Hypothesis one, part two : Findings relating to associations between reconstructed external dose of ^{137}Caesium and psychological sequelae of Chornobyl

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2 Introduction

In this section of the report, we discuss 24 hypotheses formulated within the grant proposal and the methods by which we test those hypotheses. In this section we address hypothesis one, which states that radiation does directly and significantly explains and hence predicts self-reported health as measured by the Nottingham health scale. Our sample, consisting of 340 male respondents and 363 female respondents was obtained by a process of random digit phone number selection. Thus, the sample was designed to be a probability selection of the population. In this section, we focus on three primary domains of the first part of the Nottingham health profile–namely, those domains which pertain to pain, sleep, and energy level. In so doing, we examine the dose-response relationship to them. The average cumulative dose of Caesium 137 is measured in milliGrays. Caesium 137, abbreviated as ^{137}CS or CS^{137}, has a half-life of approximately 30 years. This isotope is used as a general indicator because its deposition because the length of its half-life is typical of the length of the more serious general radiation threat. It is an isotope that could conceivably still be a matter of concern, unlike Iodine 131, which has a half-life of approximately 8 days. This dose is the amount of the radiation that the body has been exposed to by where and how the respondent has reported his living and working, drinking, and participating in the activities inquired about during the interview.

The second part of the Nottingham health profile pertains to general activities of life that are generally affected by conditions of health– more specifically, to paid employment, home care, problems with the family at home, problems with the sex life, problems with the social life, impacts on interests and hobbies, and impacts on vacation plans. We will provide a summary description of these endogenous variables in our narrative.

We include in our variable list basis function generated by the program called MARS, referring to multivariate adaptive regression splines, developed by Professor Jerry Friedman [2]. The regression splines have variable names that begin with bf, which stands for the term, basis function. These splines help us analyze the data when it needs to be re-centered or transformed in such a manner that a regression model will find it more linear than it was in its original form.

Because one of the objectives is to discover the key relationships whose configurations forms the etiological pathways through which dose effects the psychological sequelae of Chornobyl, we divide these effects into direct, indirect, and total effects. For this reason, when we call an effect a direct effect, we refer to it not as a direct as opposed to an inverse relationship, but rather as direct

as opposed to an indirect effect, where some other variable intervenes between it and the dependent variable. The total effect of a variable on the dependent variable will be the sum of its indirect effects plus its direct effect. Therefore, the direct effect can be computed by subtracting the sum of the indirect effects from the total effect. A direct effect can be positive or negative in its relationship. Although we focus now on direct effects, our ultimate analysis will accommodate both pathways to the dependent variable. We may therefore believe that the part one effects of pain, sleep or energy level or pain may mediate (intervene) between the dose and the impact on one's activities.

This section pertaining to part one of the Nottingham is organized as follows. We examine the relationship for men and women in each of three waves between cumulative dose from ^{137}CS on the the Part 2 subscales: Paid employment, home responsibilities, problems with the family at home, social problems, sex life issues, interests and hobbies, and vacation plans. We focus on the direct effects from a a linear regression while taking account of potential mediators and moderators for eventual inclusion in a grand causal path analysis at a later time. We believe that a robust path analysis would provide more explanatory power and appeal than a a simple regression model could. Before doing so, we need to define our operationalization of the measures and to examine the zero order relationships.

3 DIRECT EFFECTS ON MENTAL HEALTH AND PHYSICAL HEALTH

3.1 H1: Radiation dose directly significantly predicts self-reported health as measured by Nottingham Health Scale

Part 2 of the Nottingham pertains to areas impact of the health problems suffered by the respondent–with respect to general activities of living. These activities include paid employment; home cleaning, cooking, and repairs; social life ; causing problems with family members at home; sex life; interests and hobbies; and vacation plans.

We can examine the relationship to be tested in several ways. First, we can examine the zero-order relationship, without the use of other covariates. This might provide us with a sense of the total relationship and as a point of departure.

These phenomena, represented by these subscales, do not exist *in vacuo*. They arise in real situations in which a number of potentially confounding influences also exist. We have to partial out or control in order for alternative effects effects to properly arrive at an understanding of the nature of the targeted relationship to be tested. We will endeavor to include the principal confounders in a regression analysis in order to properly the relationship targeted by our hypothesis. We do this in several ways. We can include them as other indepen-

dent covariates in the regression and partial out their competing or enhancing effects. We present these direct effects in Tables 3a through 5b.

However, we also begin our exploration into possible mediating and moderating effects that will combine with the direct effects to create total effects.

We begin examining interactions to determine whether there are joint relationships over and the direct effects, but merely mention them at this juncture. Moderating effects can reinforce or attenuate the direct effects, whereas the mediating effects can circumvent a direct effect to neutralize or enhance its total effect. When viewed from the perspective of the total effect, they may be confused. However, we will attempt later to distinguish them from one another they become part of our analysis.Even though we focus on the direct effects, we do not wish to exclude from consideration other aspects of the total effects.

Consequently in addition to testing a direct effect, we try to obtain a sense of whether the variable might be a moderator or a mediator as well. we test alternative paths to determine whether there might be a mediator that could influence the direct effect. But we delay the construction of the grant path model until we examine some other aspects of our analysis.

If there is a variable that mediates a dose-effect relationship, it will intervene between the dose and the effect under consideration. If a variable such as energy level intervenes between our paid employment and our average cumulative reconstructed dose, there are two paths between the dose and the paid employment. One path goes from the dose to the energy level and the other path goes from the energy level to the paid employment. If third path circumvents the energy level variable and proceeds directly to paid employment, there would be both a direct and an indirect effect from the dose to the employment.

To properly explain this point, we have to perform not one but several multiple regression analyses, and consider the signs, magnitudes, and significance all parameters involved. We assume that if one comes from an ordinary least squares regression, the second regression will also come from the same kind of a regression analysis. We cannot have one link coming from a classical ordinary least squares regression and another link coming from a logistic regression for those coefficients would not be the same. The classical regression model coefficient would assume linearity, whereas the logistic regression coefficient would not. Assume for the moment, that both links of the indirect path were of the same kind. To compute the indirect effect, we could then multiply the two coefficients by one another to obtain a product representing the indirect effect. By summing the total of indirect effects and adding the direct effect, we can obtain a measure of the total effect, assuming there is no problematic spurious effect.

The spurious effects that we know about can be computed by subtracting the direct and indirect effects from the zero-order relationship, which we use as our starting point. What is left over is the spurious effect that we know about.

The spurious effect that we do not know about can be any unsuspected antecedent variable that is related to our supposedly exogenous cumulative dose and our presumed endogenous pain subscale. However, if there is an antecedent variable, unbeknownst to us, our presumed exogenous dose is no longer exogenous but predetermined or influenced by that unknown prior “cause.”. Such

a situation would endow our observed relationship with an uncertainty that might not be possible to estimate. It would also preclude us of being 100% certain of much of anything. However, we can examine the variation of the total effect to obtain a sense of its reliability over time. If that effect impacts the health or values of the individual, downside (in the direct that harms or hurts or deprives him of value) variation below a given threshold of acceptability can be considered variation can constitute a measure of the risk posed by it to an individual.

Our objective is to minimize any kind of specification error we can by including all of the potentially related variables and thus forming some sort of general unrestricted model as a starting point. For this reason, we add covariates that could provide alternative plausible explanations to the relationship we are testing to control for their effects [1, 25-26].

Among the variables we employ as confounders are the socio-demographic characteristics of the respondents, the computed geodesic distance in miles from the accident site, as well as local measures of support that the respondents might experience. As for the sociodemographic characteristics we employ martial status, the number of children for women, and income sufficiency for various levels of quality of life. We also control for perception of risk to oneself of the Chornobyl related health threat in addition to some function of the distance of the respondent at the time of the accident from Chornobyl.

3.2 Impact on Paid Employment

3.2.1 wave one

As for the male respondents, 79.41% (270) report no paid employment, whereas 70 (20.59%) report that they have paid employment. In the female subsample, 74.4% (270) indicate that they have no paid employment, while 25.6% (93) maintain that they have paid employment.

In zero-order logistic regression relationships, with no other variables partialled out, only females exhibited evidence of a cumulative dose of ^{137}CS in milliGrays during wave one and a dependent variable of paid employment relationship ($b = 0.529, se = 0.219, z = 2.41, p = 0.016$). But this relationship was not robust enough to withstand the presence of potentially confounding variables.

As for full models, controlling for such potential confounders as age, perceived Chornobyl related health threat to oneself and to one's family, the proportion of pollution due to Chornobyl, deaths, daily stresses and hassles from health, work, relationships, partner support, medically diagnosed count of illnesses, self-reported count of illnesses, energy level (Nottingham), pain (Nottingham) reconstructed cumulative dose of ^{137}CS and two basis functions bf1 [bf1= max(0, kzchorn-40)] and bf20 [(bf20 = max(0,kzchorn-2.5e-006)], both of which were different centerings of the belief in the number of cancers in Kiev and Zhitomyr Oblasts being due to Chornobyl, we found no evidence of a dose-paid employment for men or women in wave one (1986 following Chornobyl).

3.2.2 wave two

With respect to zero-order relationships, only the female model exhibited a significant zero-order significant logistic regression coefficient in the cumulative dose paid employment relationship. However, this relationship was not robust enough to be sustained with the presence of other covariates in a trimmed main effects female model.

Zero-order significant mediator candidates for females include the basis functions bf4 and bf4m, which are transformations of somaticism that do not appear to be sustained in a path model.

3.2.3 wave three

We still find with the females that there are significant zero-order dose-adverse impact on work effects, but that when these combined with potential confounding variables, the statistical significance is insufficiently robust enough to maintain itself.

We find no evidence of a significant dose-paid employment effect over the three waves on the part of the female respondents(Tables 3a and 3b).

3.3 Impact on Home cleaning, cooking, and repairs

3.3.1 wave one

As for the male subsample, 79.4% (270) indicated that they did not experience health related interference with these home responsibilities, whereas 20.59% (70) reported such interference. 65.56% (238) of the of the females reported no interference, whereas 34.44% (125) indicated that this kind of interference occurred.

Neither men nor women exhibited evidence of a zero-order logistic relationship between the logistic regression coefficient of average cumulative reconstructed dose of and home responsibilities ^{137}CS in milliGrays.

Although men did not exhibit evidence of a dose-home care relationship in the full or even the trimmed logistic regression models, the women did.

When we trimmed these models of nonsignificant regressors, the dose-paid employment relationship was evident neither among men nor among women. After trimming out the nonsignificant other effects, the logistic regression model with home care (HP2hmcare) defined by the Nottingham weighted subscale as an endogenous variable, the cumulative dose wave one variable ($b = -.883, se = .353, z = -2.51, p = 0.01$), along with age, bf1, self-reported illness count in wave one, pain (Nottingham), and energy level (Nottingham), were all found to be statistically significantly related to the home care. Whether dose operates through these variables or not, all of these variables are likely to have a direct effect on the interference with home care responsibilities.

There were no statistically significant moderators found for this model. But there are mediators. If we use structural equation models and make the assumption that our estimation is not compromised by the use of a dichotomous

dependent variable, we we can generate several models to represent salient direct and indirect effects. Let us assume that our mixing a dichotomous dependent variable and a continuous variable for the moment will not pose a problem with the covariance structure underguirding this analysis for the sake of illustration.

From Table one, we observe a statistically significant cumulative dose direct as well as indirect effect. We find that the direct effect of cumulative dose on home care, avgcumdosew1, located in the second panel from the top is abbreviated as avgcumdos 1, in the the hp2hmc e (hp2hmcare) panel. The cumulative direct dose effect (b= - 0.127, se=.038, z=-3.37, p =0.001) is statistically significant. When the direct and indirect effects are broken down as we will do later, we will be able to ascertain the respective levels as well as directions of the direct and indirect effects. When we construct our grant path model, we will use polychoric correlations so as to avoid running afoul of distributional constraints provided by these data.

Because these variables are defined in different metrics, we provide standardized coefficients, which are analogous to correlations. However, these results must be understood to be one of several valid models describing the data. These models do not necessarily have a unique solution and should be compared with one another before finally settling on one over the others. Nonetheless, this model is presented here to show that it is not unreasonable to believe that dose could possibly have accounted for effects relating to female home responsibilities for females. If these effects were below the level of biological reactivity, it is not unreasonable to think that these people have a remembrance of where they were exposed, if they were, and that these effects could conceivably have had some sort of psychological impact. For our intents and purposes, the direct effects that we found may be located in Tables 3a through 5b.

In wave one, only women exhibited a significant dose-home care relationship. From the data in Table 3a, we can see that the coefficient of the average cumulative dose in wave one is -1.037**(se = .364, p=004). This is a logistic regression coefficient that neither standardized nor presented as an odds ratio. It has a negative effect on the home care, which is also influenced by pain and energy level and illness, among other things.

3.3.2 wave two

The dose - home care relationship washes out in wave two (Table 4a). There is a fading of this effect over time. However,this home care domain in wave one had a broad spectrum of other independent variables that appear to be statistically significantly related to home care chores and responsibilities – including age, number of illness self-reported, pain, energy level, concern over long-term exposure to radiation, bf1 (transformed somaticism), and visits to a doctor for an existing condition. Indeed, these could be cofactors that exacerbate or attenuate the dose- home chore relationship. How they mediate or moderate the dose- home care relationship will be a subject that we will investigate in the near future. But by wave two, age, sleep, energy level and stresses and hassles from relationships still were significant predictors of the home chore impact.

3.3.3 wave three

The dose- home chore and responsibility impact had already faded into statistical non-significance in wave two and continued with that status in wave three (Table 5a). Still age, Chornobyl related health threat to oneself , pain, and energy level continued to predict the home chore impact, while cumulative does does not.

Table 1 Structural equation model for female home care cooking and repair responsibilities in wave one

Endogenous variables

Observed: whppain hp2hmcare whpel

Exogenous variables

Observed: avgcumdosew1 age whpsleep

Structural equation model — Number of obs = 363
Estimation method = ml
Log likelihood = -6866.9407

	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Structural						
whppain <-						
avgcumdos~1	2.965615	1.604756	1.85	0.065	-.1796487	6.110879
age	.3717467	.0867583	4.28	0.000	.2017036	.5417897
whpsleep	.3369955	.0332688	10.13	0.000	.2717899	.4022012
_cons	-10.49499	4.181542	-2.51	0.012	-18.69066	-2.299318
hp2hmc~e <-						
whppain	.0059161	.0011746	5.04	0.000	.0036139	.0082182
whpel	.0025857	.0007392	3.50	0.000	.0011369	.0040344
avgcumdos~1	-.1274571	.0378051	-3.37	0.001	-.2015538	-.0533604
age	.0117968	.0018822	6.27	0.000	.0081079	.0154858
_cons	-.3941364	.0898391	-4.39	0.000	-.5702178	-.218055
whpel <-						
age	.4671246	.1387072	3.37	0.001	.1952636	.7389856
whpsleep	.5109679	.0532681	9.59	0.000	.4065644	.6153714
_cons	-5.029867	6.731208	-0.75	0.455	-18.22279	8.163058
Variance						
e.whppain	322.8688	23.96636			279.1528	373.4309
e.hp2hmcare	.1479963	.0109853			.1279584	.1711721
e.whpel	836.8416	62.11621			723.5377	967.8886
Covariance						
e.whppain e.whpel	213.9575	29.50558	7.25	0.000	156.1276	271.7873

LR test of model vs. saturated: chi2(2) = 1.05, Prob > chi2 = 0.5928

Thus, there could be a direct as well as multiple indirect effects of a dose-home care nature.

3.4 Problems with the family at home

3.4.1 all waves

Just under 10% of the respondents indicated this as a problem. But more than twice as many women said that it was a problem than did men. Almost 13% of the women and 6.5% of the men said that this was an issue with them. A Fisher's exact test found this to be a statistically significant difference as well (p=0.005).

No evidence was found among men or women exhibiting a dose- family problems at home impact in the full or trimmed models in wave one, two, or three. These tables make for a very interesting presentation of what contributes to problems with the family at home. Although there is no statistically significant family problem relationship, we see that age energy level, medical visits to the doctor for an existing condition, Chornobyl related health threat to the family, and PSTD in wave one are contributing factors to family problems at home in wave one (Table 3a).

By wave two, age and energy level significantly predict such problems but not by large effects, as does basis function 40, which is a transformed version of medically diagnosed illness count ($bf40 = max(0, icdxcnt - 1.01635E - 007)$.

By wave three, these variables remain predictors of family problems at home, but dose is not one of them.

3.5 Problems with the social life

The problems with social life is a dichotomous variable. Eighty-three point six four % of the respondents said that this was not a problem, whereas just a tad more than 16.36% indicated that they had such problems. About 64% of females maintained that this was a problem while almost 36% of the males indicated that that they had such problems. According to a Fisher's exact test, this two-sided test was statistically significant (p=.0003).

3.5.1 wave one

In the zero-order area, males exhibited no relationship but females did ($b = 1.066, se = .345, z = 3.08, p = 0.002$). Although the men reported no interference with social life, the women did. After many of the nonsignificant variables were trimmed from the model, the model still retained as explanatory variables: Age, Chornobyl related threat to the family, pain (Nottingham), energy level(Nottingham), self-reported PTSD in wave one, a medical visits due to a condition, in addition to a significant cumulative dose logistic regression coefficient ($b = .908, se = .339, z = 2.68, p = .007$).

There is no statistically significant reliable moderator found when all of the interactions were specified. When we removed the others to increase the power,

the interaction that had the strongest, although not significant probability, was not robust enough to retain statistical significance when other interactions were removed. Therefore, we regarded it as too fragile to be considered reliable. Hence, it was discarded.

However, there were several intervening variables. In the model below, there is a significant total effect of the average cumulative dose of ^{137}CS on the female social life. The variable for that dose is avgcumdosew1 (abbreviated avgcumdos 1). From the Table 4, we see is no significant direct effect (p=0.093), however we can see that there is a significant path from dose to pain and from pain to social problems (hp2prb~c).

3.5.2 wave two

Although a zero-order dose-social life effect relationship is apparent, this significance fades in strength as other variables are included in the model. If we use a stepwise backward elimination, the significance of this relationship can be sustained. But that procedure is rather path dependent, leaving us with the suspicion that this relationship may be a false positive indication of an algorithm that has as one of its major drawbacks a path dependence of its results. The result is too fragile to be sure about.

3.5.3 wave three

However, in wave three something else emerges(Table 5a). Unlike the other non-significant dose-effect relationships, not only is a zero-order relationship between dose and problems with the social life is statistically significant for females, but the statistical significance is sustained in a trimmed model. This may retrospectively lend a little more credence to the possibility of a reliable significance in the previous wave. For women at least, the cumulative dose statistically significantly relates to problems with social relationships.

Other factors also interfere with social relationships. They are age, pain, cumulative dose, concern with Chornobyl related heath threats, and stresses and hassles from relationships. However, in wave three this is about the extent of what appears to be a statistical association between average cumulative dose of ^{137} CS over time and any impact on the general activities of social interaction.

Table 2 The Cumulative Dose of 137 CS - Social Life Impact relationship in wave one

Endogenous variables

Observed: whppain hp2prbsoc whpel

Exogenous variables

Observed: avgcumdosew1 age whpsleep

Structural equation model Number of obs = 363
Estimation method = ml
Log likelihood = -6802.9735

	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Structural						
whppain <-						
hp2prbsoc	96.05529	16.98082	5.66	0.000	62.77349	129.3371
avgcumdos~1	-7.897162	3.733999	-2.11	0.034	-15.21566	-.5786583
age	-.7313054	.2926728	-2.50	0.012	-1.304934	-.1576771
_cons	37.8021	12.4338	3.04	0.002	13.4323	62.1719
hp2prb~c <-						
whppain	-.0477991	.0242893	-1.97	0.049	-.0954053	-.000193
whpel	-.0242065	.0124639	-1.94	0.052	-.0486353	.0002223
avgcumdos~1	.2769463	.1649062	1.68	0.093	-.0462639	.6001565
age	.0403982	.0156139	2.59	0.010	.0097956	.0710008
whpsleep	.0319589	.0139865	2.28	0.022	.0045459	.0593718
_cons	-1.124807	.4536984	-2.48	0.013	-2.01404	-.2355747
whpel <-						
whppain	1.464249	.1603092	9.13	0.000	1.150048	1.778449
age	-.0966873	.1777731	-0.54	0.587	-.4451161	.2517416
_cons	10.31864	7.512236	1.37	0.170	-4.405073	25.04235
Variance						
e.whppain	1064.902	323.7042			586.9015	1932.209
e.hp2prbsoc	2.071599	1.786462			.3821766	11.22916
e.whpel	906.6836	107.1506			719.2203	1143.009
Covariance						
e.whppain						
e.whpel	-231.2515	61.02084	-3.79	0.000	-350.8502	-111.6529

LR test of model vs. saturated: chi2(1) = 1.71, Prob > chi2 = 0.1914

With respect to zero-order relationships, only the female model exhibited a significant zero-order significant logistic regression coefficient in the cumulative dose social problems relationship. However, this relationship was not robust enough to be sustained in the more realistic trimmed main effects female model. Therefore, we do not find a reliable significant main effect of dose on social problems.

3.6 Problems with sex life

Almost one-fourth (23.19%) of the 703 respondents indicated that they had problems with their sex life. More women than men said that this was the case. About 25.9% of the women and 20.29% of the men admitted to having such problems. A Fisher's one- sided test indicated that this was a significant difference (p=0.047).

3.6.1 wave one

evidence was found among men or women exhibiting a dose-sex-life impact in the full or trimmed models in wave one.

3.6.2 wave two

With respect to zero-order relationships, only the female model exhibited a significant zero-order significant logistic regression coefficient in the cumulative dose sex life relationship. Like many others with significant zero-order effects found to be significant, the significance of this relationship was not robust enough to be sustained in a trimmed main effects female model.

Possible mediators of this relationship, however, may be age, self-reported illness count in wave two, Chornobyl related health threat and bf4, a transformation of the somaticism variable. Because the main effects were not found to be statistically significant, further analysis of these indirect effects will be undertaken later.

3.6.3 wave three

Although the male effects were not statistically significant, there was a zero-order female dose-sex life effect that was not sustained in the trimmed model. Therefore, this relationship is also considered too fragile to be counted.

3.7 Impact on Interests and Hobbies

Almost 15% of the respondents indicated that health problems interfered with interests and hobbies. A little more than 18.18% of the women and 11.18% men indicated that they experienced health problems interfering with their interests and hobbies, for which the Fisher's exact test indicated a statistically significant difference (p=0.011).

3.7.1 wave one

No evidence was found among men or women exhibiting a dose- interests or hobbies impact in the full or trimmed models in wave one.

3.7.2 wave two

With respect to zero-order relationships, only the female model exhibited a significant zero-order significant logistic regression coefficient in the cumulative dose interference with interests and hobbies relationship. Like many others with significant zero-order effects found to be significant, the significance of this relationship was not maintained in the more realistic trimmed main effects model.

Possible mediators of the female dose-interest and hobbies interference are age and bf4m.

3.7.3 wave three

Although the male effects were not statistically significant, there was a zero-order female dose-sex life effect that was not sustained in the trimmed model. Therefore, this relationship is also considered too fragile to be counted.

3.8 Impact on vacation plans

Only 14.79% of the respondents admitted that health problems interfered with their vacation plans. But the difference between male and female indications was not statistically significant at the 0.05 level.

3.8.1 wave one

No evidence was found among men or women exhibiting a dose-vacation plan impact in the full or trimmed models in wave one.

3.8.2 wave two

With respect to zero-order relationships, only the female model exhibited a significant zero-order significant logistic regression coefficient in the cumulative dose vacation plans relationship. Like many others with significant zero-order effects found to be significant, the significance of this relationship was not maintained in the more realistic trimmed main effects model.

Possible mediators of interference with vacation plans for women are age, illness, and Chornobyl related health threat to oneself.

3.8.3 wave three

The same sort of thing that happened in the previous domain happened here. No male dose vacation effects were found to be statistically significant, and the female zero-order effect was not sustained in the larger trimmed model.

4 Tabulation of statistical direct affects

4.0.4 wave one

Table 3a Logistic regression coefficients of reconstructed dose impacts for females in wave 1

Dependent Var:	work	homecare	familyprbs	socialprbs
Independent var				
age	0.042**	0.074***	0.033	0.084***
	(0.013)	(0.014)	(0.019)	(0.019)
	3.257	5.242	1.732	4.444
	0.001	0.000	0.083	0.000
radhlw1	0.006		0.013*	
	(0.004)		(0.006)	
	1.696		1.985	
	0.090		0.047	
whppain	0.013	0.038***	0.021*	0.038***
	(0.007)	(0.008)	(0.009)	(0.009)
	1.909	4.651	2.193	4.081
	0.056	0.000	0.028	0.000
whpel	0.014**	0.016**	0.018**	0.015*
	(0.005)	(0.005)	(0.006)	(0.006)
	3.053	3.283	2.838	2.457
	0.002	0.001	0.005	0.014
avgcumdosew1	0.226	-1.037**	-0.201	-0.106
	(0.214)	(0.364)	(0.294)	(0.643)
	1.060	-2.844	-0.685	-0.165
	0.289	0.004	0.494	0.869
illw1		0.673*		
(self rptd		(0.302)		
illness count)		2.228		
		0.026		
medcow1		0.091*		0.102*
		(0.039)		(0.046)
		2.313		2.219
		0.021		0.026
radtlw1		0.011**		
		(0.004)		
		2.658		
		0.008		
bf1		-0.017*		-0.005
(transformed		(0.007)		(0.011)
somaticism)		-2.528		-0.431
		0.011		0.666
whpsleep			0.010	
			(0.006)	
			1.629	
			0.103	

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radchw1			0.016*	
(prop pollution due			(0.007)	
to Chornbl)			2.360	
			0.018	
radfmw1				0.017**
				(0.006)
				3.003
				0.003
PTSDw1				-0.016*
				(0.006)
				-2.529
				0.011
bf1Xd1				0.024
(somaticism dose				(0.016)
interaction)				1.491
				0.136
Constant	-4.547***	-5.818***	-7.385***	-8.849***
	(0.677)	(0.781)	(1.139)	(1.168)
	-6.714	-7.453	-6.484	-7.579
	0.000	0.000	0.000	0.000
r2_p	0.178	0.350	0.333	0.450
bic	374.3034	356.909	233.5069	260.9804
N	362	363	362	363

* p<0.05, ** p<0.01, *** p<0.001

Table 3b: Logistic regression coefficients for reconstructed dose impacts for females in wave 1

Dependent var:	sexlife	inthobbies	vactions
Independent var			
age	0.072***	0.052**	0.054**
	(0.015)	(0.016)	(0.017)
	4.772	3.162	3.275
	0.000	0.002	0.001
whpel	0.015**	0.013*	0.009
	(0.005)	(0.006)	(0.006)
	2.887	2.157	1.499
	0.004	0.031	0.134
whpsleep	0.007	0.024***	0.011
	(0.005)	(0.006)	(0.006)
	1.372	3.990	1.945
	0.170	0.000	0.052
whppain	0.014	0.001	0.016
	(0.008)	(0.009)	(0.009)
	1.792	0.080	1.778
	0.073	0.936	0.075
bf20	0.009		
(xformed concern	(0.006)		
over cancer rate	1.476		
in Kiev/Zhit	0.140		
radhlw1	0.006	0.022***	0.023***
	(0.004)	(0.005)	(0.005)
	1.422	4.125	4.354
	0.155	0.000	0.000
avgcumdosew1	0.317	0.154	-0.091
	(0.250)	(0.236)	(0.255)
	1.268	0.655	-0.357
	0.205	0.513	0.721
Constant	-7.261***	-7.217***	-7.109***
	(0.949)	(0.966)	(0.961)
	-7.655	-7.472	-7.396
	0.000	0.000	0.000
r2_p	0.313	0.344	0.301
bic	332.1956	266.6538	275.0955
N	362	362	362

* p<0.05, ** p<0.01, *** p<0.001

4.0.5 wave two

Table 4a: Logistic regression coefficients of reconstructed dose for females in wave 2

Dependent var:	work	hmcare	socprobs	familyprbs
Independent var:				
age	0.013	0.037**	0.038	0.043*
	(0.014)	(0.013)	(0.019)	(0.018)
	0.963	2.786	1.944	2.326
	0.335	0.005	0.052	0.020
whppain	0.028**	0.011	0.034**	0.014
	(0.010)	(0.008)	(0.013)	(0.010)
	2.806	1.378	2.688	1.434
	0.005	0.168	0.007	0.152
whpsleep	0.002	0.011*	0.005	0.007
	(0.007)	(0.005)	(0.008)	(0.006)
	0.332	2.059	0.638	1.034
	0.740	0.039	0.524	0.301
whpel	0.017**	0.010*	0.020**	0.015*
(energy level)	(0.006)	(0.005)	(0.008)	(0.007)
	3.022	2.028	2.608	2.175
	0.003	0.043	0.009	0.030
avgcumdosew2	-0.016	0.079	0.008	0.002
	(0.050)	(0.087)	(0.054)	(0.104)
	-0.312	0.906	0.156	0.018
	0.755	0.365	0.876	0.986
bf8	-0.000		-0.000	
	(0.000)		(0.000)	
	-1.926		-1.367	
	0.054		0.172	
illw2	0.375		0.321	
	(0.238)		(0.310)	
	1.573		1.036	
	0.116		0.300	
shjobw2	0.003	-0.003	0.012*	
	(0.004)	(0.005)	(0.006)	
	0.831	-0.618	2.045	
	0.406	0.537	0.041	

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	work	hmcare	socprobs	familyprbs
radhlw2	0.007	0.008	0.018*	0.010
(Chornbl hlth	(0.005)	(0.004)	(0.007)	(0.006)
threat 2 self)	1.381	1.813	2.555	1.576
	0.167	0.070	0.011	0.115
havmilsq		-0.000		
		(0.000)		
		-0.485		
		0.628		
shhlw2		0.006		
		(0.005)		
		1.218		
		0.223		
shrelaw2		-0.013*		
(relationship		(0.005)		
stresses & hassles)		-2.463		
		0.014		
suprtw2		0.001		
		(0.003)		
		0.241		
		0.809		
bf4				-0.083
(transformed				(0.050)
somaticism)				-1.642
				0.101
bf40				-0.209*
(transformed				(0.102)
medical dx)				-2.059
				0.039
Constant	-3.455***	-4.409***	-7.245***	-4.841***
	(0.728)	(0.789)	(1.207)	(1.283)
	-4.747	-5.586	-6.000	-3.774
	0.000	0.000	0.000	0.000
Pseudo R^2	0.191	0.211	0.366	0.300
bic	338.1512	396.5309	216.8723	248.9322
N	340	363	340	363

* p<0.05, ** p<0.01, *** p<0.001

Table 4b: Logistic regression coefficients of reconstructed cumulative dose CS137 for females in wave 2

Dependent vars:	sexlife	intshobbies	vacations
Independent vars:			
age	0.063***	0.058***	0.056***
	(0.016)	(0.016)	(0.017)
	4.001	3.496	3.375
	0.000	0.000	0.001
bf4	-0.129**	-0.016	
(transformed	(0.040)	(0.050)	
somaticism)	-3.241	-0.328	
	0.001	0.743	
illw2	0.249		
	(0.253)		
	0.985		
	0.325		
whppain	0.017	0.004	0.010
	(0.011)	(0.010)	(0.009)
	1.517	0.416	1.126
	0.129	0.677	0.260
whpsleep	0.005	0.027***	0.012*
	(0.007)	(0.006)	(0.006)
	0.686	4.255	2.041
	0.492	0.000	0.041
whpel	0.007	0.009	0.007
	(0.006)	(0.007)	(0.006)
	1.130	1.349	1.209
	0.258	0.177	0.227
avgcumdosew2	0.039	0.069	0.042
	(0.048)	(0.089)	(0.091)
	0.817	0.769	0.465
	0.414	0.442	0.642

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	sexlife	intshobbies	vacations
radhlw2	0.010	0.010	0.017**
	(0.006)	(0.006)	(0.006)
	1.711	1.687	2.798
	0.087	0.092	0.005
bf30		0.001*	
(cancer rate		(0.000)	
interaction with		1.961	
neighborhood news)		0.050	
shrelaw2		-0.017**	
		(0.006)	
		-2.638	
		0.008	
suprtw2		-0.013**	
(partner support)		(0.004)	
		-2.950	
		0.003	
deaw2			0.133
(death(s) in wave 2)			(0.180)
			0.742
			0.458
shjobw2			-0.008
			(0.004)
			-1.732
			0.083
bf7m			-0.000
(transformed			(0.000)
lifetime exposure)			-0.781
			0.435
havmil			-0.000
(geodesic			(0.001)
dist fm Chrnbl)			-0.115
			0.908
Constant	-4.555***	-5.974***	-6.120***
	(1.106)	(1.344)	(1.047)
	-4.117	-4.445	-5.848
	0.000	0.000	0.000
Pseudo R^2	0.349	0.382	0.275
bic	275.7083	277.448	307.6772
N	340	363	363

* p<0.05, ** p<0.01, *** p<0.001

4.0.6 wave three

Table 5a: Logistic regression coefficients of reconstructed dose on Dependent variable impacts in wave three

Dependent variable:	work	homecare	socialprbs	famprobs
Independent var:				
age	0.042***	0.076***	0.095***	0.047**
	(0.013)	(0.014)	(0.020)	(0.018)
	3.295	5.539	4.795	2.612
	0.001	0.000	0.000	0.009
whppain	0.009	0.031***	0.035***	0.014
	(0.007)	(0.008)	(0.010)	(0.010)
	1.210	3.861	3.470	1.398
	0.226	0.000	0.001	0.162
whpsleep	0.010*	0.006	0.010	0.008
	(0.005)	(0.005)	(0.007)	(0.006)
	2.011	1.111	1.459	1.165
	0.044	0.267	0.145	0.244
whpel	0.012*	0.016**	0.008	0.014*
	(0.005)	(0.005)	(0.006)	(0.007)
	2.478	3.153	1.282	2.069
	0.013	0.002	0.200	0.039
avgcumdosew3	0.072	-0.154	0.384**	
	(0.067)	(0.081)	(0.130)	
	1.086	-1.904	2.947	
	0.277	0.057	0.003	
radhlw3		-0.011*	0.017**	
		(0.005)	(0.006)	
		-2.504	2.885	
		0.012	0.004	
shhlw3		-0.002		
		(0.004)		
		-0.396		
		0.692		

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	work	homecare	socialprbs	famprobs
illw3			0.001	
			(0.154)	
			0.005	
			0.996	
shrelaw3			-0.025***	
			(0.007)	
			-3.669	
			0.000	
bf4				-0.097
				(0.050)
				-1.940
				0.052
bf40				-0.219*
				(0.100)
				-2.201
				0.028
Constant	-4.296***	-4.942***	-9.163***	-4.254***
	(0.663)	(0.710)	(1.246)	(1.209)
	-6.478	-6.956	-7.354	-3.519
	0.000	0.000	0.000	0.000
Pseudo R^2	0.183	0.304	0.466	0.291
BIC	372.9294	372.4658	249.0779	239.7686
N	363	363	363	363

* p<0.05, ** p<0.01, *** p<0.001

Table 5b: Logistic regression models of reconstructed dose on Nottingham Part 2 impact on activities of life in wave three

Dependent vars:	sexlife	intshobbies	vacatnPlans
Independent vars			
age	0.066***	0.060***	0.069***
	(0.017)	(0.016)	(0.016)
	3.803	3.699	4.242
	0.000	0.000	0.000
marrw31	-0.775		
	(0.805)		
	-0.963		
	0.336		
marrw32	-0.554		
	(1.510)		
	-0.367		
	0.714		
marrw33	-0.857		
	(0.448)		
	-1.914		
	0.056		
marrw34	-1.151		
	(1.932)		
	-0.596		
	0.551		
marrw35	-0.974		
	(0.663)		
	-1.469		
	0.142		
o.marrw36	0.000		
	(.)		
	.		
	.		

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	sexlife	intshobbies	vacatnPlans
radhlw3	0.010*	0.017**	0.008
	(0.005)	(0.006)	(0.005)
	1.963	2.939	1.470
	0.050	0.003	0.141
bf4	-0.425*	0.008	
(re-centered	(0.182)	(0.045)	
somaticism)	-2.339	0.170	
	0.019	0.865	
bf4m	0.331*		
(transformed	(0.164)		
somaticism)	2.019		
	0.043		
shfamw3	0.008		
	(0.006)		
	1.491		
	0.136		
shrelaw3	-0.011		
	(0.006)		
	-1.838		
	0.066		
avgcumdosew3	0.124	0.036	0.072
	(0.089)	(0.069)	(0.070)
	1.390	0.523	1.038
	0.165	0.601	0.299
whppain	0.010	-0.004	0.012
	(0.009)	(0.010)	(0.009)
	1.139	-0.400	1.354
	0.255	0.689	0.176
whpsleep	0.007	0.023***	0.013*
	(0.006)	(0.006)	(0.006)
	1.191	3.802	2.132
	0.234	0.000	0.033
whpel	0.008	0.013*	0.006
	(0.006)	(0.006)	(0.006)
	1.347	2.054	1.073
	0.178	0.040	0.283
deaw3			0.369*
			(0.163)
			2.257
			0.024
suchrw3			-0.007
			(0.004)
			-1.807
			0.071
Constant	-7.257***	-7.351***	-6.945***
	(1.791)	(1.237)	(0.937)
	-4.051	-5.944	-7.409
	0.000	0.000	0.000
Pseudo	0.354	0.318	0.268
R^2	362.5934	282.0419	298.1477
N	363	363	363

* p<0.05, ** p<0.01, *** p<0.001

For the time being, this summarizes our findings regarding our direct effects concerning the average cumulative dose- life impact analysis. For a more psychological perspective we could focus on the influence of self-perceived Chornobyl threat to one's health as it influences each of the dependent variables, as it does in wave three one's home social problems,sex life, and one's interests and hobbies. We will develop the other relationships embedded in these data here in the near future.

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