Dementia worry in middle-aged and older adults in Germany: sociodemographic, health-related and psychological correlates

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Abstract

“Dementia worry” (DW; i.e., concern about developing dementia) is highly prevalent in the general population. However, research on the characteristics associated with lower and higher levels of DW is still limited. Based on previous empirical and conceptual work, we examined the extent to which DW was related to a comprehensive range of objective and subjective characteristics (sociodemographics, contact with people with dementia, physical health-related risk factors, well-being/psychological distress, aging self-perceptions, social-cognitive health beliefs about dementia). A convenience sample of $N = 219$ German adults 40 + years ($M = 65.50$ years, $SD = 11.34$; 40–94 years) reporting no dementia or cognitive impairment diagnosis completed questionnaires. We improved upon previous research by using a ten-item scale to measure DW. We used bivariate correlations and multivariate regression to examine the extent to which DW was related to the potential concomitants. 41.1% of the participants indicated DW. Together, the predictor variables explained 53.3% of the variance in DW. DW was related to psychological distress, perceived memory change, aging anxiety, and personal risk perception in both the bivariate and multivariate analyses. There was a quadratic (reverse U shape) relationship between age and DW. Physical health-related risk factors were not related to DW. Our findings suggest that DW represents a hybrid of psychological distress, aging self-perceptions, and a specific type of health concern. Healthcare practitioners should consider a person’s psychological characteristics when deciding how to intervene when someone indicates moderate or high DW.

Keywords Dementia worry · Anticipatory dementia · Fear of Alzheimer’s disease · Aging self-perceptions · Health worry

Introduction

In 1996, Cutler and Hodgson coined the term “anticipatory dementia” to describe middle-aged adults’ fear that their cognitive changes may be a harbinger of Alzheimer’s disease (AD), particularly pronounced among the children of people with AD. Since then, a number of surveys have found that “dementia worry” (DW), that is, the emotional response to

the perceived threat of developing dementia (Kessler et al. 2012), is highly prevalent not only in clinical populations, but also in the general population and across age groups (for a review, see Anderson et al. 2009). For instance, recent large surveys of adults in the USA (Cutler 2015; MetLife Foundation 2011), Great Britain (Yougov 2012), Australia (Low and Anstey 2009), and France (Cantegreil-Kallen and Pin 2012) found that 30, 31, 46, 48, and 60% of the respondents reported being at least a little worried about developing AD and/or other forms of dementia, respectively.

Although DW appears to be a widespread phenomenon, to date relatively little is known about the characteristics associated with lower and higher levels of DW. In the current study, we therefore compile results from the limited body of previous research and draw on our conceptual work (Kessler et al. 2012) to describe the extent to which DW may be associated with sociodemographic characteristics, contact with people with dementia, physical health-related risk factors, well-being, self-perceptions of aging and social-cognitive health beliefs about dementia. We then analyze

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cross-sectional questionnaire data from a sample of German adults aged 40 + years to empirically examine the extent to which DW is related to each set of concomitants.

Research on the concomitants of DW is important for several reasons. For instance, identifying concomitants of DW is key for understanding how to best help individuals reduce maladaptive worry (e.g., as in the case of “neurocognitive hypochondriacs,” Boone 2009) and channel potentially realistic concerns (Jessen et al. 2010) into adaptive behaviors (e.g., dementia screening, seeking treatment for health-related risk factors, formulating plans for care, active lifestyle) while maintaining a positive outlook. Identifying concomitants of DW is also key for understanding how to reduce the burden on the healthcare system associated the “worried well,” that is, people who seek rigorous dementia screening and other dementia-related help in the absence of dementia symptoms (Smyth 2015), and for reducing fear-related stigmatization of people with dementia.

Objective correlates of dementia worry: sociodemographic characteristics, contact with dementia, and physical health-related risk factors

So far, studies on DW have mostly focused on describing the overall level of DW in a population. The relatively few studies on concomitants of DW have generally been limited to describing the association between DW and objective correlates such as people’s sociodemographic characteristics, personal contact with dementia, and physical health-related risk factors.

Available research indicates that sociodemographic characteristics like age, gender or education explain only a small amount of interindividual variance in DW. Among the three studies of DW based on random/representative samples, one study found that DW was highest in the 50 s relative to older ages (American adults 50 + years; Cutler 2015), while another study found that DW was strongly and linearly associated with age, such that DW was more predominant among the elderly (French adults; Cantegreil-Kallen and Pin 2012), and another study found no relationship between age and DW (Australian adults; Low and Anstey 2009). Other studies based on smaller (and sometimes quite selective) convenience samples have found no association between DW and age (Cutler and Hodgson 2001; Suhr and Kinkela 2007; Werner 2002; Yeo et al. 2007). There is some evidence that women are more concerned about developing dementia than men (Cantegreil-Kallen and Pin 2012; Cutler and Hodgson 1996, 2001; Low and Anstey 2009; Yougov 2012). Education has not typically been associated with DW (Cantegreil-Kallen and Pin 2012; Cutler and Hodgson 2001; Low and Anstey 2009; Werner 2002), although in one study more highly educated people perceived less dementia

risk (Yeo et al. 2007). It has been hypothesized that married people might have more DW due to concern about becoming a burden on one’s spouse (Cutler and Hodgson 2001). Empirically, however, DW has been unrelated or only very weakly associated with marital status (Cutler 2015; Cutler and Hodgson 2001; Werner 2002).

In contrast to sociodemographic characteristics, having a family member with dementia has emerged as a major predictor of DW. Adult children with a parent with dementia are much more likely to worry about developing dementia themselves than adults with no parental history of dementia (e.g., Axelman et al. 2003; Hodgson et al. 1999; Roberts and Connell 2000). For example, in the Cutler and Hodgson (2001) study, 92% of the adult children with parental history of dementia were at least somewhat concerned about developing AD, compared with 47% of the comparison group. Other research has found that having had *any* personal contact with someone with dementia (e.g., as a caregiver, or having a close, non-genetically related family member or friend with dementia) is associated with higher DW (Alberts et al. 2011; Cantegreil-Kallen and Pin 2012; Cutler 2015; Low and Anstey 2009; Suhr and Kinkela 2007).

Finally, available evidence suggests that physical health-related risk factors for dementia including cardiovascular disease, diabetes, being overweight, physical activity, and objective cognitive functioning are only very weak correlates of people’s perception of their personal risk for developing dementia (Chung et al. 2009; Werner 2002; Yeo et al. 2007). One study found that objective cognitive functioning was not related to DW (Suhr and Kinkela 2007). Otherwise, to the best of our knowledge, the relationship between physical health-related risk factors and DW has not been investigated.

Dementia worry and well-being

Studies on the relationship between DW and well-being have found that DW was positively related to depressive symptoms in samples of older caregivers (Alberts et al. 2011), older community adults who responded to an advertisement for free memory screening (Kinzer and Suhr 2016), adults with family history of AD (Hodgson and Cutler, 1997), and certified nurses (Kessler et al. 2014a, b). DW was also associated with trait anxiety in a sample of older adults (French et al. 2012). In a recent study, DW was positively associated with symptoms of depression, anxiety, and hypochondriasis in patients of a memory clinic not otherwise diagnosed with organic mental disorder (i.e., a sample of “worried well”; Kessler et al. 2014a, b). In addition, poor subjective health was associated with DW in a representative sample of community-dwelling French adults (Cantegreil-Kallen and Pin 2012).

Dementia worry and aging self-perceptions

Negative perceptions of one's cognitive aging seem to be strongly associated with DW. About half of older adults report some memory impairment (e.g., Jonker et al. 2000). While subjective memory impairment is only a weak, albeit significant, predictor of dementia and mild cognitive impairment in the general population (Jessen et al. 2010; Reisberg et al. 2010), subjective memory complaints are strongly and consistently associated with memory-related anxiety (Verhaeghen et al. 2000) and DW (Cutler 2015; Cutler and Hodgson 1996, 2001; French et al. 2012; Kinzer and Suhr 2016; Werner 2002). In other words, people who report more cognitive problems (e.g., problems remembering names and/or dates) tend to be more worried about developing dementia than people who report fewer cognitive problems.

Compared to perceptions of memory capacity, perceptions of how one's memory has *changed over time* may be an even stronger correlate of DW. Indeed, people who perceived more memory decline also had higher DW in a representative study of older Americans (Cutler 2015). Another study found that people who indicated stronger belief in the inevitability of age-related memory decline also reported more DW (Suhr and Kinkela 2007).

DW may also be related to other, more general aging self-perceptions (Kessler et al. 2012). Because many people associate old age with senility and dementia (e.g., Hess 2005; Levy 1996), DW may constitute not only concern about developing a specific health condition, but also anxiety about the aging process more generally (Kessler et al. 2012; see also George and Whitehouse 2007). In line with this reasoning, brief exposure to negative old age stereotypes increased DW among a sample of older adults in a recent priming study (Molden and Maxfield 2017). Two studies have revealed first evidence of overlapping variance between DW and aging anxiety (Kessler et al. 2014a, b).

Dementia worry and social-cognitive health beliefs

Different types of health worries (e.g., cancer worry, heart-focused anxiety) have been intensively investigated within the health and clinical psychology literatures. Surprisingly, DW has yet to be investigated as a type of health worry. According to the Health Belief Model (Rosenstock 1974), the perceived threat of a condition depends on the perceived risk of getting the condition and the perceived seriousness of the condition. The social-cognitive model of health anxiety (Warwick and Salkovskis 1990) proposes that health anxiety additionally depends on the degree to which people perceive that they have the resources to cope with and influence the course of a condition. Building on these two well-established models, individual differences in DW may be related to a person's subjective perceptions of (1) being personally at

risk for dementia, (2) the consequences of dementia, and (3) their ability to prevent dementia, or in other words, the controllability of memory decline (Kessler et al. 2012).

Current study

To date, the relatively few studies on concomitants of DW have mostly investigated the relationship between DW and objective factors such as sociodemographic characteristics or having a parent with dementia, and most studies have focused on only a limited number of potential correlates at a time. Based on an integration of previous research and additional theoretical considerations, in the current study we used cross-sectional questionnaire data from a sample of German adults 40 + to examine the extent to which DW was related to people's (1) sociodemographic characteristics, (2) contact with people with dementia, (3) physical health-related risk factors, (4) well-being, (5) aging self-perceptions, and (6) social-cognitive health beliefs about dementia.

Our study extends previous research in several ways. We take into account that DW is a psychological phenomenon (Kessler et al. 2012). Because we simultaneously explore the relationships between DW and a wide range of concomitants, we are able to compare the extent to which DW is related to different sets of objective and subjective characteristics (e.g., the extent to which DW is related to sociodemographic characteristics relative to well-being or aging self-perceptions) as well as identify specific concomitants of DW (e.g., gender, life satisfaction, perceptions of memory change). We also improve upon previous research by using a multi-item measure of DW as opposed to the single-item measure typically used in existing studies ("How concerned are you about developing dementia?"). Finally, we assess worry about developing *any* type of dementia as opposed to just AD.

Methods

Procedure

We recruited a convenience sample of adults 40 + years in the Heidelberg/Mannheim, Germany area in three ways. First, the authors and research assistants distributed questionnaires within their social networks. Second, participants were recruited with a newspaper article seeking participants for a study on subjective experiences of aging. Third, in order to reduce selection bias toward healthy older adults, questionnaires were left at an adult daycare center and at the meeting place of a health-related support group. Participants were informed that the study was about aging and health. The term "dementia" was defined, and it was explained that dementia included AD. Participants were assured that data

would be treated anonymously. Completing the questionnaire took 35 to 60 min. A stamped and addressed envelope was provided so that questionnaires could be returned by mail.

Sample

Of the 371 distributed questionnaires, $N = 219$ were returned (response rate: 59.0%). No participant reported a diagnosis of dementia or cognitive impairment. Participants were $M = 65.50$ years old ($SD = 11.34$; 40–94 years), 55.3% were female, and 32.9% had completed tertiary education. Their subjective health was $M = 3.45$ ($SD = .86$) based on a scale ranging from 1 (*bad*) to 5 (*very good*). Table 1 displays additional descriptive statistics of the sample. Based on representative data from the European Social Survey (2012), the sample was comparable to their age peers in the general German population with regards to gender and subjective health (German general population 40 + : 52.9% female; subjective health based on a scale ranging from 1 (*very bad*) to 5 (*very good*), $M = 3.50$, $SD = .87$), with a modest bias toward well-educated individuals (German general population 40 + : 23.3% completed tertiary education) (own calculations). With approximately nine participants for each predictor variable, the sample size had more than adequate statistical power according to the minimum “five cases per independent variable” rule-of-thumb for regression (Tabachnick and Fidell 1989).

Measures

Dementia worry Participants completed a ten-item DW scale used in an earlier study (Kessler et al. 2014a). The scale was based on existing measures of DW and health worries. The scale assesses the intensity (“How concerned are you about developing dementia?” 1 = *not at all*, 4 = *very much*), frequency (“How often do you worry about developing dementia?” 1 = *never*, 5 = *always*), emotional tone (e.g., “When I think about developing dementia, I feel anxious.” 1 = *strongly disagree*, 4 = *strongly agree*), and everyday relevance of DW (e.g., “Sometimes, for instance when I repeatedly forget things during the day, I am worried that I might develop dementia.” 1 = *strongly disagree*, 4 = *strongly agree*). The intensity item is the single item typically used to measure DW. Due to the different answer scales, answers to each item were first standardized ($M = 0$, $SD = 1$) and then averaged (Cronbach’s $\alpha = .92$). Higher scores indicate more DW. Scores in the current sample ranged from -1.18 to 2.24 .

Sociodemographic characteristics Participants indicated their age, gender (*male/female*), highest completed educational level (*less than secondary*, *lower secondary*, *higher secondary*, *tertiary*), number of children and (great-)

grandchildren, and relationship status (*partner/no partner*). We also calculated a quadratic age term (centered around sample mean age).

Contact with people with dementia Participants indicated whether a first-degree family member (e.g., parent), second-degree family member (e.g., aunt), close friend, and/or acquaintance had dementia and/or whether their paid or volunteer work involved assisting someone with dementia (*yes/no*). Answers were summed; higher scores indicate more contact. Scores in the current study ranged from 0 to 2.

Physical health-related risk factors Participants indicated whether they had any of the following physical health-related risk factors for dementia (Alzheimer’s Association, 2017; World Health Organization, 2017): *heart attack*, *stroke*, *diabetes*, *high blood pressure*, *overweight*, and *physically inactive* (*yes/no*).

Well-being Participants indicated their *overall current health* using a scale ranging from 1 (*poor*) to 5 (*excellent*) (Subramanian et al. 2010). Participants indicated their *life satisfaction* using a scale ranging from 1 (*completely dissatisfied*) to 7 (*completely satisfied*) (Organisation for Economic Co-operation and Development 2011). An adapted version of the Short Version of the Brief Symptom Inventory (Spitzer et al. 2011) was used to measure recent *psychological distress*. Participants used a scale ranging from 0 (*no distress*) to 4 (*extreme distress*) to indicate the extent to which they had experienced 25 psychological symptoms over the past week (Cronbach’s $\alpha = .92$). Scores were summed; higher scores indicate more distress. Scores in the current study ranged from 25 to 85.

Aging self-perceptions We adapted two subscales of the Metamemory in Adulthood Questionnaire (Dixon et al. 1988; German version: Zimprich and Kurtz 2015) to assess self-perceptions of cognitive aging. Participants used a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) to indicate their *perceived memory change* (nine items; e.g., “I forget appointments much more often than 10 years ago.”) and their current *perceived memory capacity* (11 items; e.g., “I can remember birthdays well.”). Answers were averaged (Cronbach’s $\alpha = .90$ and $.79$). Higher scores indicate better perceived memory capacity and more memory decline, respectively. *Aging anxiety* was measured with seven items from the Aging Anxiety Scale (Lynch 2000; Kafer et al. 1980; German version: Kessler et al. 2014a). Participants used a scale ranging from 1 (*completely disagree*) to 4 (*completely agree*) to indicate the extent to which they worried about age-related changes in physical appearance, changes in physical health, financial dependence, physical disability/mobility, loss of social contacts, loss of cognitive ability or autonomy to make decisions, and about the future in general. Answers were averaged (Cronbach’s $\alpha = .83$); higher scores indicate more aging anxiety. Scores in the current study ranged from 1 to 4.

Table 1 Descriptive statistics and intervariable correlations

	1	2	3	4	5	6	7	8	9	10	11
1 Dementia worry	1										
Sociodemographics											
2 Age	.16*	1									
3 Age ²	128.06 (165.46)	–.11	1								
4 Gender (female)	.15*	–.09	.09	1							
5 Education	2.56 (1.18)	–.26**	.14	–.19**	1						
6 Children	1.69 (1.09)	.23**	–.02	–.01	–.09	1					
7 Grandchildren	1.57 (2.27)	.39**	–.03	.00	–.26**	.51**	1				
8 No partner	26.7%	.33**	.15*	.14*	–.07	.10	.08	1			
Contact with dementia											
9 Contact	.73 (.79)	–.13	.02	.05	.07	.02	–.03	–.11	1		
Physical health-related risk factors											
10 Heart attack	5.9%	.18**	.05	–.09	–.06	.12	.06	.07	.06	1	
11 Stroke	3.2%	.12	–.03	–.05	–.08	.02	.00	.13	–.10	.28**	1
12 Diabetes	11.9%	.22**	–.12	–.01	–.09	.00	.04	.13*	–.12	.03	.01
13 High blood pressure	50.2%	.31**	–.09	–.18**	–.14*	.08	.18**	.10	.01	.17*	.13
14 Overweight	28.8%	.07	–.15*	–.14*	–.08	.10	.03	–.01	–.03	.14*	.11
15 Inactive	54.9%	.13	.10	–.06	–.06	.09	.15*	.06	.01	.02	.05
Well-being											
16 Health	3.45 (.86)	–.31**	.12	.08	.11	–.04	–.10	–.21**	.11	–.13	–.07
17 Satisfaction	5.47 (1.21)	–.37**	.08	–.01	.09	–.05	.04	–.10	–.08	–.05	.04
18 Distress	1.39 (0.38)	.49**	.11	.13	.01	.10	.08	.13	.10	.10	.03
Aging self-perceptions											
19 Memory capacity	3.51 (.60)	–.17*	.01	.03	.08	–.17*	–.16*	–.04	–.04	.01	–.20**
20 Memory change	2.53 (.78)	.45**	–.07	.04	–.18**	.24**	.25**	.22**	–.07	–.03	.15*
21 Aging anxiety	2.23 (.57)	.62**	.00	.10	–.19**	.10	.20**	.13	.04	–.08	.02
Social-cognitive health beliefs											
22 Risk	0.00 (.88)	.51**	.00	.08	–.04	.00	.06	–.08	.21**	–.09	.06
23 Consequences	–0.02 (.67)	.31**	.01	.15*	–.13	.02	.07	.03	–.07	–.06	.09
24 Controllability	3.75 (.54)	–.37**	–.20**	–.02	.20**	–.21**	–.23**	–.06	.06	.10	–.13
12											
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19											
20											
21											
22											
23											
24											
1 Dementia worry											
Sociodemographics											
2 Age											

Table 1 (continued)

	12	13	14	15	16	17	18	19	20	21	22	23
3 Age ²												
4 Gender (female)												
5 Education												
6 Children												
7 Grandchildren												
8 No partner												
Contact with dementia												
Contact												
Physical health-related risk factors												
10 Heart attack												
11 Stroke												
12 Diabetes	1											
13 High blood pressure	.17*	1										
14 Overweight	.05	.27**	1									
15 Inactive	.19*	.17*	.10	1								
Well-being												
16 Health	-.32**	-.17*	-.29**	-.21**	1							
17 Satisfaction	-.06	-.12	-.12	-.04	.38**	1						
18 Distress	.02	.05	.07	.06	-.35**	-.52**	1					
Aging self-perceptions												
19 Memory capacity	-.04	.00	-.06	-.04	.14*	.05	-.07	1				
20 Memory change	.19**	.04	.01	.07	-.30**	-.17*	.26**	-.52**	1			
21 Aging anxiety	.07	.06	.01	.09	-.36**	-.42**	.49**	-.21**	.43**	1		
Social-cognitive health beliefs												
22 Risk	-.02	.04	.11	.02	-.19**	-.20**	.25**	-.21**	.27**	.42**	1	
23 Consequences	-.03	-.05	-.07	-.04	-.09	-.14*	.18*	-.05	.17*	.42**	.16*	1
24 Controllability	.00	-.13*	-.07	-.16*	.26**	.18**	-.27**	.51**	-.60**	-.39**	-.33**	-.15*

* $p \leq .05$, ** $p \leq .01$ ^aDescriptive data based on raw data without imputations

Social-cognitive health beliefs about dementia. *Personal dementia risk* was assessed with three items (e.g., “Compared with other people of my age and sex, I think my risk for developing dementia is...” 1 = *very low*, 5 = *very high*) and *perceived consequences of dementia* was assessed with six items (e.g., “Being diagnosed with dementia would ruin my life.” 1 = *disagree completely*, 5 = *agree completely*) based on Werner (2002) and Roberts and Connell (2000). Both scales are available in Appendix. Due to the different answer scales, answers were first standardized ($M = 0$, $SD = 1$) and then averaged (Cronbach’s $\alpha = .86$ and $.78$). Higher values indicate greater risk and worse consequences, respectively. Scores in the current sample ranged from -1.83 to 3.2 for perceived risk and from -1.76 to 1.39 for perceived consequences. *Perceived controllability of memory decline* was measured with 13 items based on the Memory Controllability Scale (Lachman et al. 1995) and an answer scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). A sample item is: “If I use my memory a lot, it will stay in shape, just like my muscles do if I exercise.” Answers were averaged (Cronbach’s $\alpha = .82$); higher values indicate greater perceived controllability. Scores in the current study ranged from 2.46 to 5 .

Analytical strategy

Analyses were conducted with SPSS 20. Item non-response was low (9.6% on one of the perceived consequence items, $\leq 5\%$ across all other items). To preserve power, we used the multiple imputation procedure to create five data sets with missing values imputed. All study items were included in the imputation model. Data were imputed on the item level; no rounding or constraints were used (Graham 2009). Unless otherwise noted, analyses were conducted on each of the five data sets and we interpreted the pooled results.

To be able to compare results with previous studies, we first analyzed responses to the single item typically used to measure DW. We then analyzed the zero-order correlations between the study variables to be able to compare our results with the results of studies which assessed the relationship between DW and single predictors, and also to check for potential problems with multicollinearity.

Next, we ran a commonality analysis to determine the unique variance in DW explained by each of the six variable sets: sociodemographics, contact with dementia, physical health-related risk factors, well-being, aging self-perceptions, and social-cognitive beliefs. Specifically, we ran a series of six separate hierarchical linear regressions with each variable set entered in the final step. The change in R^2 in the last step represents the unique variance explained by the last entered variable set. We used the results of the saturated regression model (including all predictor variables) to

interpret the relationship between DW and each individual predictor. We examined the histogram of the model residuals to ensure that there were no major deviations from normality, in line with the assumptions of regression analysis.

Results

In response to the single item typically used to measure DW, 17.8% of the sample indicated that they were not at all worried about developing dementia; 41.1% indicated that they were hardly worried; 37.9% indicated that they were somewhat worried; and 3.2% indicated that they were very worried. Answers to the single-item measure were highly and positively correlated with scores on the ten-item DW scale ($r = .76$).

Table 1 displays the descriptive statistics of the study variables and the intervariable correlations. According to the zero-order correlations, DW (scale score) was associated with age (+), female gender (+), education (−), subjective health (−), life satisfaction (−), psychological distress (+), perceived memory capacity (−), perceived memory change (+), aging anxiety (+), personal risk perception (+), perceived consequences (+), and perceived controllability (−). The highest correlation was $r = .60$ between perceived memory change and perceived controllability. The generally low and moderate correlations along with the variance inflation factor and tolerance statistics (≤ 2.55 and $\geq .39$, respectively, in the saturated model) indicated that there was no major problem with multicollinearity according to standard rules-of-thumb (i.e., correlations $< .80$, variance inflation factor < 10 , tolerance $> .10$).

Inspection of the histogram of the model residuals indicated no major violations from normality (see Appendix). Together the predictor variables explained 53.3% of the variance in DW based on the average adjusted R^2 -value of the saturated regression model. The results of the commonality analysis indicated that 33.8% of the variance in DW was shared among the predictor variables. The sociodemographic variables uniquely explained 3.0% of the variance in DW. The well-being variables uniquely explained 5.1% of the variance. Aging self-perceptions uniquely explained 5.4% of the variance. The social-cognitive health beliefs variables uniquely explained 6.0% of the variance. Neither contact with people with dementia nor physical health-related risk factors uniquely explained variance in DW.

Table 2 displays the results of the saturated regression model. In the saturated model, there was a quadratic (reverse U shape) relationship between age and DW (see Fig. 1). In addition, subjective health (+), psychological distress (+), perceived memory change (+), aging anxiety (+), and personal risk perception (+) were each significantly associated

Table 2 Results of the saturated linear regression model of dementia worry

	B	S.E.	β^a	t
Intercept	− 2.59**	.71		− 3.67
<i>Sociodemographics (3.0%)</i>				
Age	.01	.01	.12	1.53
Age squared	.00*	.00	− .11	− 2.06
Gender (female)	.10	.08	.06	1.22
Education	.01	.03	.01	.16
Children	− .06	.04	− .09	− 1.60
Grandchildren	− .01	.02	− .02	− .28
Partner	− .03	.10	− .02	− .26
<i>Contact with dementia</i>				
Contact	.00	.05	.00	− .02
<i>Physical health-related risk factors</i>				
Heart	− .07	.18	− .02	− .37
Stroke	.19	.23	.04	.82
Diabetes	.06	.12	.02	.48
High blood pressure	− .04	.08	− .03	− .53
Overweight	.08	.09	.05	.91
Inactive	− .06	.08	− .04	− .69
<i>Well-being (5.1%)</i>				
Health	.13*	.05	.14	2.33
Satisfaction	− .05	.04	− .08	− 1.25
Distress	.02**	.00	.23	3.57
<i>Aging self-perceptions (5.4%)</i>				
Memory capacity	.08	.08	.23	1.01
Memory change	.17*	.08	.07	2.24
Aging anxiety	.40**	.09	.30	4.26
<i>Social-cognitive beliefs (6.0%)</i>				
Risk	.25**	.05	.29	4.95
Consequences	.04	.06	.04	.69
Controllability	− .06	.10	− .04	− .55

$R^2 = .58$, Adjusted $R^2 = .53$

^aStandardized beta coefficients based on the results of the regression model with all variables standardized prior to analysis. Where applicable, the proportion of unique variance in DW explained by each variable set is displayed in parentheses

* $p \leq .05$, ** $p \leq .01$

with DW. The saturated model was significant, $F(23, 195) = 11.55$ to 12.44 across the five data sets, all $p < .001$.

Discussion

According to recent surveys, dementia is second only to cancer among the most feared conditions (Alzheimer's Research UK 2011; DAK Gesundheit 2015; MetLife Foundation 2006, 2011). While the incidence of dementia increases, biomedical and lifestyle interventions have not yet been especially successful in stopping, slowing, or reversing the

Fig. 1 Dementia worry is highest among participants around age 70 after controlling for a range of other variables. The figure is based on the relationship between age and the unstandardized residual of the saturated model with DW as the dependent variable and six sets of predictor variables (excluding age)

course of dementia. It is therefore not surprising that people are concerned about developing dementia themselves. In the current study based on a sample of German adults aged 40 + years, 41.1% of participants indicated that they were at least somewhat worried about developing dementia. The proportion of people worried about developing dementia in the current study is very similar to the results from studies conducted in other industrialized countries (e.g., Cantegreil-Kallen and Pin 2012; Cutler 2015; Low and Anstey 2009; MetLife Foundation 2011; Yougov 2012) and demonstrates that DW is a widespread phenomenon. It is therefore of utmost societal importance to understand and productively deal with DW.

Considering perspectives and existing research from epidemiology and public health, clinical gero-psychology, lifespan psychology, and health psychology, in the current study we investigated the relationship between DW and a wide range of potential objective and subjective correlates. The usefulness of our approach is clearly reflected in the high proportion of explained variance in the saturated model (53.3%). The results support our theoretical framework which describes psychological characteristics as key determinants and concomitants of DW (Kessler et al. 2012). Specifically, we found high bivariate correlations ($> .45$) between DW and psychological distress, perceived memory change, aging anxiety, and personal risk perception. The same variables also explained unique variance in DW in the saturated model. Overall, our findings indicate that DW can

be best understood as a hybrid of psychological distress, aging self-perceptions (in general and with respect to cognitive aging), and a specific type of health concern (Kessler et al. 2012).

One implication of our results is that healthcare practitioners (e.g., primary care physicians, psychologists, memory clinic employees) should consider a person's psychological characteristics when deciding how to intervene when someone indicates moderate or high DW in the absence of an organic mental disorder. Productive interventions might include treatment of psychological symptoms, support coping with the aging process, and/or support preparing for a future with dementia. Given the shared variance between aging anxiety and DW, another implication is that public health interventions and media should clearly communicate that dementia is not synonymous with aging (and vice versa) in order to minimize “spill over” effects whereby dementia awareness negatively colors perceptions of old age and the aging process.

Previous results about the association between chronological age and DW based on single-item assessments have been inconsistent (cf. Cutler 2015). Using a multi-item measure of DW, we found a reverse U-shaped association between age and DW among adults 40 + at the multivariate level. Accordingly, our results suggest that DW might peak in the 70 s and slightly decrease thereafter. The relationship between age and DW in the current study differs somewhat from previous results from representative studies of older Americans (DW highest among people 50 to 59 years and progressively lower at older ages; Cutler 2015), French adults (linear increase with age; Cantegreil-Kallen and Pin 2012), and Australian adults (no relationship with age; Low and Anstey 2009). As dementia incidence increases exponentially between the ages of 65 and 90, the relationship between DW and age observed in the current study may reflect the “unrealistic optimism” of the oldest old. This particular finding is in line with the “well-being paradox,” according to which people are normatively able to maintain their subjective well-being as they get older, despite the risks and challenges of old age (Staudinger 2000). We caution, however, that our cross-sectional data, convenience sample, and the small sample of participants 80 + ($n = 22$; 10.0%) may limit the generalizability of our results. As in previous studies, in the current study women and people with less education indicated more DW, in line with the higher prevalence of dementia among women and people with less education (e.g., Fratiglioni et al. 2000; Sharp and Gatz 2011). However, gender and education were statistically insignificant correlates of DW in the saturated model. Although living alone as an unmarried person is a risk factor for dementia (Sundström et al. 2016), we found no relationships between marital status and DW, in line with previous research (Cutler 2015; Cutler and Hodgson 2001; Werner 2002).

Another important result is that DW was associated with perceived memory change (see also Cutler 2015), but *not* associated with perceived memory capacity in the saturated model. The results therefore demonstrate that it is specifically a person's perceptions of his/her own cognitive *aging* (i.e., how memory is changing over time) that goes along with DW as opposed to perceived (limited) cognitive capacity per se. Relatedly, among the social-cognitive belief variables, only personal risk perception was related to DW in the multivariate model (see Table 2). Helping people to distinguish between normal age-related cognitive changes and dementia symptoms may thus be key to reducing unproductive DW.

Furthermore, this study is the first to show that the major physical health-related risk factors for dementia including heart attack, stroke, diabetes, high blood pressure, being overweight, and physical inactivity poorly predict DW. The current results thus suggest that scientific evidence about the physical health-related risk factors for dementia, along with how people can reduce their risk, should be more effectively communicated to the public and particularly to people at greater risk. Being at least somewhat worried about developing dementia can potentially motivate people to adopt and maintain healthier lifestyles (Kim et al. 2015), and thus reduce their risk.

In contrast to the lack of relationship between objective health and DW, there was a significant relationship between *subjective* health and DW. Paradoxically, better subjective health was associated with *lower* DW according to the bivariate analyses (see Table 1), but with *higher* DW according to the multivariate analyses (see Table 2). Subjective health is related both to a person's physical and functional health as well as the personality factor neuroticism (Moor et al. 2006). Our multivariate model included subjective health along with other measures of well-being (psychological distress, life satisfaction). Hence, the negative relationship between subjective health and DW in the saturated model may indicate that people who feel more physically healthy *after controlling for their well-being* might actually tend to worry about developing dementia more than their physically less healthy counterparts.

In contrast with most previous research, in the current study we did not find evidence that people with more personal contact with dementia were more worried about developing dementia themselves. This puzzling result may be due to our statistical approach and study protocol. Much of the existing evidence on the positive relationship between personal contact and DW has been based upon group comparisons (e.g., comparing average DW in a group of adult children of people with dementia relative to a control group; Cutler and Hodgson 2001). In the current study, we assessed the correlation between DW and contact as a personal (versus group) characteristic. Furthermore, in some previous

studies, participants have been asked to answer a single-item measure of DW sandwiched between many questions on less emotional topics like job history, life insurance, and household composition (e.g., Cutler 2015). In such circumstances, only people for whom dementia is already a salient topic (e.g., people with extensive personal contact with dementia) may be able to accurately evaluate their DW. In contrast, by requiring participants to answer a battery of questions only about aging and dementia, our study protocol may have given even participants who have never consciously thought about dementia (e.g., people without prior personal contact) enough time to become aware of and accurately evaluate their DW. The relationship between personal contact with dementia and DW may also depend on additional moderating factors (e.g., beliefs about cognitive aging; Suhr and Kinkela 2007).

Limitations

Our results are based on cross-sectional data which were suitable for investigating the shared and unique variance associated with different constructs. We cannot, however, infer causal relationships between the concomitants and DW, nor can we draw conclusions about how DW might develop over time. It should also be noted that we used self-reported data also for the objective correlates (e.g., physical health-related risk factors, diagnosis of dementia/cognitive impairment). Furthermore, our results are based on an ethnically homogeneous convenience sample in Germany. There was evidence that our sample was more educated than their peers in the general population and the results may therefore be biased. Findings should be replicated in representative studies and in other countries. Finally, although we were able to explain a large proportion of the variance in DW, there may be other important personal (e.g., personality traits, income), physical health-related (e.g., smoking, head injury, heavy alcohol use), and contextual/structural (e.g., healthcare resources) correlates not included in the current study.

Conclusion

As populations age and more people face the possibility of developing dementia, it is of utmost societal importance that emotional reactions to dementia are used as productively as

possible. Against this background, our results demonstrate the added value of taking a cross-disciplinary perspective for predicting and understanding DW. We emphatically encourage further research on DW as an important measure to help individuals and societies cope with the increasing prevalence of dementia.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Appendix

Perceived Dementia Risk Scale (3 items)

1. How high would you estimate your risk of developing dementia at some point? I think my risk of developing dementia is...

1	2	3	4	5
Very low	Low	Average (50%)	High	Very high

2. Now please indicate the probability (%) that you will stay free of dementia. I think the probability that I will stay free of dementia is ____%.
3. Compared with other people of my age and sex, I think my risk for developing dementia is

1	2	3	4	5
Very low	Low	Average (50%)	High	Very high

Items 1 and 3 are based in part on Werner (2002) and Roberts and Connell (2000). Item 2 is reversed scored. Item scores are standardized and then averaged.

Perceived Consequences of Dementia Scale (6 items)

1. How serious (or impairing) would the consequences of dementia be for your life?

1	2	3	4	5	6	7
Not at all serious			Relatively serious			Very serious

Do you agree with the following statements?

	Disagree com- pletely	Disagree some- what	Neither agree nor disagree	Agree some- what	Agree com- pletely
If I had dementia, I would still be able to enjoy my life.	☐	☐	☐	☐	☐
Being diagnosed with dementia would ruin my life.	☐	☐	☐	☐	☐
It would be humiliating to have dementia.	☐	☐	☐	☐	☐
I would rather die than develop dementia.	☐	☐	☐	☐	☐
Dementia is the worst disease that I could get.	☐	☐	☐	☐	☐

Items were based in part on Werner (2002) and Roberts and Connell (2000). Item 2 is reversed scored. Items are standardized and then averaged.

Histograms of regression model residuals

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