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Health-related quality of life and certain health behaviours in ischemic heart disease patients six months after their rehabilitation

Factors influencing health behaviour change

Doctoral dissertation (PhD thesis) statements

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Introduction: the topic of the dissertation

Cardiovascular diseases, among them coronary heart diseases are common diseases, which develop over a long time, and are burdensome for both patients and the health care system (Allender et al., 2008). Angina pectoris and myocardial infarction are ischemic heart diseases. Their background is atherosclerosis, a chronic inflammation process (Halmos, Kautzky & Suba, 2004; Libby, Ridker & Maseri, 2002); there are also other factors leading to the acute coronary event.

Certain features of lifestyle are important in both the development and progression of ischemic heart diseases: these are the traditional and psychosocial risk factors. Both traditional and psychosocial risk factors are more common in people with low socio-economic status (e.g. Smith, Ben-Shlomo & Lynch, 2002; Stringhini et al., 2010; Kopp, Skrabski, Szántó & Siegrist, 2006; Haukkala, 2002), so are cardiovascular diseases, and among them coronary heart diseases (Perk et al., 2012; Kopp et al., 2006). Modifiable traditional risk factors are smoking, high blood lipid level and unfavourable blood lipid composition, hypertension, obesity, sedentary lifestyle, and diabetes (Perk et al., 2012). With the exception of smoking, the other modifiable risk factors are influenced mainly by diet and physical activity. Psychosocial stress and negative affectivity: hostility or anger and depression or anxiety are the most important among psychosocial risk factors, both in the aetiology and progression of the disease (e.g. Kopp et al., 2006; Berkes, 2012a; Chida & Steptoe, 2009; Goldston & Baillie, 2008; Barth, Schumacher & Herrmann-Lingen, 2004; Rugulies, 2002). Negative affectivity may play an important role in a cardiovascular event through more mechanisms (Berkes, 2012a). Recent literature deals not only with risk factors but also with possible protective factors; of these I examine the role of sense of coherence and vitality (Berkes, 2012a, Berkes, 2010; Antonovsky, 1990; Ryan & Frederick, 1997).

Symptoms and communication of depression are different in heart disease patients (Lespérance & Frasure-Smith, 2000); so Hare and Davis (1996) created Cardiac Depression Scale (CDS), which was used in this research after its validation (Berkes, 2012c).

As lifestyle is especially important, lifestyle changes and their long-term maintenance are of importance as well. However, it has been long known in psychology literature that intention very often does not lead to the intended behaviour (Wicker, 1969). There are several theories to address this problem; in my research I examined heart patients' lifestyle changes based on some of these theories. My starting point was the Theory of Planned Behaviour (TPB, Ajzen, 1991, 2011) which is a well-known, widely researched theory of psychology literature (see Figure 1).

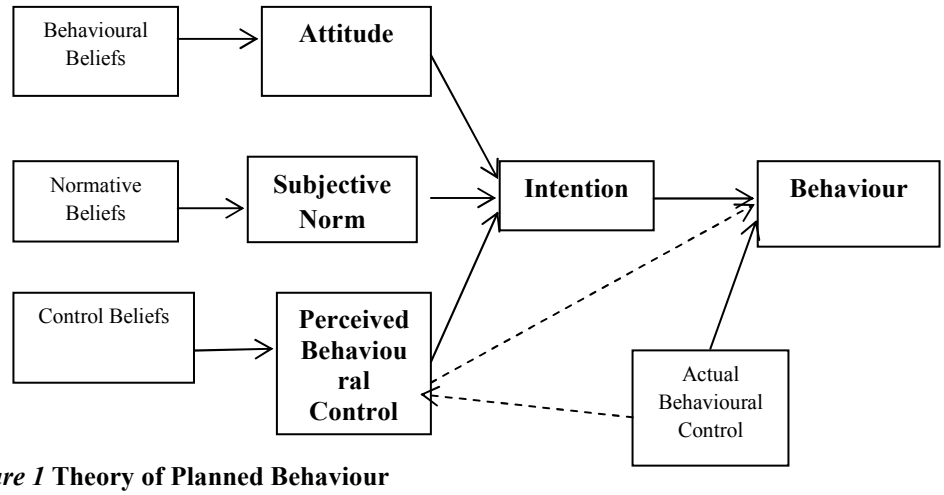


Figure 1 **Theory of Planned Behaviour**

The Theory of Planned Behaviour is based on the intention-behaviour connection. To improve the predictive power of the model, there have been several suggestions. Of these, I examined the role of past behaviour (Ouellette & Wood, 1998) and planning (action planning or Implementation Intentions: Gollwitzer, 1999; Gollwitzer & Sheeran, 2006; coping planning: Schwarzer, 2008); both improve the prediction of behaviour. Planning is also a self-regulatory strategy. Self-regulation is based on self-regulatory capacity which is limited and may be depleted (Muraven & Baumeister, 2000; Hagger, Wood, Stiff & Chatzisarantis, 2010), and depends on executive functions. All of these factors are integrated into a recent theory, Temporal Self-regulation Theory (TST, Hall & Fong, 2007). In this model, the predictors of intention are connectedness beliefs (beliefs about the later outcomes of the behaviour) and temporal valuation that is perceived temporal distance of the benefits and costs of the behaviour. Behavioural prepotency (past behaviour or cues to action) and self-regulatory capacity (executive function and energy levels) have direct and indirect effect on behaviour (see Figure 2).

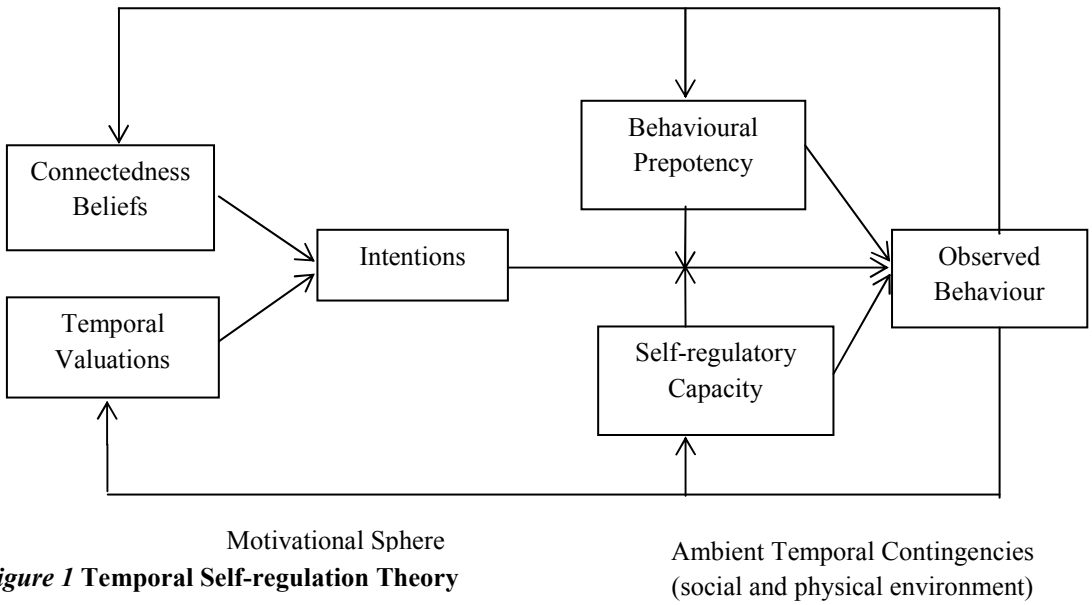


Figure 1 **Temporal Self-regulation Theory**

I studied the implementation of three behaviours which are effective in cardiac rehabilitation and which have a favourable effect on prognosis (about cardiac rehabilitation, see Berkes, 2012b). The three behaviours are physical exercise, relaxation and smoking cessation. Physical exercise is one of the oldest and most effective elements of cardiac rehabilitation (Perk et al., 2012; Jolliffe et al., 2001; Lawler, Filion & Eisenberg, 2011); relaxation also has a strong beneficial effect (Van Dixhoorn & White, 2005), but this is less well-known. Similarly to physical exercise, smoking cessation reduces a traditional risk factor, but the behaviour itself is different from the previous two behaviours. While physical exercise and relaxation requires the repeated practice of the given behaviour, smoking cessation is – ideally – a one-time stopping of an addiction, which is still maintained in certain everyday situations.

The aims of the research

The main aim of my research was to investigate health-related quality of life and health behaviour of ischemic heart disease patients six months after their rehabilitation. Participants were patients younger than 65 years old, who either had a myocardial infarction or a coronary artery bypass surgery (CABG), or percutaneous transluminal coronary angioplasty (PTCA) prior to the inpatient rehabilitation.

I examined some psychological features of participants. Among these features there were some negative (depression, anxiety, cynical distrust) and positive (subjective vitality and sense of coherence) variables. I examined health-related quality of life and cardiac prognosis based on these features, and of course, using some demographic and medical variables as well.

I also examined three health behaviours: physical exercise, relaxation and smoking cessation with the original model of Theory of Planned Behaviour, with a model based on the same theory but without the three beliefs. I also examined the model completed with past behaviour and planning, and finally I examined these behaviours with Temporal Self-regulation Theory. I employed regression analyses to examine these behaviours with background variables (demographic, medical and psychological variables), and finally I tested these models with path analyses.

I employed two scales, the psychometric features of which were also to be examined. I used Cardiac Depression Scale (Hare & Davis, 1996) after validation (Berkes, 2012c) and Subjective Vitality Scale (state and trait, Ryan & Frederick, 1997) as its validation.

The methods of the research

Participants of this longitudinal study were cardiac rehabilitation inpatients who were younger than 65 years old, had an ischemic heart disease, and who suffered a myocardial infarction, bypass surgery or PTCA prior to their rehabilitation treatment. The follow-up period was six months. Time 1 data collection was carried out in the two largest rehabilitation centres in Hungary: the National Heart Hospital in Balatonfüred

and the Rehabilitation Centre in Sopron. All patients meeting the inclusion criteria were asked to participate in the research. Six month later I posted the Time 2 questionnaire to the participants. The research received the necessary ethical approval from both the Research Ethics Committee of the Pedagogy and Psychology Faculty of Eötvös Loránd University, and from both of the institutes.

The planned sample size of the research was 500; during Time 1 data collection 369 participants (74%) had a valid questionnaire. Six month later, during Time 2 data collection, 302 participants replied (60% of the planned sample size, 82% of Time 1 participants). There was a difference in age and marital status between respondents and non-respondents. Participants who did not answer to the second questionnaire were younger than respondents, and a bigger percentage of single participants refused to answer. There were no other differences between respondents and non-respondents.

The mean age of the sample was 55.61 years (SD=7.31, range 25-65). 75% of participants (n=278) were males. 65% of participants had a myocardial infarction prior to their rehabilitation; about half of the other participants had a bypass surgery or a coronary angioplasty.

Measures:

Cardiac Depression Scale (CDS, Hare & Davis, 1996; Berkes, 2012c).

CES-D Depression Scale (*Center for Epidemiologic Studies Depression Scale,* Radloff, 1977, Hungarian version: Barótfi, 2006).

Spielberger State-Trait Anxiety Inventory (Spielberger; Rózsa, 2004).

*Subjective Vitality Scale (*Ryan & Frederick, 1997).

Cynical Distrust Scale (Greenglass & Julkunen, 1989).

Sense of Coherence (SOC-13; Antonovsky, Hungarian version: Balajti, Vokó, Ádány & Kósa, 2007).

Brief Illness Perception Questionnaire (Broadbent, Petrie, Main & Weinman, 2006). I used the question about the causes of the heart disease.

Items to measure elements of the Theory of Planned Behaviour, past behaviour, action and coping planning and elements of Temporal Self-regulation Theory. These items were created by me, based on the suitable literature.

Time 2 measures:

RAND 36-Item Short Form Health Survey (Hays & Morales, 2001).

Cardiac Depression Scale (see above).

I also collected data on the medical condition of the participants (diagnoses, treatment method, the presence of certain risk factors and comorbidities), some anthropometric data (height and body weight), and also some data in connection with the function of the heart (left ventricular ejection fraction, left ventricular function, results of the 6 minute walk test or treadmill test).

Statistical analyses were carried out using SPSS 20.0 and Amos 21.0. Path analyses were conducted using maximum likelihood estimation method.

Results and discussion

Medical features of the sample

In 80% of participants there is more than one risk factor present. Overweight and obesity is of special importance: the mean body mass index of the sample is 28.7 (SD=4.48, range 16.2-50.03); 80% of the participants are either overweight or obese.

The condition of most of the participants is quite favourable based on the heart function data. Left ventricular function was decreased to some degree in 22% of the participants. The mean result of the 6 minute walk test is 425.13 (+/- 97.9) metres; the results of MI patients were better than the results of other ischemic heart disease patients (438 m vs. 400 m, p=0.02).

Prognosis

17% of participants were rehospitalized during the six month follow-up because of a reason connected to their heart disease. 4 participants died. The logistic regression analysis showed that only disease type was in connection with unfavourable prognosis (rehospitalisation because of a cardiac reason or death): participants who underwent bypass surgery had a lower chance of bad prognosis (OR=0.20, 95% CI=0.04-0.99, p=.048). This result is in line with previous research (Bravata et al., 2007). Contrary to my hypotheses and the previous results of the literature, unfavourable prognosis was not predicted by any of the demographic features or SES or psychological variables.

Psychological features

Correlations between psychological variables were moderate and they were in the expected direction: between negative emotional states (depression, anxiety, and cynical distrust) the correlation was positive, between positive variables (vitality, sense of coherence) as well, and there was negative correlation between positive and negative features.

Depression measured with Cardiac Depression Scale showed 16% of participants as depressed, while according to CES-D, 29% could be regarded as depressed. The latter is closer to the usual findings of the literature (Dobbels et al., 2002). Trait anxiety was present at 33% of participants, while state anxiety at 36% of participants, so approximately one third of the participants suffered from depression or anxiety during their rehabilitation.

I also compared participants with different diseases (one group consisted of participants who had a myocardial infarction, the second group was patients who underwent bypass surgery, and participants who had a PCI belonged to the third group). The psychological condition was the least favourable in patients who had a coronary stenting: they had a higher level of depression, trait anxiety and lower level of trait vitality. State vitality was the lowest in participants who had a bypass surgery. The latter is understandable, as bypass surgery is very demanding for the organism. However, the unfavourable psychological condition of patients who had a PCI shows that these patients require more attention and help during their treatment, even if their condition is less risky in medical terms.

The level of depression increased in the six months after the rehabilitation programme: measured with Cardiac Depression Scale, 27% of participants could be regarded as moderately or severely depressed. One of the reasons may be that patients had to face difficulties caused by their illness and also role limitations when they returned to their everyday environment. Special attention should be paid to the psychological condition of patients after their rehabilitation, and also help should be provided to rehabilitation patients help them prepare for the difficulties of this period.

The decrease of health-related quality of life was smallest in social functioning (Mean=75, SD= 26), then physical functioning and pain (Mean=67, SD=24, and 27 respectively). The largest decrease was experienced in role limitations due to physical health problems: Mean=43 (SD=43). The high standard deviation shows that there are huge differences between participants in this regard. General health decreased to about half of its previous level (Mean=48, SD=23).

The results of the linear regression analysis showed that health-related quality of life is predicted by subjective financial status ($p=.001$), depression ($p<.0001$) and state vitality ($p=.04$) measured during rehabilitation. Quality of life was worse in participants who had financial difficulties, higher level of depression or lower level of state vitality. Both somatic/affective and cognitive factors of depression were predictive of quality of life, contrary to the hypothesis that somatic/affective factor will predict quality of life alone (de Jonge et al., 2006).

During Time 1 measurement, the perceived causes of one's heart disease were assessed. 80% mentioned stress or a stress-related factor; about 80% mentioned lifestyle factors (smoking, diet, lack of physical exercise, overweight, or other lifestyle factors, e.g. alcohol). It means lifestyle factors did appear, but not as often as they were present. E.g. 7% of participants mentioned overweight, 14% mentioned lack of physical exercise, and diet was mentioned in 18% (these answers could appear in the same questionnaires, as participants were asked to mention three causes). These rates are low compared to the fact that 80% of participants are overweight or obese.

Results about health behaviours and models of behaviour change

Health behaviours six months after the rehabilitation programme

Six months after the rehabilitation programme, 71% of Time 2 respondents did some physical exercise at least three times a week, and 15% did some kind of relaxation with the same frequency. 41% of smokers quit smoking during that period. These results support my hypothesis: among the three behaviours, physical exercise will be practised most commonly, and least of the participants will practise relaxation.

Temporal evaluation of the consequences of behaviours

The benefits of all the three behaviours are perceived to be significantly later than the costs of the behaviours. This can be an obstacle in the realization of the behaviours (Hall & Fong, 2007).

The benefits of these behaviours are expected to appear either while they are doing the given behaviour, or after doing exercises or relaxation regularly for one month, or one month after giving up smoking. The costs of the behaviours were most often also expected to appear at two points in time: while thinking about doing the given behaviour or while they were doing it. It means thinking about starting the behaviour ('I should start to do some exercises/relaxation/I should give up smoking') generates strong negative emotions. Doing the behaviour is an especially important point, because a lot of people expect to experience either the positive or the negative consequences during that time. It requires further research to find out whether it means that both positive and negative expectations, that is ambivalence is present, or whether for some people positive, for others negative experiences appear while doing these behaviours. After one month (or more) of regular exercise/relaxation or one month or later after giving up smoking, participants expect to experience the benefits of the behaviours – but of course the period before this one month is the period when the costs of the behaviours appear for most people. These results show that the first month is of vital importance in the behaviour change process.

Differences between the three behaviours

Past behaviour is the best predictor of future behaviour (Ouellette & Wood, 1998). Prior to 30 days before their treatment, 60% of participants did physical activity regularly at some point in time, while it was true about relaxation only for 9% of participants. Only 32% of participants had any kind of relaxation experience. If we compare this to the fact that relaxation is one of the most effective intervention in cardiac rehabilitation (Van Dixhoorn & White, 2005), and to the fact that relaxation reduces stress which was one of the causes of the heart disease of 80% of participants, it is evident, that an important element of patient education could be the stress-reducing effect of relaxation, and also it would be important to change the perception of stress as something that cannot be influenced.

These health behaviours were also practised in the rehabilitation centres, but there was a difference between the two here as well. Practically all participants practised physical exercise (80% more kinds of physical exercise), while two thirds of participants (67%) did not practise any kind of relaxation.

In psysical exercise, the correlation between intention and behaviour was much lower (r=.20) than either in the case of the other two behaviours (relaxation: .42, smoking cessation .41), or the usual results of the literature (.43-.53, Armitage & Conner, 2001; McEachan et al., 2011). This correlation is comparable to Johnston and colleagues' (2004) results in a cardiac patient sample (the correlation between intention and regular exercise was .20 in their study too). It means in a cardiac sample physical exercise is influenced heavily by factors other than the ones included in the model; the model is less effective than in most cases in the literature.

In connection with relaxation, the mean of the elements of the model were usually lower than in connection with physical exercise as it was hypothesized. Intention, subjective norm, perceived behavioural control, all three beliefs (behavioural,

normative and control beliefs) were lower, attitude was less favourable; planning (both action and coping planning) and behavioural prepotency (past behaviour and cues) were lower.

Attitudes towards physical exercise are more favourable than attitudes towards quitting smoking. More consequences of physical exercise were present than those of smoking cessation, and the positive consequences of quitting smoking are more distant in time than the positive consequences of physical exercise. These factors would make it easier to do physical exercise. However, perceived behavioural control and social pressure are higher in connection with smoking cessation, and – related to higher perceived control – planning is higher, both action and coping planning, than in the case of physical exercise. It means participants were better prepared for quitting smoking than for doing physical exercise regularly.

Prediction of the behaviours with background variables

First I examined the different models about the three behaviours with background variables (demographic and socio-economic features, medical condition and psychological variables).

As for physical exercise, with the full model of Theory of Planned Behaviour, depression and state vitality were predictive; none of the variables of the model proved to be significant predictors. This role of depression is in accordance with the results of Allan et al. (2007). The explained variance of the behaviour is 18%, which is lower than the usual predictive power of the model, but in line with the fact that in cardiac samples the predictive power of the model is usually lower. In the TPB model without the beliefs, apart from state vitality, attitude became a significant predictor, and the explained variance of the behaviour decreased to 15%. When past behaviour was added, it became one of the significant predictors and state vitality remained the other. Planning did not prove to be a significant predictor. The model with the past behaviour explained 18% of the variance, in the model complete with planning it increased to 21%, but still these numbers are lower than the usual findings of the literature (McEachan et al., 2011).

The Temporal Self-regulation Theory (Hall & Fong, 2007) explained 33% of the variance of the behaviour. Significant predictors were type of disease (patients who had a myocardial infarction had a higher chance of doing physical exercise than patients who did not have a MI), depression, temporal distance of the positive consequences of physical exercise and past behaviour. It means among the new elements of the model, temporal distance of the positive consequences proved to be predictive: the closer participants perceived the positive consequences of physical exercise, the more likely they did it regularly.

Intention to do physical exercise did not prove to be a significant predictor of actual physical exercise behaviour. It means that increasing intention does not result in the appearance of the behaviour, so it is not worth increasing it in an intervention.

As for relaxation, the complete model of the TPB accounted for 15% of the variance in behaviour; there is no significant predictor in the model. In the model

without beliefs, intention became a significant predictor, and it remained significant when past behaviour was added to the model, which is also a significant predictor. However, when planning was added, past behaviour remained the only significant predictor. The predictive power of the models was increasing with each new element, but still, the TPB model with past behaviour and planning explained only 24% of the variance in relaxation. The Temporal Self-regulation Theory explained somewhat larger percentage of the variance in behaviour (26%); significant predictors were past behaviour and cues in the environment that is other people doing relaxation.

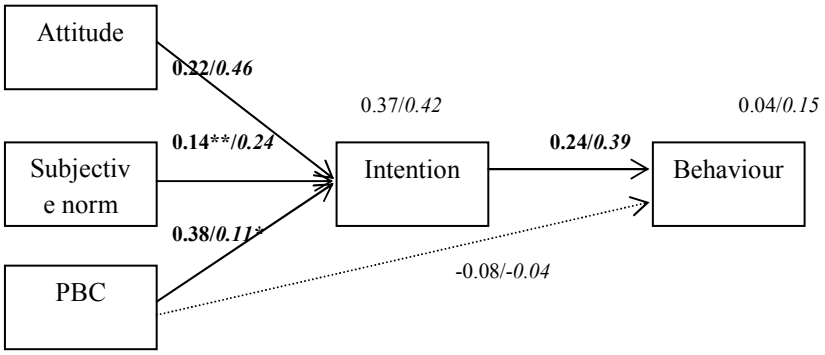
Smoking cessation was predicted by perceived behavioural control in all models. In the first models without planning, intention to quit and earlier quitting attempt were also significant predictors. In the complete TPB model (with beliefs) disease type, depression and behavioural beliefs were also predictive. However, it must be noted that these analyses were conducted with a small sample size, so must be interpreted with caution. In the Temporal Self-regulation Theory model intention to quit and previous quit attempts were predictive.

All in all, these models explain quite low percentage of the variance in the behaviours; the predictive power of the Temporal Self-regulation Theory is a bit stronger than that of the Theory of Planned Behaviour. Past behaviour is a significant predictor in all the three behaviours; in fact in relaxation it is the only significant predictor, at least in the TPB models. In physical exercise, the role of state vitality was found to be important, and attitude was important only in one model. In some models of relaxation and smoking cessation, intention was also a significant predictor, though in relaxation with past behaviour entered, it ceased to be significant. It is still an important piece of information, as intention – unlike past behaviour – can be influenced in an intervention. In physical exercise the temporal distance of the positive consequences of the behaviour proved to be a significant predictor as well; and it could also be changed in an intervention. In relaxation environmental cues were a significant predictor, which means people doing relaxation around the person have an important influence. The role of other environmental cues should also be studied.

Path analyses of physical exercise and relaxation

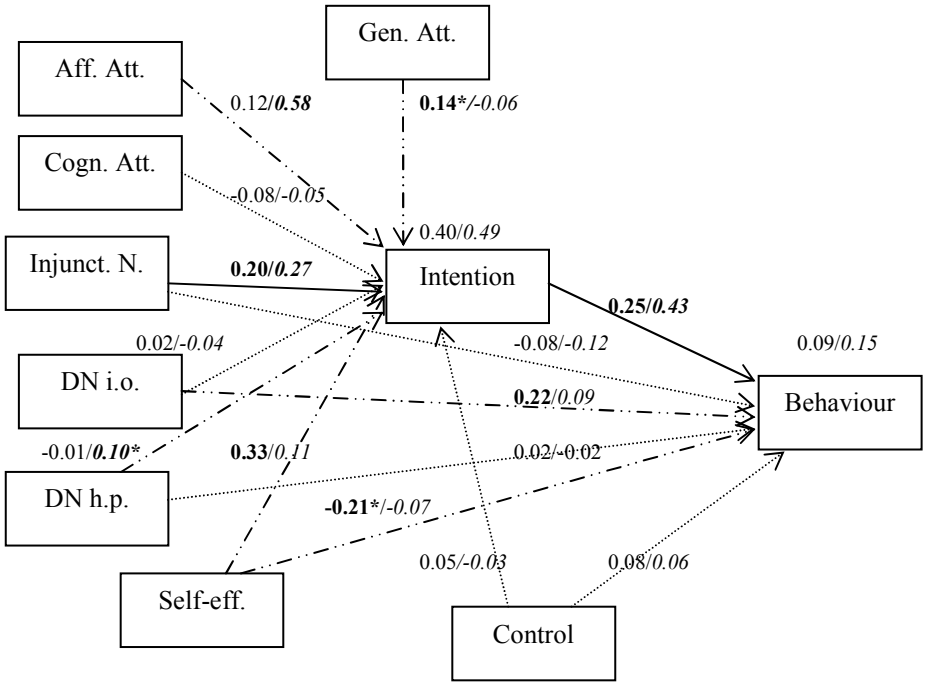
I examined three models of the Theory of Planned Behaviour: the complete model, a basic model without beliefs (see Figure 3) and a model in which the predictors of intention were further divided into elements in line with previous research. Among these models the third was the most informative (see Figure 4). As there are a lot of models in my dissertation, here only the models are shown which either had a very good model fit (Figures 3 and 5) or their results are important (Figure 4).

Figure 3 **The Theory of Planned Behaviour without beliefs (basic model) in physical exercise and relaxation**



Note: PBC: Perceived Behavioural Control. The first regression weight refers to physical exercise, the second to relaxation (the latter in italics). Significant regression weights are in bald (p< .0001, except *: p< .05, **: p< .01). Paths which were not significant in either behaviour are represented with a dotted line.

Figure 4 **Theory of Planned Behaviour, with elements of predictors of intention**



Note: Aff. Att.: affective attitude, Cogn. Att.: cognitive attitude, Gen. Att.: General Attitude, Injunct. N.: Injunctive Subjective Norm, DN i.o.: Descriptive Subjective Norm, important others, DN h.p.: Descriptive Subjective Norm, heart patients, Self-eff.: Self-efficacy. The first regression weight refers to physical exercise, the second to relaxation (the latter in italics). Significant regression weights are in bald (p< .0001, except *: p< .05). Paths which were not significant in either behaviour are represented with a dotted line; paths which were significant only in one of the two behaviours are represented with a dashed line.

The following conclusions can be drawn from the model when the predictors of intention were further divided into their elements. Among the element of attitude,

cognitive attitude does not have a significant relationship with intention. In physical exercise it was general attitude (good-bad), while in relaxation it was affective attitude which was the predictor of intention. It means if we want to modify attitude in an intervention, modification of cognitive attitude does not result in the change in intention; it is not worth emphasising that the behaviour is healthy and has a beneficial effect. Instead, affective attitude should be changed: that the activity is enjoyable and pleasant, or the general opinion about the behaviour should be made more favourable.

Injunctive subjective norm, that is the perceived social pressure of others, was only connected to intention, but not behaviour (there is in fact even a non-significant negative connection between injunctive norm and behaviour in both behaviours). However, while descriptive subjective norm (the actual behaviour of important others) does not affect intention, it has an effect on behaviour, at least in physical exercise. This different role of the two kinds of subjective norm is in line with Manning's (2009) results. The descriptive norm of heart patients (their supposed behaviour) had a connection to intention only in relaxation. It means increasing social pressure may increase intention but does not help change behaviour. But the actual behaviour of important others is effective in helping realize the behaviour. So if somebody wants their heart patient relative to do more exercise, they should not increase social pressure instead they should do more physical exercise themselves.

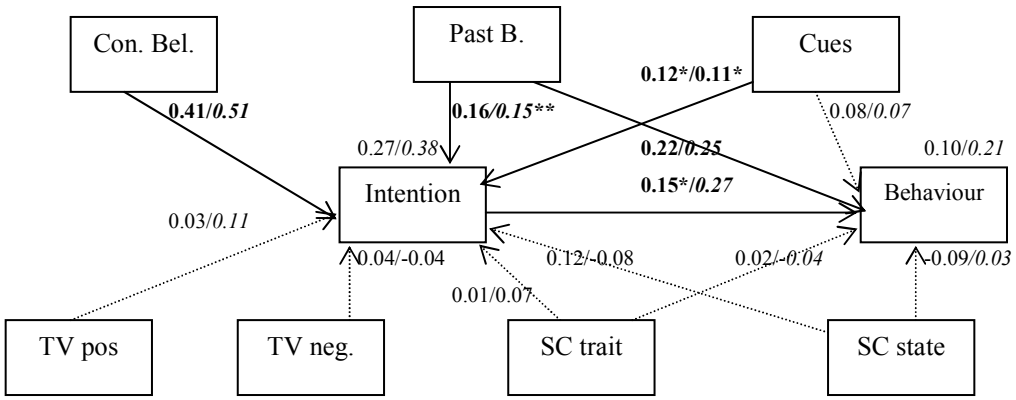
Dividing perceived behavioural control into self-efficacy and control over behaviour showed that the latter had no connection either with intention or with behaviour. Only self-efficacy had a role, and only in physical exercise; neither of control items were predictive in relaxation. In physical exercise self-efficacy had a positive connection with intention, but a significant negative connection with behaviour. It means that the more participants thought they were capable of doing exercise, the less they realized it. These results contradict the previous results of the literature, either in general samples (Hagger, Chatzisarantis & Biddle, 2002; Armitage & Conner, 2001), or cardiac samples. Previous research showed the important predictive role of perceived behavioural control in behaviour in cardiac patient samples (Johnston et al., 2004; Sol, van der Graaf, van Petersen & Visseren, 2011). I have the following guesses to interpret this result. The item contained an expression to keep motivation constant ("I could do physical exercise at least three times a week *if I wanted to*"; Rhodes & Courneya, 2004). Possibly those who gave higher scores in this item, were in a better physical and emotional condition, which means they could get back to their former lives and work more easily. But it also may mean they could not find the time to do physical exercise.

Past behaviour had a significant connection both with intention and behaviour in all of the models in physical exercise and relaxation. This result is in line with previous research (McEachan et al., 2011; Hagger et al., 2002; Conner & Armitage, 1998). This role of past behaviour means it is worth discovering about past behaviour during rehabilitation. If past behaviour is the same as the intended behaviour, it may help make intervention more effective; if it is the opposite of the intended behaviour, it is revealed there is a possible obstacle which requires attention.

Neither action planning, nor coping planning had any kind of connection with behaviour. There might have been methodological problems present: naturally, participants were not able to make plans which are exactly the same the theories require, and even if there is a plan, it is not sure the plan is detailed and specific enough. It means the role of planning requires further research.

The Temporal Self-regulation Theory was tested with two different models: with the original and with a modified one. In the latter there is a path between behavioural prepotency (past behaviour and environmental cues) and self-regulatory capacity (vitality) and intention (see Figure 5). The predictor of intention was connectedness beliefs which are the same as behavioural beliefs in the TPB that is it is the belief about the consequences of the behaviour. Behaviour was predicted by intention and past behaviour. In the modified model, both parts of behavioural prepotency, past behaviour and environmental cues were predictors of intention. Neither element of self-regulatory capacity (trait or state vitality) was a predictor of either intention or behaviour.

Figure 5 **The Temporal Self-regulation Theory, with direct paths between Behavioural Prepotency and Self-regulatory Capacity and Intention**



Note: Con. Bel.: Connectedness Beliefs, TV pos.: Temporal Valuations positive: the temporal valuation of the positive consequences of the behaviour, TV neg.: Temporal Valuations negative: the temporal valuation of the negative consequences of the behaviour, Past B.: Past Behaviour, Cues: Environmental Cues to action, SC trait: Self-regulatory Capacity (trait vitality), SC state: Self-regulatory Capacity (state vitality). The first regression weight refers to physical exercise, the second to relaxation (the latter in italics). Significant regression weights are in bald (p< .0001, except *: p< .05, **: p< .01). Paths which were not significant in either behaviour are represented with a dotted line.

Model Fit Indices

The detailed results of the models are shown in Table 1. The model fit was acceptable in the basic model of Theory of Planned Behaviour (without beliefs, Model1/b) in relaxation; its model fit is better than that of the other models of TPB in physical exercise as well, but still not acceptable. The other model with good fit is the modified form of Temporal Self-regulation Theory (Model 4/b) which has good fit in both behaviours.

The model fit is not acceptable in the rest of the models, that is the full model of the Theory of Planned Behaviour (with beliefs: Model 1/a), the TPB model in which the

predictors of intention were present with their components (Model 1/c), and the models with past behaviour (Model 2), and models with planning (Models 3/a and 3/b), and the original TST model (Model 4/a).

These results support the view that model fit is acceptable in models which have a theoretical background. Adding different elements, e.g. past behaviour or planning may increase the predictive power of the Theory of Planned Behaviour, but these models do not show good model fit.

Table 1 **Model fit of models for physical exercise and relaxation**

	CMIN	CMIN/df	CFI	RMSEA (90% CI)	pclose	AIC
Model 1/a TPB full model						
Physical exercise	**226.82**	**13.34**	**0.62**	**0.18 (0.16-0.21)**	**< .0001**	**280.82**
Relaxation	*124.59*	*7.33*	*0.82*	*0.13 (0.11-0.15)*	*< .0001*	*178.59*
Model 1/b TPB basic model (without beliefs)						
Physical exercise	**11.47**	**5.73**	**0.97**	**0.11 (0.06-0.18)**	**0.04**	**47.47**
Relaxation	*0.54*	*0.27*	*1.00*	*0.00 (0.00-0.07)*	*0.89*	*36.54*
Model 1/c TPB basic model. predictors of intention in components (see Fig. 4)						
Physical exercise	**10.91**	**3.64**	**0.99**	**0.09 (0.04-0.14)**	**0.11**	**134.91**
Relaxation	*5.43*	*1.81*	*0.99*	*0.05 (0.00-0.11)*	*0.44*	*129.43*
Model 2 TPB and past behaviour						
Physical exercise	**175.72**	**35.14**	**0.54**	**0.31 (0.27-0.34)**	**< .0001**	**219.72**
Relaxation	*105.42*	*21.08*	*0.72*	*0.23 (0.20-0.27)*	*< .0001*	*149.42*
Model 3/a TPB, past behaviour and planning, dual mediation model						
Physical exercise	**322.34**	**26.86**	**0.56**	**0.27 (0.24-0.29)**	**< .0001**	**376.34**
Relaxation	436.71	36.39	0.59	0.31 (0.29-0.34)	*< .0001*	500.71
Model 3/b TPB, past behaviour and planning, sequential mediation model						
Physical exercise	**198.4**	**18.04**	**0.74**	**0.22 (0.19-0.24)**	**< .0001**	**264.40**
Relaxation	123.35	11.24	0.89	0.17 (0.14-0.19)	*< .0001*	189.35
Model 4/a TST original model: Behavioural Prepotency and Self-regulatory Capacity only with a						

direct path to behaviour						
Physical exercise	**41.58**	**5.94**	**0.94**	**0.12 (0.08-0.15)**	**0.001**	**135.58**
Relaxation	*28.53*	*4.08*	*0.97*	*0.09 (0.06-0.13)*	*0.022*	*122.53*
Model 4/b TST modified model: Behavioural Prepotency and Self-regulatory Capacity with a direct path to intention as well						
Physical exercise	**11.69**	**3.90**	**0.98**	**0.09 (0.04-0.15)**	**0.09**	**113.69**
Relaxation	4.61	1.54	0.998	0.04 (0.00-0.10)	0.53	106.61

Note: TPB: Theory of Planned Behaviour, TST: Temporal Self-regulation Theory

Temporal Self-regulation Theory is a promising theory: both its explanatory power and fit indices are good. It requires further research, especially with neuropsychological measurement of executive functions which are part of self-regulatory capacity.

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