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Chapter 1

The role of dispositional optimism in physical and mental well-being

Quality of Life: A Positive Psychology Perspective

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Abstract

Dispositional optimism is a personality trait that refers to the extent to which individuals expect positive outcomes for their future. Higher optimism has been associated with a better physical health and mental well-being. It is thought that these favorable outcomes result from the more effective coping styles used by optimists. These coping styles include goal-oriented strategies which enhance the perception of controllability of stressors and better social embedding and protect against feelings of loneliness. Optimists meet adversities using a proactive approach to deal with the source of stress, whether it concerns a health, psychological, or social problem. Dispositional optimism has been associated with a reduced risk for various physical disorders, including a lower risk for cardiovascular disease morbidity and mortality, whereas evidence for a link with cancer is more ambiguous. The protective effect of optimism on physical health may be mediated through health-promoting behaviors, such as healthier dietary patterns and more physical activity. Biological processes such as low inflammation, low oxidative stress, and a resilient hypothalamic-pituitary adrenal axis activity may underlie the association. It is therefore undeniable that dispositional optimism plays a central role in health-related quality of life and subjective well-being. Intervention studies aiming to increase optimism are scarce and have shown that manipulation of one's future expectancies may change dispositional optimism on the short term. Future well-designed trials should therefore explore whether the level of optimism can be improved through cognitive behavior therapy, exercise, lifestyle modification, social skills training or biological interventions.

1. Introduction

In the last decades more research has focused on the beneficial effects of positive psychological factors on health. One of the most extensively investigated factors of positive psychology is optimism. It is commonly believed that being optimistic confers a buffer against mental and physical health problems. But are these benefits real? Do optimistic people fare better when facing challenges and adversity? And, if so, what are the mechanisms underlying these associations? This review aims to provide the reader with an overview of the current knowledge on optimism and its correlation with several biological and psychosocial markers.

2. Optimism

Reviewing the literature, it appears that the notion of optimism has been approached from a variety of perspectives. Basically, optimism involves holding positive expectancies for one's future. However, while some theoretical views focus on expectancies that apply to a particular situation, others focus on more general expectancies. There are two main scientific conceptualizations which are theoretically interconnected but not equivalent, i.e. dispositional optimism (Scheier *et al.*, 1994) and explanatory (style) optimism (Peterson & Seligman, 1984).

Dispositional optimism refers to one's generalized positive expectations towards the future (Carver *et al.*, 2010) and is usually measured by asking people directly whether they expect their future to be good or bad (Scheier *et al.*, 1994). People with high dispositional optimism tend to expect good things rather than bad things to happen in their future. On the contrary, people with low dispositional optimism have the inclination to anticipate negative outcomes regarding life challenges and have the perception that these situations are unchangeable and uncontrollable. These perceptions of lack of control on a stressor are linked to learned helplessness, by which people become passive and unresponsive to the stressor because they believe that there is no sense in trying to change something that is unchangeable (Maier & Seligman, 1976). These differences in expectations on one's future are thought to greatly influence our behavior. The concept of dispositional optimism is based on the self-regulation theory of Carver and Scheier, which posits that people organize their behavior towards goals they perceive as desirable and attainable (Carver *et al.*, 2010). Accordingly, individuals who hold positive expectations for their future see their desired outcomes as attainable and endeavor in the achievement of their goals. In contrast, people who hold negative expectations for their future see their desired outcomes as unattainable and give up more easily. Thus, without confidence in the attainability of the desired goals, no action will be taken to achieve them.

Explanatory optimism or an optimistic explanatory style rests on the hypothesis that future expectancies are mainly derived from attributions to past events (Peterson & Seligman, 1984). This conceptual model stems from the learned helplessness theory (Seligman, 1975). This model proposes that people with an optimistic explanatory style attribute drawbacks to temporary, external, and specific situations, whereas people with a negative explanatory style attribute problems to permanent, internal, and global causes (Gillham *et al.*, 2001; Tomakowsky *et al.*, 2001). Therefore, explanatory optimism is commonly assessed by measuring patterns of attributions about the causes of past events and inferring whether these past attributions ultimately yield future expectancies.

As evident from these definitions, there is a clear theoretical connection between dis-

positional optimism and explanatory style optimism; both assume that the consequences of optimism derive from differences in expectancies (Scheier & Carver, 1992). However, there are also some important differences between dispositional optimism and explanatory optimism. Whereas explanatory style optimism focuses on the attributions that people give to a certain past event, dispositional optimism directly measures one's future expectancies. Therefore, dispositional optimism centers around a focus on the future and is closely related to life engagement, vitality, and feelings of having a purpose in life (Giltay *et al.*, 2006a). Furthermore, the difference between dispositional optimism and explanatory style optimism has been confirmed by the relatively poor correlations (range 0.10–0.25) found between the two scales that measure these two conceptualizations of optimism (Ahrens & Haaga, 1993; Dember, 2001; Peterson & Vaidya, 2001; Tomakowsky *et al.*, 2001).

Besides these two main conceptualisations of optimism, other approaches have also been proposed. The self-efficacy theory is based on people's expectancies of being able to execute desired behaviors successfully by using adequate coping strategies across a broad range of demanding situations (Schwarzer, 1994). In contrast to dispositional optimism, the self-efficacy theory is more focused on the importance of personal agency in subsequent behavior and holds that this behavior is best predicted by domain-specific expectancies (Bandura, 1982).

Another way to look at optimism is unrealistic optimism, which is characterized by people's tendency to overestimate the chances of future desirable outcomes (Helweg-Larsen & Shepperd, 2001; Weinstein, 1980; Weinstein & Klein, 1996). People may consider their chances of getting happily married or receiving a promotion above average (Lench, 2009). There is some evidence that the general population is prone to be overly (and unrealistically) optimistic (Klein & Weinstein, 1997). However, there are cultural and gender differences. It seems that people from Western cultures (i.e. North America, Western Europe) are more likely to be unrealistically optimistic than people from Eastern cultures (i.e. Japan), when comparing their risk perception of potential adverse future events (Rose *et al.*, 2008). Furthermore, men are more likely to be overconfident about their chances to avert a negative event than women (Lin & Raghubir, 2005).

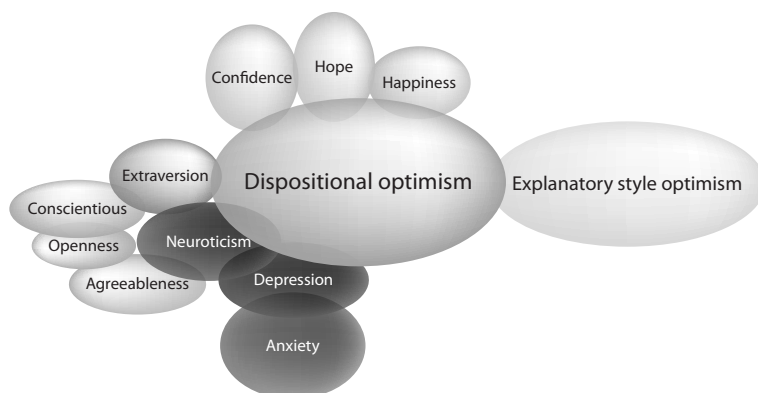


Figure 1. Psychological constructs related to dispositional optimism.

Other constructs related to optimism are hope, hopelessness and happiness. Optimism has been inversely related to hopelessness, which refers to the incapacity to imagine plausible ways to achieve a personal goal (Snijder *et al.*, 2002). Compared to hope, dispositional optimism may reflect more general beliefs about a variety of aspects (Rand, 2009). Thus, hope focuses more directly on the personal attainment of specific goals, whereas optimism focuses more broadly on the expected quality of future outcomes in general (Bryant & Cvengros, 2004). Nevertheless, optimism has been shown to be significantly correlated with hope ($r=0.55$) (Magaletta & Oliver, 1999). Happiness is a state that reflects a positive balance when a person evaluates positive versus negative experiences and perceives that this balance has met his/her expectations (Veenhoven, 1994). Dispositional optimism, by contrast, is a personality trait that implies a disposition to believe that, in our future, good things are more likely to happen than bad things (Scheier *et al.*, 1994). Optimism and happiness are interrelated, but happiness is less stable over long periods of time and is more closely linked to hedonism and more dependent on environmental factors, such as economic and social problems (Veenhoven, 2003).

In the following sections, we give an overview of important determinants of optimism, the effects of optimism on health outcomes, and the potential mechanisms underlying these associations. In view of the fact that our group has primarily investigated dispositional optimism, the current literature review will only focus on studies concerning dispositional optimism and its correlates with health outcomes, coping, biological factors, and social integration. Thus, throughout this chapter, when we refer to optimism, we explicitly refer to dispositional optimism.

3. Development of optimism

Optimism is thought to stem from a combination of genetic and environmental factors (Gillham & Reivich, 2004; Vaughan, 2000). Although there is some indication of a genetic predisposition for optimism, it does not explain how optimism develops (Plomin *et al.*, 1992). Increasing evidence suggests that also certain environmental factors during childhood may play a crucial role in the development of one's disposition to optimism (Gillham & Reivich, 2004). For example, children who experience negative events in childhood, such as abuse or parental hostility, are more likely to display lower optimism (Brodhagen & Wise, 2008; Hjelle *et al.*, 1996; Korkeila *et al.*, 2004). Furthermore, parents appear to be able to increase the optimistic outlook of their children by modeling their children's optimistic beliefs and behaviors when facing adversity. Parents may also promote optimism by helping their children build skills and develop beliefs in their ability to face challenges (Gillham & Reivich, 2004). Also a secure attachment between parents and their children appears to increase levels of optimism of the children (Carver & Scheier, 2002). Other predictors of higher levels in optimism in the adolescence and early adulthood are parental socioeconomic status, school achievement, vocational education, and work history (Ek *et al.*, 2004). Younger age has been found to be predictive of higher levels of optimism, also in older populations (Giltay *et al.*, 2006a). Other correlates of higher levels of optimism in older age are a higher education, living with others, and feeling healthy (Giltay *et al.*, 2007a). However, it is yet to be investigated whether these or other sociodemographic factors may predict higher levels of optimism over time in older adults.

4. Measuring optimism

The most commonly used instrument to measure dispositional optimism is the Life Orientation Test (LOT), which was developed by Scheier and Carver in 1985. This instrument was later revised (becoming a briefer version) to eliminate some content overlap with coping and to exclude items that did not completely refer to positive expectations (Scheier *et al.*, 1994). This newer version was called the Life Orientation Test-Revised (LOT-R) and consists of 10 items rated on a 5-point Likert scale, with six items yielding an optimism score and four filler items (Figure 1) (Scheier *et al.*, 1994). Scheier and Carver (1985) reported a Cronbach's alpha of .76 and a test-retest correlation of .79 over a 4-week period. In a later psychometric analysis of the LOT-R a Cronbach's alpha of .71 was reported (Herzberg *et al.*, 2006). Other instruments to measure optimism include the four-item questionnaire (4Q) and a subscale of the Scale for Subjective Wellbeing of Older subjects (SSWO). The 4Q consists of four statements rated on a 3-point Likert scale (Figure 2) (Giltay *et al.*, 2006b). A Cronbach's alpha of .71 was reported for the 4Q (Giltay *et al.*, 2008). The SSWO optimism subscale consists of seven items also rated on a 3-point Likert scale (Giltay *et al.*, 2004) (Figure 3). A Cronbach's alpha of .76 has been reported for the optimism subscale of the SSWO (Giltay *et al.*, 2004).

An issue that frequently arises in optimism research is the dimensionality of the most frequently used LOT-R. While some studies support the use of the LOT-R as a uni-dimensional scale (optimism) (Achat *et al.*, 2000; Scheier *et al.*, 1999; Segerstrom *et al.*, 1998), others support a bidimensional approach (optimism and pessimism) (Herzberg *et al.*, 2006; Kubzansky *et al.*, 2004; Mroczek *et al.*, 1993). Segerstrom *et al.* found that the LOT-R was best used as a unidimensional scale, but recognized that there is some psychometric evidence for bidimensionality (Segerstrom *et al.*, 2011).

5. Temporal stability of optimism

Dispositional optimism has been posited as a trait-like characteristic that determines the self-regulation of behavior (Scheier & Carver, 1992). A reliability coefficient of the LOT ranging from .58 to .82 has been reported over periods of time lasting from several weeks to one year (Atienza *et al.*, 2004; Scheier *et al.*, 1994). Similar reliability coefficients (Cronbach's alpha of 0.78) were found for the 4Q in a prospective study with 15-years of follow-up (Giltay *et al.*, 2006b). Thus, one's level of optimism is presumably relatively stable over time, as is also evident from the high temporal stability in longitudinal studies (Achat *et al.*, 2000; Bromberger & Matthews, 1996; Scheier *et al.*, 1994). In a small non-randomized study, dispositional optimism remained relatively unaffected after intensive mental training and physical coaching (Norlander *et al.*, 2002). However, fluctuations in optimism over time have also been reported, suggesting that changes in dispositional optimism are possible (Sweeney *et al.*, 2006).

6. Optimism as a predictor of health outcomes

Epidemiological studies have shown that degree of optimism is related to a myriad of health outcomes, both in the general population and in patients. Higher levels of optimism correlate with subjective health outcomes such as a perceived health or better functional status (Achat *et al.*, 2000) and objective health measures such as disease progression and mortality (Chida & Steptoe, 2008). Especially cardiovascular mortality risk and survival have been well-investigated (Giltay *et al.*, 2004; Giltay *et al.*, 2006a). Regarding mental health, optimism has

been associated with better psychological well-being (Cederblad *et al.*, 1995; Giltay *et al.*, 2006b), less depressive symptoms (Giltay *et al.*, 2006b), and better psychological adjustment in chronically ill patients (Fournier *et al.*, 2002a). In the following sections, we provide an overview of the different correlations between optimism and physical and mental health.

6.1 Physical health

6.1.1 Physical functioning and perceived health

In the last decades, optimism has been increasingly associated with better health outcomes and quality of life (Bain *et al.*, 2003; Wrosch & Scheier, 2003). An analysis of the Normative Ageing Study showed that dispositional optimism was positively correlated with several scales of the Medical Outcome Study 36-item short-form health survey (SF-36), independently of depression and demographic variables in middle-aged men (Achat *et al.*, 2000). Similarly, another study among older women showed that optimism was associated with better physical functioning (Umstadtd *et al.*, 2007). Self-rated health was also strongly associated with levels of optimism in community-dwelling older persons (Giltay *et al.*, 2007a). This association has also been found in patient populations. A study among patients receiving cardiac rehabilitation showed that higher optimism was positively associated with perceived health through more adaptive coping (Shen *et al.*, 2004).

6.1.2 Morbidity and mortality

6.1.2.1 Cardiovascular disease

There is increasing evidence suggesting that optimism may also affect disease progression and recovery (Table 1). Scheier *et al.* studied the effects of optimism in a group of patients undergoing coronary artery bypass surgery and found that those patients with higher optimism scores responded better to the surgical intervention and displayed a faster physical recovery (Scheier *et al.*, 1999). These beneficial effects were also present six months after the intervention, as optimistic patients were more likely to engage in vigorous physical exercise and resume work (Scheier *et al.*, 1989). In a similar study conducted among women who underwent a coronary artery bypass operation, women who were optimistic were more likely to accept their situation and to display more favorable outcomes (King *et al.*, 1998). In a later longitudinal study among patients participating in a cardiac rehabilitation program, optimism was found to decrease global coronary risk by increased aerobic capacity through engagement in healthy behaviors (Shepperd *et al.*, 1996). Accordingly, a prospective study among patients undergoing a cardiac transplantation showed that positive expectations predicted better adherence to medical treatment and a favorable recovery (Leedham *et al.*, 1995).

Optimism has also been associated with survival and decreased mortality risk both in community-dwelling healthy populations and in patients (Chida & Steptoe, 2008). In a prospective study among a community-dwelling population of elderly men and women, higher optimism scores were predictive for less all-cause and cardiovascular mortality after 9 years of follow-up, although this association was stronger in men than in women (Giltay *et al.*, 2004). These findings were confirmed in a later study which specifically investigated the risk of cardiovascular death in a cohort of older men from the general population (Giltay *et al.*, 2006a). The latter study showed that the association with all-cause mortality was substantially weaker (Giltay *et al.*, 2006c).

6.1.2.2 Cancer

The evidence of optimism being beneficial for disease progression and recovery in patients

with cancer is less consistent. A study among post-operative breast cancer patients showed that optimism was associated with less altered immune responses as, for example, less natural killer cell activity (Von Ah *et al.*, 2007). Furthermore, higher optimism scores were associated with better physical functioning and less somatic complaints in patients with cancer (Tallman *et al.*, 2007; Wyatt *et al.*, 1999).

The association between optimism and cancer mortality has been examined in cohorts of cancer patients, but with mixed results. While some prospective studies found a protective effect of dispositional optimism on survival of cancer patients (Allison *et al.*, 2003; Butow *et al.*, 1999; Schulz *et al.*, 1996), others did not (Schofield *et al.*, 2004). However, as reported in a review on the relationship between coping styles and cancer survival, studies displaying positive findings were mostly small, with short follow-up periods, and lacked adjustment for important confounders (Petticrew *et al.*, 2002). In more recent and larger prospective studies no evidence was found for lower survival rates in cancer patients with higher optimism levels prior to treatment (Schofield *et al.*, 2004). In a study among community-dwelling older men, optimism did not predict a lower risk of non-cardiovascular mortality, especially cancer mortality (Giltay *et al.*, 2006c). Taken together, there is little and inconsistent evidence that a higher level of dispositional optimism helps to increase survival rates in cancer patients.

6.1.2.3 Chronic diseases

The benefits of optimism have also been studied in relation to chronic diseases. In a longitudinal study among patients with diabetes mellitus low optimism was identified as a risk factor for worsening levels of glycosylated hemoglobin after one year of follow-up (Yi *et al.*, 2008). Furthermore, optimism was also reported to predict less somatic complaints in patients with diabetes mellitus (Motivala *et al.*, 1999). Further research showed that optimism was related to slower disease progression in patients with human immunodeficiency virus (HIV) (Ironson *et al.*, 2005; Ironson & Hayward, 2008; Milam *et al.*, 2004), patients with arthritis (Ferreira & Sherman, 2007; Fournier *et al.*, 2002b), patients undergoing hemodialysis (Morales Garcia *et al.*, 2011), and patients with obstructive pulmonary diseases (Kubzansky *et al.*, 2002). Dispositional optimism was also related to better adjustment to certain diseases, such as Parkinson's disease or multiple sclerosis (Ridder *et al.*, 2000). Nevertheless, these studies provided only correlational evidence and cannot imply causation since residual confounding and reverse causation may play an important role in these relationships. In other words, it is possible that chronic diseases with an aggressive progression may result in poorer levels of optimism than chronic diseases with milder progression.

6.2 Mental well-being

Dispositional optimism has been related to a greater stress resilience and lower risk for mental health problems, such as depressive or anxiety symptoms (Scheier *et al.*, 1994). Several studies have reported more depressive symptoms in young or middle-aged adults with lower optimism (Bromberger & Matthews, 1996; Cohen *et al.*, 2001; Fontaine & Jones, 1997; Shnek *et al.*, 2001). A prospective cohort study with 10 years of follow-up among college students showed that high optimism was predictive of less depressive symptoms at the end of the follow-up, even after adjustment for baseline depressive symptoms, negative affect, positive affect, and daily hassles (Vickers & Vogeltanz, 2000). Furthermore, there is also some evidence to suggest that optimism buffers the relationship between hopelessness and suicidal ideation in depressed young adults (Hirsch & Conner, 2006). In middle-aged adults, optimism was found to be predictive of less depressive symptoms (Andersson, 1996), reduced

duration of the depressive episode and the time till the patient resumed work (Kronstrom *et al.*, 2011). Those few studies among older persons have also shown an inverse association between optimism and depression (Isaacowitz & Seligman, 2002). In a prospective cohort study among elderly men, a lower cumulative incidence of depressive symptoms was found among those men with higher optimism scores (Giltay *et al.*, 2006b). Accordingly, in another study among community-dwelling older women, low optimism was found to be associated with sub-threshold depression (Vahia *et al.*, 2010). A recent prospective study among middle-aged depressed participants showed that persons with higher optimism scores displayed a better and faster recovery without the need of a lengthy treatment as less optimistic persons (Karlsson *et al.*, 2011). Thus, even after development of a depressive episode, dispositional optimism seems to have a beneficial effect on the recovery process. The association of optimism with depressive and anxiety has also been found among cancer patients (Horney *et al.*, 2011; Zenger *et al.*, 2010). All in all, dispositional optimism seems to have a beneficial effect on the recovery process even after the development of a depressive episode.

7. Potential mechanistic correlates of optimism

From the reviewed literature, it is clear that dispositional optimism is positively associated with a wide range of positive health outcomes, regarding both mental and physical health. Nonetheless, most studies only provide evidence of a correlation and cannot unequivocally answer the question of causation. Despite this uncertainty, a number of potential psychosocial and biological mechanisms have been proposed to explain the associations between dispositional optimism and favorable health outcomes. This section presents a summary of the literature on these potential underlying mechanisms.

7.1 Coping style

The protective effect of optimism on health is thought to be partially explained by optimists' engagement in more adaptive coping strategies in the face of uncontrollable stressors such as a health disorder (Taylor, 2007). Coping refers to the cognitive and behavioral adaptation to manage demands that exceed the resources of a person (Lazarus & Folkman, 1984). Since coping involves the interaction between the person and his/her environment, it is reasonable to expect variation among people in their predispositions to cope in particular ways (Nes & Segerstrom, 2006).

Coping is commonly thought to be a mechanism through which dispositional optimism translates into better adjustment to stressors (Aspinwall & Taylor, 1992; Park *et al.*, 1997; Scheier & Carver, 1985). Optimism is positively associated with approach-oriented coping (e.g. positive reappraisal and acceptance) and inversely associated with avoidance coping (e.g. denial and behavioral disengagement). Approach-oriented coping refers to the engagement of cognitive and behavioral efforts to reduce, eliminate, and actively manage the demands evoked by a stressor (Suls & Fletcher, 1985). This mediation is explained in the behavioral self-regulation model proposed by Carver and Scheier (Carver & Scheier, 2000). In this model, when a desired goal is blocked (e.g., due to a threat or challenge), optimists put forth more effort on overcoming the obstacle because of their conviction that positive outcomes are attainable. Presumably, approach-oriented coping is more likely to be used in situations that are perceived as amenable to positive change. Furthermore, as shown in a meta-analysis on the association between optimism and coping, optimists show active attempts to change and accommodate to stressors, reflecting flexible engagement in adaptive coping regarding

TABLE 1. Studies investigating the associations of dispositional optimism with somatic morbidity and mortality

Study	N	Sample type	Optimism measure	Outcome	Study design	Results
Review studies:						
Chida et al (2008)	70 studies	Healthy & disease populations	Several scales	Survival	Meta-analysis of longitudinal studies	Optimism predicted survival
Ironson et al (2008)*	122 studies	HIV patients	Several scales	Disease progression	Review of longitudinal studies	Optimism predicted slower disease progression
Original research:						
Allison et al (2003)	101	Patients with head and neck cancer	LOT	Survival	Longitudinal, FU= 1 year	Optimism predicted survival
Burow et al (1999)	125	Patients with metastatic melanoma	COPE	Survival	Longitudinal, FU= 2 years	Optimism predicted survival
Ferreira et al (2007)	73	Patients with osteoarthritis	LOT-R	Well-being	Cross-sectional	Optimism associated to less pain and higher well-being
Fournier et al (2002b)	104	Patients with chronic diseases	LOT-R	Physical functioning (SF-36)	Cross-sectional	Optimism associated with better adaptation to disease
Gilay et al (2004)	941	Older community-dwelling subjects	SSWO	All-cause and CV mortality	Longitudinal, FU= 9 years	Optimism predicted less all-cause and CV mortality
Gilay et al (2006b)	887	Older community-dwelling men	4-item questionnaire	CV mortality	Longitudinal, FU= 15 years	Optimism predicted less CV mortality
Ironson et al (2005)	177	HIV patients	LOT-R	Disease progression	Longitudinal, FU= 2.5 years	Optimism predicted slower disease progression
Kling et al (1998)	55	Women undergoing by-pass surgery	LOT	Sickness impact profile	Longitudinal, FU= 12 months	Optimism predicted better functional ability
Milam et al (2004)	412	HIV patients	LOT-R	Disease progression, CD4 counts	Longitudinal, FU= 18 months	Moderate optimism predicts less disease progression
Morales García et al (2011)	239	Patients undergoing chronic haemodialysis	LOT-R	Health related quality of life	Cross-sectional	Optimists associated with subjective health status
Morviala et al (1999)	38	Diabetic patients	LOT	Somatic complaints	Longitudinal, FU= 10 years	Optimism predicted less somatic complaints
Ridder et al (2000)	166	PD or MS patients	LOT	Adaptation to disease	Cross-sectional	Optimists associated with better adaptation to disease
Shepherd et al (1996)	22	Cardiac patients	LOT	Global Coronary Risk	Longitudinal, FU= 18 weeks	Optimism predicted less CV morbidity
Scheier et al (1989)	51	Middle-aged men	LOT	Physical function after operation	Longitudinal, FU= 6 months	Optimism predicted better recovery
Scheier et al (1999)	309	Patients undergoing by-pass surgery	LOT-R	Rehospitalization rate	Longitudinal, FU= 6 months	Optimism predicted lower rehospitalization rates
Schofield et al (2004)	204	Patients with lung cancer	LOT	Survival	Longitudinal, FU= 5 years	Optimism did not predict lung cancer survival
Schulz et al (1996)	238	Cancer patients	LOT	Mortality	Longitudinal, FU= 8 months	Low optimism predicted mortality
Talman et al (2007)	56	Cancer patients	LOT	Positive coping	Longitudinal, FU= 3 years	Optimism predicted better coping
Tomaskowsky et al (2001)	78	HIV-infected men	LOT, EASQ	CD4 counts	Longitudinal, FU= 2 years	Optimism did not predict CD4 counts
Von Ah et al (2007)	54	Breast cancer patients	LOT-R	Immunological markers	Cross-sectional	Optimism was not associated with immune responses
Wyatt et al (1999)	699	Cancer patients	LOT	Somatic complaints	Longitudinal, FU= 6 weeks	Optimism predicted less somatic complaints
Yi et al (2008)	111	Diabetes patients	LOT	Glycosylated hemoglobin	Longitudinal, FU= 1 year	Low optimism predicted worsening HbA1c

COPE= General Coping Strategies Scale; CV= cardiovascular; EASQ= Expanded Attribution Style Questionnaire; FEV1= Forced Expiratory Volume in 1 second; FVC= Forced Vital Capacity; FU= follow-up; HbA1c= glycosylated hemoglobin; HIV= Human Immunodeficiency Virus-infection; LOT= Life Orientation Test; LOT-R= Life Orientation Test- Revised; MMPI-2= Minnesota multiphasic personality inventory-2; MS= Multiple Sclerosis; PD= Parkinson's disease; SF-36= short form 36 health survey questionnaire; SSWO= Dutch Scale of Subjective Well-being for Older Persons.

controllability of stressors (Nes & Segerstrom, 2006). In this meta-analysis, larger effect sizes were found for approach coping in relation to academic and health stressors, whereas emotion-approach coping was more strongly associated with traumas. In other words, even when the stressor is uncontrollable or unchangeable (e.g. traumatic events), optimists use a coping strategy that seeks to reduce or manage the emotional consequences of the stressor.

Thus, in summary, optimists tend to view a stressful situation in a more positive light, develop a problem-focused strategy to face the stressor, and are more flexible regarding the demands of the stressor (Scheier *et al.*, 1994).

7.2 Social integration

Optimism also seems to play an important role in the social domain, as evident from an increasing amount of research in this field. Although little is known about the potential protective effect of optimism on loneliness, several cross-sectional studies have shown that optimism is linked to less loneliness in college students (Montgomery *et al.*, 2003; Neto & Barros, 2003) and in low-vision older women (Barron *et al.*, 1992). This association has also been investigated in several longitudinal studies (Brisette *et al.*, 2002; Jackson *et al.*, 2000; Nurmi *et al.*, 1996; Rius-Ottenheim *et al.*, 2011; Srivastava *et al.*, 2006). One longitudinal study examined the effect of dispositional optimism and quality of close relationships on loneliness in a college student sample during a 6-week follow-up period and showed that lower levels of optimism and social support were associated with more feelings of loneliness (Jackson *et al.*, 2000). In another longitudinal study among college students, higher optimism was prospectively associated with greater increases in perceived social support over 6 months of follow-up (Brisette *et al.*, 2002). Accordingly, results from a longitudinal study among college students study indicated that less optimistic students were more likely to use a social-avoidance coping strategy and felt more loneliness than their more optimistic peers (Nurmi *et al.*, 1996).

Optimism is also beneficial for social integration in older populations. A study among older married couples showed that optimism was predictive of a better relationship status after one year of follow-up (Srivastava *et al.*, 2006). Another prospective study among community-dwelling older men showed that higher optimism scores were predictive of lower loneliness scores after 10 years of follow-up (Rius-Ottenheim *et al.*, 2011). It is conceivable that, after a negative event, optimists use coping strategies that foster more positive appraisals of the existing social network or lead to actively pursue new social relationships (Scheier *et al.*, 1986). In this way, dispositional optimism might lead to the achievement of a better social embedding and protect against feelings of loneliness.

7.3 Health behaviors

Another pathway through which optimism may influence health is through engagement in health promoting behaviors and avoidance of health damaging behaviors (Giltay *et al.*, 2007a). This hypothesis has been confirmed by linking dispositional optimism to non-smoking, increased physical activity, moderate alcohol use and consumption of more fruits, vegetables, and whole grains (Giltay *et al.*, 2007b; Kelloniemi *et al.*, 2005; Steptoe *et al.*, 2006). The engagement in more healthy behaviors is, in turn, critical for prevention of chronic conditions such as cardiovascular diseases or metabolic syndrome (Blokstra *et al.*, 2010; Yamashiro *et al.*, 2010).

Physical activity has frequently been proposed as a lifestyle factor that might mediate the association between positive psychological factors and better health outcomes. Optimism is

cross-sectionally associated with physical activity (Giltay *et al.*, 2007b; Kavussanu & McAuley, 1995). However, more studies with a prospective design are needed to elucidate the direction of causality of this association.

Optimism has been inversely associated with smoking dependence and alcohol use. Two cross-sectional studies among twin females (Kendler *et al.*, 1999) and school students (Carvajal *et al.*, 2000); and another prospective study among college students (Baker, 2007) have shown that persons with higher optimism scores are less likely to develop nicotine dependence. Regarding alcohol use, cross-sectional evidence has associated higher optimism with moderate alcohol use (Steptoe *et al.*, 2006), while lower optimism has been associated with heavy alcohol consumption (Kelloniemi *et al.*, 2005). Accordingly, a prospective study among community-dwelling older men showed that higher optimism was predictive of moderate alcohol consumption (Giltay *et al.*, 2007b). Thus, there seems to be a non-linear U-shaped association between alcohol use and optimism.

Optimists are more likely to have healthier dietary habits, as they tend to consume more foods rich in fiber and low in fat or saturated fats. A Finnish cross-sectional study showed that higher optimism scores were positively associated with higher consumption of fresh vegetables or salads, berries, fruit, low-fat cheese, and salad dressing (Kelloniemi *et al.*, 2005). Another cross-sectional study among a Dutch older population showed that optimists were more likely to consume more fruit, vegetables, whole-grain bread, and fish fatty acids (eicosapentanoic acid [EPA] and docosahexaenoic acid [DHA]; however with borderline significance) (Giltay *et al.*, 2007b). These cross-sectional findings regarding fish fatty acids were only partially confirmed in a later longitudinal study among older community-dwelling men and women, as the consumption of fish fatty acids was associated with optimism measured with the 4Q, but not with the LOT-R (van de Rest *et al.*, 2010).

Some have argued that health-related behaviors might be seen as coping strategies used in contexts in which the source of stress is health-related (i.e. due to an illness or physical disability). That is, as being in good health is a desired goal, optimists tend to engage in positive health practices to achieve their goal. In this way, health-promoting behaviors are presumably related to optimists' capacity to anticipate benefits of behavioral change on health (Aspinwall & Brunhart, 1996). This hypothesis has been confirmed in both patients and population-based studies. In a study among patients following a cardiac rehabilitation program it was observed that patients with higher optimism scores achieved a greater success in lowering levels of saturated fat, body fat, and global coronary risk by embracing a healthier diet and raising the level of physical exercise across the rehabilitation period (Shepperd *et al.*, 1996). Also in another study among chronically ill patients, it was found that higher optimism predicted greater engagement in self-care behaviors (de Ridder *et al.*, 2004). Finally, in a group of undergraduate students it was shown that dispositional optimism was positively correlated with engagement in health-promoting behaviors (Robbins *et al.*, 1991).

7.4 Systemic stress, oxidative stress, and inflammation

The association between dispositional optimism and better physical health is probably not exclusively mediated by lifestyle factors, but also through biological factors.

Chronic stress is associated with impaired immunity and increased inflammatory markers (Kemeny & Schedlowski, 2007). Several studies have aimed to elucidate the moderating

effect of optimism on the relationship between stress and immunity. A study among college students under stress, found that those students with lower optimism scores displayed an increased lymphocyte turnover and an improved natural killer cell activity when compared with students with higher optimism scores (Segerstrom, 2001). More recently, the same authors showed that changes in optimism were correlated to changes in cell-mediated immunity, although this association was partly mediated by positive affect (Segerstrom & Sephton, 2010). Similarly, a prospective cohort study found an association between higher optimism and T lymphocytes (CD8+, CD11b+), but only in case of acute stressors and not with prolonged stressors (Cohen *et al.*, 1999). In older persons, optimism has also been associated with a better immune response to influenza vaccine (Kohut *et al.*, 2002).

It has been hypothesized that changes in immune responses may result from the effects of psychological stress on the activation of the hypothalamic-pituitary-adrenal (HPA) axis. Psychological stress enhances release of glucocorticoids which are, in turn, responsible for changes in cellular and humoral responses (Glaser & Kiecolt-Glaser, 2005). The resultant release of glucocorticoids may also affect the systemic inflammatory status. In a study among middle-aged healthy adults ($n=6814$), higher dispositional optimism scores were inversely associated with circulating levels of C-reactive protein (CRP), a non-specific systemic inflammatory acute-phase protein (Roy *et al.*, 2010). Another study using a Mendelian randomisation design, haplotypes of the CRP (a well-known inflammatory marker) were found to be associated with dispositional optimism, but only in the overweight/obese group (BMI >25 kg/m²) (Rius-Ottenheim, 2011a). This finding suggests that the association between dispositional optimism and inflammation levels may be moderated through longstanding changes in health behaviours and lifestyle.

On the cellular level, telomere length has become increasingly popular in the study of the effects of chronic stress on the immune system (e.g. leukocytes). Telomeres are repetitive DNA sequences that cap chromosomal ends and play a critical role in promoting chromosomal stability (Blackburn, 2001). When the telomeres reach a critical minimal length, the cell will go into senescence, leading ultimately to apoptosis. Since telomere length reflects the number of cell divisions, it has been proposed as a marker of biological aging. Telomeres shorten more rapidly under certain conditions, such as exposure to prolonged stressors (e.g. oxidative stress) (Richter & Von Zglinicki, 2007). Therefore, it has been hypothesized that chronic psychological stress may be translated in accelerated telomere attrition. Several cross-sectional studies among middle-aged adults have documented telomere shortening in relation to dispositional pessimism (O'Donovan *et al.*, 2009). However, in a prospective study investigating the association between leukocyte telomere length and dispositional optimism, no association was found between changes in telomere length and changes in dispositional optimism (Rius-Ottenheim, 2011b).

8. Interventions to increase optimism

To date, very little experimental work has been conducted to examine interventions to increase optimism and, if present, was mainly focused on explanatory optimism (Gillham & Reivich, 2004; Ruthig *et al.*, 2004). Only recently, more studies have focused on interventions to (temporarily) increase dispositional optimism by means of experimental manipulation. Findings from these recent experimental studies indicate that an individual's future expectancies are malleable and may result in increased levels of dispositional optimism (Fosnaugh *et al.*, 2009; Peters *et al.*, 2010). The first study was conducted among 160 college

students who took part in two different experiments to increase optimism: one based on positive mental imagery and the other based on optimism priming. In both experiments, after a follow-up of a couple of weeks, students who had participated in the interventions displayed higher optimistic responses than those students in the control condition (Fosnaugh *et al.*, 2009). Similar results were reported in a second intervention study in which 82 college students were asked to imagine their best possible self using mental imagery and found that the intervention of mental imagery increased dispositional optimism levels, independently of mood changes during the intervention (Peters *et al.*, 2010). Extending these findings, a recent experimental study among 54 college students showed that positive imagery increased optimism independently of mood and that the achieved changes in optimism were sustainable over the limited time period of two weeks (Meevissen *et al.*, 2011). Although these studies provide preliminary evidence on the potential of a facet of cognitive behavioural therapy (CBT) (i.e. mental imagery) to increase dispositional optimism, some issues may hamper the interpretation of their results, such as the short follow-up periods. Furthermore, all these studies were conducted among young healthy participants and, given the correlates of dispositional optimism with health, it would be interesting to investigate the effects of CBT in a sample of older participants, patients with a somatic disease, and in patients with current or lifetime psychopathology.

Besides CBT other non-psychotherapeutic interventions might affect one's level of optimism. The prospective studies reviewed in the earlier sections suggest several promising avenues. First, optimism was inversely associated with depression and probably also with other forms of psychopathology (Bromberger & Matthews, 1996; Cohen *et al.*, 2001; Fontaine & Jones, 1997). Persons with very low levels of optimism should therefore be screened for major depression and (in serious cases) be referred for treatment. Second, consistent associations were found between optimism, better perceived social support, and low levels of loneliness (Brissette *et al.*, 2002; Nurmi *et al.*, 1996). This suggests that psychosocial interventions aimed at improving interpersonal relationships may be beneficial, such as social (e.g., family) support groups and social skills training (Kühner, 2000). Experimental studies should explore whether improving emotional support and social activities also improve optimism. Third, healthier diets, more physical activity, and non-obesity were associated with higher levels of optimism. It may be hypothesized that a healthier lifestyle beneficially affects one's level of optimism, which should be explored in future studies. For example, a large double-blind, randomized trial that investigated whether long-term treatment with low doses of n-3 fatty acids increase the level of optimism in over 4000 patients who had had a myocardial infarction (Kromhout *et al.*, 2010). Fourth, there is a strong association between prevalent coronary heart disease (CHD) and low optimism. This suggests that the classic risk factors for CHD such as obesity cigarette smoking, hypertension, hypercholesterolemia, and diabetes mellitus, may also be associated with optimism. Also weight loss, achieved through diet and lifestyle modification, are associated with a reduction of depressive symptoms (de Wit *et al.*, 2010). Although CHD risk factors were not directly associated with optimism (Giltay *et al.*, 2008), they may indirectly decrease optimism through the increased risk of onset of symptomatic cardiovascular disease. Future trials should explore whether treatment of high blood pressure, lipidemia, heart disease, and diabetes, may also increase levels of optimism. Such interventions (combined with smoking cessation) may also reduce chronic low-grade inflammation, which is also associated with low optimism (Rius-Ottenheim, 2011a). Fifth, more adaptive coping strategies have been associated with higher levels of optimism (Aspinwall & Taylor, 1992; Park *et al.*, 1997; Scheier & Carver, 1985). Interventional studies

show that it is possible to learn more positive coping skills in order to reduce perceived stress and depressive symptoms (Kim *et al.*, 2011). Another study in which general practitioners taught their patients more adaptive coping strategies showed improvements in affect, better management of illness, and a better quality of life (Mjaaland & Finset, 2009). Other interventions that have proven effective in the management of perceived stress include relaxation techniques, mindfulness, and guided mental imagery (Palmer & Rodger, 2009; Shapiro *et al.*, 1998). However, though mindfulness is seen as an instrument for self-regulation, there is no evidence that mindfulness may improve optimism. Presumably, the most effective way to increase one's optimism is to combine some of the above-mentioned techniques. A combined therapy called cognitive behavioral stress management (CBSM) has been used successfully in anxiety reduction. CBSM combines relaxation, guided mental imagery, deep breathing and meditation, with cognitive behavioral techniques such as cognitive restructuring, coping skills training, and interpersonal skills learning (Antoni, 2003). In a 10-week intervention study using CBSM in women with breast cancer it was shown that this combined intervention not only reduced anxiety or depressive symptoms, but also increased levels of optimism. Importantly, these effects remained 12 months later (Antoni *et al.*, 2006).

To summarise, future intervention studies are necessary and should use a longer follow-up period and investigate whether the increases of dispositional optimism are durable. Furthermore, other interventions besides CBT should be explored, particularly in older patients.

9. Concluding remarks and recommendations

From the literature reviewed here, it can be concluded that optimism is a disposition with personality trait-like characteristics that is strongly correlated to physical and mental well-being. Highly optimistic persons rate their health more positively and are at lower risk for cardiovascular disease than less optimistic persons. However, it remains unclear whether these health advantages translate into lower morbidity and mortality rates. Optimists enjoy a better mental health, as observed from the lower incidence of depressive and anxiety symptoms. Even if they actually develop depressive symptoms, optimists display a faster and better recovery than less optimistic depressed patients. This evidence emphasizes the importance of assessing the levels of dispositional optimism in healthy individuals as well as in patients. Patients with low optimism should receive more attention from health practitioners, since low levels of optimism are a risk marker for negative somatic and psychological health outcomes.

Despite the increasing evidence for a beneficial effect of dispositional optimism on health, it remains to be elucidated which mechanisms actually mediate these associations, as most evidence is derived from correlational studies. The strongest correlate of dispositional optimism may be the more effective coping. By using more adaptive, problem-oriented coping strategies, optimists adapt their behavior and are more successful in the management of adverse life events. These advantages are also translated to the social domain, as shown by several studies reporting that optimists feel less lonely and perceive more social support. The benefits of optimism on health are also related to the engagement in a healthier lifestyle. Optimists are usually more physically active, follow a healthier diet, and smoke less often than less optimistic people. An increasing amount of cross-sectional studies corroborate these relationships, which may in turn explain the lower cardiovascular risk observed in high optimistic persons. Nevertheless, the exact pathways remain to be elucidated. In fact, the nature of these associations between optimism and health is likely bidirectional. It is true that optimistic people tend to be more socially integrated and to engage and maintain healthy

behaviours; but their lifestyle probably also reinforces their optimism. In other words, it is possible that perceived social support and engagement in healthy practices, such as a change to a healthier diet, more physical activity, or weight loss, may result in increases in levels of optimism. Future longitudinal research should therefore investigate both directions of these associations between optimism, social support, and lifestyle factors.

It remains controversial whether it is possible to increase one's optimism and thereby decrease the health risks of less optimistic people. Although there is some evidence of success in the short-term manipulation of one's future expectancies, it remains unknown whether it is possible to lastingly change dispositional optimism. One could argue that in order to achieve a more enduring effect, an intervention should be aimed at experiencing actual positive outcomes instead of only imagining a positive future scenario. Alternatively, it is possible that dispositional optimism cannot be learned and that only small changes are possible in an otherwise relatively stable personality trait. Nevertheless, more research is necessary to prove or refute the hypothesis that having an optimistic disposition causes the prevention of or improves the recovery from physical disease.

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Appendix

The revisted life orientation test (LOT-R)					
Please be as honest and accurate as you can throughout. Try not to let your response to one statement influence your responses to other statements. There are no 'correct' or 'incorrect' answers. Answer according to your own feelings, rather than how you think 'most people' would answer.					
	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. In uncertain times, I usually expect the best	①	②	③	④	⑤
2. It's easy for me to relax	①	②	③	④	⑤
3. If something can go for me, it will	⑤	④	③	②	①
4. I'm always optimistic about my future	①	②	③	④	⑤
5. I enjoy my friends a lot	①	②	③	④	⑤
6. It's important for me to keep busy	①	②	③	④	⑤
7. I hardly ever expect things to go my way	⑤	④	③	②	①
8. I don't get upset too easily	①	②	③	④	⑤
9. I rarely count on good things happening to me	⑤	④	③	②	①
10. Overall, I expect more good things	①	②	③	④	⑤
Note: Of the six items that are scored, three are keyed in a positive direction and three in a negative direction. Negatively worded items (i.e. items 3, 7 and 9) are reversely coded before scoring. The total score ranges from 0 to 24, and higher scores indicate greater optimism.					

Figure 2. Life Orientation Test- Revised

Four-item optimism questionnaire (4Q)

Below you will find some statements,
You are expected to indicate what best applies to how you felt during the last week including today

	Fully in agreement	Partially in agreement	Not in agreement	Don't know
1. I still expect much from life	2	1	0	1
2. I do not look forward to what lies ahead for me in the years to come	0	1	2	1
3. My days seem to be passing by slowly	0	1	2	1
4. I am still full of plans	2	1	0	1

Note

Of the four items that are scored, two are keyed in a positive direction and two in a negative direction. Negatively worded items (i.e. items 2 and 3) are reversely coded before scoring. The additional answer category 'do not know' is coded as the midpoint (coded as 1). The total score ranges from 0 to 8, and higher scores indicate greater optimism.

Figure 3. Four-item optimism questionnaire

Scale for Subjective Well-being of Elderly optimism subscale (SSWO-Optimism)			
Below you will find some statements that refer to general well-being. You are expected to indicate what applies best to you. There are no 'true' or 'false' answers. Please try to be as honest and take your time in completing this questionnaire.			
	Very often	Sometimes	Hardly ever
1. The feeling that life is full of promises I have...	②	①	①
2. I still expect much of life.	Agree ②	Don't know ①	Don't agree ①
3. Moments of happiness I have...	A lot ②	Not very often ①	Almost never ①
4. I do not make future plans any more.	Agree ①	Don't know ①	Don't agree ②
5. Happy laughter occurs to me...	Hardly ever ①	Sometimes ①	Very often ②
6. I am still full of plans.	Agree ②	Don't know ①	Don't agree ①
7. I am in good spirits...	Very often ②	Pretty often ①	Hardly ever ①
Note Of the seven items that are scored, two of the answer categories are keyed in a positive direction and five in a negative direction. Negatively keyed items (i.e. items 1, 2, 3, 6 and 7) are reversely coded before scoring. The total score ranges from 0 to 14, and higher scores indicate greater optimism.			

Figure 4. Scale of Subjective Well-being of the Elderly

