Primary Care Supply Moderates the Impact of Diseases on Self-Perceptions of Aging

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Self-perceptions of aging, important indicators of successful aging, are closely linked to health. Previous research has mainly examined the role of individual factors on self-perceptions of aging, but health is partly dependent on contextual factors such as primary care supply. This study therefore examined whether the impact of diseases on self-perceptions of aging is buffered by primary care supply in the district, as it ensures sustained health care continuity. Nationally representative German survey data on health and self-perceptions of aging ($N = 4,442, 40–85$ years) were linked to primary care supply (general practitioner density in regional districts). Multilevel modeling shows that the impact of disease burden (multiple illnesses) was buffered by primary care supply: Disease burden was less strongly associated with negative self-perceptions of aging in districts with good primary health care supply. This underlines the importance of health care resources for successful aging.

Keywords: self-perceptions of aging, primary care supply, health, multimorbidity, multilevel modeling

The last decade has seen increasing acknowledgment of the importance of self-perceptions of aging for successful aging on both the societal and individual level. A number of recent longitudinal studies have consistently shown that how we perceive our aging is crucial for how healthily and long we live (e.g., Kotter-Grühn, Kleinspahn-Ammerlahn, Gerstorf, & Smith, 2009; Levy & Myers, 2005; Levy, Slade, & Kasl, 2002; Levy, Slade, Kasl, & Kunkel, 2002; Sargent-Cox, Anstey, & Luszcz, 2012; Wurm, Tesch-Römer, & Tomasik, 2007). According to these studies, individuals with more positive self-perceptions of aging are more likely to remain in good physical, functional, and self-rated health over time and live considerably longer than people with more negative self-perceptions of aging. However, surprisingly little is known about individual and societal factors that shape self-perceptions of aging, and whether and how they interact. Contextual factors on the micro- and macrolevel shape the course of developmental processes at the individual level and further gain in importance in later life (Baltes, 1987). This implies that to better understand individual development in later life, a conjoint analysis of both more distal contextual resources (or constraints) and individual factors is required, which in turn could also provide guidelines for changes in social policy (Gerstorf & Ram, 2012). Based on a multilevel approach including micro- and macrolevel factors, the present study therefore investigated the joint role of individual- and societal factors on health and self-perceptions of aging: Do people with poor health have better self-perceptions of aging if they live in districts with more primary care clinicians?

Predictors for Self-Perceptions of Aging

Most previous studies have focused on the health consequences of self-perceptions of aging, but only a few studies have considered the question of whether individual and contextual factors contribute to how we perceive our own aging. On the individual level, previous studies have shown that self-perceptions of aging do not only predict health, but also that at the same time health predicts self-perceptions of aging (Levy, Slade, & Kasl, 2002; Sargent-Cox et al., 2012; Wurm et al., 2007). In addition, self-perceptions of aging have been shown to become less positive with increasing age (Kleinspahn-Ammerlahn, Kotter-Grühn, & Smith, 2008).

Besides individual factors, macrolevel factors also seem to play a role in self-perceptions of aging. Both experimental and longitudinal studies have provided support for the assumption that individuals integrate societal views of elderly people (i.e., age stereotypes) into their self-perceptions (Kotter-Grühn & Hess, 2012; Levy, 2003; Rothermund & Brandlstädter, 2003). This suggests that younger people internalize age stereotypes, which then shape their self-perceptions of aging as they grow older. Moreover, two cross-cultural studies (Levy, Ashman, & Slade, 2009; Levy &
Langer, 1994) showed that variations in age stereotypes in different countries can explain why individual views on aging are more strongly associated with health in some cultures than in others. This suggests that both self-perceptions of aging and the relation between self-perceptions of aging and health vary depending on contextual factors. To better understand how self-perceptions of aging are shaped and how they relate to health, it is therefore imperative to examine the role of the context we live in.

Multimorbidity and the Increased Need for Health Care

One macrolevel factor that plays a decisive role in health is primary care supply because it is known to prevent chronic illnesses (Starfield, Shi, & Macinko, 2005) and support chronic illness management in older adults (McWilliams, Meura, Zaslavsky, & Ayanian, 2009; Salisbury, Johnson, Purdy, Valderas, & Montgomery, 2011). In districts with better primary care supply, patients report higher life satisfaction and better health and compliance, and are less likely to be hospitalized or require emergency room access (for a review, see Cabana & Jee, 2004). Moreover, a review of 10 studies based on data from the United States showed that an increase of one primary care physician per 10,000 inhabitants was associated with an average mortality reduction of 5.31% (Macinko, Starfield, & Shi, 2007). These studies also suggest that higher primary care physician density facilitates the access to health care and the likelihood of sustained continuity of primary care in cases of chronic diseases.

In particular, people suffering from multimorbidity—that is, those with two or more chronic illnesses (Diederichs, Berger, & Bartels, 2011)—often have higher needs for ambulatory and inpatient health care (Gijzen et al., 2001; Wolff, Starfield, & Anderson, 2002). Although estimates of the prevalence of multimorbidity vary widely (Marengoni et al., 2011), coping with multiple illnesses is an important challenge for most older adults. A recent large-scale study suggests that about 30% of people 45 to 64 years of age have multiple illnesses, 65% in the age group between 65 and 84 years, and about 82% of the oldest old (85 years and older; Barnett et al., 2012). Besides suffering from multiple illnesses, multimorbidity is also associated with polypharmacy (Hughes, McMurdo, & Guthrie, 2013), lower quality of life (Fortin et al., 2004), and lower physical functioning (Kadam, Croft, & North Staffordshire GP Consortium Group, 2007). As the majority of chronically ill people receive a large part of their care in primary care practices (Rothman & Wagner, 2003), in particular, persons with multiple illnesses may profit from a better primary care supply, for example, by living in areas with a higher density of physicians.

Health Care and Self-Perceptions of Aging

There are several ways by which primary care supply could influence self-perceptions of aging. People with multiple illnesses living in areas with better primary care supply might in fact receive better (or more regular) health care, resulting in fewer health problems, which in turn should—according to previously mentioned studies—predict more positive self-perceptions of aging. Furthermore, subjective perceptions of good access to primary care could contribute to more positive self-perceptions of aging because this might promote a feeling of security that a physician is easily accessible if needed. However, this buffering effect is presumably more likely for people with the need for sustained health care, which often applies to people with multiple illnesses. For people in good health, primary care supply might not make a big difference for their self-perceptions of aging.

Aim of the Current Study

Based on the literature reviewed above, we expected a negative relationship between chronic diseases and positive self-perceptions of aging; that is, people with a higher number of diseases should be less likely to have positive self-perceptions of aging. Because people with multiple illnesses often have higher needs for primary care, we expected the negative association between diseases and self-perceptions of aging to be attenuated for people living in districts with better primary health care supply. We therefore hypothesized that primary care supply would buffer the impact of diseases on self-perceptions of aging for people suffering from multiple illnesses, but not for relatively healthy individuals.

We investigated these hypotheses in a large-scale representative study run in more than 200 districts. This study for the first time examined the role of a macrolevel contextual factor for the association between health and self-perceptions of aging, and how this contextual factor contributes to individual self-perceptions of aging in later life.

Method

Participants

This study is based on the German Aging Survey, 2008 (Engstler & Motel-Klingebiel, 2010), a survey representative of the German adult population aged 40 to 85 years. The sample was drawn by national probability sampling stratified by age, gender, and place of residence. From a total eligible 17,366 participants, 6,201 provided informed consent to the study. In total, 4,442 participants were included in this study because they completed the personal interview and self-completed questionnaire. Compared with the included participants, those who were excluded because they participated in only the personal interview were significantly younger, \( t(6, 205) = -1.06, p < .01, \) more often women, \( \chi^2(1) = 5.91, p < .01, \) had lower income, \( t(5, 460) = -202.37, p < .001, \) and reported worse self-rated health, \( t(6, 205) = -0.102, p < .001. \) Included and excluded participants could not be compared for self-perceptions of aging, number of diseases, and symptom severity because this information was assessed with the self-completed questionnaire. All participants (Level 1 units) were matched to the districts they lived in (Level 2 units) by a district identification number.

Measures

Level 1 (individuals).

Primary outcome. The Attitude Toward Own Aging subscale of the Philadelphia Geriatric Center Morale Scale (Lawton, 1975) is a well-validated scale to measure self-perceptions of aging (e.g., Levy, Slade, Kasl, & Kunkel, 2002; Sargent-Cox et al., 2012) and consists of five items such as “Things keep getting worse as I get...
older” and “I have as much pep as I had last year” rated on a 4-point scale from 1 (strongly agree) to 4 (strongly disagree). Items were recoded so that higher values consistently indicated more positive self-perceptions of aging. Internal consistency for the scale was high (Cronbach’s alpha = .76).

**Predictor.** Health status was assessed by the number of self-reported diseases using a symptom checklist of 11 common geriatric health problems (e.g., cardiovascular diseases, circulatory problems, back or joint diseases). Chronic diseases and multimorbidity are highly prevalent in middle age already and are associated with the need for and use of sustained health care (e.g., Barnett et al., 2012). Summary scores of diseases correlate higher than other self-reported data with medical records (Katz, Chang, Sangha, Fossel, & Bates, 1996). A recent study compared summary scores of diseases gathered by self-reports or medical records (based on the International Classification of Diseases—10) and showed that the prevalence of multimorbidity is quite similar in both data sources, particularly in older people (Violán et al., 2013).

**Control variables.** For each assessed illness, participants were asked about the symptom severity, which was answered on a 4-point scale ranging from no complaints to strong complaints. Based on this, we calculated a mean severity rating, with higher values indicating more complaints. To exclude the alternative explanation that symptom severity (as opposed to number of diseases) would interact with primary care supply in the prediction of self-perceptions of aging, we not only included symptom severity as a main effect but also tested for random slopes. Furthermore, analyses were controlled for age, gender, and the total net household income per month according to the OECD Scale 2 (Figini, 1998), as incomes is an important predictor for well-being of people with health problems (Smith, Langa, Kabeto, & Ubel, 2005). Finally, given that health declines exponentially with increasing age, we considered a nonlinear (i.e., quadratic) effect of age as a covariate.

**Level 2 (district).**

**Predictor.** Primary care supply was measured by the number of general practitioners (GPs) per 100,000 inhabitants per district based on the physicians’ register of the German National Association of Statutory Health Insurance Physicians.

**Control variables.** On the district level, the covariates population density (number of inhabitants per square kilometer) and mean gross domestic product (GDP) per inhabitant as a proxy measure for the financial resources of the district were included. GDP is considered an indicator of environmental opportunities and barriers and has been shown to be predictive for health behavior over and beyond household income (Schüz et al., 2012).

District-level information was retrieved from the INKAR (Indicators and maps for spatial and urban development in Germany and Europe) database (BBSR, Federal Institute for Research on Building, Urban Affairs and Spatial Development, 2010) and referred to the year 2008 in which the survey was conducted. These measures were matched to individual data using district identification numbers.

**Analytical Procedure**

Descriptive analyses were performed in SPSS 19.0; multilevel models were estimated using HLM 7 (Raudenbush, Bryk, & Congdon, 2010). Multilevel models break up the variance of the dependent measure into individual (Level 1) and context (Level 2) variance components. Following our hypotheses, self-perceptions of aging (dependent variable on Level 1) can be predicted using the following equation:

\[
y_{ij} = \gamma_{00} + \gamma_{01} X_{ij} + \gamma_{10} Z_j + \gamma_{11} Z_j X_{ij} + u_{0j} + u_{1j} + r_{ij}.
\]

Here, \(y_{ij}\) represents the self-perceptions of aging of a specific individual \(i\) (Level 1) within the district \(j\) (Level 2 unit); \(y_{ij}\) is regressed on a Level 1 variable \(X_{ij}\) (diseases) with the regression coefficient \(\gamma_{10}\) and an intercept \(\gamma_{00}\) (mean self-perceptions of aging across all participants). The corresponding random effects are represented as district \(j\)'s deviations from the intercept \(u_{0j}\) and from the average slope \(u_{1j}\). Apart from the Level 1 predictor (diseases), the Level 2 variable \(Z_j\) (primary care supply) is assumed to predict \(y_{ij}\) (self-perceptions of aging) with a regression coefficient \(\gamma_{11}\). The random effect \(r_{ij}\) represents an individual \(i\)'s deviation from the level of self-perceptions of aging in district \(j\).

The Level 2 predictor \(Z_j\) (primary care supply) also interacts with the Level 1 predictor \(X_{ij}\) (diseases) with a regression coefficient \(\gamma_{11}\), which, if significant, means that the degree to which individual self-perceptions of aging can be predicted from diseases on Level 1 depends on the supply of primary care on Level 2. For illustrative purposes, Equation 1 does not show the Level 1 and Level 2 control variables that were included in the analyses.

Level 1 predictors (number of diseases) and control variables (age, quadratic age, gender, household income, symptom severity) were group-mean-centered, and the Level 2 predictor (primary care supply) and control variables (population density, mean GDP per inhabitant) were grand-mean-centered to interpret both main and cross-level interaction effects (Enders & Tofighi, 2007). All random effects were allowed to co-vary. The interaction was then broken up for interpretation using simple slopes analysis (Aiken & West, 1991). Random effects were included for those Level 1 variables that contributed significantly to model fit according to a chi-square difference test between a model with and without this random effect.

**Results**

**Sample Characteristics**

Means, standard deviations, and correlations of all variables are summarized in Table 1. On average, participants were 61.81 years old (SD = 11.88), with slightly more men (50.5%) than women (49.5%) in the study. Net average monthly household income was €2,585.88 (SD = 2,078.41), and participants scored on average 2.90 (SD = 0.59) on self-perceptions of aging and reported an average of 2.26 (SD = 1.83) illnesses.

Participants came from 211 districts (of 412 districts in total in Germany), with a mean cell size of 29.4 participants (SD = 25.41) per district. There were an average 49.63 GPs (SD = 7.82) per 100,000 inhabitants, with a range of 32.9 to 72.1.

1 km² = 0.39 mile²; 1 mile² = 2.59 km².
Table 1
Means, Standard Deviations and Correlations of All Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Mean (SD) positive SPA</td>
<td>2.90 (0.59)</td>
<td>-.18*</td>
<td>.03</td>
<td>.23*</td>
<td>.29*</td>
<td>-.32*-</td>
<td>.02</td>
<td>.19**</td>
<td>.20**</td>
</tr>
<tr>
<td>2. Mean (SD) age (years)</td>
<td>61.81 (11.88)</td>
<td>-.10**</td>
<td>-.18**</td>
<td>-.39**</td>
<td>.28**</td>
<td>-.02</td>
<td>.07</td>
<td>.03*</td>
<td></td>
</tr>
<tr>
<td>3. Gender (1 = male, 2 = female), % male</td>
<td>50.5</td>
<td>-.07**</td>
<td>-.02</td>
<td>.01</td>
<td>.04*</td>
<td>.01*</td>
<td>-.02</td>
<td>.03*</td>
<td></td>
</tr>
<tr>
<td>4. Mean (SD) income (€)</td>
<td>2585.88 (2078.41)</td>
<td>-.12**</td>
<td>-.13**</td>
<td>-.06*</td>
<td>.21**</td>
<td>.30**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Mean (SD) diseases (n)</td>
<td>2.26 (1.83)</td>
<td>.66**</td>
<td>-.09*</td>
<td>.04*</td>
<td>-.10*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Mean (SD) symptom severity</td>
<td>0.30 (0.37)</td>
<td>.03*</td>
<td>-.01*</td>
<td>-.02*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Mean (SD) GPs per 100,000 inhabitants</td>
<td>49.63 (7.82)</td>
<td>-.12**</td>
<td>.06**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Mean (SD) Population density</td>
<td>647.91(800.89)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Mean (SD) GDP per inhabitant</td>
<td>28.55 (11.07)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. SPA = self-perceptions of aging; GPs = general practitioners; GDP = gross domestic product.
*Correlation of district mean of Level 1 variable and Level 2 variable.
*p < .05. ** p < .01.

Multilevel Analyses

**Model fit.** In Model 1 (see Table 2; random intercept model), the intraclass coefficient of $p = .07$ suggested a nonignorable multilevel structure of the data (Hox, 2002). In Model 2, all Level 1 and Level 2 predictors and reliable random effects were added to the model. As a result of chi-square difference tests, random slopes of age, diseases, and severity of diseases were included (see Table 2).

**Predicting self-perceptions of aging.**

**Level 1.** Both age and age$^2$ were significant predictors of self-perceptions of aging ($B = .02$, $SE = .01$ for age; $B = -.0001$, $SE = .0001$ for age$^2$; $p < .05$), indicating that with increasing age, participants had more positive self-perceptions of aging, whereas this effect was attenuated in older ages. In addition, women ($B = .04$, $SE = .02$, $p < .05$) and participants with higher income ($B = -.00004$, $SE = .00001$, $p < .01$) reported better self-perceptions of aging. Diseases and severity of diseases significantly predicted self-perceptions of aging ($B = -.04$, $SE = .01$ for diseases; $B = -.35$, $SE = .04$ for symptom severity; $p < .01$), suggesting that a higher number of diseases and greater symptom severity were associated with lower self-perceptions of aging.

**Level 2.** Primary care supply and population density were not significant predictors of individual self-perceptions of aging ($B = -.001$, $SE = .002$ for primary care supply; $B = .00002$, $SE = .00002$ for population density; $p > .05$). Individuals living in areas with high GDP per inhabitant reported more positive self-perceptions of aging ($B = .003$, $SE = .001$ for GDP per inhabitant, $p < .05$). Moreover, the cross-level interaction of diseases and primary care supply (number of GPs per 100,000 inhabitants) was significant ($B = .003$, $SE = .001$, $p < .01$), whereas the corresponding interaction between symptom severity and primary care supply was not ($B = -.01$, $SE = .01$, $p > .05$). The significant cross-level interaction was broken up using simple slopes analyses (Aiken & West, 1991; see Table 3). The regression

Note. GP = general practitioner; GDP = gross domestic product. Standard errors appear within parentheses.

*Random effects of Level 1 coefficients are reported if they significantly ($p < .05$) contributed to model fit based on a deviance test (Snijders & Bosker, 1999); due to the units of measurement, the regression coefficient of household income (.00004) indicates that SPA increase by .00004 points when income increases by 1€.

\[ p < .05. \quad ** p < .01. \]
Cross-level interactions of primary care supply (number of general practitioners per 100,000 inhabitants on Level 2) and health status (number of diseases, Level 1) in predicting self-perceptions of aging.

**Table 3**

**Coefficients of Simple Slopes Analyses**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>−1 SD GPs per 100,000 inhabitants (value = −7.82)</th>
<th>Mean GPs per 100,000 inhabitants (value = 0.00)</th>
<th>+1 SD GPs per 100,000 inhabitants (value = 7.82)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>2.92 (.02)**</td>
<td>2.91 (.02)**</td>
<td>2.90 (.02)**</td>
</tr>
<tr>
<td>Level 1 (person)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.02 (.01)*</td>
<td>.02 (.01)*</td>
<td>.02 (.01)*</td>
</tr>
<tr>
<td>Age²</td>
<td>−.0001 (.0001)*</td>
<td>−.0001 (.0001)*</td>
<td>−.0001 (.0001)*</td>
</tr>
<tr>
<td>Gender</td>
<td>.04 (.02)*</td>
<td>.04 (.02)*</td>
<td>.04 (.02)*</td>
</tr>
<tr>
<td>Income</td>
<td>.00004 (.00001)**</td>
<td>.00004 (.00001)**</td>
<td>.00004 (.00001)**</td>
</tr>
<tr>
<td>No. of diseases</td>
<td>−.06 (.01)**</td>
<td>−.04 (.01)**</td>
<td>−.02 (.01)</td>
</tr>
<tr>
<td>Symptom severity</td>
<td>−.29 (.09)**</td>
<td>−.35 (.04)**</td>
<td>−.41 (.09)**</td>
</tr>
<tr>
<td>Level 2 (district)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept on population density</td>
<td>.00002 (.00002)</td>
<td>.00002 (.00002)</td>
<td>.00002 (.00002)</td>
</tr>
<tr>
<td>Intercept on GDP per inhabitant</td>
<td>.003 (.001)*</td>
<td>.003 (.001)*</td>
<td>.003 (.001)*</td>
</tr>
<tr>
<td>Random effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>.03 (.17)</td>
<td>.03 (.17)</td>
<td>.03 (.17)</td>
</tr>
<tr>
<td>Age</td>
<td>.0004 (.01)</td>
<td>.0004 (.01)</td>
<td>.0004 (.01)</td>
</tr>
<tr>
<td>No. of diseases</td>
<td>.0003 (.02)</td>
<td>.0003 (.02)</td>
<td>.0003 (.02)</td>
</tr>
<tr>
<td>Symptom severity</td>
<td>.03 (.17)</td>
<td>.03 (.17)</td>
<td>.03 (.17)</td>
</tr>
<tr>
<td>Residual</td>
<td>.26 (.51)</td>
<td>.26 (.51)</td>
<td>.26 (.51)</td>
</tr>
</tbody>
</table>

*Note.* GP = general practitioner; GDP = gross domestic product. Standard errors appear within parentheses. *p < .05. **p < .01.

The coefficient of diseases in predicting self-perceptions of aging varied according to the context-level moderator primary care supply, suggesting that primary care buffered the impact of diseases on self-perceptions of aging (see Figure 1). This means that people without chronic diseases had similar self-perceptions of aging regardless of primary care supply in their districts, whereas context-level primary care affected self-perceptions of aging of people with multiple illnesses: For those who lived in districts with more GPs per 100,000 inhabitants (+1 SD; dotted line in Figure 1), the number of diseases was not significantly related to self-perceptions of aging, whereas for people who lived in districts with a lower number of GPs, more diseases were significantly associated with worse self-perceptions of aging (−1 SD; dashed line in Figure 1).

**Discussion**

This study highlights the importance of considering contextual factors to understand the link between health and self-perceptions of aging in later life. A number of recent studies have pointed out the importance of self-perceptions of aging for health and longevity; however, comparatively little is known about how self-perceptions of aging are shaped, and how and when age-related phenomena such as multiple illnesses impact self-perceptions of aging. This study provides first evidence that both individual and context factors contribute to self-perceptions of aging. We found that district-level primary care supply buffers the negative association between individual health problems (number of chronic diseases) and self-perceptions of aging. This is a crucial finding as both chronic diseases and self-perceptions of aging have been shown to be vitally important for quality of life, functional health, and longevity in later life (e.g., Fortin et al., 2004; Levy, Slade, & Kasl, 2002; Levy, Slade, Kasl, et al., 2002). Primary care supply is a modifiable contextual factor that seems to attenuate negative effects on self-perceptions of aging and thereby may contribute to the individual’s quality of life.

Our study suggests that the contextual factor primary care supply should be considered in addition to individual factors, especially for persons with multiple illnesses. Multimorbidity is
highly prevalent in the second half of life (Marengoni et al., 2011). In contrast to the findings regarding the number of illnesses, primary care supply did not buffer the impact of symptom severity on self-perceptions of aging. The perception of multiple severe symptoms can also be caused by a single disease, and being able to access medical specialists rather than GPs might be a more important structural factor in this case. This might have led to the nonsignificant finding for primary care supply in the context of severe symptoms. However, primary care supply is essential for individuals with multimorbidity, for example, as frontline services or for issues with often complex drug regimens (Barnett et al., 2012). People with multiple chronic conditions experience steeper declines in health status and have a higher likelihood to become disabled and higher health care utilization (Cornoni-Huntley, Foley, & Guralnik, 1991), which additionally underlines the specific need for primary care supply. Our findings suggest that if this need is met on the local or district level, multimorbidity is less detrimental for positive self-perceptions of aging.

Limitations

A clear limitation of our study is the lack of objective health data (e.g., medical records). As previously mentioned, summary scores for multiple illnesses based on self-reports and medical records are quite consistent in older adults; however, in middle-aged adults, self-report data show higher prevalences of multimorbidity than medical records; that is, in younger age groups, self-reports appear to be more sensitive to identifying symptoms-based conditions (Violán et al., 2013). To account for this potential bias, we considered self-reported symptom severity in addition to the mere number of illnesses. This also allowed testing the alternative route of explanation, namely that symptom severity rather than multimorbidity predicts self-perceptions of aging in the context of primary care supply. However, the interaction effect of multiple illnesses and context-level primary care supply remained significant after controlling for symptom severity, whereas there were no interactions of symptom severity with primary care supply. Concerning primary care supply, we cannot rule out that persons use health care in other districts than the ones they live in, as people living in one district in Germany are allowed to use primary care supply in other (e.g., neighboring) districts as well. Based on data of more than 60 million cases in Germany, a study of Fülöp, Kopetsch, and Pascal (2009) showed, however, that 71.5% of the patients consult the nearest GP in their neighborhood. This suggests that the number of GPs per 100,000 inhabitants per district is a good indicator for primary care supply for the majority of people in Germany. Even if some participants used primary care supply in other districts, this should have rather attenuated than strengthened the present findings. Another limitation is that the moderation effect of primary care supply might be primarily due to other factors on the context level such as population density. In additional analyses, we therefore considered this context-level indicator and also an indicator of district-level wealth (GDP per inhabitant) as moderators, but neither indicator turned out to be significant. However, we cannot rule out the possibility that other context-level indicators may account for the effect of primary care supply. Finally, although the study was based on a large, representative survey data set, the findings could have been biased because people who were included in the analyses were older and thus more likely to suffer from chronic diseases than those who had to be excluded, which might have overestimated the effect of primary care supply. However, at the same time, participants in this study rated their health better and had higher incomes than nonparticipants, which suggests that this positive selectivity might have attenuated the effect.

Future Research and Implications

The present study is a first step in including the level of the macrolevel system (Bronfenbrenner, 1979) in understanding the well-documented relationship between individual health and self-perceptions of aging. Further research is needed to fully explore this approach. Among other efforts, future work should expand the present cross-sectional analyses by longitudinal analyses and examine whether the result may differ between countries with various health care systems.

Population aging has drawn attention to the increasing frequency of multimorbidity, in particular in the industrialized world; this comes with the importance of dealing with the person as a whole (World Health Organization, 2008). In the next few decades, primary care supply could play a more important role in the prevention and treatment of multimorbidity as well as the longitudinal continuity of care for people with multiple illnesses, particularly because some industrialized nations such as the United States have a surplus of specialists, but not of primary care physicians (Starfield et al., 2005). Germany is currently experiencing an increase in regional disparities; this pertains to both the enlargement of regional disparities in physician density and in social inequalities in general (Voigtländer, Berger, & Razum, 2010). Policy interventions may be more effective if they not only consider individual characteristics but also contextual factors such as health care access plus other environmental resources and opportunity structures (Bernard et al., 2007; Litaker, Koroukian, & Love, 2005). Together, these factors might contribute to healthy aging and, more subtle, to more positive self-perceptions of aging.

Conclusion

The aim of this study was to investigate whether primary care supply contributes to the understanding of the link between health and self-perceptions of aging. We demonstrated that it is worthwhile to consider not only individual factors as predictors of self-perceptions of aging but also contextual factors. For persons with multiple illnesses, the negative association between health status and self-perceptions of aging was buffered by primary care supply. Persons with multiple illnesses living in districts with above-average primary care supply reported more positive self-perceptions of aging. As self-perceptions of aging are of considerable importance for quality of life and longevity, we conclude that future research should pay increasing attention not only to individual but also to contextual factors that may promote positive self-perceptions of aging in older adults.

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### Analysis Table

<table>
<thead>
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<th>Model</th>
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<th>Coefficient</th>
<th>Standard Error</th>
<th>p Value</th>
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<td>.91</td>
</tr>
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</tr>
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<td>Age + symptom severity + symptom severity</td>
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<td>.001</td>
<td>.91</td>
</tr>
</tbody>
</table>

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4 $B_{no\ of\ diseases/population\ density} = .00, \ SE = .00, \ p = .85$;

5 $B_{no\ of\ diseases/GDP\ per\ inhabitant} = .00, \ SE = .001, \ p = .91$;

6 $B_{symptom\ severity/population\ density} = .00, \ SE = .00, \ p = .85$;

7 $B_{symptom\ severity/GDP\ per\ inhabitant} = .002, \ SE = .01, \ p = .80$. 

References


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Received November 7, 2012
Revision received January 20, 2014
Accepted January 24, 2014