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Supplemental Material

Occupational Exposure to Pesticides and the Incidence of Lung Cancer in the Agricultural Health Study

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Table S1. Lung Cancer risk among applicators by lifetime exposure-days of indicated pesticide, stratified by smoking status, Agricultural Health Study

Pesticide by lifetime exposure-days	Never Smokers			Former Smokers			Current Smokers			P for Interaction
	Cases (n)	Hazard Ratio	95% confidence interval	Cases (n)	Hazard Ratio	95% confidence interval	Cases (n)	Hazard Ratio	95% confidence interval	
Chlorimuron-ethyl (herbicide; pyrimidinylsulfonyleurea) [§]										
Non-exposed	16	1.0	Referent	84	1.0	Referent	80	1.0	Referent	
≤ median	8	2.17	0.92-5.11	10	0.58	0.30-1.12	24	1.09	0.69-1.73	
> median	7	3.80	1.53-9.48	12	1.22	0.66-2.26	17	1.10	0.59-1.73	
<i>P</i> _{trend}		0.001			0.987			0.872		0.107
Dicamba (herbicide; benzoic acid)										
No exposure	27	1.0	Referent	118	1.0	Referent	148	1.0	Referent	
≤ median	13	0.68	0.35-1.32	32	0.59	0.40-0.87	38	0.63	0.44-0.90	
> median	7	0.59	0.25-1.38	32	0.74	0.50-1.10	42	0.89	0.63-1.25	
<i>P</i> _{trend}		0.464			0.024			0.182		0.311
Pendimethalin (herbicide; dinitroaniline) [§]										
No exposure	20	1.0	Referent	70	1.0	Referent	70	1.0	Referent	
≤ median	8	1.11	0.49-2.54	18	0.74	0.44-1.25	28	0.95	0.61-1.48	
> median	2	0.41	0.10-1.80	20	1.19	0.72-1.99	35	1.27	0.82-1.96	
<i>P</i> _{trend}		0.585			0.678			0.206		0.141
Carbaryl (insecticide; carbamate) [§]										
No exposure	15	1.0	Referent	42	1.0	Referent	55	1.0	Referent	
≤ median	9	0.80	0.35-1.83	47	1.08	0.71-1.63	40	0.79	0.53-1.19	
> median	8	1.73	0.72-4.17	25	1.06	0.64-1.75	28	1.11	0.69-1.76	
<i>P</i> _{trend}		0.538			0.509			0.856		0.612
Carbofuran (insecticide; carbamate)										
No exposure	40	1.0	Referent	127	1.0	Referent	169	1.0	Referent	
≤ median	6	0.48	0.20-1.14	27	0.80	0.53-1.21	36	0.87	0.60-1.24	
> median	2	0.30	0.07-1.23	23	1.21	0.77-1.90	26	0.89	0.58-1.36	
<i>P</i> _{trend}		0.049			0.927			0.586		0.213

Table S1 (continued). Lung Cancer risk among applicators by lifetime exposure-days of indicated pesticide, stratified by smoking status.

Pesticide by lifetime exposure-days	Never Smokers			Former Smokers			Current Smokers			P for Interaction
	Cases (n)	Hazard Ratio	95% confidence interval	Cases (n)	Hazard Ratio	95% confidence interval	Cases (n)	Hazard Ratio	95% confidence interval	
Chlordane (insecticide; chlorinated organic) [§]										
No exposure	20	1.0	Referent	69	1.0	Referent	80	1.0	Referent	
≤ median	9	1.98	0.90-4.36	18	0.99	0.59-1.67	21	1.47	0.91-2.38	
> median	1	0.36	0.05-2.70	12	1.01	0.55-1.87	12	1.27	0.69-2.34	
<i>P</i> _{trend}		0.889			0.750			0.348		0.343
Chlorpyrifos (insecticide; phosphorothioate)										
No exposure	41	1.0	Referent	138	1.0	Referent	160	1.0	Referent	
≤ median	8	0.57	0.27-1.22	47	1.03	0.74-1.43	51	0.92	0.67-1.26	
> median	5	0.43	0.17-1.09	28	0.81	0.53-1.22	54	1.14	0.83-1.57	
<i>P</i> _{trend}		0.068			0.670			0.864		0.017
DDT (insecticide; chlorinated organic) [§]										
No exposure	14	1.0	Referent	55	1.0	Referent	71	1.0	Referent	
≤ median	10	1.56	0.67-3.61	28	0.87	0.55-1.37	24	1.01	0.63-1.61	
> median	6	1.85	0.68-5.02	20	1.22	0.72-2.06	19	1.06	0.62-1.80	
<i>P</i> _{trend}		0.336			0.881			0.965		0.453
Malathion (insecticide; phosphorothioate) [§]										
No exposure	10	1.0	Referent	27	1.0	Referent	41	1.0	Referent	
≤ median	13	0.97	0.43-2.23	51	1.42	0.89-2.27	40	0.91	0.59-1.41	
> median	11	1.24	0.52-2.94	34	1.18	0.71-1.97	35	1.17	0.74-1.86	
<i>P</i> _{trend}		0.551			0.596			0.299		0.940

*Hazard ratios adjusted for smoking (pack-years among current and pack-years among former smokers), age, gender, and total days of any pesticide application

[§]Lifetime-days of use were obtained from the take home questionnaire

Table S2. Lung cancer risk among applicators by lifetime exposure-days of indicated pesticide, stratified by histology, Agricultural Health Study

Pesticide by lifetime exposure-days	Adenocarcinoma			Non-Adenocarcinoma		
	Cases (n)	Hazard Ratio	95% confidence interval	Cases (n)	Hazard Ratio	95% confidence interval
Chlorimuron-ethyl (herbicide; pyrimidinylsulfonyleurea) [§]						
No exposure	52	1.0	Referent	128	1.0	Referent
≤median	13	1.03	0.55-1.95	29	0.98	0.65-1.48
>median	6	0.77	0.33-1.82	30	1.49	0.99-2.25
<i>P</i> _{trend}		0.415			0.047	
Dicamba (herbicide; benzoic acid)						
No exposure	74	1.0	Referent	219	1.0	Referent
≤median	22	0.60	0.35-1.01	61	0.61	0.45-0.83
>median	24	0.96	0.63-1.48	57	0.81	0.62-1.05
<i>P</i> _{trend}		0.331			0.010	
Pendimethalin (herbicide; dinitroaniline) [§]						
No exposure	47	1.0	Referent	113	1.0	Referent
≤median	12	0.92	0.62-1.36	42	1.15	0.58-2.27
>median	12	1.45	0.92-2.30	45	0.71	0.34-1.48
<i>P</i> _{trend}		0.677			0.138	
Carbaryl (insecticide; carbamate) [§]						
No exposure	28	1.0	Referent	84	1.0	Referent
≤median	28	1.09	0.64-1.86	68	0.91	0.65-1.26
>median	14	1.05	0.55-2.04	47	1.20	0.84-1.75
<i>P</i> _{trend}		0.712			0.459	
Carbofuran (insecticide; carbamate)						
No exposure	91	1.0	Referent	245	1.0	Referent
≤median	15	0.62	0.36-1.08	54	0.83	0.62-1.12
>median	10	0.71	0.37-1.38	41	1.00	0.72-1.41
<i>P</i> _{trend}		0.168			0.680	
Chlordane (insecticide; chlorinated organic) [§]						
No exposure	46	1.0	Referent	123	1.0	Referent
≤median	17	1.60	0.92-2.80	31	1.19	0.80-1.76
>median	5	0.73	0.29-1.85	20	1.16	0.72-1.87
<i>P</i> _{trend}		0.977			0.343	
Chlorpyrifos (insecticide; phosphorothioate)						
No exposure	86	1.0	Referent	253	1.0	Referent
≤median	25	0.92	0.57-1.47	81	0.96	0.74-1.23
>median	20	0.85	0.51-1.41	67	0.94	0.71-1.24
<i>P</i> _{trend}		0.530			0.666	
DDT (insecticide; chlorinated organic) [§]						
No exposure	36	1.0	Referent	104	1.0	Referent
≤median	17	1.00	0.56-1.80	45	0.99	0.79-1.42
>median	15	1.52	0.82-2.84	30	1.11	0.73-1.69
<i>P</i> _{trend}		0.424			0.961	
Malathion (insecticide; phosphorothioate) [§]						
No exposure	22	1.0	Referent	56	1.0	Referent
≤median	32	1.07	0.60-1.90	72	1.08	0.74-1.57
>median	18	0.86	0.46-1.62	62	1.31	0.91-1.90
<i>P</i> _{trend}		0.528			0.041	

*Hazard ratios adjusted for smoking (pack-years among current and pack-years among former smokers), age, gender, and total days of any pesticide application.

[§]Lifetime-days of use were obtained from the take home questionnaire

Table S3. Hazard Ratios and 95% Confidence Limits for Lung Cancer by Lifetime Days of Pesticide Exposure and Intensity-Weighted Lifetime Exposure to 30 Pesticides, Agricultural Health Study

Lifetime Days Pesticide Exposure					Intensity-Weighted Lifetime Exposure Days				
Pesticide	Cases (n)	Hazard* Ratio	95% Confidence Interval	P for Trend		Cases (n)	Hazard* Ratio	95% Confidence Interval	P for trend
Atrazine									
Non-exposed	169	1.00	Ref.		Non-exposed	169	1.00	Ref.	
Q1	76	1.10	0.84-1.44		Q1	93	1.25	0.93-1.66	
Q2	119	0.95	0.73-1.24		Q2	93	0.98	0.76-1.26	
Q3	85	1.04	0.80-1.36		Q3	87	0.89	0.68-1.17	
Q4	78	0.84	0.64-1.10	0.177	Q4	85	0.86	0.65-1.15	0.187
Cyanazine									
Non-exposed	303	1.00	Ref.		Non-exposed	303	1.00	Ref.	
Q1	11	0.95	0.67-1.35		Q1	35	1.01	0.54-1.89	
Q2	81	0.89	0.64-1.22		Q2	42	0.87	0.68-1.11	
Q3	28	0.75	0.53-1.05		Q3	40	0.71	0.48-1.05	
Q4	35	0.87	0.61-1.22	0.144	Q4	38	0.91	0.63-1.30	0.250
EPTC									
Non-exposed	382	1.00	Ref.		Non-exposed	382	1.00	Ref.	
Q1	11	1.06	0.58-1.94		Q1	13	0.66	0.38-1.15	
Q2	26	0.74	0.50-1.11		Q2	17	1.00	0.61-1.62	
Q3	15	1.01	0.61-1.70		Q3	23	1.26	0.83-1.92	
Q4	13	1.08	0.62-1.90	0.602	Q4	12	0.70	0.39-1.25	0.300
Alachlor									
Non-exposed	223	1.00	Ref.		Non-exposed	223	1.00	Ref.	
Q1	58	1.00	0.74-1.33		Q1	66	0.99	0.75-1.31	
Q2	84	0.85	0.66-1.10		Q2	70	0.84	0.64-1.10	
Q3	59	1.11	0.83-1.48		Q3	60	1.08	0.81-1.43	
Q4	42	0.78	0.55-1.10	0.285	Q4	47	0.81	0.59-1.13	0.200
Metribuzin^S									
Non-exposed	175	1.00	Ref.		Non-exposed	175	1.00	Ref.	
Q1	10	1.05	0.55-2.00		Q1	15	0.93	0.54-1.59	
Q2	39	0.80	0.57-1.14		Q2	27	0.74	0.49-1.12	
Q3	14	1.29	0.74-2.25		Q3	19	1.45	0.90-2.34	
Q4	15	1.17	0.68-2.00	0.611	Q4	17	1.07	0.64-1.78	0.373
Paraquat^S									
Non-exposed	198	1.00	Ref.		Non-exposed	198	1.00	Ref.	
Q1	10	1.02	0.50-2.08		Q1	13	1.03	0.58-1.80	
Q2	22	1.23	0.78-1.91		Q2	15	1.33	0.75-2.35	
Q3	7	0.98	0.45-2.12		Q3	13	1.00	0.57-1.75	
Q4	16	1.24	0.73-2.10	0.678	Q4	14	1.35	0.77-2.36	0.537

Lifetime Days Pesticide Exposure					Intensity-Weighted Lifetime Exposure Days				
Pesticide	Cases (n)	Hazard* Ratio	95% Confidence Interval	P for Trend		Cases (n)	Hazard* Ratio	95% Confidence Interval	P for trend
Petroleum Oil^S									
Non-exposed	197	1.00	Ref.		Non-exposed	197	1.00	Ref.	
Q1	4	0.79	0.29-2.14		Q1	11	0.93	0.51-1.71	
Q2	24	1.05	0.68-1.60		Q2	17	1.11	0.67-1.82	
Q3	11	1.32	0.72-2.42		Q3	12	1.20	0.67-2.15	
Q4	15	1.33	0.78-2.27	0.505	Q4	14	1.35	0.78-2.34	0.740
Imazethapyr									
Non-exposed	318	1.00	Ref.		Non-exposed	318	1.00	Ref.	
Q1	22	1.28	0.82-2.01		Q1	25	0.82	0.54-1.26	
Q2	37	0.73	0.52-1.03		Q2	35	0.83	0.58-1.19	
Q3	38	0.81	0.57-1.15		Q3	35	0.90	0.63-1.28	
Q4	38	0.88	0.62-1.24	0.616	Q4	39	0.85	0.60-1.19	0.268
Glyphosate									
Non-exposed	92	1.00	Ref.		Non-exposed	92	1.00	Ref.	
Q1	26	1.09	0.67-1.76		Q1	104	1.02	0.75-1.38	
Q2	159	1.12	0.85-1.45		Q2	120	1.21	0.91-1.61	
Q3	153	1.18	0.89-1.55		Q3	111	1.26	0.95-1.68	
Q4	101	1.15	0.85-1.55	0.693	Q4	104	1.10	0.82-1.48	0.686
Butylate^S									
Non-exposed	192	1.00	Ref.		Non-exposed	192	1.00	Ref.	
Q1	13	0.59	0.33-1.03		Q1	17	0.77	0.47-1.27	
Q2	22	1.41	0.90-2.20		Q2	13	1.16	0.66-2.05	
Q3	11	1.72	0.94-3.17		Q3	12	1.52	0.84-2.72	
Q4	12	0.98	0.54-1.78	0.842	Q4	16	1.05	0.62-1.78	0.551
Trifluralin									
Non-exposed	247	1.00	Ref.		Non-exposed	247	1.00	Ref.	
Q1	45	0.98	0.71-1.35		Q1	46	0.86	0.62-1.19	
Q2	78	0.84	0.65-1.09		Q2	64	0.82	0.62-1.10	
Q3	40	0.80	0.56-1.15		Q3	50	0.93	0.68-1.26	
Q4	49	0.72	0.53-1.00	0.136	Q4	52	0.73	0.54-1.00	0.113
2,4-D									
Non-exposed	153	1.00	Ref.		Non-exposed	153	1.00	Ref.	
Q1	112	0.76	0.58-0.98		Q1	97	0.77	0.59-1.02	
Q2	97	0.75	0.58-0.97		Q2	99	0.70	0.54-0.91	
Q3	86	0.79	0.60-1.03		Q3	87	0.84	0.64-1.09	
Q4	84	0.74	0.56-0.97	0.41	Q4	95	0.75	0.57-0.98	0.195

Lifetime Days Pesticide Exposure					Intensity-Weighted Lifetime Exposure Days				
Pesticide	Cases (n)	Hazard* Ratio	95% Confidence Interval	P for Trend		Cases (n)	Hazard* Ratio	95% Confidence Interval	P for trend
2,4,5-T^S									
Non-exposed	187	1.00	Ref.		Non-exposed	187	1.00	Ref.	
Q1	10	0.84	0.43-1.64		Q1	14	0.75	0.43-1.32	
Q2	21	0.71	0.45-1.12		Q2	17	0.89	0.54-1.47	
Q3	12	1.02	0.57-1.83		Q3	13	0.68	0.39-1.20	
Q4	16	1.17	0.70-1.96	0.773	Q4	15	1.47	0.86-2.51	0.939
Permethrin (crops)									
Non-exposed	394	1.00	Ref.		Non-exposed	394	1.00	Ref.	
Q1	11	1.18	0.64-2.16		Q1	13	1.18	0.68-2.05	
Q2	14	0.87	0.50-1.51		Q2	16	0.82	0.48-1.40	
Q3	18	0.90	0.54-1.50		Q3	14	1.03	0.60-1.78	
Q4	13	1.27	0.72-2.25	0.749	Q4	13	1.10	0.62-1.96	0.377
Permethrin (animals)									
Non-exposed	428	1.00	Ref.		Non-exposed	428	1.00	Ref.	
Q1	3	1.37	0.43-4.27		Q1	7	0.62	0.25-1.51	
Q2	6	0.59	0.23-1.50		Q2	9	1.02	0.48-2.14	
Q3	15	0.98	0.57-1.70		Q3	9	0.92	0.45-1.86	
Q4	6	0.65	0.27-1.59	0.718	Q4	5	0.72	0.29-1.73	0.492
Terbufos									
Non-exposed	316	1.00	Ref.		Non-exposed	316	1.00	Ref.	
Q1	64	0.93	0.71-1.21		Q1	40	0.89	0.64-1.24	
Q2	30	0.86	0.59-1.26		Q2	34	1.02	0.72-1.45	
Q3	23	0.88	0.57-1.36		Q3	34	0.88	0.62-1.26	
Q4	19	0.84	0.53-1.36	0.34	Q4	28	0.79	0.53-1.17	0.701
Fonofos									
Non-exposed	373	1.00	Ref.		Non-exposed	373	1.00	Ref.	
Q1	29	1.24	0.85-1.81		Q1	19	1.22	0.77-1.96	
Q2	17	0.83	0.51-1.36		Q2	23	0.88	0.58-1.34	
Q3	21	0.88	0.57-1.36		Q3	24	0.93	0.62-1.41	
Q4	21	1.20	0.76-1.90	0.858	Q4	22	1.23	0.80-1.90	0.669
Lindane^S									
Non-exposed	213	1.00	Ref.		Non-exposed	213	1.00	Ref.	
Q1	11	0.69	0.37-1.31		Q1	8	0.60	0.29-1.28	
Q2	11	1.19	0.63-2.24		Q2	12	1.09	0.59-2.00	
Q3	10	1.20	0.61-2.35		Q3	7	0.94	0.44-2.01	
Q4	5	1.05	0.43-2.58	0.676	Q4	10	1.60	0.82-3.14	0.754

Lifetime Days Pesticide Exposure					Intensity-Weighted Lifetime Exposure Days				
Pesticide	Cases (n)	Hazard* Ratio	95% Confidence Interval	P for Trend		Cases (n)	Hazard* Ratio	95% Confidence Interval	P for trend
Aldicarb^S									
Non-exposed	223	1.00	Ref.		Non-exposed	223	1.00	Ref.	
Q1	5	2.13	0.85-5.31		Q1	8	1.36	0.64-2.88	
Q2	14	0.99	0.51-1.91		Q2	5	1.18	0.48-2.92	
Q3	4	0.80	0.24-2.62		Q3	5	0.91	0.36-2.34	
Q4	5	0.81	0.26-2.51	0.379	Q4	3	0.72	0.21-2.50	0.504
Phorate^S									
Non-exposed	182	1.00	Ref.		Non-exposed	182	1.00	Ref.	
Q1	7	0.74	0.35-1.57		Q1	13	0.69	0.39-1.21	
Q2	26	0.70	0.47-1.06		Q2	20	0.71	0.44-1.12	
Q3	16	1.05	0.63-1.75		Q3	15	1.14	0.67-1.93	
Q4	14	1.43	0.82-2.47	0.837	Q4	15	1.35	0.79-2.29	0.758
Aldrin^S									
Non-exposed	192	1.00	Ref.		Non-exposed	192	1.00	Ref.	
Tertile 1	7	1.02	0.48-2.18		Tertile 1	17	0.79	0.48-1.30	
Tertile 2	30	0.68	0.50-1.00		Tertile 2	17	0.66	0.40-1.08	
Tertile 3	15	0.81	0.47-1.40	0.535	Tertile 3	18	0.81	0.50-1.31	0.173
Toxaphene^S									
Non-exposed	196	1.00	Ref.		Non-exposed	196	1.00	Ref.	
Tertile 1	10	2.15	1.14-4.08		Tertile 1	16	1.04	0.62-1.73	
Tertile 2	29	1.11	0.75-1.64		Tertile 2	17	1.56	0.94-2.57	
Tertile 3	12	1.19	0.65-2.17	0.712	Tertile 3	18	1.26	0.77-2.06	0.734
Coumaphos									
Non-exposed	405	1.00	Ref.		Non-exposed	405	1.00	Ref.	
Tertile 1	8	2.71	1.34-5.46		Tertile 1	12	1.05	0.59-1.87	
Tertile 2	22	1.05	0.69-1.62		Tertile 2	15	1.35	0.80-2.25	
Tertile 3	11	1.00	0.54-1.82	0.587	Tertile 3	14	1.14	0.67-1.95	0.552
DDVP									
Non-exposed	423	1.00	Ref.		Non-exposed	423	1.00	Ref.	
Tertile 1	7	2.18	1.03-4.59		Tertile 1	10	1.39	0.72-2.66	
Tertile 2	15	0.63	0.37-1.05		Tertile 2	11	0.56	0.31-1.03	
Tertile 3	10	0.89	0.47-1.67	0.855	Tertile 3	11	0.99	0.54-1.80	0.5987
Captan									
Non-exposed	412	1.00	Ref.		Non-exposed	412	1.00	Ref.	
Tertile 1	13	0.70	0.41-1.21		Tertile 1	12	0.72	0.41-1.27	
Tertile 2	15	1.07	0.58-1.96		Tertile 2	154	1.03	0.59-1.81	
Tertile 3	12	0.76	0.41-1.38	0.395	Tertile 3	154	0.79	0.44-1.42	0.301

Lifetime Days Pesticide Exposure					Intensity-Weighted Lifetime Exposure Days				
Pesticide	Cases (n)	Hazard* Ratio	95% Confidence Interval	P for Trend		Cases (n)	Hazard* Ratio	95% Confidence Interval	P for trend
Benomyl[§]									
Non-exposed	221	1.00	Ref.		Non-exposed	221	1.00	Ref.	
Q1	4	1.10	0.41-2.95		Q1	9	1.16	0.71-1.90	
Q2	10	1.00	0.53-1.90		Q2	6	1.37	0.77-2.44	
Q3	7	0.86	0.40-1.82		Q3	5	1.43	0.87-2.34	
Q4	4	1.25	0.46-3.41	0.003	Q4	5	0.76	0.41-1.39	0.659
Chlorothalonil									
Non-exposed	465	1.00	Ref.		Non-exposed	465	1.00	Ref.	
Q1	9	0.81	0.36-1.78		Q1	17	0.73	0.36-1.46	
Q2	24	1.53	1.00-2.32		Q2	15	0.80	0.45-1.44	
Q3	17	1.13	0.69-1.86		Q3	16	1.08	0.50-2.35	
Q4	10	0.97	0.49-1.92	0.873	Q4	12	0.83	0.42-1.62	0.932
Metalaxy[§]									
Non-exposed	184	1.00	Ref.		Non-exposed	184	1.00	Ref.	
Q1	19	1.34	0.81-2.20		Q1	14	1.13	0.64-1.97	
Q2	16	1.02	0.61-1.71		Q2	16	1.20	0.70-2.05	
Q3	12	1.08	0.60-1.95		Q3	17	1.13	0.68-1.88	0.758
Q4	18	1.33	0.82-2.19	0.729	Q4	18	1.30	0.79-2.12	
Methyl Bromide									
Non-exposed	403	1.00	Ref.		Non-exposed	403	1.00	Ref.	
Q1	20	1.14	0.73-1.79		Q1	31	1.04	0.72-1.50	
Q2	44	1.01	0.74-1.37		Q2	27	0.89	0.60-1.31	
Q3	30	1.04	0.71-1.50		Q3	37	1.23	0.88-1.73	
Q4	28	1.01	0.68-1.49	0.432	Q4	26	1.01	0.67-1.52	0.706
Ethylene Dibromide[§]									
Non-exposed	228	1.00	Ref.		Non-exposed	228	1.00	Ref.	
Q1	3	0.67	0.21-2.07		Q1	5	0.95	0.39-2.30	
Q2	5	1.80	0.74-4.37		Q2	5	2.72	1.12-6.64	
Q3	4	18.8	6.85-51-58		Q3	6	2.03	0.90-4.58	
Q4	7	1.14	0.54-2.42	0.607	Q4	3	0.84	0.27-2.62	0.277

*Hazard ratios adjusted for age, smoking (pack-years among current and pack-years among former smokers) and gender, total lifetime pesticide use.

[§]Lifetime-days and Intensity-weighted lifetime Days of use were obtained from the take home questionnaire