

TECHNICAL APPENDIX

METHOD

The principal analyses were multi-sample structural equation modelling conducted with EQS (Multivariate Software Inc., Encino, CA, USA). This technique permits the simultaneous comparison of a single model across groups, enabling one to assess whether the same structural model is appropriate for all groups or requires adjustment, and so determines whether the groups come from the same population. Whilst the model of best fit obtained is an overall measure of fit across groups, the analysis also calculates parameters individually for each group which allows one to identify differences between groups. Theoretically, although one would expect that the different groups would come from a similar population, one would also expect that the relationship of health to itself might differ across time and between groups, and that age and gender would predict the groups differentially. These relationships might differ between stable and non-stable marital status groups, thus indicating that a transition in marital status causes disruptions in the time–health relationship. For each health variable a four-stage nested model was analysed. The endogenous (dependent) variables are health at Time 1 (T1), Time 2 (T2), Time 3 (T3) and Time 4 (T4), where T1 is the baseline or pre-marital status transition time point, and T2–T4 are the post-marital status transition time points. Age and Gender were the exogenous (independent) variables. Problems is used for illustration.

- (1) The initial model allowed groups to vary freely: age and gender predicted Problems at T1, which predicted Problems at T2, which predicted Problems at T3, which predicted Problems at T4. Paths were also included between groups T1–T3, T1–T4, and T2–T4, to identify the effects of marital status change (see Fig. 1 in main article).
- (2) On theoretical grounds, the model was then modified to constrain the parameters associated with the exogenous variables (age and gender) to be equal across groups.

The theoretical rationale was to examine whether the influence of age and gender was the same between groups.

- (3) In the third stage, on statistical grounds [using the Lagrange Multiplier (LM) test], constraints for age and gender were released. The LM test indicates which paths can be freed to improve the fit.
- (4) Next, on theoretical grounds, the parameters associated with the endogenous variables – the remaining health pathways (e.g. T1–T2, T1–T3) – were constrained across groups. The theoretical rationale was to determine whether or not health was influenced by marital status and marital status change. On statistical grounds the LM test was conducted to identify whether there were parameters which, if released, would improve the fit.
- (5) The final model released the constraints suggested by the LM test.
- (6) Finally, the χ^2 difference test was used to establish which model was the best and most parsimonious fit.

The estimation method used was ML. Four fit indices are reported: Comparative Fit Index (CFI); Bentler-Bonnet Normed Fit Index (NFI); the Root Mean Squared Error of Approximation (RMSEA); and χ^2 . To indicate a good fit both the CFI and the NFI should be ≥ 0.9 , and ideally ≥ 0.95 , and the RMSEA should be ≤ 0.05 . A standard error ≤ 0.8 indicates a reasonable error of approximation in association with a RMSEA ≤ 0.05 . Finally, a non-significant χ^2 indicates a good fit, although with large sample sizes this often is not achievable (Maruyama, 1998). The sample size varied for each of the health variables [Problems ($n=1797$), Limitations ($n=1731$), Service use ($n=1798$), SRH ($n=1753$)] which were tested in separate models.

RESULTS

Appendix Table 1 shows the fit indices and $\Delta\chi^2$. Appendix Table 2 shows the total effects (comprising both direct and indirect effects)

Appendix Table 1. Showing models with additional fit indices, $\Delta\chi^2$ difference test for Problems (A), Limitations (B), Service use (C) and Self-rated health (D)

	Models	NFI ^a	RMSEA (CI)	$\Delta\chi^2$	Δdf	$p <$
(A) Problems	1	0.991	0.008 (0–0.019)	18.9	10	0.05
	2	0.986	0.012 (0–0.021)	4.5	1	0.05
	3	0.987	0.011 (0–0.02)	30	39.3	N.S.
	4	0.978	0.012 (0–0.019)	31.6	7	0.001
	5	0.986	0.000 (0–0.011)			
(B) Limitations	1	0.978	0.026 (0.016–0.032)	16.1	10	N.S.
	2	0.981	0.023 (0.016–0.031)	11.3	2	0.01
	3	0.983	0.021 (0.013–0.029)	52.9	6	0.001
	4	0.965	0.026 (0.021–0.032)	53.9	4	0.001
	5	0.976	0.019 (0.017–0.029)			
(C) Service use	1	0.921	0.031 (0.022–0.037)	31.3	10	0.001
	2	0.951	0.031 (0.024–0.037)	15.6	1	0.001
	3	0.958	0.028 (0.021–0.035)	92.4	30	0.001
	4	0.921	0.031 (0.025–0.036)	63.4	6	0.001
	5	0.946	0.024 (0.018–0.029)			
(D) Self-rated health	1	0.986	0.014 (0–0.023)	20.2	10	0.05
	2	0.98	0.017 (0.007–0.025)	14.2	2	0.001
	3	0.984	0.012 (0–0.021)	72.7	30	0.001
	4	0.963	0.02 (0.014–0.026)	41.7	7	0.001
	5	0.975	0.011 (0–0.019)			

^a Bentler-Bonnet normed fit.

and Appendix Table 3 shows the measurement equations.

Problems

The initial model was a good fit [χ^2 (36, $n = 1797$) = 39.51, $p = 0.32$, CFI = 1.0, RMSEA = 0.01, NFI = 0.99]. In the next stage modification and the model remained a good fit. However, the LM test indicated that on statistical grounds, the path between Age and T1 should be released with respect to NW. Next the paths between Problems over time were constrained across all groups, and between Age and T1 (with the exception of the NW, which had already been released), and between Gender and T1. The LM test indicated that fit could be significantly improved if paths were released between: T1–T2 for D and ND; T1–T3 for NW; T1–T3 for NW; T3–T4 for NW; Age–T1 for NM; Gender–T1 for NM. These constraints were then released in the final model [χ^2 (68, $n = 1797$) = 61.57, $p = 0.7$, CFI = 1.00, RMSEA = 0.00, NFI = 0.99] and significantly (using the $\Delta\chi^2$ test) improved the fit of the model. D and ND predicted more strongly

Problems between T1 and T2 than the other groups. NW provided a stronger prediction between groups T1–T3 and T3–T4, but weaker between T2–T3, than the other groups. The Age–T1 relationship was non-significant for NM and NW and for the Gender–T1 pathway was significantly stronger for NM. These effects are direct effects. In addition, the indirect effect of T1, via T2 and T3, on T4 was smaller but also strong (and smaller indirect effects of T2 on T4). This indicates that in addition to the effects of marital status change, baseline Problems indirectly influence subsequent Problems.

Limitations

The initial model was a good fit [χ^2 (36, $n = 1731$) = 73.48, $p < 0.01$, CFI = 0.99, RMSEA = 0.03, NFI = 0.98]. following the first modification, although the model still fitted the data, the LM test indicated that fit could be improved if the paths between Age and T1 were released for the W and D. These were released and the Limitation paths were constrained. Fit remained good, but the LM test indicated that the fit

Appendix Table 2. *Standardized total effects for Problems (A), Limitations (B), Service use (C) and Self-rated health (D) by marital status group*

	Married	Widowed	Divorced	Never married	New widowed	New divorced
(A) Problems						
T1 = Age + Gender	0.16 + 0.01	0.16 + 0.01	0.26 + 0.01	-0.03 + 0.23	0.01 + 0.01	0.25 + 0.01
T2 = T1 + Age + Gender	0.67 + 0.11 + 0.01	0.67 + 0.11 + 0.01	0.72 + 0.19 + 0.01	0.63 - 0.02 + 0.14	0.65 + 0.01 + 0.01	0.88 + 0.22 + 0.01
T3 = T1 + T2 + Age + Gender	0.64 + 0.50 + 0.10 + 0.01	0.64 + 0.50 + 0.10 + 0.01	0.66 + 0.52 + 0.17 + 0.01	0.59 + 0.49 - 0.02 + 0.13	0.72 + 0.35 + 0.01 + 0.01	0.78 + 0.50 + 0.19 + 0.01
T4 = T1 + T2 + T3 + Age + Gender	0.62 + 0.46 + 0.35 + 0.10 + 0.01	0.61 + 0.46 + 0.35 + 0.1 + 0.01	0.68 + 0.51 + 0.38 + 0.18 + 0.01	0.64 + 0.51 + 0.4 - 0.02 + 0.15	0.68 + 0.42 + 0.45 + 0.01 + 0.01	0.81 + 0.50 + 0.38 + 0.20 + 0.01
(B) Limitations						
T1 = Age + Gender	-0.01 - 0.01	-0.16 - 0.004	-0.17 - 0.01	-0.01 - 0.01	-0.01 - 0.01	-0.02 - 0.01
T2 = T1 + Age + Gender	0.73 - 0.01 - 0.01	0.70 + 0.11 - 0.003	0.81 + 0.14 - 0.004	-0.82 - 0.01 - 0.004	0.73 - 0.01 - 0.003	0.78 - 0.02 - 0.004
T3 = T1 + T2 + Age + Gender	0.65 + 0.46 - 0.02 - 0.004	0.65 + 0.46 + 0.10 - 0.003	0.71 + 0.48 + 0.12 - 0.004	0.70 + 0.47 - 0.01 - 0.004	0.63 + 0.44 - 0.01 - 0.003	0.72 + 0.47 - 0.02 - 0.004
T4 = T1 + T2 + T3 + Age + Gender	0.64 + 0.49 + 0.42 - 0.01 - 0.004 +	0.63 + 0.50 + 0.42 + 0.10 - 0.003	0.68 + 0.83 + 0.44 + 0.12 - 0.004	0.7 + 0.51 + 0.42 - 0.01 - 0.004	0.63 + 0.48 + 0.43 - 0.01 - 0.003	0.82 + 0.04 + 0.49 - 0.02 - 0.01
(C) Service use						
T1 = Age + Gender	0.12 + 0.10	0.33 + 0.06	0.19 + 0.08	0.12 + 0.09	0.12 + 0.08	0.21 + 0.09
T2 = T1 + Age + Gender	0.38 + 0.05 + 0.04	0.66 + 0.216 + 0.04	0.47 + 0.9 + 0.04	0.55 + 0.06 + 0.05	0.65 + 0.08 + 0.05	0.76 + 0.16 + 0.07
T3 = T1 + T2 + Age + Gender	0.40 + 0.39 + 0.05 + 0.04	0.56 + 0.43 + 0.18 + 0.04	0.47 + 0.37 + 0.09 + 0.04	0.56 + 0.56 + 0.06 + 0.05	0.59 + 0.53 + 0.07 + 0.04	0.57 + 0.41 + 0.12 + 0.05
T4 = T1 + T2 + T3 + Age + Gender	0.38 + 0.33 + 0.41 + 0.05 + 0.04	0.53 + 0.37 + 0.43 + 0.17 + 0.03	0.42 + 0.30 + 0.4 + 0.08 + 0.04	0.47 + 0.41 + 0.42 + 0.05 + 0.04*	0.6 + 0.52 + 0.45 + 0.07 + 0.05	0.49 + 0.33 + 0.39 + 0.10 + 0.04
(D) Self-rated health						
T1 = Age + Gender	-0.004 + 0.03	-0.004 + 0.02	0.20 + 0.02	-0.21 + 0.02	-0.01 + 0.02	-0.01 + 0.02
T2 = T1 + Age + Gender	0.65 - 0.002 + 0.02	0.56 - 0.002 + 0.01	0.72 + 0.15 + 0.01	0.67 - 0.14 + 0.02	0.64 - 0.004 + 0.01	0.64 - 0.004 + 0.02
T3 = T1 + T2 + Age + Gender	0.59 + 0.48 - 0.002 + 0.01	0.60 + 0.28 - 0.002 + 0.01	0.65 + 0.49 + 0.14 + 0.01	0.62 + 0.5 - 0.13 + 0.01	0.56 + 0.47 - 0.003 + 0.01	0.56 + 0.47 - 0.004 + 0.01
T4 = T1 + T2 + T3 + Age + Gender	0.54 + 0.45 + 0.45 - 0.002 + 0.01	0.62 + 0.22 + 0.43 - 0.002 + 0.01	0.59 + 0.45 + 0.44 + 0.12 + 0.01	0.56 + 0.46 + 0.44 - 0.12 + 0.01	0.51 + 0.44 + 0.45 - 0.003 + 0.01	0.51 + 0.044 + 0.45 - 0.003 + 0.01

Appendix Table 3. *Measurement equations [standard error (S.E.), marital status (MS)] for each of the health outcomes (M = Married; W = Widowed; D = Divorced; NM = Never married; NW = New Widowed; ND = New divorced; ~ = non-significant)*

Health outcome	Equation	Constrained	Unconstrained	
(A) Problems	T1 = Age + Gender	0.028 + 0.033 ~ (S.E.) (0.004, 0.06)	-0.006 ~ + 0.55 (0.02, 0.23)	0.001 ~ + 0.03 (0.01, 0.06)
	(MS groups)	(M, W, D, ND)	(NM)	(NW)
	T2 = T1	0.74 (S.E.) (0.02)	0.867 (0.05)	0.9 (0.08)
	(MS groups)	(M, W, NM, NW)	(D)	(ND)
	T3 = T1 + T2	0.35 + 0.52 (S.E.) (0.03, 0.02)	0.543 + 0.336 (0.08, 0.07)	
	(MS groups)	(M, W, D, NM, ND)	(NW)	
	T4 = T1 + T2 + T3	0.23 + 0.30 + 0.35 (S.E.) (0.03, 0.02, 0.02)	0.233 + 0.303 + 0.522 (0.03, 0.02, 0.06)	
	(MS groups)	(M, W, D, NM, ND)	(NW)	
(B) Limitations	T1 = Age + Gender	-0.002 ~ -0.01 ~ (S.E.) (0.01, 0.06)	0.03 - 0.01 ~ (0.01, 0.06)	0.02 - 0.01 ~ (0.01, 0.06)
	(MS groups)	(M, NM, NW, ND)	(W)	(D)
	T2 = T1	0.72 (S.E.) (0.02)	0.85 (0.04)	85 (0.06)
	(MS groups)	(M, W, NW, ND)	(D)	(NM)
	T3 = T1 + T2	0.34 + 0.49 (S.E.) (0.03, 0.03)		
	(MS groups)	(M, W, D, NM, NW, ND)		
	T4 = T1 + T2 + T3	0.14 + 0.42 + 0.48 (S.E.) (0.03, 0.03, 0.02)	0.08 ~ + 0.42 + 0.48 (0.04, 0.03, 0.02)	0.56 - 0.19 ~ + 0.48 (0.13, 0.14, 0.02)
	(MS groups)	(M, W, NM, NW)	(D)	(ND)
(C) Service use	T1 = Age + Gender	0.010 + 0.11 (S.E.) (0.002, 0.03)	0.03 + 0.11 (0.004, 0.03)	
	(MS groups)	(M, D, NM, NW, ND)	(W)	
	T2 = T1	0.40 0.69 0.60 0.69 0.81 (S.E.) (0.03) (0.04) (0.09) (0.07) (0.11)		
	(MS groups)	(M, D, W, NM, NW, ND)		
	T3 = T1 + T2	0.28 + 0.41 (S.E.) (0.02, 0.02)	0.28 + 0.59 (0.02, 0.07)	0.28 + 0.57 (0.02, 0.06)
	(MS groups)	(M, W, D, ND)	(NM)	(NW)
	T4 = T1 + T2 + T3	0.16 + 0.18 + 0.42 (S.E.) (0.02, 0.03, 0.02)	0.16 + 0.29 + 0.42 (0.02, 0.06, 0.02)	
	(MS groups)	(M, W, D, NM, ND)	(NW)	
(D) Self-rated health	T1 = Age + Gender	-0.001 + 0.05 (S.E.) (0.003, 0.05)	0.02 + 0.05 (0.01, 0.05)	-0.03 + 0.05 (0.01, 0.05)
	(MS groups)	(M, W, NW, ND)	(D)	(NM)
	T2 = T1	0.64 (S.E.) (0.02)		
	(MS groups)	(M, W, D, NM, NW, ND)		
	T3 = T1 + T2	0.26 + 0.48 (S.E.) (0.02, 0.03)	0.41 + 0.23 (0.05, 0.04)	
	(MS groups)	(M, D, NM, NW, ND)	(W)	
	T4 = T1 + T2 + T3	0.12 + 0.24 + 0.46 (S.E.) (0.03, 0.03, 0.02)	0.31 + 0.08 + 0.46 (0.05, 0.04, 0.02)	
	(MS groups)	(M, D, NM, NW, ND)	(W)	

could be improved if the following paths were released: T1-T2 for D and NM; T1-T4 for D and ND; and T2-T4 for D and ND. The final model significantly improved the fit [χ^2 (68, $n=1731$) = 108.86, $p < 0.01$, CFI = 0.99,

RMSEA = 0.02, NFI = 0.98]. D and NM predicted more strongly Limitations between T1 and T2 than other groups. ND provided a stronger predicted direct effect between T1 and T4 than others. There were small significant

differences between groups for Age-T1 with W and D showing a stronger effects than the other groups. However, there were no group differences for Gender-T1. In addition to these direct effects, there were significant indirect effects of T1 on T4, and moderate indirect effects of T2 on T4 for all groups.

Service use

The initial model was found to be a good fit [χ^2 (36, $n=1798$)=92.51, $p<0.01$, CFI=0.98, RMSEA=0.03, NFI=0.96]. Following the first modification the model fit the data less well and the LM Test indicated that fit would be improved if the path between Age and T1 were released for W. This constraint was released in the next stage and the service use pathways were constrained. This model showed a poor fit to the data and the LM Test indicated improvement if the following were released: T1-T2 for W, NM, NW-ND; T2-T3 for NM and NW; and T2-T4 for NW. These were released in the final model and significantly improved the fit [χ^2 (68, $n=1798$)=137.25, $p<0.01$, CFI=0.97, RMSEA=0.02, NFI=0.94]. W, NM, NW and ND at T1 all predicted T2 more strongly than M and D, with ND providing the strongest prediction. T2 predicted more strongly T3 for NM and NW than the other groups. In addition, NW at T2 predicted T4 more strongly than the others. The Age-T1 relationship was stronger for W than for others. There were no differences for Gender-T1. There were also significant indirect effects of T1 on T4, and of T2 on T4 for all groups.

Self-rated health

Model 1 was a good fit [χ^2 (36, $n=1753$)=48.21, $p=0.08$, CFI=1.0, RMSEA=0.01, NFI=

0.99]. Whilst the first modified model remained a good fit, the LM test indicated that the model could be improved if the following constraints were released: Age-T1 for D and NM. This was done in the next modification and SRH constraints were imposed across all groups. This model remained a good fit but the LM Test indicated that improvement would be made if the following constraints were released for W: T1-T3, T1-T4, T2-T3, and T2-T4. These constraints were released in the final model. This provided a significantly better fit [χ^2 (70, $n=1753$)=85.23, $p=0.10$, CFI=1.0, RMSEA=0.01, NFI=1.0]. W predicted more strongly T1-T3 and T1-T4 than the other groups, and less strongly T2-T3. The relationships between Age-T1 for D and NM were significantly stronger than for the other groups. There were no differences between the groups for the Gender-T1. There were also significant indirect effects of T1 on T4, and moderate indirect effects of T2 on T4 for all groups.

TECHNICAL DISCUSSION

In addition to examining the direct effects of marital status and marital status change on health, the indirect effects were examined. For all health variables there were indirect effects of T1 on T4 via T2 and T3 and a smaller effect of T2 on T4 via T3. This suggests that the health status in the intervening years mediates the later effects on health status.

REFERENCE

- Maruyama, G. M. (1998). *Basics of Structural Equation Modelling*. Sage: Thousand Oaks.