File Attachment # 107: A Robust Path Analysis of Outdoor Avoidance, Voluntary Abortions, and Other Factors among Ukrainian Residents of Kiev and Zhytomyr after Chornobyl (Hypotheses 9, 10, 13, 14, 17, 18, 21, 22)

30 September 2012

DRU: Modeling Nuclear Disaster Risk: The Effects of Perceived Risk and Radiation Exposure on Post-Chornobyl Psychosocial and Health Behavior Outcomes in Ukrainian Residents.....NSF Grant 082 6983

Contents

List of Figures

1 Acknowledgements

This project has been funded by National Science Foundation HSD grant 08262983, and to them we remain deeply grateful. We are also grateful to the developers of Stata in College Station, Texas, Salford Systems, Inc. in San Diego, California, and AutoMetrics in Oxford, London for the software they have developed and which we are using. We are also grateful to Ben Jann of ETH in Switzerland for his development of the estout.ado program which allows us to format our output so neatly. We are grateful for invaluable data management

2 Introduction

2.0.1 The area surveyed

In this analysis, we examine apparent agoraphobia, voluntary abortions, along with actual and perceived health threats following the Chornobyl nuclear incident among residents of the area. The survey respondents lived in either Kiev or Zhitomyr Oblasts. The Chornobyl nuclear plant was located near Pripyat in the Oblast of Kiev and Zhitomyr was the adjacent Oblast to its west. Respondents were selected from a random generation of phone numbers which were attached to the area codes for the raions and cities in both the Kiev and Zhitomyr Oblasts provided by the Ukrainian telephone company. Approximately 14% of the randomly generated numbers were actual phone numbers assigned. Respondents who failed to answer at first were given up to four call backs before the number

was discarded and the next one tried. Willing respondents were paid a nominal sum for their time after an interview was completed at their home at a mutually convenient time. Only those who agreed voluntarily were interviewed.

The data were recorded on laptop computers and, after an independent auditing group confirmed that the responses were completely voluntary and offered with the consent of the respondents, was the data uploaded to the Vovici company whose personnel input the data into a computer file.

2.0.2 Hypotheses being tested

In this analysis, we address hypotheses 9, 10, 13, and 14, which relate to direct effects in the relationship between radiation dose and perceived risk of exposure on the one hand, and voluntary abortions on the part of women. Hypothesis 9 submits that radiation explains or predicts voluntary abortions. Hypothesis 10 postulates that radiation explains or predicts avoidance of outdoors. Hypothesis 13 submits that perceived risk of exposure directly predicts voluntary abortions and Hypothesis 16 maintains that perceived risk of exposure directly predicts apparent agoraphobia.

We also address several hypotheses that pertain to indirect effects concerning avoidance of going outdoors and voluntary abortions. We address hypothesis 17, which suggests that radiation dose indirectly predicts voluntary abortions through the mediator of the number of medically diagnosed illnesses. We also test hypothesis 18 which suggests that radiation dose indirectly explains or predicts avoidance of venturing outdoors through the mediation of the Nottingham health measures. Similarly, Hypothesis 21 suggests that perceived risk indirectly predicts, which here means indirectly explains, voluntary abortions through a mediator of the number of medically diagnosed illnesses. The Nottingham measures that we use for this general rubric are the measures for sleep, energy level, and physical ability. Hypothesis 22 submits that perceived risk of exposure to radiation predicts avoidance of outdoors through the mediator of the Nottingham health scale and subscales. The path model that we analyze attempts to address these eight hypotheses. We first address these hypotheses for females and then address to apparent agoraphobia for males later.

2.0.3 Hypothesis operationalization

We define the terms in these hypotheses according to testable items and scales. We operationalize radiation dose as external radiation dose with the cumulative external dose in milliGrays. These variables are respectively called cumdose1, cumdose2, and cumdose3, with the numeric suffix indicating the wave in which they were measured. These measures were reconstructed cumulative external doses to which the respondents were exposed.

The instrument used to assess the Chornobyl related health risk was comprised of factor scores of three variables, the percent to which one thought his or her health had been affected by Chornobyl, the percent to which the respondent thought that the family health had been affected by Chornobyl, and the pro-

portion of cancer cases in the Zhitomyr and Kiev Oblasts which were products of the Chornobyl disaster. The alpha reliabilities of these perceived risk scales are contained in Table 1. To render this measure wave specific, we computed this score separately for each wave of our study.

Table 1: Alpha reliabilities of Chornobyl related health risk scales

Wave	**Scale**
1	crhrw1 = 0.796
2	crhrw2 = 0.822
3	crhrw3 = 0.834

In the indirect effects tests, the female Nottingham health scales are used. Their alpha reliabilities are listed in Table 2.

Table 2: Alpha reliabilities of female Nottingham health scales

Gender	**Scale**
female	whpsleep = 0.746
female	whpel = 0.613
female	whppa = 0.789

3 Path analysis

We fit the model with conventional standard errors so that there is no statistically significant difference between the model structure and the data. To control for autocorrelation between waves, we employed a clustered-robust path analysis to test several of our hypotheses.

Model building with full-information maximum likelihood can be complex with large models. Model building entails testing sundry plausible alternative paths between variables and pruning out paths that appear to be not statistically significant. Because changing one path can change all paths, model fitting is done on the basis of a global fit index. When the model comprising significant paths is not inconsistent with the data, the likelihood ratio χ^2 for the number of degrees of freedom identifying those paths minus the constraints, will no longer be statistically significant. A model may not unique. Depending on the variables in the model, it is possible for several combinations of paths to provide a fit. The one that offers the best fit is usually deemed the optimal model, if the paths correspond to theoretical reality. However, such model building usually proceeds non-optimally from specific-to-general.

4 Assumptions and Model structure

We rely on the same assumptions and model structure explained in our Hypothesis 4 and 5 discussion on path models. Because of sample size constraints limiting the number of variables to a model, we endeavor to maintain an approximate limit of 15 observed variables to the model, although larger signal to noise ratios will permit a few more variables. Because we have to test for indirect effects in a number of our hypotheses we need to use a form of path analysis for the hypothesis testing. We economize by making the working assumption for the time being that the exogenous variables are fixed rather than random.

Path models generally assume unidirectional causality, unless arrows from two variables point to one another, in which case, the model assumes that the index of stability is less than one. In short, there is no reverse causality. If is a feedback loop in the presumed causal structure, the model must be identified for the parameters to be uniquely estimable.

We should add however that path analysis assumes a closed system, that all of the relevant variables are in the model. If there is a missing variable, it could be an antecedent variable between two of the key variables in the model, which could generate a spurious relationship on which much of the model is then based. I that case, a large portion of the model could be predicted on a spurious basis, leading to all kind of erroneous conclusions. Specification error or omitted variable bias can propagate other biases throughout a model. For this reason, we will perform some auxiliary regressions to show that any variable not included in the model does not pose such a threat.

Although perceived risk of exposure and fear of consuming contaminated food are both fear of exposure to radiation, one is fear of external exposure and the other is fear of internal exposure. We interpret these two concepts as separate and do not conflate them in the interpretation of our hypotheses.

We interpret the term predict to mean explain when we interpret the hypotheses. Accurate prediction would require a world characterized by unrealistic conditions of stationarity, parameter constancy, extended model constancy, estimation bias, forecast error bias, no regime shifts or structural breaks, forecast origin certainty, and lack of error accumulation, among many other conditions often not readily available [6, 300-316].

5 Model estimation

We had originally planned on estimating our models with OLS or two-stage least squares (TSLS). However, we use maximum likelihood estimation where we can rather than two stage least squares (TSLS) for several reasons. Although TSLS may outperform ML in small samples, we have large samples in our analysis. Although TSLS are not unbiased in finite samples, it is consistent. Maximum likelihood estimation is also biased for finite samples, but is preferred because it is consistent, invariant to reparameterization, computable, asymptotically normal, as well as asymptotically more efficient because it uses

all of the information available. ML can outperform TSLS in obtaining asymptotically efficient estimates and can also be used for nonlinear applications if observations are independent and identically distributed as well as asymptotically symmetric, as long as they are not on the boundaries of the parameter space [1, 108], [3, 245-247,253-258]. More importantly if there are autoregressive errors in the model, which are common with repeated measures, ML can provide an estimate that is stationary [3, 347], which in this case is necessary. To be sure that this condition is satisfied, we test the stability index and find that it is less than unity (stability index = 0.0006), indicating that the modulus of the largest eigenvalue satisfies the stability conditions.

6 Pathways to apparent female agoraphobia and voluntary abortions model

In Figure 1, the path diagram depicts statistically significant interrelated paths. Table 3 presents the model output that is depicted in the figure and 4 presents their robust effects. Tables 5, 6, and 7 present respectively their direct, indirect, and total effects. From this figure and these tables we can test the hypothesis 12, 16, 20, and 24 for the male subsample.

Figure 1 is color-coded to aid interpretation of the paths. Cumulative external radiation dose have a rose-colored fill and red arrows emanating from them to designate their direct effects. Chornobyl related health risk variables are boxes that have a stone color filling the rectangle with purple arrows emanating from them. Abortion variables are white colored boxes with magenta arrows designating their direct effects. Fear of going outdoors are represented by orange boxes with orange arrows. The number of medically diagnosed illnesses is a gray box with green outline with dark green direct effects. Fear of eating contaminated food is represented by a light grey box with light blue arrows portraying its direct effects. The Nottingham energy level measure is mint colored, the Nottingham variable for sleeping issues is white box with medium blue arrows stemming from it and the the Nottingham physical ability variable is gold colored box. The color codes are designed to facilitate interpretation of the path diagram.

7 Pathways to female outdoor aversion and voluntary abortion

The model exhibits both respectable the omnibus goodness of fit and its stability as a dynamic model. We then address the model in relation to hypothesis 12, which postulates that radiation directly substance abuse. Next, we turn to a discussion of it in relation to hypothesis 16, which submits that perceived exposure risk directly predicts substance abuse. We not only discuss a strict interpretation of these hypotheses, but a broader one as well, where we consider

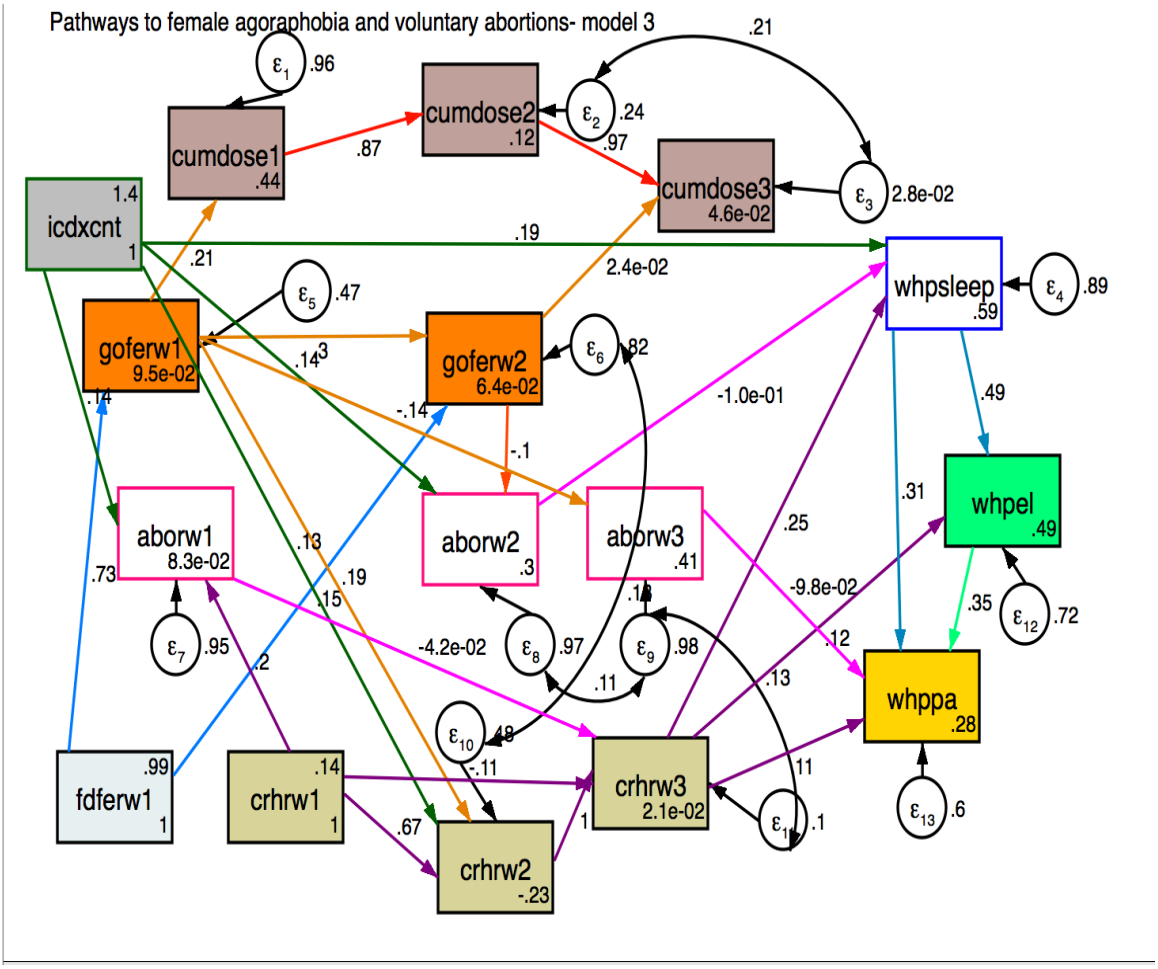

Figure 1: Pathways to outdoor aversion and voluntary abortions among females

indirect and total effects.

The model fits the data well. The model is fitted with conventional standard errors, for goodness of fit statistics are not available for robust models. Once the model is fit and the goodness of fit criteria are satisfied, we proceed to compute the robust estimates which control for heteroskedasticity and serial correlation. We take the standardized version of those and assess the paths with this version. After the model is fit, there appears to be no statistically significant difference between the global model and the data as indicated by LR test of model vs. saturated: LR test of model vs. saturated:$\chi^2(86) = 99.21, Prob > \chi^2 = 0.1562$.

The stability index = 4.42e-09, which is smaller than one, indicating that the model satisfies the conditions for stability of the model. We can now turn to the hypothesis testing of direct effects. The parameter estimates contained in Figure 1 can be found in Table 3. The clustered-robust estimates which we use for our analysis can be found in Table 4. Their decomposition into direct, indirect, and total effects is contained in the following three tables. We turn to Table 5 now to examine the direct effects with which we begin the hypothesis testing.

Table 3 Pathways to male substance abuse

(2 observations with missing values excluded;
specify option ´method(mlmv)´ to use all observations)

Endogenous variables

Observed: cumdose1 cumdose2 cumdose3 whpsleep whpel whppa goferw1 goferw2 aborw3 crhrw2 aborw2 aborw1 crhrw3

Exogenous variables

Observed: fdferw1 crhrw1 icdxcnt

Structural equation model — Number of obs = 361
Estimation method = ml
Log likelihood = -13436.967

	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Structural						
cumdo~1 <-						
goferw1	.0032023	.0007829	4.09	0.000	.0016679	.0047366
_cons	.2413505	.0366004	6.59	0.000	.169615	.313086
cumdo~2 <-						
cumdose1	2.18886	.0650405	33.65	0.000	2.061383	2.316337
_cons	.1616705	.0419252	3.86	0.000	.0794987	.2438424
cumdo~3 <-						
cumdose2	1.228932	.0129503	94.90	0.000	1.20355	1.254314
goferw2	.0024603	.0008766	2.81	0.005	.0007421	.0041785
_cons	.0812865	.0204274	3.98	0.000	.0412495	.1213235
whpsl~p <-						
aborw2	-4.233705	2.130612	-1.99	0.047	-8.409629	-.0577817
crhrw3	8.759233	1.727193	5.07	0.000	5.373996	12.14447
icdxcnt	2.523497	.6661465	3.79	0.000	1.217874	3.82912
_cons	18.19965	2.631538	6.92	0.000	13.04193	23.35737
whpel <-						
whpsleep	.5418411	.0516632	10.49	0.000	.4405831	.6430991
crhrw3	4.486308	1.789785	2.51	0.012	.9783935	7.994222
_cons	16.95847	2.018407	8.40	0.000	13.00247	20.91448
whppa <-						
whpsleep	.2177445	.0336108	6.48	0.000	.1518686	.2836204
whpel	.2186883	.0298938	7.32	0.000	.1600975	.277279
aborw3	-4.971303	2.087643	-2.38	0.017	-9.063008	-.8795992
crhrw3	2.707541	1.02623	2.64	0.008	.6961675	4.718915
_cons	5.980459	1.288088	4.64	0.000	3.455854	8.505064
goferw1 <-						
fdferw1	.6985567	.0343253	20.35	0.000	.6312805	.765833
_cons	3.436444	1.828957	1.88	0.060	-.1482459	7.021133

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Table 3 continued:

	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
goferw2 <-						
goferw1	.1467846	.033438	4.39	0.000	.0812473	.2123218
fdferw1	.0702821	.0318374	2.21	0.027	.007882	.1326822
_cons	1.116902	1.171066	0.95	0.340	-1.178346	3.41215
aborw3 <-						
goferw1	-.0016422	.0006038	-2.72	0.007	-.0028256	-.0004587
_cons	.1733552	.0282858	6.13	0.000	.117916	.2287943
crhrw2 <-						
goferw1	.0046191	.0008892	5.19	0.000	.0028764	.0063619
crhrw1	.6194044	.0339626	18.24	0.000	.552839	.6859698
icdxcnt	.0477625	.0137328	3.48	0.001	.0208466	.0746783
_cons	-.1983836	.059535	-3.33	0.001	-.3150701	-.0816972
aborw2 <-						
goferw2	-.0043521	.0021684	-2.01	0.045	-.0086019	-.0001022
icdxcnt	.0433149	.0162928	2.66	0.008	.0113816	.0752483
_cons	.2192323	.0649627	3.37	0.001	.0919077	.3465568
aborw1 <-						
crhrw1	.1926739	.049221	3.91	0.000	.0962025	.2891452
icdxcnt	.0548145	.0200384	2.74	0.006	.0155399	.0940891
_cons	.0748925	.0794357	0.94	0.346	-.0807987	.2305837
crhrw3 <-						
crhrw2	1.043845	.0232374	44.92	0.000	.9983002	1.089389
aborw1	-.0414874	.0167388	-2.48	0.013	-.0742947	-.00868
crhrw1	-.1068446	.0218238	-4.90	0.000	-.1496184	-.0640708
_cons	.0185662	.015747	1.18	0.238	-.0122972	.0494297
Variance						
e.cumdose1	.2890055	.0215113			.2497751	.3343975
e.cumdose2	.4618044	.0343732			.3991179	.5343367
e.cumdose3	.087367	.0065934			.0753546	.1012944
e.whpsleep	843.9022	62.81357			729.3487	976.4477
e.whpel	850.5979	63.31195			735.1356	984.1951
e.whppa	274.2456	20.41273			237.0188	317.3194
e.goferw1	608.3375	45.27996			525.7602	703.8847
e.goferw2	247.6323	18.43204			214.0177	286.5266
e.aborw3	.1730736	.0128913			.1495649	.2002775
e.crhrw2	.3643757	.027125			.314908	.4216139
e.aborw2	.5146966	.0383115			.4448279	.5955394
e.aborw1	.7700159	.057314			.665492	.8909567
e.crhrw3	.0793903	.0059099			.0686125	.0918611

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Table 3 continued:

	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Covariance						
e.cumdose2 e.cumdose3	.042052	.0123439	3.41	0.001	.0178585	.0662455
e.goferw2 e.crhrw2	1.235576	.5063493	2.44	0.015	.2431498	2.228003
e.aborw3						
e.aborw2	.0314257	.0157095	2.00	0.045	.0006357	.0622156
e.crhrw3	.0146636	.0062571	2.34	0.019	.0023998	.0269274

LR test of model vs. saturated: chi2(86) = 99.21, Prob > chi2 = 0.1562

Stability analysis of simultaneous equation systems

Eigenvalue stability condition
stability index = 4.42e-09
All the eigenvalues lie inside the unit circle.
SEM satisfies stability condition.

7.1 Direct effects among females

7.1.1 Hypothesis 9: Does radiation dose directly explain voluntary abortions?

Hypothesis 12 submits that radiation dose directly predicts or explains the substance abuse. When we examine the clustered-robust direct effects estimates in Table 5 on page 15, 16, and 17 we find no direct effects originating with cumulative external dose under any of the female abortion (aborw1, aborw2, or aborw3) panels. In sum, we do not find supporting evidence for a direct effect of cumulative external dose with respect to voluntary abortions. Hypothesis 9 is inconsistent with our model and data.

7.1.2 Hypothesis 10 Does radiation dose directly explain aversion to venturing outdoors?

Hypothesis 10 postulates direct effects of radiation dose on female aversion to going outdoors. If we turn to Table 5 on page 15, we can examine the fear of going outdoors panels for waves 1 and 2. When we tried to model that for wave3, it prevented the model from fitting. Moreover, there were no paths to it or from it, for which reason it was dropped from the model. Nevertheless, we find no evidence of direct effects of cumulative external dose impacting the fear of going outdoors variables in Table 5. Hence, hypothesis 10 also appears to be inconsistent with the data.

7.1.3 Hypothesis 13: Does perceived risk directly explain voluntary abortions?

Hypothesis 13 suggests that there is a direct effect of perceived risk of exposure to radiation on voluntary abortions among women. When we turn to Table 5, page 16, we see evidence of a direct effect of perceived risk of exposure on voluntary abortions in wave 1, but not in waves 2 or 3 where we find no direct paths emanating from perceived risk. More specifically, in wave 1, the ($crhrw1$ $standardized$ β for $crhrw1 = 0.202,\ p = 0.000$), for which reason there is partial support for this hypothesis among women.

7.1.4 Hypothesis 14: Does perceived risk of exposure directly predict or explain avoidance of going outdoors ?

In Table 5, on page 17, we do not find a perceived of exposure indirectly explaining the fear of venturing outdoors. In the fear of going outdoors panels, we find no evidence of an indirect path from perceived risk of exposure, even if fear of consuming contaminated food is indirectly related to fear of going outdoors. Strictly speaking, hypothesis 14 is therefore not consistent with our data.

7.2 Indirect effects among females

7.2.1 Hypothesis 17: Does radiation dose indirectly predict voluntary abortions through the mediator of number of medically diagnosed illnesses?

For evidence of indirect effects we have to turn to Table 6 for women and Table 11 for men. For the women, the number of medically diagnosed illnesses does not serve as a mediator. Rather it is an exogenous variable in the model. Although it does not mediate radiation dose, it does serve as an explanatory variable for voluntary abortions in waves 1 and 2, but not in wave 3. Therefore, it does not serve as an indirect explanatory variable, but rather as a direct explanatory variable for voluntary abortions. This hypothesis in its current formulation is not supported by the data.

7.2.2 Hypothesis 18: Does radiation dose indirectly predict or explain avoidance of outdoors through mediation of any of the Nottingham variables?

Table 6 reveals the indirect effects of variables on avoidance of venturing outdoors. On page 19, we observe the avoidance variables in waves 1 and 2 and within those panels, we find no evidence of Nottingham mediation. Hypothesis 18 therefore is inconsistent with our data.

7.2.3 Hypothesis 21: Does perceived risk of exposure indirectly explain voluntary abortions via mediation of the number of medically diagnosed illnesses?

In Table 6, on page 20, we find that voluntary abortions in waves 1 and 2 are partly explained directly rather than indirectly by medically diagnosed illnesses. Rather than serving as a mediating variable, the number of medically diagnosed illnesses is an exogenous variable having a direct, not an indirect effect, on voluntary abortions. Therefore, a strict construction of the hypothesis reveals that this hypothesis is not consistent with the data for females.

7.2.4 Hypothesis 22: Does perceived risk of exposure indirectly explain avoidance of outdoors through the mediation of the Nottingham health measures?

We find that the Nottingham measures do not mediate the perceived risk of exposure's explanation of avoidance of going outdoors. In this formulation, the hypothesis is not consistent with the data.

Table 4 Clustered-robust effects among females

Endogenous variables

Observed: cumdose1 cumdose2 cumdose3 whpsleep whpel whppa goferw1 goferw2 aborw3 crhrw2 aborw2 aborw1 crhrw3

Exogenous variables

Observed: fdferw1 crhrw1 icdxcnt

Structural equation model — Number of obs = 361
Estimation method = ml
Log pseudolikelihood= -13436.967

(Std. Err. adjusted for 361 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Structural						
cumdo~1 <-						
goferw1	.0032023	.0011962	2.68	0.007	.0008578	.0055467
_cons	.2413505	.019026	12.69	0.000	.2040602	.2786408
cumdo~2 <-						
cumdose1	2.18886	.083603	26.18	0.000	2.025001	2.352719
_cons	.1616705	.0419462	3.85	0.000	.0794575	.2438836
cumdo~3 <-						
cumdose2	1.228932	.0352197	34.89	0.000	1.159902	1.297961
goferw2	.0024603	.0012627	1.95	0.051	-.0000146	.0049352
_cons	.0812865	.0294283	2.76	0.006	.0236081	.1389649
whpsl~p <-						
aborw2	-4.233705	1.644764	-2.57	0.010	-7.457384	-1.010027
crhrw3	8.759233	1.749043	5.01	0.000	5.331171	12.18729
icdxcnt	2.523497	.7810614	3.23	0.001	.9926446	4.054349
_cons	18.19965	2.678384	6.80	0.000	12.95012	23.44919
whpel <-						
whpsleep	.5418411	.053608	10.11	0.000	.4367713	.6469108
crhrw3	4.486308	1.788977	2.51	0.012	.9799771	7.992638
_cons	16.95847	1.92508	8.81	0.000	13.18539	20.73156
whppa <-						
whpsleep	.2177445	.0397755	5.47	0.000	.139786	.295703
whpel	.2186883	.0347415	6.29	0.000	.1505961	.2867804
aborw3	-4.971303	1.627593	-3.05	0.002	-8.161327	-1.78128
crhrw3	2.707541	.9684807	2.80	0.005	.809354	4.605729
_cons	5.980459	1.127836	5.30	0.000	3.769941	8.190978

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Table 4 clustered robust effects continued:

	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
goferw1 <-						
fdferw1	.6985567	.0405626	17.22	0.000	.6190554	.778058
_cons	3.436444	1.396699	2.46	0.014	.6989635	6.173924
goferw2 <-						
goferw1	.1467846	.0374639	3.92	0.000	.0733566	.2202125
fdferw1	.0702821	.02815	2.50	0.013	.0151091	.1254552
_cons	1.116902	.8204754	1.36	0.173	-.4912003	2.725004
aborw3 <-						
goferw1	-.0016422	.0005981	-2.75	0.006	-.0028144	-.00047
_cons	.1733552	.0359345	4.82	0.000	.1029249	.2437855
crhrw2 <-						
goferw1	.0046191	.000923	5.00	0.000	.00281	.0064283
crhrw1	.6194044	.0372516	16.63	0.000	.5463925	.6924162
icdxcnt	.0477625	.0151675	3.15	0.002	.0180348	.0774902
_cons	-.1983836	.0594983	-3.33	0.001	-.3149983	-.081769
aborw2 <-						
goferw2	-.0043521	.0015136	-2.88	0.004	-.0073186	-.0013855
icdxcnt	.0433149	.0219053	1.98	0.048	.0003813	.0862486
_cons	.2192323	.0636457	3.44	0.001	.094489	.3439756
aborw1 <-						
crhrw1	.1926739	.0548624	3.51	0.000	.0851454	.3002023
icdxcnt	.0548145	.0225188	2.43	0.015	.0106784	.0989506
_cons	.0748925	.0682257	1.10	0.272	-.0588274	.2086124
crhrw3 <-						
crhrw2	1.043845	.0277145	37.66	0.000	.9895253	1.098164
aborw1	-.0414874	.0137175	-3.02	0.002	-.0683732	-.0146016
crhrw1	-.1068446	.0314328	-3.40	0.001	-.1684517	-.0452375
_cons	.0185662	.0159832	1.16	0.245	-.0127603	.0498928
Variance						
e.cumdose1	.2890055	.1001246			.1465586	.5699029
e.cumdose2	.4618044	.2566491			.1553819	1.372511
e.cumdose3	.087367	.0322766			.0423528	.1802241
e.whpsleep	843.9022	64.0204			727.3073	979.1884
e.whpel	850.5979	59.92645			740.8927	976.5473
e.whppa	274.2456	26.72383			226.5659	331.9593
e.goferw1	608.3375	68.8233			487.3548	759.3534
e.goferw2	247.6323	39.5962			181.0093	338.7769
e.aborw3	.1730736	.0395079			.1106434	.27073
e.crhrw2	.3643757	.0378495			.2972561	.4466506
e.aborw2	.5146966	.0851243			.3721973	.7117529
e.aborw1	.7700159	.3733713			.2976888	1.99176
e.crhrw3	.0793903	.0122786			.0586299	.1075017

Continued on the next page...

Table 4 clustered robust effects continued:

	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Covariance						
e.cumdose2						
e.cumdose3	.042052	.074167	0.57	0.571	-.1033126	.1874166
e.goferw2						
e.crhrw2	1.235576	.5105715	2.42	0.016	.2348745	2.236278
e.aborw3						
e.aborw2	.0314257	.0305258	1.03	0.303	-.0284039	.0912552
e.crhrw3	.0146636	.0118402	1.24	0.216	-.0085427	.03787

.

Table 5 Clustered-robust Direct effects on substance abuse among females

Direct effects

(Std. Err. adjusted for 361 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Structural					
cumdo~1 <-					
goferw1	.0032023	.0011962	2.68	0.007	.2104657
fdferw1	0	(no path)			0
cumdo~2 <-					
cumdose1	2.18886	.083603	26.18	0.000	.8708033
goferw1	0	(no path)			0
fdferw1	0	(no path)			0
cumdo~3 <-					
cumdose1	0	(no path)			0
cumdose2	1.228932	.0352197	34.89	0.000	.9664745
goferw1	0	(no path)			0
goferw2	.0024603	.0012627	1.95	0.051	.0243841
fdferw1	0	(no path)			0
whpsl~p <-					
goferw1	0	(no path)			0
goferw2	0	(no path)			0
crhrw2	0	(no path)			0
aborw2	-4.233705	1.644764	-2.57	0.010	-.0999854
aborw1	0	(no path)			0
crhrw3	8.759233	1.749043	5.01	0.000	.2515391
fdferw1	0	(no path)			0
crhrw1	0	(no path)			0
icdxcnt	2.523497	.7810614	3.23	0.001	.1899395
whpel <-					
whpsleep	.5418411	.053608	10.11	0.000	.4860795
goferw1	0	(no path)			0
goferw2	0	(no path)			0
crhrw2	0	(no path)			0
aborw2	0	(no path)			0
aborw1	0	(no path)			0
crhrw3	4.486308	1.788977	2.51	0.012	.115575
fdferw1	0	(no path)			0
crhrw1	0	(no path)			0
icdxcnt	0	(no path)			0

Continued on the next page...

Table 5 clustered robust direct effects for females --continued:

	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
whppa <-						
whpsleep	.2177445	.0397755	5.47	0.000		.3143344
whpel	.2186883	.0347415	6.29	0.000		.3519126
goferw1	0	(no path)				0
goferw2	0	(no path)				0
aborw3	-4.971303	1.627593	-3.05	0.002		-.0978355
crhrw2	0	(no path)				0
aborw2	0	(no path)				0
aborw1	0	(no path)				0
crhrw3	2.707541	.9684807	2.80	0.005		.112243
fdferw1	0	(no path)				0
crhrw1	0	(no path)				0
icdxcnt	0	(no path)				0
goferw1 <-						
fdferw1	.6985567	.0405626	17.22	0.000		.7309543
goferw2 <-						
goferw1	.1467846	.0374639	3.92	0.000		.3045433
fdferw1	.0702821	.02815	2.50	0.013		.1525816
aborw3 <-						
goferw1	-.0016422	.0005981	-2.75	0.006		-.1412366
fdferw1	0	(no path)				0
crhrw2 <-						
goferw1	.0046191	.000923	5.00	0.000		.1917468
fdferw1	0	(no path)				0
crhrw1	.6194044	.0372516	16.63	0.000		.6719865
icdxcnt	.0477625	.0151675	3.15	0.002		.1272799
aborw2 <-						
goferw1	0	(no path)				0
goferw2	-.0043521	.0015136	-2.88	0.004		-.1041398
fdferw1	0	(no path)				0
icdxcnt	.0433149	.0219053	1.98	0.048		.1380493
aborw1 <-						
crhrw1	.1926739	.0548624	3.51	0.000		.2017199
icdxcnt	.0548145	.0225188	2.43	0.015		.140964
crhrw3 <-						
goferw1	0	(no path)				0
crhrw2	1.043845	.0277145	37.66	0.000		1.026683
aborw1	-.0414874	.0137175	-3.02	0.002		-.0422841
fdferw1	0	(no path)				0
crhrw1	-.1068446	.0314328	-3.40	0.001		-.114009
icdxcnt	0	(no path)				0

Table 6 Indirect effects among females
Indirect effects

(Std. Err. adjusted for 361 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Structural					
cumdo~1 <-					
goferw1	0	(no path)			0
fdferw1	.002237	.0008441	2.65	0.008	.1538408
cumdo~2 <-					
cumdose1	0	(no path)			0
goferw1	.0070093	.0026183	2.68	0.007	.1832742
fdferw1	.0048964	.001862	2.63	0.009	.1339651
cumdo~3 <-					
cumdose1	2.689959	.1027424	26.18	0.000	.8416091
cumdose2	0	(no path)			0
goferw1	.0089751	.0032081	2.80	0.005	.1845559
goferw2	0	(no path)			0
fdferw1	.0064425	.0023457	2.75	0.006	.1386225
whpsl~p <-					
goferw1	.0449386	.0085784	5.24	0.000	.0526898
goferw2	.0184253	.006408	2.88	0.004	.0104125
crhrw2	9.143278	.2427575	37.66	0.000	.2582508
aborw2	0	(no path)			0
aborw1	-.3633976	.1201547	-3.02	0.002	-.0106361
crhrw3	0	(no path)			0
fdferw1	.0326872	.009439	3.46	0.001	.0401026
crhrw1	4.657493	.9949073	4.68	0.000	.1427178
icdxcnt	.2334035	.1996673	1.17	0.242	.0175679
whpel <-					
whpsleep	0	(no path)			0
goferw1	.0459811	.0089637	5.13	0.000	.0483639
goferw2	.0099836	.0034721	2.88	0.004	.0050613
crhrw2	9.637212	.2558717	37.66	0.000	.2441893
aborw2	-2.293995	.8912008	-2.57	0.010	-.0486009
aborw1	-.3830289	.1266456	-3.02	0.002	-.010057
crhrw3	4.746112	.9477034	5.01	0.000	.122268
fdferw1	.032822	.0101012	3.25	0.001	.0361241
crhrw1	4.909098	1.068272	4.60	0.000	.134947
icdxcnt	1.707272	.4837175	3.53	0.000	.1152791

Continued on the next page...

Table 6 clustered robust indirect effects for females --continued:

	OIM				
	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]
whppa <-					
whpsleep	.1184943	.0117234	10.11	0.000	.1710575
whpel	0	(no path)			0
goferw1	.0410593	.0072001	5.70	0.000	.0694965
goferw2	.0061953	.0021546	2.88	0.004	.0050541
aborw3	0	(no path)			0
crhrw2	6.924696	.1838533	37.66	0.000	.2823483
aborw2	-1.423536	.5530335	-2.57	0.010	-.0485321
aborw1	-.2752206	.0909996	-3.02	0.002	-.0116286
crhrw3	3.926296	.7174697	5.47	0.000	.1627673
fdferw1	.0291177	.0076295	3.82	0.000	.05157
crhrw1	3.52737	.7230356	4.88	0.000	.1560349
icdxcnt	1.102492	.321185	3.43	0.001	.1197933
goferw1 <-					
fdferw1	0	(no path)			0
goferw2 <-					
goferw1	0	(no path)			0
fdferw1	.1025373	.0266365	3.85	0.000	.2226072
aborw3 <-					
goferw1	0	(no path)			0
fdferw1	-.0011472	.0004262	-2.69	0.007	-.1032375
crhrw2 <-					
goferw1	0	(no path)			0
fdferw1	.0032267	.0006904	4.67	0.000	.1401582
crhrw1	0	(no path)			0
icdxcnt	0	(no path)			0
aborw2 <-					
goferw1	-.0006388	.000163	-3.92	0.000	-.0317151
goferw2	0	(no path)			0
fdferw1	-.0007521	.000271	-2.78	0.006	-.0390721
icdxcnt	0	(no path)			0
aborw1 <-					
crhrw1	0	(no path)			0
icdxcnt	0	(no path)			0
crhrw3 <-					
goferw1	.0048217	.0009635	5.00	0.000	.1968632
crhrw2	0	(no path)			0
aborw1	0	(no path)			0
fdferw1	.0033682	.0007413	4.54	0.000	.143898
crhrw1	.6385684	.0473287	13.49	0.000	.6813874
icdxcnt	.0475825	.0160382	2.97	0.003	.1247155

Table 7 Total clustered robust effects among females

Total effects

(Std. Err. adjusted for 361 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Structural					
cumdo~1 <-					
goferw1	.0032023	.0011962	2.68	0.007	.2104657
fdferw1	.002237	.0008441	2.65	0.008	.1538408
cumdo~2 <-					
cumdose1	2.18886	.083603	26.18	0.000	.8708033
goferw1	.0070093	.0026183	2.68	0.007	.1832742
fdferw1	.0048964	.001862	2.63	0.009	.1339651
cumdo~3 <-					
cumdose1	2.689959	.1027424	26.18	0.000	.8416091
cumdose2	1.228932	.0352197	34.89	0.000	.9664745
goferw1	.0089751	.0032081	2.80	0.005	.1845559
goferw2	.0024603	.0012627	1.95	0.051	.0243841
fdferw1	.0064425	.0023457	2.75	0.006	.1386225
whpsl~p <-					
goferw1	.0449386	.0085784	5.24	0.000	.0526898
goferw2	.0184253	.006408	2.88	0.004	.0104125
crhrw2	9.143278	.2427575	37.66	0.000	.2582508
aborw2	-4.233705	1.644764	-2.57	0.010	-.0999854
aborw1	-.3633976	.1201547	-3.02	0.002	-.0106361
crhrw3	8.759233	1.749043	5.01	0.000	.2515391
fdferw1	.0326872	.009439	3.46	0.001	.0401026
crhrw1	4.657493	.9949073	4.68	0.000	.1427178
icdxcnt	2.7569	.7809316	3.53	0.000	.2075074
whpel <-					
whpsleep	.5418411	.053608	10.11	0.000	.4860795
goferw1	.0459811	.0089637	5.13	0.000	.0483639
goferw2	.0099836	.0034721	2.88	0.004	.0050613
crhrw2	9.637212	.2558717	37.66	0.000	.2441893
aborw2	-2.293995	.8912008	-2.57	0.010	-.0486009
aborw1	-.3830289	.1266456	-3.02	0.002	-.010057
crhrw3	9.23242	2.053131	4.50	0.000	.237843
fdferw1	.032822	.0101012	3.25	0.001	.0361241
crhrw1	4.909098	1.068272	4.60	0.000	.134947
icdxcnt	1.707272	.4837175	3.53	0.000	.1152791

Continued on the next page...

Table 7 clustered robust indirect effects for females --continued:

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
whppa <-						
whpsleep	.3362388	.0421143	7.98	0.000		.4853919
whpel	.2186883	.0347415	6.29	0.000		.3519126
goferw1	.0410593	.0072001	5.70	0.000		.0694965
goferw2	.0061953	.0021546	2.88	0.004		.0050541
aborw3	-4.971303	1.627593	-3.05	0.002		-.0978355
crhrw2	6.924696	.1838533	37.66	0.000		.2823483
aborw2	-1.423536	.5530335	-2.57	0.010		-.0485321
aborw1	-.2752206	.0909996	-3.02	0.002		-.0116286
crhrw3	6.633838	1.264709	5.25	0.000		.2750103
fdferw1	.0291177	.0076295	3.82	0.000		.05157
crhrw1	3.52737	.7230356	4.88	0.000		.1560349
icdxcnt	1.102492	.321185	3.43	0.001		.1197933
goferw1 <-						
fdferw1	.6985567	.0405626	17.22	0.000		.7309543
goferw2 <-						
goferw1	.1467846	.0374639	3.92	0.000		.3045433
fdferw1	.1728195	.0264222	6.54	0.000		.3751888
aborw3 <-						
goferw1	-.0016422	.0005981	-2.75	0.006		-.1412366
fdferw1	-.0011472	.0004262	-2.69	0.007		-.1032375
crhrw2 <-						
goferw1	.0046191	.000923	5.00	0.000		.1917468
fdferw1	.0032267	.0006904	4.67	0.000		.1401582
crhrw1	.6194044	.0372516	16.63	0.000		.6719865
icdxcnt	.0477625	.0151675	3.15	0.002		.1272799
aborw2 <-						
goferw1	-.0006388	.000163	-3.92	0.000		-.0317151
goferw2	-.0043521	.0015136	-2.88	0.004		-.1041398
fdferw1	-.0007521	.000271	-2.78	0.006		-.0390721
icdxcnt	.0433149	.0219053	1.98	0.048		.1380493
aborw1 <-						
crhrw1	.1926739	.0548624	3.51	0.000		.2017199
icdxcnt	.0548145	.0225188	2.43	0.015		.140964
crhrw3 <-						
goferw1	.0048217	.0009635	5.00	0.000		.1968632
crhrw2	1.043845	.0277145	37.66	0.000		1.026683
aborw1	-.0414874	.0137175	-3.02	0.002		-.0422841
fdferw1	.0033682	.0007413	4.54	0.000		.143898
crhrw1	.5317238	.0419139	12.69	0.000		.5673784
icdxcnt	.0475825	.0160382	2.97	0.003		.1247155

8 Pathways to male aversion to venturing outdoors

In this section, we present the male model pertaining to the aversion of going outdoors and investigate the impact of radiation dose and perceived risk of exposure on it. In Figure 2, we provide the path diagram describing the male model. In Table 8, we present the parameter estimates of the male model depicted therein.

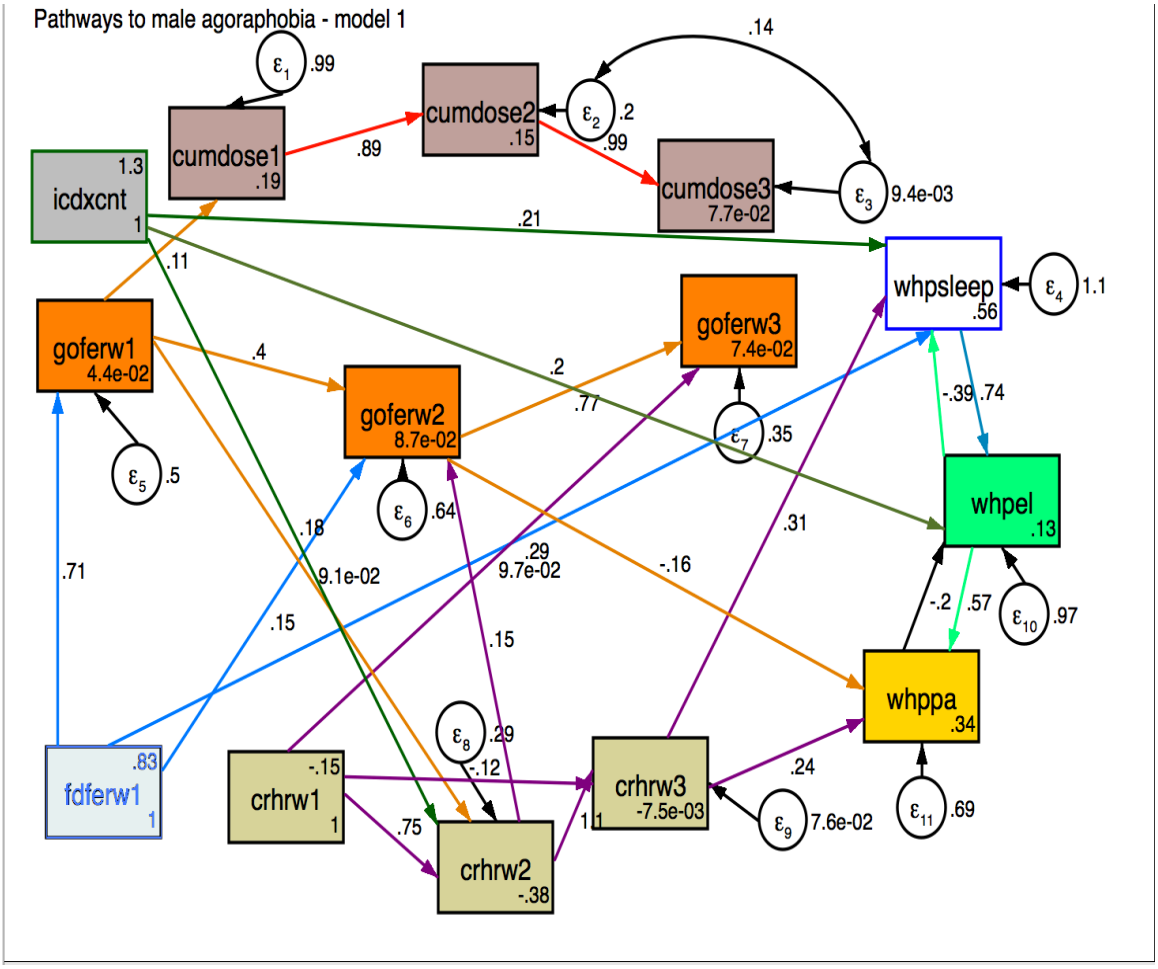

Figure 2: Pathways to male aversion to going outdoors

The Table of parameter estimates corresponding to Figure 2 is given in Table 14.

8.1 Items and scales

The items and scales we use are for the most part the same. However, we do not use the abortion items for the males. Moreover, the Nottingham health scales have different reliabilities for the males than they do for the females and these are given in Table 8.

Table 8: Alpha reliabilities of male Nottingham health scales

Gender	**Scale**
male	whpsleep = 0.721
male	whpel = 0.613
male	whppa = 0.789

8.2 The male path model

The model is a fits the data well. There is no statistically significant difference between the model and the data with $\chi^2(63) = 73.73, Prob > \chi^2 = 0.1672$. Even though there are two reciprocal effects in the model, the stability index is within the unit circle indicating that the model satisfies the conditions of stability with the stability index = 0.63433.

8.3 Direct effects among males

8.3.1 Hypothesis 10: Does radiation dose directly explain aversion to venturing outdoors?

In Table 11, page 30, we find no direct effect of cumulative external radiation dose on aversion to going outdoors in any wave among males. Hypothesis 10 is not supported by the data for males.

8.3.2 Hypothesis 14: Dose perceived risk of exposure directly explain aversion to venturing outdoors?

In Table 11, page 30, we find evidence of perceived risk of exposure from wave 1 directly explaining fear of going outdoors in waves 2 and 3. Hypothesis 14 is therefore partly consistent with the male data.

Table 9 Male Model parameter estimates

Endogenous variables

Observed: cumdose1 cumdose2 cumdose3 whpsleep whpel goferw1 goferw2 crhrw2 goferw3 whppa crhrw3

Exogenous variables

Observed: fdferw1 crhrw1 icdxcnt

equation model Number of obs = 339
Estimation method = ml
Log likelihood = -12836.654

	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Structural						
cumdo~1 <-						
goferw1	.0054626	.0027209	2.01	0.045	.0001299	.0107954
_cons	.3160102	.1065226	2.97	0.003	.1072298	.5247905
cumdo~2 <-						
cumdose1	1.339597	.0366997	36.50	0.000	1.267667	1.411527
_cons	.3879549	.0632438	6.13	0.000	.2639992	.5119105
cumdo~3 <-						
cumdose2	1.054421	.0062729	168.09	0.000	1.042126	1.066716
_cons	.204808	.0152714	13.41	0.000	.1748766	.2347395
whpsl~p <-						
whpel	-.3227438	.1636219	-1.97	0.049	-.6434368	-.0020507
crhrw3	8.335343	1.914707	4.35	0.000	4.582586	12.0881
fdferw1	.1819313	.0464768	3.91	0.000	.0908384	.2730242
icdxcnt	3.049287	1.178615	2.59	0.010	.7392443	5.35933
_cons	13.99702	3.237866	4.32	0.000	7.650916	20.34312
whpel <-						
whpsleep	.8986316	.1751858	5.13	0.000	.5552738	1.241989
whppa	-.4104538	.2062155	-1.99	0.047	-.8146288	-.0062788
icdxcnt	3.62869	1.207472	3.01	0.003	1.262089	5.995291
_cons	3.753548	3.048373	1.23	0.218	-2.221152	9.728249
goferw1 <-						
fdferw1	.6033135	.032513	18.56	0.000	.5395893	.6670377
_cons	1.457905	1.643415	0.89	0.375	-1.763128	4.678939

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Table 9 Male model parameter estimates--continued:

	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
goferw2 <-						
goferw1	.2049207	.0313369	6.54	0.000	.1435016	.2663399
crhrw2	2.70413	.8794741	3.07	0.002	.9803925	4.427868
fdferw1	.0648031	.0278273	2.33	0.020	.0102625	.1193437
_cons	1.452656	1.050367	1.38	0.167	-.606026	3.511339
crhrw2 <-						
goferw1	.0025293	.0008559	2.96	0.003	.0008518	.0042068
crhrw1	.7495949	.0302139	24.81	0.000	.6903768	.808813
icdxcnt	.1010899	.0166014	6.09	0.000	.0685518	.133628
_cons	-.3461971	.0462386	-7.49	0.000	-.4368232	-.255571
goferw3 <-						
goferw2	.7599253	.0335134	22.68	0.000	.6942403	.8256103
crhrw1	1.725182	.6043795	2.85	0.004	.5406196	2.909744
_cons	1.230034	.6062301	2.03	0.042	.0418445	2.418223
whppa <-						
whpel	.2737342	.0339799	8.06	0.000	.2071349	.3403335
goferw2	-.141059	.0415259	-3.40	0.001	-.2224483	-.0596698
crhrw3	3.79712	.8071495	4.70	0.000	2.215136	5.379104
_cons	4.897661	1.104212	4.44	0.000	2.733446	7.061876
crhrw3 <-						
crhrw2	1.055212	.0258798	40.77	0.000	1.004489	1.105936
crhrw1	-.1183935	.0256569	-4.61	0.000	-.1686801	-.0681068
_cons	-.0069225	.0140543	-0.49	0.622	-.0344684	.0206233
Variance						
e.cumdose1	2.751988	.2113789			2.36737	3.199094
e.cumdose2	1.271465	.0976606			1.093765	1.478035
e.cumdose3	.066661	.0051469			.0572995	.0775519
e.whpsleep	699.1699	156.1378			451.3292	1083.109
e.whpel	873.1006	130.0843			651.9927	1169.192
e.goferw1	544.0054	41.78481			467.9752	632.388
e.goferw2	180.7822	13.8858			155.5161	210.1532
e.crhrw2	.2437889	.0187253			.2097169	.2833964
e.goferw3	97.46582	7.486305			83.84399	113.3007
e.whppa	144.4763	11.46321			123.6687	168.785
e.crhrw3	.0643684	.0049441			.0553723	.0748261
Covariance						
e.cumdose2						
e.cumdose3	.0416992	.017854	2.34	0.020	.0067061	.0766923

LR test of model vs. saturated: chi2(63) = 73.73, Prob > chi2 = 0.1672

Stability analysis of simultaneous equation systems

stability index = .6343367
All the eigenvalues lie inside the unit circle.
SEM satisfies stability condition.

Table 10 Clustered robust male model estimates

```
Endogenous variables
Observed:  cumdose1 cumdose2 cumdose3 whpsleep whpel goferw1 goferw2 crhrw2
           goferw3 whppa crhrw3
Exogenous variables
Observed:  fdferw1 crhrw1 icdxcnt
Iteration 7:   log pseudolikelihood = -12836.654
Structural equation model                       Number of obs      =       339
Estimation method  = ml
Log pseudolikelihood= -12836.654
                                    (Std. Err. adjusted for 339 clusters in id)
```

	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Structural						
cumdo~1 <-						
goferw1	.0054626	.0058836	0.93	0.353	-.006069	.0169943
_cons	.3160102	.0652954	4.84	0.000	.1880335	.4439868
cumdo~2 <-						
cumdose1	1.339597	.2873117	4.66	0.000	.7764767	1.902718
_cons	.3879549	.0833225	4.66	0.000	.2246458	.5512639
cumdo~3 <-						
cumdose2	1.054421	.0247893	42.54	0.000	1.005835	1.103007
_cons	.204808	.016906	12.11	0.000	.1716729	.2379432
whpsl~p <-						
whpel	-.3227438	.1652876	-1.95	0.051	-.6467015	.0012139
crhrw3	8.335343	2.119461	3.93	0.000	4.181275	12.48941
fdferw1	.1819313	.0517988	3.51	0.000	.0804076	.283455
icdxcnt	3.049287	1.284999	2.37	0.018	.5307353	5.567839
_cons	13.99702	3.413887	4.10	0.000	7.30592	20.68811
whpel <-						
whpsleep	.8986316	.1838416	4.89	0.000	.5383087	1.258954
whppa	-.4104538	.2878747	-1.43	0.154	-.9746779	.1537703
icdxcnt	3.62869	1.267427	2.86	0.004	1.144578	6.112802
_cons	3.753548	2.541805	1.48	0.140	-1.228298	8.735395
goferw1 <-						
fdferw1	.6033135	.0460219	13.11	0.000	.5131123	.6935147
_cons	1.457905	.8144962	1.79	0.073	-.1384781	3.054288

Continued on the next page...

Table 10 Male model parameter estimates--continued:

	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
goferw2 <-						
goferw1	.2049207	.0502389	4.08	0.000	.1064544	.3033871
crhrw2	2.70413	.8080246	3.35	0.001	1.120431	4.287829
fdferw1	.0648031	.0349872	1.85	0.064	-.0037706	.1333767
_cons	1.452656	.7107511	2.04	0.041	.0596098	2.845703
crhrw2 <-						
goferw1	.0025293	.000802	3.15	0.002	.0009575	.0041011
crhrw1	.7495949	.0354861	21.12	0.000	.6800434	.8191463
icdxcnt	.1010899	.0212446	4.76	0.000	.0594512	.1427286
_cons	-.3461971	.0446347	-7.76	0.000	-.4336796	-.2587146
goferw3 <-						
goferw2	.7599253	.0861227	8.82	0.000	.5911278	.9287228
crhrw1	1.725182	.7016068	2.46	0.014	.3500577	3.100306
_cons	1.230034	.470385	2.61	0.009	.308096	2.151971
whppa <-						
whpel	.2737342	.0423569	6.46	0.000	.1907161	.3567523
goferw2	-.141059	.0415084	-3.40	0.001	-.222414	-.0597041
crhrw3	3.79712	.8541422	4.45	0.000	2.123032	5.471208
_cons	4.897661	1.097331	4.46	0.000	2.746933	7.04839
crhrw3 <-						
crhrw2	1.055212	.0329604	32.01	0.000	.990611	1.119814
crhrw1	-.1183935	.0379136	-3.12	0.002	-.1927027	-.0440842
_cons	-.0069225	.0143437	-0.48	0.629	-.0350358	.0211907
Variance						
e.cumdose1	2.751988	2.189622			.5786117	13.08898
e.cumdose2	1.271465	.8062854			.3668804	4.406405
e.cumdose3	.066661	.0308023			.0269497	.1648883
e.whpsleep	699.1699	168.9748			435.3765	1122.795
e.whpel	873.1006	150.3233			623.0336	1223.537
e.goferw1	544.0054	52.17591			450.7793	656.5118
e.goferw2	180.7822	25.51782			137.0903	238.3991
e.crhrw2	.2437889	.0339501			.1855562	.3202966
e.goferw3	97.46582	22.19031			62.38166	152.2817
e.whppa	144.4763	15.7596			116.6667	178.9149
e.crhrw3	.0643684	.0182932			.0368779	.1123517
Covariance						
e.cumdose2						
e.cumdose3	.0416992	.0706295	0.59	0.555	-.096732	.1801304

Table 11 Male clustered robust Direct effects

Direct effects

(Std. Err. adjusted for 339 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Structural					
cumdo~1 <-					
goferw1	.0054626	.0058836	0.93	0.353	.1084001
fdferw1	0	(no path)			0
cumdo~2 <-					
cumdose1	1.339597	.2873117	4.66	0.000	.8928449
goferw1	0	(no path)			0
fdferw1	0	(no path)			0
cumdo~3 <-					
cumdose1	0	(no path)			0
cumdose2	1.054421	.0247893	42.54	0.000	.9890902
goferw1	0	(no path)			0
fdferw1	0	(no path)			0
whpsl~p <-					
whpsleep	0	(no path)			0
whpel	-.3227438	.1652876	-1.95	0.051	-.3904838
goferw1	0	(no path)			0
goferw2	0	(no path)			0
crhrw2	0	(no path)			0
whppa	0	(no path)			0
crhrw3	8.335343	2.119461	3.93	0.000	.3097122
fdferw1	.1819313	.0517988	3.51	0.000	.2860255
crhrw1	0	(no path)			0
icdxcnt	3.049287	1.284999	2.37	0.018	.2068133
whpel <-					
whpsleep	.8986316	.1838416	4.89	0.000	.7427396
whpel	0	(no path)			0
goferw1	0	(no path)			0
goferw2	0	(no path)			0
crhrw2	0	(no path)			0
whppa	-.4104538	.2878747	-1.43	0.154	-.1984179
crhrw3	0	(no path)			0
fdferw1	0	(no path)			0
crhrw1	0	(no path)			0
icdxcnt	3.62869	1.267427	2.86	0.004	.2034159
goferw1 <-					
fdferw1	.6033135	.0460219	13.11	0.000	.7098585

Continued on the next page...

Table 11 Male clustered robust Direct effects --continued:

	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
goferw2 <-						
goferw1	.2049207	.0502389	4.08	0.000		.404869
crhrw2	2.70413	.8080246	3.35	0.001		.1487349
fdferw1	.0648031	.0349872	1.85	0.064		.1506444
crhrw1	0	(no path)				0
icdxcnt	0	(no path)				0
crhrw2 <-						
goferw1	.0025293	.000802	3.15	0.002		.0908532
fdferw1	0	(no path)				0
crhrw1	.7495949	.0354861	21.12	0.000		.7549126
icdxcnt	.1010899	.0212446	4.76	0.000		.1843158
goferw3 <-						
goferw1	0	(no path)				0
goferw2	.7599253	.0861227	8.82	0.000		.7686353
crhrw2	0	(no path)				0
fdferw1	0	(no path)				0
crhrw1	1.725182	.7016068	2.46	0.014		.0966584
icdxcnt	0	(no path)				0
whppa <-						
whpsleep	0	(no path)				0
whpel	.2737342	.0423569	6.46	0.000		.5662555
goferw1	0	(no path)				0
goferw2	-.141059	.0415084	-3.40	0.001		-.1631094
crhrw2	0	(no path)				0
whppa	0	(no path)				0
crhrw3	3.79712	.8541422	4.45	0.000		.2412279
fdferw1	0	(no path)				0
crhrw1	0	(no path)				0
icdxcnt	0	(no path)				0
crhrw3 <-						
goferw1	0	(no path)				0
crhrw2	1.055212	.0329604	32.01	0.000		1.056405
fdferw1	0	(no path)				0
crhrw1	-.1183935	.0379136	-3.12	0.002		-.1193681
icdxcnt	0	(no path)				0

8.4 Indirect effects among males

8.4.1 Hypothesis 18: Does radiation dose indirectly explain aversion to venturing outdoors through a mediator of medically diagnosed illnesses?

From Figure 2, we observe no indirect effect originating with radiation dose and extending to fear of going outdoors, much less mediated by the number of medically diagnosed illnesses. Rather the number of medically diagnosed illnesses serves not as a mediator but as an exogenous variable. For evidence we look at Table 12, page 33, and we find no indirect effect of cumulative external radiation dose having an indirect effect on aversion to going outdoors mediated by medically diagnosed illnesses in any wave among males. Hypothesis 18 is inconsistent with the male data.

8.4.2 Hypothesis 22: Dose perceived risk of exposure indirectly explain aversion to venturing outdoors mediated by the Nottingham health scale measures?

In Table 12, page 33, we find evidence of perceived risk of exposure from wave 1 directly explaining fear of going outdoors in waves 2 and 3. We then find direct effects from fear of going outdoors in wave 2 extending to the Nottingham measures of physical activity, energy level, and sleep as endogenous target variables rather than as mediating variables. Because the Nottingham measures are not mediators, this hypothesis is disconfirmed by the data.

Table 12 clustered robust male Indirect effects
(Std. Err. adjusted for 339 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Structural					
cumdo~1 <-					
goferw1	0	(no path)			0
fdferw1	.0032957	.0035647	0.92	0.355	.0769488
cumdo~2 <-					
cumdose1	0	(no path)			0
goferw1	.0073177	.0078817	0.93	0.353	.0967845
fdferw1	.0044149	.0039971	1.10	0.269	.0687033
cumdo~3 <-					
cumdose1	1.412499	.3029474	4.66	0.000	.8831041
cumdose2	0	(no path)			0
goferw1	.007716	.0083106	0.93	0.353	.0957286
fdferw1	.0046552	.0041394	1.12	0.261	.0679538
whpsl~p <-					
whpsleep	-.2068107	.0423092	-4.89	0.000	-.2068107
whpel	.0926042	.033735	2.75	0.006	.1120408
goferw1	.0157813	.0057598	2.74	0.006	.0210868
goferw2	-.0133247	.003921	-3.40	0.001	-.0090115
crhrw2	7.318996	.229562	31.88	0.000	.2722556
whppa	.0944617	.0662514	1.43	0.154	.0552481
crhrw3	-1.365156	.4423645	-3.09	0.002	-.0507244
fdferw1	-.0289677	.028192	-1.03	0.304	-.045542
crhrw1	4.661057	1.081146	4.31	0.000	.1746143
icdxcnt	-.7258537	.8030191	-0.90	0.366	-.0492299
whpel <-					
whpsleep	-.2578426	.0527493	-4.89	0.000	-.2131128
whpel	-.286928	.1045256	-2.75	0.006	-.286928
goferw1	.0200318	.0045937	4.36	0.000	.022123
goferw2	.0412856	.0121488	3.40	0.001	.0230777
crhrw2	4.575024	.144645	31.63	0.000	.140661
whppa	.1177707	.0825993	1.43	0.154	.0569317
crhrw3	4.229843	1.370637	3.09	0.002	.1299015
fdferw1	.1313405	.0352406	3.73	0.000	.1706675
crhrw1	2.928629	1.099842	2.66	0.008	.0906806
icdxcnt	1.375266	.9438743	1.46	0.145	.0770942

Continued on the next page...

Table 12 Male clustered robust Indirect effects --continued:

	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
goferw1 <-						
fdferw1	0	(no path)				0
goferw2 <-						
goferw1	.0068395	.0021686	3.15	0.002		.013513
crhrw2	0	(no path)				0
fdferw1	.1277578	.031993	3.99	0.000		.296992
crhrw1	2.027002	.6208497	3.26	0.001		.1122818
icdxcnt	.2733603	.0975218	2.80	0.005		.0274142
crhrw2 <-						
goferw1	0	(no path)				0
fdferw1	.0015259	.0004894	3.12	0.002		.0644929
crhrw1	0	(no path)				0
icdxcnt	0	(no path)				0
goferw3 <-						
goferw1	.160922	.0385728	4.17	0.000		.3215832
goferw2	0	(no path)				0
crhrw2	2.054937	.6140383	3.35	0.001		.1143229
fdferw1	.1463319	.0227574	6.43	0.000		.3440691
crhrw1	1.54037	.5311824	2.90	0.004		.0863038
icdxcnt	.2077334	.0804094	2.58	0.010		.0210715
whppa <-						
whpsleep	.1754058	.0358844	4.89	0.000		.299904
whpel	-.078542	.0286122	-2.75	0.006		-.1624746
goferw1	-.0142531	.0068272	-2.09	0.037		-.0325623
goferw2	.0113013	.0033255	3.40	0.001		.0130679
crhrw2	4.877666	.1905148	25.60	0.000		.3102242
whppa	-.0801174	.0561909	-1.43	0.154		-.0801174
crhrw3	1.157853	.3751901	3.09	0.002		.0735574
fdferw1	.0149041	.0127836	1.17	0.244		.0400627
crhrw1	3.069637	.5912227	5.19	0.000		.1966168
icdxcnt	1.736238	.3350844	5.18	0.000		.2013388
crhrw3 <-						
goferw1	.0026689	.0008462	3.15	0.002		.0959778
crhrw2	0	(no path)				0
fdferw1	.0016102	.000521	3.09	0.002		.0681306
crhrw1	.7909817	.0508067	15.57	0.000		.7974931
icdxcnt	.1066713	.021805	4.89	0.000		.1947121

Table 13 Male clustered robust Total effects

(Std. Err. adjusted for 339 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Structural					
cumdo~1 <-					
goferw1	.0054626	.0058836	0.93	0.353	.1084001
fdferw1	.0032957	.0035647	0.92	0.355	.0769488
cumdo~2 <-					
cumdose1	1.339597	.2873117	4.66	0.000	.8928449
goferw1	.0073177	.0078817	0.93	0.353	.0967845
fdferw1	.0044149	.0039971	1.10	0.269	.0687033
cumdo~3 <-					
cumdose1	1.412499	.3029474	4.66	0.000	.8831041
cumdose2	1.054421	.0247893	42.54	0.000	.9890902
goferw1	.007716	.0083106	0.93	0.353	.0957286
fdferw1	.0046552	.0041394	1.12	0.261	.0679538
whpsl~p <-					
whpsleep	-.2068107	.0423092	-4.89	0.000	-.2068107
whpel	-.2301396	.1318428	-1.75	0.081	-.278443
goferw1	.0157813	.0057598	2.74	0.006	.0210868
goferw2	-.0133247	.003921	-3.40	0.001	-.0090115
crhrw2	7.318996	.229562	31.88	0.000	.2722556
whppa	.0944617	.0662514	1.43	0.154	.0552481
crhrw3	6.970188	1.686432	4.13	0.000	.2589878
fdferw1	.1529636	.0370174	4.13	0.000	.2404835
crhrw1	4.661057	1.081146	4.31	0.000	.1746143
icdxcnt	2.323434	.8014263	2.90	0.004	.1575834
whpel <-					
whpsleep	.640789	.1310923	4.89	0.000	.5296268
whpel	-.286928	.1045256	-2.75	0.006	-.286928
goferw1	.0200318	.0045937	4.36	0.000	.022123
goferw2	.0412856	.0121488	3.40	0.001	.0230777
crhrw2	4.575024	.144645	31.63	0.000	.140661
whppa	-.2926831	.2052754	-1.43	0.154	-.1414863
crhrw3	4.229843	1.370637	3.09	0.002	.1299015
fdferw1	.1313405	.0352406	3.73	0.000	.1706675
crhrw1	2.928629	1.099842	2.66	0.008	.0906806
icdxcnt	5.003956	.908859	5.51	0.000	.2805101

Table 13 Total effects--continued:

(Std. Err. adjusted for 339 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
goferw1 <-					
fdferw1	.6033135	.0460219	13.11	0.000	.7098585
goferw2 <-					
goferw1	.2117602	.0507587	4.17	0.000	.418382
crhrw2	2.70413	.8080246	3.35	0.001	.1487349
fdferw1	.1925609	.0263807	7.30	0.000	.4476364
crhrw1	2.027002	.6208497	3.26	0.001	.1122818
icdxcnt	.2733603	.0975218	2.80	0.005	.0274142
crhrw2 <-					
goferw1	.0025293	.000802	3.15	0.002	.0908532
fdferw1	.0015259	.0004894	3.12	0.002	.0644929
crhrw1	.7495949	.0354861	21.12	0.000	.7549126
icdxcnt	.1010899	.0212446	4.76	0.000	.1843158
goferw3 <-					
goferw1	.160922	.0385728	4.17	0.000	.3215832
goferw2	.7599253	.0861227	8.82	0.000	.7686353
crhrw2	2.054937	.6140383	3.35	0.001	.1143229
fdferw1	.1463319	.0227574	6.43	0.000	.3440691
crhrw1	3.265552	.8434507	3.87	0.000	.1829622
icdxcnt	.2077334	.0804094	2.58	0.010	.0210715
whppa <-					
whpsleep	.1754058	.0358844	4.89	0.000	.299904
whpel	.1951922	.0523677	3.73	0.000	.4037809
goferw1	-.0142531	.0068272	-2.09	0.037	-.0325623
goferw2	-.1297577	.0381829	-3.40	0.001	-.1500415
crhrw2	4.877666	.1905148	25.60	0.000	.3102242
whppa	-.0801174	.0561909	-1.43	0.154	-.0801174
crhrw3	4.954973	.8831487	5.61	0.000	.3147853
fdferw1	.0149041	.0127836	1.17	0.244	.0400627
crhrw1	3.069637	.5912227	5.19	0.000	.1966168
icdxcnt	1.736238	.3350844	5.18	0.000	.2013388
crhrw3 <-					
goferw1	.0026689	.0008462	3.15	0.002	.0959778
crhrw2	1.055212	.0329604	32.01	0.000	1.056405
fdferw1	.0016102	.000521	3.09	0.002	.0681306
crhrw1	.6725882	.0403976	16.65	0.000	.678125
icdxcnt	.1066713	.021805	4.89	0.000	.1947121

Table 14: Hypothesis confirmation summarization table

Hypothesis	Disconfirmed	Partly confirmed	Fully confirmed
Hypothesis 9	Female		
Hypothesis 10	Male & Female		
Hypothesis 13		Female	
Hypothesis 14	Female	Male	
Hypothesis 17	Female		
Hypothesis 18	Male & Female		
Hypothesis 21	Female		
Hypothesis 22	Male & Female		

9 Tabular hypothesis confirmation summary

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