Koukounari, Artemis; Copas, Andrew J; Pickles, Andrew; (2018) A latent variable modelling approach for the pooled analysis of individual participant data on the association between depression and chlamydia infection in adolescence and young adulthood in the UK. Journal of the Royal Statistical Society: Series A (Statistics in Society). DOI: https://doi.org/10.1111/rssa.12387

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Supplementary Information

A1: LCA for Chlamydia infection

Table A1: Bayesian Information criteria and number of parameters for 4 different LCA models

<table>
<thead>
<tr>
<th>Model</th>
<th>$R$</th>
<th>$BIC$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>31443.459</td>
</tr>
<tr>
<td>2</td>
<td>19</td>
<td>31429.606</td>
</tr>
<tr>
<td>3</td>
<td>23</td>
<td>38738.948</td>
</tr>
<tr>
<td>4</td>
<td>21</td>
<td>34530.312</td>
</tr>
</tbody>
</table>

Model 1 considered prefixed item response probabilities for the Chlamydia test and allowed for estimation of item response probabilities for the following items: number of heterosexual/homosexual partners without a condom last year, any overlap between partners and number of partners in lifetime. Model 1 assumed measurement invariance for all items.

Model 2 considered prefixed item response probabilities for the Chlamydia test and allowed for estimation of item response probabilities for the same three items as Model 1. It also allowed for the item response probabilities to vary by gender for the following 2 items: number of heterosexual/homosexual partners without a condom last year and any overlap between partners.

Model 3 considered prefixed item response probabilities for the Chlamydia test and allowed for estimation of item response probabilities for the same three items as Models 1 and 2 as well as for any STI symptoms, and attendance of an STI clinic. It also allowed for the item response probabilities to vary by gender for the following 2 items: number of heterosexual/homosexual partners without a condom last year and any overlap between partners.

Model 4 is as Model 3 but excluding estimation of item response probabilities for item: attendance of an STI clinic.

A2: Logit values – generated during LCA and used at the last stage of analysis

During the LCA estimation and using the latent class posterior distribution, the most likely class variable $N$ is created as a nominal variable. This $N$ variable as derived during Step 1 is later on specified as a nominal indicator of the latent class variable $C$ (i.e. during Step 4) with uncertainty rates prefixed at the probabilities obtained during the LCA estimation. More specifically, during Step 4 we will regress the $C$ on the growth parameters of depression – as described in the manuscript and at logits as indicated below in Table A2. In this way the measurement error in the most likely class variable $N$ is taken into account during Step 4. This table contains results from the Mplus output if B1 code below is run.

Table A2. Mplus output, from LCA, which will be used later

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.974</td>
<td>0.000</td>
</tr>
<tr>
<td>2</td>
<td>-0.676</td>
<td>0.000</td>
</tr>
</tbody>
</table>
A3: Sensitivity Analyses

A3.1 Evaluation of the quality of obtaining precalibration parameters from the selected IRT model described in Section 3.2 of the actual paper

To evaluate the quality of obtaining precalibration parameters from the selected IRT model as described in Section 3.2, we cross-validated those with a new randomly selected calibration sample from the 2 studies -the age distribution of which follows in the Table below.

Table A.3 Number of participants in a new randomly selected calibration sample per study and age

<table>
<thead>
<tr>
<th>STUDY</th>
<th>10</th>
<th>12</th>
<th>13</th>
<th>15</th>
<th>16</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALSPAC N (%)</td>
<td>1092</td>
<td>891</td>
<td>688</td>
<td>888</td>
<td>818</td>
<td>911</td>
<td>390</td>
<td>391</td>
<td>370</td>
<td>404</td>
<td>410</td>
<td>379</td>
<td>7406</td>
</tr>
<tr>
<td>NATAL. N (%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>182 (20.02)</td>
<td>632 (71.81)</td>
<td>450 (51.85)</td>
<td>190 (100)</td>
<td>191 (100)</td>
<td>330 (100)</td>
<td>404 (100)</td>
<td>410 (100)</td>
<td>373 (100)</td>
<td>3607</td>
</tr>
<tr>
<td>Total</td>
<td>1092</td>
<td>891</td>
<td>688</td>
<td>888</td>
<td>818</td>
<td>911</td>
<td>390</td>
<td>391</td>
<td>370</td>
<td>404</td>
<td>410</td>
<td>379</td>
<td>7406</td>
</tr>
</tbody>
</table>

From this new calibration sample and the same model as described in section 3.2, results follow in the table below. Such results should be compared with results displayed in Table 4 of the actual paper. There are not big differences in the displayed coefficients from the same IRT model fitted to the different pre-calibration samples. Such coefficients would then be fixed for common item parameters in the longitudinal IRT equating models linked to second order Latent Growth Curve models as described in Section 3.3 of the actual paper. Thus, the harmonized depression scores deriving from these longitudinal IRT equating models, would not change dramatically either, which strengthens the validity of our findings from these models.

Table A.4 IRT model pre-calibration parameters of equating depression scores from both studies -n=7406

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Factor Loading (SE)</th>
<th>Standardized Factor Loading (SE)</th>
<th>Threshold (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Young person has not enjoyed anything in the last two weeks</td>
<td>1.000 (0.000)</td>
<td>0.765 (0.010)</td>
<td>7.924 (0.569)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10.711 (0.587)</td>
</tr>
<tr>
<td>2. Young person has felt unhappy/miserable in the last two weeks</td>
<td>1.090 (0.049)</td>
<td>0.803 (0.011)</td>
<td>2.742 (0.597)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6.524 (0.613)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-2.660 (0.113)</td>
</tr>
<tr>
<td>Study covariate effect (DIF)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Young person has felt so tired they sat around and did nothing in the last two weeks</td>
<td>0.498 (0.027)</td>
<td>0.509 (0.018)</td>
<td>2.793 (0.299)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.444 (0.314)</td>
</tr>
<tr>
<td>4. Young person has felt very restless in the last two weeks</td>
<td>0.445 (0.026)</td>
<td>0.467 (0.018)</td>
<td>2.434 (0.270)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.062 (0.284)</td>
</tr>
<tr>
<td></td>
<td>Statement</td>
<td>Estimate</td>
<td>SE</td>
</tr>
<tr>
<td>---</td>
<td>---------------------------------------------------------------------------</td>
<td>----------</td>
<td>-----</td>
</tr>
<tr>
<td>5</td>
<td>Young person felt they were no good anymore in the last two weeks</td>
<td>1.808</td>
<td>0.094</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Young person has cried a lot in the last two weeks</td>
<td>0.963</td>
<td>0.049</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Young person has found it hard to think properly/concentrate in the last two weeks</td>
<td>0.683</td>
<td>0.034</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Young person has hated themselves in the last two weeks</td>
<td>1.732</td>
<td>0.093</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Young person has felt they were a bad person in the last two weeks</td>
<td>1.017</td>
<td>0.053</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Young person has felt lonely in the last two weeks</td>
<td>1.198</td>
<td>0.057</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Young person has felt nobody really loved them in the last two weeks</td>
<td>1.421</td>
<td>0.074</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Young person thought they could never be as good as other kids in the last two weeks</td>
<td>1.155</td>
<td>0.056</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Young person has felt they did everything wrong in the last two weeks</td>
<td>1.416</td>
<td>0.072</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Young person has been having fun in the last two weeks</td>
<td>-0.535</td>
<td>0.034</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Young person has felt happy in the last two weeks</td>
<td>-0.550</td>
<td>0.033</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Young person has enjoyed doing lots of things in the last two weeks</td>
<td>-0.495</td>
<td>0.031</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Factor mean/Covariate effect**

<table>
<thead>
<tr>
<th>Study membership (reference category: ALSPAC)</th>
<th>Estimate (SE)</th>
<th>Standardized Estimate (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5.940 (1.107)</td>
<td>1.378 (0.255)</td>
</tr>
</tbody>
</table>
To test the validity for an association between trajectories before age 16 and Chlamydia infection, from the harmonization effort among the two studies, we explored this relationship with ALSPAC data only. More precisely, we have fitted a latent growth model (LGM) with intercept being at 10 years old and slope representing changes in MFQ scores between ages 10-16. We have subsequently saved these growth factor scores for each person (i.e. the intercept and slope) predicted from this model. We then fit a logistic regression model where the dependent variable is just the binary outcome of the original ALSPAC urine test (with 0: uninfected and 1: infected) and covariates are the growth factor scores as described above. We have also tried to fit an LGM where the intercept was age 16 and slope was representing the changes between 10-16 but the result was that the model covariance matrix was not positive definite and factor scores could not be computed from this model. Despite this computational challenge the table below shows still a positive association between the changes of MFQ scores during 10-16 years and an increased likelihood to being infected with Chlamydia at the approximate age of 17 years old (OR=2.054).

Table A.5 Logits and Odds Ratios for the Effects of Growth Factors of depression MFQ scores (i.e. Intercept at 10 years old and Slope representing changes between ages 10 – 16 years old derived from a Latent Growth Model) on Chlamydia infection as determined by the urine test in the ALSPAC data (n=2776)

<table>
<thead>
<tr>
<th>Effect</th>
<th>Logit (SE)</th>
<th>p-value</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (at 10 years old)</td>
<td>-2.353 (0.169)</td>
<td>&lt;0.001</td>
<td>0.095</td>
</tr>
<tr>
<td>Slope (changes during ages 10-16)</td>
<td>0.720 (0.063)</td>
<td>&lt;0.001</td>
<td>2.054</td>
</tr>
</tbody>
</table>

OR: Odds Ratio
Appendix Part B - Mplus scripts

B1: Step 1 - Mplus script of LCA for Chlamydia infection

Data: File is ALLCHL_OCTN.DAT;

Variable: Names are

TEST STISYM NOCOND AGEN SEX ID OVRPN NNUMPT STICLN RACE CONDN NNEWP NNUMPPLY STUDY EARSEXN;

IDVARIABLE IS ID;

USEVARIABLES

TEST NOCOND OVRPN NNUMPT SEX;

CATEGORICAL = TEST NOCOND OVRPN NNUMPT;

! TEST: is the biological Chlamydia test; NOCOND is the number of heterosexual/ homosexual partners without a condom last year, OVRPN is any overlap between partners and NNUMPT is the number of partners in lifetime

MISSING ARE ALL (-9); CLASSES = c (2);

ANALYSIS: TYPE = MIXTURE MISSING; STARTS=100 10; PROCESS=2 (STARTS); COVERAGE=0.05;

MODEL:

%OVERALL%

! Partial measurement invariance for males and females and the questions corresponding to number of partners without a condom in the last year and any overlap between partners

NOCOND OVRPN ON SEX;

%C#1%

! Below we fix the first threshold of the biological Chlamydia test to be 15. This will yield a probability of 1 for observed negatives and thus through this way we fix the specificity of this test to be 1 or 100 %

[Test$1@15];

! Partial measurement invariance for males and females and the questions corresponding to number of partners without a condom in the last year and any overlap between partners

NOCOND OVRPN ON SEX;

%C#2%

! Below we fix the first threshold of the biological Chlamydia test to be -15. This will yield a probability of 0 for observed negatives and its complementary probability of 1 for observed positives; through this approach we fix the sensitivity of this test to be 1 or 100 %

[Test$1@-15];
! Partial measurement invariance for males and females and the questions corresponding to number of partners without a condom in the last year and any overlap between partners

NOCOND OVRPN ON SEX;

SAVEDATA: FILE IS ALLCHLPP_OCTN.TXT;

! Saving class probabilities and most likely latent class membership information (this is the nominal variable N in Asparouhov and Muthén 2014 paper and as it appears in the corresponding Mplus code of Appendix B4, later on)

SAVE=CPROB;
B2: Mplus script of IRT graded response model

DATA: FILE IS DEPMNLFA2.DAT;

VARIABLE: NAMES ARE

STUD AGE SEX NOTEN MISUN TIRED RESTLS NOGOOD
CRIED CONCEN HATED BAD LONEL NOLOV NVRGOD
WRONG FUN HAPPY DOING AGE2 AGESTUD;

CATEGORICAL ARE NOTEN MISUN TIRED RESTLS NOGOOD
CRIED CONCEN HATED BAD LONEL NOLOV NVRGOD
WRONG FUN HAPPY DOING;

! NOTEN: Young person has not enjoyed anything in the last two weeks
MISUN: Young person has felt unhappy/miserable in the last two weeks
TIRED: Young person has felt so tired they sat around and did nothing in the last two weeks
RESTLS: Young person has felt very restless in the last two weeks
NOGOOD: Young person felt they were no good anymore in the last two weeks
CRIED: Young person has cried a lot in the last two weeks
CONCEN: Young person has found it hard to think properly/concentrate in the last two weeks
HATED: Young person has hated themselves in the last two weeks
BAD: Young person has felt they were a bad person in the last two weeks
LONEL: Young person has felt lonely in the last two weeks
NOLOV: Young person has felt nobody really loved them in the last two weeks
NVRGOD: Young person thought they could never be as good as other kids in the last two weeks
WRONG: Young person has felt they did everything wrong in the last two weeks
FUN: Young person has been having fun in the last two weeks
HAPPY: Young person has felt happy in the last two weeks
DOING: Young person has enjoyed doing lots of things in the last two weeks

MISSING ARE ALL (-9);

ANALYSIS:

ESTIMATOR=ml;
ALGORITHM=integration;

MODEL: DEP BY NOTEN MISUN TIRED RESTLS NOGOOD
CRIED CONCEN HATED BAD LONEL NOLOV NVRGOD
WRONG FUN HAPPY DOING;

! DEP is the factor DEPRESSION
DEP ON AGE AGE2 STUD AGESTUD SEX;

! AGE2 IS THE SQUARED TERM FOR AGE
AGESTUD IS THE INTERACTION TERM BETWEEN AGE AND STUDY

[DEP@0];
NOTEN ON STUD@0;
MISUN ON STUD;
NOTEN-DOING ON AGE @0;
NOTEN-DOING ON AGE2@0;
NOTEN-DOING ON AGESTUD@;
NOTEN-DOING ON SEX @0;
NOTENJ16 ON STUD;

OUTPUT: standardized TECH2;
SAVEDATA: FILE IS STEP2FSJUL2.DAT;SAVE = FSCORES;
B3: Mplus script of IRT growth model of longitudinal and cross-sectional depression scores

TITLE: IRT FOR ALL

DATA: FILE IS

IRTALLCOVS.dat;

VARIABLE: NAMES ARE ID MISUN18 NOTENJ18 TIRED18 RESTLS18 NOGOOD18 CRIED18

CONCEN18 HATED18 BAD18 LONEL18 NOLOV18 NVRGOD18 WRONG18
MISUN16 FUN16 NOTENJ16 TIRED16 RESTLS16 NOGOOD16 CRIED16
HAPPY16 CONCEN16 HATED16 DOING16 BAD16 LONEL16 NOLOV16
NVRGOD16 WRONG16 MISUN13 FUN13 NOTENJ13 TIRED13 RESTLS13
NOGOOD13 CRIED13 HAPPY13 CONCEN13 HATED13 DOING13 BAD13
LONEL13 NOLOV13 NVRGOD13 WRONG13 MISUN12 FUN12 NOTENJ12
TIRED12 RESTLS12 NOGOOD12 CRIED12 HAPPY12 CONCEN12 HATED12
DOING12 BAD12 LONEL12 NOLOV12 NVRGOD12 WRONG12 SEX
MISUN17 FUN17 NOTENJ17 TIRED17 RESTLS17 NOGOOD17 CRIED17
HAPPY17 CONCEN17 HATED17 DOING17 BAD17 LONEL17 NOLOV17
NVRGOD17 WRONG17 MISUN10 FUN10 NOTENJ10 TIRED10 RESTLS10
NOGOOD10 CRIED10 HAPPY10 CONCEN10 HATED10 DOING10 BAD10
LONEL10 NOLOV10 NVRGOD10 WRONG10 STUD NOTENJ19 NOTENJ20
NOTENJ21 NOTENJ22 NOTENJ23 NOTENJ24 MISUN19 MISUN20
MISUN21 MISUN22 MISUN23 MISUN24;

!USEVARIABLES  ;

CATEGORICAL ARE MISUN18 NOTENJ18 TIRED18 RESTLS18 NOGOOD18
CRIED18 CONCEN18 HATED18 BAD18 LONEL18 NOLOV18
NVRGOD18 WRONG18
MISUN16 FUN16 NOTENJ16 TIRED16
RESTLS16 NOGOOD16 CRIED16 HAPPY16 CONCEN16
HATED16 DOING16 BAD16 LONEL16 NOLOV16
NVRGOD16 WRONG16
MISUN13 FUN13 NOTENJ13 TIRED13
RESTLS13 NOGOOD13 CRIED13 HAPPY13 CONCEN13 HATED13
DOING13 BAD13 LONEL13 NOLOV13 NVRGOD13 WRONG13
MISUN12 FUN12 NOTENJ12 TIRED12 RESTLS12 NOGOOD12 CRIED12 HAPPY12
CONCEN12 HATED12 DOING12 BAD12 LONEL12 NOLOV12 NVRGOD12 WRONG12
MISUN17 FUN17 NOTENJ17 TIRED17 RESTLS17 NOGOOD17
CRIED17 HAPPY17 CONCEN17 HATED17 DOING17 BAD17 LONEL17
NOLOV17 NVRGOD17 WRONG17 MISUN10 FUN10 NOTENJ10 TIRED10 RESTLS10
NOGOOD10 CRIED10 HAPPY10 CONCEN10 HATED10 DOING10 BAD10 LONEL10
NOLOV10 NVRGOD10 WRONG10 NOTENJ19 NOTENJ20 NOTENJ21 NOTENJ22 NOTENJ23
NOTENJ24 MISUN19 MISUN20 MISUN21 MISUN22 MISUN23 MISUN24;

! the variable names are the same as in B2, the numbers at the end represent the ages for which
these measurements were taken
IDVARIABLE IS ID;
MISSING ARE ALL (-9);

ANALYSIS: ESTIMATOR IS MLF;
process=8;
LINK IS LOGIT;
INTEGRATION = MONTECARLO;
MITERATIONS = 700;

!The values at which loadings and thresholds are fixed below can be found at Table 3 in the actual
paper
MODEL:
F10 BY NOTENJ10@1 MISUN10@1.114 FUN10@-0.516 TIRED10@0.535
       RESTLS10@0.459 NOGOOD10@1.818 CRIED10@0.944 HAPPY10@-0.566
CONCEN@0.635 HATED@1.679 DOING@-0.525 BAD@1.026
LONEL@1.277 NOLOV@1.407 NVRGOD@1.145 WRONG@1.392;

F12 BY NOTENJ@1 MISUN@1.114 FUN@-0.516 TIRED@0.535
RESTLS@0.459 NOGOOD@1.818 CRIED@0.944 HAPPY@-0.566
CONCEN@0.635 HATED@1.679 DOING@-0.525 BAD@1.026
LONEL@1.277 NOLOV@1.407 NVRGOD@1.145 WRONG@1.392;

F13 BY NOTENJ@1 MISUN@1.114 FUN@-0.516 TIRED@0.535
RESTLS@0.459 NOGOOD@1.818 CRIED@0.944 HAPPY@-0.566
CONCEN@0.635 HATED@1.679 DOING@-0.525 BAD@1.026
LONEL@1.277 NOLOV@1.407 NVRGOD@1.145 WRONG@1.392;

F16 BY NOTENJ@1 MISUN@1.114 FUN@-0.516 TIRED@0.535 RESTLS@0.459
NOGOOD@1.818 CRIED@0.944 HAPPY@-0.566 CONCEN@0.635
HATED@1.679 DOING@-0.525 BAD@1.026 LONEL@1.277
NOLOV@1.407 NVRGOD@1.145 WRONG@1.392;

F17 BY NOTENJ@1 MISUN@1.114 FUN@-0.516 TIRED@0.535
RESTLS@0.459 NOGOOD@1.818 CRIED@0.944
HAPPY@-0.566 CONCEN@0.635 HATED@1.679
DOING@-0.525 BAD@1.026 LONEL@1.277
NOLOV@1.407 NVRGOD@1.145 WRONG@1.392;

F18 BY NOTENJ@1 MISUN@1.114 TIRED@0.535 RESTLS@0.459
NOGOOD@1.818 CRIED@0.944 CONCEN@0.635 HATED@1.679
BAD@1.026 LONEL@1.277 NOLOV@1.407 NVRGOD@1.145
! F stand for the factors at the different ages

! Spacings of time, intercept at 16, 1st slope during ages 10-16, 2nd slope during ages 16-24

int slp1|F10@-1 F12@-1.2 F13@-1.3 F16@0 F17@0 F18@0 F19@0 F20@0 F21@0 F22@0 F23@0 F24@0;

int slp2|F10@0 F12@0 F13@0 F16@1 F17@2 F18@3 F19@4 F20@5 F21@6 F22@7 F23@8 F24@9;
[int*0];
[slp1*0.25];
[slp2*0.1];

int*.1 (vint);
slp1*.1 (vslp1);
slp2*.1 (vslp2);

F10*4.223 (vth)
F12*4.223 (vth)
F13*4.223 (vth)
F16*4.223 (vth)
F17-F24*4.223 (vth);

int WITH slp1;
int WITH slp2;
slp1 WITH slp2;

!Covariate effects on growth factors: intercept, slope1 and slope2
int on SEX;
int on STUD;
slp1 on SEX;
!slp1 on STUD;
slp2 on SEX;
slp2 on STUD;
[CONCEN10$1@2.935];[CONCEN12$1@2.935];[CONCEN13$1@2.935];[CONCEN16$1@2.935];
[CONCEN17$1@2.935];[CONCEN18$1@2.935];

[CONCEN10$2@5.968];[CONCEN12$2@5.968];[CONCEN13$2@5.968];[CONCEN16$2@5.968];
[CONCEN17$2@5.968];[CONCEN18$2@5.968];

[HATED10$1@12.190];[HATED12$1@12.190];[HATED13$1@12.190];[HATED16$1@12.190];
[HATED17$1@12.190];[HATED18$1@12.190];

[HATED10$2@14.936];[HATED12$2@14.936];[HATED13$2@14.936];[HATED16$2@14.936];
[HATED17$2@14.936];[HATED18$2@14.936];

[BAD10$1@7.619];[BAD12$1@7.619];[BAD13$1@7.619];[BAD16$1@7.619];[BAD17$1@7.619];
[BAD18$1@7.619];

[BAD10$2@10.281];[BAD12$2@10.281];[BAD13$2@10.281];[BAD16$2@10.281];
[BAD17$2@10.281];[BAD18$2@10.281];

[LONEL10$1@7.654];[LONEL12$1@7.654];[LONEL13$1@7.654];[LONEL16$1@7.654];
[LONEL17$1@7.654];[LONEL18$1@7.654];

[LONEL10$2@10.932];[LONEL12$2@10.932];[LONEL13$2@10.932];[LONEL16$2@10.932];
[LONEL17$2@10.932];[LONEL18$2@10.932];

[NOLOV10$1@10.312];[NOLOV12$1@10.312];[NOLOV13$1@10.312];[NOLOV16$1@10.312];
[NOLOV17$1@10.312];[NOLOV18$1@10.312];

[NOLOV10$2@12.972];[NOLOV12$2@12.972];[NOLOV13$2@12.972];[NOLOV16$2@12.972];
[NOLOV17$2@12.972];[NOLOV18$2@12.972];

[NVRGOD10$1@7.644];[NVRGOD12$1@7.644];[NVRGOD13$1@7.644];[NVRGOD16$1@7.644];
[NVRGOD17$1@7.644];[NVRGOD18$1@7.644];

[NVRGOD10$2@10.338];[NVRGOD12$2@10.338];[NVRGOD13$2@10.338];
[NVRGOD16$2@10.338];[NVRGOD17$2@10.338];[NVRGOD18$2@10.338];

[WRONG10$1@9.800];[WRONG12$1@9.800];[WRONG13$1@9.800];[WRONG16$1@9.800];
[WRONG17$1@9.800];[WRONG18$1@9.800];

[WRONG10$2@12.961];[WRONG12$2@12.961];[WRONG13$2@12.961];[WRONG16$2@12.961];
[WRONG17$2@12.961];[WRONG18$2@12.961];
MODEL CONSTRAINT:

vth > 0; ! residual variance of theta
vslp1 > 0; ! variance of the slope
vslp2 > 0;
vint > 0; ! variance of the intercept

OUTPUT: TECH1, TECH4, TECH10;
NOCHISQUARE;
SAVEDATA: FILE IS
FS_IRTALL16_WITHSTUDJUL.DAT;
SAVE = FSCORES;
**B4: Mplus script of LCA with covariates; associations between Chlamydia infection and depression trajectories**

DATA: FILE IS ALLDEPCHLAUG.DAT;

VARIABLE: NAMES = INT SLP1 SLP2 SEX STUD ID N;

USEVARIABLES= INT SLP1 SLP2 STUD N;

CLASSES=C(2);

NOMINAL=N;

MISSING ARE ALL(-9);

ANALYSIS: TYPE  = MIXTURE MISSING; STARTS=0;

MODEL: %OVERALL%

  C ON INT SLP1 SLP2 STUD;

!INT SLP1 SLP2 have been saved in the previous step-these are the growth parameters from the piecewise linear model

!N is a variable indicating at which latent class each person had been assigned during the LCA fitting

!The values below were included in Table A2 in this Appendix

  %c#1%

  [n#1@5.974];

  %c#2%

  [n#1@-0.676];
Appendix Part C-Path diagrams for fitted models

C1. Latent Class Analysis for Chlamydia Infection

In this Figure and all figures representing fitted latent variable models, squares indicate observed variables while circles indicate latent variables. Gender arrows indicate partial measurement invariance for the questions included in this model. This model is Model 2 in Table A1 in this Appendix. C stands for a categorical latent variable as described in the paper.

C2. IRT model to obtain pre-calibration parameters for equating depression scores from both studies

Study arrows indicate partial measurement invariance for the questions included in this model. MFQ2 and PHQ2 are the harmonized items as described in the paper. The depression factor scores here are estimated though 16 items from the Mood and Feelings Questionnaire from ALSPAC and 2 items from Natsal-3 fitted to a calibration sample as described in the paper. This model (and its obtained
pre-calibration parameters used in Step 4 can be found in Table 3 in the paper. \( \theta \) stands for the IRT factor score although we do not use this further, just the obtained pre-calibration parameters as also shown in code B3 here in the Appendix.

**C3. Latent Growth Curve second-order IRT model of depression scores**

In this second order IRT growth model a piecewise linear model is shown at the second level while IRT \( \theta \) scores are estimated at the first level. \( \pi_0 \) denotes the intercept of the IRT \( \theta \) scores defined at 16 years old; \( \pi_1 \) denotes the slope of the IRT \( \theta \) scores covering 10-16 years old; \( \pi_2 \) denotes the slope of the IRT scores covering 16-24 years old. MFQ indicate the observed measures (16 items) at ages 10-18 from ALSPAC study and the Mood and Feelings Questionnaire. PHQ indicate the observed measures (2 items) at ages 16-24 from NATSAL-3 study and the Patient Health Questionnaire.

**C4. LCA with covariates; associations between Chlamydia infection and depression trajectories**

Fixed according to misclassification

estimated
\( \pi_0, \pi_1 \) and \( \pi_2 \) denote growth parameters of the piecewise linear model as described before. The \( n \) variable was derived during LCA estimation and was specified as a nominal indicator of the latent class variable \( c \) during the last stage of analysis with uncertainty rates prefixed at the probabilities obtained also during the LCA estimation.