OSF Preregistration:
Investigating the relationship between age-related discrimination and depressive symptoms in older adults, as moderated by perceived social support and self-esteem

Contributor: Tim Blauberger

Study Information

Research questions

Is age-related discrimination associated with increased levels of depressive symptoms and vice versa? (H1, H2, H3)

Is the relationship between age-related discrimination and depression moderated by perceived social support? (H4)

Is the relationship between age-related discrimination and depression moderated by self-esteem? (H5)

Hypotheses

H1: Subjects with higher levels of perceived age-related discrimination display higher levels of depressive symptoms and vice versa.
Prediction: Perceived age-related discrimination and depressive symptoms are associated on a between-subject level. The correlation between the random intercepts is positive and statistically significant ($p<.05$).

H2: Perceived age-related discrimination predicts depressive symptoms at following time-points on the within-subject level.
Prediction: On the within-subject level, both cross-lagged parameters (W7 to W8 and W8 to W9) of age-related discrimination to depressive symptoms are positive and statistically significant ($p<.05$).

H3: Depressive symptoms predict perceived age-related discrimination at following time-points on the within-subject level.
Prediction: On the within-subject level, both cross-lagged parameters (W7 to W8 and W8 to W9) of depressive symptoms to age-related discrimination are positive and statistically significant ($p<.05$).

H4: The relationships from H1 and H2 are stronger in individuals with low perceived social support
Prediction: Both cross-lagged parameters from discrimination to depressive symptoms and the correlation between their random intercepts will be significantly moderated by perceived social support. Higher social support is associated with lower parameter values.

H5: The relationships from H1 and H2 are stronger in individuals with low self-esteem

Prediction: Both cross-lagged parameters from discrimination to depressive symptoms and the correlation between their random intercepts will be significantly moderated by self-esteem. Higher self-esteem is associated with lower parameter values.

Data Description

Datasets used
I will use data from the HEARTS (HEalth, Ageing, and Retirement Transitions in Sweden) study (Lindwall et al., 2017). The data is observational (survey) and longitudinal. The subset we will use consists of data from waves 6 to 9 (plus covariates from wave 1) and only includes the variables used in the analysis. The waves are each a year apart and have been conducted between the end of May / beginning of June in 2020 (W6), 2021 (W7), 2022 (W8) and 2023 (W9). The númber of respondents decreased from 3660 (W7) and 3305 (W8) to 3160 (W9). The relative amount of drop-outs over these waves is 13.9%. The age of respondents ranged from 60 to 66 in the first wave, thus should approximately range from 68 to 74 in wave 9. The survey could optionally be completed either online or using a paper version. Below, you find more information about the variables of the analyzed subset.

Lindwall, M., Berg, A. I., Bjälkebring, P., Buratti, S., Hansson, I., Hassing, L., Henning, G., Kivi, M., König, S., Thorvaldsson, V., & Johansson, B. (2017). Psychological Health in the Retirement Transition: Rationale and First Findings in the HEalth, Ageing and Retirement Transitions in Sweden (HEARTS) Study. Frontiers in Psychology, 8, 1634.
https://doi.org/10.3389/fpsyg.2017.01634

Data availability

The dataset is available through protected access
Data access

The data set can be made available upon request and in accordance with applicable laws. For further information about accessibility of data, contact hearts@psy.gu.se
Data identifiers

No response
Access date

22-02-2024
Data collection procedures
A thorough description is provided in the following publication:

Lindwall, M., Berg, A. I., Bjälkebring, P., Buratti, S., Hansson, I., Hassing, L., Henning, G., Kivi, M., König, S., Thorvaldsson, V., & Johansson, B. (2017). Psychological Health in the Retirement Transition: Rationale and First Findings in the HEalth, Ageing and Retirement Transitions in Sweden (HEARTS) Study. Frontiers in Psychology, 8, 1634.
https://doi.org/10.3389/fpsyg.2017.01634
Data collection procedures documentation

No files selected
Codebook
he codebook is not publicly available, but may be requested from: hearts@psy.gu.se.

Besides that, information about the measurements used is provided in:

Lindwall, M., Berg, A. I., Bjälkebring, P., Buratti, S., Hansson, I., Hassing, L., Henning, G., Kivi, M., König, S., Thorvaldsson, V., & Johansson, B. (2017). Psychological Health in the Retirement Transition: Rationale and First Findings in the HEalth, Ageing and Retirement Transitions in Sweden (HEARTS) Study. Frontiers in Psychology, 8, 1634.
https://doi.org/10.3389/fpsyg.2017.01634

Codebook documentation

No files selected

Variables

Manipulated variables

I only use observational data. Thus, no variables have been manipulated.
Manipulated variables documentation

No files selected
Measured variables
Outcome measures: Depressive symptoms.
Depressive symptoms were assessed during waves 7, 8 and 9 using a 12-item version of the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). Of these 12 items, two were excluded for the analysis due to their social focus, in accordance with the recommendations by Carleton et al. (2013). The remaining 10 items are items 1, 2, 6, 7, 11, 12, 14, 16, 18 and 20 of the original CES-D.

To test which factor structure should be used in the following analyses, a one-factor structure (all items loading on one factor) will be compared with the 3-factor structure proposed in Carleton et al. (2013). We will use a CFA with the wave 7 data of the CES-D, using full information maximum likelihood (FIML) as the estimator. The latent variables will be scored by fixing the unstandardized factor loading of the first indicator of each factor to 1. In the 3-factor solution, factors will be allowed to correlate. Then, the two models will be compared based on their comparative fit index (CFI). If the 3-factor solution has a better model fit of ΔCFI >= .01, it will be preferred over the more parsimonious 1-factor solution. Internal reliability of each factor will be reported using Cronbach's alpha and McDonald's omega. Model fit will be assessed using RMSEA, CFI and SRMR. Acceptable model fit will be defined as RMSEA<0.08, CFI > 0.90 and SRMR <0.08. Good model fit will be defined as RMSEA <0.05, CFI > .95 and SRMR <.0.05.

The resulting model will then be tested for fit and weak and strong measurement invariance in a longitudinal CFA (using FIML as the estimator) with data from waves 7 to 9. For weak invariance, factor loadings of each indicator will be constrained to equality across measurement occasions. This model will be tested against the unconstrained model. If weak invariance does not hold, I will go on to establish partial measurement invariance by relaxing the constraints of single factor loadings. For strong invariance, the intercepts of each indicator will additionally be constrained to

equality across measurement occasions. If only partial invariance was achieved for the factor loadings, the constraints on intercepts will be limited to these indicators as well. This model of strong invariance will then be tested against the model with constrained factor loadings (weak / partial measurement invariance). If strong invariance is accepted, the constraints on loadings and intercepts will be kept for the following analyses. If strong measurement invariance cannot be established, again the intercepts of single indicators will be relaxed to achieve partial scalar invariance.
For all model comparisons, a criterion of $\Delta CFI < .01$ is used to decide whether the more constrained model will be accepted over the less constrained one.

If the 1-factor solution is preferred, the following analyses will use this factor as the variable “depressive symptoms”. If the 3-factor solution is preferred, the invariance testing will be performed in a CFA including all 3 factors, namely “anhedonia”, “somatic symptoms” and “negative affect”.

If the 3-factor structure is adopted, these factors of the CES-D will be treated independently in each following analysis. For example, for each dimension of the CES-D, a separate RI-CLPM will be estimated to test the hypotheses independently for each dimension.

Predictors: Age-related discrimination
Age-related discrimination is measured by 3 items, which will be combined into a composite score (mean score). The formulations were as follows:

In the last year, how often have you experienced someone, because of your age…1 (Never) to 5 (Very often)

a)… has acted prejudiced against you, or treated you unfairly?
b)… has shown you a lack of respect, for example by ignoring you or treating you condescendingly?
c)… has treated you badly, for example by being rude, insulting you, or refusing service?

Discrimination will not be modeled as a latent variable, as the indicators of discrimination are not considered to be effect indicators, which are causally influenced by a latent construct. Instead, we consider the construct of discrimination to be better reflected by a composite score. Internal reliability for the composites of each wave will be reported.

Covariates:
The following variables will be included as time invariant covariates in the RI-CLPM:
Age (in years, at wave 1)
Gender (0=male, 1= female at wave 1)
Education (total years of education at wave 1)
Relationship status at wave 7 (0 = not in relationship; 1 = in relationship)

The following variables will be included as time invariant covariates in the RI-CLPM
Physical activity (at wave 7, 8 and 9; during the last 3 months, 1=inactive, 2=light physical activity, 3=regular physical activity and training, 4=hard physical training).
Disease burden: sum score of 23 items regarding physical symptoms such as high blood pressure, diabetes, heart failure (0-46). 0 = no symptoms, 1 = mild discomfort, 2 = severe discomfort. Wave 7, 8 and 9. Some items (G80_, H80_, I80_) are originally coded on a 4-point

Likert-type scale in the survey. The middle two responses of these items will be coded together as “mild symptoms” for the calculation of this score.

Moderators:
Perceived social support was assessed at wave 7 using the multidimensional scale of social support (Zimet et al., 1988). All 12 items of the original scale were used. Response options ranged from 1 (completely false) to 7 (completely true). For the moderation analysis, a composite score will be created by calculating the mean across all 12 items. This mean score will then be z-standardized. Skewness, kurtosis and internal reliability will be reported.

Self-esteem was assessed at wave 6 using five items of the Rosenberg self-esteem scale. These are the positively formulated items (1, 2, 4, 6 and 7) of the original scale (Rosenberg, 1965) as recommended by Lindwall and colleagues (2012). Response options ranged from 1 (strongly disagree) to 4 (strongly agree). For the moderation analysis, a composite score will be created by calculating the mean across all 5 items. This mean score will then be z-standardized. Skewness, kurtosis and internal reliability will be reported.

Carleton, R. N., Thibodeau, M. A., Teale, M. J., Welch, P. G., Abrams, M. P., Robinson, T., & Asmundson, G. J. (2013). The center for epidemiologic studies depression scale: a review with a theoretical and empirical examination of item content and factor structure. PloS one, 8(3), e58067. https://doi.org/10.1371/journal.pone.0058067
Lindwall, M., Barkoukis, V., Grano, C., Lucidi, F., Luikkonen, J., Raudsepp, L., & Thøgersen-Ntoumani, C. (2012).
Method effects: The problem with negatively versus positively keyed items. Journal of Personality Assessment, 94, 196-204.
Radloff LS (1977) The CES-D scale: A self-report depression scale for research in the general population. Appl Psychol Meas 1: 385–401.
Rosenberg, M. (1965). Society and the adolescent self-image. Princeton, NJ: Princeton University Press.
Zimet, G.D., Dahlem, N.W., Zimet, S.G. & Farley, G.K. (1988). The Multidimensional Scale of Perceived Social Support. Journal of Personality Assessment, 52, 30-41.

Missing data
See above (“dataset used”) for the number of participants per wave and respective drop-out rates.

Previous publications from the HEARTS project reported that drop-out between waves was “not entirely random but slightly higher among men, younger individuals, participants born outside Sweden, participants with lower levels of education, people who were unmarried or divorced at T1, participants working at T1, those with higher T1 extraversion and neuroticism, but lower on T1 agreeableness” (Hill et al., 2023).

Thus, we expect slightly biased results due to data missing not at random (MNAR), which will be discussed in the limitations section.

As we are interested in cross-lagged effects, participants who only participated in one wave (either 7, 8 or 9) will be excluded. The expected sample size will be ca. N=3250 participants.

If a level of 20% missing values is exceeded for single items of the CES-D or age-related discrimination, we might omit that variable from the analysis.

To deal with missing data, all structural equation models (SEM) will be estimated using full-information maximum likelihood (FIML).

Hill, P. L., Pfund, G. N., Allemand, M., Kivi, M., Berg, A. I., Thorvaldsson, V., & Hansson, I. (2023). Between- and within-person longitudinal associations between personality traits and social support across relationships during older adulthood. European Journal of Personality, 0(0). https://doi.org/10.1177/08902070231214815

Unit of analysis

The unit of analysis will be respondents (synonymously referred to as subjects or participants).

Statistical outliers

After exclusion of participants who only responded in one wave, multivariate normality will be assessed by calculating Mardia's Kurtosis across all variables included in the following analysis. Additionally, multivariate outliers will be detected using Mahalanobis Distance (MD). However, this only serves the purpose to be aware of the possible influence of outliers. No outliers will be excluded at this stage.

Additionally, after the RI-CLPM was estimated, I will perform a sensitivity analysis based on a leaving-one-out approach. Here, cases with the highest MD will be one-by-one excluded in a rerun-analysis of the model, to assess their influence on model fit and the relevant model parameters for hypothesis testing. At this stage, "bad" cases with a detrimental effect on model fit might be excluded from the analysis (and following LSEM analyses) to ensure a better fit to the data for the wide sample.

After exclusion of outliers, the sample size will be expected to reach N>3200.

Sampling weights

No response

Knowledge of Data

Prior Publication/Dissemination

I (Tim Blauberger) have not worked on any set of data of the HEARTS study before. One of my supervisors, Anne Ingeborg Berg, has contributed to a number of papers regarding the HEARTS study as author and co-author. These also included analyses using the depressive-symptoms scale used (CES-D). However, the items regarding age-related discrimination have to my knowledge not been used in any analysis or publication so far.

Prior knowledge

My (Tim Blauberger) knowledge regarding the dataset is purely based on reading previous publications and the codebook.

My relevant knowledge includes:
which scales have been used in which wave

the number of respondents for each wave
the internal reliability of the CES-D in previous analyses (around Cronbach’s alpha = 0.8)
That the drop out of participants has not been at random, but influenced by variables such as gender and personality traits

Analyses

Statistical models
H1, H2, H3: RI-CLPM

To test hypotheses H1, H2 and H3, a RI-CLPM (Hamaker et al., 2015) will be used. The analysis will be performed using the lavaan package (Rosseel, 2012) in R (v4.3.0; R Core Team, 2023). The model will include the composite score of age-related discriminations of waves 7-9 as well as depressive symptoms as a latent construct from wave 7 to 9. Thus, the model will cover three measurement occasions. Of both age-related discrimination and depressive symptoms, a random intercept will be created to account for stable between-person differences. Then, within-unit latent variables will be created to account for time-variant fluctuations around the subject’s mean at each occasion.

The random intercepts will be allowed to correlate. In the within-subject part of the structural model, autoregressive and cross-lagged parameters will be included. Also, the within-subject components of each measurement occasion will be allowed to correlate (/their disturbance terms in waves 8 and 9).

The model will be estimated using full-information maximum likelihood. Standard errors and test statistics will be based on robust estimation using the default settings of the “MLR” estimator in lavaan.

The measurement model of depressive symptoms in the RI-CLPM will be informed by the previous invariance analysis. If weak invariance holds, all factor loadings will be constrained to be equal across occasions. If strong invariance holds, all factor loadings and intercepts of indicators will be constrained to equality across time.
If only partial invariance holds, factor loadings and intercepts of single indicators will be constrained over time.

The time-invariant covariates listed above will be included on the between-subject level of the RI-CLPM, as discussed by Mulder & Hamaker (2021) in “Extension 1”. Thus, they will be entered into the model as covariates of the random intercepts.

Disease burden and physical activity as time-variant covariates will be included on the between and within subject level. To accomplish that, an RI and within-person components will be created for the time variant covariates. The RIs of physical activity and disease burden will then be included as covariates on the between-subject level (predicting the RIs of discrimination and depressive symptoms). The within-person components of physical activity and disease burden will be included as covariates of the within-person components of depressive symptoms and discrimination at each wave.

Model fit will be assessed using RMSEA, CFI and SRMR. Acceptable model fit will be defined as RMSEA<0.08, CFI > 0.90 and SRMR <.08. Good model fit will be defined as RMSEA <0.05, CFI >.95 and SRMR <0.05.

The hypotheses H1, H2 and H3 will be tested in this model:

For H1, significance ($p<.05$) of the correlation between the random intercepts will be assessed.
For H2, significance of the cross-lagged parameters from age-related discrimination W7 to depressive symptoms W8 and age-related discrimination W8 to depressive symptoms W9 will be assessed.
For H3, significance of the cross-lagged parameters from depressive symptoms W7 to age-related discrimination W8 and depressive symptoms W8 to age-related discrimination W9 will be assessed.

For these parameters, point estimates, standard errors, confidence intervals, p-values and standardized effects will be reported.

Note: If the 3-factor structure of the CES-D is used, three separate RI-CLPMs will be estimated (one including each dimension). The factors will be handled as latent variables with 5 (somatic symptoms), 3 (negative affect) or 2 (anhedonia) indicators. If (due to the low number of 2 indicators) the latter factor causes problems in model convergence or measurement invariance, it will be replaced by a mean score of the two items.

H4 and H5: LSEM

To assess a moderating effect of social support and self-esteem, local structural equation modeling (LSEM) will be used. LSEM is implemented in the sirt package (Robitzsch, 2024) for R, which includes the functions that will be mentioned below.

To test for a moderating effect, a separate LSEM analysis will be conducted for each moderator. The baseline model entered into the LSEM analysis is the RI-CLPM described above, which will then be estimated for the focal points across the moderating variable.

The default settings for the LSEM analyses will be as follows: The range of focal points will be set to -1.8 to +1.8 (units corresponding to standard deviations of the z-standardized moderators). The distance between focal points will be 0.2, and the bandwidth-parameter of the sample weighting function will be set to h=2, according to the recommendations by Hildebrandt et al. (2016).

For all analyses, the implemented joint estimation function will be used (by setting the argument est_joint = TRUE).

First, a model with no constraints across the moderator will be computed. To test for weak factorial invariance across the moderator, factor loadings will then be constrained to be equal across levels of the moderator (using the par_invariant argument to list constrained factor loadings). If the difference to the unconstrained model in fit is $\Delta CFI < .01$, weak factorial invariance is accepted. In that case, strong invariance will be tested by the same criterion against the unconstrained model.
To test for strong measurement invariance, factor loadings and indicator intercepts will be constrained to equality across the moderator (again, using par_invariant). Global model fit

statistics will be calculated for the weak invariance and the strong invariance model using joint estimation. If weak invariance cannot be established, constraints on loadings of single indicators will be relaxed to achieve partial factorial invariance. In that case, only those indicators with retained constraints on loadings will also be constrained at their intercepts. If strong invariance cannot be established, constraints on intercepts of single indicators will be relaxed until partial (strong) invariance is achieved. Again, in each model comparison the more constrained model is accepted if $\Delta CFI < .01$. To identify parameters that should be relaxed for partial invariance, I will use the function lsem.permutationTest() on the less constrained model to identify invariant parameters.

If weak variance holds, factor loadings will be constrained to equality in the following LSEM analysis. If strong invariance also holds, indicator intercepts will additionally be constrained to equality across the moderator. If only partial measurement invariance is achieved, only those factor loadings / intercepts which remain invariant will be constrained to equality across the moderator in the following LSEM analysis.

To test the hypotheses H4 and H5, the LSEM analyses will then be performed with bootstrapping (2000 samples) by using the function lsem.permutationTest(). This analysis will return mean absolute distance (MAD) values for each parameter, indicating the change of a parameter across the levels of the moderator. The corresponding p-value will be used to infer statistical significance of this moderating effect. This way, significance ($p<.05$) of the moderating effect will be assessed for each parameter.

The same procedure will separately be performed for social support (H4) and self-esteem (H5).

In their corresponding models, the hypotheses H4 and H5 will be fully accepted, if the moderating effect (quantified by MAD) on the correlation between the random intercepts and on both cross–lagged parameters from age-related discrimination to depression is statistically significant ($p<.05$). They will partly be accepted, if either the correlation between RIs or both cross-lagged parameters display a significant MAD. The hypotheses will be fully rejected, if neither the correlation between RIs nor both cross-lagged paths display significant MADs.

If we adopt the 3-factor structure of the CES-D, LSEM will be performed separately for each dimension of depressive symptoms. In this case, H4 and H5 can be either accepted or rejected for each dimension.

Hamaker, E. L., Kuiper, R. M., & Grasman, R. P. P. P. (2015). A critique of the cross-lagged panel model. Psychological Methods, 20(1), 102–116. https://doi.org/10.1037/a0038889
Hildebrandt, A., Lüdtke, O., Robitzsch, A., Sommer, C., & Wilhelm, O. (2016). Exploring Factor Model Parameters across Continuous Variables with Local Structural Equation Models. Multivariate Behavioral Research, 51(2–3), 257–258. https://doi.org/10.1080/00273171.2016.1142856
Mulder, J. D., & Hamaker, E. L. (2021). Three Extensions of the Random Intercept Cross-Lagged Panel Model. Structural Equation Modeling: A Multidisciplinary Journal, 28(4), 638–648. https://doi.org/10.1080/10705511.2020.1784738
R Core Team (2023). R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/.
Robitzsch, A. (2024). sirt: Supplementary Item Response Theory Models. R package version 4.0-32. https://CRAN.R-project.org/package=sirt

Rosseel Y (2012). “lavaan: An R Package for Structural Equation Modeling.” Journal of Statistical Software, 48(2), 1–36. doi:10.18637/jss.v048.i02.

Effect size

n a random effects meta-analysis, Chang and colleagues (2020, Appendix S1) report an effect size of r = 0.07 (95% CI [0.04; 0.09]) for the effect of age-related discrimination on depressive symptoms. I am especially interested in detecting effect sizes of r >= 0.1.

Chang, E.-S., Kannoth, S., Levy, S., Wang, S.-Y., Lee, J. E., & Levy, B. R. (2020). Global reach of ageism on older persons’ health: A systematic review. PLOS ONE, 15(1), e0220857. https://doi.org/10.1371/journal.pone.0220857

Statistical power

A power analysis was performed using the pwrRICLPM package (Mulder, 2023). A significance level of alpha=0.05 and a sample size of N=3000 were defined.

The power to detect an effect of 0.1 in the cross-lagged parameters was estimated to be 83.8%. The power to detect an effect of 0.1 in the correlation between the random intercepts was estimated to be 91.2%.

This is an acceptable power.

Using a more conservative power analysis with the effect size of 0.07, the current analysis would have a rather low power with alpha=0.05 and N=3000:

The power to detect an effect of 0.07 in the cross-lagged parameters was estimated to be 55.7%. The power to detect an effect of 0.07 in the correlation between the random intercepts was estimated to be 60.9%.

The code for the power analysis can be found in the OSF directory.

Jeroen D. Mulder (2023) Power Analysis for the Random Intercept Cross-Lagged Panel Model Using the powRICLPM R-Package, Structural Equation Modeling: A Multidisciplinary Journal, 30:4, 645-658, DOI: 10.1080/10705511.2022.2122467

Inference criteria

For all model comparisons (factor structure of CES-D; factorial invariance across time or moderator): ΔCFI >= .01 as criterion for significant difference in model fit

For testing parameters in RI-CLPM: p<.05 (H1, H2, H3)
Each p-value for a parameter in the RI-CLPM is based on robust estimation as implemented in the ‘MLR’ estimator in lavaan.

For testing moderation of parameters in LSEM: p<.05 (H4, H5)
The p-values in the LSEM analysis are based on bootstrapping and are used to test the null hypothesis that the MAD of the moderated parameter equals zero in the population.

As stated in the predictions, any hypotheses regarding the cross-lagged parameters will only be accepted if the inference criteria for both parameters are met. Otherwise, the hypothesis will be rejected.

The moderation hypotheses will only be fully accepted, if the moderation is significant for the correlation between RIs and both cross-lagged parameters from discrimination to depressive symptoms. If the moderating effect will be significant for either only the correlation between RIs or instead for both cross-lagged parameters, the hypothesis will be partly rejected as the difference in moderation on the between vs. within-subject level is a valuable finding, but not predicted by the hypothesis.

Assumption Violation/Model Non-Convergence

Model Non-Convergence

RI-CLPM:

If any models do not converge due to the 2-item factor 'anhedonia', the factor will be replaced by the composite (mean) score of these two items instead. In the CFA, this step will be preceded by removing the covariances between error terms across measurement occasions.

LSEM:

Adjustments of range of focal points:
If the effective sample size at the extreme points is below n=600 or effective moderator value Δ<0.05 from the next focal point, the range will be limited by 0.2 on both sides.

Adjustments of bandwidth parameter:
If the LSEM analysis does not converge after reducing the range of focal points by 0.2 on each side (or 0.4 in the case of skewness), we will increase the effective sample size by increasing the bandwidth parameter h from h=2 to h=2.5 (and if the issue remains to h=3).

Reliability and Robustness Testing

Normality will be assessed both on the level of single indicators and on a multivariate level. To correct for bias in test statistics and standard errors (and an associated increase of false-positive findings) due to violations of normality, a robust estimator will be used in the analyses regarding H1, H2 and H3. The LSEM analyses cannot be performed with a robust estimation, but bootstrapping (2000 samples) will be used to infer statistical significance of moderation effects.

As described above, we will test for weak and strong measurement invariance both across measurement occasions and across moderator levels. In the following analyses, loadings and intercepts of CES-D items will be constrained accordingly.

Exploratory analysis

In case that hypotheses H2 and H3 are both accepted, we might perform an exploratory test for causal dominance in the relationship between age-related discrimination and depressive symptoms, as described in Sukpan & Kuiper (2023).

Chuenjai Sukpan & Rebecca M. Kuiper (2023) How to Evaluate Causal Dominance Hypotheses in Lagged Effects Models, Structural Equation Modeling: A Multidisciplinary Journal, DOI: 10.1080/10705511.2023.2265065