score on the continuum of readiness-to-quit but rather a different category or goal. However, Peters, Hughes, Callas and Solomon (2007) indicated that participants' goal to reduce only might lie on the same continuum as the goals stopping immediately and reducing gradually until eventually stopping. Moreover, the score was obtained not more than two times therefore, the issue was seen as negligible.

The same could be said about the social support variable. 'Not applicable' might not fit along the continuum of the other answers. Still, none of the examined participants scored 'Not applicable' on their questionnaires therefore, the issue had no influence on the analyses. Furthermore, while there was controlled for autocorrelation in the regression analysis, the presumption of a parametric spread is violated. That could have possibly skewed the results of the analyses. Nevertheless, the focus of this research was to use a time-series analysis and therefore included autocorrelation rather than a test that focusses on a non-parametric spread. Thus controlling for the autocorrelation revealed more about the actual correlation between time and social support as well as social support and readiness-to-quit.

Moreover, there are some more general limitations that apply, for instance single case experimental designs have a lot of advantages such as the possibility to examine the change of a behavior or process within a person over time. Nevertheless, SCED studies also have a major disadvantage as sample sizes are relatively small (Borckardt et al., 2008). In this case four participants were included which offers the possibility to gather a lot of in-depth information about their cognitive and behavioral processes but limits the external validity. Furthermore, the questionnaires were based on self-reporting thus no objective measures were used to verify the information. Therefore, biases such as social desirability could have influence the results of the questionnaires.

Taken together the research highlights some interesting points such as the contradiction of the ASE – model and other previous research. Still, those contradictions must be viewed in the light of the characteristics and limitations presented. Therefore, the study gives reason to further examine the correlation between social support (and different sub-variables) and readiness-to-quit. Furthermore, an important focus of this research is its attention towards COPD and the role of smoking in its incurrence. The burden caused by the illness has been shown in other studies

(Gommer & Poos, 2011). Still, there are not many focal points dedicated to aid smoking cessation in comparison to other addictions (Van Laar et al., 2015). Therefore, more effective smoking cessation programs must be developed especially for COPD patients (Jiménez-Ruiz et al., 2001).

In order to create such programs more research must be done to identify cognitive and behavioral processes that can be targeted effectively to stop smoking. Such research could make use of a different time-scale. That could result in more in-depth information since it is possible that the timing of the measurement has an influence on the participants' response. In a more specific example, given a group session takes place on Wednesday a participant might respond very differently when he takes the questionnaire on Thursday (potentially stronger under the impression of the meeting) or the following Monday. This way the processes could be surveyed even closer possibly detecting slighter changes which are missed otherwise. To detect smaller changes in participants' change of social support or readiness-to-quit it is also important to develop more extensive questionnaires using more items and more differentiating Likert scales. Those can be used to identify whether there is a change of social support within a group of participants receiving group treatment in comparison to social support outside the group and whether that has an influence on readiness-to-quit. Furthermore, more variables of the ASE model could be included such as descriptive behavior of others since de Vries, Mudde, Dijkstra and Willemsen (1998) found inconsistent results in cross-sectional studies. Therefore, it might be interesting to examine the construct and their possible interaction in time-series studies. Moreover, the addition of objective measurements to verify self-reported data could help to correct the data for biases. This is especially important since autocorrelation has shown to play a big role in participants' responses. Thus a lot more research is necessary to examine the process of smoking cessation in order to develop more successful cessation programs.

5. References

Bandura, A. (1977). Self-efficacy: Towards a Unifying Theory of Behavioral Change. *Psychological Review*, 84(2), 191-215.

Batra, A., Klingler, K., Landfeldt, B., Friederich, H. M., Westin, A., & Danielsson, T. (2005). Smoking reduction treatment with 4-mg nicotine gum: a double-blind, randomized, placebo controlled study. *Clinical pharmacology and therapeutics*, *78*(6), 689-696. DOI:10.1016/j.clpt.2005.08.019

Burns, R. J., Rothman, A. J., Fu, S. S., Lindgren, B., & Joseph, A. M. (2014). The relation between social support and smoking cessation: revisiting an established measure to improve prediction. *Annals of Behavioral Medicine*, *47*(3), 369-375.

Borckardt, J. J., Nash, M. R., Murphy, M. D., Moore, M., Shaw, D., & O'Neil, P. (2008). Clinical practice as natural laboratory for psychotherapy research: a guide to case-based time-series analysis. *American psychologist*, *63*(2), 77.. DOI:10.1037/0003-066X.63.2.77

Chan, S. S., Leung, D. Y., Abdullah, A. S., Wong, V. T., Hedley, A. J., & Lam, T. H. (2011). A randomized controlled trial of a smoking reduction plus nicotine replacement therapy intervention for smokers not willing to quit smoking. *Addiction*, *106*(6), 1155-1163.

DOI:10.1111/j.1360-0443.2011.03363.x

Chandola, T, Head, J & Bartley, M. (2004). Socio-demographic predictors of quitting smoking: How important are household factors?. *Addiction*, 99(6), 770-777.

Comstock, G. W., Brownlow, W. J., Stone, R. W., & Sartwell, P. E. (2008). Cigarette smoking and changes in respiratory findings. *American journal of epidemiology*, *168*(7), 802-809.

The EuroQol Group (1990). EuroQol-a new facility for the measurement of health-related quality of life. *Health Policy* 16(3):199-208.

Fletcher, C & Peto, R. (1977). The natural history of chronic airflow obstruction. *British Medical Journal*, 1, 1645-1648.

Global Initiative for Chronic Obstructive Lung Disease (2016). Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease. Retrieved from http://goldcopd.org/global-strategy-diagnosis-management-prevention-copd-2016/

Gommer, A. M., & Poos, M. J. (2011). COPD: prevalentie, incidentie en sterfte naar leeftijd en geslacht. *Volksgezondheid Toekomst Verkenning, Nationaal Kompas Volksgezondheid*. Retrieved from http://www.nationaalkompas.nl

Hansell, A. L., Walk, J. A. & Soriano, J. B. (2003). What do chronic obstructive pulmonary disease patients die from? A multiple cause coding analysis. *European Respiratory Journal*, 22, 809–814. DOI: 10.1183/09031936.03.00031403

Hughes, J. R. & Carpenter, M. J. (2005). The feasibility of smoking reduction: an update. *Addiction*, 100(1), 1074-1089. DOI:10..1111/i.1360-0443.2005.011 74.x

Hymowitz, N., Cummings, K. M., Hyland, A., Lynn, W. R., Pechacek, T. F., & Hartwell, T. D. (1997). Predictors of smoking cessation in a cohort of adult smokers followed for five years. *Tobacco control*, *6*(suppl 2), S57. Retrieved from http://tobaccocontrol.bmj.com/

IBM (2012). Autocorrelations. Retrieved from https://www.ibm.com/support/knowledgecenter/SSLVMB_21.0.0/com.ibm.spss.statistics.help/idh_acfu.htm

Jiménez-Ruiz, C. A., Masa, F., Miravitlles, M., Gabriel, R., Viejo, J. L., Villasante, C., & Sobradillo, V. (2001). Smoking characteristics: differences in attitudes and dependence between healthy smokers and smokers with COPD. *CHEST Journal*, *119*(5), 1365-1370. Retrieved from http://publications.chestnet.org/

Jones, R. R., Weinrott, M. R., & Vaught, R. S. (1978). Effects of serial dependency on the agreement between visual and statistical inference. *Journal of Applied Behavior Analysis, 11,* 277–283. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1311299/pdf/jaba00109-0077.pdf

Van Laar, M. W., Ooyen-Houben, M. M., Cruts, A. A., Meijer, R. F., Croes, E. A., Ketelaars, A. P., & Van der Pool, P. M. (2015). Nationale Drug Monitor Jaarbericht 2015.

Le Houezec, J., & Säwe, U. (2003). Smoking reduction and temporary abstinence: New approaches for smoking cessation. *Journal Des Maladies Vasculaires*, 28(5), 293-300.

Van der Molen, T. (2003). Clinical COPD Questionnaire. Retrieved from http://www.fysiovragenlijst.nl/docs/pdf/Clinical%20COPD%20Questionnaire%20_CCQ_.pdf

Peters, E. N., Hughes, J. R., Callas, P. W., & Solomon, L. J. (2007). Goals indicate motivation to quit smoking. *Addiction,* 102, 1158-1163. DOI:10.1111/j.1360-0443.2007.01870.x

Prochaska, J. O., Velicer, W. F., DiClemente, C. C., & Fava, J. (1988). Measuring processes of change: applications to the cessation of smoking.*Journal of consulting and clinical psychology*, *56*(4), 520. DOI:10.1037//0022-006X.56.4.520

Simmons, M. S., Connett, J. E., Nides, M. A., Lindgren, P. G., Kleerup, E. C., Murray, R. P., ... & Tashkin, D. P. (2005). Smoking reduction and the rate of decline in FEV1: results from the Lung Health Study. *European Respiratory Journal*, *25*(6), 1011-1017. DOI:10.1183/09031936.05.00086804

Spinhoven, Ph., Ormel, J., Sloekers, P.P.A., Kempen, G.J.M., Speckens, A.E.M & Van Hemert, A.M. (1997). A validation study of the Hospital Anxiety and Depression Scale (HADS) in different groups of Dutch subjects. Psychological Medicine, 27, 363-370

Tønnesen, P., Carrozzi, L., Fagerström, K. O., Gratziou, C., Jimenez-Ruiz, C., Nardini, S., ... & West, R. (2007). Smoking cessation in patients with respiratory diseases: a high priority, integral component of therapy. *European Respiratory Journal*, *29*(2), 390-417. DOI:10.1183/09031936.00060806

Tønnesen, P., Mikkelsen, K., & Bremann, L. (2006). Nurse-conducted smoking cessation in patients with COPD using nicotine sublingual tablets and behavioral support. *Chest*, 130(2), 334-342.

Vandenbos, G.R. et al. (Eds.) (2006). *The APA Dictionary of Psychology.* Washington, DC: American Psychological Association.

De Vet, E., Brug, J., de Nooijer, J., Dijkstra, A., & De Vries, N. K. (2005). Determinants of forward stage transition. *Health Education Research*, *21*, 195 - 205. DOI:10.1093/her/cyg111

De Vries, H., & Backbier, E. (1994). Self-Efficacy as an Important Determinant of Quitting among Pregnant Women Who Smoke: The ø-Pattern. *Preventive Medicine*, 23(6),167-174.

De Vries, H., Dijkstra, M., & Kuhlman, P. (1988). Self-efficacy: The third factor besides attitude and subjective norm as a predictor of behavioural intentions. *Health Education Research*, 3(3), 273-282. DOI:10.1093/her/3.3.273

De Vries, H., & Mudde, A. N. (1998). Predicting stage transitions for smoking cessation applying the attitude-social influence-efficacy model, Psychology & Health, 13(2), 369-385. DOI:10.1080/08870449808406757

De Vries, H., Mudde, A. N., Dijkstra, A., & Willemsen, M. C. (1998). Differential Beliefs, Perceived Social Influences, and Self-Efficacy Expectations among Smokers in Various Motivational Phases. Preventive Medicine, 27, 681-689. Retrieved from http://www.sciencedirect.com/

Wennike, P., Danielsson, T., Landfeldt, B., Westin, Å., & Tønnesen, P. (2003). Smoking reduction promotes smoking cessation: results from a double blind, randomized, placebo-controlled trial of nicotine gum with 2-year follow-up. *Addiction*, *98*(10), 1395-1402.

Appendix A: Tables autocorrelation – social support

Participant 1: social support - autocorrelations

Series: Social_support

			Box-Ljung Statistic		
Lag	Autocorrelation	Std. Error[a]	Value	df	Sig.[b]
1	,301	,185	2,634	1	,105
2	-,005	,182	2,635	2	,268
3	-,008	,178	2,637	3	,451
4	-,010	,174	2,640	4	,620
5	-,013	,170	2,646	5	,754
6	-,015	,166	2,654	6	,851
7	-,018	,162	2,666	7	,914
8	-,020	,157	2,682	8	,953
9	-,023	,153	2,704	9	,975
10	-,025	,148	2,733	10	,987
11	-,028	,144	2,771	11	,993
12	-,030	,139	2,818	12	,997
13	-,033	,134	2,878	13	,998
14	-,035	,128	2,954	14	,999
15	-,038	,123	3,049	15	1,000
16	-,040	,117	3,167	16	1,000

a. The underlying process assumed is independence (white noise).

b. Based on the asymptotic chi-square approximation.

Participant 2: social support - autocorrelations

Series: Social_support

			Box-Ljung Statistic		
Lag	Autocorrelation	Std. Error[a]	Value	df	Sig.[b]
1	,728	,185	15,427	1	,000
2	,456	,182	21,726	2	,000
3	,381	,178	26,310	3	,000
4	,305	,174	29,395	4	,000
5	,230	,170	31,232	5	,000
6	,155	,166	32,107	6	,000
7	,019	,162	32,121	7	,000
8	-,117	,157	32,671	8	,000
9	-,131	,153	33,407	9	,000
10	-,146	,148	34,372	10	,000
11	-,160	,144	35,619	11	,000
12	-,175	,139	37,208	12	,000
13	-,189	,134	39,217	13	,000
14	-,204	,128	41,741	14	,000
15	-,219	,123	44,901	15	,000
16	-,233	,117	48,857	16	,000

a. The underlying process assumed is independence (white noise).

b. Based on the asymptotic chi-square approximation.

Participant 3: social support - autocorrelations

Series: Social_support

			Box-Ljung Statistic		
Lag	Autocorrelation	Std. Error[a]	Value	df	Sig.[b]
1	,699	,185	14,246	1	,000
2	,535	,182	22,943	2	,000
3	,393	,178	27,842	3	,000
4	,305	,174	30,922	4	,000
5	,248	,170	33,061	5	,000
6	,202	,166	34,539	6	,000
7	,103	,162	34,949	7	,000
8	-,112	,157	35,454	8	,000
9	-,327	,153	40,034	9	,000
10	-,371	,148	46,313	10	,000
11	-,384	,144	53,478	11	,000
12	-,312	,139	58,528	12	,000
13	-,261	,134	62,342	13	,000
14	-,305	,128	68,002	14	,000
15	-,296	,123	73,810	15	,000
16	-,214	,117	77,141	16	,000

a. The underlying process assumed is independence (white noise).

b. Based on the asymptotic chi-square approximation.

Participant 4: social support - autocorrelations

Series: Social_support

			Box-Ljung Statistic		
Lag	Autocorrelation	Std. Error[a]	Value	df	Sig.[b]
1	,819	,185	19,542	1	,000
2	,708	,182	34,755	2	,000
3	,681	,178	49,424	3	,000
4	,558	,174	59,727	4	,000
5	,384	,170	64,840	5	,000
6	,236	,166	66,862	6	,000
7	,164	,162	67,892	7	,000
8	-,035	,157	67,943	8	,000
9	-,133	,153	68,697	9	,000
10	-,179	,148	70,152	10	,000
11	-,302	,144	74,567	11	,000
12	-,355	,139	81,105	12	,000
13	-,382	,134	89,277	13	,000
14	-,384	,128	98,216	14	,000
15	-,437	,123	110,846	15	,000
16	-,406	,117	122,860	16	,000

a. The underlying process assumed is independence (white noise).

b. Based on the asymptotic chi-square approximation.

Appendix B: Tables autocorrelation – readiness-to-quit

Participant 1: readiness-to-quit autocorrelations

Series: Readiness_to_quit

			Box-Ljung Statistic		
Lag	Autocorrelation	Std. Error[a]	Value	df	Sig.[b]
1	,711	,185	14,740	1	,000
2	,458	,182	21,108	2	,000
3	,255	,178	23,169	3	,000
4	,108	,174	23,553	4	,000
5	,046	,170	23,625	5	,000
6	,105	,166	24,023	6	,001
7	,199	,162	25,536	7	,001
8	,172	,157	26,732	8	,001
9	,110	,153	27,251	9	,001
10	,083	,148	27,567	10	,002
11	,021	,144	27,590	11	,004
12	-,055	,139	27,750	12	,006
13	-,153	,134	29,054	13	,006
14	-,144	,128	30,313	14	,007
15	-,221	,123	33,543	15	,004
16	-,212	,117	36,824	16	,002

a. The underlying process assumed is independence (white noise).

b. Based on the asymptotic chi-square approximation.

Participant 2: readiness-to-quit autocorrelations

Series: Readiness_to_quit

			Box-Ljung Statistic		
Lag	Autocorrelation	Std. Error[a]	Value	df	Sig.[b]
1	,739	,185	15,898	1	,000
2	,555	,182	25,256	2	,000
3	,489	,178	32,811	3	,000
4	,344	,174	36,727	4	,000
5	,122	,170	37,240	5	,000
6	-,023	,166	37,259	6	,000
7	-,111	,162	37,728	7	,000
8	-,277	,157	40,822	8	,000
9	-,442	,153	49,203	9	,000
10	-,452	,148	58,505	10	,000
11	-,463	,144	68,892	11	,000
12	-,397	,139	77,083	12	,000
13	-,350	,134	83,936	13	,000
14	-,283	,128	88,807	14	,000
15	-,179	,123	90,922	15	,000
16	-,112	,117	91,828	16	,000

a. The underlying process assumed is independence (white noise).

b. Based on the asymptotic chi-square approximation.

Participant 4: readiness-to-quit autocorrelations

Series: Readiness_to_quit

			Box-Ljung Statistic		
Lag	Autocorrelation	Std. Error[a]	Value	df	Sig.[b]
1	,236	,185	1,624	1	,203
2	,086	,182	1,846	2	,397
3	-,065	,178	1,980	3	,577
4	,014	,174	1,986	4	,738
5	-,024	,170	2,006	5	,848
6	-,058	,166	2,128	6	,908
7	-,092	,162	2,449	7	,931
8	-,238	,157	4,735	8	,785
9	-,121	,153	5,366	9	,801
10	,033	,148	5,414	10	,862
11	,374	,144	12,204	11	,349
12	,027	,139	12,242	12	,426
13	-,082	,134	12,614	13	,478
14	-,078	,128	12,981	14	,528
15	-,087	,123	13,480	15	,565
16	-,083	,117	13,982	16	,600

a. The underlying process assumed is independence (white noise).

b. Based on the asymptotic chi-square approximation.