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Exploring the relation between positive emotions and the functional status of older adults living independently: a systematic review

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ABSTRACT

Objectives: Literature suggests that positive emotions positively influence physiological parameters but their relation to functioning in the daily life of older adults living independently remains unclear. The present work aims to investigate the relation between positive emotions and functional status in daily life of older people living independently.

Method: A systematic literature review was conducted using the PubMed, PsycINFO and Scopus electronic databases. Included works were peer-reviewed empirical studies that analysed the relation between positive emotions and ability to perform activities of daily living with older adults living independently.

Results: After removal of duplicates, 10 out of 963 papers met the inclusion criteria. Cross-sectional studies ($n = 6$) provided limited evidence about a relation between positive emotions and functioning in daily life. However, longitudinal studies ($n = 4$) provide significant evidence for an interaction between the two factors, suggesting that time influences this interaction.

Conclusion: The variety on the design and samples of the studies included in this review does not allow a cohesive conclusion of the results. Nevertheless, limited evidence suggests that higher frequency in the experience of positive emotions might be associated with lower functional limitations. The issue of causality in emotions-functioning remains unclear from the review. Further observational studies are highly recommended, supported by innovative technologies.

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Positive psychology; functioning; active aging; technology; activities of daily living

Introduction

The proportion of the global population aged above 60 years old is growing more rapidly than any other age group (World Health Organization, 2002). The high prevalence of multimorbidity among the older population (Marengoni et al., 2011) brings several challenges, such as the growing demand for healthcare in society and the need for support of independent living.

As people age, the perception of being healthy tends to be more related to the functional abilities of the individual, rather to the absence of disease (Walburg, 2015; World Health Organization, 2015). Following this perspective, the World Health Organization defines Healthy Ageing as 'the process of developing and maintaining the functional ability that enables well-being in older age' (World Health Organization, 2015, p. 8). This functional ability concerns the daily activities that support both the survival of the individual (often named basic activities of daily living (ADL)) and the interactions with his environment (also known as, instrumental ADL). There is growing evidence from both theoretical and empirical research that promotion of well-being can lead to improvement of functioning, or delay of decline (Howell, Kern, & Lyubomirsky, 2007; Lamers, Bolier, Westerhof, Smit, & Bohlmeijer, 2012).

The literature often distinguishes many components of well-being. One of those components, positive emotions, is considered part of our emotional well-being (Diener, Suh, Lucas, & Smith, 1999). Emotional well-being, also known as subjective well-being, concerns the experience of pleasurable engagement with the environment, eliciting feelings, such as happiness, joy or serenity (Fredrickson, 2001; Lyubomirsky, King, & Diener, 2005). In contrast to other well-being components, such as life satisfaction (Diener et al., 1999) and psychological well-being (Ryff, 1989), that reflect more stable patterns of individual functioning, positive emotions concern feelings and emotions at a certain moment and are prone to influences from the environment (Fredrickson, 2001). Because of their daily fluctuations, positive emotions are more suitable for daily measurement than any other aspect of well-being (Catalino & Fredrickson, 2011). Despite the fact that some lines of research defend a distinction between mood, affect and emotions (Ketal, 1975), there is no consensus in literature and therefore we use these terms interchangeably, referring to positive emotional states.

Several reviews suggest that positive emotions directly influence health, for example, by alleviating symptoms and pain and improving immune response and longevity (e.g. Chida & Steptoe, 2008; Howell et al., 2007; Pressman & Cohen, 2005; Veenhoven, 2007). However, to the best of our knowledge, there is no comprehensive review of the literature in what concerns the relation between positive emotions and functional status in older adults living independently, a growing part of the world population. As functioning concerns activities and their context, it can be

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hypothesized that a person's functional status might influence the experience of positive emotions in daily life. Pressman and Cohen (2005) suggest both a direct and indirect route through which positive emotions in turn might influence health that may also account for the relationship between positive emotions and functional status. A direct route may involve mainly direct influences on physiological functioning and disease, mediated, for example, by positive influences of positive emotions on (para)sympathic activity, the opioid system and health practices such as sleep, exercise and diet. A more indirect route suggests that positive emotions might buffer potentially pathogenic response towards stress. This is related to the broaden-and-build theory of positive emotions. As proposed by this theory, people who experience positive emotions more frequently are more likely to build a variety of resilience resources, such as environmental mastery and social support (Fredrickson, 2001; Salovey, Rothman, Detweiler, & Steward, 2000), which may help to overcome stress and induces a broader range of possible behaviours (Fredrickson & Joiner, 2002). In line, it can be hypothesized that an increase in daily positive emotions might slow down or delay functional decline. The present investigation of the relation between positive emotions and functional decline will thus benefit the development of daily life interventions aiming at prevention of functional decline, thereby reducing healthcare costs and demands.

The present work involves a systematic review which aims to investigate whether there is evidence from observational studies on the relation between positive emotions and functional status of older adults living independently. Second, we aim to investigate the causality of this relation.

Methods

Search strategy

Electronic literature searches were performed on the PsycINFO, Pubmed and Scopus databases, including publications up to May 2015, with no restriction on year of publication or language. A list of positive emotions and functional status related keywords was used to identify relevant studies, through an iterative process of search and refinement. Table 1 lists the final key terms.

Eligibility criteria

Study population: eligible studies targeted general older adults living independently. Articles in which it was clearly defined that the target population suffered from a specific disease or condition were excluded, as it is known that chronic conditions influence the emotional experience of the patients (Benzo, Kirsch, Dulohery, & Abascal-Bolado, 2016; Eaton, Bradley, & Morrissey, 2014).

Study design: included studies were observational, peer-reviewed and investigated the relation between positive emotions and functional status.

Outcome variables: included studies assessed the ability to perform daily activities independently, whether referring to basic (e.g. bathing and eating) or instrumental (e.g. shopping and managing finances) ADL. The final selection of articles included studies that assessed discrete emotion adjectives (e.g. happiness and joy) and not tapping into trait-like factors, such as optimism and sense of humour. Similar distinction between positive states and trait-like factors was performed in other reviews of literature (e.g. Chida & Steptoe, 2008).

Table 1. Key terms divided by outcomes (positive emotions and functional status) and target group.

Key terms		
Positive emotions	Functional status	Target group
Positive emot* or positive mood or positive psychology or emotional well-being or emotional well-being or subjective well-being or subjective well-being or hedonic well-being or hedonic well-being or positive affect*	Functional decline or functioning or functional status or health status or activities of daily living	Older adult* or elderly or seniors or geriatrics or aging or ageing
	AND	AND

Table 2. Inclusion and exclusion criteria used in the systematic review process.

Inclusion criteria	Exclusion criteria
(1) Participants referred to as older adults included in a general sample	(1) Studies targeting institutionalized older adults exclusively
(2) Observational studies reporting on the relation between positive emotions (as discrete or as sum value) and functional status (as the ability to perform daily activities)	(2) Studies that reported on mixed measures of positive and negative emotions
(3) Studies published in peer-reviewed journals	(3) Studies which data was acquired via proxy
(4) No limitation on date of data collection or date of publication	(4) Studies written in other languages that are not English, Dutch or Portuguese

Study selection

The inclusion and exclusion criteria for the selection based on title and abstract were decided, in an iterative process, by three researchers (MC, SL and HT) and are enumerated in Table 2.

Two researchers performed the selection on the basis of title and abstract (MC and SL). During the title-based screening, in a sample of 100 randomly selected articles, the Cohen's kappa between the two researchers was 0.84 (an interrater agreement of 95%). The selection based on the abstract resulted in a Cohen's kappa of 0.82 (an interrater agreement of 91%). The selection based on full articles was carried out by MC, followed by review and refinement by SL. Disagreements between reviewers were discussed until a consensus was reached. The reference lists of selected articles were checked to verify if there were any relevant articles that had not appeared as a result of our search. All the references were checked again *a posteriori* (in October 2015) to ensure that no relevant articles had been missed.

Data collection and synthesis

Relevant data from the selected studies were summarized in review tables previously agreed on by two authors (MC and SL). Characteristics of the study population (demographic information), method (recruitment, study design, assessment tools and data analysis) and study outcomes regarding the relation between positive emotions and functional status were extracted and summarized. Results were grouped according to the aims of the review.

Results

The search query retrieved a total of 963 articles (1485 before removal of duplicates). Figure 1 shows the number of studies included and excluded at each stage of the systematic review process. The proportion of male participants in the study

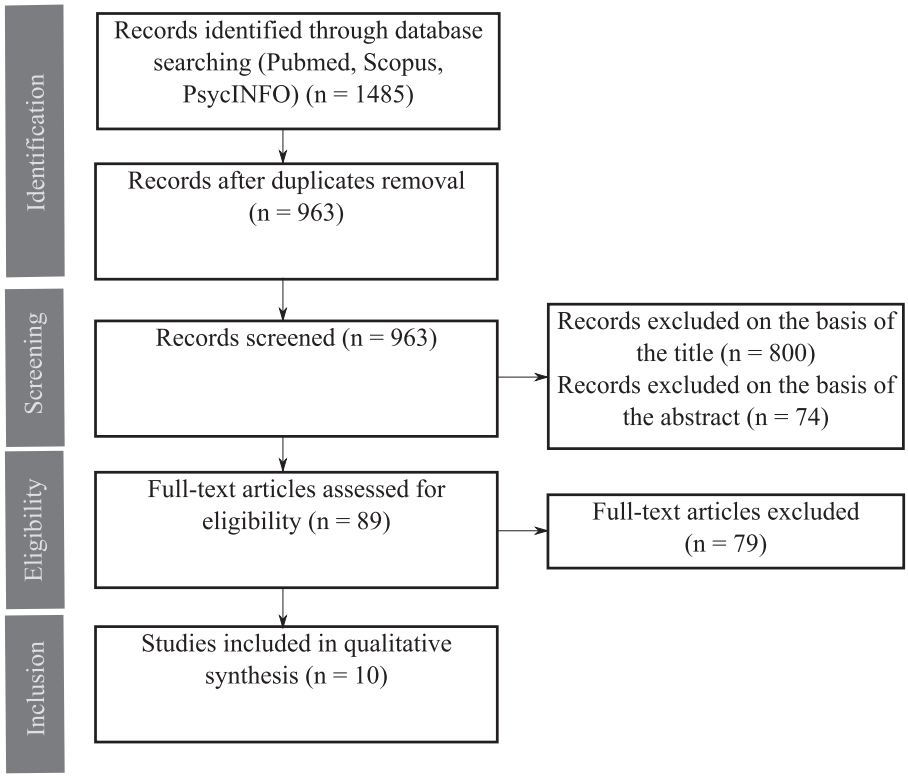

Figure 1. Flow diagram of the systematic review.

varied from 17% to 51%. All studies were performed in developed countries: five in Western Europe, three in the United States of America, one in Australia, and one in Japan. The mean age of the participants ranged from 61 up to 101 years old. The oldest study included started in 1990. Table 3 is the summary of the characteristics of each study and its outcomes.

Measures of positive emotions and functional status

Nine studies assessed positive emotions using the following standardized questionnaires: 4 or 5 positive items of Bradburn Affect Balance Scale (BABS; Bradburn, 1969), 10 positive items of Positive Affect Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988), 3 items of Short Form of the Health Survey (SF-36; Ware, 1993), 5 positive items of the Geriatric Depression Scale-15 (GDS-15; Sheikh & Yesavage, 1986), and positive scale of Philadelphia Geriatric Centre Affect Scale (PGCAS; Lawton, Kleban, Dean, Rajagopal, & Parmelee, 1992). One study asked the participants to rate the experience of positive emotions associated to each activity reported in a diary.

Six different standardized questionnaires were used to assess functional status – such as the ADL scale of the Older Americans Resources and Services Questionnaire (OARS; Fillenbaum, 1988) or the Barthel Index (Mahoney & Barthel, 1965) – whereas in the other four studies, the assessment method was either unclear or included a non-standardized set of questions.

Evidence on the relation between positive emotions and functional status

The cross-sectional studies analysed ($N = 6$) found no evidence (Cho et al., 2015) or limited evidence (Gagliardi, Marcellini, Papa, Giuli, & Mollenkopf, 2010; Isaacowitz & Smith, 2003; Kendig, Browning, & Young, 2000; Schüz, Wurm, Warner, & Tesch-Römer, 2009) for a significant relation between positive emotions and functional status of the older population.

Gagliardi et al. (2010) concluded that having more limitations in ADL was related to lower positive emotions in the Italian cohort (OR 0.91, $p = 0.001$), but not in the German sample. The Italian cohort experienced, on average, more limitations in ADL than the German cohort but higher levels of positive emotions. Isaacowitz and Smith (2003) found a significant relation between positive emotions and functional status only for the female population but not when analysing a mixed sample of 'young old' (70-84) or 'oldest-old' (85+) adults.

In a latent class analysis, Schüz et al. (2009) defined the 'healthiest' class ($n = 807$) as, among other factors, those with the highest mean values of positive emotions and the highest probability of scoring above the median functional status. Conversely, the 'unhealthiest' class ($n = 258$) was characterized by the lowest values of positive emotions and for being more prone to functional limitations.

Freedman, Stafford, Schwarz, Conrad, and Cornman (2012) investigated the influence of existence of disability and severity on the frequency and intensity of the experience of positive emotions in daily life. Participants with functional disability, experienced, on average, significantly lower levels of happiness ($p = 0.007$) and calmness ($p = 0.046$). Having a disability significantly predicted fewer number of minutes spent feeling pleasant on the previous day ($p < 0.05$). However, disability was not significantly associated with the intensity of happiness and calmness. Independently of the measure of well-being adopted, the participants in the study with a disability reported worse subjective well-being than those without a disability.

Table 3. Characteristics and summary of the outcomes of the studies included in this review.

Source	Study design, time span, sample size	Age	Measure of positive emotions	Time span assessment positive emotions	Measure of functioning	Aim of the study	Outcomes
Brummett et al. (2011)	LG, 6 years, $N = 422$	67.9 (60−85)	Three items of SF-36 ('have you been a happy person?', 'did you feel full of pep?', 'Have you felt calm and peaceful?')	Past 4 weeks	Ability to (1) walk 400 m without resting, (2) walk up and down from one floor to another without resting and (3) carrying 5 kg (e.g. shopping bag).	Analyse the role of positive emotions (value at baseline and change between baseline and follow-up) as predictors of change in functional status over a period of 6 months.	Baseline value of positive emotions not significant predictor of changes in functional status when controlling for other factors, such as marital status and social contact ($p = 0.144$). Change in positive emotions significant predictor of change in functional status at follow-up ($p = 0.004$) also in the fully adjusted model.
Cho et al. (2015)	CS, $N = 306$ (234 centenarians and 72 octogenarians)	NA	Four positive items of BABS (exclude 'satisfaction with life' term)	Past 2 weeks	Seven items of instrumental ADL and seven items of physical ADL (Fillenbaum, 1988). Three items extracted through exploratory factor analysis: dressing, taking care of appearance and getting out of bed.	Analyse the influence of, among other factors, physical functioning on subjective well-being of the oldest-old, based on successful aging and developmental adaptation models.	Higher degree of physical health impairment associated with lower levels of experience of positive affect ($p < 0.001$)
Franke et al. (2012)	LG, 6 months, $N = 11$	101, SD = 0.6	Five positive items of BABS	Past few weeks	Ability to perform 13 ADLs assessed with the ADL scale of the Older Americans Resources and Services questionnaire at baseline (OARS; Fillenbaum, 1988); upper extremity functioning and basic and advanced lower extremity functioning with functional component of the Late Life Function and Disability Instrument (LLFDI) every 2 months for a period of 6 months	Assess the extent to which, among other factors, positive emotions are prospectively associated with functional limitations in centenarians.	Higher levels of positive affect predicted better global function ($b = 0.76$), basic ($b = 0.80$) and advanced lower extremity function ($b = 0.72$) at $p < 0.01$. Better upper body function is also predicted by higher levels of positive affect ($b = 0.59$, $p < 0.05$).
Freedman et al. (2012)	DLS, $N = 751$	9.7% 50−59, 54% 60−69, 24.8% 70-79, 11.9% 80+	Pleasure (number of minutes feeling pleasant and unpleasant on the previous day), calmness and happiness	During the activity	Difficulties walking or climbing stairs, dressing or bathing, doing errands alone such as visiting a doctor's office or shopping	Investigate relationships between functional disability and subjective well-being among older couples.	Number of minutes spent feeling pleasant negatively associated with having disabilities ($p < 0.05$) and also with the severity of the disability ($p < 0.01$). Having disability was not significantly associated with experience of happiness or calmness during reported activities.
Gagliardi et al. (2010)	CS, $N = 2218$ (1518 in Germany and 600 in Italy)	German sample: 67.9, SD = 9.2 Italian sample: 69.4, SD = 9.1	10 positive items of PANAS	Past year	Not defined ADL index composed of 10 items.	Analyse the associations between personal and mobility resources with positive emotions.	Better functioning predictor of higher levels of positive affect in the Italian (OR = 0.91, $p = 0.001$) but not in the German population ($p = 0.286$).
Hirosaki et al. (2013)	LG, 2 years, $N = 505$	73.4, SD = 6.2	Five positive items of GDS-15	Not defined	Independence in seven ADLs: walking, ascending stairs, feeding, dressing, using the toilet, bathing and grooming	Investigate whether positive emotions independently predict a lower risk of functional decline among Japanese community-dwelling older adults without disabilities in ADL at baseline.	Higher experience of positive affect significantly associated with lower risk of functional decline at follow-up (OR = 0.74, $p < 0.001$). Looking at discrete emotions, happiness ($p = 0.005$) and feeling of energy ($p = 0.001$) also predicted lower risk of decline.
Isaacowitz and Smith (2003)	CS, $N = 516$	Men: 84.7; women: 85.1; (70−105)	10 positive items of PANAS	Past year	Independence in ADL (Mahoney & Barthel, 1965) and IADL (Lawton & Brody, 1969)	Analyse the relation between age and affect in the young-old (70−84) and oldest-old (85+).	Functional status not found to be a significant predictor of positive affect at any age among a population of 70+ years old.
Kendig et al. (2000)	CS, $N = 1000$	73.4	Positive scale of PGCAS	Past year	Independence in six IADL with Multilevel Assessment Instrument (Lawton, Moss, Fulcomer, & Kleban, 1982)	Investigate the mediating effect of disability in the relationship between physical illness and well-being.	IADL limitations associated with lower experience of positive affect ($p < 0.01$).
Schüz et al. (2009)	CS, $N = 2787$	61.38 (40−85)	10 positive items of PANAS	Past month	Physical functioning subscale of SF-36	Investigate relation between subjective well-being and health using latent class analysis.	Latent class analysis in which the 'healthier' class ($n = 807$) was associated with the highest mean value of positive affect and the highest probability for being above the median on the physical functioning tests. Contrarily, the 'unhealthiest' class had the highest probability of functional limitations and positive affect below the mean.
Wahl et al. (2014)	CS and LG, 4 years, $N = 87$	82, SD = 4.26	10 positive items of PANAS	Past month	Difficulty in 10 items representing 10 out-of-home activities	Examine both possible causal directions between functional status and positive affect and test the strength of this relation. The study includes a sample of sensory impaired and other of sensory unimpaired participants. In this review we only concern the results of the sensory unimpaired individuals.	In the final cross-lagged analysis, higher experience of positive affect associated with better functional status ($p < 0.001$). Functional status at baseline predictor of positive emotions at follow-up ($p < 0.001$). Positive emotions at baseline not a significant predictor of functional status at follow-up ($p > 0.10$).

Note: In longitudinal studies, the age reported is the value at baseline.
LG = Longitudinal; CS = Cross-sectional;
ADL = Activities of Daily Living; IADL = Instrumental Activities of Daily Living;
SF-36 = Short-Form Questionnaire 36; BABS = Bradburn Affect Balance Scale; PANAS = Positive Affect Negative Affect Scale; GDS-15 = Geriatric Depression Scale-15; PGCAS = Philadelphia Geriatric Centre Affect Scale.

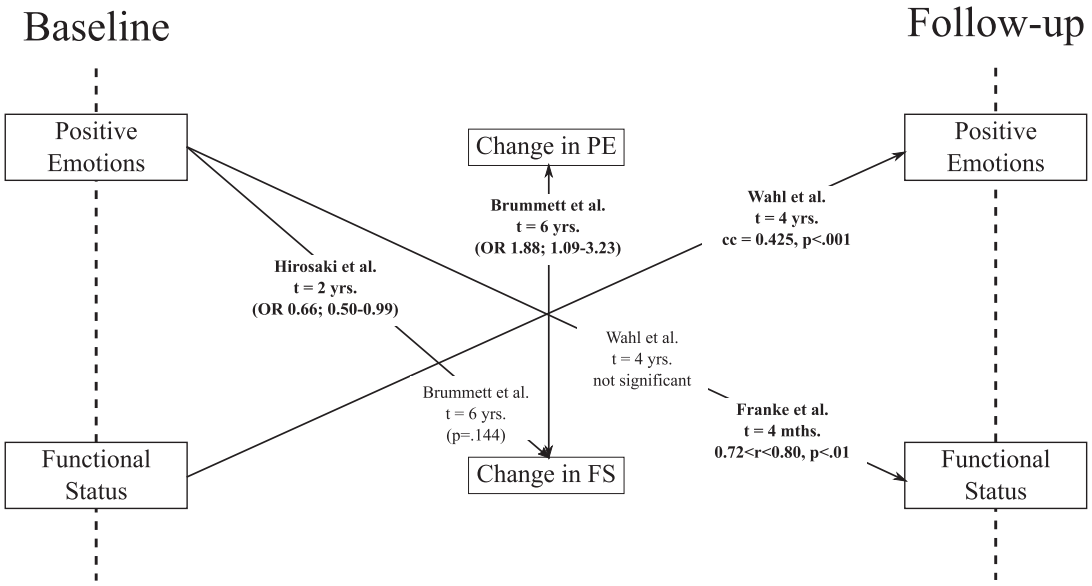

Figure 2. Relations between positive emotions (PE) and functional status (FS) analysed in the four longitudinal studies included in this review. Time span and significance level (or confidence interval) for each study. The statistically significant relations are shown in bold.

Finally, Wahl, Drapaniotis, and Heyl (2014) reported strong associations between baseline values of positive emotions and functional status ($p < 0.001$).

The causality on the relation between positive emotions and functional status

Longitudinal studies suggest significant associations between positive emotions and functional status in various directions. Figure 2 shows all the reported relations between baseline and follow-up values of positive emotions and functional status, the time span between baseline and follow-up and, finally, the mean age of the population.

In a study with a sample of centenarians ($n = 11$), Franke, Margrett, Heinz, and Martin (2012) found significant association between the baseline experience of positive emotions and at six-month follow-up values of global function ($r = 0.76$, $p < 0.01$), upper body function ($r = 0.59$, $p < 0.05$), basic lower function ($r = 0.80$, $p < 0.01$) and advanced lower function ($r = 0.72$, $p < 0.01$). However, when analysing positive emotions at baseline as predictors of functional status at follow-up, Wahl et al. (2014) did not find any significant association.

Hirosaki et al. (2013) reported that a higher frequency of experience of positive emotions at baseline predicted a lower risk of functional decline at follow-up. This association was significant for, among other, two discrete positive emotions: happiness (OR 0.50, CI 0.25−0.99, $p = 0.044$) and energy (OR 0.46, CI 0.22−0.95, $p = 0.036$). In another study, Brummett, Babyak, Grønbæk, and Barefoot (2011) reported that, adjusting for socio-demographic information and lifestyle leads to a decrease in the significance of the predictive value of positive emotions.

Only one study investigated the role of functional status as predictor of positive emotions, or change in positive emotions, at follow-up. Wahl et al. (2014) reported that the baseline values of functional status were able to predict frequency in the experience of positive emotions at four-year follow-up ($p < 0.001$).

Also, only one study evaluated the relation between change in the frequency of experience of positive emotions and change in functional status. Brummett et al. (2011) verified that, after adjusting for the covariates, a decrease in the frequency of positive emotions was associated with a higher probability of functional decline over a six-year period (OR 1.88, CI 1.09−3.23).

Discussion

This review aimed to investigate whether there is evidence from observational studies on the relation between functional status and positive emotions of older adults living independently. Despite mixed findings within and between studies, 8 of 10 studies in this review reported a significant relation between positive emotions and functional status, in the sense that higher frequency in the experience of positive emotions is associated with better functioning. Results also suggest that more frequent experience of positive emotions and high functioning might define trajectories of healthy aging. There are also indications that decrease in the frequency of experience of positive emotions might delay, or slow the functional decline. Due to the various study designs, mixed-study findings within and between studies, and the diversity in sample populations, however, one cohesive conclusion cannot be drawn from this review. For the same reason, a meta-analysis of the results was not performed.

These diversity in samples and design methods might explain why some studies find significant relations between positive emotions and functional status and others not. For example, the average age of the population samples ranges from relatively young older adults (55+) until the oldest-old (100+). The literature is not consistent on the effect of age on the experience of positive emotions. While some studies suggest that older adults experience higher intensity of positive emotions than younger (Kessler & Staudinger, 2009), others state that it is not possible to talk about the relation age-emotions without considering personality, contextual and socio-demographic information (Isaacowitz & Smith, 2003; Mroczek & Kolarz, 1998). Finally, others suggest that positive affect decreases with age, possible due to changes in functional status and health (Charles, Reynolds, & Gatz, 2001). Cultural background and geographical location might also be

considered in future research, as it might condition the experience of emotions. For example, using the same study design in Germany and Italy, Gagliardi et al. (2010) reported a significant influence of positive emotions on functional status only in the Italian sample. The authors suggest that German cultural beliefs value the community well-being rather than the individual well-being, as in Italy, possibly leading to higher perception of positive well-being in Italy than in Germany. Literature elsewhere discusses different patterns of disability and well-being over the lifespan in different cultures (Fry, 2000) and also that the relation between health and emotions is stronger in countries with low- than in high-income economies (Pressman, Gallagher, & Lopez, 2013). Future research should not take the older population as a group, but look at separated age groups as well as to consider cultural background of the samples.

The study design varies on the assessment tools used, the time span between baseline and follow-up of the longitudinal studies, and the recall time for assessment of emotions (from emotions associated to an activity to emotions over the past 12 months). Each one of the 10 studies included used a different assessment tool to evaluate the functional status of the older adults. For example, one of the studies only considered out-of-home activities while others only considered those basic ADL that are generally seen as a requirement for independent living. There were also several differences in the methods of measuring positive emotions, in terms of both the assessment tool used and the recall time asked for the evaluation of emotions. Future studies should agree on the assessment tools in order to get a better overview of the outcomes.

The causality in emotions-functioning remains unclear from the review. There is limited evidence suggesting a protective role of positive emotions on functional decline (Franke et al., 2012; Hirosaki et al., 2013) and that a decrease in the frequency of experience of positive emotions predicts functional decline (Brummett et al., 2011). Moreover, there is also limited evidence suggesting that higher functional status at baseline predicts higher experience of positive emotions at the moment of the follow-up (Wahl et al., 2014). These findings in both directions of the relation between functional status and positive emotions support the theory of 'upward spiral of positive emotions' (Fredrickson, 2013) suggesting that improvements on functional status leading to higher intensity or frequency in the experience of positive emotions, which consequently may lead to adoption of preventive and protective behaviours that improve functional status, and so on. This is also supported by the fact that older adults who adopt healthy lifestyles are more likely to report very positive attitudes to health compared to those who do not adopt healthy lifestyles (Kozlowska et al., 2008). Therefore, future interventions should aim to promote positive emotions, as it might increase resilience and open to healthy behaviours, thereby delaying functional decline.

Strengths and limitations

To the best of our knowledge, this is the first study dedicated to reviewing observation studies on the relation between positive emotions and functional status of older adults. Although a cohesive conclusion of the results is not possible, we consider that the added value of our work is to exactly elicit the numerous results obtained and the non-uniformity of methods, and sometimes even concepts. This review expands work performed in other reviews that suggest that subjective well-being has a direct influence on health and longevity (Diener & Chan, 2011; Pressman & Cohen, 2005). Our results suggest that subjective well-being also relates to the functional status and functional decline over time.

We restricted our search to measures of hedonic well-being, which can be considered both a strength and a limitation. It is a strength because it makes our study unique. We were thus interested in investigating how the experience of discrete positive emotions (e.g. happiness and joy) might be related to functioning, defined as the ability to perform ADL independently. In addition, during the review process, it became clear that there is a lack of consensus on the term positive emotions. When analysing the first selection of results based on the abstract selection, we identified more than 30 different factors named as positive emotions, such as self-esteem or work satisfaction. Being loyal to our narrow definition of positive emotions, the number of suitable studies was limited.

We restricted our results to studies of non-clinical samples as we aimed for a representative sample of the older population living independently. Our results expand literature elsewhere shows that in clinical samples, positive emotions are associated with less functional decline (Fisher, Al Snih, Ostir, & Goodwin, 2004; Penninx et al., 2000). We can now say that there are indications supporting this association also in non-clinical samples, although more empirical studies are highly recommended.

Towards future research and interventions

The results of our review are not conclusive; however, there is some indication that more frequent experience of positive emotions relates to better functioning and might delay functional decline.

First of all, future studies need to be more theoretical in their approach to the study of positive emotions and functional status. Pressman and Cohen (2005) proposed a framework to better discern the (in)direct physiological and psychological pathways through which positive emotions might influence health. This framework might also account for potential pathways from positive emotions to functional status. Such theoretical approach will also facilitate better reasoning for the inclusion of, for example, specific measures used and the time span of positive emotions assessed.

Our results suggest a clear need for empirical studies on the relation between positive emotions and functional status of the older populations. As monitoring the pattern of positive emotions might be more important than one single measurement (Catalino & Fredrickson, 2011), detecting a decline in the offset of positive emotions might flag early detection of functional decline. For future research, we recommend longitudinal studies with repeated measurements that monitor positive emotions frequently (i.e. daily or weekly) and assess functioning at more distant points in time (e.g. every three months). The emergence of new research methods as experience sampling using mobile technology or systems that require no interaction with the user (e.g. environmental sensors) supports new research works that provide better insights on the dynamics of positive emotions of the older adults (Brose & Ebner-Priemer, 2015).

Interventions aiming at healthy aging might be enhanced by coaching older adults to physically and mentally healthier

lifestyles. Interventions based on positive psychology principles have shown promising results also with the older population group (e.g. Proyer, Gander, Wellenzohn, & Ruch, 2014). Mobile and environmental technology can be seamlessly integrated in daily life facilitating real-time interventions, and therefore suitable for cultivating positive emotions.

Conclusion

To the best of our knowledge, this is the first systematic review that aims to analyse the relation between positive emotions and the functional status of older adults living independently. The majority of included studies, both cross-sectional and longitudinal in design, reported a significant association between positive emotions and functional status. Many of these studies, however, also reported mixed or inconclusive findings. We must, therefore, conclude that there is some, but limited, evidence suggesting that more frequent experience of positive emotions relates to better functional status and to delay of functional decline. A cohesive conclusion cannot be drawn from our review due to the low number of studies, as well as disparities among design methods and sample populations. The future for studying relations between physical and mental health looks promising with the development of new sensing technology, innovation methods, and with the older population becoming more confident in the use of technology.

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