A path analysis of PTSD among Ukrainian residents of Kiev and Zhitomyr Oblasts after Chornobyl

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1) Robert Alan Yaffee 2) RoseMarie Perez Foster
3) Thomas B. Borak 3) Remi J. Frazier
4) Mariya Burdina 5) Victor Chtenguelov
and 6) Gleb Prib

Affiliations:

1) Silver School of Social Work, New York University, New York, New York
2) Natural Hazards Center, University of Colorado at Boulder
3) Environmental and Radiological Health Sciences,
Colorado State University, Fort Collins, Colorado
4) Department of Economics and International Business,
University of Central Oklahoma, Edmond, Oklahoma
5) Deputy Director, Ukrainian Institute on Public Health Policy , Kiev, Ukraine
6) Applied Psychology, Academy of Labor and Social Relations, Kiev, Ukraine

Contents

1 Acknowledgements **4**

2 Introduction **5**

3 Path analysis **5**

4 Assumptions and Model structure **6**

5 Limitations of path models **7**

6 Model input qualification **9**

7 Model estimation **9**

8 Male model variables **9**

9 Male PTSD path model **11**
- 9.1 Direct effects on Chornobyl PTSD among males 19
  - 9.1.1 Hypothesis 3: Direct dose effects on Chornobyl PTSD . . 19
  - 9.1.2 Hypothesis 4: Direct dose effects on mental health as measured by the Brief Symptom Inventory 32
  - 9.1.3 Hypothesis 5: Perceived risk directly explains mental health as measured by BSI scales 32
  - 9.1.4 Hypothesis 6: Direct Perceived risk effects on male PTSD 32
  - 9.1.5 Hypothesis 8: Direct perceived risk effects on Nottingham measured illnesses 32
- 9.2 Indirect effects on male PTSD 33
  - 9.2.1 Indirect effects originating with cumulative external dose 33
  - 9.2.2 Indirect effects originating with perceived risk of exposure 33
  - 9.2.3 Major indirect effects on male PTSD 43
- 9.3 Total effects addenda on male PTSD 43
  - 9.3.1 The statistical and the psychological calculus of total effects 43
  - 9.3.2 Hypothesis 3 addendudm: Total effects of cumulative external dose on male PTSD 44
  - 9.3.3 Hypothesis 4 addendum: Total effects of cumulative dose on male mental health measured by BSI 44
  - 9.3.4 Hypothesis 5 addendum: Total effects of perceived risk on BSI measures of mental health 45
  - 9.3.5 Hypothesis 6 addendum: Total effects of perceived risk summary score on male Chornobyl PTSD 45
  - 9.3.6 Hypothesis 8 addendum: Total effects of risk of exposure on Nottingham health measures 45
  - 9.3.7 Cyclical dynamics and implications for persistence 45

10 Female PTSD path model **57**
10.1 New variables . . . 59
10.2 Model goodness of fit . . . 59
10.3 Model stability and cyclical dynamics . . . 59
10.4 Direct external dose effects for females . . . 65
10.4.1 Hypothesis 3 Dose-PTSD tests . . . 65
10.4.2 Hypothesis 4: Direct dose BSI mental health effects . . . 65
10.4.3 Hypothesis 5: Direct perceived risk of exposure and BSI mental health measures for females . . . 65
10.4.4 Hypothesis 6 Perceived risk - PTSD tests . . . 65
10.4.5 Hypothesis 8: Direct effects of perceived risk to Nottingham health measures . . . 66
10.4.6 Hypothesis 12 Radiation directly explains/predicts substance abuse . . . 66
10.4.7 Hypothesis 16 Perceived risk of exposure explaining/predicting substance abuse . . . 66
10.4.8 Predominant direct effects on PTSD among women . . . 67
10.5 Indirect effects for females . . . 76
10.5.1 Hypothesis 3 addendum: Indirect external dose effects on females . . . 76
10.5.2 Hypothesis 4 addendum: Indirect external dose effects on female BSI . . . 76
10.5.3 Hypothesis 5 addendum:Indirect perceived risk dose effects on female BSI mental health . . . 77
10.5.4 Hypothesis 6 addendum: Indirect perceived risk effects on female PTSD . . . 77
10.5.5 Hypothesis 20: Do Nottingham health measures mediate a radiation effect on substance abuse? . . . 77
10.5.6 Hypothesis 24: Do Nottingham health measures mediate a perceived risk impact on substance abuse? . . . 78
10.6 Total effects on Chornobyl PTSD among females . . . 88
10.6.1 Hypothesis 3: The total effect of exposure on females . . . 88
10.6.2 Hypothesis 4: Total effect of exposure on BSI mental health 88
10.6.3 Hypothesis 6: The total effect of perceived risk explaining/predicting PTSD . . . 89
10.6.4 Hypothesis 12: The total effect of exposure on substance abuse . . . 89
10.6.5 Hypothesis 16: The total effect of perceived risk of exposure and substance abuse . . . 89
10.7 Cyclical contribution to persistence . . . 99
10.7.1 Wave 3 self-reported depression - anxiety cycle . . . 99
10.7.2 Current BSI anxiety- MiPTSD cycle . . . 101
10.8 Hypothesis recapitulation . . . 102
10.8.1 Hypothesis 20: Nottingham health mediates a dose-substance abuse relationship . . . 103

10.8.2 Hypothesis 24: Nottingham health mediates a perceived risk -substance abuse relationship 104

11 Directions for future research **105**

List of Figures

1 Pathways to PTSD among male respondents 13
2 Cyclical decay Depressive-PTSD wave 2 feedback 47
3 Decay rate of total effects in BSI anxiety and Nottinham energy level feedback 47
4 Pathways to PTSD among females residents of Kiev and Zhitomyr Oblasts 58
5 Wave 3 Depression anxiety cyclical decay among women 100
6 Wave 3 Feedback of depression- anxiety total effects cyclical decay among women 101
7 Undulating decay of Anxiety-PTSD feedback cycle among women 102

List of Tables

1 Related files 4
2 Variable index for the male PTSD model 12
3 Pathways to Male Chornobyl PTSD 15
4 Clustered-robust standardized Direct effects among males 21
5 Clustered-robust standardized Indirect effects among males . . . 34
6 Clustered-robust standardized Total effects among males 48
7 PTSD path model for female respondents 60
8 Clustered-robust direct effects for Female PTSD model 68
9 Clustered-robust indirect effects for female PTSD 79
10 Clustered-robust total effects for Female PTSD model 91
11 Hypothesis Direct effect test result summary table 103
12 Indirect effect hypothesis test result summary table 105

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Table 1: Related files

File Type	**Name**	**Version**	**Gender**
dofile	recomputingsubabuse.do	10	both
dofile	cycles2.do	10	male
sembuilder	H3H6PTSDmaleV10.stsem	10	male
sembuilder	H3H6PTSDfemV10.stsem	10	female
fig	depptsdcycle.pdf	10	male
fig	anxELcycle2.pdf	10	male
output	H3H6malePTSDV10.smcl	10	male
output	H3H6H12H18H20H24PTSDfemV10.smcl	10	female
pathdiags	H3H6malePTSDV10pd.pdf	10	male
pathdiags	H3H3femPGTSDV10pd.pdf	10	female
report	H3H6pathanalysisPTSDV10.tex	10	both
data	chwide5sep2012.dta	10	both

2 Introduction

In this analysis we examine some plausible causal etiological paths of PTSD, BSI mental health, and Nottingham health profile scales among residents of Zhitomyr and Kiev Oblasts since Chornobyl. We base this analysis on a full-information maximum likelihood model, focusing on omnibus measures of fit, as well as statistically significant paths, broken down into direct, indirect, and total effects. We employ path analysis to identify direct effects, mediating variables among indirect effects, and the magnitudes and types of total effects. The path analysis permits us to decompose total into direct, indirect, and total effects. In the previous section on our path analysis of depression, we introduced the nomenclature we use and the basis for path analysis. In our presentation of the models we generate both conventional and robust models. Although we graph the conventional model, we rely on robust standard errors for our hypothesis testing, because our longitudinal path models cover multiple periods of time, with likely inter-wave autocorrelation and heteroskedasticity.

To guide the reader, we refer to a supporting table and sometimes a page number. If other material has been inserted since writing that reference, the material referred to may be pushed back page or two. Therefore page number referrals are approximate rather than precise but are helpful nonetheless to guide the reader to the area of referral.

3 Path analysis

Although the focus of this paper is to examine PTSD and develop a model for post-nuclear PTSD, other issues are also addressed. Hypothesis 3 postulates that radiation dose directly predicts post-traumatic stress disorder (PTSD) symptoms Hypothesis 4 submits that radiation dose directly predicts mental health as measured by the BSI. Hypothesis 5 suggests that perceived risk of exposure predicts mental as measured by the BSI. Hypothesis 6 posits perceived risk of exposure directly predicting Chornobyl PTSD. Moreover, hypothesis 8 maintains that perceived risk of exposure directly explains self-reported illnesses as measured by the Nottingham health Scale. The meaning of direct in this context refers to a direct effect in a path model. We will examine these two hypotheses with path models for men and women separately. By decomposing the effects into direct, indirect, and total, we will endeavor to ascertain the extent to which direct effects can explain or predict Chornobyl PTSD symptoms.

We use standardized scales where available and especially where different metrics are used in the computation of an estimate. In cases involving recollection of past situations, where standardized scales were not available, we use self-reported depression (depww1, depww2, depww3) for waves 1, 2, and 3, respectively to compare with the BSI depression scale. Similarly, we use self-reported anxiety (anxww1, anxww2, and anxww3) to compare with BSI anxiety. For self-reported PTSD symptoms, we use (ptsdww1, ptsdww2, and ptsdww3) to represent waves 1, 2, and 3 self-reports to compare with the Mississippi civilian revised scale for the current estimates of PTSD, we measure Chornobyl PTSD symptoms with the revised civilian version of the Mississippi Chornobyl PTSD scale (MiPTSD). This Chornobyl PTSD scale is meant to properly apply only to more or less current application, unlike the previous self-expressed PTSD symptoms.

We measure reconstructed external radiation dose with the cumulative external dose in milliGrays. These variables are respectively called cumdose1, cumdose2, and cumdose3. We also measure perceived risk of exposure by a factor score of three variables–the percent to which you believe your health has been affected by Chornobyl, the extent to which your believe your family's health has been affected by Chornobyl, and the percent to which you believe that the number of cancer cases in Zhitomyr and Kiev Oblasts are due to Chornobyl. With alpha reliabilities extending upwards of 0.726 for wave 1, 0.822 for wave 2, and 0.834 for wave three, we proceed to use these scale scores as measures of perceived risk of exposure. These variables are crhtw1, crhtw2, and crhtw3, predecessors of and identical to crhrw1, crhrw2, and crhrw3, respectively.

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.

At the end of the analysis we summarize the findings of our hypothesis testing in two tables– one for direct effects and another for indirect effects discovered to facilitate a review.

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.

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. Moreover, the feedback generally occurs during the same wave in these models. In general, the arrow of time in the path diagram goes from left to right. Although previous times may impact events at later times, time travel limitations preclude impacts from the future, rational expectations notwithstanding, especially when waves are comprised of extended periods of time.

We should add however that path analysis assumes a closed system, that all of the relevant variables are in the model. If this assumption is unrealistic, it nonetheless is so if the model is to be valid. As Maxine Singer once said in an address to the National Academy of Sciences, there are several kinds of unknowns: 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. Nevertheless, we have to assume that this model comprises a closed system, without other variables that could generate a spurious relationship between the exogenous variable and other endogenous variables, or even between the endogenous variables within the model.

5 Limitations of path models

Structural equation models are designed to distinguish direct from indirect effects but they are not always optimal for variable selection among a large pool of candidate variables. Unless the paths have a strong signal/noise ratio, models may rapidly become fragile and intractable if too many variables are entered. Ideally, we should have about 15 variables in our structural equation models if our sample size = 360, according to the Joreskog Sorbom formula for sample size in structural equation models ($n = 1.5p + 1.5p^2$), where p = the number of variables in the model) [7, 2-8]. This requirement would keep the number of variables in the model below 15 level with our gender-specific data. To omit important variables, however, could lead to a biased and potentially spurious solution. To avoid such specification error, we include a regression of the exogenous variable upon potential antecedent variables. If there is no relationship shown in this regression, it is unlikely that the explanatory variables in the supplementary regression could serve as a cause common to the exogenous and other variables in the model. After fitting the model, we used clustered robust standard error estimates to control for heteroskedasticity and serial correlation between waves. To help confirm that we have not omitted important variables, we added a supplementary regression analysis to determine whether other important related variables were related that were not included.

If variables are not in the model, they are in the error term. If omitted variables are correlated with explanatory variables in the model, specification error can bias the parameters and significance levels of the included variables. The better models control for all relevant variables. When models contain a small fraction of the relevant variables, it is likely to be susceptible to omitted variable bias.

Structural equation models are not necessarily unique models. However, the fact that several different combinations of variables may provide a fit of the data does not mean that this fit is optimal and the best of all possible possible combinations of paths.

Models are merely rough approximations of evolving reality. The more variables in the model, the more variegated and comprehensive the information set must be upon which they are conditioned. Assuming additivity and linearity may limit our models too much. We make such assumptions at the risk of blinding ourselves to other processes at work.

We are aware of these knowns. As Maxine Singer has warned in her "Thoughts of a Nonmillenarean", an address to the American Academy of Arts and Sciences, in 1997. We may have known unknowns. But it is the unknown unknowns that may render the future highly unforeseeable. It is the unknown unknowns that are the most dangerous. Those are the variables that are inadvertently omitted from our model that should be in the model. As Donald Rumsfeld was wont to warn, those are the things we must protect against.

Robert Lucas in 1976 complained that econometric models lacked deep structure and were the products of policy decisions that would change the rule of the game by which the models, which did not depend upon deep structure, would no longer be valid [9, 1]. Christopher Sims, in his article, Macroeconomics and Reality (1980), claimed that these models do not allow the data to properly express themselves by testing a large number of dynamic variables likely to interact at once. He echoed Lucas's complaint that the constraints imposed by simultaneous equation models were often artificial and unrealistic. He advocated a Bayesian vector autoregression would provide a more realistic framework from which to develop models [10]. We will ultimately use an exploratory vector autoregression analysis as one of our time series models, before moving to a more robust state space model.

These models do not permit the optimal general-to-specific modeling strategy advocated by the Hendry and Richard (1982). For these among other reasons, dependent upon the theory of reduction, one should not rely solely on overly simplified models but should proceed from general-to-specific in the modeling procedure [5, 358]. George Box wrote that all models are wrong, but some are useful. If that is true, oversimplification would be one way to predispose the model to be less likely to be reliable. For this reason, we will attempt a general to specific regression analysis and then test any variables we could not include with supplementary or auxiliary analysis.

We run a supplementary regression check for potential antecedent variables, with a view toward identifying possible antecedent variables that could bias the relationships on which we focus via providing a common cause.

We assume that our variable are measured without too much measurement error. For example, we tried to construct a latent variable for the perceived Chornobyl related health risk and found that the structure did not withstand its evolution over time. Our other key organizing variable was a dose reconstruction of external exposure which was performed according to state of the art dose reconstruction measures. For us to test all of the variables we wanted to within one model over three waves of time, we found that the latent variable models did not provide the optimal value added, given our variable limitations as prescribed by Joreskog and Sorbom. Therefore we relied primarily on path analysis of observed variables via structural equation modeling for this purpose.

6 Model input qualification

We have a variable, called `injselfr`, which is a binary indicator of whether a respondent was injured as a result of the Chornobyl disaster. We attempted to generate polyserial correlations for part of the input to the program, but when paired with other variables, missing values in one of the two categories prevented computation of that correlation coefficient. The resulting matrix was non-positive definite. With a small model we might have been able to generate those correlations, but with a large number of variables in a model, a few of the polyserial correlations could not be computed, leaving us with a non-positive definite covariance matrix, and a computational *cul-de-sac*. Therefore, we made a working assumption that the differences between conventional estimates and those that we would have obtained had we been able to substitute the polyserial correlations for the appropriate pairs of variables were not going yield substantially different results and proceeded with the standard maximum likelihood estimation using that variable, along with the others, which were not binary in coding.

7 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 estimation is 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.

8 Male model variables

Before elaborately explaining this process, it behooves us to review the names of the variables we use in this model. Table 2 presents a variable list of those variables contained in the male model below. Figure 1 is a path diagram illustrating the relationships among variable in male respondents, and then in Table

3, we present the model output for that diagram. We will turn to the analysis of the female respondents afterward.

The male model analysis is organize as follows: In Figure 1 illustrates the paths that were found be be statistically significantly interrelated. Table 2 lists the variables used in Figure 1 and in our model, while and Table 3 presents the non-robust parameter estimates effects. Table 4, 5, and 6 present direct effects, the sum of the indirect effects, and the total effects. Tables 7 and 8 present supplementary analysis.

Now we turn to an explanation of the path diagram and then to a development of the discussion of constitutes the relative magnitudes of the direct and indirect and total pathways of Chornobyl related health risk leading to clinical anxiety. Then we examine the total effects with respect to hypotheses 3 and 6, by which these hypotheses are tested.

9 Male PTSD path model

Figure 1 is color coded to aid interpretation of the paths. Cumulative external radiation dose have blue fill and red arrows emanating from them. Chornobyl related health risk variables are white boxes with purple border and purple arrows emanating from them. Injury of oneself from Chornobyl is designated by a red box bordered with forest green. The arrows emanating it are also forest green. A catastrophic experience in 1986 is designated by a white box with olive arrows projected from it. Self-reported anxiety symptoms and BSI anxiety are represented by dark orange boxes with dark orange arrows stemming from them. Self-reported PTSD symptoms in different waves are signified by light khaki colored boxes with maroon borders and arrows projecting from them. The civilian revised Mississippi PTSD scale is depicted by a sand-colored box with a maroon arrow coming from it. Self-reported depressive symptoms are symbolized by blue boxes with medium blue arrows extending from them. Fear of consuming contaminated food are indicated by red boxes with black borders and arrows. The Nottingham weighted health profile sleep measure is designated by a lime colored box with a green borders and arrows, whereas the Nottingham energy level scale is shown by a cyan box with cyan arrows stemming from it. The BSI depression box is symbolized by a light blue-gray box with a black border and dark blue arrows extending from it. Correlations with double-headed arrows are color coded according to the variables they connect. The color coding helps the reader distinguish one arrow from another. The path diagram in Figure 1 illustrates statistically significant paths discovered and elaborated in Table 3, where the reader can find detailed supporting information.

We will examine this model from several perspectives. We begin our discussion by addressing some basic omnibus characteristics of the model, relating to its goodness of fit and its stability as a dynamic model. We then address the model in relation to hypothesis 3, which postulates that radiation directly predicts Chornobyl PTSD. Next, we turn to a discussion of it in relation to hypothesis 6, which submits that perceived exposure risk directly predicts Chornobyl PTSD. It should be noted that we also show connections between PTSD and some of the BSI scales of psychological health–in this case, those for anxiety and depression (Hypothesis 4 and 5). Moreover, show how these are related to scales of health behavior – including energy level and sleep (hypothesis 8). We not only discuss a strict interpretation of these hypotheses, but a broader one as well, where we consider indirect and total effects.

We see that 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 (Likelihood ratio χ^2, = 206.15, df = 187, $p > \chi^2$=.1604). If we examine the model closely, we observe several feedback loops. One of these exists between self-reported de-

Table 2: Variable index for the male PTSD model

variable name	type	format	variable label
crhrw1	float	%9.0g	Chornobyl related health risk: wave 1 alpha = .796
crhrw2	float	%9.0g	Chornobyl related health risk: wave 2 alpha = .822
crhrw3	float	%9.0g	Chornobyl related health risk: wave 3 alpha = .834
airw1	byte	%8.0g	consider hazardous (in percent) - air and water pollution in 1986
airw2	byte	%8.0g	consider hazardous (in percent) - air and water pollution in 1996
airw3	byte	%8.0g	consider hazardous (in percent) - air and water pollution NOW
depww1	byte	%9.0g	Depression aggregated to wave 1 in 1986
depww2	double	%9.0g	Depression aggregated to wave 2: 1987 thru 1996
depww3	double	%9.0g	Depression aggregated to wave three:1997 thru 2009
anxww1	byte	%9.0g	Average Anxiety level for wave 1
anxww2	double	%9.0g	Average Anxiety level for wave 2
anxww3	double	%9.0g	Average Anxiety level for wave 3
injselfr	byte	%9.0g	Were u injured because of the Chornobyl accident in 1986?
BSIdep	byte	%9.0g	Brief symptom inventory depression subscale score
BSIanx	byte	%9.0g	Brief symptom inventory anxiety subscale score
ptsdww1	byte	%9.0g	Average PTSD level in percent in wave 1
ptsdww2	double	%9.0g	Average PTSD level in percent in wave 2
ptsdww3	double	%9.0g	Average PTSD level in percent in wave 3
MiPTSD	byte	%9.0g	Mississippi post-traumatic stress disorder scale
cataw1	byte	%8.0g	Total number of disasters experienced in time period 1976-1986
cumdose1	float	%9.0g	cumulative external dose in mGys in wave 1
cumdose2	float	%9.0g	cumulative external dose in mGys in wave 2
cumdose3	float	%9.0g	cumulative external dose in mGys in wave 3
fdferw1	byte	%8.0g	* Level (in %) of fear of eating radioactively contaminated food in 1986
fdferw2	byte	%8.0g	* Level (in %) of fear of eating radioactively contaminated food in 1987-1996
whpel	float	%9.0g	Weighted Health profile Energy level subscale
whpsleep	float	%9.0g	Weighted Health profile sleep subscale

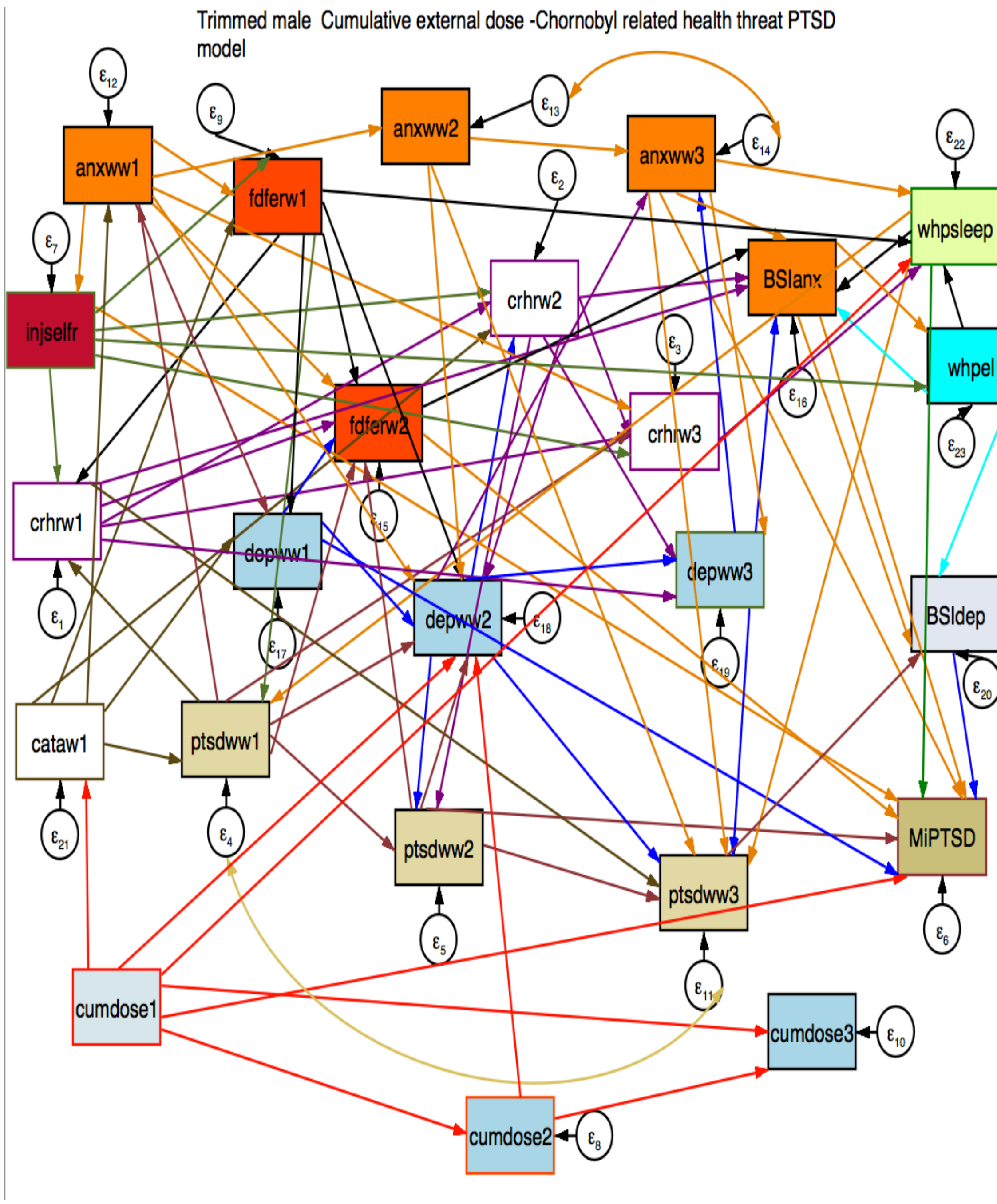

Figure 1: Pathways to PTSD among male respondents

pression and self- reported PTSD in wave 2. Another exists between energy level and BSI depression at the current time. Because the model is non-recursive, we have to test the stability by computing the stability index. We find that it is to equal 0.5776. Because the stability index is less than unity, the model, including its reciprocal path, satisfies the condition of stability (stationarity) for the model. We will examine these feedback loops later in our model analysis. Meanwhile, we can say that having assessed the global model characteristics, we can now examine the nature of the paths to test the relevant hypotheses, and we can now turn to the hypothesis testing of direct effects.

Table 3: Pathways to Male Chornobyl PTSD

```
Endogenous variables

Observed:  crhrw1 crhrw2 crhrw3 ptsdww3 fdferw2 BSIanx depww3 ptsdww2 depww2
           whpsleep ptsdww1 anxww1 MiPTSD injselfr fdferw1 whpel cumdose2
           cumdose3 cataw1 depww1 BSIdep anxww2 anxww3

Exogenous variables

Observed:  cumdose1

Structural equation model                       Number of obs      =       339
Estimation method  = ml
Log likelihood     = -23415.919
```

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
Structural						
crhrw1 <-						
ptsdww1	.0045018	.0014392	3.13	0.002	.001681	.0073225
injselfr	.5020761	.0928184	5.41	0.000	.3201553	.6839969
fdferw1	.0048078	.0014291	3.36	0.001	.0020069	.0076087
_cons	-.661096	.0650532	-10.16	0.000	-.788598	-.5335941
crhrw2 <-						
crhrw1	.7450444	.032466	22.95	0.000	.6814123	.8086766
depww2	.012571	.0017731	7.09	0.000	.0090957	.0160462
injselfr	.2177233	.0593148	3.67	0.000	.1014685	.3339781
cataw1	-.1334146	.0653162	-2.04	0.041	-.261432	-.0053972
_cons	-.2619215	.0452184	-5.79	0.000	-.3505478	-.1732951
crhrw3 <-						
crhrw1	-.1070087	.0255132	-4.19	0.000	-.1570136	-.0570038
crhrw2	1.021274	.0260639	39.18	0.000	.9701898	1.072358
ptsdww1	-.0018245	.0005099	-3.58	0.000	-.0028239	-.000825
anxww1	.0022437	.0005328	4.21	0.000	.0011996	.0032879
injselfr	.0585597	.0309452	1.89	0.058	-.0020918	.1192113
_cons	-.0506579	.0226067	-2.24	0.025	-.0949663	-.0063496
ptsdww3 <-						
crhrw1	1.039555	.4111063	2.53	0.011	.2338015	1.845309
depww3	.1190431	.037713	3.16	0.002	.045127	.1929592
ptsdww2	.7233475	.0339555	21.30	0.000	.6567959	.7898991
depww2	-.1819267	.0351853	-5.17	0.000	-.2508885	-.1129648
whpsleep	.0275381	.0154885	1.78	0.075	-.0028188	.0578949
anxww2	-.1094051	.0405685	-2.70	0.007	-.188918	-.0298922
anxww3	.2094263	.0436451	4.80	0.000	.1238835	.2949691
_cons	.5519891	.4738928	1.16	0.244	-.3768237	1.480802
fdferw2 <-						
crhrw1	2.542799	1.218447	2.09	0.037	.1546863	4.930912
ptsdww2	.6243222	.0910153	6.86	0.000	.4459355	.802709
ptsdww1	.093147	.0403175	2.31	0.021	.0141261	.1721679
anxww1	-.1093691	.0433707	-2.52	0.012	-.1943741	-.0243641
fdferw1	.3405319	.0351849	9.68	0.000	.2715707	.409493
depww1	.114398	.0455868	2.51	0.012	.0250496	.2037464
_cons	1.167934	1.438682	0.81	0.417	-1.65183	3.987698

Table 2 continued...

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
BSIanx <-						
crhrw1	-.5979033	.2900982	-2.06	0.039	-1.166485	-.0293213
crhrw2	1.058404	.3146654	3.36	0.001	.4416709	1.675136
fdferw2	.0222219	.005887	3.77	0.000	.0106836	.0337601
depww3	.0594739	.0144373	4.12	0.000	.0311774	.0877704
whpsleep	.0451556	.009703	4.65	0.000	.0261381	.0641731
whpel	-.038012	.0123689	-3.07	0.002	-.0622545	-.0137695
anxww3	-.035189	.0130462	-2.70	0.007	-.0607591	-.009619
_cons	7.237867	.2852022	25.38	0.000	6.678881	7.796853
depww3 <-						
crhrw1	-6.734748	1.069015	-6.30	0.000	-8.82998	-4.639517
crhrw2	7.782119	1.173673	6.63	0.000	5.481762	10.08248
depww2	.5277814	.0513522	10.28	0.000	.427133	.6284299
anxww3	.1911445	.0579016	3.30	0.001	.0776594	.3046297
_cons	3.742088	.7259142	5.16	0.000	2.319322	5.164853
ptsdww2 <-						
crhrw2	2.195928	.6644398	3.30	0.001	.8936502	3.498206
depww2	.336297	.0450201	7.47	0.000	.2480592	.4245349
ptsdww1	.0805204	.0159101	5.06	0.000	.0493372	.1117037
_cons	.6766411	.7626739	0.89	0.375	-.8181723	2.171454
depww2 <-						
crhrw2	-2.997931	.8641969	-3.47	0.001	-4.691725	-1.304136
ptsdww2	-.1985413	.0839801	-2.36	0.018	-.3631393	-.0339432
ptsdww1	-.0687869	.0251606	-2.73	0.006	-.1181008	-.0194731
anxww1	-.0730002	.0288625	-2.53	0.011	-.1295697	-.0164306
fdferw1	.0861067	.0223817	3.85	0.000	.0422394	.1299741
cumdose2	1.817435	.5521986	3.29	0.001	.7351456	2.899724
depww1	.1999633	.0289	6.92	0.000	.1433204	.2566063
anxww2	.7136952	.0454922	15.69	0.000	.6245321	.8028582
cumdose1	-2.302675	.8344223	-2.76	0.006	-3.938113	-.6672375
_cons	-.8063311	.9930944	-0.81	0.417	-2.75276	1.140098
whpsleep <-						
crhrw3	4.90655	1.486595	3.30	0.001	1.992877	7.820223
fdferw1	.112439	.0332317	3.38	0.001	.0473061	.177572
whpel	.1390047	.0557938	2.49	0.013	.0296509	.2483585
anxww3	.197197	.0659371	2.99	0.003	.0679628	.3264313
cumdose1	1.302139	.6803457	1.91	0.056	-.031314	2.635592
_cons	8.862195	2.046647	4.33	0.000	4.85084	12.87355
ptsdww1 <-						
whpsleep	.1805458	.0661821	2.73	0.006	.0508313	.3102602
fdferw1	.2846642	.0522065	5.45	0.000	.1823414	.386987
cataw1	40.57607	3.963624	10.24	0.000	32.80751	48.34463
_cons	1.954091	2.129102	0.92	0.359	-2.218872	6.127054
anxww1 <-						
ptsdww1	.5800759	.0479202	12.11	0.000	.4861541	.6739978
cataw1	10.2861	4.166022	2.47	0.014	2.120852	18.45136
_cons	7.304252	1.725708	4.23	0.000	3.921927	10.68658

Continued on the next page ...

Table 2 continued...

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
MiPTSD <-						
fdferw2	.0966176	.0184734	5.23	0.000	.0604105	.1328248
BSIanx	.8808533	.1843349	4.78	0.000	.5195636	1.242143
ptsdww2	.1122685	.0402348	2.79	0.005	.0334098	.1911271
whpsleep	.0458726	.0187412	2.45	0.014	.0091407	.0826046
injselfr	4.656888	.8431385	5.52	0.000	3.004367	6.309409
depww1	.066179	.015038	4.40	0.000	.0367049	.095653
BSIdep	.4610688	.1689217	2.73	0.006	.1299882	.7921493
anxww3	.0852604	.0241192	3.53	0.000	.0379877	.1325331
cumdose1	-.4836965	.2387868	-2.03	0.043	-.95171	-.015683
_cons	29.74785	1.394212	21.34	0.000	27.01524	32.48045
injselfr <-						
anxww1	.0049095	.0006713	7.31	0.000	.0035938	.0062252
_cons	.3897788	.0296403	13.15	0.000	.3316848	.4478728
fdferw1 <-						
anxww1	.2428285	.0641174	3.79	0.000	.1171607	.3684962
injselfr	10.89551	3.731779	2.92	0.004	3.581355	18.20966
cataw1	28.93849	4.635297	6.24	0.000	19.85348	38.02351
_cons	13.68546	2.5428	5.38	0.000	8.701666	18.66926
whpel <-						
BSIanx	6.715157	1.128136	5.95	0.000	4.504052	8.926262
injselfr	10.07701	3.094423	3.26	0.001	4.012051	16.14197
_cons	-33.05093	8.570161	-3.86	0.000	-49.84814	-16.25372
cumdose2 <-						
cumdose1	1.339597	.0366997	36.50	0.000	1.267667	1.411527
_cons	.3879549	.0632438	6.13	0.000	.2639992	.5119105
cumdose3 <-						
cumdose2	1.087217	.0123079	88.34	0.000	1.063094	1.11134
cumdose1	-.0439337	.0184663	-2.38	0.017	-.080127	-.0077403
_cons	.1920846	.0151063	12.72	0.000	.1624768	.2216924
cataw1 <-						
cumdose1	.026806	.0139758	1.92	0.055	-.000586	.0541981
_cons	.2362584	.0240842	9.81	0.000	.1890543	.2834626
_cons	7.304252	1.725708	4.23	0.000	3.921927	10.68658

Continued on the next page ...

Table 2 continued...

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
depww1 <-						
anxww1	.4230334	.0399292	10.59	0.000	.3447737	.5012931
fdferw1	.2023836	.038409	5.27	0.000	.1271033	.2776639
cataw1	8.274791	3.230002	2.56	0.010	1.944103	14.60548
_cons	-3.21337	1.572704	-2.04	0.041	-6.295813	-.1309281
BSIdep <-						
ptsdww3	.0313303	.0108061	2.90	0.004	.0101507	.0525098
BSIanx	.4852375	.0504145	9.62	0.000	.3864268	.5840482
whpel	.0141887	.0045427	3.12	0.002	.0052852	.0230922
_cons	3.932305	.370065	10.63	0.000	3.206991	4.657619
anxww2 <-						
anxww1	.263287	.0223494	11.78	0.000	.219483	.307091
_cons	2.821857	.9971664	2.83	0.005	.8674463	4.776267
anxww3 <-						
depww3	.445235	.0479711	9.28	0.000	.3512133	.5392567
depww2	-.1109151	.0466566	-2.38	0.017	-.2023602	-.0194699
anxww2	.6006864	.0508415	11.81	0.000	.5010389	.7003338
_cons	1.22555	.6304837	1.94	0.052	-.010175	2.461276
Variance						
e.crhrw1	.6255551	.048058			.5381117	.7272081
e.crhrw2	.2440862	.018937			.2096546	.2841726
e.crhrw3	.0599902	.004608			.0516057	.0697371
e.ptsdww3	41.36927	3.191429			35.56411	48.12201
e.fdferw2	333.1759	25.59117			286.611	387.3059
e.BSIanx	6.860466	1.024461			5.119709	9.193099
e.depww3	103.9352	9.913811			86.21264	125.3008
e.ptsdww2	104.0836	8.164002			89.25173	121.3802
e.depww2	128.8719	12.31167			106.866	155.4093
e.whpsleep	429.1495	35.11681			365.5576	503.8038
e.ptsdww1	741.8834	58.63472			635.4201	866.1843
e.anxww1	686.7744	53.30065			589.8645	799.6058
e.MiPTSD	51.35726	3.944727			44.17957	59.70109
e.injselfr	.2101846	.0161609			.180781	.2443705
e.fdferw1	965.0757	77.50306			824.524	1129.586
e.whpel	781.4557	75.59018			646.4987	944.585
e.cumdose2	1.271465	.0976606			1.093765	1.478035
e.cumdose3	.0652934	.0050152			.056168	.0759014
e.cataw1	.1843879	.0141628			.1586179	.2143448
e.depww1	478.593	36.76066			411.7046	556.3486
e.BSIdep	5.303998	.4073976			4.562711	6.165719
e.anxww2	239.9314	18.43111			206.3951	278.917
e.anxww3	65.89234	5.649859			55.6993	77.95073
Covariance						
e.ptsdww3						
e.ptsdww1	-26.2958	10.50387	-2.50	0.012	-46.883	-5.708605
e.anxww2						
e.anxww3	21.86762	12.85303	1.70	0.089	-3.32386	47.0591

LR test of model vs. saturated: chi2(187) = 206.15, Prob > chi2 = 0.1604
stability index = .5775873

9.1 Direct effects on Chornobyl PTSD among males

9.1.1 Hypothesis 3: Direct dose effects on Chornobyl PTSD

To test the hypotheses, we examine the clustered-robust direct effects estimates in Table 3. These estimates are robust to violations of residual heteroskedasticity and serial correlation. They are computed and decomposed into standardized direct, indirect, and total effects, so we may compare them to one another in order to obtain a sense of relative impact on the target endogenous variable. Table 4 contains the indirect standardized coefficients, and Table 5 contains the total effects.

In order to review the results of the hypothesis tests, we have to examine Table 3, which presents the standardized direct effects for the male PTSD model. For each endogenous variable in the upper left of the panel with an arrow pointing to it are a list of direct effects originating with other variables in a column under the endogenous variable. To find the standardized direct path coefficient we examine the right-hand column of the same row as the source (starting point) variable for the direct effect in the panel for the pointed to endogenous variable.

We interpret partial evidence as a significant relationship between the exogenous or originating variable and its target endogenous variable. If the relationship in all three wave is statistically significant, we consider this full and complete transhistorical evidentiary support. If we had both transhistorical and cross-cultural causal support, we might have the basis for a law of science. Lacking that, we search for some empirical support for associations implied by our theories or expectations to perhaps work toward theories of psychological, social psychological, sociological, or epidemiological theories with a view toward understanding the mechanisms at work.

When we turn to the MiPTSD panel of Table 3 on page 25, we do find a path proceeding directly from cumulative external dose to PTSD as measured by the Mississippi civilian revised Chornobyl PTSD scale. What appears to be counterintuitive is that the relationship defined by the path appears to be an inverse one. The larger the dose, the less the PTSD ($stdized\ \beta = -0.068\ p = 0.071$). We generally round off at 3 digits to the right of the decimal point. Yet this path is not statistically significant at the 0.05 level when estimated by the robust standard errors, although by the conventional standard errors it is (non-standardized b = -.484, p = 0.043), which can be found in Table 2 on page 16.

This is an example of where the path diagram illustrates the conventional standard errors where our decomposition of effects uses robust estimates. There are no direct paths from the wave 2 or 3 reconstructed cumulative dose estimates. Therefore, we cannot say that there is evidence of a relationship in the first wave for sure. But the inverse nature of the relationship gives us cause for pause. We might be inclined to doubt such a relationship unless it was the product of propaganda, downplaying a real problem. Perhaps the robust estimates are those on which we should rely here. If that is the case, we would say that there is no empirical evidence of a relationship at any wave if we were to insist on a 0.05 level of statistical significance. In the case where we were to say that there is partial empirical evidence of an effect, we would have to explain why the inverse relationship might be a plausible one. Such sign reversals are not uncommon in areas of non-significance¿ We have no conclusive evidence of any statistically significant evidence of a direct path from cumulative external dose to MiPTSD. Hypothesis 3 appears to be unsupported by our data.

Table 4: Clustered-robust standardized Direct effects among males

Direct effects

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Structural					
crhrw1 <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
BSIanx	0	(no path)			0
depww3	0	(no path)			0
depww2	0	(no path)			0
whpsleep	0	(no path)			0
ptsdww1	.0045018	.0013276	3.39	0.001	.1897938
anxww1	0	(no path)			0
injselfr	.5020761	.0949485	5.29	0.000	.2707234
fdferw1	.0048078	.0014116	3.41	0.001	.2020453
whpel	0	(no path)			0
cataw1	0	(no path)			0
anxww2	0	(no path)			0
anxww3	0	(no path)			0
cumdose1	0	(no path)			0
crhrw2 <-					
crhrw1	.7450444	.0396705	18.78	0.000	.7606387
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
ptsdww2	0	(no path)			0
depww2	.012571	.0017247	7.29	0.000	.2348698
whpsleep	0	(no path)			0
ptsdww1	0	(no path)			0
anxww1	0	(no path)			0
injselfr	.2177233	.0675237	3.22	0.001	.1198554
fdferw1	0	(no path)			0
whpel	0	(no path)			0
cumdose2	0	(no path)			0
cataw1	-.1334146	.0575789	-2.32	0.020	-.0634014
depww1	0	(no path)			0
anxww2	0	(no path)			0
anxww3	0	(no path)			0
cumdose1	0	(no path)			0

Continued on the next page...

Table 3 Robust standardized direct effects among males--continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
crhrw3 <-					
crhrw1	-.1070087	.0363399	-2.94	0.003	-.1095677
crhrw2	1.021274	.0320161	31.90	0.000	1.024258
crhrw3	0	(no path)			0
BSIanx	0	(no path)			0
depww3	0	(no path)			0
ptsdww2	0	(no path)			0
depww2	0	(no path)			0
whpsleep	0	(no path)			0
ptsdww1	-.0018245	.000875	-2.09	0.037	-.0787588
anxww1	.0022437	.0009468	2.37	0.018	.0937909
injselfr	.0585597	.03018	1.94	0.052	.032331
fdferw1	0	(no path)			0
whpel	0	(no path)			0
cumdose2	0	(no path)			0
cataw1	0	(no path)			0
depww1	0	(no path)			0
anxww2	0	(no path)			0
anxww3	0	(no path)			0
cumdose1	0	(no path)			0

Continued on the next page...

Table 3 Robust standardized direct effects among males--continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
ptsdww3 <-					
crhrw1	1.039555	.3880518	2.68	0.007	.0816765
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
fdferw2	0	(no path)			0
BSIanx	0	(no path)			0
depww3	.1190431	.081706	1.46	0.145	.1774303
ptsdww2	.7233475	.0740011	9.77	0.000	.7667711
depww2	-.1819267	.0818473	-2.22	0.026	-.2615818
whpsleep	.0275381	.0178898	1.54	0.124	.0575386
ptsdww1	0	(no path)			0
anxww1	0	(no path)			0
injselfr	0	(no path)			0
fdferw1	0	(no path)			0
whpel	0	(no path)			0
cumdose2	0	(no path)			0
cataw1	0	(no path)			0
depww1	0	(no path)			0
anxww2	-.1094051	.0841742	-1.30	0.194	-.171539
anxww3	.2094263	.0842513	2.49	0.013	.3337514
cumdose1	0	(no path)			0
fdferw2 <-					
crhrw1	2.542799	1.150084	2.21	0.027	.0840731
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
BSIanx	0	(no path)			0
depww3	0	(no path)			0
ptsdww2	.6243222	.123818	5.04	0.000	.2784986
depww2	0	(no path)			0
whpsleep	0	(no path)			0
ptsdww1	.093147	.0533009	1.75	0.081	.1298411
anxww1	-.1093691	.0648356	-1.69	0.092	-.1476266
injselfr	0	(no path)			0
fdferw1	.3405319	.0514893	6.61	0.000	.4731589
whpel	0	(no path)			0
cumdose2	0	(no path)			0
cataw1	0	(no path)			0
depww1	.114398	.0714912	1.60	0.110	.131254
anxww2	0	(no path)			0
anxww3	0	(no path)			0
cumdose1	0	(no path)			0

Continued on the next page...

Table 3 Robust standardized direct effects among males--continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
BSIanx <-					
crhrw1	-.5979033	.4260759	-1.40	0.161	-.2009448
crhrw2	1.058404	.45698	2.32	0.021	.3484183
crhrw3	0	(no path)			0
fdferw2	.0222219	.006182	3.59	0.000	.225882
BSIanx	0	(no path)			0
depww3	.0594739	.0151131	3.94	0.000	.3791809
ptsdww2	0	(no path)			0
depww2	0	(no path)			0
whpsleep	.0451556	.0136699	3.30	0.001	.4035832
ptsdww1	0	(no path)			0
anxww1	0	(no path)			0
injselfr	0	(no path)			0
fdferw1	0	(no path)			0
whpel	-.038012	.0161483	-2.35	0.019	-.4141789
cumdose2	0	(no path)			0
cataw1	0	(no path)			0
depww1	0	(no path)			0
anxww2	0	(no path)			0
anxww3	-.035189	.0126572	-2.78	0.005	-.2398808
cumdose1	0	(no path)			0
depww3 <-					
crhrw1	-6.734748	1.659877	-4.06	0.000	-.3550155
crhrw2	7.782119	1.772654	4.39	0.000	.4018163
crhrw3	0	(no path)			0
depww3	0	(no path)			0
ptsdww2	0	(no path)			0
depww2	.5277814	.1096747	4.81	0.000	.5091453
whpsleep	0	(no path)			0
ptsdww1	0	(no path)			0
anxww1	0	(no path)			0
injselfr	0	(no path)			0
fdferw1	0	(no path)			0
whpel	0	(no path)			0
cumdose2	0	(no path)			0
cataw1	0	(no path)			0
depww1	0	(no path)			0
anxww2	0	(no path)			0
anxww3	.1911445	.1380015	1.39	0.166	.2043761
cumdose1	0	(no path)			0

Continued on the next page...

Table 3 Robust standardized direct effects among males--continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
ptsdww2 <-					
crhrw1	0	(no path)			0
crhrw2	2.195928	.6159029	3.57	0.000	.1594236
crhrw3	0	(no path)			0
BSIanx	0	(no path)			0
depww3	0	(no path)			0
ptsdww2	0	(no path)			0
depww2	.336297	.104543	3.22	0.001	.4561581
whpsleep	0	(no path)			0
ptsdww1	.0805204	.022678	3.55	0.000	.2516144
anxww1	0	(no path)			0
injselfr	0	(no path)			0
fdferw1	0	(no path)			0
whpel	0	(no path)			0
cumdose2	0	(no path)			0
cataw1	0	(no path)			0
depww1	0	(no path)			0
anxww2	0	(no path)			0
anxww3	0	(no path)			0
cumdose1	0	(no path)			0
depww2 <-					
crhrw1	0	(no path)			0
crhrw2	-2.997931	.8535809	-3.51	0.000	-.1604588
crhrw3	0	(no path)			0
BSIanx	0	(no path)			0
depww3	0	(no path)			0
ptsdww2	-.1985413	.1562873	-1.27	0.204	-.1463721
depww2	0	(no path)			0
whpsleep	0	(no path)			0
ptsdww1	-.0687869	.0314623	-2.19	0.029	-.1584684
anxww1	-.0730002	.0335507	-2.18	0.030	-.1628498
injselfr	0	(no path)			0
fdferw1	.0861067	.0260981	3.30	0.001	.1977333
whpel	0	(no path)			0
cumdose2	1.817435	.5958586	3.05	0.002	.2680864
cataw1	0	(no path)			0
depww1	.1999633	.0543206	3.68	0.000	.3791735
anxww2	.7136952	.1062508	6.72	0.000	.778264
anxww3	0	(no path)			0
cumdose1	-2.302675	.7211999	-3.19	0.001	-.2263864

Continued on the next page...

Table 3 Robust standardized direct effects among males--continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
whpsleep <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
crhrw3	4.90655	1.484217	3.31	0.001	.1801926
fdferw2	0	(no path)			0
BSIanx	0	(no path)			0
depww3	0	(no path)			0
ptsdww2	0	(no path)			0
depww2	0	(no path)			0
whpsleep	0	(no path)			0
ptsdww1	0	(no path)			0
anxww1	0	(no path)			0
injselfr	0	(no path)			0
fdferw1	.112439	.0401819	2.80	0.005	.1776828
whpel	.1390047	.0625913	2.22	0.026	.1694631
cumdose2	0	(no path)			0
cataw1	0	(no path)			0
depww1	0	(no path)			0
anxww2	0	(no path)			0
anxww3	.197197	.0793374	2.49	0.013	.1504065
cumdose1	1.302139	.3657819	3.56	0.000	.0880969
ptsdww1 <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
fdferw2	0	(no path)			0
BSIanx	0	(no path)			0
depww3	0	(no path)			0
ptsdww2	0	(no path)			0
depww2	0	(no path)			0
whpsleep	.1805458	.0739778	2.44	0.015	.1138845
ptsdww1	0	(no path)			0
anxww1	0	(no path)			0
injselfr	0	(no path)			0
fdferw1	.2846642	.0658212	4.32	0.000	.2837518
whpel	0	(no path)			0
cumdose2	0	(no path)			0
cataw1	40.57607	5.147269	7.88	0.000	.4479925
depww1	0	(no path)			0
anxww2	0	(no path)			0
anxww3	0	(no path)			0
cumdose1	0	(no path)			0

Continued on the next page...

Table 3 Robust standardized direct effects among males--continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
anxww1 <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
BSIanx	0	(no path)			0
depww3	0	(no path)			0
depww2	0	(no path)			0
whpsleep	0	(no path)			0
ptsdww1	.5800759	.0714797	8.12	0.000	.5990434
anxww1	0	(no path)			0
injselfr	0	(no path)			0
fdferw1	0	(no path)			0
whpel	0	(no path)			0
cataw1	10.2861	5.334632	1.93	0.054	.1172803
anxww2	0	(no path)			0
anxww3	0	(no path)			0
cumdose1	0	(no path)			0
MiPTSD <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
ptsdww3	0	(no path)			0
fdferw2	.0966176	.0225814	4.28	0.000	.2282044
BSIanx	.8808533	.2347576	3.75	0.000	.2046776
depww3	0	(no path)			0
ptsdww2	.1122685	.0550254	2.04	0.041	.1182877
depww2	0	(no path)			0
whpsleep	.0458726	.0234563	1.96	0.051	.095267
ptsdww1	0	(no path)			0
anxww1	0	(no path)			0
injselfr	4.656888	.8158818	5.71	0.000	.1960942
fdferw1	0	(no path)			0
whpel	0	(no path)			0
cumdose2	0	(no path)			0
cataw1	0	(no path)			0
depww1	.066179	.0169227	3.91	0.000	.1793419
BSIdep	.4610688	.2328681	1.98	0.048	.1111292
anxww2	0	(no path)			0
anxww3	.0852604	.0461846	1.85	0.065	.1350524
cumdose1	-.4836965	.2675311	-1.81	0.071	-.0679618

Continued on the next page...

Table 3 Robust standardized direct effects among males--continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
injselfr <-					
crhrw3	0	(no path)			0
whpsleep	0	(no path)			0
ptsdww1	0	(no path)			0
anxww1	.0049095	.000593	8.28	0.000	.3717101
injselfr	0	(no path)			0
fdferw1	0	(no path)			0
whpel	0	(no path)			0
cataw1	0	(no path)			0
anxww3	0	(no path)			0
cumdose1	0	(no path)			0
fdferw1 <-					
crhrw3	0	(no path)			0
whpsleep	0	(no path)			0
ptsdww1	0	(no path)			0
anxww1	.2428285	.0799778	3.04	0.002	.2358959
injselfr	10.89551	4.009912	2.72	0.007	.1397975
fdferw1	0	(no path)			0
whpel	0	(no path)			0
cataw1	28.93849	5.23108	5.53	0.000	.3205316
anxww3	0	(no path)			0
cumdose1	0	(no path)			0
whpel <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
fdferw2	0	(no path)			0
BSIanx	6.715157	1.223786	5.49	0.000	.616295
depww3	0	(no path)			0
ptsdww2	0	(no path)			0
depww2	0	(no path)			0
whpsleep	0	(no path)			0
ptsdww1	0	(no path)			0
anxww1	0	(no path)			0
injselfr	10.07701	3.142222	3.21	0.001	.167597
fdferw1	0	(no path)			0
whpel	0	(no path)			0
cumdose2	0	(no path)			0
cataw1	0	(no path)			0
depww1	0	(no path)			0
anxww2	0	(no path)			0
anxww3	0	(no path)			0
cumdose1	0	(no path)			0

Continued on the next page...

Table 3 Robust standardized direct effects among males--continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
cumdose2 <-					
cumdose1	1.339597	.2873117	4.66	0.000	.8928449
cumdose3 <-					
cumdose2	1.087217	.0775735	14.02	0.000	1.019854
cumdose1	-.0439337	.0846185	-0.52	0.604	-.0274676
cataw1 <-					
cumdose1	.026806	.0063253	4.24	0.000	.103612
depww1 <-					
crhrw3	0	(no path)			0
whpsleep	0	(no path)			0
ptsdww1	0	(no path)			0
anxww1	.4230334	.0645267	6.56	0.000	.4976803
injselfr	0	(no path)			0
fdferw1	.2023836	.0524057	3.86	0.000	.2450927
whpel	0	(no path)			0
cataw1	8.274791	4.300853	1.92	0.054	.1109959
anxww3	0	(no path)			0
cumdose1	0	(no path)			0

Continued on the next page...

Table 3 Robust standardized direct effects among males--continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
BSIdep <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
ptsdww3	.0313303	.012817	2.44	0.015	.1292007
fdferw2	0	(no path)			0
BSIanx	.4852375	.1049672	4.62	0.000	.4677984
depww3	0	(no path)			0
ptsdww2	0	(no path)			0
depww2	0	(no path)			0
whpsleep	0	(no path)			0
ptsdww1	0	(no path)			0
anxww1	0	(no path)			0
injselfr	0	(no path)			0
fdferw1	0	(no path)			0
whpel	.0141887	.0063831	2.22	0.026	.149044
cumdose2	0	(no path)			0
cataw1	0	(no path)			0
depww1	0	(no path)			0
anxww2	0	(no path)			0
anxww3	0	(no path)			0
cumdose1	0	(no path)			0
anxww2 <-					
crhrw3	0	(no path)			0
whpsleep	0	(no path)			0
ptsdww1	0	(no path)			0
anxww1	.263287	.0353186	7.45	0.000	.5386153
injselfr	0	(no path)			0
fdferw1	0	(no path)			0
whpel	0	(no path)			0
cataw1	0	(no path)			0
anxww3	0	(no path)			0
cumdose1	0	(no path)			0

Continued on the next page...

Table 3 Robust standardized direct effects among males--continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
anxww3 <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
depww3	.445235	.1078923	4.13	0.000	.4164099
ptsdww2	0	(no path)			0
depww2	-.1109151	.1077826	-1.03	0.303	-.1000714
whpsleep	0	(no path)			0
ptsdww1	0	(no path)			0
anxww1	0	(no path)			0
injselfr	0	(no path)			0
fdferw1	0	(no path)			0
whpel	0	(no path)			0
cumdose2	0	(no path)			0
cataw1	0	(no path)			0
depww1	0	(no path)			0
anxww2	.6006864	.1061739	5.66	0.000	.5909916
anxww3	0	(no path)			0
cumdose1	0	(no path)			0

9.1.2 Hypothesis 4: Direct dose effects on mental health as measured by the Brief Symptom Inventory

In this model, we use several measures of the BSI, including those of depression and anxiety. Now we examine the panels for BSI anxiety and BSI depression for in Table 3 on pages 22 and 28 for indication of statistically significant direct effects of cumulative dose. From those panels we discover that there are no direct dose effects on either of these mental health measures. Hypothesis 4 appears to be inconsistent with our data for male respondents.

9.1.3 Hypothesis 5: Perceived risk directly explains mental health as measured by BSI scales

To test hypothesis 5, we turn to the two BSI measures of mental health in this male model found in Table 3. First we examine the panel for BSI anxiety on page 22. We see that the path from perceived risk in wave 1 to BSI anxiety is not statistically significant ($\beta = -0.200, p = 0.161$). But the direct path from perceived risk in wave 2 to BSI anxiety is significant at the 0.05 level ($crhrw2\ stdized\ \beta = 0.348,\ p = 0.021$). This finding allows us to say that we evidence of a direct effects in wave 2 of perceived risk to anxiety as measured by the BSI.

Because we also have a measure of BSI mental health in the form of the depression scale, we examine this panel on page 28. But we find no direct path from any of the perceived risks leading to BSI depression. Therefore, we only have partial confirmation of hypothesis 5 from our data insofar as it relates to wave 2 perceived risk and BSI measured anxiety.

9.1.4 Hypothesis 6: Direct Perceived risk effects on male PTSD

If we examine the panel of Table 3 relating to direct effects on Chornobyl PTSD, on page 25, we see no direct path from perceived risk of exposure at any wave. Therefore, we find no empirical evidence to support Hypothesis 6 among men.

9.1.5 Hypothesis 8: Direct perceived risk effects on Nottingham measured illnesses

In this model, we have two measures of self-reported Nottingham physical illness: sleep issues and energy level. We have to examine both of these panels in Table 3 for indications of statistically significant direct effects originating with perceived risk of exposure. We find the sleep issue (whpsleep) panel on page 24 and notice that there is a significant direct effect from wave 3 perceived risk $crhrw1\ standardized\ \beta = 0.180,\ p = .001$). Therefore we have partial recent confirmation of a direct effect from perceived risk on sleep for males.

In Table 3, on page 26, we find the energy level (whpel) panel but find no significant paths from any of the perceived risk direct effects there. Therefore, we can say only that we have partial confirmation of this hypothesis insofar as it related recently to direct effects from perceived risk to sleep issues among males.

9.2 Indirect effects on male PTSD

Most of the hypotheses pertaining to indirect effects relate to other variables not contained in this male model. To provide a more complete perspective, we consider the indirect effects to PTSD.

9.2.1 Indirect effects originating with cumulative external dose

To learn what happened with respect to indirect effects, we turn to the MiPTSD panel in Table 4 on page 38. We find statistically significant indirect robust effects from cumulative external dose in wave 1 (cumdose1 $stdized\ \beta = 0.055\ p = 0.000$) and wave 2 ($cumdose2\ stdized\ \beta = 0.049\ p = 0.002$). There was no indirect effect originating with cumdose3. Both indirect effects had positive signs indicating they contribute to PTSD indirectly. There are more than five alternative paths of cumulative external dose leading to MiPTSD, and the reader can trace them if (s)he is interested using Figure 1.

9.2.2 Indirect effects originating with perceived risk of exposure

We find statistically significant indirect effects originating with perceived risk of exposure only in waves 2 ($crhrw2\ stdized\ \beta = 0.182\ p = 0.000$) and 3 ($crhrw3\ stdized\ \beta = 0.040\ p = 0.001$)in the MiPTSD panel of Table 4. The wave 1 effect (crhrw1 stdized $\beta = .058$, p = 0.127) is not a statistically significant robust estimate. There are more than seven indirect paths leading from perceived risk of exposure to MiPTSD, and the reader can trace them using Figure 1 if (s)he wishes to do so.

Table 5: Clustered-robust standardized Indirect effects among males

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Structural					
crhrw1 <-					
crhrw1	.0039986	.00065	6.15	0.000	.0039986
crhrw2	.0086451	.0006171	14.01	0.000	.0084678
crhrw3	.006607	.0019986	3.31	0.001	.0064527
BSIanx	.0010013	.0001825	5.49	0.000	.0029794
depww3	.0001772	.0000312	5.68	0.000	.003361
depww2	.0001664	.0000298	5.58	0.000	.003046
whpsleep	.0013466	.0005333	2.52	0.012	.0358098
ptsdww1	.0027061	.0003341	8.10	0.000	.1140872
anxww1	.0046736	.0007558	6.18	0.000	.1907989
injselfr	.082695	.0284	2.91	0.004	.0445898
fdferw1	.0022516	.0004773	4.72	0.000	.0946229
whpel	.0001491	.0000924	1.61	0.106	.0048344
cataw1	.5439699	.0536355	10.14	0.000	.2532061
anxww2	.0002775	.000025	11.09	0.000	.0055372
anxww3	.0002642	.0001148	2.30	0.021	.0053582
cumdose1	.016357	.0040042	4.08	0.000	.0294296
crhrw2 <-					
crhrw1	-.0254072	.0013957	-18.20	0.000	-.025939
crhrw2	-.0311756	.0100577	-3.10	0.002	-.0311756
crhrw3	.0058973	.0017839	3.31	0.001	.0058801
ptsdww2	-.0022657	.0017924	-1.26	0.206	-.0312088
depww2	-.0010966	.0002367	-4.63	0.000	-.0204876
whpsleep	.0012019	.000476	2.52	0.012	.0326322
ptsdww1	.0064336	.0010632	6.05	0.000	.2769161
anxww1	.0071966	.0007989	9.01	0.000	.2999507
injselfr	.4312383	.0741804	5.81	0.000	.2373941
fdferw1	.006886	.0011021	6.25	0.000	.2954398
whpel	.0001331	.0000824	1.61	0.106	.0044054
cumdose2	.020854	.0068371	3.05	0.002	.0574729
cataw1	.5575104	.0587573	9.49	0.000	.2649406
depww1	.0022967	.0006234	3.68	0.000	.0813685
anxww2	.0083309	.0012074	6.90	0.000	.1697316
anxww3	.0002358	.0001024	2.30	0.021	.0048828
cumdose1	.0144475	.0085224	1.70	0.090	.026538

Continued on the next page ...

Table 4 Clustered-robust standardized Indirect effects continued among males:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
crhrw3 <-					
crhrw1	.7343082	.0391512	18.76	0.000	.7518683
crhrw2	-.0332195	.0102419	-3.24	0.001	-.0333166
crhrw3	.0049675	.0015027	3.31	0.001	.0049675
BSIanx	.0007529	.0001372	5.49	0.000	.0022937
depww3	.0001332	.0000235	5.68	0.000	.0025874
ptsdww2	-.0023109	.0018266	-1.27	0.206	-.0319236
depww2	.0116919	.0017522	6.67	0.000	.2190845
whpsleep	.0010124	.000401	2.52	0.012	.0275678
ptsdww1	.0072438	.0010441	6.94	0.000	.3126986
anxww1	.0070958	.000765	9.28	0.000	.296612
injselfr	.5985946	.0929224	6.44	0.000	.3304855
fdferw1	.0061584	.0009668	6.37	0.000	.2649952
whpel	.0001121	.0000694	1.61	0.106	.0037217
cumdose2	.0212493	.0069667	3.05	0.002	.0587336
cataw1	.3817176	.0847673	4.50	0.000	.1819302
depww1	.0023399	.0006352	3.68	0.000	.0831391
anxww2	.0084638	.0012324	6.87	0.000	.1729434
anxww3	.0001986	.0000863	2.30	0.021	.004125
cumdose1	.0130935	.0085312	1.53	0.125	.0241211
ptsdww3 <-					
crhrw1	.6459379	.4099526	1.58	0.115	.0507505
crhrw2	3.076713	.5538963	5.55	0.000	.2367774
crhrw3	.2263129	.068459	3.31	0.001	.0173658
fdferw2	.0007622	.000212	3.59	0.000	.0018112
BSIanx	.0342994	.0062508	5.49	0.000	.0080184
depww3	.1190597	.0283206	4.20	0.000	.1774551
ptsdww2	-.0361301	.0287823	-1.26	0.209	-.0382991
depww2	.3663012	.0744599	4.92	0.000	.5266833
whpsleep	.0185866	.0069944	2.66	0.008	.0388352
ptsdww1	.0943682	.016401	5.75	0.000	.312589
anxww1	.0766622	.0087764	8.74	0.000	.2458986
injselfr	2.275621	.3749315	6.07	0.000	.0964064
fdferw1	.0637675	.0081912	7.78	0.000	.2105492
whpel	.0051078	.0031636	1.61	0.106	.0130107
cumdose2	.3350888	.1098612	3.05	0.002	.0710701
cataw1	6.358303	.7152089	8.89	0.000	.2325359
depww1	.0369554	.010021	3.69	0.000	.1007572
anxww2	.2894639	.0253144	11.43	0.000	.4538577
anxww3	.0534007	.0332405	1.61	0.108	.0851019
cumdose1	.2548308	.1381239	1.84	0.065	.0360231

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Table 4 Clustered-robust standardized Indirect effects continued among males:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
fdferw2 <-					
crhrw1	.6174556	.03904	15.82	0.000	.0204151
crhrw2	.9268842	.3833708	2.42	0.016	.0300175
crhrw3	.1977894	.0598307	3.31	0.001	.0063868
BSIanx	.0299764	.005463	5.49	0.000	.002949
depww3	.0053038	.0009338	5.68	0.000	.0033267
ptsdww2	-.0412127	.0327401	-1.26	0.208	-.0183842
depww2	.209672	.0607963	3.45	0.001	.1268665
whpsleep	.0403113	.0159658	2.52	0.012	.0354444
ptsdww1	.1226305	.0164119	7.47	0.000	.1709393
anxww1	.2406846	.039213	6.14	0.000	.3248766
injselfr	6.983559	1.925095	3.63	0.000	.1245025
fdferw1	.1310845	.0170027	7.71	0.000	.182138
whpel	.004464	.0027649	1.61	0.106	.0047851
cumdose2	.3810652	.1249349	3.05	0.002	.0340112
cataw1	24.92452	2.756466	9.04	0.000	.3835933
depww1	.0420029	.0113944	3.69	0.000	.0481919
anxww2	.1543922	.0218896	7.05	0.000	.10187
anxww3	.0079082	.0034356	2.30	0.021	.0053035
cumdose1	.7482852	.2451216	3.05	0.002	.0445135
BSIanx <-					
crhrw1	.7972802	.1140231	6.99	0.000	.2679519
crhrw2	.226473	.1145065	1.98	0.048	.0745532
crhrw3	.18859	.0570479	3.31	0.001	.0619015
fdferw2	-.0038837	.0010804	-3.59	0.000	-.0394769
BSIanx	-.1747678	.0318501	-5.49	0.000	-.1747678
depww3	-.016272	.0028997	-5.61	0.000	-.1037436
ptsdww2	.0032101	.0060694	0.53	0.597	.0145555
depww2	.0414971	.0063346	6.55	0.000	.2552264
whpsleep	-.0067192	.0024394	-2.75	0.006	-.0600535
ptsdww1	.0064945	.0019112	3.40	0.001	.0920214
anxww1	.0117723	.0022539	5.22	0.000	.1615226
injselfr	.3362003	.1421123	2.37	0.018	.0609257
fdferw1	.0190509	.0021838	8.72	0.000	.2690704
whpel	.0119861	.0028194	4.25	0.000	.1306008
cumdose2	.0754183	.0247264	3.05	0.002	.0684227
cataw1	.8505182	.1472452	5.78	0.000	.1330542
depww1	.0103958	.0027202	3.82	0.000	.1212415
anxww2	.0216862	.0052252	4.15	0.000	.145447
anxww3	.0219873	.0065105	3.38	0.001	.1498853
cumdose1	.0783243	.0279312	2.80	0.005	.0473611

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Table 4 Clustered-robust standardized Indirect effects continued among males:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
depww3 <-					
crhrw1	4.210215	.2961274	14.22	0.000	.2219373
crhrw2	-1.272201	.5389224	-2.36	0.018	-.0656879
crhrw3	.0365003	.0110412	3.31	0.001	.0018791
depww3	.0939995	.0226924	4.14	0.000	.0939995
ptsdww2	-.1182772	.0931602	-1.27	0.204	-.0841194
depww2	.0683362	.0256418	2.67	0.008	.0659232
whpsleep	.0074391	.0029463	2.52	0.012	.0104285
ptsdww1	.0398199	.0228431	1.74	0.081	.0884961
anxww1	.1754403	.0247017	7.10	0.000	.3775552
injselfr	.9832649	.5994658	1.64	0.101	.0279481
fdferw1	.0755332	.0171051	4.42	0.000	.1673279
whpel	.0008238	.0005102	1.61	0.106	.0014079
cumdose2	1.083405	.3552018	3.05	0.002	.154168
cataw1	5.724116	1.201329	4.76	0.000	.1404539
depww1	.1192157	.0323824	3.68	0.000	.2180764
anxww2	.5518212	.056219	9.82	0.000	.5804973
anxww3	.0192398	.013013	1.48	0.139	.0205716
cumdose1	.2417886	.3939774	0.61	0.539	.022932
ptsdww2 <-					
crhrw1	.8587135	.0476045	18.04	0.000	.0636472
crhrw2	-.9929863	.2892366	-3.43	0.001	-.0720905
crhrw3	.1015311	.0307128	3.31	0.001	.0073496
BSIanx	.0153878	.0028043	5.49	0.000	.0033936
depww3	.0027226	.0004793	5.68	0.000	.0038282
ptsdww2	-.0653878	.0516249	-1.27	0.205	-.0653878
depww2	-.0058809	.0074011	-0.79	0.427	-.0079769
whpsleep	.020693	.0081957	2.52	0.012	.0407877
ptsdww1	.0302444	.0120238	2.52	0.012	.0945093
anxww1	.0939971	.0126864	7.41	0.000	.2844265
injselfr	1.592997	.3460567	4.60	0.000	.0636652
fdferw1	.0799331	.0113821	7.02	0.000	.2489785
whpel	.0022915	.0014193	1.61	0.106	.0055065
cumdose2	.6005099	.1968813	3.05	0.002	.1201513
cataw1	8.160969	.8766004	9.31	0.000	.2815605
depww1	.0661102	.0179509	3.68	0.000	.1700391
anxww2	.2382549	.0349034	6.83	0.000	.3524102
anxww3	.0040595	.0017636	2.30	0.021	.0061031
cumdose1	.2893085	.2377172	1.22	0.224	.0385808

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Table 4 Clustered-robust standardized Indirect effects continued among males:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
depww2 <-					
crhrw1	-2.287268	.1215208	-18.82	0.000	-.1249843
crhrw2	-.0574964	.1319192	-0.44	0.663	-.0030774
crhrw3	.0293207	.0088694	3.31	0.001	.0015648
BSIanx	.0044438	.0008098	5.49	0.000	.0007225
depww3	.0007862	.0001384	5.68	0.000	.000815
ptsdww2	.01958	.0153687	1.27	0.203	.0144351
depww2	-.0983089	.018801	-5.23	0.000	-.0983089
whpsleep	.0059758	.0023668	2.52	0.012	.0086838
ptsdww1	.1007741	.0161576	6.24	0.000	.2321592
anxww1	.2777369	.0278139	9.99	0.000	.6195796
injselfr	-.5745953	.5288702	-1.09	0.277	-.01693
fdferw1	.0268425	.0098833	2.72	0.007	.0616405
whpel	.0006618	.0004099	1.61	0.106	.0011723
cumdose2	-.1786701	.0585782	-3.05	0.002	-.0263553
cataw1	8.57216	1.451326	5.91	0.000	.2180359
depww1	-.0196469	.0053395	-3.68	0.000	-.0372547
anxww2	-.0694584	.0105054	-6.61	0.000	-.0757424
anxww3	.0011723	.0005093	2.30	0.021	.0012994
cumdose1	2.659225	1.085338	2.45	0.014	.2614404
whpsleep <-					
crhrw1	3.116858	.5066281	6.15	0.000	.1172036
crhrw2	6.738654	.4810148	14.01	0.000	.2481995
crhrw3	.2434555	.0736445	3.31	0.001	.0089409
fdferw2	.0173446	.0048252	3.59	0.000	.0197263
BSIanx	.7805213	.1422441	5.49	0.000	.0873299
depww3	.1381003	.024313	5.68	0.000	.0985128
ptsdww2	-.0149298	.0196229	-0.76	0.447	-.0075744
depww2	.1297386	.0232355	5.58	0.000	.0892801
whpsleep	.0496185	.0121593	4.08	0.000	.0496185
ptsdww1	.0796119	.012131	6.56	0.000	.1262119
anxww1	.143925	.0179624	8.01	0.000	.2209455
injselfr	6.448635	1.020859	6.32	0.000	.1307519
fdferw1	.0659566	.0076973	8.57	0.000	.1042286
whpel	-.022772	.0142115	-1.60	0.109	-.0277617
cumdose2	.2357914	.0773059	3.05	0.002	.0239348
cataw1	9.205323	1.259585	7.31	0.000	.1611248
depww1	.0279272	.0072786	3.84	0.000	.0364418
anxww2	.2162829	.0195041	11.09	0.000	.1623013
anxww3	.008716	.0237783	0.37	0.714	.0066478
cumdose1	.3284879	.1137784	2.89	0.004	.022224

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Table 4 Clustered-robust standardized Indirect effects continued among males:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
ptsdww1 <-					
crhrw1	.591687	.0961755	6.15	0.000	.0140344
crhrw2	1.279229	.0913132	14.01	0.000	.0297203
crhrw3	.9776482	.2957356	3.31	0.001	.0226475
fdferw2	.0032926	.000916	3.59	0.000	.0023621
BSIanx	.1481698	.0270028	5.49	0.000	.0104572
depww3	.0262162	.0046154	5.68	0.000	.0117963
ptsdww2	-.0028342	.0037251	-0.76	0.447	-.000907
depww2	.0246288	.0044109	5.58	0.000	.0106907
whpsleep	.018708	.0053142	3.52	0.000	.0118006
ptsdww1	.0665608	.0083717	7.95	0.000	.0665608
anxww1	.1160132	.0275504	4.21	0.000	.1123399
injselfr	4.485302	1.353654	3.31	0.001	.0573653
fdferw1	.048511	.0091163	5.32	0.000	.0483555
whpel	.022065	.0136664	1.61	0.106	.0169678
cumdose2	.0447613	.0146753	3.05	0.002	.002866
cataw1	13.40889	1.777577	7.54	0.000	.1480449
depww1	.0053015	.0013817	3.84	0.000	.0043637
anxww2	.0410579	.0037025	11.09	0.000	.0194346
anxww3	.0390894	.0169819	2.30	0.021	.0188063
cumdose1	1.709827	.3426556	4.99	0.000	.0729681
anxww1 <-					
crhrw1	.3432234	.0557891	6.15	0.000	.0084072
crhrw2	.7420497	.0529686	14.01	0.000	.0178038
crhrw3	.5671102	.1715491	3.31	0.001	.0135669
BSIanx	.0859497	.0156637	5.49	0.000	.0062643
depww3	.0152074	.0026773	5.68	0.000	.0070665
depww2	.0142866	.0025587	5.58	0.000	.0064042
whpsleep	.1155823	.0457778	2.52	0.012	.0752908
ptsdww1	.0386103	.0048562	7.95	0.000	.0398728
anxww1	.0672965	.0159813	4.21	0.000	.0672965
injselfr	2.601816	.7852219	3.31	0.001	.0343643
fdferw1	.1932669	.0409703	4.72	0.000	.1989467
whpel	.0127994	.0079276	1.61	0.106	.0101645
cataw1	31.31537	3.271463	9.57	0.000	.3570523
anxww2	.0238167	.0021478	11.09	0.000	.0116421
anxww3	.0226748	.0098508	2.30	0.021	.0112658
cumdose1	1.267559	.2751129	4.61	0.000	.0558628

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Table 4 Clustered-robust standardized Indirect effects continued among males:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
MiPTSD <-					
crhrw1	.7474093	.489867	1.53	0.127	.0583675
crhrw2	2.380813	.4999053	4.76	0.000	.1821133
crhrw3	.5266522	.1593107	3.31	0.001	.0401673
ptsdww3	.0144454	.0059095	2.44	0.015	.014358
fdferw2	.0221059	.0061497	3.59	0.000	.0522126
BSIanx	.1139264	.0497427	2.29	0.022	.0264723
depww3	.102776	.017698	5.81	0.000	.1522574
ptsdww2	.0590164	.0204989	2.88	0.004	.0621805
depww2	.1287108	.0195378	6.59	0.000	.1839456
whpsleep	.0614639	.0150694	4.08	0.000	.1276465
ptsdww1	.0894304	.012741	7.02	0.000	.2944396
anxww1	.1224487	.0149811	8.17	0.000	.3903838
injselfr	2.001585	.497614	4.02	0.000	.0842836
fdferw1	.1139829	.0105995	10.75	0.000	.3740733
whpel	-.0163513	.0207612	-0.79	0.431	-.0413987
cumdose2	.2339235	.0766935	3.05	0.002	.0493133
cataw1	8.742087	1.06122	8.24	0.000	.3177803
depww1	.0393192	.011531	3.41	0.001	.1065531
BSIdep	0	(no path)			0
anxww2	.1467996	.0123129	11.92	0.000	.2287774
anxww3	.0088314	.0236569	0.37	0.709	.013989
cumdose1	.3910917	.1018854	3.84	0.000	.0549504
injselfr <-					
crhrw3	.0027842	.0008422	3.31	0.001	.0050429
whpsleep	.0005674	.0002247	2.52	0.012	.0279864
ptsdww1	.0030374	.0003745	8.11	0.000	.2374916
anxww1	.0003304	.0000785	4.21	0.000	.0250148
injselfr	.0127736	.003855	3.31	0.001	.0127736
fdferw1	.0009488	.0002011	4.72	0.000	.0739505
whpel	.0000628	.0000389	1.61	0.106	.0037782
cataw1	.2042417	.0314015	6.50	0.000	.1763142
anxww3	.0001113	.0000484	2.30	0.021	.0041876
cumdose1	.0062231	.0015914	3.91	0.000	.0207648
fdferw1 <-					
crhrw3	.168046	.0508334	3.31	0.001	.0039054
whpsleep	.0342493	.0135649	2.52	0.012	.0216732
ptsdww1	.1833289	.0226049	8.11	0.000	.1839184
anxww1	.0734326	.0095069	7.72	0.000	.0713361
injselfr	.7709694	.2326767	3.31	0.001	.0098921
fdferw1	.0572688	.0121403	4.72	0.000	.0572688
whpel	.0037927	.0023491	1.61	0.106	.0029259
cataw1	12.32734	1.895292	6.50	0.000	.1365414
anxww3	.006719	.002919	2.30	0.021	.003243
cumdose1	1.151328	.2723676	4.23	0.000	.0492917

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Table 4 Clustered-robust standardized Indirect effects continued among males:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
whpel <-					
crhrw1	1.355828	2.458451	0.55	0.581	.0418199
crhrw2	8.66486	2.596751	3.34	0.001	.2617843
crhrw3	1.294468	.3915727	3.31	0.001	.0389948
fdferw2	.1232384	.0342843	3.59	0.000	.1149687
BSIanx	-1.169341	.2131035	-5.49	0.000	-.1073183
depww3	.2908599	.0850865	3.42	0.001	.1701909
ptsdww2	.0214747	.0408607	0.53	0.599	.0089367
depww2	.2793665	.0425708	6.56	0.000	.1576937
whpsleep	.2638245	.0759796	3.47	0.001	.2164061
ptsdww1	.0742197	.0149851	4.95	0.000	.0965152
anxww1	.1318553	.0181447	7.27	0.000	.1660355
injselfr	2.386357	.9758522	2.45	0.014	.039689
fdferw1	.1374913	.0153267	8.97	0.000	.1782207
whpel	-.1741346	.0977597	-1.78	0.075	-.1741346
cumdose2	.5077305	.166463	3.05	0.002	.0422755
cataw1	7.769508	1.175369	6.61	0.000	.1115504
depww1	.0699613	.0183042	3.82	0.000	.0748834
anxww2	.1468044	.0350811	4.18	0.000	.0903635
anxww3	-.0875302	.0937941	-0.93	0.351	-.0547619
cumdose1	.5886697	.21927	2.68	0.007	.0326685
cumdose2 <-					
cumdose1	0	(no path)			0
cumdose3 <-					
cumdose2	0	(no path)			0
cumdose1	1.456433	.2682484	5.43	0.000	.9105718
cataw1 <-					
cumdose1	0	(no path)			0
depww1 <-					
crhrw3	.2739163	.0828589	3.31	0.001	.0077091
whpsleep	.0558267	.0221108	2.52	0.012	.0427827
ptsdww1	.2988277	.0368462	8.11	0.000	.3630531
anxww1	.0924747	.0243824	3.79	0.000	.1087924
injselfr	3.461758	1.18969	2.91	0.004	.0537903
fdferw1	.0933486	.0197888	4.72	0.000	.113048
whpel	.0061821	.003829	1.61	0.106	.0057758
cataw1	25.95034	3.256834	7.97	0.000	.3480913
anxww3	.010952	.004758	2.30	0.021	.0064016
cumdose1	.9910439	.2395578	4.14	0.000	.0513834

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Table 4 Clustered-robust standardized Indirect effects continued among males:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
BSIdep <-					
crhrw1	.1687895	.2158677	0.78	0.434	.0546885
crhrw2	.8428077	.2272037	3.71	0.000	.2674745
crhrw3	.1169682	.0353825	3.31	0.001	.037013
ptsdww3	0	(no path)			0
fdferw2	.0106709	.0029686	3.59	0.000	.1045694
BSIanx	-.0050414	.0009188	-5.49	0.000	-.0048602
depww3	.0325499	.008423	3.86	0.000	.2000665
ptsdww2	.023393	.0051353	4.56	0.000	.1022601
depww2	.0298763	.0047461	6.29	0.000	.1771491
whpsleep	.0238392	.0066027	3.61	0.000	.2054082
ptsdww1	.007161	.0014019	5.11	0.000	.0978192
anxww1	.0099851	.0015657	6.38	0.000	.1320769
injselfr	.4112717	.081291	5.06	0.000	.0718514
fdferw1	.0131929	.0014566	9.06	0.000	.1796365
whpel	-.0149394	.0084998	-1.76	0.079	-.1569301
cumdose2	.0542983	.0178021	3.05	0.002	.0474913
cataw1	.7221498	.1069494	6.75	0.000	.1089123
depww1	.0071949	.001862	3.86	0.000	.0808954
anxww2	.0182472	.0042399	4.30	0.000	.1179838
anxww3	.0005865	.0090887	0.06	0.949	.0038545
cumdose1	.0543423	.0204311	2.66	0.008	.0316787
anxww2 <-					
crhrw3	.1493128	.0451667	3.31	0.001	.0073073
whpsleep	.0304313	.0120527	2.52	0.012	.0405528
ptsdww1	.1628921	.020085	8.11	0.000	.34413
anxww1	.0177183	.0042077	4.21	0.000	.0362469
injselfr	.6850244	.2067387	3.31	0.001	.0185091
fdferw1	.0508847	.010787	4.72	0.000	.1071557
whpel	.0033699	.0020872	1.61	0.106	.0054747
cataw1	10.95313	1.684011	6.50	0.000	.2554828
anxww3	.00597	.0025936	2.30	0.021	.0060679
cumdose1	.3337319	.0838318	3.98	0.000	.0300885
anxww3 <-					
crhrw1	-.8160364	.8183238	-1.00	0.319	-.0402316
crhrw2	3.354694	.8724393	3.85	0.000	.1619997
crhrw3	.1026893	.0310632	3.31	0.001	.0049445
depww3	.0441697	.0104632	4.22	0.000	.0413101
ptsdww2	-.0330717	.0261882	-1.26	0.207	-.021998
depww2	.2785758	.0513384	5.43	0.000	.2513407
whpsleep	.020929	.0082892	2.52	0.012	.0274399
ptsdww1	.1120284	.0165986	6.75	0.000	.2328543
anxww1	.2241998	.0271764	8.25	0.000	.4512509
injselfr	.913	.3253423	2.81	0.005	.0242708
fdferw1	.051668	.0087445	5.91	0.000	.1070492
whpel	.0023176	.0014355	1.61	0.106	.0037045
cumdose2	.3047125	.0999021	3.05	0.002	.0405532
cataw1	8.17719	1.334156	6.13	0.000	.1876554
depww1	.0335656	.00911	3.68	0.000	.057425
anxww2	.1780012	.0157602	11.29	0.000	.1751284
anxww3	.0971265	.067635	1.44	0.151	.0971265
cumdose1	.2685742	.136707	1.96	0.049	.0238233

9.2.3 Major indirect effects on male PTSD

If we sort the standardized indirect effects according to the magnitude of the path coefficients, we can find out which indirect effects have the largest impact, assuming that they are statistically significant. The largest indirect impact is that of self-reported anxiety in 1986, fear of consuming contaminated food the same year, and the experience of a catastrophe in the same year. Following that the next largest indirect effect constitutes self-reported PTSD symptoms. Next com a series of wave 2 impacts–including self-reported anxiety, self-reported depression, and perceived risk in wave 2. These impacts constitute the top seven ranking impacts. As for the rankings of the BSI measures of anxiety and depression on PTSD, they are in the bottom tier in terms of magnitude of indirect impacts on PTSD.

9.3 Total effects addenda on male PTSD

It is noteworthy that if we take the total effects and sort them by their absolute value from largest to smallest, and eliminate those that are not wave specific, those with the largest five total effects originate in wave 1. The set with the next largest impact originates in wave 2. The last group are somewhat of mixed origin. This is more or less typical of what we would expect in the event of a traumatic crisis.

To fully test the effects of hypothesis 3,4,5, 6, and 8 we should turn to Table 5 to see the total effects on PTSD. When we turn to the MiPTSD panel of Table 5, we find the total effects upon Chornobyl PTSD as measured by the revised Mississippi civilian PTSD scale. Because total effects are mathematically the sum of the direct and indirect effects, they are sometimes a little different from a simple sum and we should take a moment to consider whether the whole is really equal to the sum of its parts, or whether there are synergistic or conflicting effects that alter that equation when it is converted to psychological symptoms. Such moderations are not taken into consideration in a study of direct and mediated effects alone, for which structural equation modeling was originally designed.

9.3.1 The statistical and the psychological calculus of total effects

To statistically compute total effects, we add the direct to the sum of the products of coefficients within each path. In statistical path analysis, the total effects are defined as the sum of the direct and indirect effects, where an indirect effect is the sum of the indirect effects for all of the alternative paths by which an effect can travel from its source to its destination. For each of the alternative paths the indirect effect is the product of the standardized coefficients for each of the linked paths. However, in psychological calculus of total effects, the total may equal more than sum of its parts. This can occur if there is a synergy between two or more parts which reinforces and enhances them in connection with one another. There may, however, be a different sort of effect that weakens them when they are conjoined. This can occur with a partial or complete neutralization of the individual effects when two opposing units are combined. Although this results might be similar to a reinforcing or suppressing interaction effect, it may be an additive rather than a multiplicative one. Perhaps another example might be one where there was a trauma fixating the person on an event. If another observed the disaster, he or she might not be traumatized and might not respond the same way. However, the fixation of the event and the abreactions that follow may not be amenable to elementary arithmetic processing. Responses may effects taken to a power or some exponential rather than linear ones. Instead of being linear and additive, and easily amenable to linear structural equation analysis, they may nonlinear or multiplicative, or even intrinsically nonlinear.

9.3.2 Hypothesis 3 addendudm: Total effects of cumulative external dose on male PTSD

According to the results in the MiPTSD panel of Table 6, the total effect of cumulative external dose in milliGrays on average PTSD from 1986 is not statistically significant by our robust estimates ($cumdose1\ standardized\ \beta = -0.013,\ p = 0.792$). However, after a decade following Chornobyl, the reconstructed cumulative dose effect on PTSD is found to be statistically significant according to our robust estimates ($cumdose2\ standardized\ \beta = 0.049, z = 3.05, p = 0.002$.) There is no path from cumulative external dose on male MiTPSD so we can only say that during wave 2 is there any evidence to support a significant total effect. This significant effect is positive so the relationship is a direct rather than an inverse one, although it is the sum of the direct and indirect effects by definition. We can say that there is partial confirmation of Hypothesis 3 by our male data in wave 2.

9.3.3 Hypothesis 4 addendum: Total effects of cumulative dose on male mental health measured by BSI

We examine Table 6 and find the BSI anxiety panel on page 47 and the BSI depression panel on page 54. We examine the anxiety panel on page 47 first. We find significant total effects in wave 1 and wave 2 on male BSI anxiety from cumulative external dose in waves 1 ($cumdose1\ stdized\ \beta = 0.047,\ p = 0.005)\ and 2 (cumdose2\ stdized\ \beta = 0.068, p = 0.002$). For the total effects impacting BSI depression, we find confirmation of significant wave 1 and wave 2 total effects. For wave 1, the cumdose1 total effect $stdized\ \beta = .032,\ p = .0.008)\ and\ the\ cumdose2\ total\ effect\ (stdized\ \beta = 0.047,\ p = 0.002$). Consequently, we note that we do have partial confirmation of hypothesis 4 with our male total effects data.

9.3.4 Hypothesis 5 addendum: Total effects of perceived risk on BSI measures of mental health

When we turn to the BSIanx panel of Table 6, we find partial evidence to support Hypothesis 5 in the total effects of perceived Chornobyl related health risk (crhrw2 stdized $\beta = 0.423,\ p = 0.001$) and ($crhrw3\ stdized\ \beta = 0.062\ , p = 0.001$)., although wave 1 effects are not statistically significant ($crhrw1\ stdized\ \beta = 0.067, p = .586$). When we turn to the BSIdep panel within the same table, we find similar results with no statistically significant wave 1 total effect, but statistically significant total effects for perceived risk originating with the other waves: ($crhrw2\ stdized\ \beta\ = .267,\ p = 0.000$) and ($crhrw3\ stdized\ \beta = .037,\ p = 0.001$).

9.3.5 Hypothesis 6 addendum: Total effects of perceived risk summary score on male Chornobyl PTSD

When we examine the total effects of perceived risk of exposure on Chornobyl PTSD, we also examine Table 6, but we have to turn to the MiPTSD panel. We find no statistically significant total effect originating in wave 1 ($crhrw1\ stdized\ \beta = 0.058,\ p = .127$). However, we do find significant total effects originating with perceived risk in waves 2 ($crhrw2\ stdized\ \beta = 0.182,\ p = 0.000$) and 3 ($crhrw3\ \beta = .040,\ p = 0.001$). We therefore find partial confirmation of hypothesis 5 in our male data. In general we tend to find more confirmation of the perceived risk effects rather than the external cumulative dose effects.

9.3.6 Hypothesis 8 addendum: Total effects of risk of exposure on Nottingham health measures

The perceived risk total effects on Nottingham sleep exhibits significant total effects at all three waves. ($crhrw1\ stdized\ \beta = 0.117,\ p = .000$), ($crhrw2\ stdized\ \beta = 0.248,\ p = .000$) and ($crhrw3\ stdized\ \beta = 0.189,\ p = .001$). As for Nottingham energy level, we find significant total effects originating from perceived risk in waves 2 and 3, but not when they originate from wave 1. In wave 2 ($crhrw2\ stdized\ \beta = 0.262,\ p = .001$) and ($crhrw3\ stdized\ \beta = 0.039,\ p = .001$).

9.3.7 Cyclical dynamics and implications for persistence

As mentioned before there are two prominent feedback loops found in this model. When models are nonrecursive, they contained such loops. The loops have implications for persistence of effects. We have to make some assumptions for our models to hold and one assumption is that the models are stable. If this is so, the stability index will be less than one.

This means that the modulus will be less than unity. If the modulus is less than unity, it means that in an eigenvalue-eigenvector decomposition of the dynamics the absolute value of the largest eigenvalue will not exceed unity, so the product of a unit impulse will not exceed one and become explosive or chaotic. In other words, the cyclical dynamic will converge over time.

If we graph the magnitude of the impulse as it iterates toward convergence, we should observe an exponential decay if the product of the impulses of the two inputs to the feedback are positive. If their product is negative, we could witness an undulation of sign amidst an exponential decline in absolute value. In either case, the time lapse before complete convergence of this process represents a delay in the diminution of effect and a potentiation of persistence for the time being.

For simulation of the cyclical response decay, we use the following impact formula:

$$(I - (b_{1t}b_{2t})L - (b_{1t}b_{2t})^2L^2 + (b_{1t}b_{2t})^3L^3 + \cdots) \tag{1}$$

if we use wave 0 as the starting point. If we use wave 0 as the starting point, we can imagine a unit impulse on each of the variables in the feedback loop revealing a 1 at time point 0, in which case we do not subtract the I. For emphasis of the simulation, we use time point 0 as the point of graphical origin.

When these feedback loops have paths that lead to MiPTSD, as both of them do, each may contribute to a persistence of the impact. If we re-examine the path diagram in Figure 1, we observe two such feedback loops. The first of these loops inheres in the reciprocal relationship between depww2 and ptsdww2 within wave 2. However, there is a path extending from ptsdww2 to MiPTSD.

The second feedback loop takes place in a more current setting–in a reciprocal relationship between BSIanx and WHPel. In both loops, we observe arrows extending from one of the variables to the other in the loop. We then observe an orange arrow extending from BSI anxiety to MiPtSD. In sum, both of these sources of protracted effect impact MiPTSD.

For illustration, we can simulate both of these sources of persistence. We simply assume a unit impulse in both of the effects at first. Let us consider the first depression-PTSD cycle in wave 2. We make a working assumption that the reciprocal relationship is the product of the total effects of one variable upon the other, partialling out all other effects. In a cyclical analysis, we examine the cyclical decay of the response of a unit impulse over time So Figure 2 represents the decay of an single impulse. Because one of the paths has a negative sign, there is a slight undulation in the diminution over time.

The second feedback loop, display in Figure 3, between anxiety and energy level exhibits similar feedback and even more undulation. Both wave 2 self-reported depression and PTSD and more current anxiety-energy level feedback loops serve to regulate the emotions reported by the male respondents, while permitting an exponential decline in the magnitude of the effect.

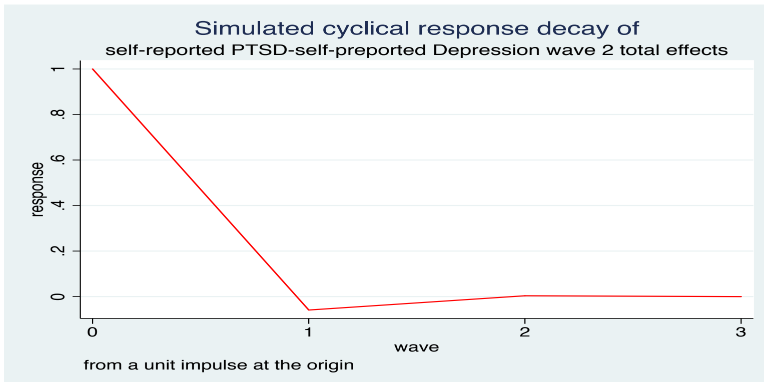

Figure 2: Cyclical decay Depressive-PTSD wave 2 feedback

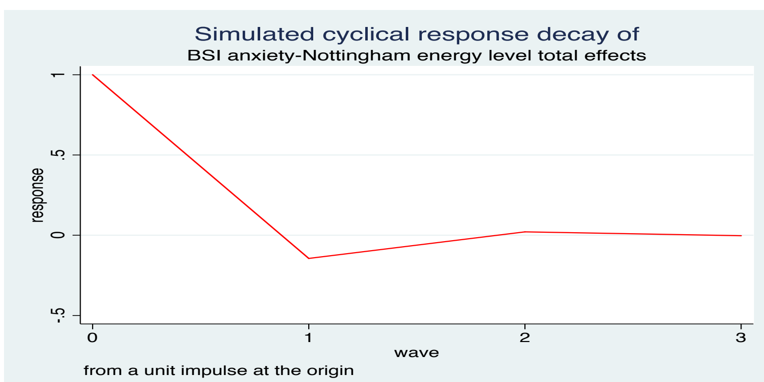

Figure 3: Decay rate of total effects in BSI anxiety and Nottinham energy level feedback

Table 6: Clustered-robust standardized Total effects among males

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Structural					
crhrw1 <-					
crhrw1	.0039986	.00065	6.15	0.000	.0039986
crhrw2	.0086451	.0006171	14.01	0.000	.0084678
crhrw3	.006607	.0019986	3.31	0.001	.0064527
BSIanx	.0010013	.0001825	5.49	0.000	.0029794
depww3	.0001772	.0000312	5.68	0.000	.003361
depww2	.0001664	.0000298	5.58	0.000	.003046
whpsleep	.0013466	.0005333	2.52	0.012	.0358098
ptsdww1	.0072078	.0013541	5.32	0.000	.303881
anxww1	.0046736	.0007558	6.18	0.000	.1907989
injselfr	.5847711	.0999096	5.85	0.000	.3153132
fdferw1	.0070594	.001476	4.78	0.000	.2966683
whpel	.0001491	.0000924	1.61	0.106	.0048344
cataw1	.5439699	.0536355	10.14	0.000	.2532061
anxww2	.0002775	.000025	11.09	0.000	.0055372
anxww3	.0002642	.0001148	2.30	0.021	.0053582
cumdose1	.016357	.0040042	4.08	0.000	.0294296
crhrw2 <-					
crhrw1	.7196373	.0383804	18.75	0.000	.7346998
crhrw2	-.0311756	.0100577	-3.10	0.002	-.0311756
crhrw3	.0058973	.0017839	3.31	0.001	.0058801
ptsdww2	-.0022657	.0017924	-1.26	0.206	-.0312088
depww2	.0114744	.0017186	6.68	0.000	.2143822
whpsleep	.0012019	.000476	2.52	0.012	.0326322
ptsdww1	.0064336	.0010632	6.05	0.000	.2769161
anxww1	.0071966	.0007989	9.01	0.000	.2999507
injselfr	.6489616	.0987088	6.57	0.000	.3572494
fdferw1	.006886	.0011021	6.25	0.000	.2954398
whpel	.0001331	.0000824	1.61	0.106	.0044054
cumdose2	.020854	.0068371	3.05	0.002	.0574729
cataw1	.4240958	.0810167	5.23	0.000	.2015392
depww1	.0022967	.0006234	3.68	0.000	.0813685
anxww2	.0083309	.0012074	6.90	0.000	.1697316
anxww3	.0002358	.0001024	2.30	0.021	.0048828
cumdose1	.0144475	.0085224	1.70	0.090	.026538

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Table 5 Total standardized effects among males - continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
crhrw3 <-					
crhrw1	.6272996	.0454238	13.81	0.000	.6423006
crhrw2	.9880545	.0336867	29.33	0.000	.9909414
crhrw3	.0049675	.0015027	3.31	0.001	.0049675
BSIanx	.0007529	.0001372	5.49	0.000	.0022937
depww3	.0001332	.0000235	5.68	0.000	.0025874
ptsdww2	-.0023109	.0018266	-1.27	0.206	-.0319236
depww2	.0116919	.0017522	6.67	0.000	.2190845
whpsleep	.0010124	.000401	2.52	0.012	.0275678
ptsdww1	.0054193	.0012806	4.23	0.000	.2339398
anxww1	.0093395	.0012781	7.31	0.000	.3904029
injselfr	.6571543	.0978836	6.71	0.000	.3628165
fdferw1	.0061584	.0009668	6.37	0.000	.2649952
whpel	.0001121	.0000694	1.61	0.106	.0037217
cumdose2	.0212493	.0069667	3.05	0.002	.0587336
cataw1	.3817176	.0847673	4.50	0.000	.1819302
depww1	.0023399	.0006352	3.68	0.000	.0831391
anxww2	.0084638	.0012324	6.87	0.000	.1729434
anxww3	.0001986	.0000863	2.30	0.021	.004125
cumdose1	.0130935	.0085312	1.53	0.125	.0241211
ptsdww3 <-					
crhrw1	1.685493	.5567569	3.03	0.002	.132427
crhrw2	3.076713	.5538963	5.55	0.000	.2367774
crhrw3	.2263129	.068459	3.31	0.001	.0173658
fdferw2	.0007622	.000212	3.59	0.000	.0018112
BSIanx	.0342994	.0062508	5.49	0.000	.0080184
depww3	.2381028	.0816227	2.92	0.004	.3548854
ptsdww2	.6872174	.0803886	8.55	0.000	.7284721
depww2	.1843746	.0938757	1.96	0.050	.2651015
whpsleep	.0461247	.0176672	2.61	0.009	.0963737
ptsdww1	.0943682	.016401	5.75	0.000	.312589
anxww1	.0766622	.0087764	8.74	0.000	.2458986
injselfr	2.275621	.3749315	6.07	0.000	.0964064
fdferw1	.0637675	.0081912	7.78	0.000	.2105492
whpel	.0051078	.0031636	1.61	0.106	.0130107
cumdose2	.3350888	.1098612	3.05	0.002	.0710701
cataw1	6.358303	.7152089	8.89	0.000	.2325359
depww1	.0369554	.010021	3.69	0.000	.1007572
anxww2	.1800588	.0791801	2.27	0.023	.2823187
anxww3	.262827	.0924623	2.84	0.004	.4188532
cumdose1	.2548308	.1381239	1.84	0.065	.0360231

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Table 5 Total standardized effects among males--continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
fdferw2 <-					
crhrw1	3.160255	1.151167	2.75	0.006	.1044881
crhrw2	.9268842	.3833708	2.42	0.016	.0300175
crhrw3	.1977894	.0598307	3.31	0.001	.0063868
BSIanx	.0299764	.005463	5.49	0.000	.002949
depww3	.0053038	.0009338	5.68	0.000	.0033267
ptsdww2	.5831096	.1164628	5.01	0.000	.2601144
depww2	.209672	.0607963	3.45	0.001	.1268665
whpsleep	.0403113	.0159658	2.52	0.012	.0354444
ptsdww1	.2157775	.058743	3.67	0.000	.3007804
anxww1	.1313155	.0766154	1.71	0.087	.1772499
injselfr	6.983559	1.925095	3.63	0.000	.1245025
fdferw1	.4716164	.0542672	8.69	0.000	.6552969
whpel	.004464	.0027649	1.61	0.106	.0047851
cumdose2	.3810652	.1249349	3.05	0.002	.0340112
cataw1	24.92452	2.756466	9.04	0.000	.3835933
depww1	.1564009	.073572	2.13	0.034	.1794458
anxww2	.1543922	.0218896	7.05	0.000	.10187
anxww3	.0079082	.0034356	2.30	0.021	.0053035
cumdose1	.7482852	.2451216	3.05	0.002	.0445135
BSIanx <-					
crhrw1	.1993769	.3657668	0.55	0.586	.0670071
crhrw2	1.284877	.3863676	3.33	0.001	.4229714
crhrw3	.18859	.0570479	3.31	0.001	.0619015
fdferw2	.0183382	.0051016	3.59	0.000	.1864051
BSIanx	-.1747678	.0318501	-5.49	0.000	-.1747678
depww3	.0432019	.0126647	3.41	0.001	.2754373
ptsdww2	.0032101	.0060694	0.53	0.597	.0145555
depww2	.0414971	.0063346	6.55	0.000	.2552264
whpsleep	.0384364	.0112884	3.40	0.001	.3435297
ptsdww1	.0064945	.0019112	3.40	0.001	.0920214
anxww1	.0117723	.0022539	5.22	0.000	.1615226
injselfr	.3362003	.1421123	2.37	0.018	.0609257
fdferw1	.0190509	.0021838	8.72	0.000	.2690704
whpel	-.0260259	.0145181	-1.79	0.073	-.2835781
cumdose2	.0754183	.0247264	3.05	0.002	.0684227
cataw1	.8505182	.1472452	5.78	0.000	.1330542
depww1	.0103958	.0027202	3.82	0.000	.1212415
anxww2	.0216862	.0052252	4.15	0.000	.145447
anxww3	-.0132018	.0139218	-0.95	0.343	-.0899954
cumdose1	.0783243	.0279312	2.80	0.005	.0473611

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Table 5 Total standardized effects among males-continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
depww3 <-					
crhrw1	-2.524533	1.823937	-1.38	0.166	-.1330782
crhrw2	6.509918	1.981364	3.29	0.001	.3361284
crhrw3	.0365003	.0110412	3.31	0.001	.0018791
depww3	.0939995	.0226924	4.14	0.000	.0939995
ptsdww2	-.1182772	.0931602	-1.27	0.204	-.0841194
depww2	.5961176	.1162046	5.13	0.000	.5750685
whpsleep	.0074391	.0029463	2.52	0.012	.0104285
ptsdww1	.0398199	.0228431	1.74	0.081	.0884961
anxww1	.1754403	.0247017	7.10	0.000	.3775552
injselfr	.9832649	.5994658	1.64	0.101	.0279481
fdferw1	.0755332	.0171051	4.42	0.000	.1673279
whpel	.0008238	.0005102	1.61	0.106	.0014079
cumdose2	1.083405	.3552018	3.05	0.002	.154168
cataw1	5.724116	1.201329	4.76	0.000	.1404539
depww1	.1192157	.0323824	3.68	0.000	.2180764
anxww2	.5518212	.056219	9.82	0.000	.5804973
anxww3	.2103843	.1510012	1.39	0.164	.2249477
cumdose1	.2417886	.3939774	0.61	0.539	.022932
ptsdww2 <-					
crhrw1	.8587135	.0476045	18.04	0.000	.0636472
crhrw2	1.202942	.6141333	1.96	0.050	.0873332
crhrw3	.1015311	.0307128	3.31	0.001	.0073496
BSIanx	.0153878	.0028043	5.49	0.000	.0033936
depww3	.0027226	.0004793	5.68	0.000	.0038282
ptsdww2	-.0653878	.0516249	-1.27	0.205	-.0653878
depww2	.3304162	.0974787	3.39	0.001	.4481812
whpsleep	.020693	.0081957	2.52	0.012	.0407877
ptsdww1	.1107649	.0224962	4.92	0.000	.3461236
anxww1	.0939971	.0126864	7.41	0.000	.2844265
injselfr	1.592997	.3460567	4.60	0.000	.0636652
fdferw1	.0799331	.0113821	7.02	0.000	.2489785
whpel	.0022915	.0014193	1.61	0.106	.0055065
cumdose2	.6005099	.1968813	3.05	0.002	.1201513
cataw1	8.160969	.8766004	9.31	0.000	.2815605
depww1	.0661102	.0179509	3.68	0.000	.1700391
anxww2	.2382549	.0349034	6.83	0.000	.3524102
anxww3	.0040595	.0017636	2.30	0.021	.0061031
cumdose1	.2893085	.2377172	1.22	0.224	.0385808

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Table 5 Total standardized effects among males--continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
depww2 <-					
crhrw1	-2.287268	.1215208	-18.82	0.000	-.1249843
crhrw2	-3.055427	.7884756	-3.88	0.000	-.1635362
crhrw3	.0293207	.0088694	3.31	0.001	.0015648
BSIanx	.0044438	.0008098	5.49	0.000	.0007225
depww3	.0007862	.0001384	5.68	0.000	.000815
ptsdww2	-.1789613	.1409185	-1.27	0.204	-.131937
depww2	-.0983089	.018801	-5.23	0.000	-.0983089
whpsleep	.0059758	.0023668	2.52	0.012	.0086838
ptsdww1	.0319872	.0321473	1.00	0.320	.0736908
anxww1	.2047368	.0331259	6.18	0.000	.4567297
injselfr	-.5745953	.5288702	-1.09	0.277	-.01693
fdferw1	.1129492	.0251617	4.49	0.000	.2593737
whpel	.0006618	.0004099	1.61	0.106	.0011723
cumdose2	1.638765	.5372804	3.05	0.002	.2417311
cataw1	8.57216	1.451326	5.91	0.000	.2180359
depww1	.1803165	.0489811	3.68	0.000	.3419188
anxww2	.6442368	.0957461	6.73	0.000	.7025216
anxww3	.0011723	.0005093	2.30	0.021	.0012994
cumdose1	.3565501	.601141	0.59	0.553	.0350541
whpsleep <-					
crhrw1	3.116858	.5066281	6.15	0.000	.1172036
crhrw2	6.738654	.4810148	14.01	0.000	.2481995
crhrw3	5.150005	1.557861	3.31	0.001	.1891334
fdferw2	.0173446	.0048252	3.59	0.000	.0197263
BSIanx	.7805213	.1422441	5.49	0.000	.0873299
depww3	.1381003	.024313	5.68	0.000	.0985128
ptsdww2	-.0149298	.0196229	-0.76	0.447	-.0075744
depww2	.1297386	.0232355	5.58	0.000	.0892801
whpsleep	.0496185	.0121593	4.08	0.000	.0496185
ptsdww1	.0796119	.012131	6.56	0.000	.1262119
anxww1	.143925	.0179624	8.01	0.000	.2209455
injselfr	6.448635	1.020859	6.32	0.000	.1307519
fdferw1	.1783957	.0425018	4.20	0.000	.2819114
whpel	.1162328	.0719913	1.61	0.106	.1417014
cumdose2	.2357914	.0773059	3.05	0.002	.0239348
cataw1	9.205323	1.259585	7.31	0.000	.1611248
depww1	.0279272	.0072786	3.84	0.000	.0364418
anxww2	.2162829	.0195041	11.09	0.000	.1623013
anxww3	.205913	.0894564	2.30	0.021	.1570544
cumdose1	1.630627	.3287832	4.96	0.000	.1103209

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Table 5 Total standardized effects among males--continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
ptsdww1 <-					
crhrw1	.591687	.0961755	6.15	0.000	.0140344
crhrw2	1.279229	.0913132	14.01	0.000	.0297203
crhrw3	.9776482	.2957356	3.31	0.001	.0226475
fdferw2	.0032926	.000916	3.59	0.000	.0023621
BSIanx	.1481698	.0270028	5.49	0.000	.0104572
depww3	.0262162	.0046154	5.68	0.000	.0117963
ptsdww2	-.0028342	.0037251	-0.76	0.447	-.000907
depww2	.0246288	.0044109	5.58	0.000	.0106907
whpsleep	.1992537	.0789169	2.52	0.012	.1256851
ptsdww1	.0665608	.0083717	7.95	0.000	.0665608
anxww1	.1160132	.0275504	4.21	0.000	.1123399
injselfr	4.485302	1.353654	3.31	0.001	.0573653
fdferw1	.3331752	.0706293	4.72	0.000	.3321073
whpel	.022065	.0136664	1.61	0.106	.0169678
cumdose2	.0447613	.0146753	3.05	0.002	.002866
cataw1	53.98496	5.639715	9.57	0.000	.5960375
depww1	.0053015	.0013817	3.84	0.000	.0043637
anxww2	.0410579	.0037025	11.09	0.000	.0194346
anxww3	.0390894	.0169819	2.30	0.021	.0188063
cumdose1	1.709827	.3426556	4.99	0.000	.0729681
anxww1 <-					
crhrw1	.3432234	.0557891	6.15	0.000	.0084072
crhrw2	.7420497	.0529686	14.01	0.000	.0178038
crhrw3	.5671102	.1715491	3.31	0.001	.0135669
BSIanx	.0859497	.0156637	5.49	0.000	.0062643
depww3	.0152074	.0026773	5.68	0.000	.0070665
depww2	.0142866	.0025587	5.58	0.000	.0064042
whpsleep	.1155823	.0457778	2.52	0.012	.0752908
ptsdww1	.6186862	.0762856	8.11	0.000	.6389162
anxww1	.0672965	.0159813	4.21	0.000	.0672965
injselfr	2.601816	.7852219	3.31	0.001	.0343643
fdferw1	.1932669	.0409703	4.72	0.000	.1989467
whpel	.0127994	.0079276	1.61	0.106	.0101645
cataw1	41.60148	6.396103	6.50	0.000	.4743326
anxww2	.0238167	.0021478	11.09	0.000	.0116421
anxww3	.0226748	.0098508	2.30	0.021	.0112658
cumdose1	1.267559	.2751129	4.61	0.000	.0558628

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Table 5 Total standardized effects among males--continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
MiPTSD <-					
crhrw1	.7474093	.489867	1.53	0.127	.0583675
crhrw2	2.380813	.4999053	4.76	0.000	.1821133
crhrw3	.5266522	.1593107	3.31	0.001	.0401673
ptsdww3	.0144454	.0059095	2.44	0.015	.014358
fdferw2	.1187235	.022964	5.17	0.000	.280417
BSIanx	.9947797	.2454783	4.05	0.000	.2311499
depww3	.102776	.017698	5.81	0.000	.1522574
ptsdww2	.1712848	.0565937	3.03	0.002	.1804682
depww2	.1287108	.0195378	6.59	0.000	.1839456
whpsleep	.1073366	.0277684	3.87	0.000	.2229134
ptsdww1	.0894304	.012741	7.02	0.000	.2944396
anxww1	.1224487	.0149811	8.17	0.000	.3903838
injselfr	6.658473	.9516831	7.00	0.000	.2803777
fdferw1	.1139829	.0105995	10.75	0.000	.3740733
whpel	-.0163513	.0207612	-0.79	0.431	-.0413987
cumdose2	.2339235	.0766935	3.05	0.002	.0493133
cataw1	8.742087	1.06122	8.24	0.000	.3177803
depww1	.1054981	.0219969	4.80	0.000	.2858951
BSIdep	.4610688	.2328681	1.98	0.048	.1111292
anxww2	.1467996	.0123129	11.92	0.000	.2287774
anxww3	.0940918	.0484111	1.94	0.052	.1490414
cumdose1	-.0926048	.3511796	-0.26	0.792	-.013011
injselfr <-					
crhrw3	.0027842	.0008422	3.31	0.001	.0050429
whpsleep	.0005674	.0002247	2.52	0.012	.0279864
ptsdww1	.0030374	.0003745	8.11	0.000	.2374916
anxww1	.0052399	.0006306	8.31	0.000	.3967249
injselfr	.0127736	.003855	3.31	0.001	.0127736
fdferw1	.0009488	.0002011	4.72	0.000	.0739505
whpel	.0000628	.0000389	1.61	0.106	.0037782
cataw1	.2042417	.0314015	6.50	0.000	.1763142
anxww3	.0001113	.0000484	2.30	0.021	.0041876
cumdose1	.0062231	.0015914	3.91	0.000	.0207648
fdferw1 <-					
crhrw3	.168046	.0508334	3.31	0.001	.0039054
whpsleep	.0342493	.0135649	2.52	0.012	.0216732
ptsdww1	.1833289	.0226049	8.11	0.000	.1839184
anxww1	.316261	.0871236	3.63	0.000	.307232
injselfr	11.66648	4.241641	2.75	0.006	.1496896
fdferw1	.0572688	.0121403	4.72	0.000	.0572688
whpel	.0037927	.0023491	1.61	0.106	.0029259
cataw1	41.26583	5.548053	7.44	0.000	.457073
anxww3	.006719	.002919	2.30	0.021	.003243
cumdose1	1.151328	.2723676	4.23	0.000	.0492917

Continued on the next page...

Table 5 Total standardized effects among males--continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
whpel <-					
crhrw1	1.355828	2.458451	0.55	0.581	.0418199
crhrw2	8.66486	2.596751	3.34	0.001	.2617843
crhrw3	1.294468	.3915727	3.31	0.001	.0389948
fdferw2	.1232384	.0342843	3.59	0.000	.1149687
BSIanx	5.545816	1.010683	5.49	0.000	.5089768
depww3	.2908599	.0850865	3.42	0.001	.1701909
ptsdww2	.0214747	.0408607	0.53	0.599	.0089367
depww2	.2793665	.0425708	6.56	0.000	.1576937
whpsleep	.2638245	.0759796	3.47	0.001	.2164061
ptsdww1	.0742197	.0149851	4.95	0.000	.0965152
anxww1	.1318553	.0181447	7.27	0.000	.1660355
injselfr	12.46337	2.766079	4.51	0.000	.207286
fdferw1	.1374913	.0153267	8.97	0.000	.1782207
whpel	-.1741346	.0977597	-1.78	0.075	-.1741346
cumdose2	.5077305	.166463	3.05	0.002	.0422755
cataw1	7.769508	1.175369	6.61	0.000	.1115504
depww1	.0699613	.0183042	3.82	0.000	.0748834
anxww2	.1468044	.0350811	4.18	0.000	.0903635
anxww3	-.0875302	.0937941	-0.93	0.351	-.0547619
cumdose1	.5886697	.21927	2.68	0.007	.0326685
cumdose2 <-					
cumdose1	1.339597	.2873117	4.66	0.000	.8928449
cumdose3 <-					
cumdose2	1.087217	.0775735	14.02	0.000	1.019854
cumdose1	1.412499	.3182587	4.44	0.000	.8831041
cataw1 <-					
cumdose1	.026806	.0063253	4.24	0.000	.1036125
depww1 <-					
crhrw3	.2739163	.0828589	3.31	0.001	.0077091
whpsleep	.0558267	.0221108	2.52	0.012	.0427827
ptsdww1	.2988277	.0368462	8.11	0.000	.3630531
anxww1	.5155081	.0701918	7.34	0.000	.6064728
injselfr	3.461758	1.18969	2.91	0.004	.0537903
fdferw1	.2957322	.0540333	5.47	0.000	.3581407
whpel	.0061821	.003829	1.61	0.106	.0057758
cataw1	34.22513	5.612799	6.10	0.000	.4590872
anxww3	.010952	.004758	2.30	0.021	.0064016
cumdose1	.9910439	.2395578	4.14	0.000	.0513834

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Table 5 Total standardized effects among males--continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
BSIdep <-					
crhrw1	.1687895	.2158677	0.78	0.434	.0546885
crhrw2	.8428077	.2272037	3.71	0.000	.2674745
crhrw3	.1169682	.0353825	3.31	0.001	.037013
ptsdww3	.0313303	.012817	2.44	0.015	.1292007
fdferw2	.0106709	.0029686	3.59	0.000	.1045694
BSIanx	.4801961	.1048438	4.58	0.000	.4629382
depww3	.0325499	.008423	3.86	0.000	.2000665
ptsdww2	.023393	.0051353	4.56	0.000	.1022601
depww2	.0298763	.0047461	6.29	0.000	.1771491
whpsleep	.0238392	.0066027	3.61	0.000	.2054082
ptsdww1	.007161	.0014019	5.11	0.000	.0978192
anxww1	.0099851	.0015657	6.38	0.000	.1320769
injselfr	.4112717	.081291	5.06	0.000	.0718514
fdferw1	.0131929	.0014566	9.06	0.000	.1796365
whpel	-.0007507	.0117731	-0.06	0.949	-.0078861
cumdose2	.0542983	.0178021	3.05	0.002	.0474913
cataw1	.7221498	.1069494	6.75	0.000	.1089123
depww1	.0071949	.001862	3.86	0.000	.0808954
anxww2	.0182472	.0042399	4.30	0.000	.1179838
anxww3	.0005865	.0090887	0.06	0.949	.0038545
cumdose1	.0543423	.0204311	2.66	0.008	.0316787
anxww2 <-					
crhrw3	.1493128	.0451667	3.31	0.001	.0073073
whpsleep	.0304313	.0120527	2.52	0.012	.0405528
ptsdww1	.1628921	.020085	8.11	0.000	.34413
anxww1	.2810053	.035404	7.94	0.000	.5748622
injselfr	.6850244	.2067387	3.31	0.001	.0185091
fdferw1	.0508847	.010787	4.72	0.000	.1071557
whpel	.0033699	.0020872	1.61	0.106	.0054747
cataw1	10.95313	1.684011	6.50	0.000	.2554828
anxww3	.00597	.0025936	2.30	0.021	.0060679
cumdose1	.3337319	.0838318	3.98	0.000	.0300885

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Table 5 Total standardized effects among males--continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
anxww3 <-					
crhrw1	-.8160364	.8183238	-1.00	0.319	-.0402316
crhrw2	3.354694	.8724393	3.85	0.000	.1619997
crhrw3	.1026893	.0310632	3.31	0.001	.0049445
depww3	.4894047	.118353	4.14	0.000	.45772
ptsdww2	-.0330717	.0261882	-1.26	0.207	-.021998
depww2	.1676607	.0995959	1.68	0.092	.1512693
whpsleep	.020929	.0082892	2.52	0.012	.0274399
ptsdww1	.1120284	.0165986	6.75	0.000	.2328543
anxww1	.2241998	.0271764	8.25	0.000	.4512509
injselfr	.913	.3253423	2.81	0.005	.0242708
fdferw1	.051668	.0087445	5.91	0.000	.1070492
whpel	.0023176	.0014355	1.61	0.106	.0037045
cumdose2	.3047125	.0999021	3.05	0.002	.0405532
cataw1	8.17719	1.334156	6.13	0.000	.1876554
depww1	.0335656	.00911	3.68	0.000	.057425
anxww2	.7786876	.1091155	7.14	0.000	.76612
anxww3	.0971265	.067635	1.44	0.151	.0971265
cumdose1	.2685742	.136707	1.96	0.049	.0238233

10 Female PTSD path model

In Figure 4, we present the path diagram for the female Chornobyl PTSD model. This diagram shows the statistically significant paths that extend to PTSD among the females in our sample. To facilitate explanation the paths have been color-coded. Boxes represent variables and arrows represent paths. The blue boxes with black borders in the middle are self-reported depression, whereas the blue boxes along the bottom are cumulative external dose variables. The latter have red arrows projecting from them, whereas the former have blue arrows heading out of them. Anxiety variables are orange. Perceived risk of exposure area yellow boxes with purple arrows, whereas PTSD are light-kaki or sand-colored boxes. Catastrophic experience is white with an olive border, whereas vodka consumption is white with a blue border. Fear of consuming contaminated food is colored red with forest green arrows emanating from them. Two BSI measures of psychological health are included-namely, BSIanx, colored orange, and BSI depression, stone. The Nottingham weighted health profile measures of physical health behavior include sleep and energy level, are colored lime and cyan, respectively. The path coefficients, which define this model, are contained in Table 7. The clustered-robust versions for robust direct, indirect, and total effects, are respectively contained in Tables 8, 9, and 10.

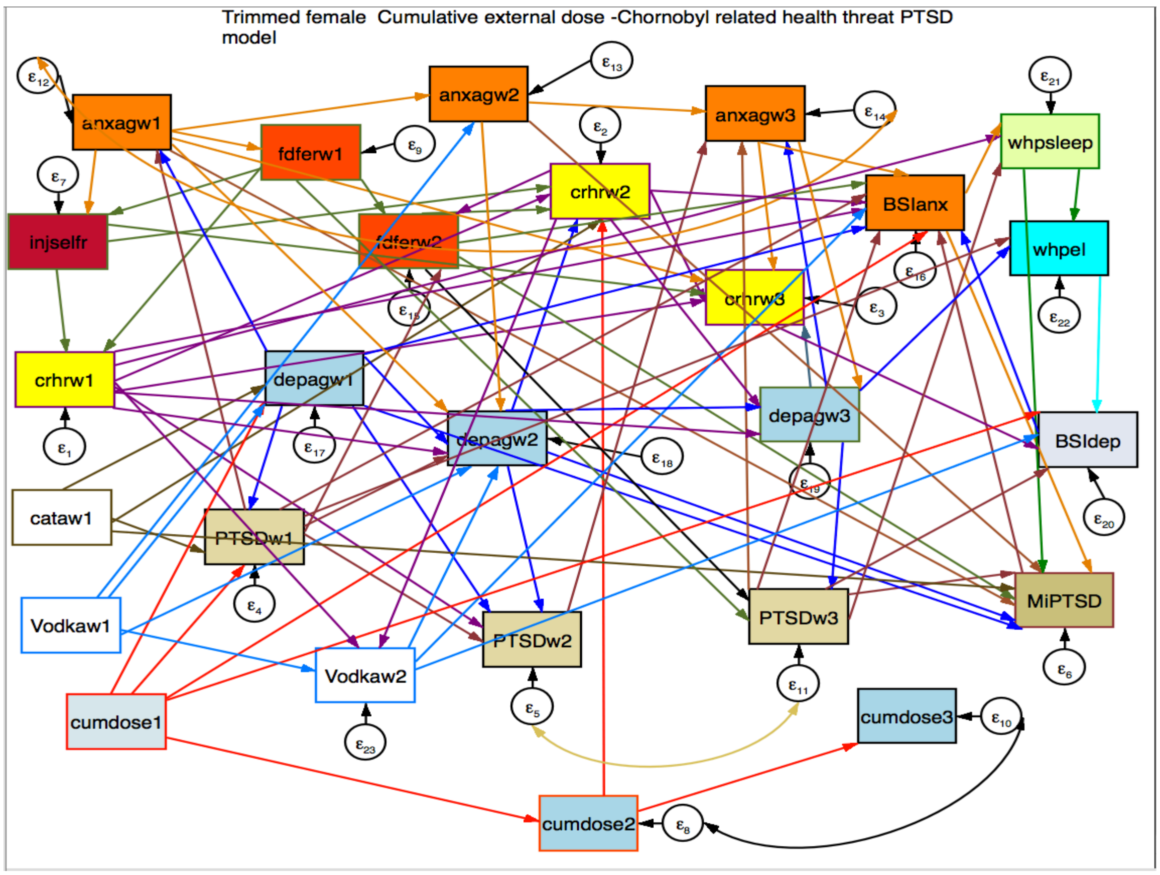

Figure 4: Pathways to PTSD among females residents of Kiev and Zhitomyr Oblasts

10.1 New variables

As the reader may have noticed, there are a few extra variables in the female model–including, Vodkaw1 and Vodkaw2, which are the average number of vodka drinks per week during wave 1 and wave 2. These variables have implications for hypotheses 12 and 20, both of which pertain to substance abuse.

10.2 Model goodness of fit

To help the reader interpret the path coefficients, Table 8 lists the parameter estimates from which the path diagram was developed. The non-robust version of the model is consistent with the data LR test of model vs. saturated: $\chi^2(231) = 253.13$, $Prob > \chi^2 = 0.1517$.

10.3 Model stability and cyclical dynamics

Inspection of the path diagram in Figure 4 reveals the presence of feedback cycles indicating that the model is nonrecursive. A check of the the stability index assures us that the model is neither globally nonstationary nor chaotic. All moduli reside within the unit circle, with the stability index = 0.5823, satisfying the condition for stability. A closer inspection reveals that within this model exhibits the same feedback loops between depression and ptsd self-reports during wave 2 and more current BSI anxiety and Nottingham energy level that we found in the male model. It may be that depression and PTSD are intertwined in a way that is similar to anxiety and energy level within PTSD. These interrelationships invite future inquiry into the dynamics of their interaction within the PTSD syndrome. In Table 7 we present the parameter estimates shown in the path diagram for women. Then, we begin to analyze the direct effects and hypothesis tests relating to them.

Table 7: PTSD path model for female respondents

```
Endogenous variables
Observed:  crhrw1 crhrw2 crhrw3 PTSDw2 BSIanx depagw2 depagw3 whpsleep
           Vodkaw2 fdferw2 BSIdep PTSDw1 anxagw1 whpel anxagw3 MiPTSD
           injselfr cumdose2 depagw1 cumdose3 fdferw1 PTSDw3 anxagw2
Exogenous variables
Observed:  cumdose1 cataw1 Vodkaw1
Structural equation model                       Number of obs      =       362
Estimation method  = ml
Log likelihood     = -25847.197
```

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
Structural						
crhrw1 <-						
injselfr	.6298492	.1021273	6.17	0.000	.4296834	.8300149
fdferw1	.0026622	.0012513	2.13	0.033	.0002096	.0051148
_cons	-.3997994	.090004	-4.44	0.000	-.5762039	-.2233949
crhrw2 <-						
crhrw1	.5589593	.0318773	17.53	0.000	.4964809	.6214377
depagw2	.0078957	.0014856	5.31	0.000	.0049841	.0108073
fdferw2	.0068324	.0013254	5.15	0.000	.0042346	.0094302
injselfr	.5176358	.0646334	8.01	0.000	.3909567	.644315
cumdose2	.0406358	.020436	1.99	0.047	.000582	.0806896
cataw1	-.4578471	.0898574	-5.10	0.000	-.6339644	-.2817299
_cons	-.424409	.0562923	-7.54	0.000	-.5347398	-.3140783
crhrw3 <-						
crhrw1	-.0728879	.022209	-3.28	0.001	-.1164167	-.0293592
crhrw2	.9729672	.02583	37.67	0.000	.9223414	1.023593
depagw3	.0020999	.0010458	2.01	0.045	.0000502	.0041495
anxagw1	-.0014199	.0004313	-3.29	0.001	-.0022651	-.0005746
anxagw3	.0021104	.0009343	2.26	0.024	.0002793	.0039415
injselfr	.1455887	.0352983	4.12	0.000	.0764052	.2147722
_cons	-.1116123	.0280836	-3.97	0.000	-.1666552	-.0565694
PTSDw2 <-						
crhrw1	1.296714	.3385422	3.83	0.000	.6331836	1.960245
depagw2	.2355194	.0201961	11.66	0.000	.1959358	.275103
PTSDw1	.0629863	.0112964	5.58	0.000	.0408458	.0851268
depagw1	-.047698	.0151466	-3.15	0.002	-.0773849	-.0180112
_cons	.4914383	.4302896	1.14	0.253	-.3519138	1.33479

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Table 7 Female PTSD model continued:

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
BSIanx <-						
crhrw1	-1.205418	.2622247	-4.60	0.000	-1.719369	-.691467
crhrw2	1.02332	.3072473	3.33	0.001	.4211261	1.625513
Vodkaw2	.3810583	.1819953	2.09	0.036	.0243541	.7377625
fdferw2	.0156305	.0071738	2.18	0.029	.00157	.029691
BSIdep	.5132076	.0564726	9.09	0.000	.4025232	.6238919
PTSDw1	.0134713	.005868	2.30	0.022	.0019703	.0249723
anxagw3	.0268248	.007832	3.43	0.001	.0114744	.0421752
MiPTSD	-.1178986	.034702	-3.40	0.001	-.1859133	-.0498839
depagw1	.0206629	.0071437	2.89	0.004	.0066615	.0346644
PTSDw3	.0783304	.0234477	3.34	0.001	.0323738	.124287
cumdose1	.605108	.3122593	1.94	0.053	-.006909	1.217125
_cons	8.010522	1.339661	5.98	0.000	5.384835	10.63621
depagw2 <-						
crhrw1	-1.812218	.746836	-2.43	0.015	-3.27599	-.3484467
Vodkaw2	4.093021	1.721746	2.38	0.017	.7184605	7.467581
PTSDw1	-.0628488	.0258004	-2.44	0.015	-.1134166	-.012281
anxagw1	-.1178432	.0282493	-4.17	0.000	-.1732108	-.0624755
depagw1	.3895504	.0329912	11.81	0.000	.3248889	.4542119
anxagw2	.4846822	.0348573	13.90	0.000	.416363	.5530013
Vodkaw1	-4.883456	1.58509	-3.08	0.002	-7.990175	-1.776737
_cons	3.363915	.8779034	3.83	0.000	1.643256	5.084574
depagw3 <-						
crhrw1	-5.755332	1.03744	-5.55	0.000	-7.788676	-3.721988
crhrw2	6.068978	1.146979	5.29	0.000	3.82094	8.317015
depagw2	.6111602	.0505339	12.09	0.000	.5121155	.7102049
anxagw3	.1358158	.0490931	2.77	0.006	.0395952	.2320365
_cons	5.103166	.8338185	6.12	0.000	3.468912	6.73742
whpsl~p <-						
crhrw1	6.484954	1.471877	4.41	0.000	3.600128	9.36978
BSIanx	4.065195	.4351435	9.34	0.000	3.212329	4.918061
PTSDw3	.3567571	.1720383	2.07	0.038	.0195683	.693946
_cons	-12.82962	3.994182	-3.21	0.001	-20.65807	-5.001169
Vodkaw2 <-						
crhrw1	-.1062609	.0311858	-3.41	0.001	-.167384	-.0451378
crhrw2	.0722496	.0341707	2.11	0.034	.0052762	.1392229
Vodkaw1	.8174944	.0210268	38.88	0.000	.7762826	.8587062
_cons	.1149023	.0226663	5.07	0.000	.0704771	.1593275

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Table 7 Female PTSD model continued:

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
fdferw2 <-						
crhrw2	-3.804558	1.692037	-2.25	0.025	-7.12089	-.4882255
PTSDw1	.0918138	.0360968	2.54	0.011	.0210653	.1625623
fdferw1	.3463298	.0334706	10.35	0.000	.2807286	.411931
_cons	1.255381	1.69579	0.74	0.459	-2.068307	4.579069
BSIdep <-						
crhrw3	.8274069	.1923626	4.30	0.000	.4503832	1.204431
Vodkaw2	.7577383	.1775118	4.27	0.000	.4098216	1.105655
whpel	.0332202	.0050997	6.51	0.000	.023225	.0432153
PTSDw3	.0530356	.0196434	2.70	0.007	.0145352	.0915359
cumdose1	.7809546	.3032565	2.58	0.010	.1865827	1.375326
_cons	7.652928	.2552862	29.98	0.000	7.152576	8.153279
PTSDw1 <-						
depagw1	.5460726	.0510132	10.70	0.000	.4460885	.6460567
cumdose1	5.452116	2.591673	2.10	0.035	.3725301	10.5317
cataw1	32.62637	4.368667	7.47	0.000	24.06394	41.1888
_cons	5.575064	1.708699	3.26	0.001	2.226076	8.924052
anxagw1 <-						
PTSDw1	.3374853	.0496902	6.79	0.000	.2400943	.4348764
depagw1	.5402776	.0584905	9.24	0.000	.4256382	.654917
_cons	9.536504	1.627139	5.86	0.000	6.34737	12.72564
whpel <-						
depagw3	.1939363	.0733963	2.64	0.008	.0500822	.3377903
whpsleep	.4760098	.0514682	9.25	0.000	.3751339	.5768857
PTSDw1	.1552063	.0463111	3.35	0.001	.0644382	.2459743
_cons	14.03258	2.190631	6.41	0.000	9.739023	18.32614
anxagw3 <-						
PTSDw2	-.3630256	.0831645	-4.37	0.000	-.526025	-.2000262
depagw3	.4373053	.039199	11.16	0.000	.3604767	.514134
PTSDw3	.217492	.0810011	2.69	0.007	.0587329	.3762512
anxagw2	.6675678	.0346849	19.25	0.000	.5995867	.7355489
_cons	.9541846	.7257864	1.31	0.189	-.4683307	2.3767

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Table 7 Female PTSD model continued:

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
MiPTSD <-						
BSIanx	1.978067	.2525154	7.83	0.000	1.483146	2.472988
depagw2	.1178757	.0359952	3.27	0.001	.0473264	.188425
whpsleep	.0841461	.0183677	4.58	0.000	.0481461	.1201461
fdferw2	.0845705	.0195624	4.32	0.000	.0462288	.1229121
anxagw1	.058889	.0193324	3.05	0.002	.0209981	.0967798
depagw1	-.0794127	.024748	-3.21	0.001	-.1279178	-.0309076
PTSDw3	.1904562	.0625339	3.05	0.002	.0678919	.3130205
anxagw2	-.1435899	.0295032	-4.87	0.000	-.2014151	-.0857647
cataw1	-3.761856	1.531026	-2.46	0.014	-6.762612	-.7610991
_cons	28.0328	1.961334	14.29	0.000	24.18865	31.87694
injse~r <-						
anxagw1	.002516	.0006944	3.62	0.000	.0011549	.003877
fdferw1	.0015706	.0006476	2.43	0.015	.0003013	.00284
_cons	.5726202	.0342634	16.71	0.000	.5054652	.6397752
cumdo~2 <-						
cumdose1	2.188894	.0649526	33.70	0.000	2.061589	2.316199
_cons	.1613576	.0418234	3.86	0.000	.0793853	.2433299
depagw1 <-						
cumdose1	11.71117	2.509191	4.67	0.000	6.793248	16.6291
cataw1	12.05375	4.301514	2.80	0.005	3.622934	20.48456
Vodkaw1	6.995877	1.350607	5.18	0.000	4.348736	9.643017
_cons	4.983128	1.697213	2.94	0.003	1.656653	8.309604
cumdo~3 <-						
cumdose2	1.231235	.0130516	94.34	0.000	1.205654	1.256816
_cons	.0990387	.0195777	5.06	0.000	.060667	.1374104
fdferw1 <-						
anxagw1	.2979369	.0541364	5.50	0.000	.1918316	.4040422
_cons	30.74794	2.262812	13.59	0.000	26.31291	35.18297
PTSDw3 <-						
depagw3	.1537033	.0180973	8.49	0.000	.1182333	.1891733
fdferw2	.0348694	.0158123	2.21	0.027	.0038779	.065861
fdferw1	.0214425	.0107878	1.99	0.047	.0002988	.0425863
_cons	1.400652	.5634926	2.49	0.013	.2962263	2.505077

Continued on the next page...

Table 7 Female PTSD model continued:

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
anxagw2 <-						
anxagw1	.2843984	.029989	9.48	0.000	.225621	.3431758
Vodkaw1	2.24764	1.037063	2.17	0.030	.2150335	4.280246
_cons	4.49094	1.254067	3.58	0.000	2.033015	6.948866
Variance						
e.crhrw1	.7840106	.058275			.6777236	.9069665
e.crhrw2	.2812911	.0210931			.2428438	.3258254
e.crhrw3	.0706794	.0052536			.0610975	.081764
e.PTSDw2	47.62305	3.541211			41.16447	55.09495
e.BSIanx	8.950395	1.314512			6.71165	11.9359
e.depagw2	170.2314	12.65742			147.1463	196.9382
e.depagw3	162.6707	14.51593			136.5691	193.761
e.whpsleep	688.7138	51.19913			595.3335	796.7413
e.Vodkaw2	.1633878	.0121496			.1412289	.1890234
e.fdferw2	495.8142	38.51755			425.7876	577.3577
e.BSIdep	9.6512	.721683			8.335495	11.17458
e.PTSDw1	680.1664	50.55637			587.9574	786.8365
e.anxagw1	724.1007	53.83747			625.9093	837.6961
e.whpel	826.0209	61.58114			713.7278	955.9814
e.anxagw3	116.3553	8.865389			100.2147	135.0957
e.MiPTSD	79.6257	7.036226			66.96313	94.68273
e.injselfr	.2003826	.0148943			.1732171	.2318085
e.cumdose2	.4605615	.0342333			.398124	.5327911
e.depagw1	672.1855	49.96316			581.0585	777.6039
e.cumdose3	.0890991	.0067161			.076862	.1032845
e.fdferw1	1319.752	98.09638			1140.835	1526.728
e.PTSDw3	58.45368	4.353591			50.51437	67.6408
e.anxagw2	392.1095	29.14527			338.9519	453.6038
Covariance						
e.PTSDw2						
e.PTSDw3	26.56358	3.119844	8.51	0.000	20.4488	32.67836
e.anxagw1						
e.anxagw3	-50.42997	17.30637	-2.91	0.004	-84.34984	-16.5101
e.cumdose2						
e.cumdose3	.0427649	.0124315	3.44	0.001	.0183995	.0671303

LR test of model vs. saturated: chi2(231) = 253.13, Prob > chi2 = 0.1517
Stability index = .5822846

10.4 Direct external dose effects for females

10.4.1 Hypothesis 3 Dose-PTSD tests

Hypothesis 3 postulates a direct relationship between between cumulative external dose in mGys and MiPTSD. When we examine the direct robust effects in Table 8 to test hypothesis 3 for females. We find no evidence on page 74 in the MiPTSD panel of a statistically significant clustered-robust direct effect originating with cumulative external dose and pointing to Chornobyl PTSD. There is no direct path from cumdose1 and no direct path from cumdose2. Nor is there a direct path from cumdose3 in the female direct effects table under the MiPTSD panel. In sum, we find no evidence in this model to support hypothesis 3 among the female subsample.

10.4.2 Hypothesis 4: Direct dose BSI mental health effects

Hypothesis 4 suggests the existence of a direct effect between reconstructed exposure and BSI mental health measures. In Table 8 we have to examine the BSI anxiety and BSI depression panels. In the BSI anxiety panel on page 69, we find no significant path for cumdose1 and no paths for either cumdose2 or cumdose3. When we turn to the BSI depression panel of the same table, on page 72, we do find a statistically significant positive standardized path coefficient for wave 1 only for cumdose1 ($cumdose1\ stdized\ \beta = .115,\ p = 0.023$). Therefore, there is partial confirmation of hypothesis 4, insofar as there is a single direct path from cumulative external dose to BSI depression in 1986.

10.4.3 Hypothesis 5: Direct perceived risk of exposure and BSI mental health measures for females

Hypothesis 5 suggests a direct relationship between perceived risk and female BSI mental health measures. To test this hypothesis we have to examine the BSI anxiety panel on page 69 of Table 8 and the BSI depression panel on page 74. In the BSI anxiety panel we fine a significant negative relationship between perceived risk during wave one which becomes significant and positive by wave 2. This may reflect the original lack of information about the situation at first ($crhrw1\ stdized\ \beta = -0.311,\ p = 0.001)\ and\ (crhrw2\ stdized\ \beta = .243\, p = 0.012$). It may also reflect the possibility that as a clearer perspective became possible, more doubts about the danger arose.

10.4.4 Hypothesis 6 Perceived risk - PTSD tests

Hypothesis 6 posits a direct relationship between perceived Chornobyl health risk and Chornobyl PTSD. If we examine the MiPTSD panel on page 72 in Table 9 for women, we find not direct path from perceived risk of exposure, regardless of the time periods covered by our study. Therefore, we find no evidence to support hypothesis 6 that Chornobyl related health risk explains or predicts PTSD among our female respondents.

10.4.5 Hypothesis 8: Direct effects of perceived risk to Nottingham health measures

Hypothesis 8 submits that perceived risk measured by the Chornobyl perceived health risk summary score directly predicts Nottingham health scales. The Nottingham health measures in the female PTSD model include scales for sleep and energy level. We therefore have to review the sleep and energy level panels in Table 8 to find the test results relating the perceived risk summary scale to these measures. When we examine the whpsleep panel, we discover a significant direct effect from perceived risk in wave 1986 to female sleep in wave 1 ($crhrw1\ stdized\ \beta = 0.197,\ p = 0.000$). But we do not find any significant paths from perceived risk to sleep in later waves. Furthermore, when we examine the energy level panel in this table, we find no direct effects from perceived risk in any of the waves. Therefore, we only find partial support for hypothesis 8 insofar as we discover a significant positive direct effect between perceived risk and sleep for women.

10.4.6 Hypothesis 12 Radiation directly explains/predicts substance abuse

Vodka consumption in wave 1 is an exogenous variable, for which reason there is no Vodkaw1 panel in Table 9.Our testing of this hypothesis has to be done, therefore, with vodka consumption in wave 2. If we examine the Vodka2 panel in Table 9 (page 69) for women, we find no evidence in support of hypothesis 12 that radiation direct predicts substance abuse. There is no path coming from cumulative external dose in wave 1 or later to support this hypothesis. Therefore, hypothesis 12 appears to be inconsistent with our data.

10.4.7 Hypothesis 16 Perceived risk of exposure explaining/predicting substance abuse

If we examine the Vodka2 panel in Table 9 (page 69) for women, we find one statistically significant direct path from perceived risk of exposure in wave 1 ($crhrw1\ stdized\ \beta = -0.110,\ p = 0.020$). The relationship is a statistically significant inverse rather than a direct one. Vodka consumption appears to dulls the awareness of perceived risk. Perhaps the more one drinks the less one is aware of any risk in the midst. The path emanating from perceived Chornobyl health risk in the following decade is not statistically significant ($crhrw2\ stdized\ \beta = 0.067,\ p = 0.123$). Moreover, there is no supporting a relationship in wave 3. Therefore, hypothesis 6 appears partly supported by the evidence. After 1986 this concern seems to have disappeared. Although there may have been such an inverse relationship in 1986, there appears to be no evidence of it in later years. For a more comprehensive perspective, we have to consider indirect effects as well.

10.4.8 Predominant direct effects on PTSD among women

If we examine the top third, in terms of the absolute value of their effect, on PTSD among women we discover a combination of anxiety, depression, and fear of consuming contaminated food directly affecting female PTSD. In declining magnitude of the absolute value of the direct effect, we find 1) BSI anxiety, 2) self-reported anxiety symptoms in wave 2, 3) sleep measured by the Nottingham health profile, 4) self-reported depressive symptoms in wave 2, 5) fear of consuming contaminated food, 6) self-reported depressive symptoms in 1986, and 7) self-reported anxiety in 1986 are the dominant effects. These are the pure effects, without mediation by other variables, contributing in some way to the type or severity of PTSD experienced by the women.

Table 8: Clustered-robust direct effects for Female PTSD model

Direct effects

(Std. Err. adjusted for 362 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Structural					
crhrw1 <-					
PTSDw1	0	(no path)			0
anxagw1	0	(no path)			0
injselfr	.6298492	.0960362	6.56	0.000	.3094638
depagw1	0	(no path)			0
fdferw1	.0026622	.0013112	2.03	0.042	.1067736
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0
crhrw2 <-					
crhrw1	.5589593	.0406267	13.76	0.000	.60659
crhrw2	0	(no path)			0
depagw2	.0078957	.0014339	5.51	0.000	.1757895
Vodkaw2	0	(no path)			0
fdferw2	.0068324	.0014155	4.83	0.000	.200472
PTSDw1	0	(no path)			0
anxagw1	0	(no path)			0
injselfr	.5176358	.0756644	6.84	0.000	.2760023
cumdose2	.0406358	.0147883	2.75	0.006	.0645207
depagw1	0	(no path)			0
fdferw1	0	(no path)			0
anxagw2	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	-.4578471	.0892904	-5.13	0.000	-.1668966
Vodkaw1	0	(no path)			0
crhrw3 <-					
crhrw1	-.0728879	.0279019	-2.61	0.009	-.0774841
crhrw2	.9729672	.0290181	33.53	0.000	.953103
PTSDw2	0	(no path)			0
depagw2	0	(no path)			0
depagw3	.0020999	.0011739	1.79	0.074	.0493188
Vodkaw2	0	(no path)			0
fdferw2	0	(no path)			0
PTSDw1	0	(no path)			0
anxagw1	-.0014199	.0005316	-2.67	0.008	-.0568453
anxagw3	.0021104	.0011668	1.81	0.071	.0549046
injselfr	.1455887	.0372061	3.91	0.000	.0760427
cumdose2	0	(no path)			0
depagw1	0	(no path)			0
fdferw1	0	(no path)			0
PTSDw3	0	(no path)			0
anxagw2	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0

Table 8 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
PTSDw2 <-					
crhrw1	1.296714	.3719125	3.49	0.000	.1462848
crhrw2	0	(no path)			0
depagw2	.2355194	.0586064	4.02	0.000	.5450904
Vodkaw2	0	(no path)			0
fdferw2	0	(no path)			0
PTSDw1	.0629863	.0136418	4.62	0.000	.250188
anxagw1	0	(no path)			0
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	-.047698	.0191656	-2.49	0.013	-.1606477
fdferw1	0	(no path)			0
anxagw2	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0
BSIanx <-					
crhrw1	-1.205418	.3627966	-3.32	0.001	-.3112629
crhrw2	1.02332	.4058448	2.52	0.012	.2434927
crhrw3	0	(no path)			0
PTSDw2	0	(no path)			0
BSIanx	0	(no path)			0
depagw2	0	(no path)			0
depagw3	0	(no path)			0
whpsleep	0	(no path)			0
Vodkaw2	.3810583	.1851292	2.06	0.040	.0971708
fdferw2	.0156305	.0081065	1.93	0.054	.1091259
BSIdep	.5132076	.0607988	8.44	0.000	.5244021
PTSDw1	.0134713	.0068988	1.95	0.051	.1224799
anxagw1	0	(no path)			0
whpel	0	(no path)			0
anxagw3	.0268248	.0090436	2.97	0.003	.1695174
MiPTSD	-.1178986	.0428571	-2.75	0.006	-.3835468
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	.0206629	.0090708	2.28	0.023	.1592946
fdferw1	0	(no path)			0
PTSDw3	.0783304	.0284924	2.75	0.006	.1817564
anxagw2	0	(no path)			0
cumdose1	.605108	.3768085	1.61	0.108	.0909477
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0

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Table 8 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
depagw2 <-					
crhrw1	-1.812218	.7920199	-2.29	0.022	-.0883331
crhrw2	0	(no path)			0
depagw2	0	(no path)			0
Vodkaw2	4.093021	1.453323	2.82	0.005	.1970205
fdferw2	0	(no path)			0
PTSDw1	-.0628488	.0398601	-1.58	0.115	-.1078638
anxagw1	-.1178432	.0446946	-2.64	0.008	-.2163268
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	.3895504	.0635179	6.13	0.000	.5668862
fdferw1	0	(no path)			0
anxagw2	.4846822	.0706336	6.86	0.000	.5639717
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	-4.883456	1.39183	-3.51	0.000	-.2573217
depagw3 <-					
crhrw1	-5.755332	1.291249	-4.46	0.000	-.2605009
crhrw2	6.068978	1.281091	4.74	0.000	.2531275
PTSDw2	0	(no path)			0
depagw2	.6111602	.0739866	8.26	0.000	.5675197
depagw3	0	(no path)			0
Vodkaw2	0	(no path)			0
fdferw2	0	(no path)			0
PTSDw1	0	(no path)			0
anxagw1	0	(no path)			0
anxagw3	.1358158	.0846626	1.60	0.109	.1504449
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	0	(no path)			0
fdferw1	0	(no path)			0
PTSDw3	0	(no path)			0
anxagw2	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0

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Table 8 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
whpsl~p <-					
crhrw1	6.484954	1.495313	4.34	0.000	.1973367
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
PTSDw2	0	(no path)			0
BSIanx	4.065195	.4406996	9.22	0.000	.4790629
depagw2	0	(no path)			0
depagw3	0	(no path)			0
whpsleep	0	(no path)			0
Vodkaw2	0	(no path)			0
fdferw2	0	(no path)			0
BSIdep	0	(no path)			0
PTSDw1	0	(no path)			0
anxagw1	0	(no path)			0
whpel	0	(no path)			0
anxagw3	0	(no path)			0
MiPTSD	0	(no path)			0
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	0	(no path)			0
fdferw1	0	(no path)			0
PTSDw3	.3567571	.1746543	2.04	0.041	.0975536
anxagw2	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0
Vodkaw2 <-					
crhrw1	-.1062609	.0463823	-2.29	0.022	-.1076017
crhrw2	.0722496	.0459713	1.57	0.116	.0674164
depagw2	0	(no path)			0
Vodkaw2	0	(no path)			0
fdferw2	0	(no path)			0
PTSDw1	0	(no path)			0
anxagw1	0	(no path)			0
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	0	(no path)			0
fdferw1	0	(no path)			0
anxagw2	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	.8174944	.0762667	10.72	0.000	.8948835

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Table 8 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
fdferw2 <-					
crhrw1	0	(no path)			0
crhrw2	-3.804558	1.768892	-2.15	0.031	-.1296651
depagw2	0	(no path)			0
Vodkaw2	0	(no path)			0
fdferw2	0	(no path)			0
PTSDw1	.0918138	.0429919	2.14	0.033	.1195659
anxagw1	0	(no path)			0
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	0	(no path)			0
fdferw1	.3463298	.042736	8.10	0.000	.5137407
anxagw2	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0
BSIdep <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
crhrw3	.8274069	.1937903	4.27	0.000	.1966893
PTSDw2	0	(no path)			0
BSIanx	0	(no path)			0
depagw2	0	(no path)			0
depagw3	0	(no path)			0
whpsleep	0	(no path)			0
Vodkaw2	.7577383	.2383173	3.18	0.001	.1891002
fdferw2	0	(no path)			0
BSIdep	0	(no path)			0
PTSDw1	0	(no path)			0
anxagw1	0	(no path)			0
whpel	.0332202	.0054098	6.14	0.000	.3064942
anxagw3	0	(no path)			0
MiPTSD	0	(no path)			0
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	0	(no path)			0
fdferw1	0	(no path)			0
PTSDw3	.0530356	.0232056	2.29	0.022	.1204357
anxagw2	0	(no path)			0
cumdose1	.7809546	.3433297	2.27	0.023	.1148717
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0

Table 8 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
PTSDw1 <-					
depagw1	.5460726	.0759595	7.19	0.000	.4630247
cumdose1	5.452116	2.579781	2.11	0.035	.0901298
cataw1	32.62637	5.547596	5.88	0.000	.3112542
Vodkaw1	0	(no path)			0
anxagw1 <-					
PTSDw1	.3374853	.0701705	4.81	0.000	.3155204
depagw1	.5402776	.0815954	6.62	0.000	.4282952
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0
whpel <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
PTSDw2	0	(no path)			0
BSIanx	0	(no path)			0
depagw2	0	(no path)			0
depagw3	.1939363	.0737982	2.63	0.009	.1173594
whpsleep	.4760098	.0542741	8.77	0.000	.4284625
Vodkaw2	0	(no path)			0
fdferw2	0	(no path)			0
BSIdep	0	(no path)			0
PTSDw1	.1552063	.0507843	3.06	0.002	.149683
anxagw1	0	(no path)			0
whpel	0	(no path)			0
anxagw3	0	(no path)			0
MiPTSD	0	(no path)			0
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	0	(no path)			0
fdferw1	0	(no path)			0
PTSDw3	0	(no path)			0
anxagw2	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0

Continued on the next page...

Table 8 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
anxagw3 <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
PTSDw2	-.3630256	.1266766	-2.87	0.004	-.1314904
depagw2	0	(no path)			0
depagw3	.4373053	.0801084	5.46	0.000	.3947822
Vodkaw2	0	(no path)			0
fdferw2	0	(no path)			0
PTSDw1	0	(no path)			0
anxagw1	0	(no path)			0
anxagw3	0	(no path)			0
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	0	(no path)			0
fdferw1	0	(no path)			0
PTSDw3	.217492	.1089377	2.00	0.046	.0798591
anxagw2	.6675678	.0607928	10.98	0.000	.6511698
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0
MiPTSD <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
PTSDw2	0	(no path)			0
BSIanx	1.978067	.303483	6.52	0.000	.6080386
depagw2	.1178757	.0450624	2.62	0.009	.1919514
depagw3	0	(no path)			0
whpsleep	.0841461	.0202744	4.15	0.000	.2194891
Vodkaw2	0	(no path)			0
fdferw2	.0845705	.0243929	3.47	0.001	.181495
BSIdep	0	(no path)			0
PTSDw1	0	(no path)			0
anxagw1	.058889	.0209303	2.81	0.005	.1760381
whpel	0	(no path)			0
anxagw3	0	(no path)			0
MiPTSD	0	(no path)			0
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	-.0794127	.0252232	-3.15	0.002	-.1881867
fdferw1	0	(no path)			0
PTSDw3	.1904562	.0721795	2.64	0.008	.1358453
anxagw2	-.1435899	.0427587	-3.36	0.001	-.2720765
cumdose1	0	(no path)			0
cataw1	-3.761856	1.593841	-2.36	0.018	-.1002984
Vodkaw1	0	(no path)			0

Continued on the next page...

Table 8 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
injse~r <-					
PTSDw1	0	(no path)			0
anxagw1	.002516	.000583	4.32	0.000	.1928528
depagw1	0	(no path)			0
fdferw1	.0015706	.0006401	2.45	0.014	.1282081
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0
cumdo~2 <-					
cumdose1	2.188894	.0836046	26.18	0.000	.8708001
depagw1 <-					
cumdose1	11.71117	4.252571	2.75	0.006	.2283232
cataw1	12.05375	4.692115	2.57	0.010	.1356172
Vodkaw1	6.995877	2.674015	2.62	0.009	.2533139
cumdo~3 <-					
cumdose2	1.231235	.0359156	34.28	0.000	.9679575
cumdose1	0	(no path)			0
fdferw1 <-					
PTSDw1	0	(no path)			0
anxagw1	.2979369	.0570277	5.22	0.000	.2797673
depagw1	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0
PTSDw3 <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
PTSDw2	0	(no path)			0
depagw2	0	(no path)			0
depagw3	.1537033	.0439153	3.50	0.000	.377898
Vodkaw2	0	(no path)			0
fdferw2	.0348694	.015939	2.19	0.029	.1049159
PTSDw1	0	(no path)			0
anxagw1	0	(no path)			0
anxagw3	0	(no path)			0
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	0	(no path)			0
fdferw1	.0214425	.010021	2.14	0.032	.0957032
PTSDw3	0	(no path)			0
anxagw2	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0

Continued on the next page...

Table 8 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
anxagw2 <-					
PTSDw1	0	(no path)			0
anxagw1	.2843984	.0468098	6.08	0.000	.4486761
depagw1	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	2.24764	1.416104	1.59	0.112	.1017831

10.5 Indirect effects for females

10.5.1 Hypothesis 3 addendum: Indirect external dose effects on females

For evidence of indirect effects among female respondents, we turn to MiPTSD panel in Table 10 on page 83. Hypothesis 3 refers to direct effects on PSTD originating with cumulative external dose. Is there auxiliary evidence tending to support Hypothesis 3 via hybrid indirect effects, mediated by other variables? We discover evidence of indirect positive effects of cumulative external dose in 1986 ($cumdose1\ stdized\ \beta = 0.161,\ p = 0.000$) as well as during the decade thereafter ($crhrw2\ stdized\ \beta = 0.013,\ p = 0.006$). Significant mediated effects, originate with cumulative external dose and impact female PTSD. Insofar as these signs are positive, they exhibit a direct, as distinguished from an inverse, relationship in waves 1 and 2. This auxiliary evidence is complements the direct effects posited by Hypothesis 3.

10.5.2 Hypothesis 4 addendum: Indirect external dose effects on female BSI

There do appear to be indirect dose effects on female mental health measured by the BSI. If we examine the BSI anxiety panel in Table 9 on about page 80, we find that the indirect effects from cumdose1 and cumdose2 are both statistically significant. $cumdose1\ sdtized\ \beta = .133,\ p = .022)\ and\ (cumdose2\ stdized\ \beta = .020,\ p = 0.006)$.

When we turn to the BSI depression panel in the same table on about page 83, we find partial support for hypothesis 4 in that we discover a significant path from cumulative external dose in wave 1 to BSI depression $cumdose1\ sdtized\ \beta = 0.053,\ p = .000)$. But we find no paths from dose in waves 2 or 3. Hence, indirect effects provides partial support for hypothesis 4.

10.5.3 Hypothesis 5 addendum:Indirect perceived risk dose effects on female BSI mental health

When we review the Nottingham panels for sleep and energy level in Table 9, we find significant indirect relationships between cumulative external dose and sleep in waves1 and 2, but not in wave 3. We also find significant indirect paths between computed exposure and energy level in waves 1 and 2. Thus, we do find evidence that partially supports the relationship between dose and female health measured by the Nottingham measures for sleep and energy level.

10.5.4 Hypothesis 6 addendum: Indirect perceived risk effects on female PTSD

Hypothesis 6 relates to direct effects of perceived threat of exposure on female PTSD. There are three statistically significant indirect paths to Chornobyl PTSD from perceived Chornobyl health risk. For 1986, there is a statistically significant indirect path ($crhrw1$ $stdized$ $\beta = -0.124,\ p = 0.032$). The second significant indirect robust path originates in the decade after 1986. ($crhrw2$ $stdized$ $\beta = 0.178, p = 0.002$), and the third significant robust path extends from wave 3 perceived exposure to Chornobyl PTSD, ($stdized$ $\beta = 0.043, p = 0.008$). Only the first of these three paths has a negative sign. Hypothesis 6 is also complemented by the significant indirect effects originating with perceived risk of exposure that impact female Choronobyl PTSD.

If we take the top eight of these indirect effects and sort them according to their absolute value, we find that 1986 self-reported depressive symptoms has the largest indirect effect upon PTSD. Second largest is that of self-reported anxiety symptoms and third largest is that of BSI depression. Fourth is the feedback through indirect effects of MiPTSD upon itself. Fifth is perceived risk of exposure to radiation in wave 2 and sixth in indirect impact is that of self-reported depressive symptoms in wave 3. Next down the list is the average number of vodka drinks per week and after that the 1986 fear of consuming contaminated food. Depression and anxiety appear to be highly indirectly related to female PTSD.

10.5.5 Hypothesis 20: Do Nottingham health measures mediate a radiation effect on substance abuse?

Hypothesis 20 suggests that radiation predicts substance abuse through mediation of the Nottingham health scales. In the female PTSD model, we have 2 Nottingham health scales–the energy level and sleep scales. If we go to the Nottingham sleep panel in the direct effects Table 9 on page 68, we find no direct paths originating with cumulative dose in either waves 1 or 2. If we turn the the direct effects Table 9 energy level panel on page 71, we find no effects originating with cumulative external dose. Therefore, a one stop mediated journey through these Nottingham scales seems unsupported by the data.

Is it possible that there might be a more circuitous indirect route by which other effects mediate an indirect effect beginning with cumulative external traveling through either energy level or sleep to substance abuse in the form of vodka consumption?

We can backtrack the Vodka effect by turning to the indirect effects Vodkaw2 panel in Table 10 on page 80, where we find no significant indirect effect emanating from external dose of radiation ($cumdose1$ $stdized$ $\beta = 0.004$, $p = 0.257$) in 1986, but we discover a significant indirect effect on vodka consumption stemming from the decade thereafter ($cumdose2$ $stdized$ $\beta = 0.004\, p = 0.005$). There is no indirect path from cumdose3. Thus, it is possible for an indirect effect to find its way to Vodka consumption in wave 2 if it proceeds through the Nottingham energy level measure to Vodka for there is an indirect effect on Vodka from energy level $whpel$ $stdized$ $\beta = -0.0004$, $p = 0.000$). There is no statistically significant indirect path coming from sleep impacting Vodka consumption in wave 2 according to the Vodkaw2 panel on page 80.

To be sure that this effect was mediated by the the energy level Nottingham, we turn to the energy level panel on page 82, where we observe significant indirect effects from external dose in 1986 and the decade following it ($cumdose1$ $stdized$ $\beta = 0.090$, $p = 0.001$) and ($cumdose2$ $stdized$ $\beta = 0.006$, $p = 0.005$). Thus, we have some evidence of an indirect relationship of cumulative external dose impacting a form of substance abuse through the a Nottingham subscale for energy level, and therefore partial confirmation of hypothesis 20. Because the leg of the journey from sleep was not statistically significant at the 0.05 level, we do not have evidence of sleep as a mediator of substance abuse for hypothesis 20. In fact, the effect is so small and indirect that it would probably not provide a sound basis for prediction. Effects must be stable and relatively large to provide a good basis for explanation or prediction.

10.5.6 Hypothesis 24: Do Nottingham health measures mediate a perceived risk impact on substance abuse?

Hypothesis 24 relates to perceived risk of radiation exposure explaining or predicting substance abuse while being mediated by Nottingham health measures. In the Chornobyl female Vodkaw2 panel of indirect effects (Table 10, p. 80), we find a statistically significant robust indirect effect originating with energy level ($whpel$ $stdized$ $\beta = -0.0004$, $p = 0.000$) but not with sleep (p = 0.553). If we turn to the female whpel panel (Table 10, p.82, we find two statistically significant indirect effect originating with perceived risk of exposure in waves 2 (crhrw2 stdized $\beta = .089$, $p = 0.000$) *and* ($crhrw3$ $stdized$ $\beta = 0.013, p = 0.008$). Therefore we have partial evidence consistent with hypothesis 24, insofar as it relates a relationship of perceived risk of exposure with vodka consumption as a substance abuse, mediated by Nottingham energy level.

Table 9: Clustered-robust indirect effects for female PTSD

Indirect effects

(Std. Err. adjusted for 362 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Structural					
crhrw1 <-					
PTSDw1	.000902	.0001875	4.81	0.000	.031758
anxagw1	.0026726	.0004014	6.66	0.000	.1006527
injselfr	0	(no path)			0
depagw1	.0019365	.0001982	9.77	0.000	.0578138
fdferw1	.0009892	.0004032	2.45	0.014	.0396758
cumdose1	.027596	.011812	2.34	0.019	.0160626
cataw1	.0527695	.0169586	3.11	0.002	.0177254
Vodkaw1	.0135474	.006073	2.23	0.026	.014645
crhrw2 <-					
crhrw1	-.0302517	.0065731	-4.60	0.000	-.0328295
crhrw2	-.0231125	.0118248	-1.95	0.051	-.0231125
depagw2	-.0001825	.0000331	-5.51	0.000	-.0040629
Vodkaw2	.0315704	.0112098	2.82	0.005	.0338337
fdferw2	-.0001579	.0000327	-4.83	0.000	-.0046334
PTSDw1	.0013986	.0004876	2.87	0.004	.0534421
anxagw1	.0037649	.0006558	5.74	0.000	.1538713
injselfr	.3210422	.0508405	6.31	0.000	.171179
cumdose2	-.0009392	.0003418	-2.75	0.006	-.0014912
depagw1	.0058025	.0005385	10.78	0.000	.1879968
fdferw1	.0050363	.0009302	5.41	0.000	.2192051
anxagw2	.0037385	.0005448	6.86	0.000	.0968489
cumdose1	.1624714	.0483016	3.36	0.001	.1026268
cataw1	.1261562	.0347043	3.64	0.000	.0459871
Vodkaw1	.0371378	.0147454	2.52	0.012	.043568

Continued....

Table 9 female indirect effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
crhrw3 <-					
crhrw1	.5009907	.0391991	12.78	0.000	.5325819
crhrw2	-.0024477	.0124567	-0.20	0.844	-.0023977
PTSDw2	-.0009291	.0003242	-2.87	0.004	-.0087548
depagw2	.0094638	.0013451	7.04	0.000	.2063988
depagw3	.0012047	.0002065	5.83	0.000	.0282943
Vodkaw2	.0387354	.0137539	2.82	0.005	.0406648
fdferw2	.0066504	.0013711	4.85	0.000	.1911477
PTSDw1	.0009774	.0005131	1.90	0.057	.0365844
anxagw1	.0044425	.0007543	5.89	0.000	.177861
anxagw3	.0004488	.0002798	1.60	0.109	.0116765
injselfr	.7720159	.0834308	9.25	0.000	.4032332
cumdose2	.0394378	.0143524	2.75	0.006	.0613402
depagw1	.0058977	.0006272	9.40	0.000	.187181
fdferw1	.0048961	.0008688	5.64	0.000	.2087487
PTSDw3	.0005566	.0002788	2.00	0.046	.0053171
anxagw2	.0062954	.0006521	9.65	0.000	.1597587
cumdose1	.1607237	.0478905	3.36	0.001	.0994502
cataw1	-.3413706	.0923655	-3.70	0.000	-.1218975
Vodkaw1	.0408597	.0167611	2.44	0.015	.0469556
PTSDw2 <-					
crhrw1	-.4924234	.1952116	-2.52	0.012	-.0555512
crhrw2	.0680378	.0443843	1.53	0.125	.0070728
depagw2	.0005372	.0000976	5.51	0.000	.0012433
Vodkaw2	.9661846	.3430665	2.82	0.005	.1076389
fdferw2	.0004649	.0000963	4.83	0.000	.0014179
PTSDw1	-.0124228	.0094234	-1.32	0.187	-.0493447
anxagw1	.0070237	.0109472	0.64	0.521	.0298408
injselfr	.5418007	.0773084	7.01	0.000	.0300309
cumdose2	.0027648	.0010062	2.75	0.006	.0004563
depagw1	.123362	.0148227	8.32	0.000	.4154851
fdferw1	.0031532	.0011073	2.85	0.004	.0142666
anxagw2	.1144124	.0166735	6.86	0.000	.3081167
cumdose1	1.167844	.4931618	2.37	0.018	.0766847
cataw1	2.530587	.6890659	3.67	0.000	.0958932
Vodkaw1	.4235723	.2943036	1.44	0.150	.0516557

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Table 9 female indirect effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
BSIanx <-					
crhrw1	.672421	.0947237	7.10	0.000	.1736325
crhrw2	.2787875	.0956466	2.91	0.004	.0663358
crhrw3	.3422929	.0801698	4.27	0.000	.083144
PTSDw2	-.0093824	.003274	-2.87	0.004	-.0214758
BSIanx	-.193906	.028965	-6.69	0.000	-.193906
depagw2	.0126157	.0045789	2.76	0.006	.0668325
depagw3	.0257657	.0039821	6.47	0.000	.1469917
whpsleep	-.0014552	.002041	-0.71	0.476	-.0123487
Vodkaw2	.2912182	.1013489	2.87	0.004	.0742613
fdferw2	.0003418	.00333	0.10	0.918	.0023865
BSIdep	-.099514	.0117893	-8.44	0.000	-.1016847
PTSDw1	.0015614	.0016808	0.93	0.353	.014196
anxagw1	.0058015	.0025012	2.32	0.020	.0564188
whpel	.013743	.002238	6.14	0.000	.1295604
anxagw3	-.0009797	.0026796	-0.37	0.715	-.0061913
MiPTSD	.0228612	.0083103	2.75	0.006	.074372
injselfr	.3881437	.113922	3.41	0.001	.0492443
cumdose2	.0529122	.019256	2.75	0.006	.0199904
depagw1	.0202458	.0031727	6.38	0.000	.1560791
fdferw1	.006268	.0012536	5.00	0.000	.0649141
PTSDw3	-.0062468	.0122372	-0.51	0.610	-.0144949
anxagw2	.0370143	.0042302	8.75	0.000	.2281638
cumdose1	.8826107	.3850208	2.29	0.022	.1326563
cataw1	.7449169	.3337204	2.23	0.026	.0646114
Vodkaw1	.8573618	.1295913	6.62	0.000	.239326
depagw2 <-					
crhrw1	-.2785792	.1905468	-1.46	0.144	-.0135788
crhrw2	.2888842	.1884527	1.53	0.125	.0129754
depagw2	.0022809	.0004142	5.51	0.000	.0022809
Vodkaw2	.009336	.0033149	2.82	0.005	.0004494
fdferw2	.0019738	.0004089	4.83	0.000	.0026012
PTSDw1	.0051364	.0010636	4.83	0.000	.0088152
anxagw1	.1329505	.02273	5.85	0.000	.2440596
injselfr	-1.16735	.2024174	-5.77	0.000	-.0279568
cumdose2	.011739	.0042721	2.75	0.006	.0008372
depagw1	-.0224645	.0050623	-4.44	0.000	-.0326911
fdferw1	-.006716	.0028301	-2.37	0.018	-.0131294
anxagw2	.0011055	.0001611	6.86	0.000	.0012864
cumdose1	4.010047	1.567486	2.56	0.011	.1137709
cataw1	2.409548	1.995185	1.21	0.227	.0394512
Vodkaw1	7.002478	1.603457	4.37	0.000	.3689784

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Table 9 female indirect effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
depagw3 <-					
crhrw1	1.625118	.6140389	2.65	0.008	.073557
crhrw2	.4456005	.1733677	2.57	0.010	.0185853
PTSDw2	-.0526721	.0183798	-2.87	0.004	-.0211332
depagw2	.080774	.0104466	7.73	0.000	.0750063
depagw3	.0682998	.0117087	5.83	0.000	.0682998
Vodkaw2	2.832101	1.005604	2.82	0.005	.1265908
fdferw2	.0456105	.0090815	5.02	0.000	.0558174
PTSDw1	-.0273235	.0279563	-0.98	0.328	-.0435452
anxagw1	.0453168	.0337597	1.34	0.179	.0772486
anxagw3	.0092762	.0057824	1.60	0.109	.0102754
injselfr	.7707672	.6389143	1.21	0.228	.017141
cumdose2	.2647252	.0963397	2.75	0.006	.0175311
depagw1	.2816186	.044662	6.31	0.000	.3805568
fdferw1	.006688	.0057322	1.17	0.243	.0121409
PTSDw3	.0315564	.015806	2.00	0.046	.012835
anxagw2	.4322269	.0477133	9.06	0.000	.4670226
cumdose1	3.728569	1.303943	2.86	0.004	.0982313
cataw1	-.4795867	1.715818	-0.28	0.780	-.0072915
Vodkaw1	1.877856	.9541261	1.97	0.049	.0918835
whpsl~p <-					
crhrw1	-2.418238	1.256828	-1.92	0.054	-.0735868
crhrw2	5.604311	1.366122	4.10	0.000	.1571477
crhrw3	1.391487	.3259059	4.27	0.000	.0398312
PTSDw2	-.0410296	.0143171	-2.87	0.004	-.0110673
BSIanx	-.7882658	.1177482	-6.69	0.000	-.0928932
depagw2	.0888622	.0193943	4.58	0.000	.055476
depagw3	.1633225	.0303032	5.39	0.000	.1098015
whpsleep	-.0059158	.0082971	-0.71	0.476	-.0059158
Vodkaw2	2.886739	.8380951	3.44	0.001	.0867487
fdferw2	.0795556	.0320349	2.48	0.013	.0654542
BSIdep	1.681745	.1992335	8.44	0.000	.2025082
PTSDw1	.0677401	.0244589	2.77	0.006	.0725792
anxagw1	.0467854	.0116488	4.02	0.000	.0536172
whpel	.0558678	.0090979	6.14	0.000	.0620676
anxagw3	.1130213	.0339356	3.33	0.001	.0841685
MiPTSD	-.3863453	.1404398	-2.75	0.006	-.1481142
injselfr	5.664994	.5765389	9.83	0.000	.0846981
cumdose2	.2277357	.0828784	2.75	0.006	.0101393
depagw1	.1972332	.0313828	6.28	0.000	.1791843
fdferw1	.0612467	.0099034	6.18	0.000	.0747488
PTSDw3	.2947643	.1223861	2.41	0.016	.0806019
anxagw2	.1739946	.0178123	9.77	0.000	.1263932
cumdose1	6.47391	1.559004	4.15	0.000	.1146665
cataw1	3.474968	1.523748	2.28	0.023	.0355192
Vodkaw1	3.696834	.6722811	5.50	0.000	.1216093

Continued on the next page...

Table 9 female indirect effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Vodkaw2 <-					
crhrw1	.0381989	.0028467	13.42	0.000	.0386809
crhrw2	-.0016699	.0008543	-1.95	0.051	-.0015582
depagw2	.0005573	.0001012	5.51	0.000	.0115772
Vodkaw2	.0022809	.0008099	2.82	0.005	.0022809
fdferw2	.0004822	.0000999	4.83	0.000	.0132027
PTSDw1	5.21e-06	.0000302	0.17	0.863	.0001857
anxagw1	-.000012	.0000259	-0.46	0.644	-.0004569
injselfr	-.0063342	.0085239	-0.74	0.457	-.0031515
cumdose2	.0028681	.0010438	2.75	0.006	.0042492
depagw1	.0002135	.0000354	6.03	0.000	.0064532
fdferw1	-.0000241	.0000908	-0.27	0.790	-.0009802
anxagw2	.0002701	.0000394	6.86	0.000	.0065292
cumdose1	.0088061	.0067769	1.30	0.194	.0051904
cataw1	-.0295719	.0179777	-1.64	0.100	-.0100586
Vodkaw1	.0012436	.001332	0.93	0.350	.0013614
fdferw2 <-					
crhrw1	-2.011499	.1499055	-13.42	0.000	-.0743967
crhrw2	.0879328	.0449881	1.95	0.051	.0029969
depagw2	-.0293454	.0053294	-5.51	0.000	-.0222669
Vodkaw2	-.1201112	.0426483	-2.82	0.005	-.004387
fdferw2	-.0253934	.005261	-4.83	0.000	-.0253934
PTSDw1	.0295021	.0064811	4.55	0.000	.0384195
anxagw1	.0888608	.0190468	4.67	0.000	.1237761
injselfr	-3.190799	.3379383	-9.44	0.000	-.0579838
cumdose2	-.1510281	.0549627	-2.75	0.006	-.0081727
depagw1	.1028252	.0094489	10.88	0.000	.113541
fdferw1	-.0191611	.0035391	-5.41	0.000	-.0284232
anxagw2	-.0142232	.0020728	-6.86	0.000	-.0125579
cumdose1	1.535048	.8531069	1.80	0.072	.0330464
cataw1	6.899171	1.797879	3.84	0.000	.0857122
Vodkaw1	.7325007	.362736	2.02	0.043	.0292872

Continued on the next page...

Table 9 female indirect effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
BSIdep <-					
crhrw1	.3029518	.0735126	4.12	0.000	.0765582
crhrw2	1.03332	.0613197	16.85	0.000	.2406235
crhrw3	0	(no path)			0
PTSDw2	-.0021862	.0007629	-2.87	0.004	-.0048973
BSIanx	.0518185	.0068401	7.58	0.000	.0507123
depagw2	.0197019	.0017368	11.34	0.000	.1021441
depagw3	.020908	.0038337	5.45	0.000	.1167326
whpsleep	.0157196	.0018506	8.49	0.000	.1305444
Vodkaw2	.1205371	.0340111	3.54	0.000	.0300811
fdferw2	.009594	.0015868	6.05	0.000	.0655518
BSIdep	.0265936	.0031505	8.44	0.000	.0265936
PTSDw1	.0069797	.002118	3.30	0.001	.0621045
anxagw1	.0043962	.0012195	3.60	0.000	.0418402
whpel	0	(no path)			0
anxagw3	.0060222	.0021411	2.81	0.005	.0372448
MiPTSD	-.0061093	.0022208	-2.75	0.006	-.0194505
injselfr	.8493619	.0914531	9.29	0.000	.1054592
cumdose2	.0419898	.0152811	2.75	0.006	.0155252
depagw1	.0155217	.0013673	11.35	0.000	.1171052
fdferw1	.0068411	.0010375	6.59	0.000	.069337
PTSDw3	.0112237	.0035096	3.20	0.001	.0254872
anxagw2	.0144466	.0013746	10.51	0.000	.0871511
cumdose1	.3638668	.1044216	3.48	0.000	.0535217
cataw1	-.035302	.1605098	-0.22	0.826	-.0029966
Vodkaw1	.7628306	.2088894	3.65	0.000	.2083927
PTSDw1 <-					
depagw1	0	(no path)			0
cumdose1	6.39515	2.454826	2.61	0.009	.1057193
cataw1	6.582221	2.724412	2.42	0.016	.0627941
Vodkaw1	3.820257	1.518111	2.52	0.012	.1172906
anxagw1 <-					
PTSDw1	0	(no path)			0
depagw1	.1842915	.0256352	7.19	0.000	.1460937
cumdose1	10.32556	3.781678	2.73	0.006	.1595841
cataw1	19.74469	4.11913	4.79	0.000	.1761041
Vodkaw1	5.068996	1.963597	2.58	0.010	.1455007

Continued on the next page...

Table 9 female indirect effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
whpel <-					
crhrw1	1.134798	1.010926	1.12	0.262	.0310825
crhrw2	3.931119	.7654516	5.14	0.000	.0992199
crhrw3	.6623615	.1551344	4.27	0.000	.0170662
PTSDw2	-.0297455	.0103796	-2.87	0.004	-.0072221
BSIanx	1.55985	.2059034	7.58	0.000	.1654592
depagw2	.1764904	.0196296	8.99	0.000	.0991758
depagw3	.0909889	.0155513	5.85	0.000	.0550614
whpsleep	-.002816	.0039495	-0.71	0.476	-.0025347
Vodkaw2	1.923363	.5076293	3.79	0.000	.0520252
fdferw2	.0467147	.0154536	3.02	0.003	.0345954
BSIdep	.800527	.0948371	8.44	0.000	.0867672
PTSDw1	.0269459	.0141772	1.90	0.057	.025987
anxagw1	.0310589	.0107444	2.89	0.004	.0320388
whpel	.0265936	.0043307	6.14	0.000	.0265936
anxagw3	.0819378	.0289823	2.83	0.005	.0549251
MiPTSD	-.1839041	.0668507	-2.75	0.006	-.0634614
injselfr	2.846072	.318	8.95	0.000	.0383016
cumdose2	.1597442	.0581347	2.75	0.006	.0064017
depagw1	.2332549	.0219636	10.62	0.000	.1907426
fdferw1	.0304511	.0045085	6.75	0.000	.0334519
PTSDw3	.3162505	.1045971	3.02	0.002	.0778393
anxagw2	.1666476	.0143352	11.63	0.000	.1089643
cumdose1	5.643519	1.63977	3.44	0.001	.0899739
cataw1	7.646529	2.51026	3.05	0.002	.0703516
Vodkaw1	2.716841	.5630276	4.83	0.000	.0804448
anxagw3 <-					
crhrw1	-2.251468	.7190227	-3.13	0.002	-.0919978
crhrw2	3.013751	.647007	4.66	0.000	.113476
PTSDw2	-.0247946	.008652	-2.87	0.004	-.0089808
depagw2	.2398002	.0430143	5.57	0.000	.2010241
depagw3	.0655803	.0115893	5.66	0.000	.0592034
Vodkaw2	.9815072	.3485072	2.82	0.005	.0396059
fdferw2	.0286929	.0047246	6.07	0.000	.0316995
PTSDw1	.0342444	.0196175	1.75	0.081	.0492682
anxagw1	.210701	.0383643	5.49	0.000	.3242434
anxagw3	.0682998	.0425756	1.60	0.109	.0682998
injselfr	.1419408	.3174049	0.45	0.655	.0028497
cumdose2	.1224662	.0445683	2.75	0.006	.0073216
depagw1	.2444495	.0247997	9.86	0.000	.2982084
fdferw1	.0091483	.0039828	2.30	0.022	.0149925
PTSDw3	.0148547	.0074404	2.00	0.046	.0054544
anxagw2	.1618216	.0165274	9.79	0.000	.1578467
cumdose1	3.317559	1.222558	2.71	0.007	.0789041
cataw1	2.683964	1.594554	1.68	0.092	.0368384
Vodkaw1	3.20563	1.408735	2.28	0.023	.1415993

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Table 9 female indirect effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
MiPTSD <-					
crhrw1	-1.262938	.7378226	-1.71	0.087	-.1002448
crhrw2	2.932996	.8016982	3.66	0.000	.2145241
crhrw3	.7941665	.1860049	4.27	0.000	.0592973
PTSDw2	-.0235534	.0082189	-2.87	0.004	-.0165722
BSIanx	-.1078184	.0698871	-1.54	0.123	-.0331423
depagw2	.0502798	.0110059	4.57	0.000	.0818767
depagw3	.0959824	.0180021	5.33	0.000	.1683187
whpsleep	-.0033763	.0047354	-0.71	0.476	-.0088069
Vodkaw2	2.128235	.566931	3.75	0.000	.1668222
fdferw2	.0441813	.0183971	2.40	0.016	.0948167
BSIdep	.9598258	.113709	8.44	0.000	.3014769
PTSDw1	.0454014	.0171182	2.65	0.008	.1268862
anxagw1	-.0129949	.0091147	-1.43	0.154	-.038846
whpel	.0318856	.0051925	6.14	0.000	.0924009
anxagw3	.0648809	.0194815	3.33	0.001	.1260333
MiPTSD	-.2204997	.0801535	-2.75	0.006	-.2204997
injselfr	.8383846	.2596494	3.23	0.001	.0326961
cumdose2	.1191847	.0433741	2.75	0.006	.0138413
depagw1	.1723718	.0207477	8.31	0.000	.4084748
fdferw1	.0508818	.0070227	7.25	0.000	.1619803
PTSDw3	.198333	.0722898	2.74	0.006	.1414635
anxagw2	.156476	.0146898	10.65	0.000	.2964932
cumdose1	3.478359	.8622135	4.03	0.000	.1607027
cataw1	2.088412	.9528446	2.19	0.028	.0556811
Vodkaw1	1.597934	.4027451	3.97	0.000	.1371118
injse~r <-					
PTSDw1	.001007	.0002094	4.81	0.000	.0721662
anxagw1	.0004679	.0000896	5.22	0.000	.0358684
depagw1	.0021621	.0002213	9.77	0.000	.1313749
fdferw1	0	(no path)			0
cumdose1	.0308106	.0127839	2.41	0.016	.0365003
cataw1	.0589165	.0170264	3.46	0.001	.0402787
Vodkaw1	.0151255	.0066733	2.27	0.023	.0332791

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Table 9 female indirect effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
cumdo~2 <-					
cumdose1	0	(no path)			0
depagw1 <-					
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0
cumdo~3 <-					
cumdose2	0	(no path)			0
cumdose1	2.695043	.1392837	19.35	0.000	.8428975
fdferw1 <-					
PTSDw1	.1005493	.0209064	4.81	0.000	.0882723
anxagw1	0	(no path)			0
depagw1	.2158758	.0220961	9.77	0.000	.1606952
cumdose1	3.076366	1.253654	2.45	0.014	.0446464
cataw1	5.882672	1.780709	3.30	0.001	.0492682
Vodkaw1	1.510241	.6474416	2.33	0.020	.0407063
PTSDw3 <-					
crhrw1	-.7049673	.2358145	-2.99	0.003	-.0784512
crhrw2	.8717156	.2216259	3.93	0.000	.0893902
PTSDw2	-.0080959	.002825	-2.87	0.004	-.0079862
depagw2	.1053293	.0117754	8.94	0.000	.2404731
depagw3	.0104979	.0017997	5.83	0.000	.0258104
Vodkaw2	.4311151	.1530775	2.82	0.005	.0473781
fdferw2	.006125	.0012127	5.05	0.000	.0184291
PTSDw1	.0021865	.0046807	0.47	0.640	.0085675
anxagw1	.0164524	.0054493	3.02	0.003	.0689528
anxagw3	.0223011	.0139017	1.60	0.109	.0607359
injselfr	.0072081	.0954708	0.08	0.940	.0003941
cumdose2	.0354229	.0128912	2.75	0.006	.0057675
depagw1	.0515001	.0067778	7.60	0.000	.171103
fdferw1	.0124361	.0019498	6.38	0.000	.0555056
PTSDw3	.0048503	.0024294	2.00	0.046	.0048503
anxagw2	.0659387	.0072626	9.08	0.000	.1751694
cumdose1	.6925846	.3060572	2.26	0.024	.0448613
cataw1	.2929954	.3141094	0.93	0.351	.0109522
Vodkaw1	.3465579	.1984351	1.75	0.081	.041691
anxagw2 <-					
PTSDw1	.0959803	.0199564	4.81	0.000	.1415665
anxagw1	0	(no path)			0
depagw1	.2060663	.0210921	9.77	0.000	.2577146
cumdose1	2.936574	1.195044	2.46	0.014	.0716016
cataw1	5.615359	1.519635	3.70	0.000	.0790137
Vodkaw1	1.441614	.5979863	2.41	0.016	.0652827

10.6 Total effects on Chornobyl PTSD among females

10.6.1 Hypothesis 3: The total effect of exposure on females

In attempting to obtain a more complete picture of pure as well as hybrid mediated relationships, we turn to Table 11, which lists the total effects of the variables upon the other variables. To obtain a sense of the relative impact of these effects, we sort the total effects on PTSD among women by the absolute values of their impact. Three of the 25 effects are not statistically significant at the 0.05 level so we ignore those. There are 22 effects remaining. If we split the rankings into groups of 7, 7, and 8, we can classify the groups according to relatively high, medium, and low impact. Among the top seven, in order of their decreasing size, were 1) BSI anxiety 2) BSI depression 3) self-reported PTSD symptoms in wave 3 4) self-expressed depressive symptoms in wave 2 5) fear of consuming contaminated food in wave 2 6) Nottingham measured sleep and 7) self-expressed depressive symptoms in 1986.

The effects with middling impacts included 8) indirect effects feedback from MiPTSD upon itself, 9) perceived risk of exposure to Chornobyl radiation in wave 2 10) self-reported depressive symptoms in wave 3 11) vodka consumption in wave 2 12) fear of consuming contaminated food in 1986, 13) reconstructed exposure to radiation in wave 1 and 14) self-reported anxiety symptoms in waves 1. The remainder have much less impact. The high and middling groups are different forms of depression, anxiety, fear of consuming contaminated food, along with some PTSD symptoms. Amidst the lower levels of impact are those of injury, energy level, catastrophic experiences, and 1986 cumulative external dose. Nonetheless, clinically diagnosable (BSI) anxiety and depression are among the top four impacts on PTSD.

We can assess the hypothesis 3 with respect to total effects to obtain a more comprehensive perspective of whether radiation explains or predicts Chornobyl PTSD. In the Chornobyl PTSD panel of Table 11 on page 96, we notice a total effect of cumulative external dose in 1986 on Chornobyl PTSD ($cumdose1$ *stdized* $\beta = 0.155,\ p = 0.000$) and in the decade after ($cumdose2$ *stdized* $\beta = 0.012,\ p = 0.005$), but we find no such effect in originating in wave 3. In terms of total effects, relating to hypothesis 3, we find total effects of external dose for both 1986 and the following decade, so hypothesis 3 is consistent with our model and data in waves 1 and 2, but we cannot say the same for wave 3. The effects are positive and therefore the relationship is direct even if it is a combination of direct and indirect effects among females. Therefore, we have partial support for hypothesis 3 in our model and data.

10.6.2 Hypothesis 4: Total effect of exposure on BSI mental health

Cumulative radiation external dose exhibits significant total effects on BSI anxiety in 1986 and in the decade, as we can see on the BSI anx panel on page 93 ($cumdose1$ *stdized* $\beta = 0.224,\ p = 0.000$) and in the decade after ($cumdose2$ *stdized* $\beta = 0.020,\ p = 0.006$).

Cumulative radiation does exhibits significant total effects for waves 1 and 2 on BSI depression as well (page 96) ($cumdose1\ stdized\ \beta = 0.168,\ p = 0.004$) and in the decade after ($cumdose2\ stdized\ \beta = 0.016,\ p = 0.006$).

Hypothesis 5: Perceived risk of exposure on Nottingham health measures

Perceived risk exhibits significant total effects on energy level in waves 2 and 3. If we turn to the energy level total effect panel on page 97, we observe no significant path in 1986 (p = .262), but in waves 2 and 3 the crhrw2 $\beta = 0.099$) and crhrw3 $\beta = 0.017$) are both statistically significant at the 0.000 level.

10.6.3 Hypothesis 6: The total effect of perceived risk explaining/predicting PTSD

We also find partial support in our data for hypothesis 6. On page 96, in the MiPTSD panel of Table 11, we find statistically significant total effects of perceived Chornobyl health risk with Chornobyl PTSD in all three waves. From wave 1 the parameter estimate of this relationship is shown to be ($crhrw1\ stdized\ \beta = -0.124,\ p = 0.032$). However, this relationship is a negative one, implying an inverse relationship, which at first glance might appear counterintuitive until we recall that because there was no direct effect the total effect consists only of the hybrid mediated product of relationships one of which could easily reverse the sign. The other perceived risk of exposure relationships are positive and consistent with the hypothesis. From wave 2, it is ($stdized\ \beta = 0.178, p = 0.002$) and from wave 3 is appears to be ($stdized\ \beta = 0.043, p = 0.008$). Therefore, female total effects appear to be partly consistent with hypothesis 6, insofar as they are statistically significant.

10.6.4 Hypothesis 12: The total effect of exposure on substance abuse

Are the total effects consistent with hypotheses 12 and 16, which respectfully submit that radiation and perceived risk of exposure predict (explain) substance abuse. We examine the Vodka2 panel in Table 11, on page 95. Because 1986 vodka consumption is an exogenous variable in this model, we have no pre-existing data to show that either pre-wave radiation or perceived risk of exposure leads to such consumption. Nor do we have any concurrent paths in our model to support either hypothesis 12 or hypothesis 16 in wave one. As for wave 2, we do have a total effect of cumdose2 on vodka consumption that is significant and positive ($cumdose2\ stdized\ \beta = 0.004,\ p = 0.005$). This is partial support for hypothesis 12 insofar as it pertains only to female drinking during the decade after 1986.

10.6.5 Hypothesis 16: The total effect of perceived risk of exposure and substance abuse

If we again review the Vodka2 panel on page 95, we observe no evidence of significant wave 1 or wave 2 perceived risk of exposure from total effects on vodka consumption. The only impact that appears to be statistically significant stems from wave 3 perceived risk of exposure. We cannot have a future perceived risk (wave 3) significantly impact a wave 2 vodka consumption unless we are talking about a rational expectation, measured in wave 2 about what one might believe in wave 3. However, the wave 3 recollection pertained to wave 3 and not earlier. For this reason, what appears to be significant is rendered unacceptable by the arrow of time inherent in the model.So we disregard the impact of crhrw3 on vodkaw2. We therefore have no empirical evidence to support hypothesis 16 based on the significance of total effects.

Table 10: Clustered-robust total effects for Female PTSD model

Total effects

(Std. Err. adjusted for 362 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Structural					
crhrw1 <-					
PTSDw1	.000902	.0001875	4.81	0.000	.031758
anxagw1	.0026726	.0004014	6.66	0.000	.1006527
injselfr	.6298492	.0960362	6.56	0.000	.3094638
depagw1	.0019365	.0001982	9.77	0.000	.0578138
fdferw1	.0036515	.0013671	2.67	0.008	.1464494
cumdose1	.027596	.011812	2.34	0.019	.0160626
cataw1	.0527695	.0169586	3.11	0.002	.0177254
Vodkaw1	.0135474	.006073	2.23	0.026	.014645
crhrw2 <-					
crhrw1	.5287076	.0394016	13.42	0.000	.5737605
crhrw2	-.0231125	.0118248	-1.95	0.051	-.0231125
depagw2	.0077132	.0014008	5.51	0.000	.1717266
Vodkaw2	.0315704	.0112098	2.82	0.005	.0338337
fdferw2	.0066745	.0013828	4.83	0.000	.1958386
PTSDw1	.0013986	.0004876	2.87	0.004	.0534421
anxagw1	.0037649	.0006558	5.74	0.000	.1538713
injselfr	.8386781	.0888246	9.44	0.000	.4471814
cumdose2	.0396966	.0144465	2.75	0.006	.0630295
depagw1	.0058025	.0005385	10.78	0.000	.1879968
fdferw1	.0050363	.0009302	5.41	0.000	.2192051
anxagw2	.0037385	.0005448	6.86	0.000	.0968489
cumdose1	.1624714	.0483016	3.36	0.001	.1026268
cataw1	-.3316909	.0924141	-3.59	0.000	-.1209096
Vodkaw1	.0371378	.0147454	2.52	0.012	.043568

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Table 10 Total effects continued:

(Std. Err. adjusted for 362 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
crhrw3 <-					
crhrw1	.4281028	.0430277	9.95	0.000	.4550978
crhrw2	.9705195	.0328868	29.51	0.000	.9507053
PTSDw2	-.0009291	.0003242	-2.87	0.004	-.0087548
depagw2	.0094638	.0013451	7.04	0.000	.2063988
depagw3	.0033046	.0011578	2.85	0.004	.0776131
Vodkaw2	.0387354	.0137539	2.82	0.005	.0406648
fdferw2	.0066504	.0013711	4.85	0.000	.1911477
PTSDw1	.0009774	.0005131	1.90	0.057	.0365844
anxagw1	.0030227	.0008805	3.43	0.001	.1210157
anxagw3	.0025592	.0011993	2.13	0.033	.0665811
injselfr	.9176046	.0942345	9.74	0.000	.4792759
cumdose2	.0394378	.0143524	2.75	0.006	.0613402
depagw1	.0058977	.0006272	9.40	0.000	.187181
fdferw1	.0048961	.0008688	5.64	0.000	.2087487
PTSDw3	.0005566	.0002788	2.00	0.046	.0053171
anxagw2	.0062954	.0006521	9.65	0.000	.1597587
cumdose1	.1607237	.0478905	3.36	0.001	.0994502
cataw1	-.3413706	.0923655	-3.70	0.000	-.1218975
Vodkaw1	.0408597	.0167611	2.44	0.015	.0469556
PTSDw2 <-					
crhrw1	.8042907	.41537	1.94	0.053	.0907336
crhrw2	.0680378	.0443843	1.53	0.125	.0070728
depagw2	.2360566	.0585702	4.03	0.000	.5463337
Vodkaw2	.9661846	.3430665	2.82	0.005	.1076389
fdferw2	.0004649	.0000963	4.83	0.000	.0014179
PTSDw1	.0505635	.0150281	3.36	0.001	.2008433
anxagw1	.0070237	.0109472	0.64	0.521	.0298408
injselfr	.5418007	.0773084	7.01	0.000	.0300309
cumdose2	.0027648	.0010062	2.75	0.006	.0004563
depagw1	.075664	.0216747	3.49	0.000	.2548375
fdferw1	.0031532	.0011073	2.85	0.004	.0142666
anxagw2	.1144124	.0166735	6.86	0.000	.3081167
cumdose1	1.167844	.4931618	2.37	0.018	.0766847
cataw1	2.530587	.6890659	3.67	0.000	.0958932
Vodkaw1	.4235723	.2943036	1.44	0.150	.0516557

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Table 10 Total effects continued:

(Std. Err. adjusted for 362 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
BSIanx <-					
crhrw1	-.5329969	.3038241	-1.75	0.079	-.1376304
crhrw2	1.302107	.3314437	3.93	0.000	.3098285
crhrw3	.3422929	.0801698	4.27	0.000	.083144
PTSDw2	-.0093824	.003274	-2.87	0.004	-.0214758
BSIanx	-.193906	.028965	-6.69	0.000	-.193906
depagw2	.0126157	.0045789	2.76	0.006	.0668325
depagw3	.0257657	.0039821	6.47	0.000	.1469917
whpsleep	-.0014552	.002041	-0.71	0.476	-.0123487
Vodkaw2	.6722765	.2013213	3.34	0.001	.1714321
fdferw2	.0159723	.0073579	2.17	0.030	.1115124
BSIdep	.4136935	.0490096	8.44	0.000	.4227174
PTSDw1	.0150327	.0058703	2.56	0.010	.1366759
anxagw1	.0058015	.0025012	2.32	0.020	.0564188
whpel	.013743	.002238	6.14	0.000	.1295604
anxagw3	.0258451	.0078372	3.30	0.001	.1633261
MiPTSD	-.0950373	.0345469	-2.75	0.006	-.3091748
injselfr	.3881437	.113922	3.41	0.001	.0492443
cumdose2	.0529122	.019256	2.75	0.006	.0199904
depagw1	.0409088	.0076771	5.33	0.000	.3153737
fdferw1	.006268	.0012536	5.00	0.000	.0649141
PTSDw3	.0720836	.0300856	2.40	0.017	.1672615
anxagw2	.0370143	.0042302	8.75	0.000	.2281638
cumdose1	1.487719	.3329151	4.47	0.000	.223604
cataw1	.7449169	.3337204	2.23	0.026	.0646114
Vodkaw1	.8573618	.1295913	6.62	0.000	.239326
depagw2 <-					
crhrw1	-2.090798	.8288556	-2.52	0.012	-.1019119
crhrw2	.2888842	.1884527	1.53	0.125	.0129754
depagw2	.0022809	.0004142	5.51	0.000	.0022809
Vodkaw2	4.102357	1.456638	2.82	0.005	.1974699
fdferw2	.0019738	.0004089	4.83	0.000	.0026012
PTSDw1	-.0577125	.0399674	-1.44	0.149	-.0990485
anxagw1	.0151073	.0463923	0.33	0.745	.0277328
injselfr	-1.16735	.2024174	-5.77	0.000	-.0279568
cumdose2	.011739	.0042721	2.75	0.006	.0008372
depagw1	.3670859	.064481	5.69	0.000	.5341951
fdferw1	-.006716	.0028301	-2.37	0.018	-.0131294
anxagw2	.4857877	.0707947	6.86	0.000	.565258
cumdose1	4.010047	1.567486	2.56	0.011	.1137709
cataw1	2.409548	1.995185	1.21	0.227	.0394512
Vodkaw1	2.119022	1.232647	1.72	0.086	.1116567

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Table 10 Total effects continued:

(Std. Err. adjusted for 362 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
depagw3 <-					
crhrw1	-4.130214	1.537791	-2.69	0.007	-.186944
crhrw2	6.514578	1.376565	4.73	0.000	.2717128
PTSDw2	-.0526721	.0183798	-2.87	0.004	-.0211332
depagw2	.6919342	.0763153	9.07	0.000	.6425259
depagw3	.0682998	.0117087	5.83	0.000	.0682998
Vodkaw2	2.832101	1.005604	2.82	0.005	.1265908
fdferw2	.0456105	.0090815	5.02	0.000	.0558174
PTSDw1	-.0273235	.0279563	-0.98	0.328	-.0435452
anxagw1	.0453168	.0337597	1.34	0.179	.0772486
anxagw3	.145092	.090445	1.60	0.109	.1607203
injselfr	.7707672	.6389143	1.21	0.228	.017141
cumdose2	.2647252	.0963397	2.75	0.006	.0175311
depagw1	.2816186	.044662	6.31	0.000	.3805568
fdferw1	.006688	.0057322	1.17	0.243	.0121409
PTSDw3	.0315564	.015806	2.00	0.046	.012835
anxagw2	.4322269	.0477133	9.06	0.000	.4670226
cumdose1	3.728569	1.303943	2.86	0.004	.0982313
cataw1	-.4795867	1.715818	-0.28	0.780	-.0072915
Vodkaw1	1.877856	.9541261	1.97	0.049	.0918835
whpsl~p <-					
crhrw1	4.066716	1.933544	2.10	0.035	.1237499
crhrw2	5.604311	1.366122	4.10	0.000	.1571477
crhrw3	1.391487	.3259059	4.27	0.000	.0398312
PTSDw2	-.0410296	.0143171	-2.87	0.004	-.0110673
BSIanx	3.276929	.4325614	7.58	0.000	.3861697
depagw2	.0888622	.0193943	4.58	0.000	.055476
depagw3	.1633225	.0303032	5.39	0.000	.1098015
whpsleep	-.0059158	.0082971	-0.71	0.476	-.0059158
Vodkaw2	2.886739	.8380951	3.44	0.001	.0867487
fdferw2	.0795556	.0320349	2.48	0.013	.0654542
BSIdep	1.681745	.1992335	8.44	0.000	.2025082
PTSDw1	.0677401	.0244589	2.77	0.006	.0725792
anxagw1	.0467854	.0116488	4.02	0.000	.0536172
whpel	.0558678	.0090979	6.14	0.000	.0620676
anxagw3	.1130213	.0339356	3.33	0.001	.0841685
MiPTSD	-.3863453	.1404398	-2.75	0.006	-.1481142
injselfr	5.664994	.5765389	9.83	0.000	.0846981
cumdose2	.2277357	.0828784	2.75	0.006	.0101393
depagw1	.1972332	.0313828	6.28	0.000	.1791843
fdferw1	.0612467	.0099034	6.18	0.000	.0747488
PTSDw3	.6515214	.2195371	2.97	0.003	.1781555
anxagw2	.1739946	.0178123	9.77	0.000	.1263932
cumdose1	6.47391	1.559004	4.15	0.000	.1146665
cataw1	3.474968	1.523748	2.28	0.023	.0355192
Vodkaw1	3.696834	.6722811	5.50	0.000	.1216093

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Table 10 Total effects continued:

(Std. Err. adjusted for 362 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Vodkaw2 <-					
crhrw1	-.068062	.0465541	-1.46	0.144	-.0689208
crhrw2	.0705797	.0460424	1.53	0.125	.0658583
depagw2	.0005573	.0001012	5.51	0.000	.0115772
Vodkaw2	.0022809	.0008099	2.82	0.005	.0022809
fdferw2	.0004822	.0000999	4.83	0.000	.0132027
PTSDw1	5.21e-06	.0000302	0.17	0.863	.0001857
anxagw1	-.000012	.0000259	-0.46	0.644	-.0004569
injselfr	-.0063342	.0085239	-0.74	0.457	-.0031515
cumdose2	.0028681	.0010438	2.75	0.006	.0042492
depagw1	.0002135	.0000354	6.03	0.000	.0064532
fdferw1	-.0000241	.0000908	-0.27	0.790	-.0009802
anxagw2	.0002701	.0000394	6.86	0.000	.0065292
cumdose1	.0088061	.0067769	1.30	0.194	.0051904
cataw1	-.0295719	.0179777	-1.64	0.100	-.0100586
Vodkaw1	.8187381	.0754757	10.85	0.000	.8962449
fdferw2 <-					
crhrw1	-2.011499	.1499055	-13.42	0.000	-.0743967
crhrw2	-3.716625	1.724252	-2.16	0.031	-.1266682
depagw2	-.0293454	.0053294	-5.51	0.000	-.0222669
Vodkaw2	-.1201112	.0426483	-2.82	0.005	-.004387
fdferw2	-.0253934	.005261	-4.83	0.000	-.0253934
PTSDw1	.1213158	.0420996	2.88	0.004	.1579854
anxagw1	.0888608	.0190468	4.67	0.000	.1237761
injselfr	-3.190799	.3379383	-9.44	0.000	-.0579838
cumdose2	-.1510281	.0549627	-2.75	0.006	-.0081727
depagw1	.1028252	.0094489	10.88	0.000	.113541
fdferw1	.3271688	.0416215	7.86	0.000	.4853175
anxagw2	-.0142232	.0020728	-6.86	0.000	-.0125579
cumdose1	1.535048	.8531069	1.80	0.072	.0330464
cataw1	6.899171	1.797879	3.84	0.000	.0857122
Vodkaw1	.7325007	.362736	2.02	0.043	.0292872

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Table 10 Total effects continued:

(Std. Err. adjusted for 362 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
BSIdep <-					
crhrw1	.3029518	.0735126	4.12	0.000	.0765582
crhrw2	1.03332	.0613197	16.85	0.000	.2406235
crhrw3	.8494106	.1989439	4.27	0.000	.20192
PTSDw2	-.0021862	.0007629	-2.87	0.004	-.0048973
BSIanx	.0518185	.0068401	7.58	0.000	.0507123
depagw2	.0197019	.0017368	11.34	0.000	.1021441
depagw3	.020908	.0038337	5.45	0.000	.1167326
whpsleep	.0157196	.0018506	8.49	0.000	.1305444
Vodkaw2	.8782755	.2543839	3.45	0.001	.2191813
fdferw2	.009594	.0015868	6.05	0.000	.0655518
BSIdep	.0265936	.0031505	8.44	0.000	.0265936
PTSDw1	.0069797	.002118	3.30	0.001	.0621045
anxagw1	.0043962	.0012195	3.60	0.000	.0418402
whpel	.0341036	.0055537	6.14	0.000	.314645
anxagw3	.0060222	.0021411	2.81	0.005	.0372448
MiPTSD	-.0061093	.0022208	-2.75	0.006	-.0194505
injselfr	.8493619	.0914531	9.29	0.000	.1054592
cumdose2	.0419898	.0152811	2.75	0.006	.0155252
depagw1	.0155217	.0013673	11.35	0.000	.1171052
fdferw1	.0068411	.0010375	6.59	0.000	.069337
PTSDw3	.0642593	.0249037	2.58	0.010	.145923
anxagw2	.0144466	.0013746	10.51	0.000	.0871511
cumdose1	1.144821	.3945761	2.90	0.004	.1683934
cataw1	-.035302	.1605098	-0.22	0.826	-.0029966
Vodkaw1	.7628306	.2088894	3.65	0.000	.2083927
PTSDw1 <-					
depagw1	.5460726	.0759595	7.19	0.000	.4630247
cumdose1	11.84727	4.232877	2.80	0.005	.1958491
cataw1	39.20859	5.376336	7.29	0.000	.3740483
Vodkaw1	3.820257	1.518111	2.52	0.012	.1172906
anxagw1 <-					
PTSDw1	.3374853	.0701705	4.81	0.000	.3155204
depagw1	.7245691	.0741638	9.77	0.000	.574389
cumdose1	10.32556	3.781678	2.73	0.006	.1595841
cataw1	19.74469	4.11913	4.79	0.000	.1761041
Vodkaw1	5.068996	1.963597	2.58	0.010	.1455007

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Table 10 Total effects continued:

(Std. Err. adjusted for 362 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
whpel <-					
crhrw1	1.134798	1.010926	1.12	0.262	.0310825
crhrw2	3.931119	.7654516	5.14	0.000	.0992199
crhrw3	.6623615	.1551344	4.27	0.000	.0170662
PTSDw2	-.0297455	.0103796	-2.87	0.004	-.0072221
BSIanx	1.55985	.2059034	7.58	0.000	.1654592
depagw2	.1764904	.0196296	8.99	0.000	.0991758
depagw3	.2849252	.078504	3.63	0.000	.1724208
whpsleep	.4731938	.0557083	8.49	0.000	.4259278
Vodkaw2	1.923363	.5076293	3.79	0.000	.0520252
fdferw2	.0467147	.0154536	3.02	0.003	.0345954
BSIdep	.800527	.0948371	8.44	0.000	.0867672
PTSDw1	.1821522	.0553052	3.29	0.001	.17567
anxagw1	.0310589	.0107444	2.89	0.004	.0320388
whpel	.0265936	.0043307	6.14	0.000	.0265936
anxagw3	.0819378	.0289823	2.83	0.005	.0549251
MiPTSD	-.1839041	.0668507	-2.75	0.006	-.0634614
injselfr	2.846072	.318	8.95	0.000	.0383016
cumdose2	.1597442	.0581347	2.75	0.006	.0064017
depagw1	.2332549	.0219636	10.62	0.000	.1907426
fdferw1	.0304511	.0045085	6.75	0.000	.0334519
PTSDw3	.3162505	.1045971	3.02	0.002	.0778393
anxagw2	.1666476	.0143352	11.63	0.000	.1089643
cumdose1	5.643519	1.63977	3.44	0.001	.0899739
cataw1	7.646529	2.51026	3.05	0.002	.0703516
Vodkaw1	2.716841	.5630276	4.83	0.000	.0804448
anxagw3 <-					
crhrw1	-2.251468	.7190227	-3.13	0.002	-.0919978
crhrw2	3.013751	.647007	4.66	0.000	.113476
PTSDw2	-.3878202	.1353285	-2.87	0.004	-.1404712
depagw2	.2398002	.0430143	5.57	0.000	.2010241
depagw3	.5028856	.0862098	5.83	0.000	.4539856
Vodkaw2	.9815072	.3485072	2.82	0.005	.0396059
fdferw2	.0286929	.0047246	6.07	0.000	.0316995
PTSDw1	.0342444	.0196175	1.75	0.081	.0492682
anxagw1	.210701	.0383643	5.49	0.000	.3242434
anxagw3	.0682998	.0425756	1.60	0.109	.0682998
injselfr	.1419408	.3174049	0.45	0.655	.0028497
cumdose2	.1224662	.0445683	2.75	0.006	.0073216
depagw1	.2444495	.0247997	9.86	0.000	.2982084
fdferw1	.0091483	.0039828	2.30	0.022	.0149925
PTSDw3	.2323467	.1163781	2.00	0.046	.0853135
anxagw2	.8293894	.063405	13.08	0.000	.8090165
cumdose1	3.317559	1.222558	2.71	0.007	.0789041
cataw1	2.683964	1.594554	1.68	0.092	.0368384
Vodkaw1	3.20563	1.408735	2.28	0.023	.1415993

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Table 10 Total effects continued:

(Std. Err. adjusted for 362 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
MiPTSD <-					
crhrw1	-1.262938	.7378226	-1.71	0.087	-.1002448
crhrw2	2.932996	.8016982	3.66	0.000	.2145241
crhrw3	.7941665	.1860049	4.27	0.000	.0592973
PTSDw2	-.0235534	.0082189	-2.87	0.004	-.0165722
BSIanx	1.870249	.2455059	7.62	0.000	.5748963
depagw2	.1681556	.0373156	4.51	0.000	.2738281
depagw3	.0959824	.0180021	5.33	0.000	.1683187
whpsleep	.0807697	.01596	5.06	0.000	.2106821
Vodkaw2	2.128235	.566931	3.75	0.000	.1668222
fdferw2	.1287518	.0241653	5.33	0.000	.2763117
BSIdep	.9598258	.113709	8.44	0.000	.3014769
PTSDw1	.0454014	.0171182	2.65	0.008	.1268862
anxagw1	.0458941	.0180949	2.54	0.011	.1371921
whpel	.0318856	.0051925	6.14	0.000	.0924009
anxagw3	.0648809	.0194815	3.33	0.001	.1260333
MiPTSD	-.2204997	.0801535	-2.75	0.006	-.2204997
injselfr	.8383846	.2596494	3.23	0.001	.0326961
cumdose2	.1191847	.0433741	2.75	0.006	.0138413
depagw1	.0929591	.0298203	3.12	0.002	.2202881
fdferw1	.0508818	.0070227	7.25	0.000	.1619803
PTSDw3	.3887892	.0742337	5.24	0.000	.2773088
anxagw2	.012886	.0357641	0.36	0.719	.0244167
cumdose1	3.478359	.8622135	4.03	0.000	.1607027
cataw1	-1.673444	1.387116	-1.21	0.228	-.0446173
Vodkaw1	1.597934	.4027451	3.97	0.000	.1371118
injse~r <-					
PTSDw1	.001007	.0002094	4.81	0.000	.0721662
anxagw1	.0029839	.0005799	5.15	0.000	.2287212
depagw1	.0021621	.0002213	9.77	0.000	.1313749
fdferw1	.0015706	.0006401	2.45	0.014	.1282081
cumdose1	.0308106	.0127839	2.41	0.016	.0365003
cataw1	.0589165	.0170264	3.46	0.001	.0402787
Vodkaw1	.0151255	.0066733	2.27	0.023	.0332791
cumdo~2 <-					
cumdose1	2.188894	.0836046	26.18	0.000	.8708001
depagw1 <-					
cumdose1	11.71117	4.252571	2.75	0.006	.2283232
cataw1	12.05375	4.692115	2.57	0.010	.1356172
Vodkaw1	6.995877	2.674015	2.62	0.009	.2533139

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Table 10 Total effects continued:

(Std. Err. adjusted for 362 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
cumdo~3 <-					
cumdose2	1.231235	.0359156	34.28	0.000	.9679575
cumdose1	2.695043	.1392837	19.35	0.000	.8428975
fdferw1 <-					
PTSDw1	.1005493	.0209064	4.81	0.000	.0882723
anxagw1	.2979369	.0570277	5.22	0.000	.2797673
depagw1	.2158758	.0220961	9.77	0.000	.1606952
cumdose1	3.076366	1.253654	2.45	0.014	.0446464
cataw1	5.882672	1.780709	3.30	0.001	.0492682
Vodkaw1	1.510241	.6474416	2.33	0.020	.0407063
PTSDw3 <-					
crhrw1	-.7049673	.2358145	-2.99	0.003	-.0784512
crhrw2	.8717156	.2216259	3.93	0.000	.0893902
PTSDw2	-.0080959	.002825	-2.87	0.004	-.0079862
depagw2	.1053293	.0117754	8.94	0.000	.2404731
depagw3	.1642012	.0441687	3.72	0.000	.4037084
Vodkaw2	.4311151	.1530775	2.82	0.005	.0473781
fdferw2	.0409945	.0156859	2.61	0.009	.123345
PTSDw1	.0021865	.0046807	0.47	0.640	.0085675
anxagw1	.0164524	.0054493	3.02	0.003	.0689528
anxagw3	.0223011	.0139017	1.60	0.109	.0607359
injselfr	.0072081	.0954708	0.08	0.940	.0003941
cumdose2	.0354229	.0128912	2.75	0.006	.0057675
depagw1	.0515001	.0067778	7.60	0.000	.171103
fdferw1	.0338787	.0103168	3.28	0.001	.1512088
PTSDw3	.0048503	.0024294	2.00	0.046	.0048503
anxagw2	.0659387	.0072626	9.08	0.000	.1751694
cumdose1	.6925846	.3060572	2.26	0.024	.0448613
cataw1	.2929954	.3141094	0.93	0.351	.0109522
Vodkaw1	.3465579	.1984351	1.75	0.081	.041691
anxagw2 <-					
PTSDw1	.0959803	.0199564	4.81	0.000	.1415665
anxagw1	.2843984	.0468098	6.08	0.000	.4486761
depagw1	.2060663	.0210921	9.77	0.000	.2577146
cumdose1	2.936574	1.195044	2.46	0.014	.0716016
cataw1	5.615359	1.519635	3.70	0.000	.0790137
Vodkaw1	3.689254	1.56098	2.36	0.018	.1670658

10.7 Cyclical contribution to persistence

10.7.1 Wave 3 self-reported depression - anxiety cycle

When review Figure 6 on page 56, we can identify two feedback cycles. The first of these cycles exists between expressions of anxiety in wave 3 and self-reports of depression in the same wave. The second is the relationship between BSI anxiety and the Chornobyl MiPTSD at the time of the interview. Ordinarily, we assume that there is no reverse causation in the path diagram, except in cases where we find arrows pointing to the other of two variables. If one arrow is called β_1 and the other arrow is called β_2, these two arrows identify a situation of reciprocal causation. Under these circumstances, the feedback, holding all other effects constant, is defined by

$$(I - \beta_1\beta_2)^{-1} = 1 + \beta_1\beta_2 + (\beta_1\beta_2)^2 + (\beta_1\beta_2)^3 + \cdots \tag{2}$$

We can graph the decay rate of these effects. First consider the wave 3 cycle between self-reported depression and self-reported anxiety. We can examine the reciprocal effects on the reciprocal effects of a unit impulse on the β_i parameters.

On page 95 and 91, respectively, we find

anxagw3 = 0.453*depagw3
depagw3 = 0.163*anxagw3

which generates the direct effect decay depicted in Figure 5.

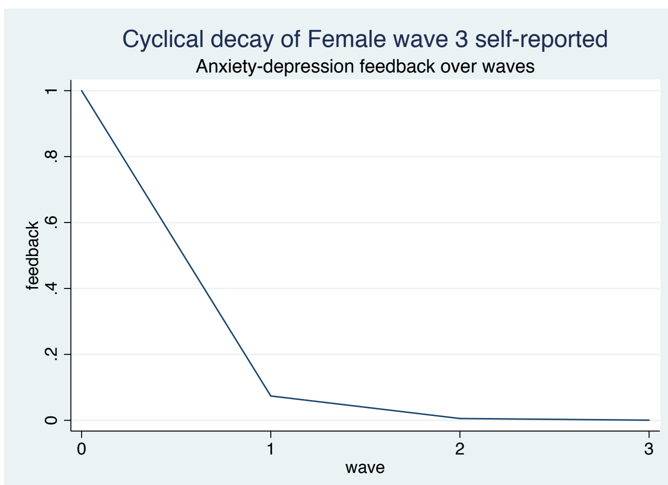

Figure 5: Wave 3 Depression anxiety cyclical decay among women

If we make the assumption that the indirect effects of a variable upon itself through other variables are more or less immediate and occur during the same wave, we may observe feedback of those direct effects along with the indirect effects of the variable upon itself. If we add to those direct effects, the indirect effects of the variable upon itself mediated by other variables, with an assumption of a unit impulse on both depagw3 and anxagw3 on pages 91 and 95 we observe the decay depicted in Figure 6 which boosts the fist impulse to delay the decay slightly.

(1- 0.069)anxagw3 = .453*depagw3
(1-0.069)depagw3 = .163*anxagw3

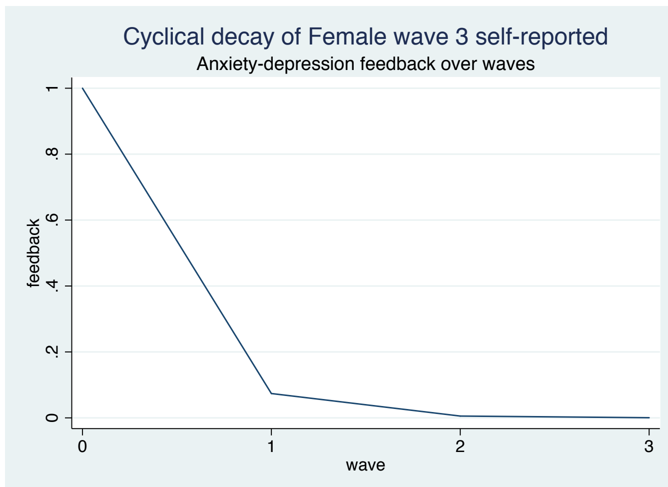

Figure 6: Wave 3 Feedback of depression- anxiety total effects cyclical decay among women

The assumption required for recycling the total rather than the direct effects requires that the indirect effects of the variable upon itself through other variables takes place during the same wave, an assumption that may not be warranted. Be that as it may, the delay in decay provides for persistence of the effects on women that has implications for the recovery of victims of these effects.

10.7.2 Current BSI anxiety- MiPTSD cycle

From pages 90 and 96, we can obtain the standardized coefficients needed for formulation of persistence of reciprocal direct effects.

$$(I - \beta_1\beta_2)^{-1} = 1 + \beta_1\beta_2 + (\beta_1\beta_2)^2 + (\beta_1\beta_2)^3 + \cdots \tag{3}$$

and they are

$$\begin{aligned} BSIanx &= -0.287 * MiPTSD \\ MiPTSD &= 0.578 * BSIanx \end{aligned} \tag{4}$$

If we partial out the cyclical effect from others in the model, the decay should resemble an exponentially declining undulation owing to the negative sign before the effects by graphically approximating $(1 + (-.287) * (.578) + \{(-.287) * (.578)\}^2 + \{(-.287) * (.578)\}^3 + \cdots$ depicted in Figure 7. Usually negative feedback reduces persistence and contributes to a more short-lived effect.

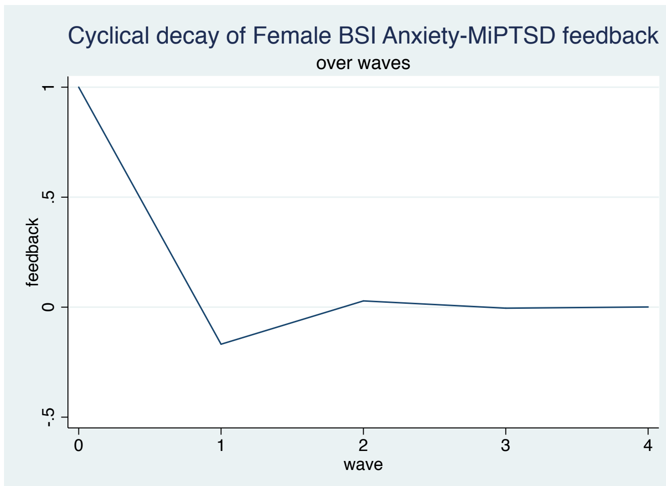

Figure 7: Undulating decay of Anxiety-PTSD feedback cycle among women

Because the assumption required to add the indirect effects of the variable upon itself mediated by others may well require a delay, we will not belabor the delayed decay of the reciprocal effect at this point.

10.8 Hypothesis recapitulation

We use the last two tables of this report to summarize the direct and indirect effect findings. Within those table an arrow signifies the direction of a relationship going from the point of origin to the target endogenous variable. A negative sign indicates an inverse relationship, such that if one variable increases, the associated variable decreases.

In the female model we observe no evidence to support hypothesis 3 that radiation directly predicts Chornobyl PTSD as measured by the revised civilian Mississippi PTSD scale.

Nor did we find evidence to support hypothesis 6 that perceived risk of exposure predicts PTSD either.

Moreover, we find no evidence in support of hypothesis 12 that radiation direct predicts substance abuse. There is no path coming from cumulative external dose in wave 1 or later to support this hypothesis.

In support of hypothesis 16, that perceived risk of exposure predicts substance abuse, we find one statistically significant direct path from perceived risk of exposure in wave 1 ($crhrw1$ $stdized$ $\beta = -0.110,\ p = 0.020$). The relationship is a statistically significant inverse rather than a direct one. Vodka consumption appears to dulls the awareness of perceived risk. Perhaps the more one drinks the less one is aware of any risk in the midst. The path emanating from perceived Chornobyl health risk in the following decade is not statistically significant ($crhrw2$ $stdized$ $\beta = 0.067,\ p = 0.123$). Moreover, there is no supporting a relationship in wave 3. Therefore, hypothesis 16 appears partly supported by the evidence in 1986. After 1986 this concern seems to have disappeared.

Table 11: Hypothesis Direct effect test result summary table

Hyp #	**Exog. var**	**Endog. var**	**Gender**	**General Result**	**effect(s) confirmed**
3	dose	MiPTSD	male	unsupported	none
3	dose	MiPTSD	female	unsupported	none
4	dose	BSI	male	unsupported	none
4	dose	BSI	female	partial	(cumdose1 $\rightarrow BSIdepw1$)
5	perceived risk	BSI	male	partial	(BSIanxw2)
5	perceived risk	BSI	female	partial	(crhrw1 $\rightarrow -BSIanxw1$)
5	perceived risk	BSI	female	partial	(crhrw2 $\rightarrow BSIanx2$)
6	perceived risk	PTSD	male	unsupported	none
6	perceived risk	PTSD	female	unspported	none
8	perceived risk	Nottingham	male	partial	(crhrw2 $\rightarrow whpsleep$)
8	perceived risk	Nottingham	female	partial	(crhrw1 $\rightarrow whpsleep$)
12	dose	substance abuse	female	unsupported	none
16	perceived risk	substance abuse	female	partial	(crhrw1 $\rightarrow -vodkaw1$)

10.8.1 Hypothesis 20: Nottingham health mediates a dose-substance abuse relationship

Only two of our hypotheses pertain to indirect effects concerning the variables in the female model. They are hypothesis 20 and 24, which pertain to substance abuse (involving drinking and/or smoking abuse). Although we deal with substance abuse with both drinking and smoking in another analysis, in this analysis we have in the female model only vodka consumption variables (number of vodka drinks per week). Because we only have variables pertaining to part of the hypothesis in the female model, at the most there can be only a partial testing of the hypothesis in this model. Nonetheless, we examine the relationship that emerged as part of the model.

Hypothesis 20 refers to dose and perceived risk being exogenous variables, Nottingham variables serving as mediators, and (smoking and/or drinking) being the target endogenous variables, respectively. Therefore, there are at least two indirect links to confirm as statistically signification. One of these extends from the point of origin (dose) to the mediator under consideration (either sleep or energy level). The other indirect path extends from the mediator to the target endogenous variable (drinking in this case). These are indirect paths because other intermediating variables may be inter-positioned between the point of origin and the point of destination, permitting multiple orders of mediation.

For the data in Table reffidnhsmdr, we have to turn to Table 9 first. This is where the data are for indirect effects. In the Vodkaw2 panel on page 83 panels, we have to look for any cumdose to find out whether there is such a point of origin from which an indirect path may extend to the Vodkaw2 endogenous variable.

We are do discover such a path. Although there is no statistically significant cumdose1 path (p = 0.194), but is a significant path originating in external dose in wave 2 $cumdose2\ stdized\ \beta = 0.004,\ p = 0.006$). Nor is there a significant cumdose3 path. Therefore, only a wave 2 cumulative dose point of origin would work for radiation dose if hypothesis 20 were to be partly true.

If hypothesis 20 is consistent with the data, there would be an indirect significant path also from the Nottingham sleep or energy level measure under consideration to the point of origin. We have found a possible source in cumdose2. When we go to page 82 and examine the Nottingham sleep panel, we find a significant indirect path for cumdose2 $cumdose2\ stdized\ \beta = 0.010,\ p = 0.006$).. Therefore, we find evidence of possible sleep mediation of an indirect path between Vodka consumption in the decade after Chornobyl and reconstructed external dose. Next we turn to page 85 and examine the energy level panel, within which we find a significant indirect path originating in cumdose2 (cumdose2 stdized $\beta = 0.006, p = 0.006$).. It appears that there is reason to believe that there are significant indirect paths from vodka in wave 2 to the Nottingham measures of sleep and energy level, from which there are significant indirect paths to radiation dose as measured by cumulative external dose in wave 2. Insofar as the hypothesis 20 is confirmed for wave 2, we have to say that the data are consistent with hypothesis 20. In the table below, we call this partial confirmation of both sleep and energy level mediating paths.

10.8.2 Hypothesis 24: Nottingham health mediates a perceived risk -substance abuse relationship

As for hypothesis 24, we use the same table 9 in which to look for our evidence. For hypothesis 24, we search for a statistically the Vodkaw2 panel on page 83 for evidence of a statistically significant path originating in one or more of the perceived risk waves. We find a statistically significant indirect path originating in crhrw1 (crhrw1 stdized $\beta = 0.039, p = 0.000$)., and we find a statistically borderline significance in the next wave ($crhrw2\ stdized\ \beta = -0.002,\ p = 0.051$). The first wave exhibits a positive (direct) relationship, whereas the second wave exhibits a possible inverse relationship. Perhaps the less the perceived risk, the more relaxed the person may become and the less use he may have of escape.

For confirmation that hypothesis 24 is mediated by Nottingham health measures we go to the indirect effects sleep panel first, on page 82, where we identify a nonsignificant crhrw1 path ($crhrw1$ $stdized$ $\beta = -0.073, p = 0.054$), and a significant path for waves2 $crhrw2$ $stdized$ $\beta = .157, p = 0.000$, not to mention a significant one at wave 3 as well. But only the wave 1 indirect path must be significant for this link to be be activated. Yet that is not possible if the wave 1 indirect path is not statistically significant, which in this case it is not.

In this case, we turn to the energy level indirect path panel on page 85. In this case, we note that indirect path for wave 1 perceived risk is not statistically significant so the link cannot be completed. The Nottingham health measures do not mediate the relationship between perceive risk and Vodka consumption on the part of the females. Hypothesis 24 appears to be inconsistent with the data.

Table 12: Indirect effect hypothesis test result summary table

Hyp #	**Ex. var**	**End. var**	**Gender**	**General Result**	**effect(s) confirmed**
20	dose	Ntm med sub abuse	female	partial confirmation	wave 2 confirmed
24	perceived risk	Ntm med sub abuse	female	disconfirmed	No Nottingham mediati

11 Directions for future research

The impulse response functions characterizing the cyclical decay of effects are the products of linear effects. In future time, we could examine possible non-linear relationships contributing to these cycles. A Granger Causality tests between self-reported anxiety and PTSD suggest that simultaneous equation models would be needed between anxiety and PTSD at every wave. Granger causality tests between self-reported depression and PTSD suggest reciprocal relationships might exist at waves 2 and 3 between these factors. The same holds for reciprocal relationships between anxiety and depression at waves 2 and 3. There appears to be a basis for believing that these cycles are multi-variable in nature and we should explore these relationships in greater detail in future research.

A closer inspection reveals that within this model exhibits the same feedback loops between depression and ptsd self-reports during wave 2 and more current BSI anxiety and Nottingham energy level that we found in the male model. It may be that depression and PTSD are intertwined in a way that is similar to anxiety and energy level within PTSD. These interrelationships invite future inquiry into the dynamics of their interaction within the PTSD syndrome.

In future research, we should explore the cyclical differences at every wave in these reciprocal relationships. Moreover, we could explore the closed system assumption with a broader test of exogeneity of reconstructed dose and other endogenous variables in the modoel.

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