ORIGINAL ARTICLE

Optimism and pessimism in the general population: Psychometric properties of the Life Orientation Test (LOT-R)

Andreas Hinz\textsuperscript{a,∗}, Christian Sander\textsuperscript{b}, Heide Glaesmer\textsuperscript{a}, Elmar Brähler\textsuperscript{a,c}, Markus Zenger\textsuperscript{d,e}, Anja Hilbert\textsuperscript{e}, Rüya-Daniela Kocalevent\textsuperscript{f}

\textsuperscript{a} Department of Medical Psychology and Medical Sociology, University of Leipzig, Germany  
\textsuperscript{b} Department of Psychiatry, University of Leipzig, Germany  
\textsuperscript{c} Clinic for Psychosomatic Medicine and Psychotherapy, University of Mainz, Germany  
\textsuperscript{d} Department of Applied Human Studies, University of Applied Sciences Magdeburg-Stendal, Germany  
\textsuperscript{e} Integrated Research and Treatment Center Adiposity Diseases, Medical Psychology and Medical Sociology, Psychosomatic Medicine und Psychotherapy, University of Leipzig, Germany  
\textsuperscript{f} Institute and Policlinic for Medical Psychology, University Medical Center Hamburg, Germany

Received 7 November 2016; accepted 17 February 2017  
Available online 31 March 2017

KEYWORDS  
Optimism;  
Pessimism;  
Factor structure;  
Measurement invariance;  
Descriptive survey study

Abstract  
Background/Objective: The Life Orientation Test-Revised (LOT-R) is often used to assess dispositional optimism. The aims of this study were to test psychometric properties of the LOT-R, to provide normative scores, and to test the association between optimism and several psychological, sociodemographic, and behavioral factors.  
Method: A randomly selected German general population community sample with an age range of 18-80 years (N = 9,711) was surveyed.  
Results: The Confirmatory Factor Analysis (CFA) proved two (correlated) factors: Optimism and Pessimism. Invariance tests across gender and age groups confirmed metric invariance. There were only small gender differences in the LOT-R total score ($M = 16.4$ for females and $M = 16.1$ for males). The correlation between the subscales Optimism and Pessimism was strong for young and well educated people. Low optimism mean scores were observed for unemployed people, people with low income, smokers, and obese people. Normative scores of the LOT-R are provided.  
Conclusions: The study confirmed the bidimensional structure of the LOT-R and invariance across age and gender. We can recommend using this instrument for measuring dispositional optimism and pessimism in epidemiological research and clinical practice.

© 2017 Asociación Española de Psicología Conductual. Published by Elsevier España, S.L.U. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
Optimismo y pesimismo en la población general: propiedades psicométricas del Life Orientation Test (LOT-R)

Resumen. Antecedentes/Objetivo: La versión revisada del Life Orientation Test (LOT-R) se emplea a menudo para evaluar el optimismo disposicional. Los objetivos de este estudio fueron establecer las propiedades psicométricas del LOT-R, y probar la asociación entre optimismo y varios factores psicológicos, socio-demográficos y conductuales. Método: Para ello se entrevistó una muestra comunitaria aleatoria y convejada de residentes de la población alemana, con un rango de edad de 19-80 años (N = 9,711). Resultados: El Análisis Factorial Confirmatorio (CFA) sugiere dos factores (correlacionados): Optimismo y Pesimismo. Las pruebas de invarianza para género y edad confirmaron la invarianza métrica. Solamente se encontraron pequeñas diferencias de género en el puntaje total (M = 16,4 para mujeres y M = 16,1 para hombres). Se encontraron bajos puntajes medios en personas desempleadas, personas con bajos ingresos, fumadores y personas con obesidad. Se proveyeron valores normativos para el LOT-R. Conclusiones: El estudio confirma la estructura bidimensional del LOT-R y la invarianza en género y edad. El instrumento puede recomendarse para medir optimismo disposicional y pesimismo en investigación epidemiológica y en la práctica clínica.

© 2017 Asociación Española de Psicología Conductual. Publicado por Elsevier España, S.L.U. Este es un artículo Open Access bajo la licencia CC BY-NC-ND (http://creativecommons.org/licenses/by-nc-nd/4.0/).
known about the relationship between optimism and other sociodemographic variables (civil status, employment status) or behavioral variables (alcohol consumption, smoking). Large samples are necessary to conduct such analyses.

The aims of this study were (a) to test age and gender differences in the LOT-R mean scores and to provide new normative values, (b) to test psychometric properties and the dimensional structure of the LOT-R, including invariance tests across age and gender, and (c) to analyze associations between the LOT-R scores and several sociodemographic and behavioral variables.

**Method**

**Participants**

The LIFE-Adult-Study, conducted by the Leipzig Center for Civilization Diseases (LIFE), is a population-based study with

### Table 1  Sociodemographic characteristics of the sample.

| Age            | Males (n = 4,628) | Females (n = 5,083) | Total sample (N = 9,711) |
|----------------|-------------------|---------------------|--------------------------|
| Mean (SD)      | 57.1 (12.6)       | 56.2 (12.2)         | 56.6 (12.4)              |
| Age group      |                   |                     |                          |
| ≤ 39 years     | 255 (5.5)         | 257 (5.1)           | 512 (5.3)                |
| 40-49 years    | 1,210 (26.1)      | 1,436 (28.3)        | 2,646 (27.2)             |
| 50-59 years    | 1,030 (22.3)      | 1,227 (24.1)        | 2,257 (23.2)             |
| 60-69 years    | 1,172 (25.3)      | 1,292 (25.4)        | 2,464 (25.4)             |
| ≥ 70 years     | 961 (20.8)        | 871 (17.1)          | 1,832 (18.9)             |
| Marital status |                   |                     |                          |
| Married, living together | 2,980 (64.4) | 2,841 (55.9) | 5,821 (59.9) |
| Married, living separately | 102 (2.2) | 132 (2.6) | 234 (2.4) |
| Never married  | 907 (19.6)        | 828 (16.3)          | 1,735 (17.9)             |
| Divorced       | 521 (11.3)        | 805 (15.8)          | 1,326 (13.7)             |
| Widowed        | 111 (2.4)         | 468 (9.2)           | 579 (6.0)                |
| Missing        | 7 (0.2)           | 9 (0.2)             | 16 (0.2)                 |
| Education      |                   |                     |                          |
| ≤ 10 years     | 359 (7.8)         | 393 (7.7)           | 752 (7.7)                |
| 10-11 years    | 2,503 (54.1)      | 3,014 (59.3)        | 5,517 (56.8)             |
| ≥ 12 years     | 1,694 (36.6)      | 1,611 (31.7)        | 3,305 (34.0)             |
| Missing        | 72 (1.6)          | 65 (1.3)            | 137 (1.4)                |
| Occupational status |             |                     |                          |
| Working full time | 2,318 (50.1) | 1,974 (38.8)       | 4,292 (44.6)             |
| Working part-time | 167 (3.6)  | 751 (14.8)         | 918 (9.5)                |
| Unemployed     | 301 (6.5)         | 304 (6.0)           | 605 (6.2)                |
| Retired        | 1,734 (37.5)      | 1,844 (36.3)        | 3,578 (36.8)             |
| Other          | 68 (1.5)          | 150 (3.0)           | 218 (2.2)                |
| Missing        | 40 (0.9)          | 60 (1.2)            | 100 (1.0)                |
| Smoking        |                   |                     |                          |
| Current non-smoker | 3,463 (74.8) | 3,922 (77.2)       | 7,385 (76.0)             |
| Current smoker | 1,077 (23.3)      | 1,006 (19.8)        | 2,083 (21.4)             |
| Missing        | 88 (1.9)          | 155 (3.0)           | 243 (2.5)                |
| Alcohol consumption |             |                     |                          |
| <20 g/day      | 2,872 (62.1)      | 4,390 (86.4)        | 7,262 (74.8)             |
| ≥ 20 g/day     | 1,440 (31.1)      | 350 (6.9)           | 1,790 (18.4)             |
| Missing        | 316 (6.8)         | 343 (6.7)           | 659 (6.8)                |
| BMI (kg/m²)    |                   |                     |                          |
| <25            | 1,299 (28.1)      | 2,065 (40.6)        | 3,364 (34.6)             |
| 25–29.99       | 2,162 (46.7)      | 1,733 (34.1)        | 3,895 (40.1)             |
| ≥ 30           | 1,139 (24.6)      | 1,256 (24.7)        | 2,395 (24.7)             |
| Missing        | 28 (0.6)          | 29 (0.6)            | 57 (0.6)                 |
a representative sample of residents from Leipzig, Germany, a city with a population of about 550,000. An age- and gender-stratified random selection of inhabitants was obtained from the local residents’ registration office. The age range was 18 to 80 years. According to the study protocol, the focus was on the age group 40-80 years; the 18-39 years age range was included but underrepresented. At the study center, the participants underwent a set of assessment batteries, including collection of their sociodemographic data, medical history, lifestyle factors, and several medical examinations. Pregnancy and insufficient command of the German language were exclusion criteria. The participants received a lump sum of 20 EUR to cover their travel expenses. Details of the study design are published elsewhere (Loeffler et al., 2015). Informed consent was obtained from all participants. The study was approved by the ethics committee of the University of Leipzig.

**Instruments**

The LOT-R (Scheier et al., 1994) is composed of 10 items. Three items assess optimism, three items assess pessimism, and there are four filler items. Respondents are asked to indicate the degree to which they agree with the items on a five-point Likert scale (cf. Hartley, 2014). The scores of the Optimism and Pessimism subscales are calculated by summing up the corresponding three items, resulting in a score range of 0 to 12. The total sum score is calculated by adding the optimism score and the inverted pessimism score. Sociodemographic factors were obtained in a structured interview. Alcohol consumption was assessed with regard to frequency and amount of different alcoholic beverages consumed within the last year, and tobacco use with questions on past and current smoking, smoking duration, and amounts of different tobacco products.

**Statistical methods**

Age and gender differences were tested with a two-factorial ANOVA, using the factors age group (5 categories according to Table 1) and gender (2 categories). Cronbach’s alpha coefficient was used to determine internal consistency. Effect sizes were calculated using Cohen’s $d$, relating the mean score differences to the pooled standard deviation. Percentile rank scores were defined in the same way as in the previous German normative study (Glaesmer et al., 2012): percentile rank = $(m + 0.5 k)/N * 100$, where $m$ is the number of members of the sample obtaining a score lower than the score of interest, $k$ is the number obtaining the score of interest, and $N$ is the overall sample size. Logistic regression analyses were performed to quantify the effect of socioeconomic status, education, professional status, alcohol consumption, tobacco smoking, and obesity on the LOT-R scores, adjusting for age and gender. The calculations were performed with SPSS version 20.

The factorial structure was tested with Confirmatory Factor Analyses (CFA), performed with AMOS 20. All models were calculated using covariance matrices, and each model was estimated with the maximum likelihood method approach. All models were compared to each other on the basis of the following model fit indices: minimum discrepancy divided by its degrees of freedom (CMIN/DF), normed fit index (NFI), comparative fit index (CFI), Tucker-Lewis Index (TLI), root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), and Bayesian Information Criterion (BIC). For a good model fit, the ratio CMIN/DF should be as small as possible (Schermelleh-Engel, Moosbrugger, & Müller, 2003); values of NFI, CFI and TLI close to .95 or higher are indicative of a good or at least acceptable (> .90) model fit. Furthermore, RMSEA should be .08 or smaller, and SRMR should be .05 or smaller. The BIC is a descriptive indicator of poor fit for the comparison between two models; the model with the lower BIC should be preferred (Schermelleh-Engel et al., 2003).

To test the invariance of the model across gender and age, further analyses were conducted using multi-group CFA. After testing the factorial structure in each subgroup, measurement invariance was tested in three steps: first using the configural model (no constraints), followed by a metric invariant model (with unstandardized item loadings constrained to be equal across groups), and finally a scalar invariant model (with unstandardized item loadings and unstandardized item intercepts simultaneously constrained to be equal across groups). Based on the hierarchy of these nested and increasingly restrictive models, the models were then compared to each other. Since the $\chi^2$ statistic has been criticized for its sensitivity to sample size, we focused mainly on the differences $\Delta$CFI and $\Delta$RMSEA. Values smaller than .01 indicate the invariance of the models (Cheung & Rensvold, 2002). For scaling purposes, the variance of each latent variable was fixed to 1.0 and the mean was fixed to 0 to avoid the potential problem of selecting a marker variable that may not be invariant.

**Results**

**Sample characteristics**

The total sample of the study program comprised 10,000 people from the general population. The response rate of the study was 33%. Further details of the sampling procedure are reported elsewhere (Loeffler et al., 2015). If only one item of a subscale (Optimism or Pessimism) was missing, it was replaced with the rounded mean of the other two items. Following this procedure, valid data were available for 9,711 persons. Table 1 presents the sociodemographic characteristics of this sample.

**Age and gender differences**

Males were slightly less optimistic ($M = 8.6$) than females ($M = 8.9$), effect size $d = .12$, but there were no gender differences in pessimism (Table 2). Pessimism increased with increasing age for males and females. The ANOVA results for the effects of gender and age group on optimism and pessimism were as follows: Optimism: Gender: $F = 10.2, p = .001$; Age group: $F = 4.4, p = .002$; Gender * Age
Optimism and pessimism in the general population

|                  | Optimism |          | Pessimism |          | Total score |          |
|------------------|----------|----------|-----------|----------|-------------|----------|
|                  | n        | M        | SD        | M        | SD          | M        | SD      |
| **Males**        |          |          |           |          |             |          |         |
| ≤ 39 y.          | 255      | 8.9      | 2.4       | 4.1      | 2.2         | 16.8     | 4.0     |
| 40-49 y.         | 1,210    | 8.7      | 2.4       | 4.3      | 2.3         | 16.4     | 3.9     |
| 50-59 y.         | 1,030    | 8.6      | 2.4       | 4.6      | 2.4         | 16.0     | 3.8     |
| 60-69 y.         | 1,172    | 8.6      | 2.6       | 4.6      | 2.3         | 16.0     | 3.7     |
| ≥ 70 y.          | 961      | 8.5      | 2.6       | 4.7      | 2.3         | 15.8     | 3.3     |
| All age groups   | 4,628    | 8.6      | 2.5       | 4.5      | 2.3         | 16.1     | 3.7     |
| **Females**      |          |          |           |          |             |          |         |
| ≤ 39 y.          | 257      | 9.0      | 2.3       | 3.9      | 2.3         | 17.1     | 4.0     |
| 40-49 y.         | 1,436    | 9.0      | 2.4       | 4.1      | 2.4         | 16.9     | 4.0     |
| 50-59 y.         | 1,277    | 8.9      | 2.4       | 4.5      | 2.5         | 16.4     | 4.1     |
| 60-69 y.         | 1,292    | 8.7      | 2.5       | 4.8      | 2.4         | 16.0     | 3.6     |
| ≥ 70 y.          | 871      | 8.7      | 2.6       | 4.9      | 2.4         | 15.8     | 3.5     |
| All age groups   | 5,083    | 8.9      | 2.5       | 4.5      | 2.4         | 16.4     | 3.8     |
| **Total sample** |          |          |           |          |             |          |         |
| ≤ 39 y.          | 512      | 8.9      | 2.3       | 4.0      | 2.2         | 16.9     | 4.0     |
| 40-49 y.         | 2,646    | 8.9      | 2.4       | 4.2      | 2.4         | 16.7     | 4.0     |
| 50-59 y.         | 2,257    | 8.8      | 2.4       | 4.5      | 2.5         | 16.2     | 4.0     |
| 60-69 y.         | 2,464    | 8.7      | 2.5       | 4.7      | 2.3         | 16.0     | 3.6     |
| ≥ 70 y.          | 1,832    | 8.6      | 2.6       | 4.8      | 2.4         | 15.8     | 3.4     |
| All age groups   | 9,711    | 8.8      | 2.5       | 4.5      | 2.4         | 16.2     | 3.8     |

psychometric properties of the LOT-R

The reliability coefficients were: Optimism: alpha = .70; Pessimism: alpha = .63, and Total score: alpha = .66. The correlation between Optimism and Pessimism was calculated for several subgroups of the sample, concerning gender, age group, and education. For the total sample the correlation was r = - .22. Separated by gender, the correlations were r = -.21 (males) and r = -.24 (females). The age groups yielded the following results: r = -.50 (≤ 39 y.), r = -.40 (40-49 y.), r = -.31 (50-59 y.), r = -.12 (60-69 y.), and r = .05 (≥ 70 y.). Concerning education (in years), the correlations were r = .13 (< 10 y.), r = -.17 (10-11 y.), and r = -.38 (≥ 12 y.). The percentiles rank scores of the LOT-R are listed in Table 3.

Confirmatory factorial analyses and invariance testing

Factor models were tested with CFA according to the study of Cano-Garcia et al. (2015). In that study seven models were tested, but models 3 and 4 were identical, so we calculated six models. Model 1 (one-factor model) is the unidimensional model of the LOT-R. Model 2 is a two-factor model (optimism and pessimism) with both latent variables correlated with each other. In this model, the positive items load onto one factor, and the negative items load onto the other. Model 3 also considers two factors (optimism and pessimism), but these factors are assumed to be uncorrelated. In Model 4 the three pessimism items are combined by a methods factor. Accordingly, in Model 5 the methods factor is related to the three optimism items. Model 6 is the ‘‘random intercept factor model’’ according to Maydeu-Olivares and Coffman (2006). It includes a method factor in addition to a unidimensional model of the LOT-R. Within this model, the intercepts of the method factor are allowed to vary freely across the individuals. Fit indices are given in Table 4. While models 1 and 3 showed insufficient model fit, the remaining four models (2, 4, 5, and 6) are characterized by very similar and good model fit coefficients. Among these four models we preferred the most parsimonious model (Model 2) for further analysis of measurement invariance. Empirical data support the assumption of a bi-dimensional factor structure of the LOT-R, with two latent factors that correlate with r = -.35. Standardized factor loadings of the latent variables on the related items varied between .56 and .76 for the optimism subscale and between .48 and .72 for the pessimism subscale.

The invariance of the preferred model (Model 2) was tested across the subgroups of men and women and five age groups. Results of the measurement invariance tests are shown in Table 5. As the indices of ∆CFI and ∆RMSEA indicate (< .01), this model can be assumed to be metric invariant across gender and age groups. Due to ∆CFI > .02, scalar invariance could not be confirmed completely across men and women and all age groups. According to Gregorich
Table 3 Percentile rank scores of the LOT-R.

| Raw score | Optimism Percent rank | Pessimism Percent rank | Total score Percent rank | Raw score | Percent rank |
|-----------|------------------------|------------------------|--------------------------|-----------|-------------|
| 0         | 0.3                    | 2.3                    | 0.1                      | 13        | 20.6        |
| 1         | 0.7                    | 7.7                    | 0.1                      | 14        | 28.8        |
| 2         | 1.1                    | 15.6                   | 0.1                      | 15        | 38.0        |
| 3         | 2.0                    | 28.0                   | 0.2                      | 16        | 47.9        |
| 4         | 3.8                    | 43.3                   | 0.3                      | 17        | 57.6        |
| 5         | 7.3                    | 58.4                   | 0.5                      | 18        | 66.7        |
| 6         | 14.1                   | 72.7                   | 0.7                      | 19        | 74.9        |
| 7         | 24.1                   | 84.3                   | 1.1                      | 20        | 82.0        |
| 8         | 36.5                   | 92.0                   | 1.7                      | 21        | 88.1        |
| 9         | 50.8                   | 96.5                   | 2.8                      | 22        | 93.1        |
| 10        | 65.1                   | 98.7                   | 4.6                      | 23        | 96.8        |
| 11        | 77.6                   | 99.4                   | 7.6                      | 24        | 99.2        |
| 12        | 91.6                   | 99.8                   | 13.2                     |           |             |

Table 4 Summary of fit indices of the factor models.

|   | \( \chi^2 \) (df) | CMIN/DF | NFI | CFI | TLI | RMSEA | SRMR | BIC |
|---|------------------|--------|-----|-----|-----|-------|------|-----|
| Model 1 | 3072.612 (9) | 341.401 | .682 | .682 | .470 | .187 | .115 | 3182.754 |
| Model 2 | 147.725 (8) | 18.466 | .985 | .986 | .973 | .042 | .022 | 267.046 |
| Model 3 | 729.289 (9) | 81.032 | .924 | .925 | .876 | .091 | .095 | 839.432 |
| Model 4 | 114.216 (6) | 19.036 | .988 | .989 | .972 | .043 | .018 | 251.892 |
| Model 5 | 11.3642 (6) | 18.940 | .988 | .989 | .972 | .043 | .018 | 251.320 |
| Model 6 | 151.523 (8) | 18.940 | .984 | .985 | .972 | .043 | .020 | 270.844 |

Note. df = degrees of freedom; CMIN/DF = minimum discrepancy, divided by its degrees of freedom; NFI = normed fit index; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; BIC = Bayesian Information Criterion.

Table 5 Test for invariance across gender and age of model 2 (two-factor model with correlated factors).

| Gender | N   | \( \chi^2 \) (df) | \( \Delta \chi^2 \) | \( \Delta df \) | \( \Delta p \) | CMIN/DF | CFI | \( \Delta CFI \) | RMSEA | \( \Delta RMSEA \) |
|--------|-----|-------------------|---------------------|----------------|----------------|---------|-----|-----------------|-------|------------------|
| Men    | 4,611 | 47.542 (8)     | 5.943               | .991           | .033          |
| Women  | 5,057 | 124.997 (8)    | 15.625              | .978           | .054          |

Multigroup analysis

Dimensional/configural

| Age group | N   | \( \chi^2 \) (df) | \( \Delta \chi^2 \) | \( \Delta df \) | \( \Delta p \) | CMIN/DF | CFI | \( \Delta CFI \) | RMSEA | \( \Delta RMSEA \) |
|-----------|-----|-------------------|---------------------|----------------|----------------|---------|-----|-----------------|-------|------------------|
| 18-39 years | 512 | 30.288 (8) | 3.786               | .968           | .074          |
| 40-49 years | 2,643 | 41.020 (8) | 5.127               | .990           | .040          |
| 50-59 years | 2,255 | 47.165 (8) | 5.896               | .985           | .047          |
| 60-69 years | 2,444 | 62.924 (8) | 7.866               | .975           | .053          |
| ≥70 years | 1,814 | 75.471 (8) | 9.434               | .956           | .068          |

Multigroup analysis

Dimensional/configural

| Age group | N   | \( \chi^2 \) (df) | \( \Delta \chi^2 \) | \( \Delta df \) | \( \Delta p \) | CMIN/DF | CFI | \( \Delta CFI \) | RMSEA | \( \Delta RMSEA \) |
|-----------|-----|-------------------|---------------------|----------------|----------------|---------|-----|-----------------|-------|------------------|
| 18-39 years | 256.899 (40) | 6.422 | .978 | .024 |
| 40-49 years | 316.016 (64) | 59.117 | 24 | .001 | 4.938 | .975 | .003 | .020 | .004 |
| 50-59 years | 572.700 (88) | 256.684 | 24 | .001 | 6.508 | .952 | .023 | .024 | .004 |
| 60-69 years | 357.280 (80) | 41.264 | 16 | .001 | 4.466 | .973 | .002 | .019 | .001 |

Note. df = degrees of freedom, CMIN/DF: minimum discrepancy, divided by its degrees of freedom, CFI: comparative fit index, RMSEA: root mean square error of approximation, \(^1\) constraint of equal intercepts freed for item 6, \(^2\) constraint of equal intercepts freed for items 5 and 6.
(2006), the constraint of equal intercepts was freed for item 6 (invariance test for gender) and items 5 and 6 (invariance test for age) respectively, and the model was re-estimated for partial scalar invariance. As shown in Table 5, partial invariance across gender and all age groups could be confirmed. The $\Delta \chi^2$ statistic indicated significant differences in all cases of the invariance tests, but due to its sensitivity to sample size we focused on differences in RMSEA and CFI values (Schermelleh-Engel et al., 2003).

### Relationship between LOT-R scores and sociodemographic and behavioral variables

Low optimism (LOT-R total) scores were observed for people who were widowed ($M = 15.5$), unemployed ($M = 14.2$), had low levels of education ($M = 15.1$), and had low income ($M = 15.1$) (Table 6). The associations between the other factors (smoking, alcohol consumption and overweight) and optimism were lower; the influence of alcohol intake on optimism was negligible.

### Discussion

The first aim of this study was to test age and gender differences. As in previous studies, age differences were small in magnitude. Males were slightly less optimistic than females. Though the gender difference was statistically significant, the effect size of this difference was low ($d = .12$). Two previous German general population studies (Armbruster et al., 2015; Glaesmer et al., 2012) also found very small gender effects ($d \leq .07$), and in a Colombian general population sample (Zenger et al., 2013) males were slightly more optimistic than females ($d = .12$ for the Total score). We also observed slight age differences; the older age groups reported less optimism than the younger ones. This was also in line with previous studies (Armbruster et al., 2015; Glaesmer et al., 2012; Zenger

---

Table 6 LOT-R mean scores, broken down by sociodemographic and behavioral factors.

|                      | Optimism | Pessimism | Total score |
|----------------------|----------|-----------|-------------|
|                      | $M$ (SD) | $M$ (SD)  | $M$ (SD)    |
| Marital status       |          |           |             |
| Married, co-habiting | $d=0.16$ | $p=.001$  | $d=0.25$    | $p=.001$    | $d=0.25$    | $p=.001$    |
| Married, living apart| 8.9      | (2.4)     | 4.4         | (2.3)       | 16.4        | (3.6)       |
| Unmarried            | 8.9      | (2.5)     | 4.7         | (2.7)       | 16.2        | (4.1)       |
| Divorced             | 8.6      | (2.5)     | 4.4         | (2.4)       | 16.1        | (4.1)       |
| Widowed              | 8.5      | (2.6)     | 4.8         | (2.5)       | 15.8        | (4.1)       |
| Occupational situation| $d=0.57$ | $p=.001$  | $d=0.54$    | $p=.001$    | $d=0.73$    | $p=.001$    |
| Working full-time    | 9.1      | (2.3)     | 4.2         | (2.3)       | 16.9        | (3.8)       |
| Working part-time    | 8.8      | (2.4)     | 4.3         | (2.4)       | 16.5        | (3.9)       |
| Unemployed           | 7.7      | (2.6)     | 5.5         | (2.4)       | 14.2        | (4.1)       |
| Retirement           | 8.6      | (2.6)     | 4.9         | (2.4)       | 15.7        | (3.5)       |
| Education            |          |           |             |
| $<10$ y.             | 8.2      | (2.6)     | 5.2         | (2.4)       | 15.1        | (3.3)       |
| $10-11$ y.           | 8.6      | (2.5)     | 4.8         | (2.4)       | 15.9        | (3.7)       |
| $\geq 12$ y.         | 9.1      | (2.4)     | 3.9         | (2.3)       | 17.2        | (3.9)       |
| Income               |          |           |             |
| $<999$ €             | 8.2      | (2.6)     | 5.1         | (2.4)       | 15.1        | (3.8)       |
| $1000$ € - $1999$ €  | 8.8      | (2.4)     | 4.6         | (2.3)       | 16.2        | (3.7)       |
| $\geq 2000$ €        | 9.4      | (2.2)     | 3.7         | (2.2)       | 17.7        | (3.6)       |
| Smoking              |          |           |             |
| Current non-smoker   | 8.9      | (2.4)     | 4.4         | (2.3)       | 16.4        | (3.8)       |
| Current smoker       | 8.5      | (2.5)     | 4.8         | (2.5)       | 15.7        | (3.9)       |
| Alcohol consumption  |          |           |             |
| $\leq 20$ g/day      | 8.8      | (2.4)     | 4.5         | (2.4)       | 16.3        | (3.8)       |
| $>20$ g/day          | 8.8      | (2.4)     | 4.4         | (2.3)       | 16.4        | (3.8)       |
| BMI (kg/m²)          |          |           |             |
| $<25$                | 8.9      | (2.5)     | 4.2         | (2.4)       | 16.6        | (3.9)       |
| $25-29.99$           | 8.8      | (2.4)     | 4.5         | (2.4)       | 16.2        | (3.7)       |
| $\geq 30$            | 8.6      | (2.6)     | 4.9         | (2.4)       | 15.7        | (3.8)       |

**Note.** $d$: effect size for the comparison between categories with the lowest and highest mean scores; $p$: significance.
et al., 2013). The low occurrence of gender and age differences justifies reporting normative data for the whole population, without differentiating between age and gender groups.

Are optimism and pessimism independent variables? Most researchers reported only weak negative correlations between these subscales and concluded independency. In our total sample, the correlation was $r = -.22$, which is in line with other studies: $r = -.12$ (Zenger et al., 2013) and $r = -.20$ (Glaesmer et al., 2012). As in the most recent German study (Armbuster et al., 2015), the correlation between optimism and pessimism depends on the age of the subjects. Among young people, there was a clear negative correlation, while in the oldest group the correlation was even slightly positive. This is also in line with a strong negative correlation between the latent variables found in a Spanish sample of university students (Cano-Garcia et al., 2015). One reason for the lack of a clear negative correlation between optimism and pessimism in the general population is the so-called acquiescence effect, a tendency to give affirmative answers to items irrespective of their content. This acquiescence or yes-set effect (Savalei & Falk, 2014) contributes to a small or inverse association of constructs which are theoretically in an opposite position. This acquiescence effect seems to be more pronounced in older people and in people with lower education levels. Whenever examinations use samples of students one must be aware that their response behavior differs from that of older and less educated people, a fact that limits the generalizability of those findings.

Regarding the dimensionality of the questionnaire, the two-factor model with correlated latent variables (Model 2) fit the data well, and the results are in line with those of a German and a Colombian representative sample (Glaesmer et al., 2012; Zenger et al., 2013) and other studies (Herzberg et al., 2006; Ribeiro, Pedro, & Marques, 2012). Therefore, the latent constructs of optimism and pessimism measured with the LOT-R can be seen as partially independent variables that are moderately correlated. Additionally, the (partial) invariance of the two-factor model across age and gender was confirmed. This is an important precondition in a statistical sense and allows for making meaningful comparisons between these subgroups.

Education, professional situation, and income were substantial predictors of optimism. Optimism was highest among well educated people with high income, working full-time. Several effect sizes were greater than .50, and, therefore, higher than those of the age or gender differences. It can be concluded that samples with students cannot be generalized to the whole general population. Unemployment was the factor most strongly associated with pessimism. In this context, it is also interesting to note that the effect sizes of the total scale are generally higher than those of the subscales optimism and pessimism. However, in contrast to the correlations with the other scales, the optimism subscale was not generally better than the pessimism subscale in terms of effect sizes between sociodemographic groups. There was no association between optimism and alcohol intake; and the association with cigarette smoking was statistically significant, but also weak in magnitude ($d = .18$ for the total score).

Smokers were slightly less optimistic and more pessimistic than non-smokers. Perhaps this lack of optimism is one reason why it is difficult for those smokers to give up smoking.

Some limitations of this study should be mentioned. The response rate (33%) was low, and the sample is not representative of Germany, because it is based on a community sample. Nevertheless, the similarity of the LOT-R mean scores with those of a previous German sample (Glaesmer et al., 2012) indicates that there were no severe discrepancies in terms of mean scores. Due to the cross-sectional design of this study, we cannot derive causal relationships between optimism and associated factors such as obesity or employment status. Unemployed people might experience more pessimism, but it is also possible that pessimism causes behavior that leads to unemployment. Though this study cannot contribute to questions of causality, due to its large sample size it is useful in providing precise estimates of the strength of the associations.

Despite the limited representativeness, we believe that the mean scores presented in this study can be used as reference values whenever samples of patients are examined with the LOT-R. In many cases, this would be better than examining a small group of “normal” subjects as controls. Gender differences should be taken into account when making comparisons between several groups of patients. Taken together, the LOT-R proved to be a suitable instrument for the assessment of habitual optimism and pessimism.

**Funding**

This publication is supported by LIFE - Leipzig Research Centre for Civilization Diseases, an organizational unit affiliated to the Medical faculty of the University of Leipzig. LIFE is funded by means of the European Union, by the European Regional Development Fund (ERDF) and by funds of the Free State of Saxony within the excellence initiative (project numbers 713-241202, 14505/2470, 14575/2470). A. Hilbert was funded by the German Federal Ministry of Education and Research (grant 01E01501).

**Acknowledgements**

We acknowledge support from the German Research Foundation (DFG) and Universitat Leipzig within the program of Open Access Publishing.

**References**

Anthony, E. G., Kritz-Silverstein, D., & Barrett-Connor, E. (2016). Optimism and mortality in older men and women: The Rancho Bernardo Study. *Journal of Aging Research, 2016*, 5185104. http://dx.doi.org/10.1155/2016/5185104

Armbuster, D., Pieper, L., Klotzsche, J., & Hoyer, J. (2015). Predictions get tougher in older individuals: A longitudinal study of optimism, pessimism and depression. *Social Psychiatry and Psychiatric Epidemiology, 50*, 153–163. http://dx.doi.org/10.1007/s00127-014-0959-0
Optimism and pessimism in the general population

Cano-Garcia, F. J., Sanduverte-Chaves, S., Chacón-Moscoso, S., Rodríguez-Franco, L., García-Martínez, J., Antuña-Belterin, M. A., & Pérez-Gil, J. A. (2015). Factor structure of the Spanish version of the Life Orientation Test-Revised (LOT-R). Testing several models. International Journal of Clinical and Health Psychology, 15, 139–148. http://dx.doi.org/10.1016/j.ijchp.2015.01.003

Carver, C. S., & Scheier, M. F. (2014). Dispositional optimism. Trends in Cognitive Sciences, 18, 293–299. http://dx.doi.org/10.1016/j.tics.2014.02.003

Carver, C. S., Scheier, M. F., & Segerstrom, S. C. (2010). Optimism. Clinical Psychology Review, 30, 879–889. http://dx.doi.org/10.1016/j.cpr.2010.01.006

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. Structural Equation Modeling, 9, 233–255. http://dx.doi.org/10.1207/S15328007SEM0902_5

Chiesi, F., Galli, S., Primi, C., Innocenti Borgi, P., & Bonacchi, A. (2013). The accuracy of the Life Orientation Test-Revised (LOT-R) in measuring dispositional optimism: evidence from item response theory analyses. Journal of Personality Assessment, 95, 523–529. http://dx.doi.org/10.1080/00223891.2013.781029

Giltay, E. J., Geleijnse, J. M., Zitman, F. G., Hoekstra, T., & Schouten, E. G. (2004). Dispositional optimism and all-cause and cardiovascular mortality in a prospective cohort of elderly Dutch men and women. Archives of General Psychiatry, 61, 1126–1135. http://dx.doi.org/10.1001/archpsyc.61.11.1126

Gison, A., Rizza, F., Bonassi, S., Donati, V., & Giaquinto, S. (2015). Effects of dispositional optimism on quality of life, emotional distress and disability in Parkinson’s disease outpatients under rehabilitation. Functional Neurology, 30, 105–111. http://dx.doi.org/10.1138/FNNeur.2015.30.2.105

Glaesmer, H., Rief, W., Martin, A., Mewes, R., Brähler, E., Zenger, M., & Hinz, A. (2012). Psychometric properties and population-based norms of the Life Orientation Test Revised (LOT-R). British Journal of Health Psychology, 17, 432–445. http://dx.doi.org/10.1111/j.2044-8287.2011.00246.x

Gregorcic, S. E. (2006). Do self-report instruments allow meaningful comparisons across diverse population groups? Testing measurement invariance using the confirmatory factor analysis framework. Medical Care, 44, 578–594. http://dx.doi.org/10.1097/01.mlr.0000224545.12228.8f

Grossardt, B. R., Bower, J. H., Geda, Y. E., Colligan, R. C., & Rocca, W. A. (2009). Pessimistic, anxious, and depressed personality traits predict all-cause mortality: The Mayo Clinic cohort study of personality and aging. Psychosomatic Medicine, 71, 491–500. http://dx.doi.org/10.1097/PSY.0b013e31819e67db

Hartley, J. (2014). Some thoughts on Likert-type scales. International Journal of Clinical and Health Psychology, 14, 83–86. http://dx.doi.org/10.1016/j.ijchp.2014.07.0040.7

Herzberg, P. Y., Glaesmer, H., & Hoyer, J. (2006). Separating Optimism and Pessimism: A robust psychometric analysis of the revised life orientation test (LOT-R). Psychological Assessment, 18, 433–438. http://dx.doi.org/10.1037.0230.18.4.433

Jiang, W., Li, F., Jiang, H., Yu, L., Liu, W., Li, Q., & Zuo, L. (2014). Core self-evaluations mediate the associations of dispositional optimism and life satisfaction. Plos One, 9, e97752. http://dx.doi.org/10.1371/journal.pone.0097752

Kreis, S., Molto, A., Bailly, F., Dadoun, S., Fabre, S., Rein, C., Hudry, C., Zenasni, F., Rozenberg, S., Pertuiset, E., Fautrel, B., & Gossec, L. (2015). Relationship between optimism and quality of life in patients with two chronic rheumatic diseases: Axial spondyloarthritids and chronic low back pain: a cross sectional study of 288 patients. Health and Quality of Life Outcomes, 13, 78. http://dx.doi.org/10.1186/s12955-015-0268-7

Loffler, M., Engel, C., Ahnert, P., Alfermann, D., Arelin, K., Baber, R., et al. (2015). The LIfE-Adult-Study: Objectives and design of a population-based cohort study with 10,000 deeply phenotyped adults in Germany. BMC Public Health, 15, 691. http://dx.doi.org/10.1186/1471-2458-15-1932

Maydeu-Olivares, A., & Coffman, D. L. (2006). Random intercept item factor analysis. Psychological Methods, 11, 344–364. http://dx.doi.org/10.1037/1082-989X.11.4.344

Monzani, D., Steca, P., & Greco, A. (2014). Brief report: Assessing dispositional optimism in adolescence—factor structure and concurrent validity of the Life Orientation Test—Revised. Journal of Adolescence, 37, 97–101. http://dx.doi.org/10.1016/j.adolescence.2013.11.006

Nes, L. S., & Segerstrom, S. C. (2006). Dispositional optimism and coping: A meta-analytic review. Personality and Social Psychology Review, 10, 235–251. http://dx.doi.org/10.1007/s12160-009-9111-x

Ribeiro, J. L. P., Pedro, L., & Marques, S. (2012). Dispositional optimism is unidimensional or bidimensional? The Portuguese Revised Life Orientation Test. Spanish Journal of Psychology, 15, 1299–1271. http://dx.doi.org/10.5209/rev_SJOP.2012.v15.n3.39412

Roy, B., Diez-Roux, A. V., Seeman, T., Ranjit, N., Shea, S., & Cushman, M. (2010). Association of optimism and pessimism with inflammation and hemostasis in the Multi-Ethnic Study of Atherosclerosis (MESA). Psychosomatic Medicine, 72, 134–140. http://dx.doi.org/10.1097/PSY.0b013e3181cb981b

Saboocchi, F., Petersson, L.-M., Alexanderson, K., Branstrom, R., & Wennman-Larsen, A. (2016). Expecting the best and being prepared for the worst: Structure, profiles, and 2-year temporal stability of dispositional optimism in women with breast cancer. Psycho-Oncology, 25, 957–963. http://dx.doi.org/10.1002/pon.4045

Savalei, V., & Falk, C. F. (2014). Recovering substantive factor loadings in the presence of acquiescence bias: A comparison of three approaches. Multivariate Behavioral Research, 49, 407–424. http://dx.doi.org/10.1080/00273611.2014.931800

Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem) - A reevaluation of the Life Orientation Test. Journal of Personality and Social Psychology, 67, 1063–1078. http://dx.doi.org/10.1037.0022-3514.67.6.1063

Scheier, M. F., Matthews, K. A., Owens, J. F., Schulz, R., Bridges, M. W., Magovern, G. J., & Carver, C. S. (1999). Optimism and rehospitalization after coronary artery bypass graft surgery. Archives of Internal Medicine, 159, 829–835. http://dx.doi.org/10.1002.0154.57.6.1024

Schermelleh-Engel, K., Moosbruger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of signiﬁcance and descriptive goodness-of-ﬁt measures. Methods of Psychological Research Online, 8, 23–74. http://www.dps.de/fachgruppen/methoden/mpr-online

Steca, P., Monzani, D., Greco, A., Chiesi, F., & Primi, C. (2015). Item response theory analysis of the life orientation test-revised: Age and gender differential item functioning analyses. Assessment, 22, 341–350. http://dx.doi.org/10.1177/107319111544471

Vera-Villarroyel, P., Valtierra, A., & Contreras, D. (2016). Affectivity as a mediator of the relation between optimism and quality of life in men who have sex with men with HIV. International Journal of Clinical and Health Psychology, 16, 256–265. http://dx.doi.org/10.1016/j.jichp.2016.07.001
Zenger, M., Brix, C., Borowski, J., Stolzenburg, J., & Hinz, A. (2010). The impact of optimism on anxiety, depression and quality of life in urogenital cancer patients. *Psycho-Oncology, 19*, 879–886. [http://dx.doi.org/10.1002/pon.1635](http://dx.doi.org/10.1002/pon.1635)

Zenger, M., Finck, C., Zanon, C., Jimenez, W., Singer, S., & Hinz, A. (2013). Evaluation of the Latin American version of the Life Orientation Test-Revised. *International Journal of Clinical and Health Psychology, 13*, 243–252. [http://dx.doi.org/10.1016/S1697-2600(13)70029-2](http://dx.doi.org/10.1016/S1697-2600(13)70029-2)