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Do executive functions explain older adults' health-related quality of life beyond event-based prospective memory?

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ABSTRACT
Previous work has shown that event-based prospective memory (EBPM) predicted health-related quality of life (HrQoL). In the present study, we aimed to examine whether the relationship between EBPM and HrQoL extended to life satisfaction, and whether it persisted after controlling for other cognitive functions related to EBPM, namely executive functions and retrospective memory. We tested two models using structural equation modeling with latent variables in a sample of older adults. In the first model, we assessed whether EBPM predicted life satisfaction and HrQoL; in the second model, we controlled for retrospective memory and executive functions. The first model indicated that EBPM was related to HrQoL. However, in the second model, this relationship was eliminated by executive functions; life satisfaction was not related to any of the cognitive variables. Findings corroborated the link between HrQoL and EBPM, suggesting that such relationship stems from executive functions rather than retrospective memory.

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Delayed intentions; executive functions; episodic memory; quality of life; healthy aging; structural equation modeling

Event-based prospective memory (EBPM) is the ability to remember and execute future intentions when a particular event approaches (Einstein & McDaniel, 1990). Accomplishing an event-based intention successfully requires retrospective memory (RM) and executive functions (EF). More precisely, EBPM retrieval is supported by two distinct pathways, according to the multi-process framework (Einstein & McDaniel, 2005). One depends on top–down executive processes that allow to maintain the intention in working memory, and/or to monitor the environment for the EBPM cue. The second pathway depends on bottom–up spontaneous retrieval processes often triggered by an EBPM target cue. Spontaneous retrieval is assumed to relate on RM, presumably via memory recognition (Smith & Skinner, 2019), and does not require monitoring or active maintenance of the intention (McDaniel & Einstein, 2000; McDaniel et al., 2015). With regard to aging, studies showed that EBPM in older adults requires more self-initiated retrieval processes mediated by prefrontal activation (Burgess et al., 2003; Okuda et al.,

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2007; Volle et al., 2011) that are more sensitive to age-related cognitive decline (Craik, 1986; Greenwood, 2000; Raz et al., 2005; West, 1996), such as inhibition, shifting and updating (Gonneaud et al., 2011; Schnitzspahn et al., 2013). In line with this theoretical perspective, Smith and Bayen (2006) demonstrated that older adults were less likely to recruit EF supporting the detection of PM cues than younger adults, showing that the impairment in EBPM accuracy was due to attentional processes and EF.

Diversely from these theoretical and empirical perspectives, other authors conceived EBPM as a meta-tasking component of EF (Suchy, 2015, 2020; Suchy et al., 2020). Meta-tasking is an aspect of EF that involves the ability to branch and interleave goals of a task with sub-goals of another task; thus, meta-tasking is crucial for successful planning and execution of many daily PM tasks (Kurniadi et al., 2021). Several empirical findings showed that older adults with EF impairment more often forget important daily EBPM tasks, such as managing their medication, which further indicates that EBPM failures are due to an impairment of EF, rather than RM (Suchy, 2020; Suchy et al., 2020). Interestingly, in line with these empirical findings, neuroimaging studies showed that frontopolar cortex, often been associated with PM as well (Burgess et al., 2003; Cona et al., 2015; Okuda et al., 2007; Volle et al., 2011), is implicated in meta-tasking (Miele et al., 2011; Suchy, 2015). Taken together, these findings supported the Contextually Valid Executive Assessment model (Suchy, 2015), which argued that PM is a meta-tasking component of EF, and as such, it interacts with contextual factors as a predictor of functional outcomes, such as everyday functioning or health-related quality of life (HrQoL).

HrQoL is a multi-dimensional construct that reflects the perception of the individuals' state of health and ability to function in relation to the environment. The relationship between older adults' EBPM and HrQoL has been emphasized in previous studies (Einstein & McDaniel, 1990; Hering et al., 2018; Kliegel et al., 2011), but it has been empirically investigated only recently (Woods et al., 2015). Woods et al. (2015) directly examined the relationship between EBPM and HrQoL in healthy older adults, and showed that higher EBPM performance predicted better HrQoL, after controlling for general cognitive and executive functioning. While EBPM seems to be related to better quality of life in terms of health-related issues, it is still unknown whether EBPM also affects other aspects of quality of life, such as life satisfaction (LS). According to Diener et al. (1985), LS is the "global assessment of a person's quality of life according to his[/her] chosen criteria" (Diener et al., 1985, p. 71). In this definition, LS refers to a cognitive evaluation that includes aspects of people's lives beyond health and comprises life conditions, goal achievements, past experiences, as well as the comparison of people's perceived life circumstances with their subjective life standard (Diener & Suh, 1997; Diener et al., 1999; Pavot & Diener, 2009). For these reasons, previous studies have interpreted LS as the cognitive aspect of well-being (Allerhand et al., 2014; Ihle et al., 2020; Pavot & Diener, 2008; Veldema & Jansen, 2019), or used it as measure of the subjective dimension of quality of life (Ryff & Heidrich, 1997; Stewart et al., 2013), sometimes together with measures of physical health (Collins et al., 2009; Heckman, 2003).

Interestingly, higher levels of LS have been associated with better perceived physical health and fewer long-term health conditions (Siahpush et al., 2008) as well as a lower risk of dementia (Peitsch et al., 2016); thus, LS may represent an important resource for healthy aging, as it helps older adults to face the psychophysical changes of late adulthood. If LS is associated with healthy aging and severe neurocognitive impairments, it is necessary to identify the cognitive factors that are related to LS. Moreover, given that EBPM is associated with RM and EF, it is important to investigate how executive and mnemonic demands contribute to LS (and HrQoL), in order to better understand which cognitive function may explain better the influence of EBPM on older adults' quality of life. So far, the few existing studies on LS and HrQoL in healthy older adults that focused on both RM and EF showed inconsistent findings: some indicated that both domains affect HrQoL and LS in older adults (Enkvist et al., 2013; Takada et al., 2014), but others did not report such effects (Siedlecki et al., 2008; Veldema & Jansen, 2019); another study found that only EF positively affected HrQoL, whereas RM did not exert any effect (Davis et al., 2010). Other studies investigated the relationship between EBPM and quality of life in different clinical populations, such as individuals diagnosed with bipolar disorder, Parkinson's disease, or HIV (Doyle et al., 2012; Pirogovsky et al., 2012; Sullivan et al., 2021; Xiang et al., 2014). Nonetheless, these findings are mixed, with some of them showing no relationship between EBPM and quality of life (Xiang et al., 2014), whereas others showed significant effects (Doyle et al., 2012; Pirogovsky et al., 2012).

In older adults' everyday life, EBPM is particularly important to fulfil health-related intentions; however, EBPM is also relevant for a series of other daily activities such as meeting friends or handling finances (Hering et al., 2018; Suchy, 2020; Woods et al., 2015), which actively influence LS (Jones et al., 2003; Ku et al., 2016; De León et al., 2020). Hence, if EBPM is engaged in all these activities, it is likely that the effect of EBPM on quality of life goes beyond its health-related aspects, extending toward LS. Therefore, using structural equation modeling (SEM) in a sample of 994 healthy older adults, we aimed to investigate (1) whether EBPM predicts LS to the same extent as it does with HrQoL, and (2) whether EBPM relates to different aspects of QoL beyond the effects of EF and/or RM processes. It is indeed important to consider the role of EF and RM because both relate to EBPM (Kliegel et al., 2011), but they can also contribute independently to older adults' quality of life (Davis et al., 2010; Enkvist et al., 2013; Siedlecki et al., 2008; Takada et al., 2014; Veldema & Jansen, 2019). Moreover, given the large sample's age-range (70–102 years old), and because individuals' global comorbidity can also affect quality of life (Collins et al., 2009; Heckman, 2003), we controlled for age and number of diseases in our analyses. The present study is the first systematic investigation examining the association between EBPM – and related cognitive functions – and quality of life beyond health-related aspects in a large sample of healthy older adults.

Methods

Participants

We analyzed the data from 994 older adults, collected during the second wave of the Vivre-Leben-Vivere (VLV) survey (Ihle et al., 2018; Oris et al., 2016). The VLV survey is an interdisciplinary project on life and health conditions of administered over 3080 participants aged 65 years and above in Switzerland, and it comprised a large battery of self-administered questionnaires as well as face-to-face interviews including several domains, such as sociodemographic, autonomy and functional independence, physical and mental health, personality, and cognition (see Ihle et al., 2015; Oris et al., 2016). Using a stratified sampling method, the participants were selected by age group, sex and Swiss canton (Basel, Bern, Geneva, Tessin, and Valais). Participants in the second wave of the VLV project were those (1) who were re-contacted from the first wave, except for those who had initially answered through proxies and those who lived in the Italian-speaking area, which were excluded in the second wave due to budget reasons, and (2) who then accepted to participate to the second wave of the VLV project. In total, 1063 participants took part in the second wave, of which 4 participants had to be excluded as they did not correspond to the respective person that participated in the first wave. Out of the remaining 1059 participants, 2 only answered the written questionnaire but did not participate in the face-to-face interview. For another 16 participants, some problems emerged with their interview data, so that for those interview data had to be removed from the sample. Forty-seven participants did not fill out the paper-pencil questionnaire, which resulted in the final sample comprising 994 participants, which completed both the self-administered questionnaire and the face-to-face interview. All participants had a MMSE score of 24 or above. The mean age of the final sample was 80 years (females = 504; *SD* = 6.57; range = 70–102 years old; MMSE mean score, *M* = 28.20; *SD* = 2.26). All participants gave their written informed consent for inclusion before they participated in the study. The present study was conducted in accordance with the Declaration of Helsinki, and the protocol had been approved by the ethics commission of the Faculty of Psychology and Social Sciences of the University of Geneva (CE_FPSE_05.04.2017).

Materials

Measures of quality of life

We used the Satisfaction with Life Scale (Diener et al., 1985) as measure of LS, and the EuroQoL-5D questionnaire (Euroqol Group, 1990) as measure of HrQoL. The Satisfaction with Life Scale comprised five statements (e.g., "I am satisfied with my life.") that participants rated using a seven-point Likert-type scale (1 = "strongly disagree"; 7 = "strongly agree"). The five items are coded in the models as follows: LS1, LS2, LS3, LS4, LS5. Internal consistency for the Satisfaction with Life Scale was good (α = .87). The EuroQoL-5D comprised five items covering the following domains: mobility (HrQoL1), self-care (HrQoL2), household (HrQoL3), pain (HrQoL4), and depression/anxiety (HrQoL5). Participants responded to each item using a three-point Likert-type scale (1 = lower health-related problems; 3 = higher health-related problems). Internal consistency for the EuroQoL-5D was acceptable (α = .71). For the analysis, we reversed the scores of the HrQoL questionnaire, so that higher scores indicated higher levels of HrQoL.

Cognitive functions

EBPM was measured with four single-item EBPM tasks that participants had to carry out during the interview (Cuttler & Graf, 2007; Zeintl et al., 2007). As the interview started, participants were instructed to say "red pencil" when the experimenter would mention a red pencil later (PM1); to knock twice on the table when the experimenter would talk about physical activity (PM2); to state their date of birth when activities in the course of the participant's life would be mentioned (PM3); to remind the experimenter to turn on the mobile phone at the end of the interview (PM4).

All the PM tasks were instructed at the beginning, so before the actual interview started; each PM task was scattered throughout an interview, in the same order for all participants. Before the interview, it was ensured that all participants correctly understood the instructions before starting the interview by asking them to immediately repeat the instructions in their own words. For each PM task, we computed a binary score indicating whether the task was carried out (=1) or not (=0); task substitution (i.e., providing an incorrect response to a PM cue) as well as the loss of content (i.e., correct recognition of a cue without adequate retrieval of the intention) were not included in the scoring. RM was measured using immediate recall and delayed recall tasks included in the Cognitive Telephone screening instrument. Participants had to memorize four semantically unrelated word pairs, which had to be recalled immediately and after a delay. We calculated individual sum scores separately for immediate and delayed recall by summing up the number of correctly recalled words at each task (range: 0– 4).

EF measurements comprised the Trial Making Test B (TMT-B; Reitan, 1958), tests of reasoning, as well as phonological and semantic fluency. The TMT-B is a measure of cognitive flexibility, participants had to connect numbers in ascending order, and letters in alphabetic order by alternating between the two tasks (i.e., 1-A-2-B-3-C . . .) as fast as they can and without making errors. For the analyses, we took the time in seconds needed to correctly connect all the 25 numbers/letters. During the reasoning (RS) task (Reverberi et al., 2005), the participants completed 8 sequences of five numbers following specific rules. The test was interrupted if the participants failed two consecutive sequences. For each sequence, a binary score was reported indicating whether each the participants made a correct response or not (0 = no response/incorrect response; 1 = correct response); then, we computed the sum score for each participant by summing up the accuracy score at the 8 sequences (range: 0– 8). During the phonological fluency task (Benton & Hamsher, 1976), participants were asked to name as many different words as possible that begin with the letter "A"; during the semantic fluency task, participants were asked to name as many professions as possible. The sum of the number of correct words named by the participant at each fluency task was computed.

Covariates

We controlled for years of age and self-reported chronic diseases; using the Chronic Diseases Comorbidity Index (CDCI, Robinson & Clore, 2002), we summed up the overall number of chronic diseases that individuals reported and treated it as a global indicator of individuals' comorbidity.

Data analysis

The data analysis was carried out in Rstudio (version 1.3.959) using lavaan 0.6–8.1589 (Rosseel, 2012). We tested two models using SEM. In Model 1, we aimed to replicate the finding in the literature showing a positive effect of EBPM on HrQoL, and to test whether such effect extends to LS too. Thus, we modeled the three latent variables: EBPM, constructed from the four EBPM tasks; HrQoL, constructed from the five HrQoL items; and LS, constructed from the five LS items. The latent EBPM variable, and the observed variables age and CDCI, predicted both LS and HrQoL. All three predictors were allowed to correlate freely. In Model 2, we wanted to control for the effect of cognitive functions related to EBPM; therefore, we additionally included latent variables of RM and EF. The latent variable of RM was constructed from the immediate and delayed recall sum scores, whereas the latent variable of EF was constructed using the sum score obtained at reasoning test, phonological and semantical fluency, as well as the time needed to complete the TMT-B. In Model 2, age, CDCI, EBPM, RM and EF predicted both LS and HrQoL; we allowed all predictor variables to correlate. Considering that the models comprised categorical (EBPM) and ordinal indicators (LS and HrQoL), we used the robust version of the diagonally weighted least squares method for the model estimation. Missing data were present (0.09% missing for the whole dataset) and were handled with pairwise deletion.

Results

Model 1 provided good statistical fit ($\chi^2 = 332.15$, $df = 94$, $p < .001$, $CFI = .97$, $RMSEA = .055$, $SRMR = .068$), as well as Model 2 ($\chi^2 = 606.81$, $df = 190$, $p < .001$, $CFI = .96$, $RMSEA = .047$, $SRMR = .068$). Considering model 1 (Figure 1), the findings showed that EBPM positively predicted HrQoL selectively ($\beta = .10$; $p = .02$). However, this association was no longer significant in model 2 ($p = .94$), after controlling for EF and RM (Figure 2). In model 2, only EF significantly predicted HrQoL ($\beta = .22$; $p = .04$), whereas RM did not ($p = .10$). LS was not related to any of the cognitive variables in both models (all *ps* > .05).[1]

Discussion

In the present study, we investigated whether EBPM predicted HrQoL and LS in a sample of healthy older adults, after controlling for the effects of EF and RM, cognitive functions related to EBPM, as well as age and number of diseases. Our results did not confirm the independent relationship between EBPM and HrQoL demonstrated in past studies (Woods et al., 2015). Interestingly, by looking into different possible cognitive mechanisms related to EBPM, they highlighted that EF selectively predicted HrQoL beyond the effects of EBPM. Our results deviated from findings of Woods et al. (2015), which showed that EBPM predicted HrQoL in older adults after controlling for cognitive and executive functions. Moreover, our findings are in line with previous studies showing that EF predicted older adults' HrQoL (Davis et al., 2010), although they contrast with other studies that did not find any relationship between EF and older adults' HrQoL and LS (Siedlecki et al., 2008; Veldema & Jansen, 2019) as well as with those studies that found a positive effect of RM (Enkvist et al., 2013; De León et al., 2020; Takada et al., 2014).

In this regard, there might be several reasons that could explain these inconsistent empirical findings. The first explanation could lie in the nature of the PM tasks: for instance, Woods and colleagues used the Memory for Intentions Screening Test (Kamat et al., 2014; Woods et al., 2015) an extensive battery of both time-based and EBPM tasks, whereas we used only single-item EBPM tasks. Perhaps having a time-based PM battery with multiple PM cues might show similar findings as Woods et al. (2015), as time-based tasks require more self-initiated retrieval processes mediated by prefrontal activation (Burgess et al., 2003; Mattli et al., 2014; Maylor et al., 2002; Okuda et al., 2007; Volle et al., 2011) which might be more sensitive to age-related cognitive decline (Craik, 1986; Greenwood, 2000; Raz et al., 2005; West, 1996). In this regard, the EBPM tasks used in the

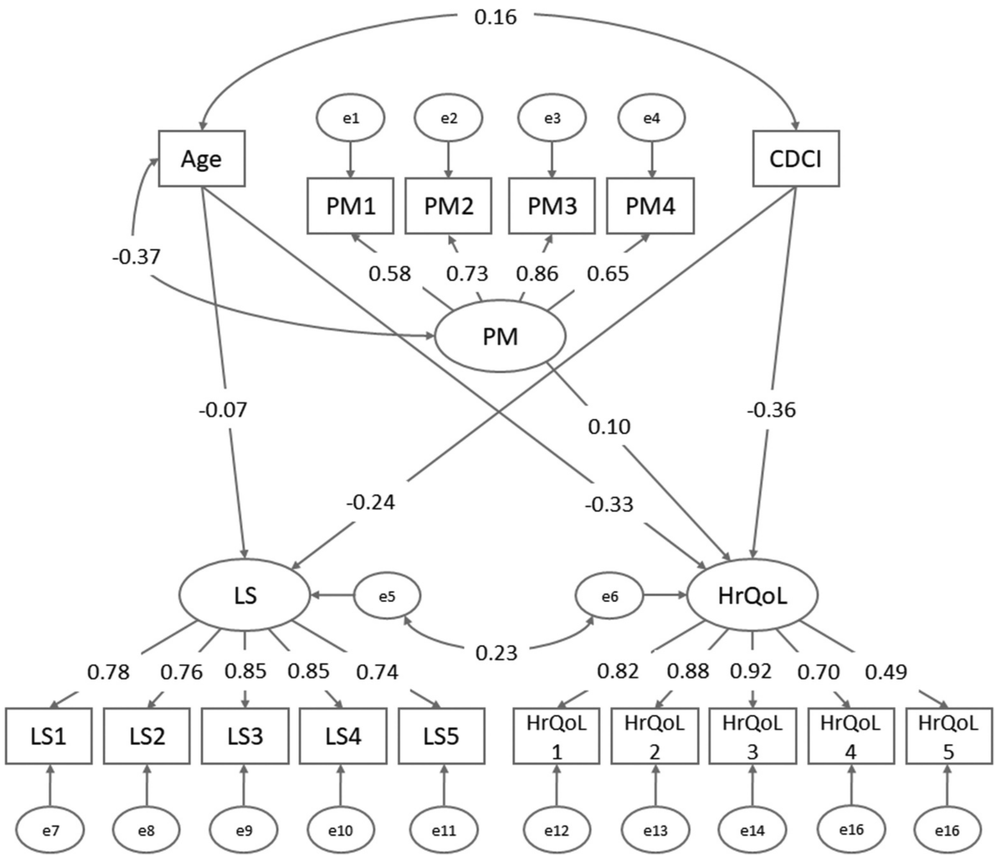

Figure 1. Standardized coefficients' estimates for Model 1 examining the links between prospective memory, life satisfaction, and health-related quality of life (controlling for age and comorbidity for chronic diseases). Non-significant pathways are omitted ($p > .05$). Single-headed arrows indicate factor loadings and regression weights, while double-headed arrows indicate correlations. CDCI = chronic diseases comorbidity index; PM = prospective memory; LS = life satisfaction; HrQoL = health-related quality of life.

present study could have dampened the executive demands of the PM tasks themselves. Therefore, in future studies increasing the strategic – frontally mediated – demand of the PM tasks (McDaniel et al., 2015) could reveal stronger effects of PM on HrQoL.

Another possible explanation could lie in the way of computing the PM accuracy scores. In the present study, we computed the score only considering if participants carried out the PM task or not (i.e.,: omission errors, namely missed PM response), whereas Woods et al. (2015) computed the PM score accounting not only for omission errors, but also for task substitution (i.e., providing an incorrect response to a PM cue) as well as the loss of the intention's content (i.e., correct recognition of a cue without adequate retrieval of the intention). Computing the PM scores accounting for these types of errors might also strengthen the effect of PM on HrQoL. Another possible explanation could lie in the typology of EF evaluated. In the present study, we included in the EF latent construct reasoning, fluency, and flexibility, respectively, whereas Woods et al. (2015) controlled for inhibition, task-switching and working memory. Some studies showed that, while EBPM

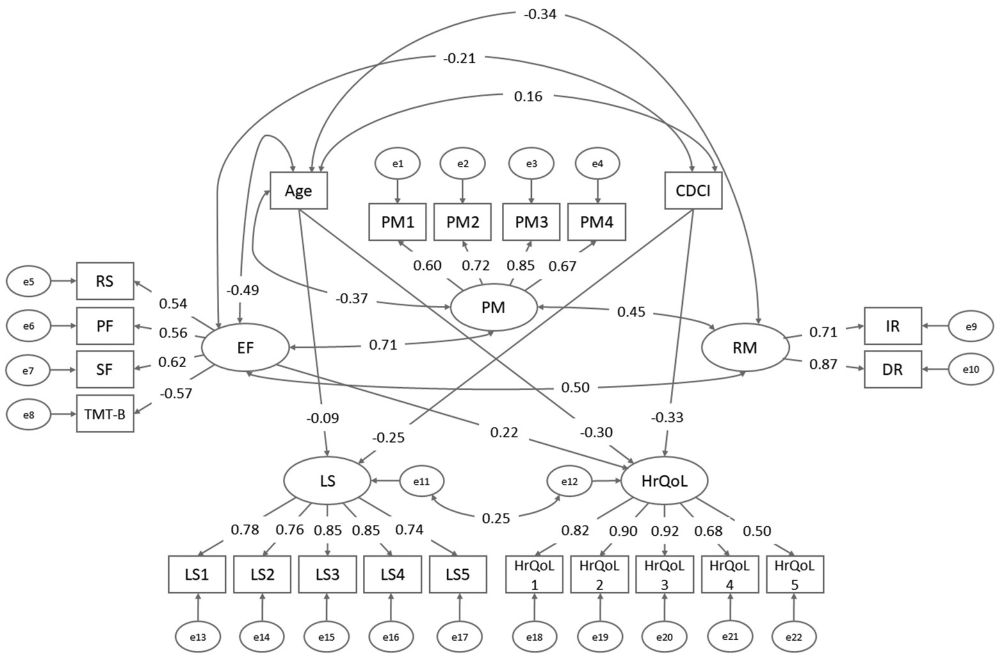

Figure 2. Standardized coefficients' estimates for Model 2 examining the links between prospective memory and related cognitive functions (i.e.,: executive functions and retrospective memory), life satisfaction, and health-related quality of life (controlling for age and comorbidity for chronic diseases). Non-significant pathways are omitted ($p > .05$). CDCI = chronic diseases comorbidity index; PM = prospective memory; EF = executive functions, RM = retrospective memory; LS = life satisfaction; HrQoL = health-related quality of life; RS = reasoning; PF =phonological fluency; SF = semantic fluency task; IR = immediate recall; DR = delayed recall.

was mainly mediated working memory processes (e.g., updating), time-based PM was mainly related to inhibition (Gonneaud et al., 2011). However, other studies showed that inhibition was more involved in event – compared to time-based tasks, with the latter requiring more task-switching processes than inhibitory control (Kliegel et al., 2016; Zuber & Kliegel, 2019). Thus, although it is not clear yet which EF – and to which extent – is involved in PM, the divergence of the EF measured might also be another factor that can explain the difference between our results and the ones by Woods et al. (2015). In this regard, future studies could include a broader EF battery, and measure whether and how different EF can better explain the level of older adults' HrQoL.

Another possible explanation could lie in the different statistical approaches and in sample size. Indeed, although SEM is conceptually analogous to multiple regression models, it has some advantages over regressions; the most important is that it allows to test relationships between multiple intra-correlated latent variables in large samples. For this reason, it is less sensitive to multi-collinearity, being able to extract co-varying sources of information (Bollen & Pearl, 2013; Gow et al., 2008): contrarily to multiple regressions, in which the correlation between predictors is automatically assumed, in SEM each correlation needs to be explicitly specified (if not, the correlation between the variables is assumed to be zero, which indeed would be very problematic for multi-collinearity issues). Moreover, by computing LS and HRQoL, as well as PM, RM and EF, as latent variables, we obtained a pure measure of these concepts which removed the portion of variance that comes from item-specific variations that are not shared between items' scales and cognitive tasks (such as a specific question or topic, or wording of the item). Finally, the strength of our results lies in the large sample of healthy older adults, which allowed higher confidence in terms of statistical power and generalizability of the results. Therefore, considering these important differences, future studies could replicate our findings including large sample of healthy older adults with batteries systematically differing in their executive demands, and using SEM rather than classical multiple regression models.

Conceptually, our results seem to support the Contextually Valid Executive Assessment model (Suchy, 2015), which argued that PM, as meta-tasking component of the EF, interacts with contextual factors as a predictor of functional outcomes, such as everyday functioning and HrQoL (Suchy, 2020; Suchy et al., 2020). Moreover, our results can be explained by the frontal aging hypothesis, which argued that age-related decrements in neurocognitive functions, as well as the risk to develop dementia, functional impairments and depression, are driven by decline in the prefrontal brain regions (West, 1996; for a review, see Kuo & Lipsitz, 2004). Considering that EF are linked to prefrontal cortex functioning, a disruption of prefrontal circuits might be related to a wider range of health-related behaviors and issues compared to EBPM. Furthermore, a mediation role of EBPM between EF and HrQoL cannot be considered, at least in the present study, because the effect of EBPM on HrQoL was no longer significant when EF were added in model 2, indicating the lack of shared causality between EBPM and EF in the relationship with HrQoL. Therefore, our results suggested that there is a unique association between EF and HrQoL, which eventually explained the variance exerted by EBPM. However, HrQoL is linked to other subdomains – such as daily functioning – which can be related to EBPM independently from each other (Hering et al., 2018; Karimi & Brazier, 2016). Thus, dividing HrQoL's constructs in sub-domains may reveal that the observed association with EBPM is driven by specific aspect(s) of HrQoL (e.g., personal care and/or household's activities). Future studies will have to investigate the relationship between EBPM – and related cognitive functions – with specific aspects of HrQoL, formalizing models with different subdomains of HrQoL as predicted by EBPM accuracy scores. Such research could contribute to better understanding the role of PM in the sub-domains of older adults' HrQoL.

Concerning specifically the relationship between RM and HrQoL, one possible reason that could explain why RM did not predict HrQoL could be that the sample comprised highly performing older adults (as indicated by the high MMSE mean score), which may thus not be affected by any memory-related decline. If older adults with cognitive impairment were included in the sample, perhaps different results might have emerged (Peitsch et al., 2016). Another possible – methodological – reason could be related to the fact that latent variable of RM in model 2 had only two observed indicators, whereas EF and EBPM had four indicators each. This imbalance among observed indicators might have reduced the variance explained by RM. Furthermore, we only included verbal recall tasks; future studies could use other RM tasks, such as visuo-spatial memory recognition, to elucidate better the relationship between RM and quality of life (Enkvist et al., 2013; Wilson et al., 2013). Finally, our findings showed that LS was not related to any of the cognitive measures in healthy older adults. Previous studies investigating different clinical populations (e.g., Doyle et al., 2012; Pirogovsky et al., 2012; Sullivan et al., 2021; Xiang et al., 2014) showed mixed empirical evidence, with some of them showing no relationship between EBPM and LS (Xiang et al., 2014), whereas others showed a significant relationship independent from other aspects of cognition (Doyle et al., 2012; Pirogovsky et al., 2012). One possible explanation for the lack of association between LS and the cognitive measure in the present study could be that older adults neither engage in an evaluation based on reasoning and attentional processes, nor do they search their memory for relevant information when they judge the level of LS; rather, they would rely on existing beliefs about their life to make a global judgment (Robinson & Clore, 2002). In this perspective, LS might be affected exclusively by other emotional or social factors (De León et al., 2020). In this regard, among other factors that can explain our results, mood may play a role as well, which was not assessed in the VLV project. For example, it is known that depression predicts several physical health conditions as well as scores of PM, RM and EF measures (Ng et al., 2017; Shen et al., 2011; Zhou et al., 2017). Future studies could integrate this construct in the model to establish any effect of PM and related cognitive functions on older adults' quality of life related to mood.

Overall, our results demonstrated for the first time in a large sample of older adults that EF explain HrQoL better than EBPM, contrasting previous findings (Woods et al., 2015). In terms of possible applications, our results could motivate future studies to investigate the effects of training interventions on several cognitive functions and HrQoL in older adults. For instance, a possible future intervention could establish training that tackles PM, EF and RM as promoters of better quality of life among healthy, highly functioning older adults; according to our results, only training EF would be beneficial for improving HrQoL. However, this conclusion remains open to future research. Moreover, our study's design is cross-sectional, which, by definition, cannot prove causal relationships. Future studies will have to replicate our findings using longitudinal designs and measuring how age-related changes in older adults' EBPM performance affect LS and HrQoL over time.

In conclusion, our findings corroborate that EBPM is an important resource related to older adults' HrQoL (Woods et al., 2015), but they also provide additional evidence that EBPM is not associated with other aspects of quality of life, such as LS; furthermore, our findings highlight the importance of considering other cognitive and EF related to EBPM when studying the relationship between quality of life and EBPM.

Note

1. Additional analyses controlling for gender and education does not change the general pattern of the results.

Disclosure statement

The authors have no conflicts of interest to disclose.

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