Tracking the determinants of change in health and well-being among older adults: A cross-lagged panel model using data from the Irish Longitudinal Study on Ageing

Jonathan Pratschke

jpratschke@unisa.it

Department of Economics and Statistics

University of Salerno

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1 Introduction

Access to high-quality data on health and well-being in Ireland has improved in recent years as a result of the introduction of important new longitudinal studies, including the Growing Up in Ireland Study (GUI) and the Irish Longitudinal Study on Ageing (TILDA). These surveys are destined to have a considerable impact on policy in coming years. As a result of their relatively large samples and panel design, they permit the estimation of more complex statistical models than was previously possible. As additional waves of data become available, they appear destined to provide crucial insights into the dynamics of health and well-being across the life course.

In this paper, we explore the relationship between health and well-being amongst older adults as these characteristics evolve over time, including the influence of a range of explanatory variables. We use the first two waves of TILDA to assess whether physical health and cognitive functioning, measured at the beginning of the study, influence socio-emotional well-being after two years, and vice versa. We include several explanatory variables with a view to controlling for other aspects of respondents' lives and identifying factors which may influence health and well-being. We use Structural Equation Modelling to ensure that the complex inter-temporal relationships between these variables are captured in a coherent and plausible way, and we use advanced missing data estimation techniques to control for the distinctive patterns of non-response that characterise this dataset.

TILDA is a large representative study based on face-to-face interviews with adults aged 50 years and over and their partners/spouses in private households in Ireland (Kenny et al. 2010). Survey questionnaires and a range of physical, cognitive and biological measurements

form part of the data collection protocol. The study relies on a two-stage sampling design, and households were initially selected from within a stratified sample of clusters with probability of selection proportional to the estimated number of persons aged 50 or over in each cluster. All persons aged 50 or over in the selected households, as well as their spouses or partners, could participate in the study. Out of a total of 8,163 respondents aged over 50 at the first wave (2009-11), 7,207 people participated in the second wave (2012-13). A third wave of data collection (with follow-up health assessment) began in 2014, and the present analysis will be extended to include this wave as soon as the data are released (late 2017). The design of the survey and instruments used in TILDA was informed by the aim of making comparisons with other national longitudinal studies, which lends further relevance to this case.

2 Missing data

The dataset used to estimate the model comprises 6,098 cases. Where a small number of responses were missing for individual items, we used the EM algorithm to estimate these in SPSS Statistics Version 20. The scale scores were then calculated in the normal way before estimating the final model. Table 1 below compares the indicators available in the Anonymised Microdata File (AMF) for the first two waves, with a view to identifying comparable indicators for a longitudinal analysis. Table 2 provides summary data on the variables that were selected for the model and Table 3 describes how missing data were treated for each variable.

Table 1: Key Variables from Waves 1 & 2 of TILDA

Variable	Wave 1	Wave 2
Lives alone	Respondent currently lives alone [SOCliveswith3 (1=1;2=0;3=0)]	"Are you ... living as a single person? (response value 3)" [cm004] + "Excluding yourself, does anyone else live in this household?" [cm007] *Problem: cm004 and cm007 are included in Wave 2 but not in AMF 2.1*
Age	Age in years, divided by 10 (age/10)	
Gender	Gender is male [GENDER (1=1;2=0)]	
Relationship quality	Mean rating of quality of relationship with partner, children, other relatives, friends [mean(((sum(SCQqrspou1_mva, SCQqrspou2_mva, SCQqrspou3_mva, SCQqrspou4_mva, SCQqrspou5_mva, SCQqrspou6_mva, SCQqrspou7_mva)-7)/21), ((sum(SCQqrchld1_mva, SCQqrchld2_mva, SCQqrchld3_mva, SCQqrchld4_mva, SCQqrchld5_mva, SCQqrchld6_mva, SCQqrchld7_mva)-7)/21), ((sum(SCQqrchld9_mva, SCQqrchld10_mva, SCQqrchld11_mva, SCQqrchld12_mva, SCQqrchld13_mva, SCQqrchld14_mva, SCQqrchld15_mva)-7)/21), ((sum(SCQqrfrend1_mva, SCQqrfrend2_mva, SCQqrfrend3_mva, SCQqrfrend4_mva, SCQqrfrend5_mva, SCQqrfrend6_mva, SCQqrfrend7_mva)-7)/21))]	*Problem: Relationship questions are included in Wave 2 but not in AMF 2.1* *Solution: Use Wave 1 variable only*
Close friends/relatives	Number of close relatives and friends divided by 10 [SOCrelFriends, which is based on cn002 to cn004]	"How many of your children do you feel very close to?" [cn002] + "In general, (apart from your children), how many (other) relatives do you have that you feel close to? (People you feel at ease with, can talk to about private matters, and can call on for help)?" [cn003] + "In general, how many close friends do you have? (People that you feel at ease with, can talk to about private matters, and can call on for help)" [cn004], divided by 10 *Problem: cn002 in Wave 2 but not in AMF 2.1* *Solution: Use Wave 1 variable only*

Variable	Wave 1	Wave 2
Smokes	Current or recent smoker (i.e. quit less than 1 year ago) [BEHsmoker=2 or (age-bh003<=1 & bh004>=10)]	Current or recent smoker (i.e. quit less than 1 year ago) [bh002=1 or (age-bh003<=1 & bh004>=10)] *Problem: bh001 to bh004 included in Wave 2 but not in AMF2.1* *Solution: Use Wave 1 variable only*
Alcohol problem	4-item CAGE scale [BEHcage (sysmis=0); (0=0);(1=0);(2=1);(3=1);(4=1)]	*Problem: CAGE scale not in Wave 2* *Solution: Use Wave 1 variable only*
Socio-economic position		
Third-level	Respondent has a third-level qualification (university/college) [dm001=5 or dm001=6 or dm001=7]	*Problem: dm001 included in Wave 2 but not in AMF2.1* *Solution: Use Wave 1 variable only*
Income	Gross household disposable equivalent income [ln((INCASSETSweeklyHHdisy capped at 20000)+10)]	*Problem: Relevant variables included in Wave 2 but not in AMF2.1* *Solution: Use Wave 1 variable only*
High occupation	Professional, technical-managerial employee or large farmer [SESsocial_Class=1 or SESsocial_Class=2 or (SESsocial_Class=8 & we302>=100) or (SESsocial_Class=8 & we307>=100)]	*Problem: Variables not included in Wave 2* *Solution: Use Wave 1 variable only*
Cognitive functioning		
MMSE	30-item Mini Mental State Examination, rescaled 0-1 [COGmmse_ha/30]	30-item Mini Mental State Examination, rescaled 0-1 [mmsescr_capi/30]
Memory	Mean score for three memory tests, rescaled 0-1 [((COGimmediaterecall1+COGimmediaterecall2+COGdelayedrecall)/30] [NOTE: there is an error in the datafile, as there are no 0 values for these memory tests – 0 appears to have been recoded as missing]	Mean score for three memory tests, rescaled 0-1 [((ph117 or ph119)+(ph118 or ph120)+(ph712 or ph713))/30] [NOTE: many cases are coded -1, which presumably means “not applicable”, although this is not indicated as a valid value in the documentation]
Executive function	“Now I would like you to name as many different animals as you can think of”, divided by 10 [ph125/10]	“Now I would like you to name as many different animals as you can think of”, divided by 10 [ph125/10]
Physical Health		
Impairments	Number of impairments [DISimpairments]	Number of impairments [sum of fl001_01 to fl001_11, to a maximum of 5]

Variable	Wave 1	Wave 2
Self-rated health	"Would you say your health is... 1. excellent, 2. very good, 3. good, 4. fair, 5. poor?" [ph001]; "What about your emotional or mental health? Is it... 1. excellent, 2. very good, 3. good, 4. fair, 5. poor?" [ph002]	"Would you say your health is... 1. excellent, 2. very good, 3. good, 4. fair, 5. poor?" [ph001]; "What about your emotional or mental health? Is it... 1. excellent, 2. very good, 3. good, 4. fair, 5. poor?" [ph002]
LLTI	"Do you have any long-term health problems, illness, disability or infirmity?" [ph003]; "Does this illness or disability limit your activities in any way?" [ph004]	"Do you have any long-term health problems, illness, disability or infirmity?" [ph003]; "Does this illness or disability limit your activities in any way?" [ph004]
Pain	"Are you often troubled with pain?" [ph501; 1. yes, 5. no]; "How bad is the pain most of the time? Is it... 1. mild; 2. moderate, 3. severe" [ph502]; "Does the pain make it difficult for you to do your usual activities such as household chores or work?" [ph504; 1. yes, 5. no]; "Are you taking any medication to control the pain?" [ph505; 1. yes, 5. no]	"Are you often troubled with pain?" [ph501; 1. yes, 5. no]; "How bad is the pain most of the time? Is it... 1. mild; 2. moderate, 3. severe" [ph502]; "Does the pain make it difficult for you to do your usual activities such as household chores or work?" [ph504; 1. yes, 5. no]; "Are you taking any medication to control the pain?" [ph505; 1. yes, 5. no]
Active lifestyle		
Social involvement	Respondent is involved with clubs, groups or associations [SOCClubs]	Respondent is involved with clubs, groups or associations [cn001 (1=1);(2=0)]
Physical activity	Natural log of IPAQ metabolic equivalent minutes plus 100 [ln(IPAQmetminutes+100)]	Natural log of IPAQ metabolic equivalent minutes plus 100 [ln(ipaqmetminutes+100)]
Active participation	Frequency of: films, plays, concerts; classes/lectures; travel; work in home or garden; hobby; play cards/games; eat out; sport; visit or receive family/friends [(reverse coded): SCQsocact2+SCQsocact3+SCQsocact4+SCQsocact5+SCQsocact8+SCQsocact9+SCQsocact11+SCQsocact13)/56]	*Problem: SCQsocact1 to SCQsocact14 included in Wave 2 but not in AMF2.1* *Solution: Use Wave 1 variable only*
Socio-emotional well-being		
CESD	20-item CES Depression Scale, rescaled 0-1 [((sum(mh001 to mh0020))-20)/60; the following items are reverse coded: mh004 mh008 mh0012 mh0016]	MHcesd_capi/60
Loneliness	5-item UCLA Loneliness Scale, rescaled 0-1 [((sum(SCQlonelns1,SCQlonelns2,SCQlonelns3,SCQlonelns4,SCQlonelns5))-5)/10]	MHucla_loneliness/10

Variable	Wave 1	Wave 2
Life satisfaction	Single question item with 7-point response scale, rescaled 0-1 [((mh023 (1=7);(2=6);(3=5);(4=4);(5=3);(6=2); (7=1))-1)/6]	Single question item with 7-point response scale, rescaled 0-1 [((mh023 (1=7);(2=6);(3=5);(4=4);(5=3);(6=2);(7=1))-1)/6]
CASP	19-item CASP Scale, rescaled 0-1 [((sum(SCQcasp1 to SCQcasp19))-19)/57]; the following items are reverse coded: SCQcasp3 SCQcasp5 SCQcasp7 SCQcasp10 SCQcasp11 SCQcasp12 SCQcasp13 SCQcasp14 SCQcasp15 SCQcasp16 SCQcasp17 SCQcasp18 SCQcasp19	MHcasp19_total/57

Table 2: Variables Used in the Model, with Summary Data

Variable name	Description	Transformations	Measurement scale and summary data
Depression 1	CESD Depression Scale for Wave 1	Rescaled 0-1	Continuous variable Min: .00 Max: 0.88 Mean: .10 SD: .12
Depression 2	CESD Depression Scale for Wave 2	Rescaled 0-1	Continuous variable Min: .00 Max: 0.85 Mean: .09 SD: .11
Loneliness 1	UCLA Loneliness Scale for Wave 1	Rescaled 0-1	Continuous variable Min: .00 Max: 1.00 Mean: .19 SD: .22
Loneliness 2	UCLA Loneliness Scale for Wave 2	Rescaled 0-1	Continuous variable Min: .00 Max: 1.00 Mean: .19 SD: .22
Life Satisfaction 1	Life Satisfaction item for Wave 1	Rescaled 0-1	Continuous variable Min: .00 Max: 1.00 Mean: .85 SD: .19
Life Satisfaction 2	Life Satisfaction item for Wave 2	Rescaled 0-1	Continuous variable Min: .00 Max: 1.00 Mean: .85 SD: .20
Quality of Life 1	CASP Quality of Life Scale for Wave 1	Rescaled 0-1	Continuous variable Min: .18 Max: 1.00 Mean: .77 SD: .14
Quality of Life 2	CASP Quality of Life Scale for Wave 2	Rescaled 0-1	Continuous variable Min: .07 Max: .95 Mean: .72 SD: .13
MMSE 1	Mini Mental State Examination Score for Wave 1	Rescaled 0-1	Continuous variable Min: .47 Max: 1.00 Mean: .95 SD: .06
MMSE 2	Mini Mental State Examination Score for Wave 2	Rescaled 0-1	Continuous variable Min: .43 Max: 1.00 Mean: .95 SD: .07

Variable name	Description	Transformations	Measurement scale and summary data
Memory 1	Mean score on three memory tests for Wave 1	Rescaled 0-1	Continuous variable Min: .00 Max: 1.00 Mean: .65 SD: .65
Memory 2	Mean score on three memory tests for Wave 2	Rescaled 0-1	Continuous variable Min: .00 Max: 1.00 Mean: .66 SD: .66
Exec. function 1	Number of animals listed in 60 seconds for Wave 1	Rescaled by dividing by 10	Continuous variable Min: .00 Max: 5.00 Mean: 2.12 SD: .69
Exec. function 2	Number of animals listed in 60 seconds for Wave 2	Rescaled by dividing by 10	Continuous variable Min: .00 Max: 4.50 Mean: 1.93 SD: .61
Impairments 1	Number of functional impairments for Wave 1	Rescaled by dividing by 10	Continuous variable Min: .00 Max: 1.40 Mean: .21 SD: .26
Impairments 2	Number of functional impairments for Wave 2	Rescaled by dividing by 10	Continuous variable Min: .00 Max: 1.40 Mean: .23 SD: .27
LLTI 1	Limiting long-term illness for Wave 1	None	Dichotomous variable No: 62.1% Yes: 37.9%
LLTI 2	Limiting long-term illness for Wave 2	None	Dichotomous variable No: 57.7% Yes: 42.3%
Pain 1	Respondent experienced moderate or severe pain for Wave 1	None	Dichotomous variable No: 75.3% Yes: 24.7%
Pain 2	Respondent experiences moderate or severe pain for Wave 2	None	Dichotomous variable No: 75.5% Yes: 24.5%
Self-rated health 1	Self assessment of own health status for Wave 1	Rescaled 0-1	Continuous variable Min: .00 Max: 1.00 Mean: .59 SD: .27
Self-rated health 2	Self assessment of own health status for Wave 2	Rescaled 0-1	Continuous variable Min: .00 Max: 1.00 Mean: .61 SD: .25

Variable name	Description	Transformations	Measurement scale and summary data
Third-level qualification	Respondent has a third-level qualification	None	Dichotomous variable No: 67.8% Yes: 32.2%
High social class	Respondent is in higher social classes	None	Dichotomous variable No: 74.8% Yes: 25.2%
Income	Equivalent gross household income for respondent	Natural log of income + 10	Continuous variable Min: 2.34 Max: 9.90 Mean: 6.29 SD: .92
Gender	Gender of respondent	None	Dichotomous variable No: 54.5% Yes: 45.5%
Age	Age of respondent	Rescaled by dividing by 10	Continuous variable Min: 5.00 Max: 8.00 Mean: 6.32 SD: .89
Smokes	Respondent currently smokes (or stopped recently)	None	Dichotomous variable No: 82.6% Yes: 17.4%
Drinking problem	Respondent has a drinking problem	None	Dichotomous variable No: 88.0% Yes: 12.0%
Lives alone	Respondent lives alone	None	Dichotomous variable No: 79.3% Yes: 20.7%
Physical exercise	IPAQ score for physical activity	Natural log of met. minutes + 100	Continuous variable Min: 4.61 Max: 9.87 Mean: 7.36 SD: 1.32
Social participation	Social participation scale score	Rescaled 0-1	Continuous variable Min: 4.61 Max: 9.87 Mean: 7.32 SD: 1.30
Intimacy Scale	Intimate relations scale score	Rescaled 0-1	Continuous variable Min: .07 Max: 1.00 Mean: .79 SD: .13
Social network	Number of close friends and relatives	Rescaled by dividing by 10	Continuous variable Min: .00 Max: 2.50 Mean: 1.07 SD: .57

Table 3: Missing Data Procedures for Measures Included in the Analysis

Variable	Missing Wave 1	Missing Wave 2	Procedure
CESD Depression Scale	2-48 missing values on individual items	107 missing values on overall scale (individual items not included in AMF)	EM estimation
Loneliness Scale	108-138 missing values on individual items	1,214 missing values on overall scale (individual items not included in AMF)	EM estimation for Wave 1; FIML estimation within SEM model for Wave 2
Life Satisfaction	6 missing values	11 missing values	EM estimation
CASP Quality of Life Scale	104-324 missing values on each item	1,304-1,371- missing values for each sub-scale	EM estimation of items/sub-scales where possible; otherwise missing data handled using FIML in SEM
MMSE	1,536 missing values	No missing values	FIML estimation within SEM model
Memory	No missing values (Note: missing values were coded 0 for Wave 1 to correct an error in the data file)	47 missing values	EM estimation
Executive function	32 missing values	4 missing values	EM estimation
Impairments	No missing values	No missing values	No missing values
LLTI	5 missing values	4 missing values	Assumed to imply “no”
Pain	3-4 missing values	No missing values	Assumed to have no or mild pain
Self-rated health	1 missing value	No missing values	EM estimation
Third-level qualification	2 missing values	Only Wave 1 included in model	Assumed not to have a third-level qualification
Social class	667 missing values coded originally as “Don't know” or “Refused”	Only Wave 1 included in model	Assumed not to be in high social class
Income	3,755 missing values	Only Wave 1 included in model	FIML estimation within SEM model
Gender	No missing values	Only Wave 1 included in model	No missing values
Age	No missing values	Only Wave 1 included in model	No missing values

Variable	Missing Wave 1	Missing Wave 2	Procedure
Smokes	No missing values	Only Wave 1 included in model	No missing values
Drinking problem	155 missing values	Only Wave 1 included in model	Assumed not to have a drinking problem
Lives alone	No missing values	Only Wave 1 included in model	No missing values
Physical exercise	67 missing values	Only Wave 1 included in model	EM estimation
Social particip.	86-399 missing values	Only Wave 1 included in model	Assume “never” for these items
Intimacy Scale	Large number of missing values for respondents who do not have a spouse or children	Only Wave 1 included in model	EM estimation for no more than 3 items out of the 7 that compose the scale for spouse, child, other relatives, friends; overall scale is the mean
Social network	3 missing values	Only Wave 1 included in model	EM estimation

The total number of respondents aged 50 and over in the first wave of TILDA is 8,163. A total of 1,260 cases had to be excluded because the entire self-completion questionnaire was missing at Wave 1, whilst 805 cases were excluded because they did not participate in Wave 2 (implying an attrition rate of 9.9%). In the sample of 6,098 cases used to estimate the statistical model, there were 16 missing data patterns due to non-completion of specific parts of the data collection protocol, as indicated in Table 3 above. A total of 1,148 members of the sample refused or were unable to complete the health tests during Wave 1 and 3,335 refused to provide information on household income. There are numerous cases with missing data relating to the UCLA Loneliness scale at Wave 2 (707) and the CASP scale at Wave 2 (715). These missing data patterns were handled during estimation of the Structural Equation Model using Full-Information Maximum Likelihood (FIML) estimation, a powerful and innovative technique which makes maximal use of available data and adjusts all statistical tests and fit indices for the reduced sample size (Bentler 2006; Enders 2001). This

approach involves calculating the likelihood function at the individual level in relation to a model for means and covariances.

3 Model fit

Model fit indices and statistics are reported below. The chi-square statistic suggests poor fit, although this statistic is strongly influenced by sample size (small discrepancies are artificially inflated). It is therefore appropriate to rely on alternative fit indices, which suggest a well-fitting model. The CFI and SRMR, when applied to the covariance matrices, satisfy the Hu-Bentler combined fit criteria (CFI > 0.95; SRMR < 0.08) (Hu and Bentler 1999).

Likelihood Ratio Chi-square:	3,625 (397 df), p < 0.000
Based on covariance matrix only:	
Comparative Fit Index (CFI):	0.96
Yuan-Bentler Corrected CFI:	0.96
Standardised Root Mean-Square Residual (SRMR):	0.036
Root Mean-Square Error of Approximation (RMSEA):	0.038 (0.037, 0.039)
Yuan-Bentler Corrected RMSEA:	0.035 (0.035, 0.037)
Based on covariance matrix and means:	
McDonald's Fit Index (MFI):	0.77
Yuan-Bentler Corrected MFI:	0.79
Root Mean-Square Error of Approximation (RMSEA):	0.037 (0.035, 0.038)
Yuan-Bentler Corrected RMSEA:	0.035 (0.034, 0.036)

Tests of the assumption that data are missing completely at random (GLS Test of Homogeneity of Means = 1,446 with 462 degrees of freedom, $p < 0.000$; GLS Test of Homogeneity of Covariance Matrices = 12,636 with 7,365 degrees of freedom, $p < 0.000$) suggest that this assumption cannot be upheld. Thus, at least some of the missing data patterns have differing mean and covariance matrices. This does not invalidate the attempt to estimate an overall model that holds across all of the patterns, as Bentler (2006) indicates, and does not imply that the estimated coefficients are unreliable. This is because some of the missing data patterns involve small numbers of cases, and are therefore likely to differ from the others purely on the basis of sampling variation.

4 Measures

The SEM model comprises the following latent variables: Socio-emotional Well-being, Cognitive Functioning, Physical Health and Socio-economic Position. Nine observed Wave 1 variables are also included: Smokes, Alcohol Problem, Age, Gender, Lives Alone, Physical Exercise, Social Participation, Intimate Relationships and Social Network. All variables used in the model are listed in Table 2, together with summary data on the sample.

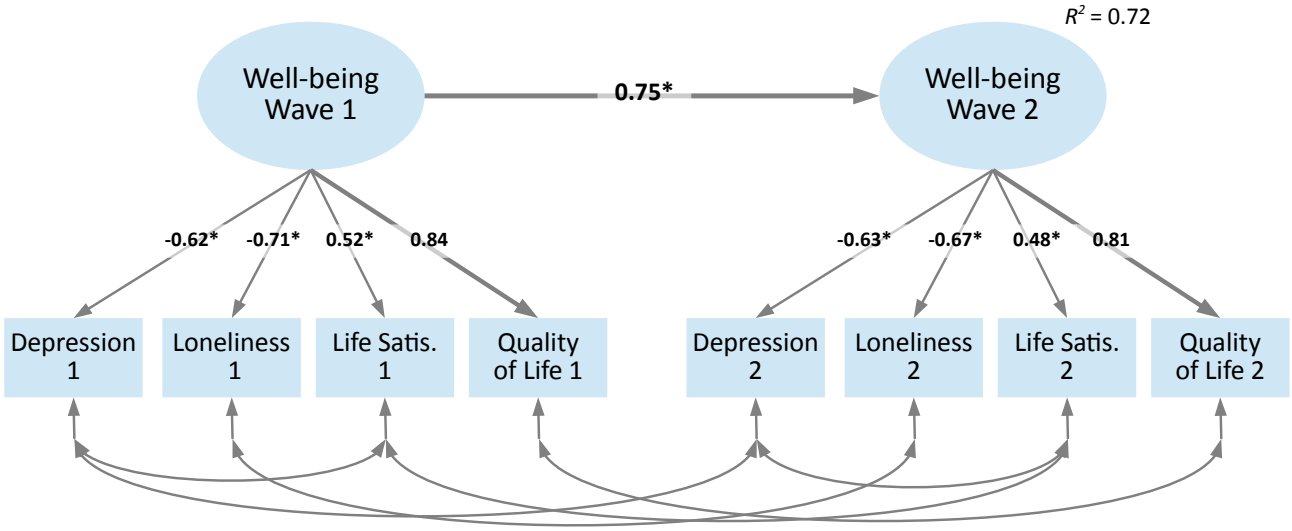
Socio-emotional Well-being is a latent variable with four indicators:

1. Depression (the 20-item CESD score) (Radloff 1977)
2. Loneliness (the 5-item UCLA Loneliness Scale) (Russell 1996)
3. Quality of Life (the 19-item CASP scale; (Hyde et al. 2003)
4. Life Satisfaction (a single item with a 7-point response scale)

The standardised factor loadings range between 0.48 and 0.84, as shown in Figure 1 below, which reports the standardised coefficients for the measurement model for Socio-emotional

Well-being (coefficients obtained during final estimation run for full model). An error covariance was specified between Depression and Life Satisfaction due to the relatively strong negative association that holds between these two concepts, which was anticipated. Corresponding unstandardised factor loadings were constrained to be equal at Waves 1 and 2 to ensure that the meaning of the latent variable does not change over time. Coefficients which are statistically significant ($p < 0.05$), using robust Fisher standard errors to control for non-normality, are indicated by an asterisk (*).

Figure 1 Measurement Model for Socio-emotional Well-being



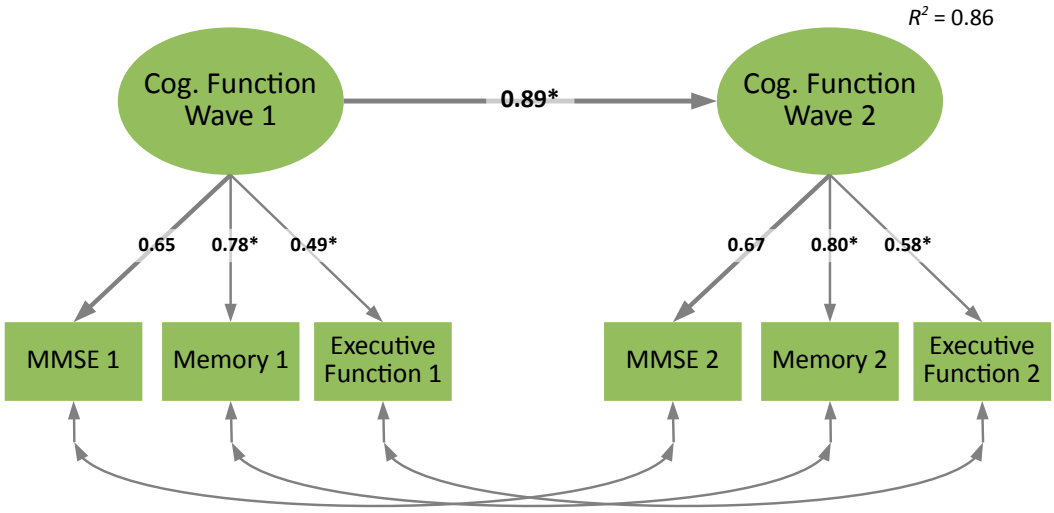
Cognitive Functioning is a latent variable with three indicators:

1. the 30-item Mini Mental State Examination (Folstein, Folstein, and McHugh 1975)
2. the respondent's mean score on three 10-item Memory Tests (Roth et al. 1986)
3. a measure of Executive Function based on naming as many animals as possible in a minute

These indicators were chosen with a view to obtaining a summary measure of cognitive functioning, which reflects not only the effects of ageing but also global cognitive abilities. Figure 2 summarises the measurement model for this variable and includes the standardised coefficients, as before. The factor loadings are strong and, as in the case of the previous

latent variable, corresponding coefficients were constrained to be equal at Waves 1 and 2 to ensure that the meaning of the latent variable remains stable.

Figure 2 Measurement Model for Cognitive Functioning



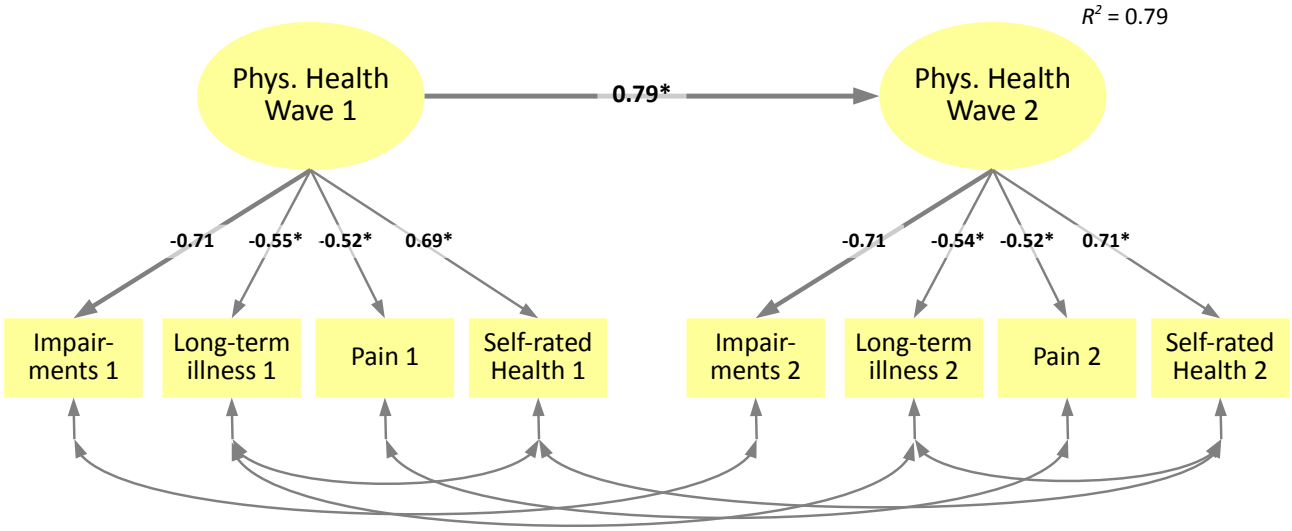
Physical Health is the third latent variable, and has the following four indicators:

1. number of Functional Impairments (this is the sum of functional limitations, such as being unable to walk 100m or climb a flight of stairs without resting, limitations in the activities of daily living (ADL), such as dressing or getting in or out of bed and limitations in independent activities of daily living (IADL), such as shopping for groceries or taking medications)
2. presence of a Limiting Long-term Illness (LLTI)
3. respondent often experiences (at least) moderate Pain
4. Self-rated Health (measured on a five-point scale)

An error covariance was specified between LLTI and Self-rated Health on the basis of the Lagrange Multiplier Test results. This suggests that respondents' assessments of their overall health are more strongly correlated with the presence of a long-term illness than would be expected on the basis of their shared dependence on the latent variable. The measurement model for Physical Health is shown in Figure 3 below (again extrapolating from the broader SEM model). The standardised factor loadings vary between -0.52 and 0.71; the negative sign for the loadings of Impairments, LLTI and Pain are simply due to the measurement scales of these indicators. As before, corresponding unstandardised factor loadings were constrained

to be equal at Waves 1 and 2 to ensure that the meaning of the latent variable remains stable over time.

Figure 3 Measurement Model for Physical Health

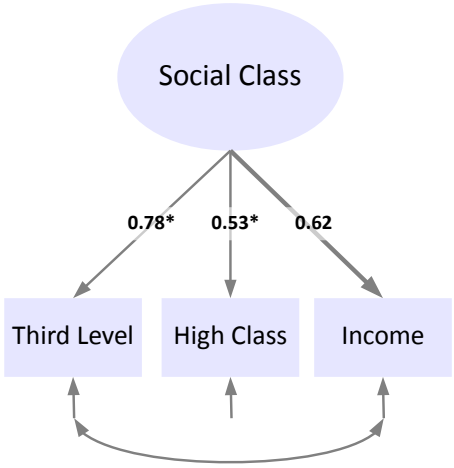


Socio-economic Position is a latent variable with three indicators:

1. Third-level Qualification
2. High Occupational Group (professional, managerial/technical workers and farmers with more than 100 acres)
3. Net equivalent weekly Household Income after tax and social charges

An error covariance was added between Third-level Qualification and Occupation, which was not anticipated but may be explained by the way in which access to professional, managerial and technical work roles is mediated by educational attainments. The standardised factor loadings range between 0.53 and 0.78 and are shown in Figure 4 below, once again considering just one part of the overall model.

Figure 4 Measurement Model for Socio-economic Position



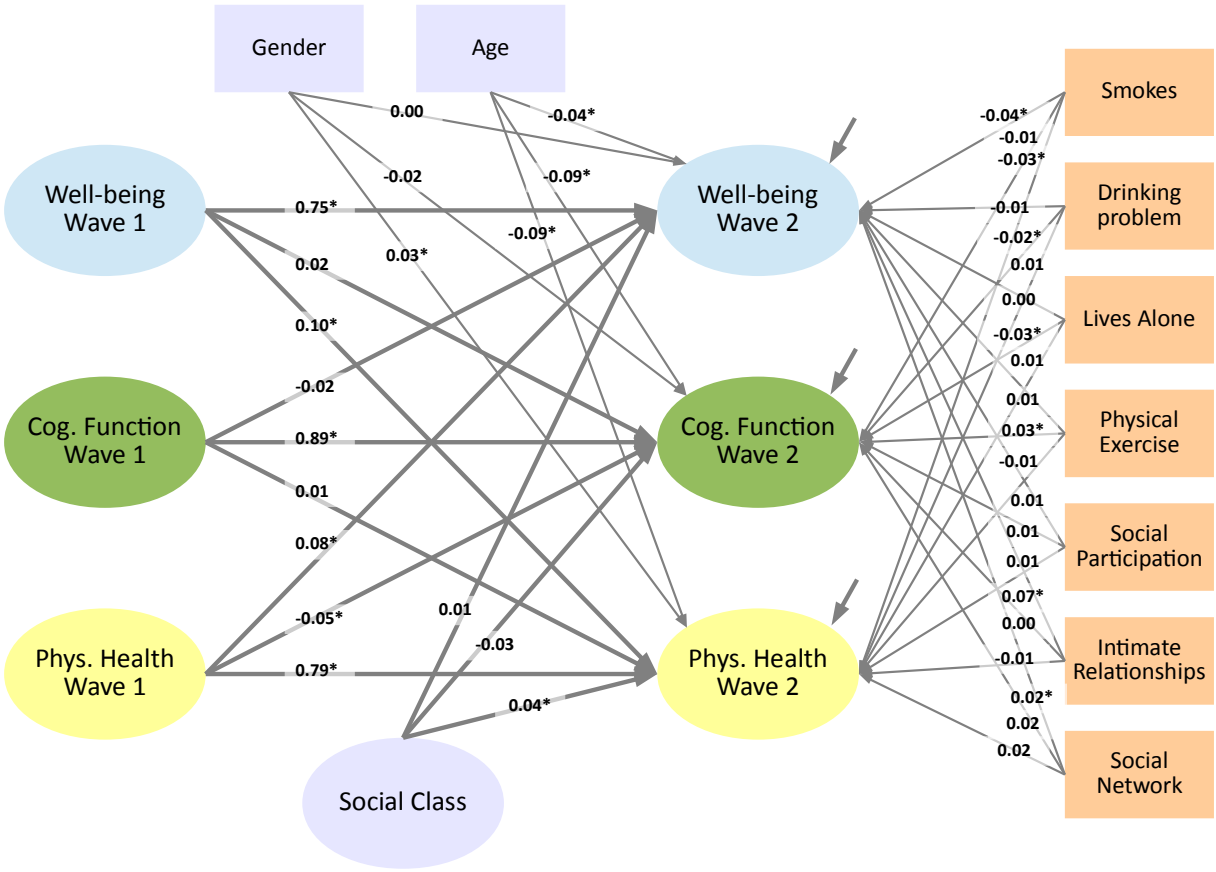
5 Research Design

The pathways specified in the SEM model respect, above all, the chronological ordering of the variables. Thus, health and well-being measured at Wave 2 are influenced by variables measured at Wave 1. Socio-emotional Well-being, Cognitive Health and Physical Health at Wave 2 are regressed on all three sets of values at Wave 1 (using a cross-lagged specification), and are regressed on the explanatory variables described earlier, with a view to identifying the determinants of change between the two waves.

The focus of the model is thus on explaining the determinants of change in health and well-being over the two-year period between Wave 1 and Wave 2 data collection. The direct effects for the Wave 2 scores, after controlling for their corresponding values at Wave 1, capture the effect of the explanatory variables on the change in health or well-being over this period. By including lagged and cross-lagged effects, we can assess, for example, the impact of Well-being (at Wave 1) on the change in Cognitive Functioning or Physical Health (between Wave 1 and Wave 2) and vice versa. The overall structure of the model is shown in Figure 5 below, omitting all correlations between exogenous explanatory variables in order to

simplify the diagram. Full results are provided in Appendix A. For the results of a cross-sectional analysis of the first wave of TILDA, see Pratschke (2016).

Figure 5 Structural Equation Model of Change in Health and Well-being



6 Results

There is a roughly symmetrical cross-lagged effect between Well-being at Wave 1 and Physical Health at Wave 2, on the one hand, and between Physical Health at Wave 1 and Well-being at Wave 2, on the other. Well-being tends to decline more rapidly once physical health deteriorates, whilst trends in physical health depend on previous well-being. The effects are quite large, considering that they relate to a period of just two years and bearing in mind that the model controls for most of the factors that have been identified in the

literature as important covariates of health and well-being. For a one standard deviation increase in Physical Health, Socio-emotional Well-being tends to increase by 0.08 of a standard deviation. For a one standard deviation increase in Socio-emotional Well-being, Physical Health tends to increase by 0.10 of a standard deviation over a two-year period.

The first of these cross-lagged effects is likely to involve, for example, the psychological effects of chronic illness, accompanied by pain and functional impairments, leading in some cases to depression, dissatisfaction and isolation. The second cross-lagged effect starts with socio-emotional distress, and involves a subsequent deterioration of physical health – or in positive terms, high socio-emotional well-being playing a protective role in relation to physical health. In both cases, these pathways may involve direct or indirect effects, mediated by the effects of medication, changes in behaviour or mental states/cognitions. Individual health and well-being may therefore be described as a dynamic system characterised by 'feedback' between Socio-emotional Well-being and Physical Health, a spiral which tends to reinforce the differentials in health and well-being which emerge earlier in the life cycle.

There is also a significant cross-lagged effect whereby Physical Health at Wave 1 has an effect on the subsequent curve of Cognitive Functioning, which further reinforces this interdependent system. In this case, the ageing process may lead initially to an increase in functional impairments, pain and illness, and subsequently erode cognitive abilities.

The model suggests that Socio-economic Position has a significant influence on changes in Physical Health, whilst also correlating strongly with Wave 1 scores for all three of the other latent variables, particularly Cognitive Functioning. Once we control for age and other

factors, therefore, members of the higher social classes tend to have better physical health, which implies a gap between chronological and biological age, based on Socio-economic Position, as previous research has suggested (Adams and White 2004).

There are a number of statistically-significant effects on the change in Health and Well-being between Waves 1 and 2 involving observed variables measured at Wave 1. The first of these relates to age: amongst older people in the sample, Well-being, Cognitive Functioning and Physical Health tended to decline more rapidly than amongst younger people, as one might expect. Respondents with more intimate relationships tend to have higher Well-being after two years than those with weaker relationships, and Socio-emotional Well-being also increases more rapidly (or declines more slowly) for those with a larger social network of close friends and relatives. Physical Health is better for men than women, after controlling for age and other factors, and smoking is associated with a more rapid decline in Physical Health and Socio-emotional Well-being. Having a drinking problem also has a small negative effect on Cognitive Functioning, as do living alone (negative) and taking physical exercise (positive).

As we stressed earlier, these effects relate to the *change* in health and well-being over just two years, between Wave 1 and Wave 2 of the TILDA study. They should, nevertheless, be interpreted in relation to the social differentials that already existed at Wave 1, as the observed changes are intimately related to the initial levels and both form part of the overall curve or trajectory of health and well-being. We will use the pattern of correlations between the exogenous variables in the model to describe these differentials at Wave 1. As far as Socio-emotional Well-being is concerned, there is a strong and significant bivariate correlation with Socio-Economic Position (0.22), whilst the correlation with (male) gender is

-0.01 and that with age is just 0.02, neither of which are statistically significant. As far as lifestyle factors and health-related behaviours are concerned, there is a particularly strong correlation between Socio-emotional Well-being at Wave 1 and the strength of intimate relationships (0.56), followed by social participation (0.32) and the number of close friends and relatives (0.24). The correlation with physical exercise is also quite high (0.22), and there are small negative correlations with smoking (-0.17) and having a drinking problem (-0.11). The baseline correlation between Socio-emotional Well-being and both Cognitive Functioning and Physical Health was 0.22. This latent variable thus exhibits a moderate social gradient, is largely independent of age and reflects, above all, social connectedness and an active lifestyle.

Turning now to Cognitive Functioning, we observe a much stronger bivariate correlation with Socio-Economic Position than in the previous case (0.52), whilst the correlation with age is also strong at 0.48. There is a small but statistically significant negative correlation with (male) gender (-0.13). As far as lifestyle factors and health-related behaviours are concerned, there is no significant correlation between Cognitive Functioning at Wave 1 and the strength of intimate relationships (-0.02) and only a very weak (but nevertheless significant) correlation with the number of close friends and relatives (0.05). This marks a strong contrast with Socio-emotional Well-being, although the correlation with social participation is identical to that reported for well-being (0.36), and the coefficient for living alone is -0.18. The correlation with physical exercise is lower than for Socio-emotional Well-being (0.15), and there are small correlations with smoking (-0.06) and having a drinking problem (0.11), although the latter is now positive in sign and requires further investigation. The baseline correlation between Cognitive Functioning and Socio-emotional Well-being was 0.22, and the coefficient for Physical Health was 0.35. This latent variable thus exhibits a strong social

gradient, depends heavily on age and has a moderate association with social participation and inclusion.

The third latent variable, Physical Health, has a moderate bivariate correlation with Socio-Economic Position (0.27), like Socio-emotional Well-being, whilst the correlation with age is higher at 0.18. There is also a statistically significant positive correlation with (male) gender (0.07), which is small but nevertheless contrasts with the negative correlation observed for Cognitive Functioning. As far as lifestyle factors and health-related behaviours are concerned, there is a relatively weak correlation between Cognitive Functioning at Wave 1 and the strength of intimate relationships (0.16) and the number of close friends and relatives (0.11). The correlation with social participation (0.24) is also lower than for Well-being or Cognitive Functioning. The correlation coefficient for living alone is -0.14, which is weaker than that for Cognitive Functioning but stronger than that for Socio-Emotional Well-being. The correlation with physical exercise is relatively high (0.33) – higher than for the other two latent variables – and there is a small negative correlation with smoking (-0.11), but not for having a drinking problem (not significant at 0.02). The baseline correlation between Physical Health and Socio-emotional was 0.22, and that with Physical Health was 0.35. This latent variable thus exhibits a moderate social gradient, depends moderately on age and is associated with variables reflecting an active lifestyle, social participation and inclusion. It is worth noting that smoking correlates negatively and physical exercise correlates positively with all three latent variables, confirming the importance of these two behaviours from the perspective of health promotion and well-being.

7 Conclusions

In the previous sections of this paper, we explored the relationship between health and well-being amongst older adults using a cross-lagged longitudinal Structural Equation Model. The results confirm the value of TILDA and reveal the value of specifying this kind of model when using panel data. The focus of the study is on explaining the determinants of change in health and well-being over the two-year period between Wave 1 and Wave 2 TILDA data collection. In the sample of 6,098 cases used to estimate the model, there were 16 missing data patterns due to non-completion of specific parts of the data collection protocol. These missing data patterns were handled during estimation of the Structural Equation Model using Full-Information Maximum Likelihood (FIML) estimation, and a secondary aim of the study was to evaluate this technique.

Socio-emotional Well-being, Cognitive Health and Physical Health at Wave 2 were regressed on all three sets of values at Wave 1 (using a cross-lagged specification), and on a set of explanatory variables, with a view to identifying the determinants of change between waves. The direct effects on the Wave 2 scores, after controlling for corresponding values at Wave 1, capture the effect of the explanatory variables on the change in health or well-being over this period. By including lagged and cross-lagged effects, we were able to assess the impact of Well-being (at Wave 1) on the change in Cognitive Functioning or Physical Health (between Wave 1 and Wave 2) and vice versa.

The results suggest that there is a roughly symmetrical, cross-lagged effect between Well-being at Wave 1 and Physical Health at Wave 2, on the one hand, and between Physical Health at Wave 1 and Well-being at Wave 2, on the other. Well-being tends to decline more

rapidly once physical health deteriorates, whilst trends in physical health depend on previous well-being. The effects are quite large, considering that they relate to a period of just two years, and bearing in mind that the model controls for many well-known covariates. For a one standard deviation increase in Physical Health, Socio-emotional Well-being tends to increase by 0.08 of a standard deviation. For a one standard deviation increase in Socio-emotional Well-being, Physical Health tends to increase by 0.10 of a standard deviation over a two-year period.

We also found a significant cross-lagged effect whereby Physical Health at Wave 1 has an effect on the subsequent curve of Cognitive Functioning. The model suggests that Socio-economic Position has a significant influence on changes in Physical Health, whilst also correlating strongly with Wave 1 scores for all three of the other latent variables, particularly Cognitive Functioning. There are a number of other statistically-significant effects on the change in Health and Well-being between Waves 1 and 2 involving observed variables measured at Wave 1, including age, gender, intimate relationships, social networks, smoking, having a drinking problem, living alone and exercising.

Respondents with more intimate relationships tend to have higher Well-being after two years than those with weaker relationships, and the same pattern holds for social networks. Smoking is associated with a more rapid decline in Physical Health and Socio-emotional Well-being, whilst having a drinking problem has a small negative effect on Cognitive Functioning. Significant effects are also found for living alone, which has a negative effect on Cognitive Functioning, and taking physical exercise, which has a positive influence. The Maximum Likelihood-based estimation techniques used in this study made an important contribution

to the results, as they enable us to maintain statistical power and to avoid the risk of bias due to non-random patterns of missing data.

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1 Appendix A: Full results of Structural Equation Model

```
Variable names and descriptions:

V4=GENDER;     V5=CESD_W1;     V6=CESD_W2;     V7=LONELINESS_W1;     V8=LONELINESS_W2;
V9=LIFE_SATIS_W1;    V10=LIFE_SATIS_W2;    V11=CASP_W1;    V12=CASP_W2;    V13=MMSE_W1;
V14=MMSE_W2;   V15=MEMORY_W1;   V16=MEMORY_W2;   V17=EXEC_FUNC_W1;   V18=EXEC_FUNC_W2;
V25=IPAQ_W1;     V26=IPAQ_W2;     V27=INVOLVE_W1;     V28=INVOLVE_W2;     V29=PARTIC;
V31=SELFRATED_HEALTH_W1;     V32=SELFRATED_HEALTH_W2;     V35=LLTI_W1;     V36=LLTI_W2;
V37=PAIN_W1;   V38=PAIN_W2;   V39=IMPAIRMENTS_W1;   V40=IMPAIRMENTS_W2;   V41=THIRDLEVEL;
V42=HICLASS;   V44=INCOME;   V46=SMOKER;   V47=ALCOHOL_PROB;   V49=LIVES_ALONE;   V50=AGE;
V52=REL_QUALITY; V53=RELATIVES&FRNDS;

  GOODNESS OF FIT SUMMARY FOR METHOD = ML

  INDEPENDENCE MODEL CHI-SQUARE        =   80850.245 ON   562 DEGREES OF FREEDOM

  INDEPENDENCE AIC =   79726.245   INDEPENDENCE CAIC =   75390.012
         MODEL AIC =    2831.366          MODEL CAIC =    -231.773

  -2LN(L) BASED ON THE UNSTRUCTURED MODEL =   -2899.390
  -2LN(L) BASED ON THE   STRUCTURED MODEL =     725.977

  LIKELIHOOD RATIO CHI-SQUARE =     3625.366 BASED ON   397 DEGREES OF FREEDOM
  PROBABILITY VALUE FOR THE CHI-SQUARE STATISTIC IS      0.00000

 GLS TEST OF HOMOGENEITY OF MEANS

  CHI-SQUARE =     1446.420 BASED ON     462 DEGREES OF FREEDOM
  PROBABILITY VALUE FOR THE CHI-SQUARE STATISTIC IS      0.00000

 GLS TEST OF HOMOGENEITY OF COVARIANCE MATRICES

  CHI-SQUARE =    12636.621 BASED ON    7365 DEGREES OF FREEDOM
  PROBABILITY VALUE FOR THE CHI-SQUARE STATISTIC IS      0.00000
    NUMBER OF CASES USED FOR THE ABOVE STATISTIC IS         6098

 GLS COMBINED TEST OF HOMOGENEITY OF MEANS/COVARIANCES

  CHI-SQUARE =    14083.042 BASED ON    7827 DEGREES OF FREEDOM
  PROBABILITY VALUE FOR THE CHI-SQUARE STATISTIC IS      0.00000

  FIT INDICES (BASED ON COVARIANCE MATRIX ONLY, NOT THE MEANS)
  -----------
  BENTLER-BONETT     NORMED FIT INDEX =     0.952
  BENTLER-BONETT NON-NORMED FIT INDEX =     0.939
  COMPARATIVE FIT INDEX (CFI)         =     0.957
  BOLLEN'S          (IFI) FIT INDEX   =     0.957
  MCDONALD'S        (MFI) FIT INDEX   =     0.754
  JORESKOG-SORBOM'S  GFI  FIT INDEX   =     0.965
  JORESKOG-SORBOM'S AGFI  FIT INDEX   =     0.947
  ROOT MEAN-SQUARE RESIDUAL (RMR)     =     0.007
  STANDARDIZED RMR                    =     0.036
  ROOT MEAN-SQUARE ERROR OF APPROXIMATION (RMSEA)    =     0.038
  90% CONFIDENCE INTERVAL OF RMSEA  (       0.037,         0.039)

  FIT INDICES (BASED ON COVARIANCE MATRIX AND MEANS)
  -----------
  MCDONALD'S        (MFI) FIT INDEX   =     0.767
  ROOT MEAN-SQUARE ERROR OF APPROXIMATION (RMSEA)    =     0.037
  90% CONFIDENCE INTERVAL OF RMSEA  (       0.035,         0.038)

  RELIABILITY COEFFICIENTS
  ------------------------
  CRONBACH'S ALPHA                    =     0.224


  GOODNESS OF FIT SUMMARY FOR YUAN-BENTLER CORRECTION BASED ON EXPECTED INFO.

  SCALED (YUAN-BENTLER) INDEPENDENCE MODEL CHI-SQUARE=   75653.784 ON   562 D.F.

  INDEPENDENCE AIC =   74529.784   INDEPENDENCE CAIC =   70193.552
```

MODEL AIC = 2532.335 MODEL CAIC = -530.804

SCALED CHI-SQUARE (YUAN-BENTLER) = 3326.335 ON 397 DEGREES OF FREEDOM
PROBABILITY VALUE FOR THE CHI-SQUARE STATISTIC IS 0.00000

MEAN- AND VARIANCE-ADJUSTED CHI-SQUARE = 2858.677 ON 341 D.F.
PROBABILITY VALUE FOR THE CHI-SQUARE STATISTIC IS 0.00000

FIT INDICES (BASED ON COVARIANCE MATRIX ONLY, NOT THE MEANS)

BENTLER-BONETT NORMED FIT INDEX = 0.953
BENTLER-BONETT NON-NORMED FIT INDEX = 0.941
COMPARATIVE FIT INDEX (CFI) = 0.958
BOLLEN'S (IFI) FIT INDEX = 0.958
MCDONALD'S (MFI) FIT INDEX = 0.774
ROOT MEAN-SQUARE ERROR OF APPROXIMATION (RMSEA) = 0.036
90% CONFIDENCE INTERVAL OF RMSEA (0.035, 0.037)

FIT INDICES (BASED ON COVARIANCE MATRIX AND MEANS)

MCDONALD'S (MFI) FIT INDEX = 0.786
ROOT MEAN-SQUARE ERROR OF APPROXIMATION (RMSEA) = 0.035
90% CONFIDENCE INTERVAL OF RMSEA (0.034, 0.036)

ITERATIVE SUMMARY

ITERATION	PARAMETER ABS CHANGE	ALPHA	FUNCTION
1	0.005180	1.00000	0.71711
2	0.001270	1.00000	0.63083
3	0.000585	1.00000	0.63046
4	0.000126	1.00000	0.63045

MEASUREMENT EQUATIONS WITH STANDARD ERRORS AND TEST STATISTICS
STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.
(ROBUST STATISTICS IN PARENTHESES)

```
GENDER  =V4  =     .455*V999  +  1.000 E4
                   .006
                 71.726@
               (    .006)
               (  71.474@

CESD_W1 =V5  =    -.641*F1    +  1.000 E5
                   .009
                -72.620@
               (    .012)
               ( -55.171@

CESD_W2 =V6  =    -.641*F2    +  1.000 E6
                   .009
                -72.620@
               (    .012)
               ( -55.171@

LONE_W1 =V7  =   -1.330*F1    -   .003*V999  +  1.000 E7
                   .020           .005
                -65.374@         -.677
               (    .022)     (    .004)
               ( -61.040@     (   -.802)

LONE_W2 =V8  =   -1.330*F2    +   .016*V999  +  1.000 E8
                   .020           .004
                -65.374@        3.732@
               (    .022)     (    .003)
               ( -61.040@     (   4.657@

LIFE_W1 =V9  =     .874*F1    +   .982*V999  +  1.000 E9
                   .017           .003
                50.057@       280.712@
               (    .022)     (    .003)
               (  40.144@     ( 307.046@

LIFE_W2 =V10 =     .874*F2    +   .965*V999  +  1.000 E10
                   .017           .003
                50.057@       286.332@
               (    .022)     (    .003)
               (  40.144@     ( 309.392@

CASP_W1 =V11 =    1.000 F1    +   .922*V999  +  1.000 E11
                                     .003
                                 334.349@
                               (    .002)
                               ( 377.415@

CASP_W2 =V12 =    1.000 F2    +   .853*V999  +  1.000 E12
                                     .002
                                 359.531@
                               (    .002)
                               ( 458.112@

MMSE_W1 =V13 =    1.000 F3    +   .680*V999  +  1.000 E13
                                     .001
                                 685.918@
                               (    .001)
                               ( 820.394@

MMSE_W2 =V14 =    1.000 F4    +   .707 V999  +  1.000 E14




MEM_W1  =V15 =    3.167*F3    -   .197*V999  +  1.000 E15
                   .049           .013
                64.833@       -14.849@
```

```
              (    .048)     (    .013)
              (  66.020@     ( -14.912@

MEM_W2  =V16 =    3.167*F4    -   .120*V999  +  1.000 E16
                    .049          .012
                  64.833@       -9.880@
              (    .048)     (    .013)
              (  66.020@     (  -9.559@

EXEC_W1 =V17 =    7.887*F3    +  1.000 E17
                    .028
                 283.303@
              (    .026)
              ( 304.560@

EXEC_W2 =V18 =    7.887*F4    +  1.000 E18
                    .028
                 283.303@
              (    .026)
              ( 304.560@

IPAQ_W1 =V25 =    7.363*V999  +  1.000 E25
                    .017
                 437.493@
              (    .017)
              ( 435.223@

PARTIC2 =V29 =     .493*V999  +  1.000 E29
                    .002
                 267.751@
              (    .002)
              ( 267.891@

SRH_W1  =V31 =     .982*F5    +  1.000 E31
                    .019
                  51.655@
              (    .022)
              (  43.712@

SRH_W2  =V32 =     .982*F6    +  1.000 E32
                    .019
                  51.655@
              (    .022)
              (  43.712@

LLTI_W1 =V35 =   -1.420*F5    +  1.239*V999  +  1.000 E35
                    .033          .020
                -42.900@       62.775@
              (    .036)     (    .018)
              ( -39.133@     (  70.392@

LLTI_W2 =V36 =   -1.420*F6    +  1.298*V999  +  1.000 E36
                    .033          .020
                -42.900@       64.487@
              (    .036)     (    .018)
              ( -39.133@     (  72.919@

PAIN_W1 =V37 =   -1.202*F5    +   .975*V999  +  1.000 E37
                    .029          .018
                -42.057@       53.780@
              (    .031)     (    .020)
              ( -39.351@     (  49.688@

PAIN_W2 =V38 =   -1.202*F6    +   .985*V999  +  1.000 E38
                    .029          .018
                -42.057@       53.599@
              (    .031)     (    .020)
              ( -39.351@     (  49.049@

IMP_W1  =V39 =   -1.000 F5    +   .820*V999  +  1.000 E39
                                    .012
                                  67.048@
                               (    .015)
                               (  54.078@

IMP_W2  =V40 =   -1.000 F6    +   .851*V999  +  1.000 E40
```

```
                                .012
                              68.710@
                           (    .016)
                           (  54.843@

THIRDLEV=V41 =     .636*F7    +  1.000 E41
                     .014
                   45.678@
                (    .009)
                (  72.637@

HICLASS =V42 =     .404*F7    +   .047*V999  +  1.000 E42
                     .012           .008
                   32.595@         5.926@
                (    .009)     (    .004)
                (  46.484@     (  10.579@

INCOME  =V44 =    1.000 F7    +  5.862*V999  +  1.000 E44
                                     .019
                                  309.296@
                               (    .016)
                               ( 358.143@

SMOKER  =V46 =     .174*V999  +  1.000 E46
                     .005
                   35.898@
                (    .005)
                (  35.898@

ALCPROB =V47 =     .120*V999  +  1.000 E47
                     .004
                   28.895@
                (    .004)
                (  28.884@

ALONE   =V49 =     .207*V999  +  1.000 E49
                     .005
                   40.346@
                (    .005)
                (  40.548@

  AGE   =V50 =    6.318*V999  +  1.000 E50
                     .011
                  561.807@
                (    .011)
                ( 553.874@

RELQUAL =V52 =     .792*V999  +  1.000 E52
                     .002
                  468.976@
                (    .002)
                ( 468.919@

RELFRND =V53 =    1.066*V999  +  1.000 E53
                     .007
                  145.440@
                (    .007)
                ( 145.435@


 CONSTRUCT EQUATIONS WITH STANDARD ERRORS AND TEST STATISTICS
 STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.
 (ROBUST STATISTICS IN PARENTHESES)


   F1   =F1  =    -.148*V999  +  1.000 D1
                     .003
                  -49.282@
                (    .003)
                ( -58.037@

   F2   =F2  =    -.001*V4    +   .001*V25   +   .006*V29   -   .011*V46
                     .002           .001           .009           .003
                    -.232          1.160           .638         -3.829@
                (    .002)     (    .001)     (    .009)     (    .003)
```

```
            (   -.241)     (   1.166)     (    .632)     (  -3.627@

             -   .003*V47   +   .000*V49   -   .005*V50   +   .055*V52
                 .003           .003           .002           .012
               -1.033           .139         -3.066@         4.677@
            (    .003)     (    .003)     (    .002)     (    .013)
            (  -1.055)     (    .143)     (  -3.127@     (   4.221@

             +   .004*V53   +   .723*F1    -   .038*F3    +   .046*F5
                 .002           .021           .047           .011
                2.051@        33.815@         -.810          4.321@
            (    .002)     (    .024)     (    .044)     (    .011)
            (   2.190@     (  29.585@     (   -.859)     (   4.055@

             +   .001*F7    -   .074*V999  +  1.000 D2
                 .003           .026
                 .412         -2.880@
            (    .002)     (    .026)
            (    .471)     (  -2.820@

F3   =F3  =      .266*V999  +  1.000 D3
                 .001
               289.233@
            (    .001)
            ( 405.792@

F4   =F4  =    -.001*V4    +   .001*V25   +   .002*V29   -   .001*V46
                 .001           .000           .004           .001
              -1.381          2.417@          .546          -.660
            (    .001)     (    .000)     (    .004)     (    .001)
            (  -1.474)     (   2.508@     (    .574)     (   -.728)

             -   .003*V47   -   .003*V49   -   .005*V50   +   .001*V52
                 .001           .001           .001           .005
               -2.148@        -2.518@        -6.957@         .218
            (    .001)     (    .001)     (    .001)     (    .005)
            (  -2.442@     (  -2.618@     (  -7.332@     (    .223)

             +   .001*V53   +   .008*F1    +   .947*F3    -   .011*F5
                 .001           .009           .024           .005
                1.734           .961         39.930@        -2.388@
            (    .001)     (    .008)     (    .024)     (    .004)
            (   1.832)     (   1.064)     (  39.990@     (  -2.528@

             -   .002*F7    +   .024*V999  +  1.000 D4
                 .001           .011
               -1.708          2.105@
            (    .001)     (    .011)
            (  -1.942)     (   2.139@

F5   =F5  =      .606*V999  +  1.000 D5
                 .012
               49.513@
            (    .014)
            (  43.959@

F6   =F6  =      .011*V4    -   .001*V25   +   .007*V29   -   .013*V46
                 .004           .002           .015           .005
                2.795@         -.486           .441         -2.544@
            (    .004)     (    .002)     (    .016)     (    .005)
            (   2.773@     (   -.475)     (    .421)     (  -2.410@

             +   .003*V47   +   .003*V49   -   .018*V50   -   .020*V52
                 .006           .005           .003           .020
                 .493           .669         -5.673@        -1.014
            (    .006)     (    .005)     (    .003)     (    .022)
            (    .515)     (    .642)     (  -5.642@     (   -.914)

             +   .006*V53   +   .157*F1    +   .050*F3    +   .784*F5
                 .003           .036           .084           .020
                1.692          4.392@          .600         38.450@
            (    .003)     (    .039)     (    .083)     (    .023)
            (   1.700)     (   4.004@     (    .607)     (  34.293@

             +   .012*F7    +   .270*V999  +  1.000 D6
                 .005           .047
```

```
                2.536@         5.741@
            (    .004)     (    .049)
            (   2.814@     (   5.481@

   F7   =F7  =     .507*V999  +  1.000 D7
                    .012
                  41.227@
            (    .007)
            (  74.179@
```

VARIANCES OF INDEPENDENT VARIABLES

STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.

	E		D	
E4 -GENDER	.246*I	D1 - F1	.013*I	
	.004 I		.000 I	
	55.313@I		39.798@I	
	(.001)I		(.000)I	
	(395.039@I		(33.605@I	
	I		I	
E5 -CESD_W1	.009*I	D2 - F2	.003*I	
	.000 I		.000 I	
	49.975@I		24.943@I	
	(.000)I		(.000)I	
	(28.333@I		(20.680@I	
	I		I	
E6 -CESD_W2	.007*I	D3 - F3	.002*I	
	.000 I		.000 I	
	48.350@I		34.155@I	
	(.000)I		(.000)I	
	(26.292@I		(31.244@I	
	I		I	
E7 -LONE_W1	.023*I	D4 - F4	.000*I	
	.000 I		.000 I	
	47.993@I		10.646@I	
	(.001)I		(.000)I	
	(43.493@I		(10.516@I	
	I		I	
E8 -LONE_W2	.027*I	D5 - F5	.035*I	
	.001 I		.001 I	
	44.228@I		29.884@I	
	(.001)I		(.002)I	
	(35.903@I		(22.457@I	
	I		I	
E9 -LIFE_W1	.026*I	D6 - F6	.007*I	
	.001 I		.000 I	
	51.771@I		16.551@I	
	(.001)I		(.001)I	
	(30.404@I		(12.926@I	
	I		I	
E10 -LIFE_W2	.031*I	D7 - F7	.329*I	
	.001 I		.012 I	
	51.967@I		26.306@I	
	(.001)I		(.005)I	
	(26.291@I		(60.342@I	
	I		I	
E11 -CASP_W1	.005*I		I	
	.000 I		I	
	32.638@I		I	
	(.000)I		I	
	(25.896@I		I	
	I		I	
E12 -CASP_W2	.006*I		I	
	.000 I		I	
	31.944@I		I	
	(.000)I		I	
	(23.682@I		I	
	I		I	
E13 -MMSE_W1	.002*I		I	
	.000 I		I	
	41.700@I		I	
	(.000)I		I	
	(23.855@I		I	

```
                                I                                 I
E14 -MMSE_W2                 .003*I                               I
                             .000 I                               I
                           47.279@I                               I
                         (    .000)I                               I
                         (  24.522@I                               I
                                I                                 I
E15 -MEM_W1                  .012*I                               I
                             .000 I                               I
                           29.835@I                               I
                         (    .000)I                               I
                         (  27.835@I                               I
                                I                                 I
E16 -MEM_W2                  .012*I                               I
                             .000 I                               I
                           32.157@I                               I
                         (    .000)I                               I
                         (  34.839@I                               I
                                I                                 I
E17 -EXEC_W1                 .353*I                               I
                             .008 I                               I
                           46.753@I                               I
                         (    .009)I                               I
                         (  39.348@I                               I
                                I                                 I
E18 -EXEC_W2                 .246*I                               I
                             .005 I                               I
                           51.352@I                               I
                         (    .005)I                               I
                         (  49.196@I                               I
                                I                                 I
E25 -IPAQ_W1                1.727*I                               I
                             .031 I                               I
                           55.287@I                               I
                         (    .028)I                               I
                         (  61.448@I                               I
                                I                                 I
E29 -PARTIC2                 .021*I                               I
                             .000 I                               I
                           55.280@I                               I
                         (    .000)I                               I
                         (  47.153@I                               I
                                I                                 I
E31 -SRH_W1                  .038*I                               I
                             .001 I                               I
                           40.546@I                               I
                         (    .001)I                               I
                         (  42.590@I                               I
                                I                                 I
E32 -SRH_W2                  .032*I                               I
                             .001 I                               I
                           39.567@I                               I
                         (    .001)I                               I
                         (  39.270@I                               I
                                I                                 I
E35 -LLTI_W1                 .164*I                               I
                             .003 I                               I
                           47.987@I                               I
                         (    .003)I                               I
                         (  56.166@I                               I
                                I                                 I
E36 -LLTI_W2                 .173*I                               I
                             .004 I                               I
                           48.921@I                               I
                         (    .003)I                               I
                         (  62.722@I                               I
                                I                                 I
E37 -PAIN_W1                 .135*I                               I
                             .003 I                               I
                           49.680@I                               I
                         (    .003)I                               I
                         (  48.703@I                               I
                                I                                 I
E38 -PAIN_W2                 .135*I                               I
                             .003 I                               I
                           50.364@I                               I
```

```
                    (    .003)I                                  I
                    (  49.736@I                                  I
                              I                                  I
E39 -IMP_W1               .034*I                                 I
                          .001 I                                 I
                        38.933@I                                 I
                    (    .001)I                                  I
                    (  30.745@I                                  I
                              I                                  I
E40 -IMP_W2               .034*I                                 I
                          .001 I                                 I
                        40.128@I                                 I
                    (    .001)I                                  I
                    (  29.726@I                                  I
                              I                                  I
E41 -THIRDLEV             .086*I                                 I
                          .004 I                                 I
                        20.855@I                                 I
                    (    .003)I                                  I
                    (  27.378@I                                  I
                              I                                  I
E42 -HICLASS              .135*I                                 I
                          .003 I                                 I
                        48.317@I                                 I
                    (    .002)I                                  I
                    (  54.269@I                                  I
                              I                                  I
E44 -INCOME               .524*I                                 I
                          .021 I                                 I
                        25.432@I                                 I
                    (    .036)I                                  I
                    (  14.555@I                                  I
                              I                                  I
E46 -SMOKER               .144*I                                 I
                          .003 I                                 I
                        55.213@I                                 I
                    (    .003)I                                  I
                    (  45.519@I                                  I
                              I                                  I
E47 -ALCPROB              .106*I                                 I
                          .002 I                                 I
                        55.223@I                                 I
                    (    .003)I                                  I
                    (  33.433@I                                  I
                              I                                  I
E49 -ALONE                .164*I                                 I
                          .003 I                                 I
                        57.227@I                                 I
                    (    .003)I                                  I
                    (  57.283@I                                  I
                              I                                  I
E50 -  AGE                .771*I                                 I
                          .014 I                                 I
                        55.688@I                                 I
                    (    .010)I                                  I
                    (  76.405@I                                  I
                              I                                  I
E52 -RELQUAL              .017*I                                 I
                          .000 I                                 I
                        55.215@I                                 I
                    (    .000)I                                  I
                    (  47.252@I                                  I
                              I                                  I
E53 -RELFRND              .328*I                                 I
                          .006 I                                 I
                        55.214@I                                 I
                    (    .006)I                                  I
                    (  51.406@I                                  I
                              I                                  I
```

COVARIANCES AMONG INDEPENDENT VARIABLES

STATISTICS SIGNIFICANT AT THE 5% LEVEL ARE MARKED WITH @.

	E	D
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```
E5  -CESD_W1            -.006*I D3  -   F3              .001*I
E4  -GENDER              .001 I D1  -   F1              .000 I
                       -10.147@I                      13.100@I
                     (    .001)I                   (    .000)I
                     ( -10.136@I                   (  12.817@I
                               I                             I
E6  -CESD_W2            -.005*I D5  -   F5              .013*I
E4  -GENDER              .001 I D1  -   F1              .000 I
                        -8.685@I                      29.995@I
                     (    .001)I                   (    .001)I
                     (  -8.873@I                   (  23.826@I
                               I                             I
E25 -IPAQ_W1             .102*I D7  -   F7              .014*I
E4  -GENDER              .008 I D1  -   F1              .001 I
                       12.429@I                      13.098@I
                     (    .008)I                   (    .001)I
                     (  12.693@I                   (  14.723@I
                               I                             I
E29 -PARTIC2            -.008*I D4  -   F4              .000*I
E4  -GENDER              .001 I D2  -   F2              .000 I
                       -9.450@I                       3.812@I
                     (    .001)I                   (    .000)I
                     (  -9.660@I                   (   4.298@I
                               I                             I
E47 -ALCPROB             .019*I D6  -   F6              .002*I
E4  -GENDER              .002 I D2  -   F2              .000 I
                        9.453@I                      15.446@I
                     (    .002)I                   (    .000)I
                     (   9.440@I                   (  13.682@I
                               I                             I
E49 -ALONE              -.005*I D5  -   F5              .003*I
E4  -GENDER              .002 I D3  -   F3              .000 I
                       -1.934 I                      18.487@I
                     (    .002)I                   (    .000)I
                     (  -1.980@I                   (  16.760@I
                               I                             I
E50 -  AGE               .017*I D7  -   F7              .013*I
E4  -GENDER              .005 I D3  -   F3              .000 I
                        3.225@I                      26.089@I
                     (    .005)I                   (    .000)I
                     (   3.223@I                   (  34.712@I
                               I                             I
E52 -RELQUAL            -.004*I D6  -   F6              .000*I
E4  -GENDER              .001 I D4  -   F4              .000 I
                       -5.132@I                       7.380@I
                     (    .001)I                   (    .000)I
                     (  -5.160@I                   (   7.280@I
                               I                             I
E53 -RELFRND             .018*I D7  -   F7              .029*I
E4  -GENDER              .004 I D5  -   F5              .002 I
                        4.929@I                      15.051@I
                     (    .004)I                   (    .002)I
                     (   4.865@I                   (  16.623@I
                               I                             I
D1  -   F1              -.000*I                               I
E4  -GENDER              .001 I                               I
                       -.338 I                               I
                     (    .001)I                             I
                     (   -.337)I                             I
                               I                             I
D3  -   F3              -.003*I                               I
E4  -GENDER              .000 I                               I
                       -9.287@I                              I
                     (    .000)I                             I
                     ( -10.034@I                             I
                               I                             I
D5  -   F5               .006*I                               I
E4  -GENDER              .001 I                               I
                        4.543@I                              I
                     (    .001)I                             I
                     (   4.568@I                             I
                               I                             I
E6  -CESD_W2             .002*I                               I
E5  -CESD_W1             .000 I                               I
                       20.555@I                              I
                     (    .000)I                             I
```

```
                    (  13.267@I                          I
                               I                         I
E9  -LIFE_W1                -.003*I                      I
E5  -CESD_W1                 .000 I                      I
                          -15.735@I                      I
                    (     .000)I                         I
                    ( -10.949@I                          I
                               I                         I
E10 -LIFE_W2                -.003*I                      I
E6  -CESD_W2                 .000 I                      I
                          -13.199@I                      I
                    (     .000)I                         I
                    (  -9.584@I                          I
                               I                         I
E8  -LONE_W2                 .013*I                      I
E7  -LONE_W1                 .000 I                      I
                          29.379@I                       I
                    (     .001)I                         I
                    (  24.934@I                          I
                               I                         I
E44 -INCOME                 -.006*I                      I
E7  -LONE_W1                 .003 I                      I
                          -2.470@I                       I
                    (     .003)I                         I
                    (  -2.396@I                          I
                               I                         I
E49 -ALONE                   .015*I                      I
E7  -LONE_W1                 .001 I                      I
                          17.574@I                       I
                    (     .001)I                         I
                    (  16.820@I                          I
                               I                         I
E44 -INCOME                 -.012*I                      I
E8  -LONE_W2                 .003 I                      I
                          -4.123@I                       I
                    (     .003)I                         I
                    (  -3.996@I                          I
                               I                         I
E49 -ALONE                   .012*I                      I
E8  -LONE_W2                 .001 I                      I
                          12.837@I                       I
                    (     .001)I                         I
                    (  12.260@I                          I
                               I                         I
E10 -LIFE_W2                 .005*I                      I
E9  -LIFE_W1                 .000 I                      I
                          12.248@I                       I
                    (     .000)I                         I
                    (  10.045@I                          I
                               I                         I
E12 -CASP_W2                 .002*I                      I
E11 -CASP_W1                 .000 I                      I
                          14.041@I                       I
                    (     .000)I                         I
                    (  12.682@I                          I
                               I                         I
E14 -MMSE_W2                 .001*I                      I
E13 -MMSE_W1                 .000 I                      I
                          18.691@I                       I
                    (     .000)I                         I
                    (  11.963@I                          I
                               I                         I
E16 -MEM_W2                  .002*I                      I
E15 -MEM_W1                  .000 I                      I
                           6.414@I                       I
                    (     .000)I                         I
                    (   6.530@I                          I
                               I                         I
E18 -EXEC_W2                 .108*I                      I
E17 -EXEC_W1                 .005 I                      I
                          22.806@I                       I
                    (     .005)I                         I
                    (  21.020@I                          I
                               I                         I
E44 -INCOME                 -.037*I                      I
E17 -EXEC_W1                 .010 I                      I
```

```
                      -3.529@I                                  I
                   (    .012)I                                  I
                   (  -3.134@I                                  I
                              I                                 I
E44 -INCOME                -.017*I                             I
E18 -EXEC_W2                .008 I                             I
                      -2.133@I                                  I
                   (    .008)I                                  I
                   (  -2.042@I                                  I
                              I                                 I
E29 -PARTIC2                .030*I                             I
E25 -IPAQ_W1                .002 I                             I
                      12.344@I                                  I
                   (    .003)I                                  I
                   (  11.727@I                                  I
                              I                                 I
E39 -IMP_W1                -.047*I                             I
E25 -IPAQ_W1                .004 I                             I
                     -12.017@I                                  I
                   (    .004)I                                  I
                   ( -11.272@I                                  I
                              I                                 I
E40 -IMP_W2                -.045*I                             I
E25 -IPAQ_W1                .004 I                             I
                     -12.070@I                                  I
                   (    .004)I                                  I
                   ( -11.207@I                                  I
                              I                                 I
E46 -SMOKER                -.023*I                             I
E25 -IPAQ_W1                .006 I                             I
                      -3.745@I                                  I
                   (    .007)I                                  I
                   (  -3.485@I                                  I
                              I                                 I
E47 -ALCPROB                .013*I                             I
E25 -IPAQ_W1                .005 I                             I
                       2.477@I                                  I
                   (    .005)I                                  I
                   (   2.529@I                                  I
                              I                                 I
E49 -ALONE                 -.030*I                             I
E25 -IPAQ_W1                .006 I                             I
                      -4.692@I                                  I
                   (    .006)I                                  I
                   (  -4.715@I                                  I
                              I                                 I
E50 -  AGE                 -.192*I                             I
E25 -IPAQ_W1                .015 I                             I
                     -12.923@I                                  I
                   (    .015)I                                  I
                   ( -12.546@I                                  I
                              I                                 I
E52 -RELQUAL                .004*I                             I
E25 -IPAQ_W1                .002 I                             I
                       1.968@I                                  I
                   (    .002)I                                  I
                   (   1.890)I                                  I
                              I                                 I
E53 -RELFRND                .060*I                             I
E25 -IPAQ_W1                .010 I                             I
                       6.262@I                                  I
                   (    .010)I                                  I
                   (   6.087@I                                  I
                              I                                 I
D1  -   F1                  .033*I                             I
E25 -IPAQ_W1                .002 I                             I
                      15.488@I                                  I
                   (    .002)I                                  I
                   (  14.480@I                                  I
                              I                                 I
D3  -   F3                  .009*I                             I
E25 -IPAQ_W1                .001 I                             I
                      10.173@I                                  I
                   (    .001)I                                  I
                   (  10.147@I                                  I
                              I                                 I
```

```
D5  -   F5                .080*I                                I
E25 -IPAQ_W1              .004 I                                I
                        18.167@I                                I
                    (    .005)I                                I
                    (  16.100@I                                I
                              I                                 I
D7  -   F7                .082*I                                I
E25 -IPAQ_W1              .011 I                                I
                         7.698@I                                I
                    (    .010)I                                I
                    (   8.458@I                                I
                              I                                 I
E46 -SMOKER              -.005*I                                I
E29 -PARTIC2              .001 I                                I
                        -6.818@I                                I
                    (    .001)I                                I
                    (  -6.628@I                                I
                              I                                 I
E47 -ALCPROB              .001*I                                I
E29 -PARTIC2              .001 I                                I
                         1.404 I                                I
                    (    .001)I                                I
                    (   1.416)I                                I
                              I                                 I
E49 -ALONE               -.003*I                                I
E29 -PARTIC2              .001 I                                I
                        -4.823@I                                I
                    (    .001)I                                I
                    (  -4.411@I                                I
                              I                                 I
E50 -  AGE               -.013*I                                I
E29 -PARTIC2              .002 I                                I
                        -7.927@I                                I
                    (    .002)I                                I
                    (  -7.701@I                                I
                              I                                 I
E52 -RELQUAL              .002*I                                I
E29 -PARTIC2              .000 I                                I
                         7.489@I                                I
                    (    .000)I                                I
                    (   6.694@I                                I
                              I                                 I
E53 -RELFRND              .010*I                                I
E29 -PARTIC2              .001 I                                I
                         9.560@I                                I
                    (    .001)I                                I
                    (   9.517@I                                I
                              I                                 I
D1  -   F1                .005*I                                I
E29 -PARTIC2              .000 I                                I
                        21.548@I                                I
                    (    .000)I                                I
                    (  19.050@I                                I
                              I                                 I
D3  -   F3                .002*I                                I
E29 -PARTIC2              .000 I                                I
                        22.593@I                                I
                    (    .000)I                                I
                    (  20.881@I                                I
                              I                                 I
D5  -   F5                .006*I                                I
E29 -PARTIC2              .000 I                                I
                        15.181@I                                I
                    (    .000)I                                I
                    (  13.065@I                                I
                              I                                 I
D7  -   F7                .027*I                                I
E29 -PARTIC2              .001 I                                I
                        21.158@I                                I
                    (    .001)I                                I
                    (  25.449@I                                I
                              I                                 I
E32 -SRH_W2               .011*I                                I
E31 -SRH_W1               .001 I                                I
                        17.590@I                                I
                    (    .001)I                                I
```

```
                    (  17.264@I                          I
                               I                         I
E35 -LLTI_W1                -.009*I                      I
E31 -SRH_W1                  .001 I                      I
                           -7.824@I                      I
                    (       .001)I                       I
                    (  -7.671@I                          I
                               I                         I
E36 -LLTI_W2                -.002*I                      I
E32 -SRH_W2                  .001 I                      I
                           -1.547 I                      I
                    (       .001)I                       I
                    (  -1.489)I                          I
                               I                         I
E36 -LLTI_W2                 .047*I                      I
E35 -LLTI_W1                 .002 I                      I
                           18.958@I                      I
                    (       .003)I                       I
                    (  17.570@I                          I
                               I                         I
E38 -PAIN_W2                 .045*I                      I
E37 -PAIN_W1                 .002 I                      I
                           22.112@I                      I
                    (       .002)I                       I
                    (  18.655@I                          I
                               I                         I
E40 -IMP_W2                  .016*I                      I
E39 -IMP_W1                  .001 I                      I
                           23.110@I                      I
                    (       .001)I                       I
                    (  18.760@I                          I
                               I                         I
E50 -  AGE                   .026*I                      I
E39 -IMP_W1                  .002 I                      I
                           11.195@I                      I
                    (       .002)I                       I
                    (  11.318@I                          I
                               I                         I
E50 -  AGE                   .028*I                      I
E40 -IMP_W2                  .002 I                      I
                           12.236@I                      I
                    (       .002)I                       I
                    (  12.072@I                          I
                               I                         I
E44 -INCOME                 -.081*I                      I
E41 -THIRDLEV                .008 I                      I
                         -10.773@I                       I
                    (       .007)I                       I
                    ( -12.302@I                          I
                               I                         I
E50 -  AGE                   .037*I                      I
E42 -HICLASS                 .004 I                      I
                           10.143@I                      I
                    (       .004)I                       I
                    (  10.649@I                          I
                               I                         I
E49 -ALONE                  -.079*I                      I
E44 -INCOME                  .006 I                      I
                         -12.337@I                       I
                    (       .006)I                       I
                    ( -13.030@I                          I
                               I                         I
E47 -ALCPROB                 .011*I                      I
E46 -SMOKER                  .002 I                      I
                           6.777@I                       I
                    (       .002)I                       I
                    (   5.857@I                          I
                               I                         I
E49 -ALONE                   .009*I                      I
E46 -SMOKER                  .002 I                      I
                           4.659@I                       I
                    (       .002)I                       I
                    (   4.452@I                          I
                               I                         I
E50 -  AGE                  -.038*I                      I
E46 -SMOKER                  .004 I                      I
```

```
                      -8.942@I                                  I
                   (    .004)I                                  I
                   (  -9.327@I                                  I
                              I                                 I
E52 -RELQUAL           -.004*I                                  I
E46 -SMOKER             .001 I                                  I
                      -5.982@I                                  I
                   (    .001)I                                  I
                   (  -5.561@I                                  I
                              I                                 I
E53 -RELFRND           -.009*I                                  I
E46 -SMOKER             .003 I                                  I
                      -3.184@I                                  I
                   (    .003)I                                  I
                   (  -3.155@I                                  I
                              I                                 I
D1  -   F1             -.007*I                                  I
E46 -SMOKER             .001 I                                  I
                     -11.695@I                                  I
                   (    .001)I                                  I
                   ( -10.401@I                                  I
                              I                                 I
D3  -   F3             -.001*I                                  I
E46 -SMOKER             .000 I                                  I
                      -4.036@I                                  I
                   (    .000)I                                  I
                   (  -4.140@I                                  I
                              I                                 I
D5  -   F5             -.008*I                                  I
E46 -SMOKER             .001 I                                  I
                      -7.022@I                                  I
                   (    .001)I                                  I
                   (  -6.539@I                                  I
                              I                                 I
D7  -   F7             -.030*I                                  I
E46 -SMOKER             .003 I                                  I
                      -9.506@I                                  I
                   (    .003)I                                  I
                   ( -10.949@I                                  I
                              I                                 I
E49 -ALONE             -.001*I                                  I
E47 -ALCPROB            .002 I                                  I
                      -.434 I                                   I
                   (    .002)I                                  I
                   (   -.445)I                                  I
                              I                                 I
E50 -  AGE             -.041*I                                  I
E47 -ALCPROB            .004 I                                  I
                     -11.294@I                                  I
                   (    .003)I                                  I
                   ( -12.300@I                                  I
                              I                                 I
E52 -RELQUAL           -.006*I                                  I
E47 -ALCPROB            .001 I                                  I
                     -10.192@I                                  I
                   (    .001)I                                  I
                   ( -10.090@I                                  I
                              I                                 I
E53 -RELFRND            .003*I                                  I
E47 -ALCPROB            .002 I                                  I
                      1.444 I                                   I
                   (    .002)I                                  I
                   (   1.417)I                                  I
                              I                                 I
D1  -   F1             -.004*I                                  I
E47 -ALCPROB            .001 I                                  I
                      -7.881@I                                  I
                   (    .001)I                                  I
                   (  -7.069@I                                  I
                              I                                 I
D3  -   F3              .002*I                                  I
E47 -ALCPROB            .000 I                                  I
                      7.508@I                                   I
                   (    .000)I                                  I
                   (   8.021@I                                  I
                              I                                 I
```

```
D5  -   F5               .001*I                                  I
E47 -ALCPROB             .001 I                                  I
                        1.381 I                                  I
                    (    .001)I                                  I
                    (   1.432)I                                  I
                              I                                  I
D7  -   F7               .012*I                                  I
E47 -ALCPROB             .003 I                                  I
                        4.313@I                                  I
                    (    .003)I                                  I
                    (   4.235@I                                  I
                              I                                  I
E50 -  AGE               .077*I                                  I
E49 -ALONE               .004 I                                  I
                       17.495@I                                  I
                    (    .005)I                                  I
                    (  16.867@I                                  I
                              I                                  I
E52 -RELQUAL             .003*I                                  I
E49 -ALONE               .001 I                                  I
                        4.794@I                                  I
                    (    .001)I                                  I
                    (   4.478@I                                  I
                              I                                  I
E53 -RELFRND             -.017*I                                 I
E49 -ALONE               .003 I                                  I
                       -5.878@I                                  I
                    (    .003)I                                  I
                    (  -5.918@I                                  I
                              I                                  I
D1  -   F1               -.002*I                                 I
E49 -ALONE               .001 I                                  I
                       -3.389@I                                  I
                    (    .001)I                                  I
                    (  -3.296@I                                  I
                              I                                  I
D3  -   F3               -.003*I                                 I
E49 -ALONE               .000 I                                  I
                      -12.225@I                                  I
                    (    .000)I                                  I
                    ( -11.662@I                                  I
                              I                                  I
D5  -   F5               -.011*I                                 I
E49 -ALONE               .001 I                                  I
                       -9.761@I                                  I
                    (    .001)I                                  I
                    (  -9.531@I                                  I
                              I                                  I
D7  -   F7               -.010*I                                 I
E49 -ALONE               .003 I                                  I
                       -3.036@I                                  I
                    (    .003)I                                  I
                    (  -3.216@I                                  I
                              I                                  I
E52 -RELQUAL             .019*I                                  I
E50 -  AGE               .001 I                                  I
                       13.196@I                                  I
                    (    .001)I                                  I
                    (  13.595@I                                  I
                              I                                  I
E53 -RELFRND             .007*I                                  I
E50 -  AGE               .006 I                                  I
                        1.052 I                                  I
                    (    .006)I                                  I
                    (   1.043)I                                  I
                              I                                  I
D1  -   F1               .002*I                                  I
E50 -  AGE               .001 I                                  I
                        1.442 I                                  I
                    (    .001)I                                  I
                    (   1.496)I                                  I
                              I                                  I
D3  -   F3               -.018*I                                 I
E50 -  AGE               .001 I                                  I
                      -29.111@I                                  I
                    (    .001)I                                  I
```

```
                    ( -31.059@I                              I
                              I                              I
D5  -   F5                 -.029*I                           I
E50 -  AGE                  .003 I                           I
                          -10.797@I                          I
                        (    .003)I                          I
                        ( -10.539@I                          I
                              I                              I
D7  -   F7                 -.093*I                           I
E50 -  AGE                  .007 I                           I
                          -12.545@I                          I
                        (    .007)I                          I
                        ( -13.930@I                          I
                              I                              I
E53 -RELFRND                .015*I                           I
E52 -RELQUAL                .001 I                           I
                           15.245@I                          I
                        (    .001)I                          I
                        (  14.779@I                          I
                              I                              I
D1  -   F1                  .008*I                           I
E52 -RELQUAL                .000 I                           I
                           34.880@I                          I
                        (    .000)I                          I
                        (  30.231@I                          I
                              I                              I
D3  -   F3                 -.000*I                           I
E52 -RELQUAL                .000 I                           I
                           -.951 I                           I
                        (    .000)I                          I
                        (   -.937)I                          I
                              I                              I
D5  -   F5                  .004*I                           I
E52 -RELQUAL                .000 I                           I
                           10.360@I                          I
                        (    .000)I                          I
                        (   9.102@I                          I
                              I                              I
D7  -   F7                 -.000*I                           I
E52 -RELQUAL                .001 I                           I
                           -.306 I                           I
                        (    .001)I                          I
                        (   -.328)I                          I
                              I                              I
D1  -   F1                  .015*I                           I
E53 -RELFRND                .001 I                           I
                           16.096@I                          I
                        (    .001)I                          I
                        (  16.372@I                          I
                              I                              I
D3  -   F3                  .001*I                           I
E53 -RELFRND                .000 I                           I
                            3.591@I                          I
                        (    .000)I                          I
                        (   3.656@I                          I
                              I                              I
D5  -   F5                  .012*I                           I
E53 -RELFRND                .002 I                           I
                            7.291@I                          I
                        (    .002)I                          I
                        (   7.153@I                          I
                              I                              I
D7  -   F7                  .024*I                           I
E53 -RELFRND                .005 I                           I
                            5.063@I                          I
                        (    .004)I                          I
                        (   5.443@I                          I
                              I                              I
```

STANDARDIZED SOLUTION: R-SQUARED

```
GENDER  =V4  =    .000*V999  + 1.000 E4                                    .000
CESD_W1 =V5  =   -.618*F1    +  .786 E5                                    .383
CESD_W2 =V6  =   -.633*F2    +  .774 E6                                    .401
LONE_W1 =V7  =   -.704*F1    +  .000*V999  +  .710 E7                      .496
LONE_W2 =V8  =   -.666*F2    +  .000*V999  +  .746 E8                      .444
LIFE_W1 =V9  =    .522*F1    +  .000*V999  +  .853 E9                      .273
LIFE_W2 =V10 =    .480*F2    +  .000*V999  +  .878 E10                     .230
CASP_W1 =V11 =    .843 F1    +  .000*V999  +  .538 E11                     .710
CASP_W2 =V12 =    .814 F2    +  .000*V999  +  .581 E12                     .662
MMSE_W1 =V13 =    .653 F3    +  .000*V999  +  .757 E13                     .426
MMSE_W2 =V14 =    .668 F4    +  .000 V999  +  .744 E14                     .446
MEM_W1  =V15 =    .777*F3    +  .000*V999  +  .629 E15                     .604
MEM_W2  =V16 =    .800*F4    +  .000*V999  +  .600 E16                     .640
EXEC_W1 =V17 =    .492*F3    +  .871 E17                                   .242
EXEC_W2 =V18 =    .584*F4    +  .812 E18                                   .341
IPAQ_W1 =V25 =    .000*V999  + 1.000 E25                                   .000
PARTIC2 =V29 =    .000*V999  + 1.000 E29                                   .000
SRH_W1  =V31 =    .689*F5    +  .725 E31                                   .474
SRH_W2  =V32 =    .714*F6    +  .700 E32                                   .510
LLTI_W1 =V35 =   -.550*F5    +  .000*V999  +  .835 E35                     .302
LLTI_W2 =V36 =   -.536*F6    +  .000*V999  +  .844 E36                     .287
PAIN_W1 =V37 =   -.522*F5    +  .000*V999  +  .853 E37                     .273
PAIN_W2 =V38 =   -.519*F6    +  .000*V999  +  .855 E38                     .269
IMP_W1  =V39 =   -.713 F5    +  .000*V999  +  .701 E39                     .508
IMP_W2  =V40 =   -.704 F6    +  .000*V999  +  .700 E40                     .510
THIRDLEV=V41 =    .780*F7    +  .626 E41                                   .608
HICLASS =V42 =    .534*F7    +  .000*V999  +  .845 E42                     .285
INCOME  =V44 =    .621 F7    +  .000*V999  +  .784 E44                     .386
SMOKER  =V46 =    .000*V999  + 1.000 E46                                   .000
ALCPROB =V47 =    .000*V999  + 1.000 E47                                   .000
ALONE   =V49 =    .000*V999  + 1.000 E49                                   .000
  AGE   =V50 =    .000*V999  + 1.000 E50                                   .000
RELQUAL =V52 =    .000*V999  + 1.000 E52                                   .000
RELFRND =V53 =    .000*V999  + 1.000 E53                                   .000
   F1   =F1  =    .000*V999  + 1.000 D1                                    .000
   F2   =F2  =   -.002*V4    +  .012*V25   +  .007*V29   -  .038*V46
               -  .010*V47   +  .001*V49   -  .038*V50   +  .065*V52
               +  .020*V53   +  .746*F1    -  .015*F3    +  .079*F5
               +  .006*F7    +  .000*V999  +  .530 D2                     .719
   F3   =F3  =    .000*V999  + 1.000 D3                                    .000
   F4   =F4  =   -.015*V4    +  .027*V25   +  .006*V29   -  .007*V46
               -  .022*V47   -  .026*V49   -  .094*V50   +  .003*V52
               +  .018*V53   +  .021*F1    +  .891*F3    -  .045*F5
               -  .027*F7    +  .000*V999  +  .370 D4                     .863
   F5   =F5  =    .000*V999  + 1.000 D5                                    .000
   F6   =F6  =    .030*V4    -  .006*V25   +  .005*V29   -  .026*V46
               +  .005*V47   +  .007*V49   -  .087*V50   -  .014*V52
               +  .017*V53   +  .096*F1    +  .012*F3    +  .791*F5
               +  .037*F7    +  .000*V999  +  .457 D6                     .791
   F7   =F7  =    .000*V999  + 1.000 D7                                    .000
```

CORRELATIONS AMONG INDEPENDENT VARIABLES

```
                E                                D
               ---                              ---
E5  -CESD_W1           -.129*I D3  -   F3              .224*I
E4  -GENDER                 I D1  -   F1                   I
                            I                              I
E6  -CESD_W2           -.114*I D5  -   F5              .588*I
E4  -GENDER                 I D1  -   F1                   I
                            I                              I
E25 -IPAQ_W1            .156*I D7  -   F7              .217*I
E4  -GENDER                 I D1  -   F1                   I
                            I                              I
E29 -PARTIC2           -.115*I D4  -   F4              .145*I
E4  -GENDER                 I D2  -   F2                   I
                            I                              I
E47 -ALCPROB            .120*I D6  -   F6              .488*I
E4  -GENDER                 I D2  -   F2                   I
                            I                              I
E49 -ALONE             -.023*I D5  -   F5              .348*I
```

```
E4  -GENDER                  I D3  -   F3                    I
                             I                               I
E50 -  AGE                .039*I D7  -   F7                .518*I
E4  -GENDER                  I D3  -   F3                    I
                             I                               I
E52 -RELQUAL              -.065*I D6  -   F6                .337*I
E4  -GENDER                  I D4  -   F4                    I
                             I                               I
E53 -RELFRND               .062*I D7  -   F7                .269*I
E4  -GENDER                  I D5  -   F5                    I
                             I                               I
D1  -   F1                -.005*I                            I
E4  -GENDER                  I                               I
                             I                               I
D3  -   F3                -.129*I                            I
E4  -GENDER                  I                               I
                             I                               I
D5  -   F5                 .066*I                            I
E4  -GENDER                  I                               I
                             I                               I
E6  -CESD_W2               .292*I                            I
E5  -CESD_W1                 I                               I
                             I                               I
E9  -LIFE_W1              -.213*I                            I
E5  -CESD_W1                 I                               I
                             I                               I
E10 -LIFE_W2              -.180*I                            I
E6  -CESD_W2                 I                               I
                             I                               I
E8  -LONE_W2               .507*I                            I
E7  -LONE_W1                 I                               I
                             I                               I
E44 -INCOME               -.057*I                            I
E7  -LONE_W1                 I                               I
                             I                               I
E49 -ALONE                 .244*I                            I
E7  -LONE_W1                 I                               I
                             I                               I
E44 -INCOME               -.101*I                            I
E8  -LONE_W2                 I                               I
                             I                               I
E49 -ALONE                 .185*I                            I
E8  -LONE_W2                 I                               I
                             I                               I
E10 -LIFE_W2               .159*I                            I
E9  -LIFE_W1                 I                               I
                             I                               I
E12 -CASP_W2               .332*I                            I
E11 -CASP_W1                 I                               I
                             I                               I
E14 -MMSE_W2               .333*I                            I
E13 -MMSE_W1                 I                               I
                             I                               I
E16 -MEM_W2                .162*I                            I
E15 -MEM_W1                  I                               I
                             I                               I
E18 -EXEC_W2               .367*I                            I
E17 -EXEC_W1                 I                               I
                             I                               I
E44 -INCOME               -.085*I                            I
E17 -EXEC_W1                 I                               I
                             I                               I
E44 -INCOME               -.047*I                            I
E18 -EXEC_W2                 I                               I
                             I                               I
E29 -PARTIC2               .158*I                            I
E25 -IPAQ_W1                 I                               I
                             I                               I
E39 -IMP_W1               -.192*I                            I
E25 -IPAQ_W1                 I                               I
                             I                               I
E40 -IMP_W2               -.186*I                            I
E25 -IPAQ_W1                 I                               I
                             I                               I
E46 -SMOKER               -.047*I                            I
E25 -IPAQ_W1                 I                               I
```

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                                I                                I
E47 -ALCPROB             .031*I                                I
E25 -IPAQ_W1                    I                                I
                                I                                I
E49 -ALONE              -.057*I                                I
E25 -IPAQ_W1                    I                                I
                                I                                I
E50 -  AGE              -.166*I                                I
E25 -IPAQ_W1                    I                                I
                                I                                I
E52 -RELQUAL             .025*I                                I
E25 -IPAQ_W1                    I                                I
                                I                                I
E53 -RELFRND             .079*I                                I
E25 -IPAQ_W1                    I                                I
                                I                                I
D1  -   F1               .223*I                                I
E25 -IPAQ_W1                    I                                I
                                I                                I
D3  -   F3               .153*I                                I
E25 -IPAQ_W1                    I                                I
                                I                                I
D5  -   F5               .326*I                                I
E25 -IPAQ_W1                    I                                I
                                I                                I
D7  -   F7               .109*I                                I
E25 -IPAQ_W1                    I                                I
                                I                                I
E46 -SMOKER             -.087*I                                I
E29 -PARTIC2                    I                                I
                                I                                I
E47 -ALCPROB             .018*I                                I
E29 -PARTIC2                    I                                I
                                I                                I
E49 -ALONE              -.059*I                                I
E29 -PARTIC2                    I                                I
                                I                                I
E50 -  AGE              -.100*I                                I
E29 -PARTIC2                    I                                I
                                I                                I
E52 -RELQUAL             .096*I                                I
E29 -PARTIC2                    I                                I
                                I                                I
E53 -RELFRND             .123*I                                I
E29 -PARTIC2                    I                                I
                                I                                I
D1  -   F1               .320*I                                I
E29 -PARTIC2                    I                                I
                                I                                I
D3  -   F3               .361*I                                I
E29 -PARTIC2                    I                                I
                                I                                I
D5  -   F5               .236*I                                I
E29 -PARTIC2                    I                                I
                                I                                I
D7  -   F7               .330*I                                I
E29 -PARTIC2                    I                                I
                                I                                I
E32 -SRH_W2              .319*I                                I
E31 -SRH_W1                     I                                I
                                I                                I
E35 -LLTI_W1            -.114*I                                I
E31 -SRH_W1                     I                                I
                                I                                I
E36 -LLTI_W2            -.022*I                                I
E32 -SRH_W2                     I                                I
                                I                                I
E36 -LLTI_W2             .278*I                                I
E35 -LLTI_W1                    I                                I
                                I                                I
E38 -PAIN_W2             .331*I                                I
E37 -PAIN_W1                    I                                I
                                I                                I
E40 -IMP_W2              .461*I                                I
E39 -IMP_W1                     I                                I
                                I                                I
```

```
E50 -  AGE              .160*I                          I
E39 -IMP_W1                 I                          I
                            I                          I
E50 -  AGE              .171*I                          I
E40 -IMP_W2                 I                          I
                            I                          I
E44 -INCOME            -.384*I                          I
E41 -THIRDLEV               I                          I
                            I                          I
E50 -  AGE              .116*I                          I
E42 -HICLASS                I                          I
                            I                          I
E49 -ALONE             -.271*I                          I
E44 -INCOME                 I                          I
                            I                          I
E47 -ALCPROB            .086*I                          I
E46 -SMOKER                 I                          I
                            I                          I
E49 -ALONE              .057*I                          I
E46 -SMOKER                 I                          I
                            I                          I
E50 -  AGE             -.113*I                          I
E46 -SMOKER                 I                          I
                            I                          I
E52 -RELQUAL           -.077*I                          I
E46 -SMOKER                 I                          I
                            I                          I
E53 -RELFRND           -.041*I                          I
E46 -SMOKER                 I                          I
                            I                          I
D1  -   F1             -.168*I                          I
E46 -SMOKER                 I                          I
                            I                          I
D3  -   F3             -.061*I                          I
E46 -SMOKER                 I                          I
                            I                          I
D5  -   F5             -.106*I                          I
E46 -SMOKER                 I                          I
                            I                          I
D7  -   F7             -.139*I                          I
E46 -SMOKER                 I                          I
                            I                          I
E49 -ALONE             -.005*I                          I
E47 -ALCPROB                I                          I
                            I                          I
E50 -  AGE             -.143*I                          I
E47 -ALCPROB                I                          I
                            I                          I
E52 -RELQUAL           -.132*I                          I
E47 -ALCPROB                I                          I
                            I                          I
E53 -RELFRND            .018*I                          I
E47 -ALCPROB                I                          I
                            I                          I
D1  -   F1             -.113*I                          I
E47 -ALCPROB                I                          I
                            I                          I
D3  -   F3              .114*I                          I
E47 -ALCPROB                I                          I
                            I                          I
D5  -   F5              .021*I                          I
E47 -ALCPROB                I                          I
                            I                          I
D7  -   F7              .062*I                          I
E47 -ALCPROB                I                          I
                            I                          I
E50 -  AGE              .216*I                          I
E49 -ALONE                  I                          I
                            I                          I
E52 -RELQUAL            .059*I                          I
E49 -ALONE                  I                          I
                            I                          I
E53 -RELFRND           -.072*I                          I
E49 -ALONE                  I                          I
                            I                          I
D1  -   F1             -.048*I                          I
```

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 E49 -ALONE                    I                                 I
                               I                                 I
 D3  -   F3                -.179*I                               I
 E49 -ALONE                    I                                 I
                               I                                 I
 D5  -   F5                -.143*I                               I
 E49 -ALONE                    I                                 I
                               I                                 I
 D7  -   F7                -.044*I                               I
 E49 -ALONE                    I                                 I
                               I                                 I
 E52 -RELQUAL               .168*I                               I
 E50 -  AGE                    I                                 I
                               I                                 I
 E53 -RELFRND               .013*I                               I
 E50 -  AGE                    I                                 I
                               I                                 I
 D1  -   F1                 .020*I                               I
 E50 -  AGE                    I                                 I
                               I                                 I
 D3  -   F3                -.481*I                               I
 E50 -  AGE                    I                                 I
                               I                                 I
 D5  -   F5                -.179*I                               I
 E50 -  AGE                    I                                 I
                               I                                 I
 D7  -   F7                -.185*I                               I
 E50 -  AGE                    I                                 I
                               I                                 I
 E53 -RELFRND               .199*I                               I
 E52 -RELQUAL                  I                                 I
                               I                                 I
 D1  -   F1                 .564*I                               I
 E52 -RELQUAL                  I                                 I
                               I                                 I
 D3  -   F3                -.014*I                               I
 E52 -RELQUAL                  I                                 I
                               I                                 I
 D5  -   F5                 .158*I                               I
 E52 -RELQUAL                  I                                 I
                               I                                 I
 D7  -   F7                -.004*I                               I
 E52 -RELQUAL                  I                                 I
                               I                                 I
D1  -   F1                .234*I                                 I
 E53 -RELFRND                  I                                  I
                               I                                  I
 D3  -   F3                 .054*I                                I
 E53 -RELFRND                  I                                  I
                               I                                  I
 D5  -   F5                 .110*I                                I
 E53 -RELFRND                  I                                  I
                               I                                  I
 D7  -   F7                 .073*I                                I
 E53 -RELFRND                  I                                  I
                               I                                  I
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