

## 1 Supplementary Materials

### 3 Background model

$$4 \quad \lambda_{ovary} = \exp(\alpha_{3bcat} + \gamma_{3bcat} \log\left(\frac{a}{70}\right) + \epsilon_{3bcat} \log^2\left(\frac{a}{70}\right) + \vartheta \left(\frac{byr - 1915}{10}\right) + \zeta * city + \eta$$

$$5 \quad * city * NIC + \mu * city * dis + \mathbf{v}' * \mathbf{f})$$

$$6 \quad \lambda_{type1} = \exp(\alpha_{2bcat} + \gamma_{2bcat} \log\left(\frac{a}{70}\right) + \epsilon_{2bcat} \log^2\left(\frac{a}{70}\right) + \vartheta \left(\frac{byr - 1915}{10}\right) + \zeta * city + \eta$$

$$7 \quad * city * NIC + \mu * city * dis + \mathbf{v}' * \mathbf{f})$$

$$8 \quad \lambda_{type2} = \exp(\alpha + \gamma \log\left(\frac{a}{70}\right) + \epsilon \log^2\left(\frac{a}{70}\right) + [\eta \log^2\left(\frac{a}{70}\right)]_{a>70} + \vartheta \left(\frac{byr - 1915}{10}\right) + \zeta$$

$$9 \quad * city + \eta * city * NIC + \mu * city * dis + \mathbf{v}' * \mathbf{f})$$

11 where “*3bcat*” and “*2bcat*” subscripts indicate 3 categorical (–1914, 1915–1929, 1930–  
12 1945) and 2 categorical birth-cohort-specific parameters, respectively, “*a*” is age in  
13 years, “*byr*” is birth year, “*NIC*” is an indicator of not-in-city status, “*dis*” is an indicator  
14 whether the subjects were between 3,000 m to 10,000 m from the hypocenter at the time  
15 of bombing, and “*f*” is a vector of other factors, e.g., reproductive factors. We applied  
16 categorical birth cohort (“*3bcat*” for total ovarian cancer and “*2bcat*” for Type-1  
17 cancers) and a birth cohort-specific attained-age in addition to continuous birth year  
18 (*byr*) in background modeling, because there was non-monotonic interaction between  
19 attained age and birth cohort; the incidence rate monotonically increased with attained  
20 age in earlier and later birth cohort but it peaked at around 70 years in middle birth  
21 cohort for total ovarian cancer, and the peak incidence age was older in earlier birth year

22 for Type-1 cancers. No such interaction between age and birth year was found for  
23 Type-2 cancers. The same background model as Type-2 cancers was employed for other  
24 epithelial cancers which could not be typed, and ovarian cancers with not otherwise  
25 specified morphology. Other lifestyle and reproductive risk factors (*f*) included: age at  
26 menarche, parity, the number of full-term pregnancies, age at first pregnancy, time to  
27 and from menopause, body mass index, and smoking history. The decision of whether to  
28 include the risk factor in the background was based on the likelihood ratio test and/or  
29 prior epidemiological evidence concerning the association with sporadic ovarian cancer.  
30

31 **Supplement Table S1. Classification of ovarian cancer into histological groups**

	ICD-O morphology code	n	%
<b>Type-1</b>		<b>77</b>	<b>26.7</b>
<b>Mucinous carcinoma</b>		<b>43</b>	<b>14.9</b>
8470	Mucinous cystadenocarcinoma/ NOS		
8471	Papillary mucinous cystadenocarcinoma		
8472	Mucinous cystic tumor of borderline malignancy <sup>a</sup>		
8480	Mucinous adenocarcinoma		
8481	Mucin-producing adenocarcinoma		
<b>Clear cell carcinoma</b>		<b>17</b>	<b>5.9</b>
8310	Clear cell adenocarcinoma, NOS		
9110	Mesonephroma, malignant		
<b>Endometrioid carcinoma</b>		<b>11</b>	<b>3.8</b>
8380	Endometrioid adenocarcinoma, NOS		
8560	Adenosquamous carcinoma		
8570	Adenocarcinoma with squamous metaplasia		
<b>Squamous carcinoma, Transitional cell or Brenner carcinoma</b>		<b>6</b>	<b>2.1</b>
8070	Squamous cell carcinoma, NOS		
8120	Transitional cell carcinoma, NOS		
9000	Brenner tumor, malignant		
<b>Type-2</b>		<b>75</b>	<b>26.0</b>
<b>Serous carcinoma</b>		<b>70</b>	<b>24.3</b>
8441	Serous cystadenocarcinoma, NOS		
8442	Serous cystadenoma, borderline malignancy <sup>a</sup>		
8460	Papillary serous cystadenocarcinoma		
8461	Serous surface papillary carcinoma		
8462	Serous papillary cystic tumor of borderline malignancy <sup>a</sup>		
9014	Serous adenocarcinofibroma		
<b>Undifferentiated epithelial carcinoma</b>		<b>5</b>	<b>1.7</b>
8020	Carcinoma, undifferentiated, NOS		
<b>Other epithelial carcinoma</b>		<b>66</b>	<b>22.9</b>
8050	Papillary carcinoma, NOS		
8140	Adenocarcinoma, NOS		
8260	Papillary adenocarcinoma, NOS		
8440	Cystadenocarcinoma, NOS		
8450	Papillary cystadenocarcinoma, NOS		
<b>Non-epithelial or mixed origin</b>		<b>17</b>	<b>5.9</b>
<b>Sex cord-stromal carcinoma</b>		<b>9</b>	<b>3.1</b>
8620	Granulosa cell tumor, malignant		
8810	Fibrosarcoma, NOS		
<b>Germ cell carcinoma</b>		<b>5</b>	<b>1.7</b>
9060	Dysgerminoma		
9080	Teratoma, malignant, NOS		
9081	Teratocarcinoma		
9084	Teratoma with malignant transformation		
<b>Mixed epithelial-stromal carcinoma</b>		<b>3</b>	<b>1.0</b>
8951	Mesodermal mixed tumor		
8980	Carcinosarcoma, NOS		
<b>Morphology, NOS</b>		<b>53</b>	<b>18.4</b>
8000	Neoplasm, malignant		
8010	Carcinoma, NOS		
<b>Total</b>		<b>288</b>	<b>100</b>

32 ICD-O= the International Classification of Disease for Oncology; NOS=not otherwise  
33 specified.

34 <sup>a</sup> Registered as malignancy only in the ICD-O-2

35 **Supplement Table S2. Incidence rate of subtypes other than Type 1 or 2 in the LSS**  
 36 **cohort, 1958–2009**

	Other epithelial		Non-epithelial or mixed origin		NOS	
	Case	Rate	Case	Rate	Case	Rate
<b>City</b>						
Hiroshima	45	0.3	14	0.1	36	0.3
Nagasaki	21	0.4	3	0.1	17	0.3
<b>Attained age, year</b>						
0–19	0	0.0	0	0.0	0	0.0
20–39	1	0.0	1	0.0	1	0.0
40–49	11	0.4	0	0.0	3	0.1
50–59	16	0.4	7	0.2	4	0.1
60–69	19	0.5	2	0.0	10	0.2
70–79	11	0.4	7	0.2	12	0.4
80+	8	0.5	0	0.0	23	1.3
<b>Age at exposure, year</b>						
0–9	6	0.1	3	0.1	2	0.0
10–19	17	0.4	6	0.1	9	0.2
20–29	13	0.3	2	0.0	4	0.1
30–39	17	0.5	4	0.1	16	0.5
40–49	9	0.5	2	0.1	19	1.0
50+	4	0.5	0	0.0	3	0.3
<b>DS02R1 weighted absorbed ovary dose, Gy</b>						
NIC	17	0.4	4	0.1	9	0.2
<0.005	27	0.4	7	0.1	19	0.3
0.005–0.1	12	0.2	5	0.1	11	0.2
0.1–0.2	3	0.3	1	0.1	5	0.5
0.2–0.5	4	0.4	0	0.0	3	0.3
0.5–1	1	0.2	0	0.0	4	0.7
1+	2	0.7	0	0.0	2	0.7
<b>Total</b>	<b>66</b>	<b>0.3</b>	<b>17</b>	<b>0.1</b>	<b>53</b>	<b>0.3</b>

37 Non-epithelial or mixed origin includes sex cord-stromal, germ cell and mixed  
 38 epithelial-stromal carcinomas.

39 DS02R1=dosimetry system 2002 revision 1; NIC=not in the city of Hiroshima or  
 40 Nagasaki at the time of the bombings; LSS=Life Span Study; NOS=not otherwise  
 41 specified.

42 <sup>a</sup> Incidence rate per 10,000 person-years

**Supplement Table S3. Excess relative risk per Gy (ERR/Gy) for other subtypes of ovarian cancer**

	Cases	ERR/Gy	95% CI		P for ERR
			Lower	Upper	
Other epithelial	66	0.05	<-0.27	1.76	0.93
Non-epithelial or mixed origin	17	NE	-	-	-
Morphology, NOS	53	1.75	-0.07	5.85	0.07
DCO <sup>a</sup>	21	2.58	<0	14.93	0.17
Non-DCO <sup>b</sup>	32	1.32	<0	6.40	0.22

NE=not estimated; NOS=not otherwise specified; DCO=death certificate only; CI=confidence interval.

<sup>a</sup> Morphology, NOS, ascertained by death certificate only

<sup>b</sup> Morphology, NOS, ascertained by other sources than death certificate

**Supplement Table S4. Distribution of assigned and unassigned histological types by radiation dose (Gy)**

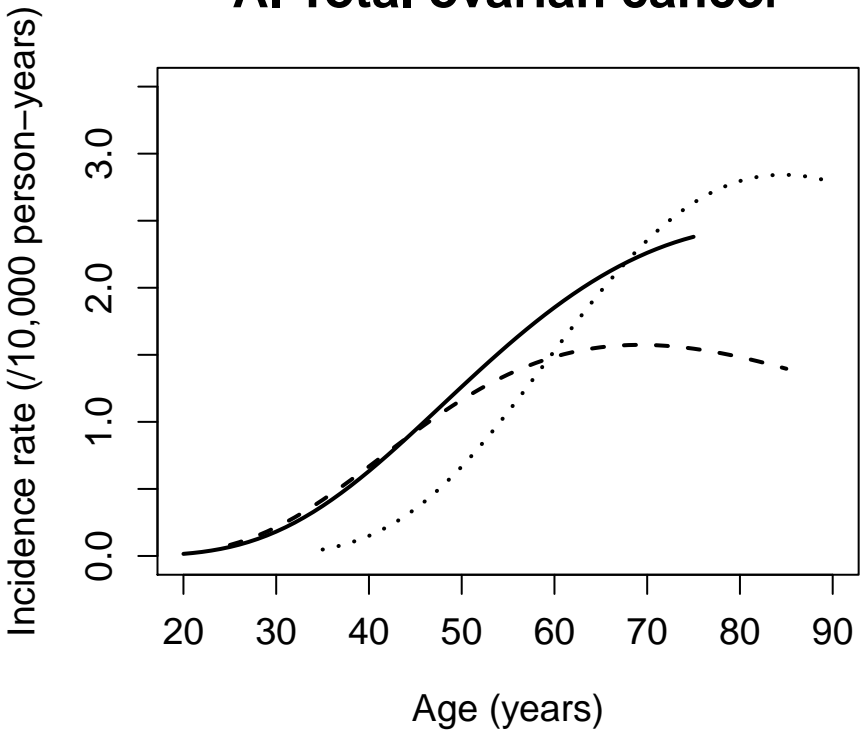
	Assigned histological type				Unassigned histological type			
	Type-1	Type-2	Total		Other epithelial	NOS	Total	
	n	n	n	%	n	n	n	%
NIC	18	21	39	26%	17	9	26	22%
<0.005	28	22	50	33%	27	19	46	39%
0.005–0.1	21	17	38	25%	12	11	23	19%
0.1–0.2	4	5	9	6%	3	5	8	7%
0.2–0.5	4	4	8	5%	4	3	7	6%
0.5–1	1	3	4	3%	1	4	5	4%
1+	1	3	4	3%	2	2	4	3%
Total	77	75	152	100%	66	53	119	100%

NIC=not in the city of Hiroshima or Nagasaki at the time of the bombings; NOS=not otherwise specified

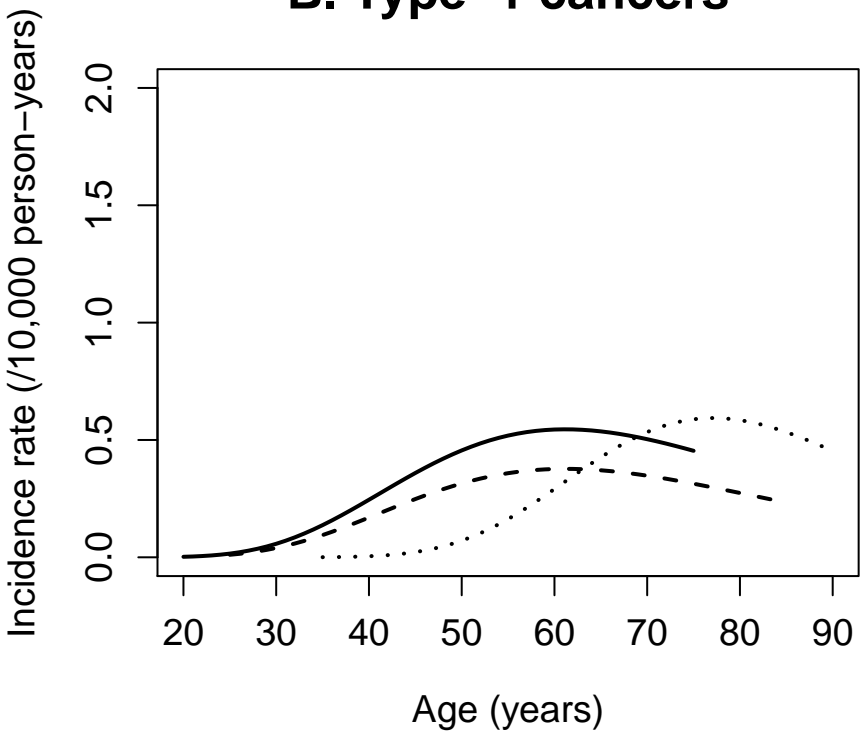
**Fig. S1.** Background incidence rates for total ovarian cancer, type 1 and type 2 cancers by attained age and year of birth. The dotted line is fitted background incidence rate among women born prior to 1915, the dashed line is that among women born between 1915 and 1929, and the solid line is that among women born after 1930. Panel A: Total ovarian cancer. Panel B: Type 1 cancers. Panel C: Type 2 cancers.



### A. Total ovarian cancer



### B. Type-1 cancers



### C. Type-2 cancers

