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

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1 Acknowledgements

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2 Notes for revision of version 9 to version 10

Fix the arrows in the sem builders so they only point up to the present. They should not go backward. Include the time series analysis from the AutoMetrics and from the tsanalysisPTSD.do in the timeSeries folder.

3 Introduction

In this analysis we examine some plausible causal etiological paths of anxiety among residents of Zhitomyr and Kiev Oblasts in the years since Chornobyl. We will focus on omnibus measures of fit, as well as statistically significant paths, broken down into direct, indirect, and total effects. We employ path analysis to allow us to find out which variables are mediating ones and which have direct effects. The path analysis permits us to decompose total into direct, indirect, and spurious effects. In the previous section on our path analysis of depression,

Table 1: Related files

File Type	Name	Version	Gender
dofile	recomputingsubabuse.do	10	both
sembuilder	H3H6PTSDmaleV10.stsem	10	male
sembuilder		10	female
output	H3H6malePTSDV10.smcl	10	male
pathdiags	H3H6malePTSDV10pd.pdf	10	male
output	overallvar.smcl	1	both
output	mptsd.out	1	male
report	H3H6pathanalysisPTSDV10.tex	10	both
data	chwide5sep2012.dta	10	both

we introduced the nomenclature we use and the basis for path analysis. In our presentation of the PTSD models we were able to generate both conventional and robust models. Although we graph the conventional model, we rely on robust standard errors wherever possible, so tables for both types of standard error are presented.

4 Path analysis

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.

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

6 Limitations of path models

Structural equation models are not designed to distinguish direct from indirect effects but they are not always optimal for handling a large network of 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 such specification error, we included the apparently relevant variables. This mandated inclusion of the variables necessary for testing the hypothesis plus those potentially related to the primary target endogenous variable. 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.

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 suggested a Bayesian vector autoregression would provide a more realistic framework from which to develop models [10].

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]. As George Box wrote, "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.

7 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.

8 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.

9 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.

10 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

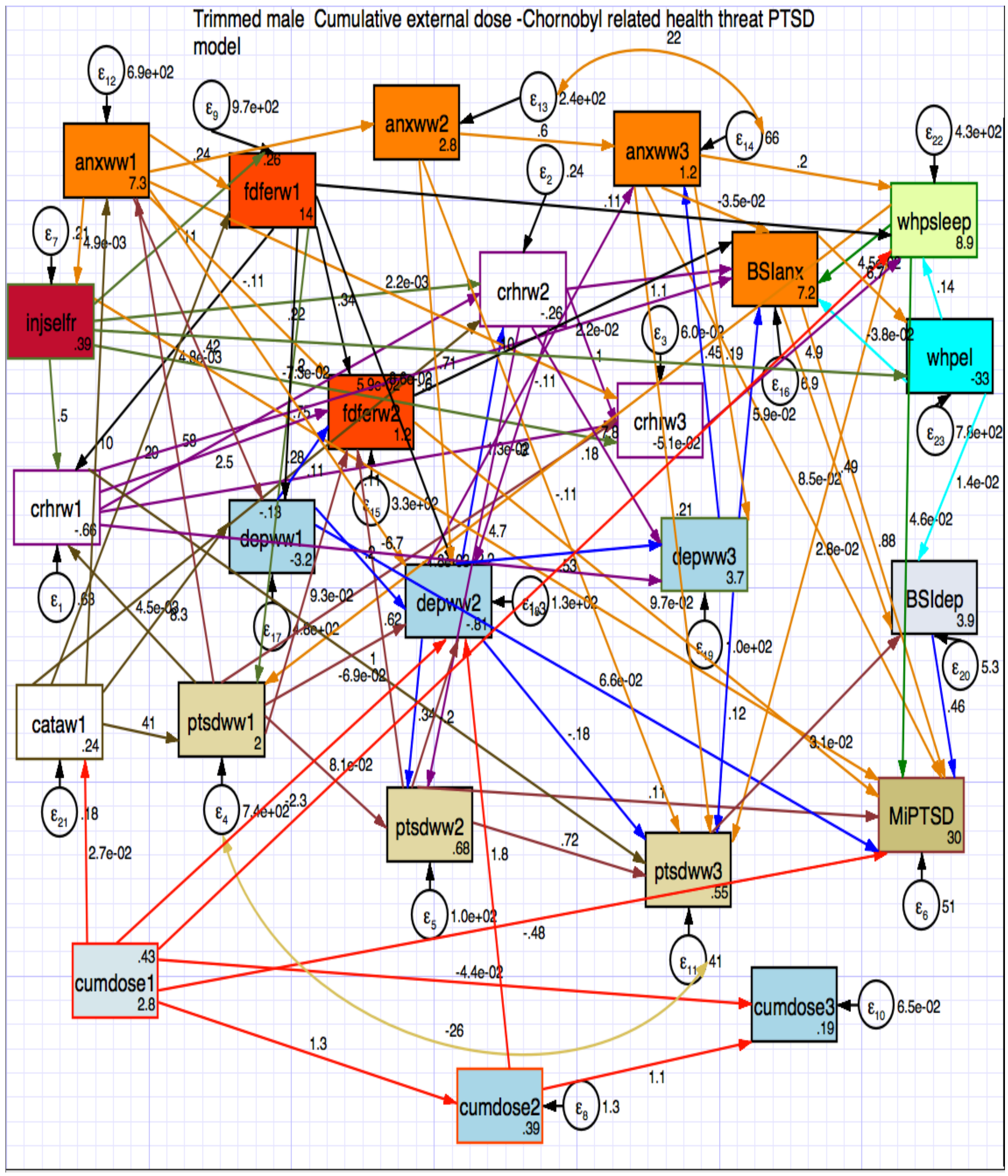

Figure 1: Pathways to PTSD among male respondents

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

10.1 Direct effects on Chornobyl PTSD among males

10.1.1 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 with the source (starting point) of the direct effect identified in the left hand column in the panel for the endogenous variable.

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

10.1.2 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 5 appears to be inconsistent with our data for male respondents.

10.1.3 Hypothesis 5: Perceived risk direct 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.

10.1.4 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.

10.1.5 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.

10.2 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.

10.2.1 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.

10.2.2 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

10.2.3 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.

In terms of indirect impacts of the BSI anxiety and depression, they are in the bottom tier in terms of magngitude of indirect impacts on PTSD.

10.3 Total effects on male PTSD

To fully test the effects of hypothesis 3 and 6, 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.

10.3.1 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.

10.3.2 Total effects of cumulative external dose on male PTSD

According to the results in the MiPTSD panel of Table 5, the total effect of cumulative external dose in milliGrays on average PTSD from 1986 is not statistically significant by our robust estimates ($cumdose1\ standardized\ \beta = 0.0187,\ z = 0.30,\ p = 0.768$). However, after a decade following Chornobyl, the reconstructed cumulative dose effect on PTSD is found to be statistically significant according to our robust estimates ($cumdose2\ standardized\ \beta = 0.080, z = 4.49, p = 0.000$.) This appears counterintuitive until we recall that there was no direct effect path for cumdose2 and that the total effect consists of a sum of products of multiple alternative paths through which this effect could travel and that the total effect of cumdose2 is actual a hybrid total effect of a variety of more than seven mediated paths.

10.3.3 Total effects of perceived risk of exposure on male PTSD

To the extent that the total effects are comprised of mediated effects, these results could be the end-result of a myriad of mediations through which effects can find their way to PTSD appearing to be latent for some time until they emerge as statistically significant. One way to do this could be to examine the wave 1 mediators and compare them to the wave 2 mediators to discover whether the wave 2 mediators potentiate the effect, where some of the wave 1 mediators might suppress the effect.

10.3.4 Other interesting total effects on male PTSD

We sort the total effects according to decreasing size and observe which ones require more pressing attention. How can we compare the effects. We see that the top four effects are all wave 1 effects. The next three effects down the list are all wave 2 effects. The wave three effects are scattered through the remainder of the list.

For the sake of a rough comparison, we arbitrarily assume arguendo that these total effects are independent of one another, even though they are not unconnected. We can, given that assumption, we tally their sums and compare them according to wave. We also assume that the BSI and Nottingham scales represent the current time. When we tally their sums, we find that the current time sums comprise the smallest of all of the waves.

Therefore, we divide all other sums by the sum of the current time total effects on PTSD and find that the wave 1 effects would be about 9.7 times the size of the current BSI and whp effects. The wave 2 effects would be approximately 4.2 times that size, and the wave 3 effects would be about 1.3 times that size. This gives us a very rough approximation of the total impact from each wave, with the current time total effects serving as a baseline for the ratios.

10.3.5 Self-reported male Depressive - PTSD symptoms cycle: Implications for persistence

We might ask whether the dynamics of these models contribute to the persistence of effects, apart from the qualitative nature of trauma itself. Are there impulse-response effects that feedback upon themselves to contribute to a gradual attenuation of an effect among males rather than an immediate one? We relax the assumption that the waves possess the same length of time, so we can graph the feedback effect. For simplification of presentation, we can also assume that there is an impulse of one unit through each of the variables in the loop at time 0, to observe the decay.

If we re-examine Figure 5, we find two feedback loops that could account for some persistence of effect owing to an autoregressive feedback process underway. The first of these cyclical processes occurs in the decade following Chornobyl between self-expressed depressive symptoms (depagw2) and self-reported PTSD systems also in wave 2 (PTSDw2), whereas the second one occurs between Nottingham energy level (whpel) and BSI depression (BSIdep) at the current time.

Let us consider the first depression-PTSD cycle in wave 3. Variables in feedback loops have indirect effects upon themselves. Therefore, in a cyclical analysis, we examine the decay of the cycle of an impulse-response of a variable upon itself over each wave. So Figure 2 represents the decay of an single impulse.

In the Depression-Anxiety analysis, we examined exclusively the decay rate of cyclical impact of the variable upon itself, and we display that decay rate is in Figure 2. However, if we include not only the direct effect of the impulse of the other variable but the feedback as an indirect effect through the other variable of the variable back onto itself, and then look at the feedback of the total effects, we display that decay in Figure 3.

The differences between the effects are miniscule. The negative product after one wave generates an undulation around the zero level over time. Waves 4 and 5 would be considered forecasts. What is important for us is to see how the level changes after 1 or 2 waves to obtain a general notion of how the response to the cyclical impulses are generally and approximately experienced over time.

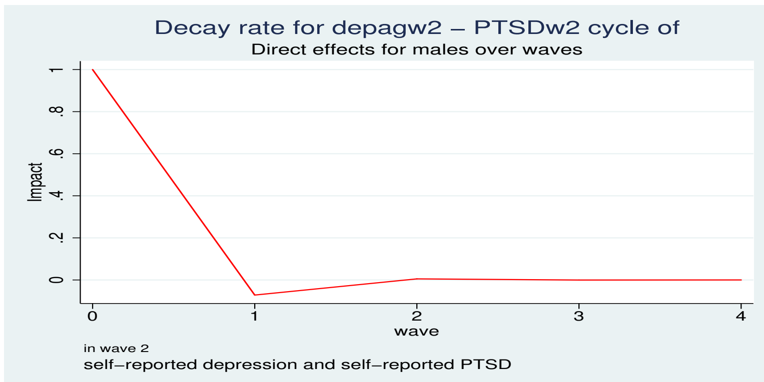

Figure 2: Decay rate of direct effects in Depressive-PTSD wave 2 feedback

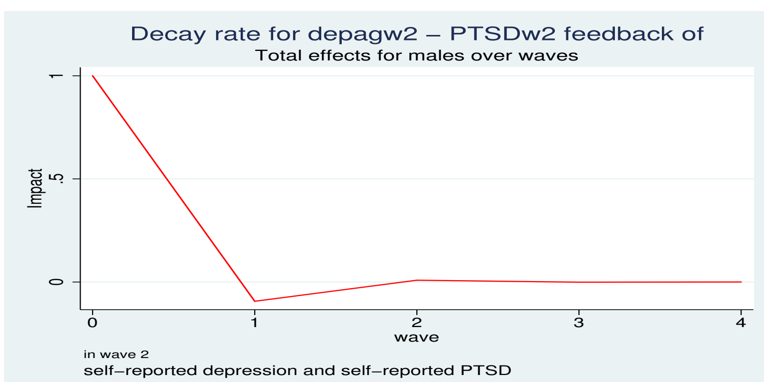

Figure 3: Decay rate of total effects in Depressive-PTSD wave 2 feedback

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

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.
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
catawl	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
catawl	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

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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.
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

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.
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

10.3.6 Energy level- BSI depression cyclical implications for persistence

Another cyclical effect that we want to consider is the impulse - response feedback at the current time between Nottingham energy level and BSI depression. BSI depression is important because it directly impacts MiPTSD. We will examine the cyclical decay of the direct effects and then the cyclical decay of the total effects as we have just one with our wave 2 vicious cycle.

In the BSI depression WHP energy level cycle, the direct effect contains a negative impulse from the BSI depression while the energy level input does not. This generates an undulation in the cyclical decay of the direct effects.

However, when considering the total effect cycle, we find that the total effect inputs both have negative impulses which cancel out the negative signs in the attenuation of the impact. The effect is a more gradual attenuation over the lags (waves), which could account for greater persistence of the depression effect, prior to its impact on PTSD.

Because the stability index is less than unity, these effects attenuate until they become negligible, whether or not they undulate. Nonetheless, the presence of two depression cycles–one with PTSD in wave 2 and the other with energy level at the current time provide for persistence of the effects over time.

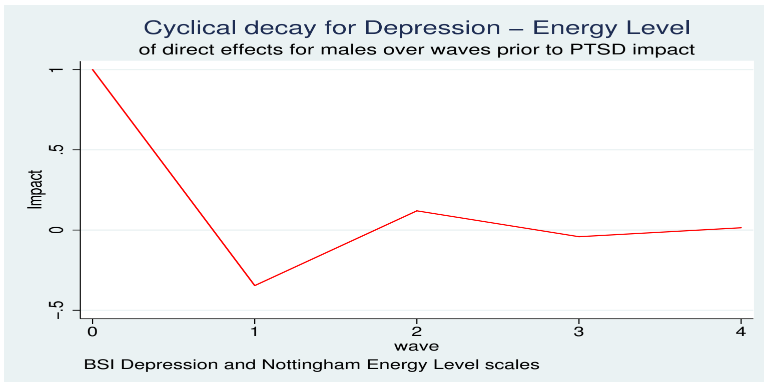

Figure 4: Decay rate of direct effects in Depressive-PTSD wave 2 feedback

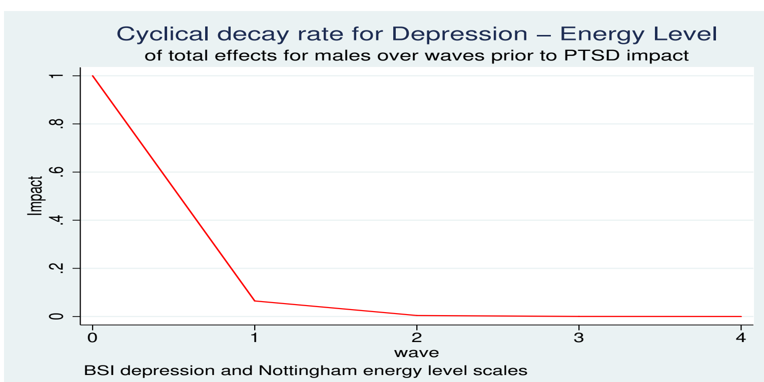

Figure 5: Decay rate of total effects in Depressive-PTSD wave 2 feedback

10.4 A sequential non-nested alternative perspective

Another approach that may be used to assess the impact of these variables. based on a sequence of non-nested regressions. The problem is that our dependent variable is not the same over all three waves. Nor is our cumulative external dose, because in the later model, the newer variable (e.g., MiPTSD replaces PTSDw3 and cumdose2 replaces the cumdose1 and later cumdose3 replaces cumdose2). This non-nesting make nested comparisons inappropriate.

Nevertheless, there is heuristic value in observing parameter stability, with respect to significance and with respect to persistence, and with respect to sign and magnitude.

Several aspects of this model remain stable over time, regardless of wave. The constant is positive and significant throughout the three waves of the model. Cumulative external dose remains unrelated to any of the other variables in the model at the 0.05 level of significance. Self-reported PTSD symptoms generally serve as precursors of the PTSD in the next wave, although this may not be so between self-reported PTSD and current PTSD as defined by the BSI.

The important thing to notice is that these models explain a substantial amount of the variance in the target endogenous variable, although this is less so for wave 2, which means that these models explain much of the PTSD reported and defined by the BSI.

Table 7: Supplementary male PTSD regressions with clustered robust standard errors

	mptsd1 b/t/p	mptsd2 b/t/p	mptsd3 b/t/p	mptsdbsi b/t/p
crhrw1	3.667*	0.508	1.485#	-0.832
	(2.276)	(0.566)	(1.732)	(-1.038)
	(0.023)	(0.572)	(0.084)	(0.300)
depagw1	0.001	0.020	-0.016	0.049*
	(0.019)	(0.527)	(-0.603)	(2.288)
	(0.985)	(0.598)	(0.547)	(0.023)
anxagw1	0.455***	-0.004	0.008	0.026
	(5.691)	(-0.134)	(0.413)	(1.075)
	(0.000)	(0.893)	(0.680)	(0.283)
injselfr	0.843	0.323	1.262#	3.478***
	(0.289)	(0.357)	(1.800)	(3.982)
	(0.773)	(0.722)	(0.073)	(0.000)
fdferw1	0.209***	-0.034#	0.018	-0.008
	(3.573)	(-1.715)	(0.857)	(-0.464)
	(0.000)	(0.087)	(0.392)	(0.643)
cumdose2	-0.118	0.154	1.766	2.353
	(-0.332)	(0.515)	(1.331)	(1.089)
	(0.740)	(0.607)	(0.184)	(0.277)
cataw1	23.533***	-0.764	1.336	-0.469
	(4.884)	(-0.387)	(1.118)	(-0.401)
	(0.000)	(0.699)	(0.264)	(0.689)
PTSDw1		0.051	-0.035#	0.020
		(1.595)	(-1.934)	(0.888)
		(0.112)	(0.054)	(0.375)
crhrw2		0.573	-0.280	-1.524
		(0.574)	(-0.237)	(-0.908)
		(0.567)	(0.813)	(0.364)
depagw2		0.167*	-0.217*	0.008
		(2.131)	(-2.483)	(0.150)
		(0.034)	(0.014)	(0.881)
anxagw2		0.107	-0.136	-0.059
		(1.333)	(-1.512)	(-0.879)
		(0.183)	(0.131)	(0.380)
cumdose1		-0.676#	-0.457#	-1.047#
		(-1.938)	(-1.814)	(-1.909)
		(0.053)	(0.071)	(0.057)
fdferw2		0.152**	0.014	0.099***
		(3.198)	(0.493)	(3.621)
		(0.002)	(0.623)	(0.000)
PTSDw2			0.686***	0.108#
			(8.868)	(1.848)
			(0.000)	(0.065)
crhrw3			-0.685	3.058*
			(-0.818)	(2.034)
			(0.414)	(0.043)
depagw3			0.166#	-0.072
			(1.772)	(-1.212)
			(0.077)	(0.226)
anxagw3			0.249**	0.143#
			(2.772)	(1.691)
			(0.006)	(0.092)

cumdose3			-1.280	-1.845
			(-1.023)	(-0.977)
			(0.307)	(0.329)

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Table 6 continued:

	mptsd1 b/t/p	mptsd2 b/t/p	mptsd3 b/t/p	mptsdbsi b/t/p
PTSDw3				0.011
				(0.153)
				(0.878)
BSIdep				0.440#
				(1.879)
				(0.061)
BSIanx				0.842***
				(3.474)
				(0.001)
whpel				0.030
				(1.603)
				(0.110)
whpsleep				0.026
				(0.964)
				(0.336)
_cons	1.029	0.202	0.010	30.956***
	(0.489)	(0.284)	(0.015)	(18.476)
	(0.625)	(0.777)	(0.988)	(0.000)
r2	0.642	0.435	0.696	0.658
r2_a	0.635	0.412	0.678	0.633
ll	-1547.994	-1244.248	-1121.317	-1138.587
bic	3142.597	2570.061	2353.328	2416.999
N	339	339	339	339

# p<.1, * p<.05, ** p<.01, *** p<.001

10.5 Hypothesis tests for males recapitulated

With respect to hypothesis 3 that radiation as measured by our reconstructed external cumulative dose, we do not find evidence that such exposure explains Chornobyl PTSD on the part of a representative sample of Ukrainian male residents of Kiev and Zhitomyr Oblasts according to the test of our robust estimates. The red arrow from cumdose1 to MiPTSD represents a non-robust estimate of a direct path, and even when the non-robust path appeared to be statistically significant, it was an inverse relationship. Because we insist on the robust estimates, to handle the serial correlation between waves, and probable heteroskedasticity, we use our robust estimates for our hypothesis testing and the p-value of that arrow was (p = 0.077).

As for hypothesis 6, we find that in terms of the direct effects on PTSD, there is no evidence of a statistically significant relationship between the summary score for perceived Chornobyl health risk and Chornobyl PTSD. The evidence suggesting such effects derives from hybrid indirect paths mediated by many other variables at later times, which leads to a significant regression result of perceived risk of exposure being significantly related to MiPTSD. The total effects are comprised to some extent of these hybrid effects, which could be misleading.

To be sure that we had included all of the principal variables in the model that we could and that no variable that we had omitted from this model might be responsible for a spurious model. Such a result could be based on a relationship of antecedent variable related to our one exogenous variable, cumdose1. Therefore, we regressed this cumdose1 on a set of variables that might have predated Chornobyl that might be related to some of our endogenous variables. To test the exogeneity of cumdose1, we regressed it on perceived residential distance from Chornobyl, perceived, perceived work distance from Chornobyl, smoking, drinking beer and hard liquor, distance from Chornobyl in 1986, a general measure of psychological health, the BSI total score, among others. The regression results are shown below in Table 7. From these results, we find no statistically significant result indicating that our one exogenous variable in the male model is other than exogenous, such that our model could be the result of a spurious regression condition.

Table 8: Exogeneity for the male model

Table 7 Exogeneity test for male model

	cumdose1 b/t/p
polprw1	0.003
	(1.235)
	(0.218)
ecprw1	-0.000
	(-0.232)
	(0.817)
BSIsoma	-0.045
	(-0.989)
	(0.323)
BSItotal	0.018
	(0.722)
	(0.471)
BSIdep	-0.073
	(-0.739)
	(0.461)
BSIanx	0.021
	(0.657)
	(0.512)
havmil	0.002
	(0.792)
	(0.429)
kmwork	-0.001
	(-0.425)
	(0.671)
kmacc	-0.001
	(-1.045)
	(0.297)
beerw1	0.014
	(0.643)
	(0.520)

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Vodkaw1	0.028
	(1.117)
	(0.265)
smokw1	-0.001
	(-0.313)
	(0.754)
pillw1	0.014
	(0.514)
	(0.607)
medcow1	-0.043
	(-1.541)
	(0.124)
hospw1	0.008
	(1.190)
	(0.235)
MiPTSD	-0.027
	(-0.782)
	(0.435)
PTSDw1	0.004
	(0.639)
	(0.523)
whpsleep	0.007
	(1.089)
	(0.277)
whpel	0.003
	(0.661)
	(0.509)
_cons	1.018
	(1.241)
	(0.216)
r2	0.061
r2_a	0.004
ll	-636.789
bic	1389.800
N	334.000

* p<.05, ** p<.01, *** p<.001

There remains another question. Do we have superexogeneity? Can we use this as a basis for prediction. We use the nowcasting approach to test the weak nowcast rationality as a basis for ascertaining whether we might be able to use it for forecasting. We would also ascertain whether the errors are correlated across the equations to allow forecasting.

11 Female PTSD path model

In Figure 6, 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

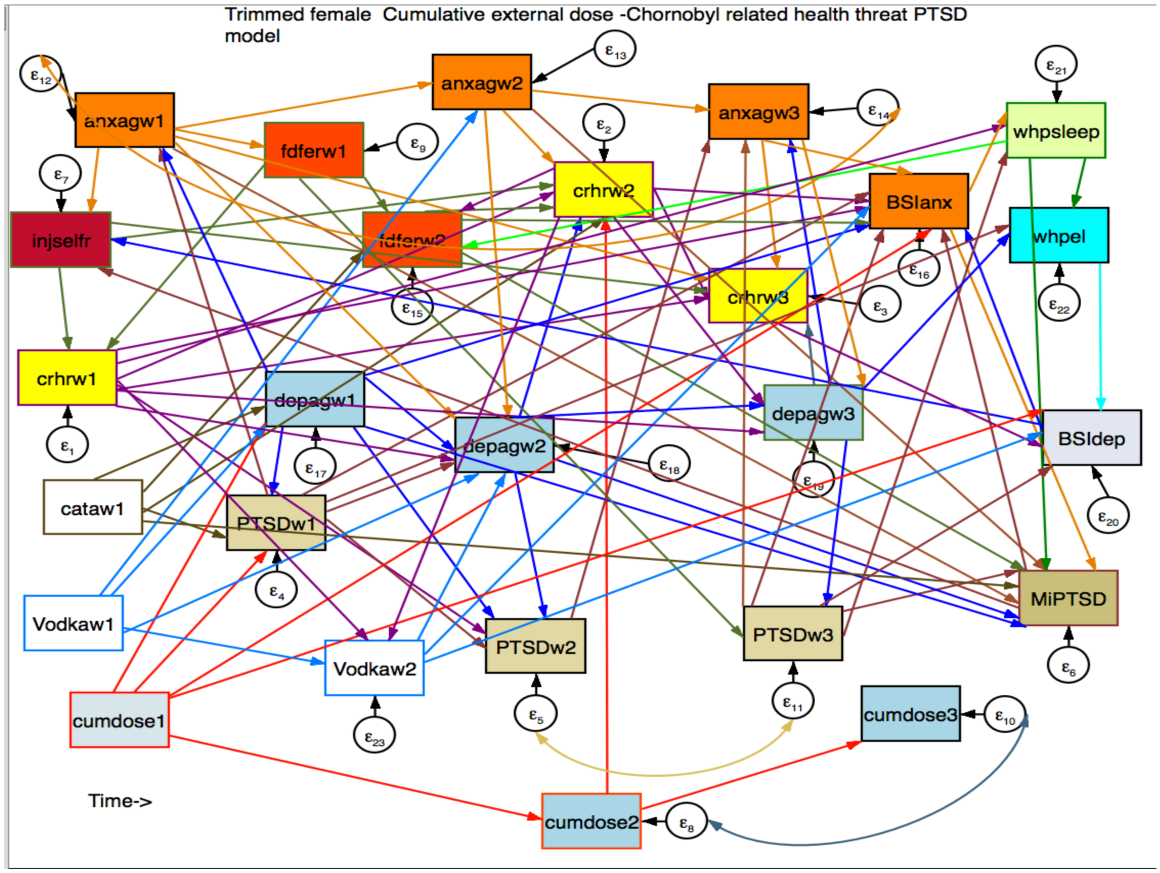

Figure 6: Pathways to PTSD among females residents of Kiev and Zhitomyr Oblasts

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-kakhi 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, colored stone. The Nottingham weighted health profile measures of physical health behavior include sleep and energy level, colored lime and cyan, respectively. The path coefficients, which define this model, are contained in Table 8. The clustered-robust versions for robust direct, indirect, and total effects, are respectively contained in Tables 9, 10, and 11.

11.1 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.

11.2 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 $\chi^{239} = 246.50$, $prob > \chi^2 = 0.2036$). Inspection of the path diagram reveals the presence of some feedback cycles, so the model is nonrecursive. Therefore, we have to check the stability index to be sure the model is neither globally nonstationary nor chaotic. All moduli reside within the unit circle, with the stability index = 0.5519. Thus, the model satisfies the condition for stability.

Table 9: 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     = -25843.881
```

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
Structural						
crhrw1 <-						
injselfr	.6576961	.1046066	6.29	0.000	.4526709	.8627214
fdferw1	.0026003	.0012525	2.08	0.038	.0001455	.0050551
_cons	-.4166371	.0910439	-4.58	0.000	-.5950798	-.2381943
crhrw2 <-						
crhrw1	.5557786	.0318209	17.47	0.000	.4934108	.6181463
depagw2	.0059531	.0018117	3.29	0.001	.0024023	.0095039
fdferw2	.0068558	.0013528	5.07	0.000	.0042045	.0095072
injselfr	.4710579	.0653966	7.20	0.000	.3428829	.5992329
cumdose2	.0405558	.0203668	1.99	0.046	.0006375	.0804741
anxagw2	.0030472	.0015435	1.97	0.048	.0000221	.0060724
cataw1	-.4706	.0897229	-5.25	0.000	-.6464537	-.2947463
_cons	-.4070694	.0566271	-7.19	0.000	-.5180565	-.2960822
crhrw3 <-						
crhrw1	-.0729162	.02221	-3.28	0.001	-.116447	-.0293853
crhrw2	.9731001	.0258313	37.67	0.000	.9224717	1.023729
depagw3	.0021063	.0010458	2.01	0.044	.0000566	.004156
anxagw1	-.0014094	.0004313	-3.27	0.001	-.0022547	-.000564
anxagw3	.0021135	.0009343	2.26	0.024	.0002823	.0039447
injselfr	.1413229	.0353419	4.00	0.000	.0720541	.2105917
_cons	-.1090629	.0281035	-3.88	0.000	-.1641447	-.053981
PTSDw2 <-						
crhrw1	1.330322	.3372839	3.94	0.000	.669258	1.991387
depagw2	.2369381	.0201514	11.76	0.000	.1974421	.2764341
PTSDw1	.0614851	.0112428	5.47	0.000	.0394496	.0835205
depagw1	-.0478394	.0151007	-3.17	0.002	-.0774364	-.0182425
_cons	.5017973	.4299977	1.17	0.243	-.3409827	1.344577

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Table 8 Female PTSD model continued:

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
BSIanx <-						
crhrw1	-1.178736	.2587176	-4.56	0.000	-1.685814	-.6716591
crhrw2	.8587632	.3009953	2.85	0.004	.2688233	1.448703
Vodkaw2	.3768461	.1792932	2.10	0.036	.025438	.7282542
fdferw2	.0163029	.0073878	2.21	0.027	.001823	.0307827
BSIdep	.5065969	.0555243	9.12	0.000	.3977712	.6154226
PTSDw1	.0128756	.005781	2.23	0.026	.0015451	.0242062
anxagw3	.027766	.0077271	3.59	0.000	.0126211	.0429109
MiPTSD	-.1092733	.0336938	-3.24	0.001	-.1753119	-.0432348
depagw1	.0206398	.0070381	2.93	0.003	.0068454	.0344342
PTSDw3	.0750765	.0230172	3.26	0.001	.0299636	.1201894
cumdose1	.6210384	.3081484	2.02	0.044	.0170785	1.224998
_cons	7.670506	1.299364	5.90	0.000	5.123799	10.21721
depagw2 <-						
crhrw1	-1.970204	.7496915	-2.63	0.009	-3.439572	-.5008355
Vodkaw2	4.203216	1.715742	2.45	0.014	.8404231	7.566008
PTSDw1	-.0627807	.0258007	-2.43	0.015	-.1133491	-.0122123
anxagw1	-.1170076	.0282521	-4.14	0.000	-.1723807	-.0616345
depagw1	.3889646	.0329925	11.79	0.000	.3243005	.4536288
anxagw2	.4840471	.034858	13.89	0.000	.4157266	.5523676
Vodkaw1	-4.974908	1.580665	-3.15	0.002	-8.072954	-1.876862
_cons	3.367731	.8778324	3.84	0.000	1.647211	5.088251
depagw3 <-						
crhrw1	-5.759557	1.037326	-5.55	0.000	-7.792678	-3.726436
crhrw2	5.909336	1.145852	5.16	0.000	3.663508	8.155164
depagw2	.6115399	.0505189	12.11	0.000	.5125247	.7105551
anxagw3	.1370719	.0490175	2.80	0.005	.0409993	.2331445
_cons	5.109525	.8334672	6.13	0.000	3.475959	6.743091
whpsl~p <-						
crhrw1	6.090748	1.477543	4.12	0.000	3.194818	8.986678
BSIanx	3.999585	.4342677	9.21	0.000	3.148436	4.850734
PTSDw3	.3640397	.1719562	2.12	0.034	.0270118	.7010676
_cons	-12.22224	3.988682	-3.06	0.002	-20.03992	-4.40457
Vodkaw2 <-						
crhrw1	-.1086225	.0311274	-3.49	0.000	-.169631	-.0476139
crhrw2	.0711203	.0341007	2.09	0.037	.0042842	.1379565
Vodkaw1	.8175431	.0210272	38.88	0.000	.7763305	.8587556
_cons	.115395	.0226688	5.09	0.000	.070965	.159825

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Table 8 Female PTSD model continued:

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
fdferw2 <-						
crhrw2	-3.916082	1.837447	-2.13	0.033	-7.517413	-.3147513
whpsleep	-.0030177	.042179	-0.07	0.943	-.085687	.0796516
fdferw1	.3587042	.0336285	10.67	0.000	.2927935	.4246148
cataw1	6.563734	3.858697	1.70	0.089	-.9991721	14.12664
_cons	1.799721	1.903489	0.95	0.344	-1.931049	5.530491
BSIdep <-						
crhrw3	.5961001	.2110932	2.82	0.005	.182365	1.009835
Vodkaw2	.7709773	.1778658	4.33	0.000	.4223667	1.119588
whpel	.0342601	.0051169	6.70	0.000	.0242311	.0442891
PTSDw3	.0557317	.0196994	2.83	0.005	.0171216	.0943417
cumdose1	.8228591	.3040649	2.71	0.007	.2269028	1.418815
_cons	7.627618	.2557405	29.83	0.000	7.126376	8.12886
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	.3374817	.0496883	6.79	0.000	.2400945	.4348689
depagw1	.5403306	.058489	9.24	0.000	.4256942	.654967
_cons	9.5359	1.627132	5.86	0.000	6.346779	12.72502
whpel <-						
depagw3	.1948576	.0734313	2.65	0.008	.0509348	.3387804
whpsleep	.4719271	.0516158	9.14	0.000	.370762	.5730922
PTSDw1	.1557906	.0463251	3.36	0.001	.064995	.2465862
_cons	14.11707	2.192513	6.44	0.000	9.819824	18.41431
anxagw3 <-						
PTSDw2	-.3633742	.0831721	-4.37	0.000	-.5263886	-.2003598
depagw3	.4367973	.0391892	11.15	0.000	.3599879	.5136067
PTSDw3	.2174371	.0810189	2.68	0.007	.058643	.3762312
anxagw2	.6678959	.0346864	19.26	0.000	.5999118	.7358799
_cons	.9586395	.7258899	1.32	0.187	-.4640787	2.381358

Continued on the next page...

Table 8 Female PTSD model continued:

	Coef.	OIM Std. Err.	z	P>|z|	[95% Conf.	Interval]
MiPTSD <-						
BSIanx	1.931204	.2509805	7.69	0.000	1.439292	2.423117
depagw2	.1223538	.0358835	3.41	0.001	.0520235	.1926841
whpsleep	.0811321	.0181991	4.46	0.000	.0454625	.1168017
fdferw2	.0871967	.0196431	4.44	0.000	.048697	.1256965
anxagw1	.0599898	.0192288	3.12	0.002	.0223021	.0976775
depagw1	-.0791003	.0246045	-3.21	0.001	-.1273242	-.0308764
PTSDw3	.1937151	.0621261	3.12	0.002	.0719502	.31548
anxagw2	-.1436947	.0293405	-4.90	0.000	-.201201	-.0861885
cataw1	-3.782129	1.523037	-2.48	0.013	-6.767228	-.7970309
_cons	28.40848	1.945887	14.60	0.000	24.59461	32.22235
injse~r <-						
BSIdep	.0134193	.0075807	1.77	0.077	-.0014387	.0282772
anxagw1	.0020282	.0006885	2.95	0.003	.0006788	.0033776
MiPTSD	.0063218	.0023597	2.68	0.007	.0016969	.0109466
_cons	.1990348	.1063606	1.87	0.061	-.0094282	.4074977
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	.1545432	.0182439	8.47	0.000	.1187858	.1903006
fdferw1	.0331416	.0094638	3.50	0.000	.014593	.0516903
_cons	1.482088	.5671076	2.61	0.009	.3705775	2.593598

Continued on the next page...

Table 8 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	.7841716	.0582996			.6778415	.9071812
e.crhrw2	.2790506	.0209757			.240824	.3233449
e.crhrw3	.0706829	.0052541			.0611001	.0817686
e.PTSDw2	47.63018	3.542152			41.16994	55.10414
e.BSIanx	8.686013	1.236643			6.571029	11.48174
e.depagw2	170.2361	12.65807			147.1498	196.9444
e.depagw3	162.4846	14.47872			136.4467	193.4912
e.whpsleep	688.7552	51.20422			595.3658	796.7937
e.Vodkaw2	.1634084	.0121527			.1412441	.1890507
e.fdferw2	501.3491	39.52553			429.569	585.1235
e.BSIdep	9.673893	.72541			8.35166	11.20546
e.PTSDw1	680.1664	50.55637			587.9574	786.8365
e.anxagw1	724.1014	53.83758			625.9098	837.697
e.whpel	826.4126	61.64158			714.0134	956.5056
e.anxagw3	116.3804	8.869843			100.2319	135.1305
e.MiPTSD	78.77391	6.815102			66.48765	93.33056
e.injselfr	.1893972	.0141727			.1635602	.2193157
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	59.59658	4.431567			51.51414	68.94713
e.anxagw2	392.1095	29.14527			338.9519	453.6038
Covariance						
e.PTSDw2						
e.PTSDw3	27.06788	3.148783	8.60	0.000	20.89638	33.23938
e.anxagw1						
e.anxagw3	-50.48829	17.30841	-2.92	0.004	-84.41215	-16.56444
e.cumdose2						
e.cumdose3	.0427649	.0124315	3.44	0.001	.0183995	.0671303

LR test of model vs. saturated: chi2(229) = 246.50, Prob > chi2 = 0.2036
stability index = .5518545
All the eigenvalues lie inside the unit circle.
SEM satisfies stability condition.

11.3 Direct external dose effects for females

11.3.1 Hypothesis 3 Dose-PTSD tests

We examine the direct robust effects in Table 9 on page 72 to test hypothesis 3 for females. Like the male model for PTSD, where we find no evidence of a statistically significant clustered-robust direct effect originating with cumulative external dose and pointing to Chornobyl PTSD , we observe no statistically significant direct effect stemming from cumulative external and extending to Chornobyl PTSD on page 72 either. There is no direct path from cumdose1 and no direct path from cumdose2. There is no path from cumdose3 either. Hence, we find no evidence in this model to support hypothesis 3 among females, which postulates a direct relationship between cumulative external dose in mGys and MiPTSD.

11.4 Direct perceived risk of exposure- PTSD effects for females

11.4.1 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.

11.5 Direct effects predicting substance abuse

11.5.1 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.

11.5.2 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 (*crhrw*2 *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.

11.6 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 9 Clustered-robust direct effects for Female PTSD model
(Std. Err. adjusted for 362 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
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	.6576961	.0971155	6.77	0.000	.3229772
cumdose2	0	(no path)			0
depagw1	0	(no path)			0
fdferw1	.0026003	.0013115	1.98	0.047	.1046694
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
crhrw2 <-					
crhrw1	.5557786	.0405624	13.70	0.000	.6029688
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
PTSDw2	0	(no path)			0
BSIanx	0	(no path)			0
depagw2	.0059531	.0014544	4.09	0.000	.1328492
depagw3	0	(no path)			0
whpsleep	0	(no path)			0
Vodkaw2	0	(no path)			0
fdferw2	.0068558	.0014163	4.84	0.000	.202745
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	.4710579	.0756845	6.22	0.000	.2509654
cumdose2	.0405558	.0145498	2.79	0.005	.0646088
depagw1	0	(no path)			0
fdferw1	0	(no path)			0
PTSDw3	0	(no path)			0
anxagw2	.0030472	.0011932	2.55	0.011	.0792063
cumdose1	0	(no path)			0
cataw1	-.4706	.0884024	-5.32	0.000	-.1721186
Vodkaw1	0	(no path)			0

Table 9 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
crhrw3 <-					
crhrw1	-.0729162	.0279019	-2.61	0.009	-.0772479
crhrw2	.9731001	.0289963	33.56	0.000	.9502266
crhrw3	0	(no path)			0
PTSDw2	0	(no path)			0
BSIanx	0	(no path)			0
depagw2	0	(no path)			0
depagw3	.0021063	.0011741	1.79	0.073	.04953
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	-.0014094	.0005308	-2.66	0.008	-.056437
whpel	0	(no path)			0
anxagw3	.0021135	.0011668	1.81	0.070	.0551605
MiPTSD	0	(no path)			0
injselfr	.1413229	.0367969	3.84	0.000	.0735228
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
PTSDw2 <-					
crhrw1	1.330322	.3740763	3.56	0.000	.1493717
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
BSIanx	0	(no path)			0
depagw2	.2369381	.0587759	4.03	0.000	.547232
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	.0614851	.0133549	4.60	0.000	.2439593
anxagw1	0	(no path)			0
whpel	0	(no path)			0
MiPTSD	0	(no path)			0
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	-.0478394	.0191019	-2.50	0.012	-.1609487
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....

Table 9 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
BSIanx <-					
crhrw1	-1.178736	.3584256	-3.29	0.001	-.3038144
crhrw2	.8587632	.3909255	2.20	0.028	.2040197
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	.3768461	.1823407	2.07	0.039	.0962581
fdferw2	.0163029	.0083609	1.95	0.051	.114539
BSIdep	.5065969	.0593657	8.53	0.000	.5206616
PTSDw1	.0128756	.0067983	1.89	0.058	.1172727
anxagw1	0	(no path)			0
whpel	0	(no path)			0
anxagw3	.027766	.0089447	3.10	0.002	.1763083
MiPTSD	-.1092733	.040853	-2.67	0.007	-.3515461
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	.0206398	.0089234	2.31	0.021	.1593995
fdferw1	0	(no path)			0
PTSDw3	.0750765	.0280259	2.68	0.007	.1750784
anxagw2	0	(no path)			0
cumdose1	.6210384	.368549	1.69	0.092	.0935083
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0
depagw2 <-					
crhrw1	-1.970204	.7981652	-2.47	0.014	-.0957824
crhrw2	0	(no path)			0
crhrw3	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	4.203216	1.461451	2.88	0.004	.2025059
fdferw2	0	(no path)			0
BSIdep	0	(no path)			0
PTSDw1	-.0627807	.039816	-1.58	0.115	-.1078542
anxagw1	-.1170076	.0446634	-2.62	0.009	-.2150121
whpel	0	(no path)			0
MiPTSD	0	(no path)			0
injselfr	0	(no path)			0
cumdose2	0	(no path)			0
depagw1	.3889646	.0633926	6.14	0.000	.5665978
fdferw1	0	(no path)			0
PTSDw3	0	(no path)			0
anxagw2	.4840471	.0705009	6.87	0.000	.5637969
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	-4.974908	1.404925	-3.54	0.000	-.2624018

Continued....

Table 9 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
depagw3 <-					
crhrw1	-5.759557	1.291332	-4.46	0.000	-.2594855
crhrw2	5.909336	1.261574	4.68	0.000	.2453972
crhrw3	0	(no path)			0
PTSDw2	0	(no path)			0
BSIanx	0	(no path)			0
depagw2	.6115399	.0738923	8.28	0.000	.5667274
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	.1370719	.0844807	1.62	0.105	.1521387
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
whpsl~p <-					
crhrw1	6.090748	1.489647	4.09	0.000	.1847073
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
PTSDw2	0	(no path)			0
BSIanx	3.999585	.4354082	9.19	0.000	.4705834
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	.3640397	.1741633	2.09	0.037	.0998846
anxagw2	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0

Table 9 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Vodkaw2 <-					
crhrw1	-.1086225	.0466771	-2.33	0.020	-.109607
crhrw2	.0711203	.046087	1.54	0.123	.0661484
crhrw3	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	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	0	(no path)			0
anxagw2	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	.8175431	.0762921	10.72	0.000	.8950273
fdferw2 <-					
crhrw1	0	(no path)			0
crhrw2	-3.916082	1.925495	-2.03	0.042	-.1324222
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	-.0030177	.0422916	-0.07	0.943	-.0036506
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	.3587042	.0427352	8.39	0.000	.5297007
PTSDw3	0	(no path)			0
anxagw2	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	6.563734	4.404484	1.49	0.136	.0811776
Vodkaw1	0	(no path)			0

Table 9 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
BSIdep <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
crhrw3	.5961001	.2245103	2.66	0.008	.1411091
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	.7709773	.2405446	3.21	0.001	.1916115
fdferw2	0	(no path)			0
BSIdep	0	(no path)			0
PTSDw1	0	(no path)			0
anxagw1	0	(no path)			0
whpel	.0342601	.0055341	6.19	0.000	.3146108
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	.0557317	.0235449	2.37	0.018	.1264553
anxagw2	0	(no path)			0
cumdose1	.8228591	.3407019	2.42	0.016	.1205491
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0
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	.3374817	.0701669	4.81	0.000	.3155096
depagw1	.5403306	.0815862	6.62	0.000	.4283272
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0

Continued....

Table 9 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
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	.1948576	.0737078	2.64	0.008	.1181154
whpsleep	.4719271	.0545683	8.65	0.000	.4249863
Vodkaw2	0	(no path)			0
fdferw2	0	(no path)			0
BSIdep	0	(no path)			0
PTSDw1	.1557906	.0508209	3.07	0.002	.1503457
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
anxagw3 <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
PTSDw2	-.3633742	.1267096	-2.87	0.004	-.1313637
BSIanx	0	(no path)			0
depagw2	0	(no path)			0
depagw3	.4367973	.0799781	5.46	0.000	.3935398
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	.2174371	.1089414	2.00	0.046	.0798552
anxagw2	.6678959	.0607314	11.00	0.000	.649534
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	0	(no path)			0

Table 9 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
MiPTSD <-					
crhrw1	0	(no path)			0
crhrw2	0	(no path)			0
crhrw3	0	(no path)			0
PTSDw2	0	(no path)			0
BSIanx	1.931204	.3005108	6.43	0.000	.6002887
depagw2	.1223538	.0448187	2.73	0.006	.2016353
depagw3	0	(no path)			0
whpsleep	.0811321	.0200862	4.04	0.000	.21434
Vodkaw2	0	(no path)			0
fdferw2	.0871967	.0244781	3.56	0.000	.190424
BSIdep	0	(no path)			0
PTSDw1	0	(no path)			0
anxagw1	.0599898	.02089	2.87	0.004	.1816666
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	-.0791003	.0249581	-3.17	0.002	-.1898855
fdferw1	0	(no path)			0
PTSDw3	.1937151	.0712583	2.72	0.007	.1404183
anxagw2	-.1436947	.0427616	-3.36	0.001	-.2758194
cumdose1	0	(no path)			0
cataw1	-3.782129	1.584694	-2.39	0.017	-.1021511
Vodkaw1	0	(no path)			0
injse~r <-					
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	0	(no path)			0
whpsleep	0	(no path)			0
Vodkaw2	0	(no path)			0
fdferw2	0	(no path)			0
BSIdep	.0134193	.0069123	1.94	0.052	.108964
PTSDw1	0	(no path)			0
anxagw1	.0020282	.0005743	3.53	0.000	.1561139
whpel	0	(no path)			0
anxagw3	0	(no path)			0
MiPTSD	.0063218	.0022038	2.87	0.004	.1606825
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

Table 9 Female Direct effects continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
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	.2797733
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	.1545432	.0452219	3.42	0.001	.3791308
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
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	.0331416	.0099758	3.32	0.001	.1474448
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
anxagw2 <-					
PTSDw1	0	(no path)			0
anxagw1	.2843984	.0468098	6.08	0.000	.4486842
depagw1	0	(no path)			0
cumdose1	0	(no path)			0
cataw1	0	(no path)			0
Vodkaw1	2.24764	1.416104	1.59	0.112	.1017825

11.7 Indirect effects for females

11.7.1 Hypothesis 3 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 ($cumdose1$ $stdized$ $\beta = 0.155,\ p = 0.000$) as well as during the decade thereafter ($crhrw2$ $stdized$ $\beta = 0.012,\ p = 0.005$). 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.

11.7.2 Hypothesis 6 Indirect perceived risk effects on females

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.

11.7.3 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.

11.7.4 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 10 Clustered-robust indirect effects for female PTSD model
(Std. Err. adjusted for 362 clusters in id)

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Structural					
crhrw1 <-					
crhrw1	-.0048498	.0034066	-1.42	0.155	-.0048498
crhrw2	.0172684	.0035417	4.88	0.000	.015917
crhrw3	.0078061	.00294	2.66	0.008	.0073683
BSIanx	.0082675	.0010471	7.90	0.000	.032076
depagw2	.0008395	.0001616	5.19	0.000	.0172675
depagw3	.0005919	.0001095	5.40	0.000	.013138
whpsleep	.0004772	.0000757	6.31	0.000	.0157369
Vodkaw2	.0167402	.004248	3.94	0.000	.0165898
fdferw2	.0005403	.0001037	5.21	0.000	.014727
BSIdep	.0130952	.0046241	2.83	0.005	.0522173
PTSDw1	.0009072	.0001793	5.06	0.000	.0320577
anxagw1	.0023434	.000431	5.44	0.000	.0885769
whpel	.0004486	.0000725	6.19	0.000	.0164281
anxagw3	.0003272	.0000941	3.48	0.001	.0080605
MiPTSD	.0032926	.0015057	2.19	0.029	.0410978
injselfr	.0060479	.0014414	4.20	0.000	.00297
cumdose2	.0007003	.0002513	2.79	0.005	.0010284
depagw1	.002004	.0002098	9.55	0.000	.0600466
fdferw1	.0002552	.0000358	7.13	0.000	.0102725
PTSDw3	.0022332	.0004633	4.82	0.000	.0202054
anxagw2	.0002044	.0001583	1.29	0.197	.0048961
cumdose1	.0458582	.0155511	2.95	0.003	.026789
cataw1	.0367205	.0177789	2.07	0.039	.0123792
Vodkaw1	.0239886	.0058789	4.08	0.000	.0260263
crhrw2 <-					
crhrw1	-.0337007	.0071504	-4.71	0.000	-.0365622
crhrw2	-.0033689	.0145667	-0.23	0.817	-.0033689
crhrw3	.0095553	.0035988	2.66	0.008	.0097853
PTSDw2	-.000145	.0000506	-2.87	0.004	-.0014009
BSIanx	.0100749	.0012834	7.85	0.000	.0424074
depagw2	.0008826	.0002028	4.35	0.000	.0196969
depagw3	.0007227	.0001338	5.40	0.000	.0174036
whpsleep	.0005653	.0003255	1.74	0.082	.0202226
Vodkaw2	.0448872	.0119438	3.76	0.000	.048261
fdferw2	.000494	.0001221	4.05	0.000	.014608
BSIdep	.0160297	.0056717	2.83	0.005	.0693459
PTSDw1	.0011315	.0004046	2.80	0.005	.0433782
anxagw1	.0040128	.0006796	5.90	0.000	.1645571
whpel	.0005492	.0000887	6.19	0.000	.021817
anxagw3	.000399	.0001148	3.48	0.001	.0106643
MiPTSD	.0040462	.0018463	2.19	0.028	.054792
injselfr	.343132	.0506941	6.77	0.000	.1828104
cumdose2	-.0001366	.000049	-2.79	0.005	-.0002177
depagw1	.0053398	.0005351	9.98	0.000	.1735828
fdferw1	.0040843	.0007639	5.35	0.000	.1783629
PTSDw3	.0027261	.0005654	4.82	0.000	.0267591
anxagw2	.0029836	.0005089	5.86	0.000	.0775523
cumdose1	.1766243	.0475395	3.72	0.000	.1119395
cataw1	.1358042	.0469712	2.89	0.004	.0496694
Vodkaw1	.0536018	.0148367	3.61	0.000	.0630928

Table 10 Clustered-robust indirect effects for female PTSD model continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
crhrw3 <-					
crhrw1	.4932602	.0406271	12.14	0.000	.5225632
crhrw2	.0188032	.0155377	1.21	0.226	.0183612
crhrw3	.0104058	.0039192	2.66	0.008	.0104058
PTSDw2	-.001091	.0003804	-2.87	0.004	-.0102938
BSIanx	.010976	.0013975	7.85	0.000	.0451143
depagw2	.0086935	.0013948	6.23	0.000	.1894451
depagw3	.0019951	.0002979	6.70	0.000	.0469142
whpsleep	.0006174	.0003284	1.88	0.060	.0215681
Vodkaw2	.0541355	.0147138	3.68	0.000	.0568364
fdferw2	.0073633	.0014166	5.20	0.000	.2126352
BSIdep	.0174565	.0061755	2.83	0.005	.0737431
PTSDw1	.0007067	.0004326	1.63	0.102	.0264553
anxagw1	.0046245	.0007929	5.83	0.000	.185182
whpel	.0005981	.0000966	6.19	0.000	.0232004
anxagw3	.0008889	.0003689	2.41	0.016	.0232009
MiPTSD	.0044048	.0020103	2.19	0.028	.0582464
injselfr	.7451731	.0860216	8.66	0.000	.3876738
cumdose2	.0402274	.0144319	2.79	0.005	.0625793
depagw1	.0054349	.0006239	8.71	0.000	.1725215
fdferw1	.0038512	.0006463	5.96	0.000	.1642297
PTSDw3	.0035278	.000715	4.93	0.000	.0338145
anxagw2	.008603	.0014501	5.93	0.000	.2183597
cumdose1	.176736	.0473766	3.73	0.000	.1093774
cataw1	-.3465518	.1039463	-3.33	0.001	-.1237695
Vodkaw1	.0583669	.0176115	3.31	0.001	.0670867
PTSDw2 <-					
crhrw1	-.5416786	.198768	-2.73	0.006	-.0608209
crhrw2	.0836336	.0464033	1.80	0.071	.0086556
crhrw3	.0065729	.0024756	2.66	0.008	.0006966
BSIanx	.0069582	.0008818	7.89	0.000	.0030312
depagw2	.0011182	.0001666	6.71	0.000	.0025827
depagw3	.0004983	.0000922	5.40	0.000	.0012418
whpsleep	.0004005	.0000728	5.50	0.000	.0014829
Vodkaw2	1.011725	.3486567	2.90	0.004	.1125785
fdferw2	.0009287	.000148	6.28	0.000	.0028423
BSIdep	.0110266	.0038945	2.83	0.005	.0049369
PTSDw1	-.0124582	.0094988	-1.31	0.190	-.0494314
anxagw1	.0069481	.0110324	0.63	0.529	.0294885
whpel	.0003778	.000061	6.19	0.000	.0015532
MiPTSD	.0027736	.001268	2.19	0.029	.0038872
injselfr	.5590131	.0769438	7.27	0.000	.0308234
cumdose2	.0033918	.0012168	2.79	0.005	.0005592
depagw1	.123051	.0149266	8.24	0.000	.413987
fdferw1	.0024462	.0010357	2.36	0.018	.0110557
PTSDw3	.0018799	.00039	4.82	0.000	.0019098
anxagw2	.1152707	.0168011	6.86	0.000	.3100921
cumdose1	1.168935	.4904622	2.38	0.017	.0766728
cataw1	2.462398	.6742135	3.65	0.000	.0932078
Vodkaw1	.4280787	.2949669	1.45	0.147	.0521485

Continued....

Table 10 Clustered-robust indirect effects for female PTSD model continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
BSIanx <-					
crhrw1	.5406395	.0864798	6.25	0.000	.1393476
crhrw2	.2468959	.0848552	2.91	0.004	.058656
crhrw3	.250372	.0942981	2.66	0.008	.0609137
PTSDw2	-.0098442	.0034327	-2.87	0.004	-.0225975
BSIanx	-.1745221	.0268874	-6.49	0.000	-.1745221
depagw2	.0095657	.0043165	2.22	0.027	.0507149
depagw3	.0265677	.0041898	6.34	0.000	.1519921
whpsleep	-.0004973	.0020122	-0.25	0.805	-.004227
Vodkaw2	.2982623	.1013931	2.94	0.003	.0761853
fdferw2	-.0030551	.0028555	-1.07	0.285	-.0214644
BSIdep	-.0865801	.0103844	-8.34	0.000	-.0889839
PTSDw1	.0008702	.0014696	0.59	0.554	.0079263
anxagw1	.0061673	.0024705	2.50	0.013	.0600842
whpel	.0143898	.0023244	6.19	0.000	.1358105
anxagw3	-.0006749	.0026132	-0.26	0.796	-.0042858
MiPTSD	.0199338	.0071321	2.79	0.005	.0641295
injselfr	.1365389	.1046586	1.30	0.192	.017282
cumdose2	.0448409	.0160871	2.79	0.005	.0169712
depagw1	.018495	.0029086	6.36	0.000	.1428354
fdferw1	.0055381	.0013283	4.17	0.000	.0574574
PTSDw3	-.0012912	.0121695	-0.11	0.916	-.003011
anxagw2	.0389311	.0041791	9.32	0.000	.2404081
cumdose1	.8686398	.3678904	2.36	0.018	.130789
cataw1	.8247241	.3386361	2.44	0.015	.0716611
Vodkaw1	.8656266	.1320265	6.56	0.000	.2420635
depagw2 <-					
crhrw1	-.2887275	.1956207	-1.48	0.140	-.0140366
crhrw2	.2560206	.1928965	1.33	0.184	.0114725
crhrw3	-.0160871	.0060589	-2.66	0.008	-.0007382
BSIanx	-.0170515	.0021575	-7.90	0.000	-.0032162
depagw2	6.23e-06	.0005475	0.01	0.991	6.23e-06
depagw3	-.0012204	.0002259	-5.40	0.000	-.0013169
whpsleep	-.0009892	.0001507	-6.56	0.000	-.0015857
Vodkaw2	-.0272062	.0078191	-3.48	0.001	-.0013108
fdferw2	.000886	.0004096	2.16	0.031	.0011741
BSIdep	-.0269872	.0095262	-2.83	0.005	-.0052316
PTSDw1	.0051073	.0011444	4.46	0.000	.008774
anxagw1	.1331749	.022636	5.88	0.000	.2447209
whpel	-.0009246	.0001493	-6.19	0.000	-.0016459
MiPTSD	-.0067809	.003102	-2.19	0.029	-.0041147
injselfr	-1.367363	.2199279	-6.22	0.000	-.0326441
cumdose2	.0103831	.003725	2.79	0.005	.0007412
depagw1	-.0225831	.005105	-4.42	0.000	-.0328964
fdferw1	-.0057088	.0029595	-1.93	0.054	-.0111714
PTSDw3	-.0046046	.0009552	-4.82	0.000	-.0020254
anxagw2	.0013069	.0004143	3.15	0.002	.0015222
cumdose1	3.966246	1.56179	2.54	0.011	.1126404
cataw1	2.445573	1.989661	1.23	0.219	.040081
Vodkaw1	7.068097	1.617511	4.37	0.000	.3728071

Continued....

Table 10 Clustered-robust indirect effects for female PTSD model continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
depagw3 <-					
crhrw1	1.412035	.615033	2.30	0.022	.0636165
crhrw2	.4425991	.1721438	2.57	0.010	.0183798
crhrw3	.0014333	.0005398	2.66	0.008	.000061
PTSDw2	-.0532596	.0185718	-2.87	0.004	-.0213703
BSIanx	.0012236	.0002102	5.82	0.000	.0002139
depagw2	.067489	.0102968	6.55	0.000	.0625435
depagw3	.0690196	.011811	5.84	0.000	.0690196
whpsleep	-.0000354	.0018456	-0.02	0.985	-.0000526
Vodkaw2	2.85642	.9925178	2.88	0.004	.1275344
fdferw2	.0436293	.0089978	4.85	0.000	.0535797
BSIdep	.0024044	.0009236	2.60	0.009	.000432
PTSDw1	-.0292502	.0274282	-1.07	0.286	-.0465681
anxagw1	.0492644	.033544	1.47	0.142	.0838941
whpel	.0000824	.0000133	6.19	0.000	.0001359
anxagw3	.0094977	.0058318	1.63	0.103	.0105416
MiPTSD	.000707	.000298	2.37	0.018	.0003976
injselfr	.1329836	.6350603	0.21	0.834	.0029422
cumdose2	.2576077	.0924191	2.79	0.005	.0170423
depagw1	.2772818	.0438154	6.33	0.000	.3743136
fdferw1	.0054128	.0059868	0.90	0.366	.0098162
PTSDw3	.0322196	.015976	2.02	0.044	.0131335
anxagw2	.4458294	.0487964	9.14	0.000	.4812306
cumdose1	3.654434	1.280203	2.85	0.004	.0961799
cataw1	-.3175649	1.706455	-0.19	0.852	-.0048232
Vodkaw1	1.899033	.9602502	1.98	0.048	.0928247
whpsl~p <-					
crhrw1	-2.826253	1.264211	-2.24	0.025	-.0857086
crhrw2	4.884714	1.349615	3.62	0.000	.1365398
crhrw3	1.04901	.3950906	2.66	0.008	.0300283
PTSDw2	-.0430932	.0150267	-2.87	0.004	-.0116389
BSIanx	-.6475923	.1012691	-6.39	0.000	-.0761944
depagw2	.0815741	.0179591	4.54	0.000	.0508851
depagw3	.1700077	.0322846	5.27	0.000	.1144347
whpsleep	.0009155	.0078328	0.12	0.907	.0009155
Vodkaw2	2.962815	.8564596	3.46	0.001	.0890429
fdferw2	.0587307	.0301354	1.95	0.051	.0485486
BSIdep	1.759788	.2021521	8.71	0.000	.2128016
PTSDw1	.0600708	.0239769	2.51	0.012	.0643743
anxagw1	.0453059	.011484	3.95	0.000	.0519328
whpel	.0602905	.0097388	6.19	0.000	.0669497
anxagw3	.1185919	.0345103	3.44	0.001	.0886004
MiPTSD	-.3372269	.1374477	-2.45	0.014	-.1276474
injselfr	4.596278	.4947854	9.29	0.000	.0684489
cumdose2	.1981034	.0710714	2.79	0.005	.0088217
depagw1	.1869333	.031042	6.02	0.000	.1698596
fdferw1	.0519119	.0086186	6.02	0.000	.0633683
PTSDw3	.3105255	.1220151	2.54	0.011	.0852015
anxagw2	.1820353	.0170128	10.70	0.000	.1322603
cumdose1	6.480121	1.565545	4.14	0.000	.1147985
cataw1	3.575319	1.529799	2.34	0.019	.036552
Vodkaw1	3.733317	.6888738	5.42	0.000	.1228331

Table 10 Clustered-robust indirect effects for female PTSD model continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Vodkaw2 <-					
crhrw1	.0376571	.0027875	13.51	0.000	.0379985
crhrw2	-.0021153	.0008956	-2.36	0.018	-.0019675
crhrw3	-.0001683	.0000634	-2.66	0.008	-.0001603
BSIanx	-.0001815	.0000225	-8.08	0.000	-.0007106
depagw2	.000395	.0001011	3.91	0.000	.008198
depagw3	-.0000129	2.39e-06	-5.40	0.000	-.0002888
whpsleep	-.0000116	.0000196	-0.59	0.553	-.0003872
Vodkaw2	.001374	.000564	2.44	0.015	.001374
fdferw2	.000464	.0000977	4.75	0.000	.0127634
BSIdep	-.0002824	.0000989	-2.86	0.004	-.0011363
PTSDw1	-.0000181	.0000158	-1.15	0.252	-.0006444
anxagw1	.0000308	.0000243	1.27	0.203	.0011765
whpel	-9.67e-06	1.56e-06	-6.19	0.000	-.0003575
anxagw3	-7.16e-06	2.06e-06	-3.48	0.001	-.0001781
MiPTSD	-.0000699	.0000322	-2.17	0.030	-.0008802
injselfr	-.0141921	.0085841	-1.65	0.098	-.0070325
cumdose2	.0027986	.001004	2.79	0.005	.0041467
depagw1	.0001621	.0000252	6.43	0.000	.0049007
fdferw1	-.0000197	.0000945	-0.21	0.835	-.0008
PTSDw3	-.0000487	.0000101	-4.82	0.000	-.0004446
anxagw2	.0004067	.0000919	4.42	0.000	.0098327
cumdose1	.0075803	.0066822	1.13	0.257	.0044684
cataw1	-.0277995	.0177734	-1.56	0.118	-.0094567
Vodkaw1	.0012065	.0018009	0.67	0.503	.0013208
fdferw2 <-					
crhrw1	-2.054351	.1598719	-12.85	0.000	-.0753662
crhrw2	-.0015475	.0585151	-0.03	0.979	-.0000523
crhrw3	-.040585	.0152856	-2.66	0.008	-.0014054
PTSDw2	.0006978	.0002433	2.87	0.004	.000228
BSIanx	-.0495694	.0053585	-9.25	0.000	-.0070554
depagw2	-.0270153	.0055987	-4.83	0.000	-.0203863
depagw3	-.0033433	.00062	-5.39	0.000	-.0027224
whpsleep	-.0022164	.0012781	-1.73	0.083	-.0026813
Vodkaw2	-.1847226	.0485174	-3.81	0.000	-.0067159
fdferw2	-.0289596	.0055819	-5.19	0.000	-.0289596
BSIdep	-.0680842	.0223895	-3.04	0.002	-.0099598
PTSDw1	.0314549	.0065003	4.84	0.000	.0407781
anxagw1	.0910199	.0195833	4.65	0.000	.1262155
whpel	-.0023326	.0003768	-6.19	0.000	-.0031335
anxagw3	-.0019204	.0005528	-3.47	0.001	-.0017356
MiPTSD	-.0148276	.0073681	-2.01	0.044	-.0067897
injselfr	-3.202304	.359968	-8.90	0.000	-.0576914
cumdose2	-.1588825	.0570005	-2.79	0.005	-.008559
depagw1	.0559659	.0071908	7.78	0.000	.0615199
fdferw1	-.0161512	.003008	-5.37	0.000	-.0238505
PTSDw3	-.0127113	.0026933	-4.72	0.000	-.0042192
anxagw2	-.0241666	.0054478	-4.44	0.000	-.0212412
cumdose1	.3923366	.4917946	0.80	0.425	.0084082
cataw1	3.41049	1.082897	3.15	0.002	.0421795
Vodkaw1	.3205927	.2840002	1.13	0.259	.0127604

Table 10 Clustered-robust indirect effects for female PTSD model continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
BSIdep <-					
crhrw1	.1821674	.0703566	2.59	0.010	.0456845
crhrw2	.8205657	.0584371	14.04	0.000	.1896789
crhrw3	.0230557	.0086835	2.66	0.008	.0054578
PTSDw2	-.0021594	.000753	-2.87	0.004	-.0048229
BSIanx	.0606174	.0070976	8.54	0.000	.05898
depagw2	.0171872	.0016662	10.32	0.000	.0886601
depagw3	.0215277	.0040993	5.25	0.000	.1198317
whpsleep	.0165416	.0019713	8.39	0.000	.1367925
Vodkaw2	.1249043	.0328645	3.80	0.000	.0310426
fdferw2	.0063637	.001224	5.20	0.000	.0435014
BSIdep	.0386776	.0055138	7.01	0.000	.0386776
PTSDw1	.0064545	.0020786	3.11	0.002	.0571999
anxagw1	.0039763	.0010935	3.64	0.000	.0376923
whpel	.0013251	.000214	6.19	0.000	.0121684
anxagw3	.0059425	.0020934	2.84	0.005	.0367144
MiPTSD	-.0028697	.0028163	-1.02	0.308	-.0089828
injselfr	.5938456	.0707676	8.39	0.000	.0731339
cumdose2	.0332787	.011939	2.79	0.005	.0122549
depagw1	.0139398	.0012533	11.12	0.000	.1047476
fdferw1	.0050496	.000818	6.17	0.000	.0509743
PTSDw3	.0134645	.0038486	3.50	0.000	.030551
anxagw2	.0152012	.0016738	9.08	0.000	.0913349
cumdose1	.3407568	.0978124	3.48	0.000	.049921
cataw1	.0450769	.1665904	0.27	0.787	.003811
Vodkaw1	.7786049	.2164677	3.60	0.000	.2118472
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	.1842895	.0256349	7.19	0.000	.1460887
cumdose1	10.32614	3.781802	2.73	0.006	.1595893
cataw1	19.74519	4.119168	4.79	0.000	.1761044
Vodkaw1	5.069353	1.963719	2.58	0.010	.1455075

Continued....

Table 10 Clustered-robust indirect effects for female PTSD model continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
whpel <-					
crhrw1	.6934566	1.009086	0.69	0.492	.0189379
crhrw2	3.542952	.754158	4.70	0.000	.0891837
crhrw3	.4953354	.1865591	2.66	0.008	.0127688
PTSDw2	-.0307149	.0107104	-2.87	0.004	-.0074705
BSIanx	1.582135	.2025701	7.81	0.000	.1676352
depagw2	.1708109	.0200398	8.52	0.000	.0959521
depagw3	.0936802	.0163684	5.72	0.000	.0567855
whpsleep	.0004252	.0038263	0.11	0.912	.0003829
Vodkaw2	1.954828	.508176	3.85	0.000	.0529058
fdferw2	.0362181	.0145279	2.49	0.013	.0269611
BSIdep	.8309601	.0954469	8.71	0.000	.0904888
PTSDw1	.0226494	.0137336	1.65	0.099	.0218578
anxagw1	.0309806	.0106768	2.90	0.004	.0319799
whpel	.0284688	.0045986	6.19	0.000	.0284688
anxagw3	.0845269	.0292744	2.89	0.004	.056869
MiPTSD	-.1590088	.06488	-2.45	0.014	-.0542014
injselfr	2.195021	.2798302	7.84	0.000	.0294373
cumdose2	.1436872	.0515491	2.79	0.005	.0057621
depagw1	.2273223	.0215067	10.57	0.000	.186014
fdferw1	.0255534	.0039355	6.49	0.000	.0280901
PTSDw3	.3246238	.1043025	3.11	0.002	.0802103
anxagw2	.1727806	.0147022	11.75	0.000	.1130496
cumdose1	5.615932	1.63315	3.44	0.001	.0895932
cataw1	7.733741	2.52095	3.07	0.002	.071201
Vodkaw1	2.727055	.5549182	4.91	0.000	.0808005
anxagw3 <-					
crhrw1	-2.33165	.7191658	-3.24	0.001	-.0946447
crhrw2	2.957565	.6354412	4.65	0.000	.1106557
crhrw3	-.0017142	.0006456	-2.66	0.008	-.0000657
PTSDw2	-.025017	.0087235	-2.87	0.004	-.0090439
BSIanx	-.0019528	.0002266	-8.62	0.000	-.0003075
depagw2	.2329122	.0428471	5.44	0.000	.194469
depagw3	.0658892	.0118351	5.57	0.000	.059364
whpsleep	-.0001622	.0008534	-0.19	0.849	-.0002171
Vodkaw2	.976027	.3401942	2.87	0.004	.0392623
fdferw2	.0201858	.0041883	4.82	0.000	.0223345
BSIdep	-.0028757	.0009809	-2.93	0.003	-.0004655
PTSDw1	.0332543	.0195678	1.70	0.089	.0476999
anxagw1	.2127448	.0386089	5.51	0.000	.3264117
whpel	-.0000985	.0000159	-6.19	0.000	-.0001464
anxagw3	.0688464	.0424658	1.62	0.105	.0688464
MiPTSD	-.0006753	.0003209	-2.10	0.035	-.0003421
injselfr	-.1405753	.3160031	-0.44	0.656	-.0028021
cumdose2	.1199463	.0430318	2.79	0.005	.0071493
depagw1	.2422999	.0245942	9.85	0.000	.2946973
fdferw1	.0088636	.0041024	2.16	0.031	.0144822
PTSDw3	.014473	.0074938	1.93	0.053	.0053153
anxagw2	.1678321	.0170703	9.83	0.000	.163218
cumdose1	3.277893	1.211011	2.71	0.007	.0777262
cataw1	2.748808	1.596572	1.72	0.085	.0376149
Vodkaw1	3.212743	1.41395	2.27	0.023	.1414867

Table 10 Clustered-robust indirect effects for female PTSD model continued:

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
MiPTSD <-					
crhrw1	-1.553115	.722316	-2.15	0.032	-.1244306
crhrw2	2.411442	.7745169	3.11	0.002	.1780768
crhrw3	.5631637	.2121054	2.66	0.008	.0425888
PTSDw2	-.024011	.0083727	-2.87	0.004	-.0171326
BSIanx	-.0714556	.0642488	-1.11	0.266	-.022211
depagw2	.0430651	.0103867	4.15	0.000	.07097
depagw3	.0966634	.0185856	5.20	0.000	.1718944
whpsleep	-.0014647	.0065938	-0.22	0.824	-.0038695
Vodkaw2	2.124509	.5590182	3.80	0.000	.16868
fdferw2	.0292384	.016811	1.74	0.082	.063852
BSIdep	.9447468	.1104408	8.55	0.000	.3018147
PTSDw1	.0333296	.0154401	2.16	0.031	.0943604
anxagw1	-.0119781	.0088187	-1.36	0.174	-.0362732
whpel	.0323671	.0052283	6.19	0.000	.0949542
anxagw3	.0660779	.0192419	3.43	0.001	.1304209
MiPTSD	-.2019943	.0759832	-2.66	0.008	-.2019943
injselfr	.1940389	.2378308	0.82	0.415	.0076341
cumdose2	.0977979	.0350859	2.79	0.005	.0115053
depagw1	.163996	.0201622	8.13	0.000	.3936833
fdferw1	.0506601	.0072106	7.03	0.000	.1633734
PTSDw3	.1965163	.0702312	2.80	0.005	.1424488
anxagw2	.1605775	.0147072	10.92	0.000	.3082256
cumdose1	3.322383	.8396767	3.96	0.000	.1554938
cataw1	2.504128	1.088853	2.30	0.021	.0676337
Vodkaw1	1.5458	.4129824	3.74	0.000	.1343643
injse~r <-					
crhrw1	-.0073739	.0051796	-1.42	0.155	-.0150158
crhrw2	.026256	.005385	4.88	0.000	.049282
crhrw3	.0118688	.0044702	2.66	0.008	.0228138
PTSDw2	-.0001808	.000063	-2.87	0.004	-.0032784
BSIanx	.0125703	.0015921	7.90	0.000	.0993136
depagw2	.0012764	.0002458	5.19	0.000	.0534636
depagw3	.0009	.0001666	5.40	0.000	.0406778
whpsleep	.0007256	.000115	6.31	0.000	.0487244
Vodkaw2	.0254527	.0064589	3.94	0.000	.0513652
fdferw2	.0008215	.0001577	5.21	0.000	.0455978
BSIdep	.0064915	.0007502	8.65	0.000	.0527108
PTSDw1	.0009818	.0002003	4.90	0.000	.0706502
anxagw1	.0003569	.000121	2.95	0.003	.0274693
whpel	.0006821	.0001102	6.19	0.000	.0508646
anxagw3	.0004975	.0001431	3.48	0.001	.0249569
MiPTSD	-.0013155	.0005142	-2.56	0.011	-.0334358
injselfr	.0091956	.0021916	4.20	0.000	.0091956
cumdose2	.0010648	.000382	2.79	0.005	.0031841
depagw1	.0021934	.0002563	8.56	0.000	.1338348
fdferw1	.000388	.0000544	7.13	0.000	.0318056
PTSDw3	.0033955	.0007044	4.82	0.000	.0625598
anxagw2	.0003107	.0002407	1.29	0.197	.0151593
cumdose1	.0575618	.017455	3.30	0.001	.0684744
cataw1	.0325732	.0196992	1.65	0.098	.0223613
Vodkaw1	.0305022	.0068659	4.44	0.000	.0673895

Table 10 Clustered-robust indirect effects for female PTSD model 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	.1005482	.0209053	4.81	0.000	.0882712
anxagw1	0	(no path)			0
depagw1	.215891	.022094	9.77	0.000	.1607063
cumdose1	3.076538	1.253696	2.45	0.014	.0446488
cataw1	5.88282	1.780732	3.30	0.001	.0492693
Vodkaw1	1.510347	.6474797	2.33	0.020	.0407091
PTSDw3 <-					
crhrw1	-.6718797	.2384741	-2.82	0.005	-.07426
crhrw2	.9816481	.2093807	4.69	0.000	.100006
PTSDw2	-.0082309	.0028701	-2.87	0.004	-.0081021
depagw2	.1049393	.0118427	8.86	0.000	.238576
depagw3	.0106665	.0018253	5.84	0.000	.0261675
whpsleep	-5.47e-06	.0002852	-0.02	0.985	-.00002
Vodkaw2	.4414401	.1533868	2.88	0.004	.0483522
fdferw2	.0067426	.0013905	4.85	0.000	.0203137
BSIdep	.0003716	.0001427	2.60	0.009	.0001638
PTSDw1	-.0011881	.0043853	-0.27	0.786	-.0046403
anxagw1	.0174876	.005499	3.18	0.001	.073058
anxagw3	.0226513	.0139572	1.62	0.105	.0616771
MiPTSD	.0001093	.000046	2.37	0.018	.0001507
injselfr	.0205517	.0981442	0.21	0.834	.0011155
cumdose2	.0398115	.0142827	2.79	0.005	.0064613
depagw1	.050007	.006813	7.34	0.000	.1656091
fdferw1	.0008365	.0009252	0.90	0.366	.0037216
PTSDw3	.0049793	.002469	2.02	0.044	.0049793
anxagw2	.0688999	.0075412	9.14	0.000	.1824494
cumdose1	.6667293	.2950158	2.26	0.024	.043048
cataw1	.1458889	.296515	0.49	0.623	.0054359
Vodkaw1	.343538	.1996054	1.72	0.085	.0411951
anxagw2 <-					
PTSDw1	.0959793	.0199554	4.81	0.000	.1415642
anxagw1	0	(no path)			0
depagw1	.2060808	.0210901	9.77	0.000	.2577314
cumdose1	2.936738	1.195091	2.46	0.014	.0716052
cataw1	5.615501	1.519645	3.70	0.000	.0790152
Vodkaw1	1.441716	.5980269	2.41	0.016	.0652869

11.8 Total effects on Chornobyl PTSD among females

11.8.1 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 (*cumdose*1 *stdized* $\beta = 0.155$, $p = 0.000$) and in the decade after (*cumdose*2 *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.

11.8.2 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 (*crhrw*1 *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.

11.8.3 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 92. Because 1986 vodka consumption is an exogenous variable in this model, we have no preexisting 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.

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

If we again review the Vodka2 panel on page 92, 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 11 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 <-					
crhrw1	-.0048498	.0034066	-1.42	0.155	-.0048498
crhrw2	.0172684	.0035417	4.88	0.000	.015917
crhrw3	.0078061	.00294	2.66	0.008	.0073683
BSIanx	.0082675	.0010471	7.90	0.000	.032076
depagw2	.0008395	.0001616	5.19	0.000	.0172675
depagw3	.0005919	.0001095	5.40	0.000	.013138
whpsleep	.0004772	.0000757	6.31	0.000	.0157369
Vodkaw2	.0167402	.004248	3.94	0.000	.0165898
fdferw2	.0005403	.0001037	5.21	0.000	.014727
BSIdep	.0130952	.0046241	2.83	0.005	.0522173
PTSDw1	.0009072	.0001793	5.06	0.000	.0320577
anxagw1	.0023434	.000431	5.44	0.000	.0885769
whpel	.0004486	.0000725	6.19	0.000	.0164281
anxagw3	.0003272	.0000941	3.48	0.001	.0080605
MiPTSD	.0032926	.0015057	2.19	0.029	.0410978
injselfr	.6637441	.0966692	6.87	0.000	.3259472
cumdose2	.0007003	.0002513	2.79	0.005	.0010284
depagw1	.002004	.0002098	9.55	0.000	.0600466
fdferw1	.0028555	.0013052	2.19	0.029	.1149419
PTSDw3	.0022332	.0004633	4.82	0.000	.0202054
anxagw2	.0002044	.0001583	1.29	0.197	.0048961
cumdose1	.0458582	.0155511	2.95	0.003	.026789
cataw1	.0367205	.0177789	2.07	0.039	.0123792
Vodkaw1	.0239886	.0058789	4.08	0.000	.0260263

Continued on the next page ....

Table 11 Clustered robust total effects for female PTSD model-continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
crhrw2 <-					
crhrw1	.5220778	.0405464	12.88	0.000	.5664066
crhrw2	-.0033689	.0145667	-0.23	0.817	-.0033689
crhrw3	.0095553	.0035988	2.66	0.008	.0097853
PTSDw2	-.000145	.0000506	-2.87	0.004	-.0014009
BSIanx	.0100749	.0012834	7.85	0.000	.0424074
depagw2	.0068357	.0014263	4.79	0.000	.1525462
depagw3	.0007227	.0001338	5.40	0.000	.0174036
whpsleep	.0005653	.0003255	1.74	0.082	.0202226
Vodkaw2	.0448872	.0119438	3.76	0.000	.048261
fdferw2	.0073498	.0014218	5.17	0.000	.2173529
BSIdep	.0160297	.0056717	2.83	0.005	.0693459
PTSDw1	.0011315	.0004046	2.80	0.005	.0433782
anxagw1	.0040128	.0006796	5.90	0.000	.1645571
whpel	.0005492	.0000887	6.19	0.000	.021817
anxagw3	.000399	.0001148	3.48	0.001	.0106643
MiPTSD	.0040462	.0018463	2.19	0.028	.054792
injselfr	.8141899	.0915425	8.89	0.000	.4337758
cumdose2	.0404191	.0145007	2.79	0.005	.0643912
depagw1	.0053398	.0005351	9.98	0.000	.1735828
fdferw1	.0040843	.0007639	5.35	0.000	.1783629
PTSDw3	.0027261	.0005654	4.82	0.000	.0267591
anxagw2	.0060308	.001387	4.35	0.000	.1567586
cumdose1	.1766243	.0475395	3.72	0.000	.1119395
cataw1	-.3347958	.1041236	-3.22	0.001	-.1224492
Vodkaw1	.0536018	.0148367	3.61	0.000	.0630928

Continued on the next page ....

Table 11 Clustered robust total effects for female PTSD model-continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
crhrw3 <-					
crhrw1	.4203441	.0444293	9.46	0.000	.4453153
crhrw2	.9919033	.0337875	29.36	0.000	.9685878
crhrw3	.0104058	.0039192	2.66	0.008	.0104058
PTSDw2	-.001091	.0003804	-2.87	0.004	-.0102938
BSIanx	.010976	.0013975	7.85	0.000	.0451143
depagw2	.0086935	.0013948	6.23	0.000	.1894451
depagw3	.0041014	.0011667	3.52	0.000	.0964442
whpsleep	.0006174	.0003284	1.88	0.060	.0215681
Vodkaw2	.0541355	.0147138	3.68	0.000	.0568364
fdferw2	.0073633	.0014166	5.20	0.000	.2126352
BSIdep	.0174565	.0061755	2.83	0.005	.0737431
PTSDw1	.0007067	.0004326	1.63	0.102	.0264553
anxagw1	.0032151	.0009249	3.48	0.001	.1287451
whpel	.0005981	.0000966	6.19	0.000	.0232004
anxagw3	.0030024	.0012454	2.41	0.016	.0783614
MiPTSD	.0044048	.0020103	2.19	0.028	.0582464
injselfr	.886496	.0965287	9.18	0.000	.4611966
cumdose2	.0402274	.0144319	2.79	0.005	.0625793
depagw1	.0054349	.0006239	8.71	0.000	.1725215
fdferw1	.0038512	.0006463	5.96	0.000	.1642297
PTSDw3	.0035278	.000715	4.93	0.000	.0338145
anxagw2	.008603	.0014501	5.93	0.000	.2183597
cumdose1	.176736	.0473766	3.73	0.000	.1093774
cataw1	-.3465518	.1039463	-3.33	0.001	-.1237695
Vodkaw1	.0583669	.0176115	3.31	0.001	.0670867
PTSDw2 <-					
crhrw1	.7886438	.4197271	1.88	0.060	.0885507
crhrw2	.0836336	.0464033	1.80	0.071	.0086556
crhrw3	.0065729	.0024756	2.66	0.008	.0006966
BSIanx	.0069582	.0008818	7.89	0.000	.0030312
depagw2	.2380563	.058727	4.05	0.000	.5498147
depagw3	.0004983	.0000922	5.40	0.000	.0012418
whpsleep	.0004005	.0000728	5.50	0.000	.0014829
Vodkaw2	1.011725	.3486567	2.90	0.004	.1125785
fdferw2	.0009287	.000148	6.28	0.000	.0028423
BSIdep	.0110266	.0038945	2.83	0.005	.0049369
PTSDw1	.0490269	.0147373	3.33	0.001	.194528
anxagw1	.0069481	.0110324	0.63	0.529	.0294885
whpel	.0003778	.000061	6.19	0.000	.0015532
MiPTSD	.0027736	.001268	2.19	0.029	.0038872
injselfr	.5590131	.0769438	7.27	0.000	.0308234
cumdose2	.0033918	.0012168	2.79	0.005	.0005592
depagw1	.0752116	.0216367	3.48	0.001	.2530382
fdferw1	.0024462	.0010357	2.36	0.018	.0110557
PTSDw3	.0018799	.00039	4.82	0.000	.0019098
anxagw2	.1152707	.0168011	6.86	0.000	.3100921
cumdose1	1.168935	.4904622	2.38	0.017	.0766728
cataw1	2.462398	.6742135	3.65	0.000	.0932078
Vodkaw1	.4280787	.2949669	1.45	0.147	.0521485

Table 11 Clustered robust total effects for female PTSD model-continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
BSIanx <-					
crhrw1	-.6380969	.3053973	-2.09	0.037	-.1644668
crhrw2	1.105659	.3274592	3.38	0.001	.2626757
crhrw3	.250372	.0942981	2.66	0.008	.0609137
PTSDw2	-.0098442	.0034327	-2.87	0.004	-.0225975
BSIanx	-.1745221	.0268874	-6.49	0.000	-.1745221
depagw2	.0095657	.0043165	2.22	0.027	.0507149
depagw3	.0265677	.0041898	6.34	0.000	.1519921
whpsleep	-.0004973	.0020122	-0.25	0.805	-.004227
Vodkaw2	.6751084	.2035683	3.32	0.001	.1724434
fdferw2	.0132477	.0074633	1.78	0.076	.0930746
BSIdep	.4200168	.0490334	8.57	0.000	.4316777
PTSDw1	.0137459	.0057833	2.38	0.017	.125199
anxagw1	.0061673	.0024705	2.50	0.013	.0600842
whpel	.0143898	.0023244	6.19	0.000	.1358105
anxagw3	.0270911	.0079415	3.41	0.001	.1720225
MiPTSD	-.0893396	.0337286	-2.65	0.008	-.2874166
injselfr	.1365389	.1046586	1.30	0.192	.017282
cumdose2	.0448409	.0160871	2.79	0.005	.0169712
depagw1	.0391348	.007622	5.13	0.000	.3022349
fdferw1	.0055381	.0013283	4.17	0.000	.0574574
PTSDw3	.0737854	.0300534	2.46	0.014	.1720674
anxagw2	.0389311	.0041791	9.32	0.000	.2404081
cumdose1	1.489678	.333136	4.47	0.000	.2242973
cataw1	.8247241	.3386361	2.44	0.015	.0716611
Vodkaw1	.8656266	.1320265	6.56	0.000	.2420635
depagw2 <-					
crhrw1	-2.258931	.8340322	-2.71	0.007	-.109819
crhrw2	.2560206	.1928965	1.33	0.184	.0114725
crhrw3	-.0160871	.0060589	-2.66	0.008	-.0007382
BSIanx	-.0170515	.0021575	-7.90	0.000	-.0032162
depagw2	6.23e-06	.0005475	0.01	0.991	6.23e-06
depagw3	-.0012204	.0002259	-5.40	0.000	-.0013169
whpsleep	-.0009892	.0001507	-6.56	0.000	-.0015857
Vodkaw2	4.176009	1.45968	2.86	0.004	.2011951
fdferw2	.000886	.0004096	2.16	0.031	.0011741
BSIdep	-.0269872	.0095262	-2.83	0.005	-.0052316
PTSDw1	-.0576735	.0398201	-1.45	0.148	-.0990802
anxagw1	.0161673	.0462592	0.35	0.727	.0297088
whpel	-.0009246	.0001493	-6.19	0.000	-.0016459
MiPTSD	-.0067809	.003102	-2.19	0.029	-.0041147
injselfr	-1.367363	.2199279	-6.22	0.000	-.0326441
cumdose2	.0103831	.003725	2.79	0.005	.0007412
depagw1	.3663815	.0641743	5.71	0.000	.5337014
fdferw1	-.0057088	.0029595	-1.93	0.054	-.0111714
PTSDw3	-.0046046	.0009552	-4.82	0.000	-.0020254
anxagw2	.485354	.0705698	6.88	0.000	.5653191
cumdose1	3.966246	1.56179	2.54	0.011	.1126404
cataw1	2.445573	1.989661	1.23	0.219	.040081
Vodkaw1	2.093189	1.227374	1.71	0.088	.1104054

Table 11 Clustered robust total effects for female PTSD model-continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
depagw3 <-					
crhrw1	-4.347522	1.543091	-2.82	0.005	-.1958691
crhrw2	6.351935	1.354837	4.69	0.000	.2637771
crhrw3	.0014333	.0005398	2.66	0.008	.000061
PTSDw2	-.0532596	.0185718	-2.87	0.004	-.0213703
BSIanx	.0012236	.0002102	5.82	0.000	.0002139
depagw2	.6790289	.0766307	8.86	0.000	.6292709
depagw3	.0690196	.011811	5.84	0.000	.0690196
whpsleep	-.0000354	.0018456	-0.02	0.985	-.0000526
Vodkaw2	2.85642	.9925178	2.88	0.004	.1275344
fdferw2	.0436293	.0089978	4.85	0.000	.0535797
BSIdep	.0024044	.0009236	2.60	0.009	.000432
PTSDw1	-.0292502	.0274282	-1.07	0.286	-.0465681
anxagw1	.0492644	.033544	1.47	0.142	.0838941
whpel	.0000824	.0000133	6.19	0.000	.0001359
anxagw3	.1465696	.0903124	1.62	0.105	.1626804
MiPTSD	.000707	.000298	2.37	0.018	.0003976
injselfr	.1329836	.6350603	0.21	0.834	.0029422
cumdose2	.2576077	.0924191	2.79	0.005	.0170423
depagw1	.2772818	.0438154	6.33	0.000	.3743136
fdferw1	.0054128	.0059868	0.90	0.366	.0098162
PTSDw3	.0322196	.015976	2.02	0.044	.0131335
anxagw2	.4458294	.0487964	9.14	0.000	.4812306
cumdose1	3.654434	1.280203	2.85	0.004	.0961799
cataw1	-.3175649	1.706455	-0.19	0.852	-.0048232
Vodkaw1	1.899033	.9602502	1.98	0.048	.0928247
whpsl~p <-					
crhrw1	3.264496	1.93857	1.68	0.092	.0989987
crhrw2	4.884714	1.349615	3.62	0.000	.1365398
crhrw3	1.04901	.3950906	2.66	0.008	.0300283
PTSDw2	-.0430932	.0150267	-2.87	0.004	-.0116389
BSIanx	3.351993	.4292509	7.81	0.000	.3943889
depagw2	.0815741	.0179591	4.54	0.000	.0508851
depagw3	.1700077	.0322846	5.27	0.000	.1144347
whpsleep	.0009155	.0078328	0.12	0.907	.0009155
Vodkaw2	2.962815	.8564596	3.46	0.001	.0890429
fdferw2	.0587307	.0301354	1.95	0.051	.0485486
BSIdep	1.759788	.2021521	8.71	0.000	.2128016
PTSDw1	.0600708	.0239769	2.51	0.012	.0643743
anxagw1	.0453059	.011484	3.95	0.000	.0519328
whpel	.0602905	.0097388	6.19	0.000	.0669497
anxagw3	.1185919	.0345103	3.44	0.001	.0886004
MiPTSD	-.3372269	.1374477	-2.45	0.014	-.1276474
injselfr	4.596278	.4947854	9.29	0.000	.0684489
cumdose2	.1981034	.0710714	2.79	0.005	.0088217
depagw1	.1869333	.031042	6.02	0.000	.1698596
fdferw1	.0519119	.0086186	6.02	0.000	.0633683
PTSDw3	.6745651	.220754	3.06	0.002	.1850861
anxagw2	.1820353	.0170128	10.70	0.000	.1322603
cumdose1	6.480121	1.565545	4.14	0.000	.1147985
cataw1	3.575319	1.529799	2.34	0.019	.036552
Vodkaw1	3.733317	.6888738	5.42	0.000	.1228331

Table 11 Clustered robust total effects for female PTSD model-continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
Vodkaw2 <-					
crhrw1	-.0709653	.0467987	-1.52	0.129	-.0716085
crhrw2	.069005	.0460847	1.50	0.134	.0641809
crhrw3	-.0001683	.0000634	-2.66	0.008	-.0001603
BSIanx	-.0001815	.0000225	-8.08	0.000	-.0007106
depagw2	.000395	.0001011	3.91	0.000	.008198
depagw3	-.0000129	2.39e-06	-5.40	0.000	-.0002888
whpsleep	-.0000116	.0000196	-0.59	0.553	-.0003872
Vodkaw2	.001374	.000564	2.44	0.015	.001374
fdferw2	.000464	.0000977	4.75	0.000	.0127634
BSIdep	-.0002824	.0000989	-2.86	0.004	-.0011363
PTSDw1	-.0000181	.0000158	-1.15	0.252	-.0006444
anxagw1	.0000308	.0000243	1.27	0.203	.0011765
whpel	-9.67e-06	1.56e-06	-6.19	0.000	-.0003575
anxagw3	-7.16e-06	2.06e-06	-3.48	0.001	-.0001781
MiPTSD	-.0000699	.0000322	-2.17	0.030	-.0008802
injselfr	-.0141921	.0085841	-1.65	0.098	-.0070325
cumdose2	.0027986	.001004	2.79	0.005	.0041467
depagw1	.0001621	.0000252	6.43	0.000	.0049007
fdferw1	-.0000197	.0000945	-0.21	0.835	-.0008
PTSDw3	-.0000487	.0000101	-4.82	0.000	-.0004446
anxagw2	.0004067	.0000919	4.42	0.000	.0098327
cumdose1	.0075803	.0066822	1.13	0.257	.0044684
cataw1	-.0277995	.0177734	-1.56	0.118	-.0094567
Vodkaw1	.8187495	.0752573	10.88	0.000	.8963481
fdferw2 <-					
crhrw1	-2.054351	.1598719	-12.85	0.000	-.0753662
crhrw2	-3.91763	1.871172	-2.09	0.036	-.1324745
crhrw3	-.040585	.0152856	-2.66	0.008	-.0014054
PTSDw2	.0006978	.0002433	2.87	0.004	.000228
BSIanx	-.0495694	.0053585	-9.25	0.000	-.0070554
depagw2	-.0270153	.0055987	-4.83	0.000	-.0203863
depagw3	-.0033433	.00062	-5.39	0.000	-.0027224
whpsleep	-.0052341	.0410578	-0.13	0.899	-.0063318
Vodkaw2	-.1847226	.0485174	-3.81	0.000	-.0067159
fdferw2	-.0289596	.0055819	-5.19	0.000	-.0289596
BSIdep	-.0680842	.0223895	-3.04	0.002	-.0099598
PTSDw1	.0314549	.0065003	4.84	0.000	.0407781
anxagw1	.0910199	.0195833	4.65	0.000	.1262155
whpel	-.0023326	.0003768	-6.19	0.000	-.0031335
anxagw3	-.0019204	.0005528	-3.47	0.001	-.0017356
MiPTSD	-.0148276	.0073681	-2.01	0.044	-.0067897
injselfr	-3.202304	.359968	-8.90	0.000	-.0576914
cumdose2	-.1588825	.0570005	-2.79	0.005	-.008559
depagw1	.0559659	.0071908	7.78	0.000	.0615199
fdferw1	.342553	.0414729	8.26	0.000	.5058501
PTSDw3	-.0127113	.0026933	-4.72	0.000	-.0042192
anxagw2	-.0241666	.0054478	-4.44	0.000	-.0212412
cumdose1	.3923366	.4917946	0.80	0.425	.0084082
cataw1	9.974225	4.056795	2.46	0.014	.1233571
Vodkaw1	.3205927	.2840002	1.13	0.259	.0127604

Table 11 Clustered robust total effects for female PTSD model-continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
BSIdep <-					
crhrw1	.1821674	.0703566	2.59	0.010	.0456845
crhrw2	.8205657	.0584371	14.04	0.000	.1896789
crhrw3	.6191558	.2331939	2.66	0.008	.1465669
PTSDw2	-.0021594	.000753	-2.87	0.004	-.0048229
BSIanx	.0606174	.0070976	8.54	0.000	.05898
depagw2	.0171872	.0016662	10.32	0.000	.0886601
depagw3	.0215277	.0040993	5.25	0.000	.1198317
whpsleep	.0165416	.0019713	8.39	0.000	.1367925
Vodkaw2	.8958816	.2586496	3.46	0.001	.2226541
fdferw2	.0063637	.001224	5.20	0.000	.0435014
BSIdep	.0386776	.0055138	7.01	0.000	.0386776
PTSDw1	.0064545	.0020786	3.11	0.002	.0571999
anxagw1	.0039763	.0010935	3.64	0.000	.0376923
whpel	.0355852	.0057481	6.19	0.000	.3267792
anxagw3	.0059425	.0020934	2.84	0.005	.0367144
MiPTSD	-.0028697	.0028163	-1.02	0.308	-.0089828
injselfr	.5938456	.0707676	8.39	0.000	.0731339
cumdose2	.0332787	.011939	2.79	0.005	.0122549
depagw1	.0139398	.0012533	11.12	0.000	.1047476
fdferw1	.0050496	.000818	6.17	0.000	.0509743
PTSDw3	.0691962	.0256121	2.70	0.007	.1570064
anxagw2	.0152012	.0016738	9.08	0.000	.0913349
cumdose1	1.163616	.3892378	2.99	0.003	.1704701
cataw1	.0450769	.1665904	0.27	0.787	.003811
Vodkaw1	.7786049	.2164677	3.60	0.000	.2118472
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	.3374817	.0701669	4.81	0.000	.3155096
depagw1	.7246201	.0741567	9.77	0.000	.5744159
cumdose1	10.32614	3.781802	2.73	0.006	.1595893
cataw1	19.74519	4.119168	4.79	0.000	.1761044
Vodkaw1	5.069353	1.963719	2.58	0.010	.1455075

Continued on the next page ....

Table 11 Clustered robust total effects for female PTSD model-continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
whpel <-					
crhrw1	.6934566	1.009086	0.69	0.492	.0189379
crhrw2	3.542952	.754158	4.70	0.000	.0891837
crhrw3	.4953354	.1865591	2.66	0.008	.0127688
PTSDw2	-.0307149	.0107104	-2.87	0.004	-.0074705
BSIanx	1.582135	.2025701	7.81	0.000	.1676352
depagw2	.1708109	.0200398	8.52	0.000	.0959521
depagw3	.2885378	.0787651	3.66	0.000	.1749009
whpsleep	.4723523	.0561759	8.41	0.000	.4253692
Vodkaw2	1.954828	.508176	3.85	0.000	.0529058
fdferw2	.0362181	.0145279	2.49	0.013	.0269611
BSIdep	.8309601	.0954469	8.71	0.000	.0904888
PTSDw1	.17844	.0551612	3.23	0.001	.1722035
anxagw1	.0309806	.0106768	2.90	0.004	.0319799
whpel	.0284688	.0045986	6.19	0.000	.0284688
anxagw3	.0845269	.0292744	2.89	0.004	.056869
MiPTSD	-.1590088	.06488	-2.45	0.014	-.0542014
injselfr	2.195021	.2798302	7.84	0.000	.0294373
cumdose2	.1436872	.0515491	2.79	0.005	.0057621
depagw1	.2273223	.0215067	10.57	0.000	.186014
fdferw1	.0255534	.0039355	6.49	0.000	.0280901
PTSDw3	.3246238	.1043025	3.11	0.002	.0802103
anxagw2	.1727806	.0147022	11.75	0.000	.1130496
cumdose1	5.615932	1.63315	3.44	0.001	.0895932
cataw1	7.733741	2.52095	3.07	0.002	.071201
Vodkaw1	2.727055	.5549182	4.91	0.000	.0808005

Continued on the next page ....

Table 11 Clustered robust total effects for female PTSD model-continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
anxagw3 <-					
crhrw1	-2.33165	.7191658	-3.24	0.001	-.0946447
crhrw2	2.957565	.6354412	4.65	0.000	.1106557
crhrw3	-.0017142	.0006456	-2.66	0.008	-.0000657
PTSDw2	-.3883912	.1354331	-2.87	0.004	-.1404077
BSIanx	-.0019528	.0002266	-8.62	0.000	-.0003075
depagw2	.2329122	.0428471	5.44	0.000	.194469
depagw3	.5026865	.0861033	5.84	0.000	.4529038
whpsleep	-.0001622	.0008534	-0.19	0.849	-.0002171
Vodkaw2	.976027	.3401942	2.87	0.004	.0392623
fdferw2	.0201858	.0041883	4.82	0.000	.0223345
BSIdep	-.0028757	.0009809	-2.93	0.003	-.0004655
PTSDw1	.0332543	.0195678	1.70	0.089	.0476999
anxagw1	.2127448	.0386089	5.51	0.000	.3264117
whpel	-.0000985	.0000159	-6.19	0.000	-.0001464
anxagw3	.0688464	.0424658	1.62	0.105	.0688464
MiPTSD	-.0006753	.0003209	-2.10	0.035	-.0003421
injselfr	-.1405753	.3160031	-0.44	0.656	-.0028021
cumdose2	.1199463	.0430318	2.79	0.005	.0071493
depagw1	.2422999	.0245942	9.85	0.000	.2946973
fdferw1	.0088636	.0041024	2.16	0.031	.0144822
PTSDw3	.2319101	.1164345	1.99	0.046	.0851705
anxagw2	.835728	.0635175	13.16	0.000	.8127521
cumdose1	3.277893	1.211011	2.71	0.007	.0777262
cataw1	2.748808	1.596572	1.72	0.085	.0376149
Vodkaw1	3.212743	1.41395	2.27	0.023	.1414867

Continued on the next page ....

Table 11 Clustered robust total effects for female PTSD model-continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
MiPTSD <-					
crhrw1	-1.553115	.722316	-2.15	0.032	-.1244306
crhrw2	2.411442	.7745169	3.11	0.002	.1780768
crhrw3	.5631637	.2121054	2.66	0.008	.0425888
PTSDw2	-.024011	.0083727	-2.87	0.004	-.0171326
BSIanx	1.859749	.2484236	7.49	0.000	.5780777
depagw2	.1654189	.0378372	4.37	0.000	.2726052
depagw3	.0966634	.0185856	5.20	0.000	.1718944
whpsleep	.0796674	.0170213	4.68	0.000	.2104705
Vodkaw2	2.124509	.5590182	3.80	0.000	.16868
fdferw2	.1164351	.0238874	4.87	0.000	.2542761
BSIdep	.9447468	.1104408	8.55	0.000	.3018147
PTSDw1	.0333296	.0154401	2.16	0.031	.0943604
anxagw1	.0480117	.0183231	2.62	0.009	.1453934
whpel	.0323671	.0052283	6.19	0.000	.0949542
anxagw3	.0660779	.0192419	3.43	0.001	.1304209
MiPTSD	-.2019943	.0759832	-2.66	0.008	-.2019943
injselfr	.1940389	.2378308	0.82	0.415	.0076341
cumdose2	.0977979	.0350859	2.79	0.005	.0115053
depagw1	.0848957	.0296994	2.86	0.004	.2037978
fdferw1	.0506601	.0072106	7.03	0.000	.1633734
PTSDw3	.3902314	.074859	5.21	0.000	.2828671
anxagw2	.0168827	.0368647	0.46	0.647	.0324061
cumdose1	3.322383	.8396767	3.96	0.000	.1554938
cataw1	-1.278002	1.38743	-0.92	0.357	-.0345174
Vodkaw1	1.5458	.4129824	3.74	0.000	.1343643

Continued on the next page ....

Table 11 Clustered robust total effects for female PTSD model-continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
injse~r <-					
crhrw1	-.0073739	.0051796	-1.42	0.155	-.0150158
crhrw2	.026256	.005385	4.88	0.000	.049282
crhrw3	.0118688	.0044702	2.66	0.008	.0228138
PTSDw2	-.0001808	.000063	-2.87	0.004	-.0032784
BSIanx	.0125703	.0015921	7.90	0.000	.0993136
depagw2	.0012764	.0002458	5.19	0.000	.0534636
depagw3	.0009	.0001666	5.40	0.000	.0406778
whpsleep	.0007256	.000115	6.31	0.000	.0487244
Vodkaw2	.0254527	.0064589	3.94	0.000	.0513652
fdferw2	.0008215	.0001577	5.21	0.000	.0455978
BSIdep	.0199107	.0070308	2.83	0.005	.1616748
PTSDw1	.0009818	.0002003	4.90	0.000	.0706502
anxagw1	.0023851	.0005922	4.03	0.000	.1835832
whpel	.0006821	.0001102	6.19	0.000	.0508646
anxagw3	.0004975	.0001431	3.48	0.001	.0249569
MiPTSD	.0050063	.0022893	2.19	0.029	.1272467
injselfr	.0091956	.0021916	4.20	0.000	.0091956
cumdose2	.0010648	.000382	2.79	0.005	.0031841
depagw1	.0021934	.0002563	8.56	0.000	.1338348
fdferw1	.000388	.0000544	7.13	0.000	.0318056
PTSDw3	.0033955	.0007044	4.82	0.000	.0625598
anxagw2	.0003107	.0002407	1.29	0.197	.0151593
cumdose1	.0575618	.017455	3.30	0.001	.0684744
cataw1	.0325732	.0196992	1.65	0.098	.0223613
Vodkaw1	.0305022	.0068659	4.44	0.000	.0673895
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	2.695043	.1392837	19.35	0.000	.8428975
fdferw1 <-					
PTSDw1	.1005482	.0209053	4.81	0.000	.0882712
anxagw1	.2979369	.0570277	5.22	0.000	.2797733
depagw1	.215891	.022094	9.77	0.000	.1607063
cumdose1	3.076538	1.253696	2.45	0.014	.0446488
cataw1	5.88282	1.780732	3.30	0.001	.0492693
Vodkaw1	1.510347	.6474797	2.33	0.020	.0407091

Continued on the next page ....

Table 11 Clustered robust total effects for female PTSD model-continued:

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

	Coef.	Robust Std. Err.	z	P>|z|	Std. Coef.
PTSDw3 <-					
crhrw1	-.6718797	.2384741	-2.82	0.005	-.07426
crhrw2	.9816481	.2093807	4.69	0.000	.100006
PTSDw2	-.0082309	.0028701	-2.87	0.004	-.0081021
depagw2	.1049393	.0118427	8.86	0.000	.238576
depagw3	.1652097	.0454796	3.63	0.000	.4052983
whpsleep	-5.47e-06	.0002852	-0.02	0.985	-.00002
Vodkaw2	.4414401	.1533868	2.88	0.004	.0483522
fdferw2	.0067426	.0013905	4.85	0.000	.0203137
BSIdep	.0003716	.0001427	2.60	0.009	.0001638
PTSDw1	-.0011881	.0043853	-0.27	0.786	-.0046403
anxagw1	.0174876	.005499	3.18	0.001	.073058
anxagw3	.0226513	.0139572	1.62	0.105	.0616771
MiPTSD	.0001093	.000046	2.37	0.018	.0001507
injselfr	.0205517	.0981442	0.21	0.834	.0011155
cumdose2	.0398115	.0142827	2.79	0.005	.0064613
depagw1	.050007	.006813	7.34	0.000	.1656091
fdferw1	.0339782	.010171	3.34	0.001	.1511664
PTSDw3	.0049793	.002469	2.02	0.044	.0049793
anxagw2	.0688999	.0075412	9.14	0.000	.1824494
cumdose1	.6667293	.2950158	2.26	0.024	.043048
cataw1	.1458889	.296515	0.49	0.623	.0054359
Vodkaw1	.343538	.1996054	1.72	0.085	.0411951
anxagw2 <-					
PTSDw1	.0959793	.0199554	4.81	0.000	.1415642
anxagw1	.2843984	.0468098	6.08	0.000	.4486842
depagw1	.2060808	.0210901	9.77	0.000	.2577314
cumdose1	2.936738	1.195091	2.46	0.014	.0716052
cataw1	5.615501	1.519645	3.70	0.000	.0790152
Vodkaw1	3.689356	1.560993	2.36	0.018	.1670695

11.9 Cyclical contribution to persistence

11.9.1 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

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

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 7.

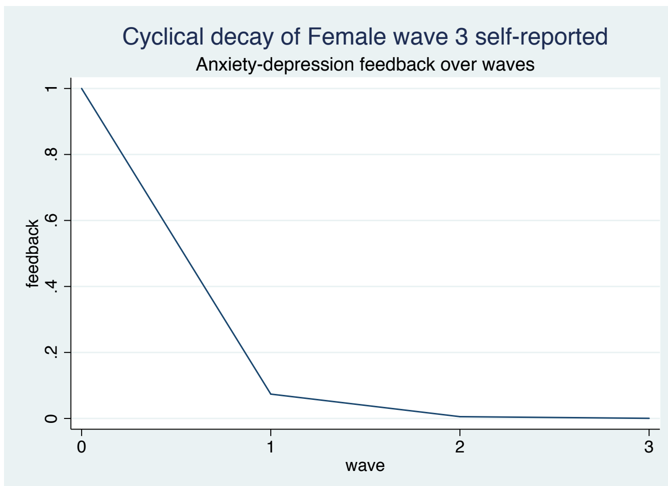

Figure 7: Wave 3 Depression anxiety cyclical decay among women

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 8 which boosts the fist impulse to delay the decay slightly.

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

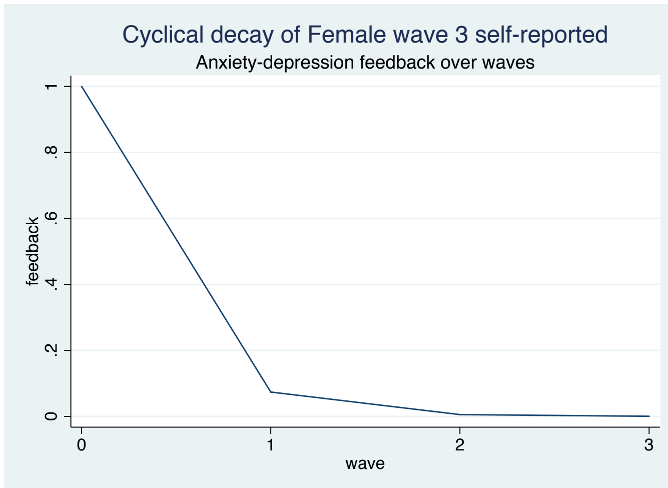

Figure 8: Wave 3 Feedback of depression- anxiety total effects cyclical decay among women

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.

11.9.2 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.

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

and they are

$$\begin{aligned} BSIanx &= -0.287 * MiPTSD \\ MiPTSD &= 0.578 * BSIanx \end{aligned} \tag{3}$$

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 9. Usually negative feedback reduces persistence and contributes to a more short-lived effect.

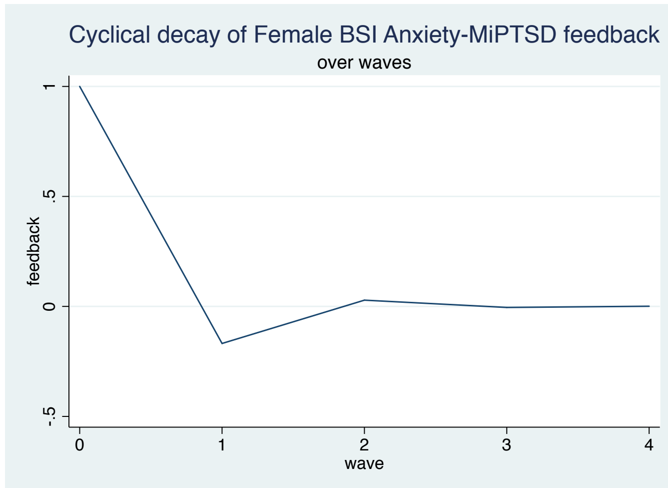

Figure 9: Undulating decay of Anxiety-PTSD feedback cycle among women

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.

11.10 Spurious relationship tests

The target endogenous variable in this model is the civilian Mississippi PTSD revised specifically for application to Chornobyl. There are three exogenous variables in this model. We wanted to be sure that they were not creating a spurious relationship between Chornobyl PTSD and BSI anxiety, which we found to be increasing PTSD persistence. Therefore, we tested several direct causal links which might artificially construct a common cause for those two reciprocally linked endogenous variables. The resulting models of direct relationships that fit the data revealed no basis for concern.

First, we examined the relationship between vodka consumption and the two reciprocally linked variables. Although it is possible for Vodka consumption to be related to cumulative external 1986 exposure, as shown in Figure 10, it is not realistic to believe that this would be the case. Vodka consumption does not lead to cumulative external dose unless it causes one to loose one's bearings and to meander into the exclusion zone. Although this could lead to a statistically significant link between Vodka and the cumdose1 variable, such events would not be commonplace among the populace. We observe no link extending from Vodka consumption in 1986 to external cumulative dose in the same year in Figure 6, nor do we find any arrow extending from such vodka consumption to MiPTSD in Figure 6 either. Therefore, vodka consumption is not likely to be a common cause of exposure to radiation in that year and anxiety or contemporary

Chornobyl PTSD.

/Users/robertyaffee/Documents/data/rptfigs/vodkawX1.pdf

Figure 10: Possible but unrealistic

It is more likely that vodka consumption in 1986 is not exogenous after all, but really follows from anxiety in the first wave.

We also examined the relationship between catastrophe during the first wave to determine whether that could engender a spurious relationship between BSI anxiety and MiPTSD, but found no linking relationship extending from such catastrophic experience to either MiPTSD or BSI anxiety in a model depicted in Figure 11.

We also wondered whether cumulative external dose could create a spurious relationship between contemporary Chornobyl PTSD and BSI anxiety. In Table, we performed some non- nested regression analysis using self-reported PTSD symptoms and then MiPTSD as a dependent variable, with clustered robust standard errors, to ascertain whether reconstructed cumulative external dose in 1986 could directly affect both MiPTSD and BSI measured anxiety. The parameter estimates generated suggested no direct link from cumulative external reconstructed dose to MiPTSD. Without such a link, there cannot be a direct spurious relationship resulting from our exogenous variable, reconstructed cumulative external dose.

Merely because there is no direct spurious effect does not mean that there cannot be an indirect spurious effect. If we re-examine Figure 6, for example, we

/Users/robertyaffee/Documents/data/rptfigs/spurCatCumdose1.pdf

Figure 11: Test of spuriousness of relationship based on 1986 catastrophic experience

observe a direct effect emanating from cumulative external dose to BSI anxiety, a connection that is reasonable if the individual knew of actual exposure it would be surprising if he or she were not anxious about it. Although we see no direct link from cumulative external 1986 dose to MiPTSD, we do find one extending to self-expressed depression in 1986 and from there directly to MiPTSD. Could this indirect relationship be the basis of an indirect or proximate spurious reciprocal relationship? With the total effects standardized coefficients from cumdose1 impacting MiPTSD (cumdose1 stdized $\beta = .155,\ p = 0.000) and BSI anx (\beta = .224, p = .015$) being so small, that would be quite unlikely.

11.11 Non-nested sequential regression alternative perspective

None of the variables remains significant over all three waves. The magnitudes of the direct effects change from wave to wave. For the first three waves, the dependent variables are self-reported PTSD symptoms for the specific waves. The regression model on the far right is the civilian Mississippi PTSD revised for Chornobyl. Hence, the models are not nested under the same dependent variable. Nevertheless, it is helpful to be able to track the changes in the direct effects coefficients over the waves and to compare them with those of a model for clinical PTSD, even if they do not reveal the mediated effects revealed by structural equation path models with clustered robust effects.

Table 12 Female PTSD regression analysis with clustered robust standard errors

	wave1ptsd b/t/p	wave2ptsd b/t/p	wave3ptsd b/t/p	currentptsd b/t/p
cumdose1	0.394	-0.402#	-0.386	-0.321
	(0.808)	(-1.715)	(-1.337)	(-0.489)
	(0.420)	(0.087)	(0.182)	(0.625)
depagw1	0.233***	-0.002	0.001	-0.013
	(3.461)	(-0.100)	(0.050)	(-0.718)
	(0.001)	(0.920)	(0.960)	(0.473)
anxagw1	0.353***	-0.009	0.019	0.051**
	(6.143)	(-0.499)	(1.482)	(3.099)
	(0.000)	(0.618)	(0.139)	(0.002)
crhrw1	1.327	1.933**	-0.074	-1.206#
	(1.227)	(3.132)	(-0.140)	(-1.840)
	(0.220)	(0.002)	(0.888)	(0.066)
fdferw1	0.099**	-0.017	0.012	0.014
	(2.971)	(-1.415)	(0.986)	(1.234)
	(0.003)	(0.157)	(0.324)	(0.218)
cataw1	26.786***	0.313	0.975	-1.175
	(7.333)	(0.232)	(1.102)	(-1.237)
	(0.000)	(0.816)	(0.271)	(0.217)
injselfr	0.105	-0.151	0.919	3.488***
	(0.052)	(-0.251)	(1.545)	(5.109)
	(0.959)	(0.802)	(0.123)	(0.000)
Vodkaw1	-0.462	0.509	0.128	0.893*
	(-1.392)	(1.124)	(0.446)	(2.153)
	(0.164)	(0.261)	(0.656)	(0.032)
PTSDw1		0.058**	-0.037**	0.014
		(3.178)	(-2.961)	(0.912)
		(0.002)	(0.003)	(0.362)
cumdose2		0.011	0.325	2.386
		(0.052)	(0.333)	(1.321)
		(0.958)	(0.739)	(0.187)
depagw2		0.202***	-0.182***	0.084*
		(4.255)	(-3.918)	(2.264)
		(0.000)	(0.000)	(0.024)
anxagw2		0.055#	-0.107**	-0.117**
		(1.655)	(-2.674)	(-2.608)
		(0.098)	(0.008)	(0.009)
crhrw2		-0.663	0.549	0.439
		(-1.031)	(0.546)	(0.330)
		(0.303)	(0.585)	(0.742)
Vodkaw2		-0.316	-0.050	-0.637
		(-0.663)	(-0.156)	(-1.382)
		(0.508)	(0.876)	(0.167)
fdferw2		0.092**	0.024	0.057#
		(3.227)	(1.095)	(1.836)
		(0.001)	(0.274)	(0.067)
PTSDw2			0.663***	0.051
			(8.363)	(0.966)
			(0.000)	(0.334)
cumdose3			-0.021	-2.202
			(-0.024)	(-1.294)
			(0.981)	(0.196)
anxagw3			0.159***	0.063
			(3.371)	(1.484)
			(0.001)	(0.138)

crhrw3			-0.704	1.751
			(-0.789)	(1.551)
			(0.430)	(0.121)
depagw3			0.142**	-0.053
			(2.796)	(-1.425)
			(0.005)	(0.155)
fdferw3			0.005	0.046
			(0.198)	(1.329)
			(0.843)	(0.184)
cataw2			-0.695	2.114
			(-0.642)	(0.451)
			(0.521)	(0.652)
Vodkaw3			0.001	0.197
			(0.007)	(0.922)
			(0.995)	(0.357)
PTSDw3				0.166**
				(3.103)
				(0.002)
BSIanx				1.225***
				(8.989)
				(0.000)
_cons	1.612	0.002	-0.072	32.456***
	(1.114)	(0.003)	(-0.135)	(27.180)
	(0.266)	(0.998)	(0.892)	(0.000)
r2	0.532	0.365	0.576	0.551
r2_a	0.526	0.351	0.561	0.535
bic	6549.524	5090.842	4819.724	5084.934
N	701.000	701.000	701.000	701.000

# p<.1, * p<.05, ** p<.01, *** p<.001

Some observations about these unstandardized regression coefficients are noteworthy. Because these models are not nested under the same dependent variable, comparison of the adjusted R^2 as a measure of relative fit of the models is not warranted.Perhaps a rough comparison of the first three models where the dependent variable is a self-report of PTSD symptoms with the last model, where the dependent variable is a clinical measure would make more sense. Nevertheless, all of the models exhibit respectable measures goodness of fit.

The parameter estimates are unstandardized regression coefficients, whose standard errors are clustered robust, as in the path models, to control not only for heteroskedasticity but also for serial correlation between the waves of the study. We find that reconstructed external dose does not significantly predict or explain any of the PTSD measures. There seems to be no statistically significant direct effect of actual exposure to radiation on any of the PTSD measures. It may be a relief to many who thought that they had suffered some damage to their biological systems to discover that this, for the general public, is probably not the case.

Nevertheless, self-reported PTSD in the previous wave is usually a significant explanatory variable (predictor) for self-reported PTSD in the next wave. Fear of consuming contaminated foods plagues the female respondents. It is a significant predictor in waves 1 and 2, but by wave 3 it is no longer statistically significant. It is possible that many may fear injury by Chornobyl from having consumed contaminated food or liquids. Perceived risk of exposure to radiation in 1986 significantly predicts self-reported PTSD in the following decade. It also significantly predicts clinically diagnosable PTSD at the time of the interview.

Substance abuse in the form of excessive liquor consumption is found to be statistically significant insofar as vodka consumption in 1986 appears to predict the revised civilian Mississippi PTSD. However, in waves 2 and 3 this variable exhibits no direct effects on the PTSD dependent variables.

11.12 Hypothesis recapitulation

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.

Hypothesis 24 suggests that perceived risk of exposure indirectly predicts substance abuse through the mediation of the Nottingham health measures. If this were so, there might be direct effects from the perceived risk on the Nottingham measures of sleep and energy level. Perceived risk in wave 1 does directly impact sleep (stdized $\beta = .185, p = 0.000$) but this is not so for energy level. But there are no direct paths from sleep to Vodka2 or Vodka1. Nevertheless, there are tiny but significant indirect paths from the energy level on vodka consumption in wave 2. But only wave 2 has an indirect path in to energy level from perceived risk of exposure that is statistically significant. This effect would be an unlikely source of prediction for it would be too indirect and too small to be used for such a purpose.

12 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 nonlinear 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 multivariable in nature and we should explore these relationships in greater detail in future research.

In future research, we would explore the cyclical differences at every wave in these reciprocal relationships.

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