Changing Predictors of Self-Rated Health: Disentangling Age and Cohort Effects

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Previous studies have shown that some predictors of self-rated health (SRH) become more important with age, while others become less important. Although based on cross-sectional data, these findings are often interpreted as age-related changes in evaluation criteria. However, results could be due to cohort effects as well. We attempted to disentangle age and cohort effects by combining and comparing cross-sectional and longitudinal data from a large-scale longitudinal survey. The sample consisted of 2,982 community-dwelling participants from 2 measurement occasions of the German Ageing Survey ages 40–81 years at baseline. Multigroup latent regression models were used to examine whether associations between various predictors and SRH differed between age groups and whether they changed over time. Comparisons of cross-sectional age differences in SRH-predictor associations and longitudinal age changes in the same associations allow the identification of cohort effects. Number of chronic conditions showed a constant negative association with SRH independently of age and cohort. In contrast, the association between SRH and all other predictors (physical functioning, exercise, life satisfaction, depressive symptoms, and positive affect) changed longitudinally, pointing to an age effect. Prediction of SRH by depressive symptoms and positive affect showed an additional cohort effect: The negative associations between depressive symptoms and SRH and the positive associations between positive affect and SRH were stronger among younger cohorts. The findings provide not only longitudinal support for previous cross-sectional studies, but also show the impact of historical change: Emotional facets of psychological well-being increase in relevance for SRH across cohorts.

Keywords: aging, self-rated health, cohort, comparison, longitudinal

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Self-rated health (SRH)—the self-perception and self-evaluation of one’s health status—has been used as an efficient measure of health. While many large-scale surveys used SRH as a “proxy” for a more comprehensive measure of objective health, what is also interesting is that measures of SRH and objective health are often at odds, particularly in later life. Moreover, in many studies, SRH turned out to be a better predictor of mortality than objective health indicators (e.g., Benyamini & Idler, 1999; DeSalvo, Bloser, Reynolds, He, & Muntner, 2006; Idler & Benyamini, 1997). Additionally, numerous studies support an independent impact of SRH on physical functioning and cognitive health (Bond, Dickinson, Matthews, Jagger, & Brayne, 2006), future morbidity (Fayers & Sprangers, 2002), and hospitalization (Kennedy, Kasl, & Vaccarino, 2001). These findings raise the questions of which factors predict SRH, and if these factors change with age.

Jylhä (2009) introduced a model that describes SRH as resulting from a complex evaluation process. According to Jylhä’s model, SRH first results from an interaction between various health factors (e.g., number of chronic conditions, physical functioning, health behaviors) and additional factors people take into consideration (e.g., chronological age, health expectations). Second, the model assumes that the importance of some of the evaluation criteria change with age. This suggests that SRH might mean something different at different age groups. In older people, SRH might more strongly reflect psychological adaptation to worsening health than in younger adults (Idler & Benyamini, 1997). Physical losses may be coped with by shifting from a temporal comparison of the current state of health with previous health states to a social comparison with people of the same age (response shift; Rapkin & Schwartz, 2004; Sprangers & Schwartz, 1999). In addition, the ability to adjust personal goals and standards (accommodative...
and physical functioning suggests that factors constituting SRH change with age (e.g., Leinonen, Heikkinen, & Jylhä, 2001). To maintain good SRH despite worsening objective health, the individual conceptualization of what “good health” is might change by reweighting different factors constituting the self-perception. In line with this assumption, several studies showed that the association between various health factors and SRH decreases with age, while psychological well-being factors such as positive affect and depressive symptoms gain in importance for SRH (e.g., Benyamini et al., 2000; French, Sargent-Cox, & Luszcz, 2012; Jylhä, Leskinen, Alalen, Leskinen, & Heikkinen, 1986; Schnittker, 2005; Shooshtari, Menec, & Tate, 2007). As age-group differences in associations between psychological constructs can arise for a number of reasons unrelated to age-related changes (Lindenberger, von Oertzen, Ghisletta, & Hertzog, 2011), a closer look at age-related changes and alternative explanations such as cohort differences is needed.

The Role of Cohort Effects for Predictors of Self-Rated Health

To date, examinations of the age-related “change” of predictors for SRH as described above are commonly based on cross-sectional differences between age groups. Age-group differences, however, could not only arise because of age effects but also because of cohort effects (Costa & McCrae, 1982). Thus, it remains unclear whether predictors of SRH solely vary by age or whether they are additionally subject to cohort effects. Three possibly interrelated trends might have changed the predictors of SRH over historical time, resulting in cohort effects.

First, according to Inglehart (1977, 1997), advanced industrial societies experience a change in values stemming from rising prosperity and the associated lack of threats to basic physiological (e.g., food, water) and safety needs (e.g., security of body, family and health; cf. Maslow’s [1954] hierarchy of needs). If these basic needs are satisfied, as for many people living in advanced industrial societies, individuals tend to long for postmodern values such as self-realization and self-esteem (Inglehart, 1977, 1997). The primary goal, thus, is no longer to ensure survival, but to enhance quality of life and well-being.

Second, there is a changing societal definition of health, possibly tied to the change of societal values described. While early medical approaches defined health primarily as the absence of disease, the modern definition of health is broader and incorporates mental and social well-being (World Health Organization [WHO], 1948). There is empirical evidence that SRH is better in earlier-born cohorts (Chen, Cohen, & Kasen, 2007; Idler, 1993; Jagger et al., 2007), perhaps because their conception of health is narrower. Later-born cohorts seem to have higher expectations about their health status or, at least, broader definitions of health (Chen et al., 2007; Jagger et al., 2007; Jylhä, 2009), both of which could explain why the relevance of different SRH predictors differs between birth cohorts.

Third, the definition and detection of diseases has also changed substantially. Problems that had once been considered outside the purview of medicine became defined and treated as medical problems (Conrad & Waggoner, 2014). This medicalization in combination with advances in technology (e.g., screenings, increasingly sensitive tests) leads to an increase in prevalence rates for various
The present study examines the importance of three health factors (number of chronic conditions, physical functioning, and exercise) and three psychological well-being indicators (life satisfaction, depressive symptoms, and positive affect) that were shown to predict SRH in previous studies (e.g., Benyamini et al., 2000; French et al., 2012; Shooshtari et al., 2007). As individuals often maintain good (or stable) SRH up to old age alongside worsening physical health status, it is assumed that health-related indicators may become less important SRH predictors with advancing age, while indicators of psychological well-being are expected to become more important (Benyamini et al., 2000; French et al., 2012; Jylhä et al., 1986; Schnittker, 2005; Shooshtari et al., 2007). Furthermore, because of historically changing conceptions of health, indicators of psychological well-being could be additionally subject to cohort effects.

We therefore expect to observe age-related increases in importance for SRH as well as possible birth cohort effects for all three psychological well-being indicators. At least for positive affect and depressive symptoms previous studies have shown that associations with SRH are stronger in older age groups (Benyamini et al., 2000; Schnittker, 2005). This is why we treat life satisfaction, depressive symptoms, and positive affect in our hypotheses equally, as all three constructs represent a facet of psychological well-being. Simultaneously, we would be able to detect differential effects for positive and negative (life satisfaction/positive affect vs. depressive symptoms) or rather cognitive and emotional facets (life satisfaction vs. positive affect/depressive symptoms) of psychological well-being.

Taken together, our hypotheses are

**Hypothesis 1:** Health predictors have a decreasing association with SRH with advancing age (age-contextual predictors of decreasing strength).

**Hypothesis 2:** Psychological well-being predictors have an increasing association with SRH with advancing age (age-contextual predictors of increasing strength).

**Hypothesis 3:** Psychological well-being predictors are not only age-contextual predictors but are additionally subject to cohort effects (cohort-contextual predictors of increasing strength).

### Method

**Data**

Data came from the German Ageing Survey (DEAS), an ongoing cohort-sequential nationwide representative survey of community-dwelling adults age 40 years and over. For this study, longitudinal data from the 2002 (baseline) and 2008 (follow-up) waves were used. In the present study, we only used the new baseline sample from the data collection wave in 2002 (N = 3,084), which was drawn by means of national probability sampling with stratified sampling by age, gender, and place of residence (Eastern or Western Germany). Of the original sample, 58.3% (1,847 individuals) could be interviewed again in 2008 (Engstler & Motel-Klingebiel, 2010). Follow-up participants were on average healthier and reported fewer depressive symptoms and a higher level of positive affect and life satisfaction; they were also
younger and better educated. Nevertheless, dropout analysis (Lindenberger, Singer, & Baltes, 2002) showed that all selectivity effects never reached a medium effect size of 0.5 $SD$. We excluded participants with missing values on all variables used in the present study. All in all, data from 2,982 participants ages 40 to 81 years in 2002 (and 46 to 87 years in 2008, respectively) were analyzed in the present study.

**Measures**

**Self-rated health.** SRH was measured by a single item asking, “How do you assess your current state of health?” Response categories were very good, good, average, bad, and very bad on a 5-point scale (European version of SRH; WHO, 1996). Higher values indicate better SRH. We treated this variable as continuous as evidence suggests that SRH forms a continuum from poor to good health (Mackenbach, van den Bos, Jourgen, van de Mheen, & Stronks, 1994; Manderbacka, Lahelma, & Martikainen, 1998).

**Health predictors.** Number of chronic conditions were assessed by a checklist of 11 health problems (e.g., cardiovascular diseases, gastrointestinal diseases). For each participant, a sum score was computed based on the number of self-reported chronic conditions. We chose to use sum scores instead of single-reported chronic conditions, as sum scores yield the strongest correlations between medical and self-reports (Katz, Chang, Sangha, Fossel, & Bates, 1996). Higher values on the sum scale indicate more self-reported chronic conditions. Physical functioning was measured by the Physical Functioning subscale of the SF-36 (Bullinger & Kirchberger, 1998). Impairments in everyday activities (e.g., walking, climbing stairs, carrying shopping bags) due to current health status were rated on a 3-point scale (1 = yes, limited a lot to 3 = no, not limited at all). The scale was transformed to a range of 0–100, with higher values indicating better physical functioning. Exercise was assessed by a single item asking, “How often do you do endurance sports, for example, swimming, long-distance running, jogging, cycling, or similar activities?” (never to daily on a 6-point scale). Higher values indicate more frequent sporting activities.

**Psychological well-being predictors.** Life satisfaction was assessed with the Satisfaction With Life Scale (Pavot & Diener, 1993). All five items were rated on a scale ranging from 1 (strongly disagree) to 5 (strongly agree). Depressive symptoms were assessed by the 15-item German version of the Center for Epidemiological Studies Depression Scale (Hautzinger, 1988). Participants were asked to indicate the frequency with which they experienced several depressive symptoms (e.g., being sad, trouble sleeping) during the past week on a 4-point scale, with 1 = rarely or none of the time—less than 1 day long and 4 = most or all of the time—5 to 7 days long. A sum score was computed and transformed to a range of 0–45. Higher values indicate more frequent depressive symptoms. Positive affect was measured with the Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988). Participants were asked to indicate with 10 positive affect items how they felt (e.g., excited, inspired) during the past few months on a 5-point scale ranging from 1 (very slightly or not at all) to 5 (extremely).

**Control variables.** Region (Eastern and Western Germany) and gender were used as controls, as the DEAS is a disproportionately stratified sample according to these variables. Education (three categories according to the International Standard Classification of Education; United Nations Educational, Scientific, and Cultural Organization, 1997) was considered as a control variable because of the strong relationship between health and education (e.g., Lynch, 2003).

**Statistical Analysis**

Statistical analyses were conducted using Mplus 7 (Muthén & Muthén, 1998–2010). The large amount of missing data in 2008 was taken into account by applying the full information maximum likelihood procedure. By using all available data regardless of whether participants stayed in the study, we minimized potential differential sample attrition effects, as biases in parameter estimates are less severe if all information available is considered in contrast to using complete case information only (Graham, 2009; Newman, 2003). Furthermore, available-case analyses have substantially higher power than their complete-case counterparts (Graham, Cumsille, & Shevock, 2013). All variables at 2002 and at 2008 were converted to $T$ scores ($M = 50$, $SD = 10$) using the mean and standard deviation at 2002 for standardization at 2008. When possible, predictors were operationalized as latent factors with two manifest indicators (i.e., two item parcels, each containing half of the items regarding the predictor at hand; Little, Cunningham, Shahar, & Widaman, 2002). Number of chronic conditions, physical functioning, life satisfaction, depressive symptoms, and positive affect showed measurement invariance between age groups and over time (differences of Comparative Fit Index for each indicator were less than or equal to 0.01 between the more restricted and the less restricted model; Cheung & Rensvold, 2002). SRH and exercise were operationalized as manifest variables as these measures consisted of single item questions. For latent variables, the loading of the first manifest indicator was fixed at one (as reference point to be able to estimate the model), and the loading of the second indicator was set equal over time (to ensure measurement equivalence). Intercepts of the manifest indicators were fixed at zero so that latent changes were conceptualized as changes in factor means.

We constructed seven age groups, each with an age range of 6 years. This distance matched the longitudinal distance between the two measurement occasions. To evaluate what constitutes SRH in different age groups and at different measurement occasions, we used multigroup latent multivariate regression models to test whether the regression weights of different predictors of SRH differed between age groups in the cross section and changed within age groups in the longitudinal section. This question is different from the “driver of change” question that could be addressed with a change score model (e.g., Schöllgen, Huxhold, & Schmiedek, 2012). Possible changes of regression coefficients were assumed to be linear, meaning that the regression weight changed for every 6-year interval by the same amount. For each predictor, a separate model was estimated to simplify the interpretation of the results as the extent of the unique effect of the predictor on SRH is dependent on the covariance between the predictor and a third variable unrelated to SRH (see Lindenberger).
Model fit was evaluated by the root-mean-square error of approximation (RMSEA; Steiger, 1990). Values of RMSEA close to .08 (or smaller) indicate acceptable fit (Marsh, Hau, & Wen, 2004). Only RMSEA for final models of each indicator are reported.

We illustrate our approach in Figure 2. In the analyses, we first compared the importance of a predictor for SRH between the different age groups shown for the year 2002 (vertical solid lines and change in cross section [ΔCS] in Figure 2). If the strength of a predictor is weaker in younger age groups and stronger in older age groups, this could be due to age-related changes and/or cohort effects. To disentangle age and cohort effects, we used the following approach: In each of the seven age groups shown in Figure 2, SRH was regressed on the predictor, both in 2002 and 2008. If the importance of this predictor for SRH changes over time (dashed lines and change in longitudinal section [ΔLS] in Figure 2) in a way that corresponds to differences between age groups in the cross section in 2002 (that is, ΔLS = ΔCS), it suggests that cross-sectional age-group differences can (at least partially) be interpreted as age-related change. To test for birth cohort effects, we compared individuals who were the same age but were born at different points in time—for example, those who reached the age of 46 to 51 in 2002 and those who reached the same age in 2008. If the importance of the predictor for SRH does not differ between cohorts of the same age (that is, ΔLS = ΔCS and, consequently, βlog2 = βlog8), the finding suggests that cohort differences do not play an additional role. However, if the importance of the predictor at hand on SRH is stronger for later-born birth cohorts (i.e., those who reached the same age only in 2008) this might point to an increasing importance of the predictor for later-born birth cohorts. To statistically test age-group differences in the cross section, changes within age groups in the longitudinal section as well as cohort differences, we used χ² difference tests in three different models.

In Model 1, ΔCS and ΔLS were fixed at zero (ΔCS = ΔLS = 0). This means the regression coefficients are the same in every age group at both measurement occasions. In Model 2, ΔCS and ΔLS were allowed to vary as the same linear function (ΔCS = ΔLS ≠ 0). This means the regression coefficients change linearly by the same amount between age groups in the cross section (ΔCS) and within age groups in the longitudinal section (ΔLS). In Model 3, ΔCS and ΔLS were allowed to vary as independent linear functions (ΔCS ≠ ΔLS ≠ 0). This means the linear change of regression coefficients differs between age groups in the cross section (ΔCS) and within age groups in the longitudinal section (ΔLS).² Alpha was set at .05. A nonsignificant contrast between Model 1 and Model 2 indicates that the predictor is invariant across age and cohorts. A significant contrast between Model 1 and Model 2 suggests that the predictor is at least an age-contextual predictor. A significant contrast between Model 2 and Model 3 implies that the tested predictor is not only age contextual but also cohort contextual. With our approach, a “pure” cohort effect could only be detected if the differences between age groups in the cross section had been significant (ΔCS ≠ 0) but not the longitudinal effect (ΔLS = 0). This was not the case for any predictor.

Finally, we tested whether the effects changed when region, gender and education are considered as controls. The inclusion of the sample stratification factors as covariates makes sample weights unnecessary (Winship & Radbill, 1994).

Results

Descriptive statistics for the sample (49.6% female, 32.9% living in Eastern Germany, 14% with a low education) are dis-

² In a fourth step, we additionally tested for every predictor whether a difference could be found regarding the linear change of regression coefficients among the age groups between the two cross sections 2002 and 2008 (ΔCS in 2002 ≠ ΔCS in 2008 ≠ ΔLS = 0; Model 4). A significant contrast between Model 3 and Model 4 would suggest that there is not only a difference in linear change regarding the regression coefficients between and within age groups, but that the linear change differs between age groups for 2002 and 2008—suggesting a possible period effect. However, this was not the case for any of the studied predictors. For an easier understanding, we only use “ΔCS” to indicate change between age groups in the cross section (both for 2002 and for 2008).
played in Table 1. SRH and physical functioning were lower in older age groups and decreased over time, whereas number of chronic conditions was lower in younger age groups and increased over time. The amount of exercise decreased over age groups in the cross section starting with the age group of 58–63 years but increased in every age group over time. Depressive symptoms remained relatively stable in the first five age groups and then increased notably while there was a decrease in every age group over time (except for the age group of 76–81 years). Positive affect as well as life satisfaction remained relatively stable over age groups and over time.

All model parameters displayed in this section were taken from models without controls. Including the controls did not substantially change the model results. Therefore, we present results from models without controls for the sake of simplicity. All final models fitted the data well: number of chronic conditions RMSEA = .06, physical functioning RMSEA = .05, exercise RMSEA = .06, depressive symptoms RMSEA = .05, positive affect RMSEA = .04 and life satisfaction RMSEA = .04.

Health and psychological well-being were significantly associated with SRH. The average prediction strength in terms of the average unstandardized regression coefficient (standard errors in parentheses) was $b = -0.70 \ (.03)$ for number of chronic conditions, $b = 0.63 \ (.02)$ for physical functioning, $b = 0.16 \ (.02)$ for exercise, $b = -0.52 \ (.02)$ for depressive symptoms, $b = 0.40 \ (.02)$ for positive affect, and $b = 0.43 \ (.02)$ for life satisfaction (according to Model 1, where no change at all regarding regression coefficients was assumed between and within age groups). The left side of Table 2 shows regressions of SRH on health and psychological well-being. The middle of Table 2 shows linear change of regression coefficients between age groups in the cross section ($\Delta_{CS}$) and within age groups in the longitudinal section ($\Delta_{LS}$), according to final models. For each predictor, unstandardized regression coefficients in the youngest age group in 2002 and 2008 are displayed. With this information, one is able to generate every regression coefficient of the regression model shown in Figure 2 by adding up the linear change in the cross section, $\Delta_{CS}$, or in the longitudinal section, $\Delta_{LS}$. For example, the unstandardized regression coefficient for depressive symptoms in the youngest age group (40–45 years) is $b = -0.42$ in 2002 (cf. Table 2). By adding $-0.02 (= \Delta_{CS},$ cf. Table 2) this results in the unstandardized regression coefficient for the second youngest age group (46–51 years; $b = -0.44$) in 2002. In a similar vein, adding $-0.14 (= \Delta_{LS},$ cf. Table 2) to the unstandardized regression coefficient for depressive symptoms in the youngest age group (40–45 years) in 2002 results in the unstandardized regression coefficient for the youngest age group (46–51 years) in 2008 ($b = 0.56$).

Predictors of SRH could show the same strength for all age groups (invariant predictor), an increasing or decreasing association with SRH with advancing age (age-contextual predictor), differences between birth cohorts (cohort-contextual predictor), or a combination of age- and cohort-contextual effects. The present study revealed that in fact three different patterns exist for SRH predictors: invariant, age-contextual, and a combination of age- and cohort-contextual predictors; they are described in the following.

### Invariant Predictors of Self-Rated Health

The contrast between Models 1 and 2 was not significant for number of chronic conditions only, $\Delta \chi^2 = 2.98, \Delta df = 1, p > .05$. Regression coefficients were equally high in every age group in both measurement occasions: $\Delta_{CS}$ (solid line) $= \Delta_{LS}$ (dashed line) $= 0$ (see left side of Figure 3). This means, as one can see in Figure 4 (top), the number of chronic conditions shows a constant association with SRH between age groups in the cross section and within age groups in the longitudinal section. This means that, contrary to our hypothesis, number of chronic conditions was an invariant predictor for SRH.

### Age-Contextual Predictors of Self-Rated Health

For physical functioning, the contrast between Models 1 and 2 was significant, $\Delta \chi^2 = 17.89, \Delta df = 1, p < .05$. In Figure 3 (middle), the result pattern for physical functioning is illustrated showing that age group differences in the importance of physical functioning for SRH are comparable to the age-related decrease in the importance of physical functioning over time: $\Delta_{CS}$ (solid line) $= \Delta_{LS}$ (dashed line) $= -0.04$ (see Table 2). This is illustrated in Figure 4 (middle). In line with our hypothesis, physical functioning was an age-contextual predictor of SRH.

The same results pattern also holds true for exercise and life satisfaction (see Table 2). The contrast between Models 1 and 2 was significant for both predictors, exercise: $\Delta \chi^2 = 4.03, \Delta df = 1, p < .05$; life satisfaction: $\Delta \chi^2 = 6.82, \Delta df = 1, p < .05$. However, the contrast between Models 2 and 3 was for both predictors not significant. As we predicted, exercise and life satisfaction were age-contextual predictors of SRH both with an increasing association but without an additional cohort effect.

### Age- and Cohort-Contextual Predictors of Self-Rated Health

For depressive symptoms, the contrast between Models 1 and 2 was significant, $\Delta \chi^2 = 12.43, \Delta df = 1, p < .05$, as was the contrast between Models 2 and 3, $\Delta \chi^2 = 8.44, \Delta df = 1, p < .05$. The right side of Figure 3 contains the regression coefficients, age-group differences ($\Delta_{CS} = -.02$, see Table 2), and changes within age groups ($\Delta_{LS} = -.14$, see Table 2). The regression coefficients change linearly but not by the same amount between age groups and within age groups. As illustrated in Figure 4 (bottom), depressive symptoms show overall an increasing association with SRH between age groups and within age groups. The increase within age groups was, however, stronger than the increase over age groups which points to an increasing importance of depressive symptoms for later-born birth cohorts.

The same pattern of results also holds true for positive affect. The contrast between Models 2 and 3 was significant, $\Delta \chi^2 = 6.28, \Delta df = 1, p < .05$. This means that, as expected, positive affect was not only an age- but also a cohort-contextual predictor of SRH.

### Discussion

The present study examined predictors of SRH using data from the 2002 and 2008 waves of the DEAS. Previous studies

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3. Rounding differences exist due to rounding to two digits after the decimal. The same applies to Table 2 and Figure 3.
Self-rated health suggests a differential pattern of age and cohort effects for SRH changes in the importance of SRH predictors. Our findings considered the possibility that cohort effects might also lead to changes in the importance of SRH predictors: The association between SRH and all predictors but chronic conditions (i.e., physical functioning, exercise, life satisfaction, depressive symptoms, and positive affect) changed longitudinally, pointing to an age effect. Moreover, and as expected, the prediction of SRH by two indicators of psychological well-being showed an additional cohort effect: The negative associations between depressive symptoms and SRH and the positive associations between positive affect and SRH have shown that the importance of health indicators for SRH decrease in older age groups, while indicators of psychological well-being become increasingly important correlates of SRH with age (e.g., Benyamin et al., 2000; French et al., 2012; Heller, Ahern, Pringle, & Brown, 2009). In our study, we considered the possibility that cohort effects might also lead to changes in the importance of SRH predictors. Our findings suggest a differential pattern of age and cohort effects for SRH predictors.
were stronger among later-born birth cohorts. However, neither age nor cohort effects were shown for the number of chronic conditions.

Invariant Predictors of SRH

Our findings suggest that the number of chronic conditions is an invariant predictor of SRH. The importance or meaning of chronic conditions for SRH is stable across the examined age range (40–81 years at baseline; 46–87 years at follow-up). In contrast, we expected the number of chronic conditions to be an age-contextual predictor of SRH (Hypothesis 1). Previous studies concluded that physical health has a decreasing association with SRH with advancing age (e.g., French et al., 2012; Heller et al., 2009). Via post hoc analyses and extreme-group contrasts, we found small differences between the youngest and the oldest age groups on the changing association between number of chronic conditions and SRH. However, the trend over all seven age groups was nonsignificant. Our finding is in line with a study by Galenkamp, Braam, Huisman, and Deeg (2011), which also found no evidence for an age-related decreasing impact of diseases on SRH. Moreover, other studies suggest that physical health remains the major determinant of SRH in old age (Manderbacka, Lundberg, & Martikainen, 1999; Quinn et al., 1999).

Age-Contextual Predictors of SRH

Our longitudinal findings support earlier reported cross-sectional age-group differences in predictors of SRH (e.g., French et al., 2012; Krause & Jay, 1994; Shooshatri et al., 2007) and emphasize the important role of chronological age for SRH predictors. The pattern of our results suggests that physical functioning and exercise are age-contextual predictors with a decreasing association between physical functioning and SRH and an increasing association between exercise and SRH (Hypothesis 1). The importance of social comparisons and expectations may explain this finding, as people tend to rate their health in comparison to same-age peers and also in comparison to what they think is normal (e.g., Jylhä, 2009). As impairments and functional limitations increase with age (Kriegsman, Deeg, & Stalman, 2004), functional impairments are so-called on-time events in later life (Neugarten, 1996). This means they are expected to occur in older ages and, hence, have a smaller impact on SRH. Similarly, the number of people who exercise (or are physically active) decreases with age (Shaw, Liang, Krause, Gallant, & McGeever, 2010). Thus, older adults who exercise stand out from their peers. Consequently, their level of activity is subjectively a strong indicator for high SRH ratings.

All of the psychological well-being indicators were also revealed to be age-contextual SRH predictors with an increasing importance with age, as expected (Hypothesis 2). This finding is in line with previous studies that showed that the association between positive affect and depressive symptoms gain in importance for SRH with age (e.g., Benyamini et al., 2000; Schnittker, 2005). The main factor in this context is probably the change in expectations with advancing age about what is good health (cf. also Moser et al., 2013).

Cohort-Contextual Predictors of SRH

A novel finding of our analyses is the empirical support of cohort effects in SRH predictors. Depressive symptoms and positive affect were not only age-contextual predictors of SRH (Hypothesis 2), but were also found to be cohort-contextual predictors of SRH (Hypothesis 3). Not only do depressive symptoms and positive affect become more important for SRH with advancing age, but they have also become increasingly important for later-

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**Figure 3.** Results of regression models with multiple group design to examine the relationship between self-rated health (SRH) and number of chronic conditions (CC) on the left, physical functioning (PF) in the middle, and depressive symptoms (DS) on the right. Solid lines represent linear change in regression coefficients between age groups in the cross section (ΔτCS, cf. Figure 2). Dashed lines represent linear change in regression coefficients within age groups in the longitudinal section (ΔτLS, cf. Figure 2).
born birth cohorts. This pattern is in line with different theoretical approaches concerning social change.

A shift in societal values has been described for advanced industrial societies (e.g., Inglehart, 1997). Values such as self-realization and self-esteem have gained societal relevance as compared to basic physiological and safety needs. If different values gain in importance on the societal level, this might also hold true for the individual level, for example, regarding SRH. This cohort related change in values is also reflected in an altered definition of health in the health sciences, from a biomedical comprehension of

Figure 4. Unstandardized regression coefficients with standard errors for number of chronic conditions (top), physical functioning (middle) and depressive symptoms (bottom) for all age groups in 2002 and 2008, respectively (cf. Figure 2 for the regression model).
health to a biopsychosocial one in which psychological well-being plays a crucial role.

Furthermore, definitions of diseases have widened tremendously during the last century, a process which often is called “medicalization.” Medicalization means the reinterpretation of certain physical and mental conditions as medical problems. This medicalization process has not only led to an increase in prevalence rates but could have potentially increased overdiagnosis and overtreatment (Moynhn et al., 2012). Some critics of this process claimed, for example, that, in the domain of mental health in particular, the interests of the pharmaceutical industry to increase the public awareness of their products have led to higher recognition of different diagnoses of mental illnesses in the general population (e.g., Ebeling, 2011). Other critics stated that campaigning focused on promoting new medical products heightens the danger that normal responses to stressors may increasingly be perceived as symptoms of mental disorders (Raven & Parry, 2012). As a consequence, medicalization could have increased the tendency of later-born cohorts to incorporate psychological well-being more strongly in their SRH in contrast to earlier-born cohorts. In general, recent cohorts might have broader expectations regarding their health status than earlier-born cohorts (Jylhä, 2009).

However, not all psychological indicators we analyzed showed the hypothesized cohort effect. We found no evidence that life satisfaction is more important for SRH in later-born cohorts than in earlier-born cohorts (Hypothesis 3). Life satisfaction was an age-contextual predictor of SRH only (showing an increasing association with SRH with advancing age; Hypothesis 2). Compared to positive affect, which reflects an emotional component of psychological well-being, life satisfaction refers to a cognitive global judgment of life (Diener, Suh, Lucas, & Smith, 1999). Depressive symptoms, in contrast, contain both emotional and cognitive components. One potential reason why the association of life satisfaction with SRH did not show a cohort effect may lie in the emotional components of positive affect and depressive symptoms. It seems that emotional factors are of particular importance for health in later-born birth cohorts. Cognitive factors of psychological well-being gain in importance for SRH with age but apparently in the same way for different birth cohorts.

Taken together, our results suggest that there are both age and cohort effects in predicting SRH. Some SRH predictors gain importance with age: Especially, indicators of psychological well-being become more important for SRH. However, our results also reveal that cohort effects have to be considered, as well. What people include when they self-rate their health changes across different birth cohorts. In particular, later-born birth cohorts may be more inclined to articulate and accept emotions or emotional well-being as an important feature of their health. Our study therefore points to an important finding: Predictors of SRH are conditional on contextual considerations that include not only individual change (age effects), but social change (cohort effects), as well.

Limitations

Several limitations to the present study need to be acknowledged. First, although the DEAS is a nationwide representative survey of the German population over 40 years old living in private households, our findings are not representative of older adults who do not dwell in the community, such as those who live in institutions. Second, because of the necessary use of a cross-sectional design for the regressions, we could not determine the causal direction of the associations between the studied predictors and SRH. A third limitation concerns the analysis strategy. The complex analysis design restricted us to examining one variable at a time. Consequently, we were not able to evaluate the associative strength of every predictor after controlling for every other predictor. Moreover, the methodological approach taken was ill-suited to include time varying covariates. This capacity would have been particularly important for examining changes in SRH in the 58–63-year-old group. This age group showed in our analysis the most positive developments in all indicators considered (see Table 1). The positive development could be caused by a retirement effect relieving the participants from unfavorable working conditions. This effect, however, needs to be examined more closely in more refined analyses centering at the point of retirement. A further limitation concerns the analyzed predictors. All health predictors were self-reported. However, the validity of self-reported morbidity (e.g., Katz et al., 1996; Simpson et al., 2004) as well as physical activity (Armitage & Conner, 2001; Sallis & Saelens, 2000) has been demonstrated in numerous other studies. Results for physical functioning were mixed: Some studies demonstrated a good agreement between self-reported and performance-based measures of functional limitations (e.g., Coman & Richardson, 2006) and others concluded that self-reported measures and performance-based assessments are complementary, but do not measure the same construct (Hoeymans, Feskens, van den Bos, & Kromhout, 1996). In addition, while the present study focused on disentangling age and cohort effects, it did not take into account other important factors. Several studies illustrated the association between personality and SRH (e.g., Löckenhoff, Terracciano, Ferrucci, & Costa, 2012). In the present study, however, personality traits (e.g., neuroticism, extraversion, openness; Costa & McCrae, 1985) could not be considered, as they were not assessed in the DEAS. Previous studies, however, suggest that personality gains in importance for SRH in older age (Duberstein et al., 2003) and shows strong associations with well-being (e.g., DeNeve & Cooper, 1998; Steel, Schmidt, & Shultz, 2008). Finally, in the present study, we only considered a general indicator on SRH while we were not able to additionally consider SRH as seen by respondents in comparison to people of the same age.

Outlook

According to the present findings, contemporary middle-aged adults seem to have a broader concept of their own health than earlier-born cohorts. In particular, they seem to place more importance on emotional well-being. Future generations of older adults may benefit from this historical change in the general conceptualization of health. For them, adjusting to age-related physical declines might become easier than for the older population today provided that they are able to counterbalance negative with positive emotional states. Moreover, the increasing awareness and decreasing stigmatization of mental health problems open up opportunities of treatment and, thus, increasing levels of SRH in future older populations. In this regard, however, the process of medicalization has to be monitored with a critical eye. Thus, the
self-definition of distressed emotional states as medical problems has also the potential to burden SRH of older adults in later-born cohorts. Furthermore, if subsequent generations of older people tend to incorporate more strongly emotional states into their SRH, optimistic persons might rate their health as more robust than should be reasonably inferred based on medical examinations. This could lead to insufficient health-related behavior and health care utilization which would be detrimental for their health. Thus, the well-known finding that SRH predicts functional health, illness, and mortality has repeatedly to be replicated with participants from later-born birth cohorts. The historically changing meaning of SRH might also change its predictive power. Previous studies already showed that SRH seems to be a stronger predictor of mortality in younger than in older age groups (Benyamini, Blumstein, Lusky, & Modan, 2003; Franks, Gold, & Fiscella, 2003). Therefore, it might be worth looking at the association between SRH and mortality in different birth cohorts in more detail.

Moreover, because the social-comparative SRH has been shown to be particularly important for the maintenance of good SRH in old age (Löckenhoff et al., 2012), future studies should examine whether later-born birth cohorts apply social-comparative evaluations in the same way as earlier-born birth cohorts. Furthermore, personality might also be subject to cohort effects as recent findings suggest. Billstedt and colleagues (2013) found that later-born cohorts were more extraverted than those born earlier when they were in the same age. Therefore, it may be fruitful for future studies to consider both age and cohort effects regarding the associations between SRH, personality, and well-being. Finally, future studies should not only consider which factors influence SRH but additionally, how the developmental context shapes the relationships. By examining age and cohort effects we considered two moderating factors. However, due to the strong relationship between education and health (e.g., Lynch, 2003), the expectation about what is good health might not only differ (and change) according to age but additionally according to educational status.

Conclusion

Our longitudinal study is in line with previous studies in showing that reweighting of what constitutes the subjective evaluation of health may be the key mechanism by which older adults maintain high levels of SRH despite losses in physiological and functional capacity: While physical functioning lost in importance for SRH with high levels of SRH despite losses in physiological and functional health may be the key mechanism by which older adults maintain SRH, psychological well-being indicators gained in importance. How-