



## Correspondence

**Corrigendum to: “Human health risk assessment of pharmaceuticals and personal care products in plant tissue due to biosolids and manure amendments, and wastewater irrigation” [Environ. Int. 75 (2015) 223–233]**



We are writing to report corrections resulting from two errors in our paper. First, when calculating estimated daily intake (EDI) values for a number of the chemicals we evaluated, we did not consistently take into consideration that the concentrations of a number of the chemicals were reported in fresh weight of tissue. Second, we used a vegetable intake rate for toddlers (1 to <4 years) of 2.8 cups/day based on the 95th centile of vegetable intake rate for all people as reported by the US National Health and Nutrition Examination Survey. This value is appropriate for adults but not toddlers; the appropriate 95th centile of vegetable intake for children aged 1 to 3 is 1.4 cups/day (National Cancer Institute, 2005). Correcting these errors resulted in changes to a number of the hazard quotients presented in Table 2 and Table S5. These tables have been updated with the corrected EDI values and hazard quotients and a description of the corrections to the text in which the affected trends are described is provided below. While the values for a number of the hazard quotients reported in the original paper have changed, the conclusion from the paper has not: the majority of hazard quotients for individual chemistry were <0.1 and indicate *de minimus* hazard to human health. However, when additivity is assumed, a number of the hazard quotients exceeded 0.1 indicating the potential of the mixture to pose a risk to human health and the need for further assessment.

Note: Text in bold indicates changes from original text.

**In “Abstract”:**

“Irrigation with wastewater resulted in hazard quotients of  $\geq 0.1$  for flunixin, ketoprofen, lamotrigine, metoprolol, and sildenafil.” should be changed to “...**ambrettolid, carbamazepine, diclofenac, flunixin, lamotrigine, metoprolol, naproxen, sildenafil, and tonalide.**”

**In “3.1 Amendment with Biosolids”:**

“The concentration of salbutamol in cabbage shoot resulted in a hazard quotient of 0.1 for adults and 0.6 for toddlers (Table 2).” should be changed to “...**1.5** for adults and **3.8** for toddlers (Table 2).”

“Testosterone was detected in the edible tissue of tomato and potato plants at 5.5 and 5.1 ng/g dw, respectively (Sabourin et al., 2012), resulting in hazard quotients for toddlers of 0.4 and 0.3, respectively (Table 2; Table S5).” should be changed to “...**0.2** and **0.2**, respectively (Table 2; Table S5).”

“However, the concentration of triclosan in the root of radish plants measured by Pannu et al. (2012) resulted in a hazard quotient of 0.2 for toddlers (Table 2).” should be changed to “...**0.1** for toddlers (Table 2).”

“No hazard quotients were found to be greater than 1 (Table 2; Table S5).” should be changed to “No hazard quotients were found to be greater than 1 **except for hazard quotients due to residues of car-**

**bamazepine and salbutamol reported in cabbage by Holling et al. (2012) (Table 2; Table S5).”**

**In “3.2 Amendment with Manure”:**

“Kang et al. (2013) investigated accumulation of sulfamethazine in 12 different plant species and the greatest concentration measured was approximately 5 ng/g dw in the leaf of a spinach plant (Table S2).” should be changed to “...5 ng/g **ww**...”

“The greatest hazard quotient calculated from residues observed by Kang et al. (2013) is 0.001 for toddlers (Table S5).” should be changed to “...**0.008** for toddlers (Table S5).”

**In “3.3 Irrigation with Wastewater”:**

“Of the 25 PPCPs detected in edible tissue, 5 PPCPs were detected at concentrations resulting in hazard quotients  $\geq 0.1$ , i.e., flunixin, ketoprofen, lamotrigine, metoprolol, and sildenafil (Table 2; Table S5).” should be changed to “Of the 25 PPCPs detected in edible tissue, 9 PPCPs were detected at concentrations resulting in hazard quotients  $\geq 0.1$ , **ambrettolid, carbamazepine, diclofenac, flunixin, lamotrigine, metoprolol, naproxen, sildenafil, and tonalide** (Table 2; Table S5).” In this section of the paper, correction of the error in the calculation of EDI values resulted in hazard quotients  $\geq 0.1$  for ambrettolide, carbamazepine, diclofenac, naproxen, and tonalide as can be seen in amended Table 2 below. The addition of these five PPCPs to the list of PPCPs exceeding a hazard quotient of 0.1 due to wastewater irrigation warrants some discussion. All of the residues in tissue that resulted in hazard quotients  $\geq 0.1$  for these five chemicals were reported by Calderon-Preciado et al. (2013). The residues in lettuce tissue that resulted in hazard quotients  $\geq 0.1$  for diclofenac, naproxen, and tonalide were all only reported in 1 of 9 samples taken in the study (Calderon-Preciado et al., 2013). The concentration of naproxen in edible tissue of cucumber, bell pepper, carrot, cabbage, and green bean reported by Wu et al. (2014), Goldstein et al. (2014) and Calderon-Preciado et al. (2013) all resulted in hazard quotients <0.1 (Table S5). Tonalide was not detected in the edible tissue of green beans and residues in the edible tissue of carrots resulted in hazard quotients <0.1 (Calderon-Preciado et al., 2013) (Table S5). Diclofenac was not detected in any samples of edible tissue from green bean and carrot plants (Calderon-Preciado et al., 2013). This calls into question the suggested hazard for diclofenac, naproxen, and tonalide due to a single sample resulting in hazard quotients  $\geq 0.1$ . Calderon-Preciado et al. (2013) was the only study to include ambrettolide (omega-6-Hexadecenlactone or Hexadec-6-eno-1,16-lactone). Residues in the edible tissue of carrots and lettuce results in hazard quotients  $\geq 0.1$  and it was detected in the majority of samples of edible tissue from lettuce, carrot, and green bean plants (Table S5) (Calderon-Preciado et al., 2013). Ambrettolide is a flavour and fragrance additive that is registered as a food additive for direct addition to food for human consumption in the United States and Europe (European Parliament, 2012; United States Food and Drug Administration, 2014). However, based on the results from Calderon-Preciado et al. (2013) perhaps future studies of pharmaceutical and personal care product uptake into crops irrigated with wastewater should include ambrettolide in their analysis to provide further data for a more thorough assessment of potential risk to human health. The concentration of

DOI of original article: <http://dx.doi.org/10.1016/j.envint.2014.11.020>.

carbamazepine in green bean, carrot, and cucumber by Calderon-Preciado et al. (2013) and Shenker et al. (2011) resulted in hazard quotients  $\geq 0.1$  (Table S5). However, the studies conducted by Goldstein et al. (2014), Malchi et al. (2014), Marsoni et al. (2014) and Wu et al. (2014) reported residues in cucumber, carrot, lettuce, cabbage, arugula, tomato, sweet potato, celery, and spinach that did not result in hazard quotients  $\geq 0.1$  (Table S5). Therefore, as with ambrettolide, future research should include carbamazepine in the analysis of PPCP uptake from soil irrigated with wastewater to provide further data for the assessment of the potential risk to human health.

"The greatest concentration of flunixin measured in leaf tissue was 83 ng/g dw, resulting in hazard quotients of 0.08 and 0.4 for adults and toddlers, respectively (Table 2)." should be changed to "...83 ng/g **ww**..."

#### In "3.4 Exposure to Mixture of PPCPs":

"This approach would result in hazard quotients for the mixture of 0.48 and 2.23 for adults and toddlers, respectively, as result of amendment with biosolids (Table 2)." should be changed to "...hazard quotients for the mixture of **3.18** and **7.94**..."

"However, if the studies discussed above that exposed plants to concentrations of PPCPs that were not environmentally relevant are excluded from the assessment, the hazard quotients of the mixture become 0.28 and 0.043 for adults and toddlers, respectively (Table S5)." should be changed to "...**0.06** and **0.18** for adults and toddlers, respectively (Table S5)."

"The hazard quotients for the mixture as a result of amending soil with manure or irrigating with wastewater are 0.09 and 0.44 for adults and toddlers and 0.39 and 1.65 for adults and toddlers, respectively (Table 2)." should be changed to "...are **0.16** and **0.43** for adults and

**Table 2**  
Estimated daily intake of PPCPs based on greatest concentration reported in the edible tissue of plants grown in soil amended with biosolids or manure, or irrigated with wastewater, and associated hazard quotients. The adjusted hazard quotients for the mixture are in brackets.

PPCP compound	Plant	Greatest concentration in edible tissue (ng/g)	Adult EDI (ng/kg/day)	Adult intake to exceed ADI (g/day)	Adult hazard quotient	Toddler EDI (ng/kg/day)	Toddler intake to exceed ADI (g/day)	Toddler hazard quotient
<i>Biosolids-derived</i>								
Atenolol	Tomato	5.57	3.0	5501	0.01	7.6	1106	0.02
Carbamazepine	<b>α Cabbage</b>	657.6	4276.1	338	1.5*	10,634.7	68	3.7*
Ciprofloxacin	Carrot	2.15	0.9	252,958	0.0001	2.2	50,856	0.0003
Diphenhydramine	Tomato	21	11.5	1459	0.03	28.6	293	0.07
Naproxen	Corn	0.8	0.5	679,825	0.0001	1.2	136,675	0.0002
Norfloxacin	Carrot	4.5	1.9	194,053	0.0002	4.7	39,013	0.0004
Progesterone	Corn	6.65	4.2	3456	0.01	10.4	695	0.04
Salbutamol	<b>α Cabbage</b>	47.1	306.5	325	1.5*	762.2	65	3.8*
Testosterone	Tomato	5.52	3.0	555	0.08	7.5	112	0.2*
Triamterene	Carrot	0.064	0.03	478,750	0.0001	0.1	48,125	0.0002
Triclocarban	Collard/Lettuce/Tomato	250	169.8	25,431	0.002	422.3	5113	0.005
Triclosan	Radish	9200	3873.2	691	0.05	9632.8	139	0.1*
				Total	3.18* (0.06)		Total	7.94* (0.18*)
<i>Manure-derived</i>								
Chlortetracycline	<b>α Wheat</b>	44	91.9	17,409	0.009	457.0	3500	0.05
Gentamicin	<b>α Radish</b>	81	401.2	9457	0.04	997.8	1901	0.09
Monensin	<b>α Garlic</b>	5.0	26.2	153,200	0.003	65.3	30,800	0.007
Streptomycin	<b>α Lettuce</b>	27	215.7	28,370	0.02	536.6	5704	0.05
Sulfamethazine	Corn	1200	752.8	638	0.08	1872.2	128	0.2*
Tylosin	<b>α Tomato</b>	2.8	18.0	273,571	0.002	44.8	55,000	0.004
Virginiamycin	<b>α Garlic</b>	6.6	34.6	116,061	0.003	172.3	23,333	0.02
				Total	0.16* (0.08)		Total	0.42* (0.22*)
<i>Wastewater-derived</i>								
Ambrettolide	<b>α Lettuce</b>	309	2469.1	99	0.1*	6140.7	20	0.4*
Atenolol	<b>α Arugula</b>	1.8	14.4	17,022	0.04	35.8	3422	0.09
Bezafibrate	Cucumber	27	14.6	8227	0.005	36.3	1654	0.01
Caffeine	Cucumber	10	5.4	9192	0.005	13.5	1848	0.01
Carbamazepine	<b>α Green bean</b>	61.05	309.3	3639	0.1*	769.2	732	0.3*
Chloramphenicol	Corn	22.4	14.1	37,616	0.001	34.9	7563	0.003
Clofibrac acid	<b>α Lettuce</b>	18	151.8	57,652	0.01	377.6	11,591	0.03
DEET	Carrot	4	1.7	637,695	0.00001	4.2	128,205	0.00002
Diclofenac	<b>α Lettuce</b>	19	151.8	5644	0.09	377.6	1135	0.2*
Dilantin	Lettuce	1.7	1.2	63,082	0.001	2.9	12,682	0.002
10,11-Epoxy carbamazepine	<b>α Carrot</b>	0.244	1.2	910,410	0.0004	3.0	183,033	0.001
Erthromycin	Radish	2.2	0.9	153,200	0.0002	2.3	30,800	0.0005
Flunixin	<b>α Lettuce</b>	83	663.2	664	0.9*	1649.4	134	2.3*
Galaxolide	<b>α Lettuce</b>	270	2157.5	18,923	0.03	5365.6	3804	0.08
Gemfibrozil	Cucumber	8	4.3	74,685	0.0006	10.8	15,015	0.001
Ketoprofen	Cucumber	15	8.1	3064	0.01	20.2	616	0.03
Ibuprofen	<b>α Lettuce</b>	50	239.7	29,108	0.02	596.2	5852	0.05
Lamotrigine	Cucumber	22	11.9	1045	0.04	29.6	210	0.1*
Lincomycin	<b>α Arugula</b>	1.92	15.3	87,771	0.007	38.2	17,646	0.02
Metoprolol	Cucumber	29	15.7	792	0.05	39.0	159.3	0.1*
Meprobamate	Cabbage	1.5	0.8	148,093	0.0003	2.1	29,773	0.0007
Naproxen	<b>α Lettuce</b>	113	902.9	4813	0.1*	2245.6	968	0.3*
Norfloxacin	Cabbage	23.6	13.1	37,002	0.001	32.5	7439	0.003
Ofloxacin	<b>α Arugula</b>	1.17	9.3	373,179	0.002	23.3	75,026	0.004
Primidone	Lettuce	2.4	1.6	22,342	0.002	4.1	4492	0.006

Table 2 (continued)

PPCP compound	Plant	Greatest concentration in edible tissue (ng/g)	Adult EDI (ng/kg/day)	Adult intake to exceed ADI (g/day)	Adult hazard quotient	Toddler EDI (ng/kg/day)	Toddler intake to exceed ADI (g/day)	Toddler hazard quotient
Sildenafil	Cucumber	30	16.2	766	0.05	40.4	154.0	0.1*
Sulfamethazine	Radish	1.9	0.8	403,158	0.00008	2.0	81,053	0.0002
Sulfamethoxazole	Carrot	0.25	0.1	1,746,480	0.00002	0.3	351,120	0.00005
Sulfapyridine	Cucumber	1.25	0.7	202,224	0.0002	1.7	40,656.0	0.0005
Tetracycline	Cabbage	10.1	6.9	43,230	0.001	17.1	8691	0.003
Tonalide	<b>α Lettuce</b>	124	990.8	10,316	0.06	2464.2	2074	0.1*
Triclosan	<b>α Lettuce</b>	9	71.9	706,422	0.0009	178.9	142,022	0.002
				Total	1.63*		Total	4.25*
					(0.38*)			(1.15*)

α indicates that concentration in tissue and intake to exceed ADI is based on fresh weight of tissue.

\* Indicates that hazard quotient value is above 0.1.

Table S5

Estimated daily intake of PPCPs based on concentration reported in the edible tissue of plants grown in soil amended with biosolids or manure, or irrigated with wastewater, and associated hazard quotients.

PPCP compound	Plant	Greatest concentration in edible tissue (ng/g)	Adult EDI (ng/kg/day)	Adult intake to exceed ADI (g/day)	Adult hazard quotient	Toddler EDI (ng/kg/day)	Toddler intake to exceed ADI (g/day)	Toddler hazard quotient	
<i>Biosolids-derived</i>									
Atenolol	Tomato	5.57	3.0	5501	0.01	7.6	1106	0.02	
Carbamazepine	<b>α Cabbage</b>	657.6	4276.1	338	1.5*	10,634.7	68	3.7*	
	Collard	800	442.4	278	0.2*	1100.4	56	0.4*	
	Lettuce	600	407.5	370	0.1*	1013.5	74	0.3*	
	Radish	100	42.1	2221	0.01	104.7	447	0.04	
Ciprofloxacin	Pepper	25	11.8	8886	0.004	29.3	1786	0.01	
	Carrot	2.15	0.9	252,958	0.0001	2.2	50,856	0.0003	
	Corn	2.14	1.3	254,140	0.0002	3.3	51,093	0.0005	
Diphenhydramine	Tomato	21	11.5	1459	0.03	28.6	293	0.07	
	Pepper	15	7.1	2043	0.02	17.6	411	0.04	
	Lettuce	8	5.4	3830	0.01	13.5	770	0.03	
	Collard	6	3.3	5107	0.01	8.3	1027	0.02	
Naproxen	Radish	5	2.1	6128	0.01	5.2	1232	0.01	
	Corn	0.8	0.5	679,825	0.0001	1.2	136,675	0.0002	
Norfloxacin	Carrot	4.5	1.9	194,053	0.0002	4.7	39,013	0.0004	
Progesterone	Corn	6.65	4.2	3456	0.01	10.4	695	0.04	
Salbutamol	Potato	0.34	0.2	67,588	0.001	0.4	13,588	0.0013	
	<b>α Cabbage</b>	47.1	306.5	325	1.5*	762.2	65	3.8*	
Testosterone	Tomato	5.52	3.0	555	0.08	7.5	112	0.2*	
	Potato	5.1	2.3	601	0.06	5.8	121	0.2*	
Triamterene	Carrot	0.064	0.03	478,750	0.0001	0.1	48,125	0.0002	
Triclocarban	Collard/Lettuce/Tomato	250	169.8	25,431	0.002	422.3	5113	0.005	
	Radish	225	94.7	28,257	0.001	235.6	5681	0.003	
	Pepper	150	70.7	42,385	0.0009	175.7	8521	0.002	
	Cucumber	5.7	169.8	1,115,404	0.002	422.3	224,246	0.005	
	Tomato	5.2	2.8	1,222,654	0.00003	7.1	245,808	0.00009	
	Green Pepper	5.1	2.4	1,246,627	0.00003	6.0	250,627	0.00007	
	Carrot	4.6	1.9	1,382,130	0.00002	4.8	277,870	0.00006	
	Soybean	2.6	1.4	2,445,308	0.00002	3.6	491,615	0.00004	
	Radish	9200	3873.2	691	0.05	9632.8	139	0.1*	
	Lettuce	900	611.3	7064	0.007	1520.3	1420	0.02	
<i>Manure-derived</i>	<b>α Cabbage</b>	62	495.4	102,545	0.006	1232.1	20,616	0.01	
	Soybean	17	9.4	373,988	0.0001	23.5	75,188	0.0003	
	Soybean	12.6	7.0	504,587	0.00008	17.4	101,444	0.0002	
	Carrot	11.9	5.0	534,269	0.00006	12.4	107,412	0.0001	
	Radish	5.2	2.2	1,222,654	0.00003	5.4	245,808	0.00007	
	Cucumber	4	2.2	1,589,450	0.00003	5.4	319,550	0.00006	
	Chlortetracycline	<b>α Wheat</b>	44	91.9	17,409	0.009	457.0	3500	0.05
		<b>α Green onion</b>	14.4	53.0	53,194	0.005	131.7	10,694	0.01
		<b>α Cabbage</b>	11.4	74.2	67,193	0.007	184.5	13,509	0.02
		<b>α Garlic</b>	1.6	8.4	478,750	0.0008	20.9	96,250	0.002
	<b>α Spinach</b>	1.0	8.0	766,000	0.0008	19.9	154,000	0.002	
Gentamicin	<b>α Potato</b>	0.5	2.7	1,532,000	0.0003	6.7	308,000	0.0007	
	<b>α Radish</b>	81	401.2	9457	0.04	997.8	1901	0.09	
	<b>α Carrot</b>	62	305.7	12,355	0.03	760.3	2484	0.08	
Monensin	<b>α Lettuce</b>	52	415.5	14,731	0.04	1033.4	2962	0.09	
	<b>α Garlic</b>	5.0	26.2	153,200	0.0026	65.3	30,800	0.007	
	<b>α Carrot</b>	4.0	19.7	191,500	0.002	49.1	38,500	0.005	

(continued on next page)

Table S5 (continued)

PPCP compound	Plant	Greatest concentration in edible tissue (ng/g)	Adult EDI (ng/kg/day)	Adult intake to exceed ADI (g/day)	Adult hazard quotient	Toddler EDI (ng/kg/day)	Toddler intake to exceed ADI (g/day)	Toddler hazard quotient	
Streptomycin	<b>α Radish</b>	4.0	9.9	191,500	0.001	49.3	38,500	0.005	
	<b>α Spinach</b>	3.5	22.8	218,857	0.002	56.6	44,000	0.006	
	<b>α Potato</b>	3.1	16.7	247,097	0.002	41.7	49,677	0.004	
	<b>α Lettuce</b>	27	215.7	28,370	0.02	536.6	5704	0.05	
	<b>α Radish</b>	13	64.4	58,923	0.006	160.1	11,846	0.02	
Sulfamethazine	<b>α Carrot</b>	6	29.6	127,667	0.003	73.6	25,667	0.007	
	Corn	1200	752.8	638	0.08	1872.2	128	0.2*	
	Lettuce	1100	747.1	696	0.07	1858.1	140	0.2*	
	Potato	200	91.8	3830	0.01	228.4	770	0.02	
	<b>α Spinach</b>	5.0	32.5	153,200	0.003	80.9	30,800	0.008	
	<b>α Radish</b>	5.0	24.8	153,200	0.002	61.6	30,800	0.006	
	<b>α Pepper</b>	2.0	11.1	383,000	0.001	27.6	77,000	0.003	
	<b>α Lettuce</b>	1.8	14.4	425,556	0.001	35.8	85,556	0.004	
	<b>α Carrot</b>	1.4	6.9	547,143	0.0007	17.2	110,000	0.002	
	<b>α Potato</b>	1.2	6.5	638,333	0.0006	16.1	128,333	0.002	
	<b>α Garlic</b>	1.2	6.3	638,333	0.0006	15.7	128,333	0.002	
	Tylosin	<b>α Tomato</b>	2.8	18.0	273,571	0.002	44.8	55,000	0.004
		<b>α Carrot</b>	2.8	13.8	273,571	0.001	34.3	55,000	0.003
		<b>α White onion</b>	2.0	10.2	383,000	0.001	25.4	77,000	0.003
<b>α Spinach</b>		1.8	14.4	425,556	0.001	35.8	85,556	0.004	
<b>α Garlic</b>		1.2	6.3	638,333	0.0006	15.7	128,333	0.002	
<b>α Potato</b>		1.2	6.5	638,333	0.0006	16.1	128,333	0.002	
<b>α Cabbage</b>		1.0	6.5	766,000	0.0007	16.2	154,000	0.002	
<b>α Lettuce</b>		0.9	7.2	851,111	0.0007	17.9	171,111	0.002	
<b>α Pepper</b>		0.8	4.4	957,500	0.0004	11.0	192,500	0.001	
<b>α Garlic</b>		6.6	34.6	116,061	0.003	172.3	23,333	0.02	
<b>α Corn</b>		2.4	17.7	319,167	0.002	44.1	64,167	0.004	
<b>α Spinach</b>		2.0	16.0	383,000	0.002	32.4	77,000	0.003	
<b>α Garlic</b>		1.6	8.4	478,750	0.0008	20.9	96,250	0.002	
<b>α Cabbage</b>		1.2	7.8	638,333	0.0008	19.4	128,333	0.002	
<b>α Pepper</b>	1.0	5.5	766,000	0.0006	13.8	154,000	0.001		
<b>α Potato</b>	1.0	5.4	766,000	0.0005	13.4	154,000	0.001		
<b>α Tomato</b>	1.0	6.4	766,000	0.0006	16.0	154,000	0.002		
<b>α Onion</b>	0.8	4.1	957,500	0.0004	10.2	192,500	0.001		
Wastewater-derived Ambrettolide	<b>α Carrot</b>	336	1656.8	3807	0.09	4120.6	765	0.3*	
	<b>α Lettuce</b>	309	2469.1	99	0.1*	6140.7	20	0.4*	
	<b>α Green bean</b>	45.9	232.5	668	0.01	578.3	134	0.03	
	<b>α Arugula</b>	1.8	14.4	17,022	0.04	35.8	3422	0.09	
Atenolol Bezafibrate	Cucumber	27	14.6	8227	0.005	36.3	1654	0.01	
	Carrot	5	2.1	59,748	0.0007	5.2	8932	0.002	
	Sweet potato	1	0.5	222,140	0.0002	1.1	44,660	0.0003	
Caffeine	<b>α Arugula</b>	0.58	4.6	383,000	0.002	11.5	77,000	0.004	
	Cucumber	10	5.4	9192	0.005	13.5	1848	0.01	
	Carrot	7.5	3.1	12,256	0.003	7.8	2464	0.007	
	Carrot	4.5	1.9	20,427	0.002	4.7	4107	0.004	
	Sweet potato	2.5	1.1	36,768	0.001	2.9	7392	0.002	
	Tomato	1.5	0.8	61,280	0.0007	2.0	12,320.0	0.002	
	Celery	1.2	0.5	76,600	0.0004	1.3	15,400	0.001	
Carbamazepine	<b>α Green bean</b>	61.05	309.3	3639	0.1*	769.2	732	0.3*	
	<b>α Carrot</b>	60	295.9	511	0.1*	735.8	103	0.3*	
	Cucumber	55	29.8	4039	0.01	74.0	812.0	0.03	
	<b>α Cucumber</b>	25.6	163.0	8677	0.06	405.4	17,445	0.1*	
	Carrot	10	4.2	22,214	0.001	10.4	4466	0.004	
	Lettuce	2.8	1.9	79,336	0.0007	4.7	15,950	0.002	
	Cabbage	2.8	1.5	79,336	0.0005	3.9	15,950	0.001	
	<b>α Arugula</b>	2.51	20.1	88,502	0.007	49.9	17,793	0.02	
	Tomato	1.6	0.9	138,838	0.0003	2.2	27,912.5	0.0008	
	Sweet potato	1	0.5	222,140	0.0002	1.1	44,660	0.0004	
	Bell Pepper	0.8	0.4	277,675	0.0001	0.9	55,825	0.0003	
	Celery	0.77	0.3	288,494	0.0001	0.8	58,000	0.0003	
	Cucumber	0.57	1.9	389,719	0.0007	1.0	78,351	0.0003	
	Tomato	0.5	0.3	444,280	0.0001	0.7	89,320	0.0002	
	Carrot	0.5	1.9	444,280	0.001	0.5	101,640	0.0002	
	Spinach	0.2	0.1	1,110,700	0.00005	0.3	223,300	0.0001	
	Chloramphenicol	Corn	22.4	14.1	37,616	0.001	34.9	7563	0.003
Rice		20.4	5.7	41,304	0.001	28.1	8304	0.003	
Cabbage		12.7	7.0	66,346	0.001	17.5	13,339	0.002	
Spinach		10.1	6.9	83,426	0.001	17.1	16,772	0.002	
Radish		5.2	2.2	162,038	0.0002	5.4	32,577	0.0005	
<b>α Lettuce</b>		18	151.8	57,652	0.01	377.6	11,591	0.03	
Clofibrac acid	<b>α Green bean</b>	12.43	63.0	88,124	0.004	156.6	17,717	0.01	
	Carrot	6	2.5	182,563	0.0002	6.3	36,703	0.0004	
	Cucumber	4	2.2	273,845	0.0002	5.4	55,055	0.0004	

Table S5 (continued)

PCCP compound	Plant	Greatest concentration in edible tissue (ng/g)	Adult EDI (ng/kg/day)	Adult intake to exceed ADI (g/day)	Adult hazard quotient	Toddler EDI (ng/kg/day)	Toddler intake to exceed ADI (g/day)	Toddler hazard quotient
DEET	Tomato	1.75	1.0	625,931	0.00007	2.4	125,840	0.0002
	Sweet potato	0.5	0.2	2,190,760	0.00002	0.6	440,440	0.00004
	Carrot	4	1.7	637,695	0.00001	4.2	128,205	0.00002
	<b>α Lettuce</b>	19	151.8	5644	0.09	377.6	1135	0.2*
Dilantin	Lettuce	1.7	1.2	63,082	0.001	2.9	12,682	0.002
	Cabbage	1.6	0.9	67,025	0.001	2.2	13,475	0.002
	Celery	1.5	0.7	71,493	0.0005	1.6	14,373	0.001
	Carrot	0.8	1.9	134,050	0.001	0.8	26,950	0.0006
	Spinach	0.77	0.5	139,273	0.0004	1.3	28,000	0.0009
	Cucumber	0.7	0.4	153,200	0.0003	0.9	30,800	0.0007
	<b>α Carrot</b>	0.244	1.2	910,410	0.0004	3.0	183,033	0.001
	<b>α Sweet potato</b>	0.013	0.1	17,087,692	0.00002	0.2	3,435,385	0.0001
Erthromycin	Radish	2.2	0.9	153,200	0.0002	2.3	30,800	0.0005
Flunixin	<b>α Lettuce</b>	83	663.2	664	0.9*	1649.4	134	2.3*
	<b>α Green bean</b>	17.1	86.6	3225	0.1*	215.5	648	0.3*
	<b>α Carrot</b>	17	83.8	3244	0.1*	208.5	652	0.3*
Galaxolide	<b>α Lettuce</b>	270	2157.5	18,923	0.03	5365.6	3804	0.08
	<b>α Carrot</b>	34	157.8	159,663	0.002	33.4	32,099	0.0005
Gemfibrozil	Cucumber	8	4.3	74,685	0.0006	10.8	15,015	0.001
	Sweet potato	1	0.5	597,480	0.00006	1.1	120,120	0.0001
Ketoprofen	Cucumber	15	8.1	3064	0.01	20.2	616	0.03
	<b>α Lettuce</b>	50	239.7	29,108	0.02	596.2	5852	0.05
	<b>α Carrot</b>	16	93.7	45,960	0.008	233.0	9240	0.02
	<b>α Green bean</b>	9.22	46.7	94,711	0.004	116.2	19,041	0.01
Ibuprofen	Cucumber	6	3.2	145,540	0.0003	8.1	29,260.0	0.0007
	Tomato	1.5	0.8	582,160	0.00007	2.0	117,040	0.0002
	Cucumber	22	11.9	1045	0.04	29.6	210	0.1*
	Carrot	12	5.0	1915	0.02	12.5	385	0.04
Lamotrigine	Sweet potato	2	0.9	11,490	0.003	2.3	2310	0.008
	<b>α Arugula</b>	1.92	15.3	87,771	0.007	38.2	17,646	0.02
Lincomycin	Cucumber	29	15.7	792	0.05	39.0	159.3	0.1*
	Tomato	0.6	0.3	38,300	0.001	0.8	7700	0.003
Metoprolol	Cabbage	1.5	0.8	148,093	0.0003	2.1	29,773	0.0007
	Spinach	0.28	0.2	793,357	0.00003	0.9	390,500	0.0003
	Celery	0.27	0.1	822,741	0.00004	0.3	165,407	0.0001
Naproxen	<b>α Lettuce</b>	113	902.9	4813	0.1*	2245.6	968	0.3*
	<b>α Carrot</b>	17	83.8	31,992	0.01	208.5	6432	0.03
	<b>α Green bean</b>	5.26	26.6	103,395	0.004	66.3	20,787	0.009
	Cucumber	5	2.7	108,772	0.0004	6.7	21,868	0.0009
	Bell Pepper	1.1	0.5	494,418	0.00007	1.3	99,400	0.0002
	Carrot	0.6	0.3	906,433	0.00004	0.6	182,233	0.00009
	Cabbage	0.56	0.3	971,179	0.00004	0.8	195,250	0.0001
Norfloxacin	Cucumber	0.44	0.2	1,236,045	0.00003	0.6	248,500	0.00008
	Cabbage	23.6	13.1	37,002	0.001	32.5	7439	0.003
	Spinach	21.8	14.8	40,057	0.001	36.8	8053	0.003
	Radish	17.5	7.4	49,899	0.0006	18.3	10,032	0.002
	Corn	17.5	11.0	49,899	0.001	27.3	10,032	0.002
	Rice	13.8	3.8	63,278	0.0003	19.0	12,722	0.002
	<b>α Arugula</b>	1.17	9.3	373,179	0.002	23.3	75,026	0.004
Ofloxacin	Lettuce	2.4	1.6	22,342	0.002	4.1	4492	0.006
	Cabbage	2.1	1.2	25,533	0.002	2.9	5133	0.004
	Cucumber	1.7	0.9	31,541	0.001	2.3	6341	0.003
	Celery	1.5	0.7	35,747	0.0009	1.6	7187	0.002
Sildenafil	Cucumber	30	16.2	766	0.05	40.4	1540	0.1*
	Tomato	0.3	0.2	76,600	0.0005	0.4	15,400	0.001
	Carrot	0.3	0.1	76,600	0.0004	0.3	169,400	0.001
	Radish	1.9	0.8	403,158	0.00008	2.0	81,053	0.0002
Sulfamethazine	Carrot	0.25	0.1	1,746,480	0.00002	0.3	351,120	0.00005
Sulfamethoxazole	Cucumber	1.25	0.7	202,224	0.0002	1.7	40,656.0	0.0005
	Carrot	1	0.4	252,780	0.0001	1.0	50,820	0.0003
	Cabbage	10.1	6.9	43,230	0.001	17.1	8691	0.003
Tetracycline	Rice	8.5	2.4	51,367	0.0004	11.7	10,327	0.002
	Corn	6.6	4.1	66,155	0.0007	10.3	13,300	0.002
	Radish	6.5	2.7	67,172	0.0005	6.8	13,505	0.001
	Spinach	6.3	4.4	67,172	0.0008	11.0	13,505	0.002
	<b>α Lettuce</b>	124	990.8	10,316	0.06	2464.2	2074	0.1*
Tonalide	<b>α Carrot</b>	32	157.8	39,976	0.009	392.4	8037	0.02
	<b>α Lettuce</b>	9	71.9	706,422	0.0009	178.9	142,022	0.002
Triclosan	Carrot	3.5	1.4	1,869,941	0.00002	3.5	375,941	0.00004

α indicates plant tissue measured in fresh weight as opposed to dry weight.

\* Indicates that hazard quotient value is above 0.1.



toddlers and **1.63** and **4.25** for adults and toddlers, respectively (Table 2)."

"If the study reporting the uptake of sulfamethazine in corn is removed due to the concentration in manure not being realistic, the hazard quotients for the mixture as a result of manure amendment would be 0.01 and 0.04 for adults and toddlers, respectively." should be changed to "...be **0.08** and **0.22**, respectively."

"If the residues as a result of spiked wastewater reported in Goldstein et al. (2014) were used instead of the residues as a result of the spiked freshwater, the hazard quotients for the mixture as a result of irrigation with wastewater would be 0.26 and 0.84 for adults and toddlers, respectively." should be changed to "If the residues as a result of spiked wastewater reported in Goldstein et al. (2014) were used instead of the residues as a result of the spiked freshwater **and the single sample of lettuce tissue from Calderon-Preciado et al. (2013) was removed**, the hazard quotients for the mixture as a result of irrigation with wastewater would be **0.38** and **1.15** for adults and toddlers, respectively."

## References

- Calderon-Preciado, D., Matamoros, V., Save, R., Munoz, P., Biel, C., Bayona, J.M., 2013. Uptake of microcontaminants by crops irrigated with reclaimed water and groundwater under real field greenhouse conditions. *Environ. Sci. Pollut. Res.* 20, 3629–3638.
- European Parliament, 2012. Commission Implementing Regulation (EU) No 872/2012. In: European Parliament Council (Ed.) European Parliament, Brussels, Belgium (No 872/2012).
- Goldstein, M., Shenker, M., Chefetz, B., 2014. Insights into the uptake processes of wastewater-borne pharmaceuticals by vegetables. *Environ. Sci. Technol.* 48, 5593–5600.
- Holling, C.S., Bailey, J.L., Vanden Heuvel, B., Kinney, C.A., 2012. Uptake of human pharmaceuticals and personal care products by cabbage (*Brassica campestris*) from fortified and biosolids-amended soils. *J. Environ. Monit.* 14, 3029–3036.
- Kang, D.H., Gupta, S., Rosen, C., Fritz, V., Singh, A., Chander, Y., Murray, H., Rohwer, C., 2013. Antibiotic Uptake by Vegetable Crops from Manure-Applied Soils. *J. Agric. Food Chem.* 61, 9992–10001.
- Malchi, T., Maor, Y., Tadmor, G., Shenker, M., Chefetz, B., 2014. Irrigation of root vegetables with treated wastewater: evaluating uptake of pharmaceuticals and the associated human health risks. *Environ. Sci. Technol.* 48, 9325–9333.
- Marsoni, M., De Mattia, F., Labra, M., Bruno, A., Bracale, M., Vannini, C., 2014. Uptake and effects of a mixture of widely used therapeutic drugs in *Eruca sativa* L. and *Zea mays* L. plants. *Ecotoxicol. Environ. Saf.* 108, 52–57.
- National Cancer Institute, 2005. Usual Dietary Intakes: Food Intakes, US Population, 2001–2004. National Cancer Institute, Bethesda, Maryland, US.
- Pannu, M.W., Toor, G.S., O'Connor, G.A., Wilson, P.C., 2012. Toxicity and bioaccumulation of biosolids-borne triclosan in food crops. *Environ. Toxicol. Chem.* 31, 2130–2137.
- Sabourin, L., Duenk, P., Bonte-Gelok, S., Payne, M., Lapen, D.R., Topp, E., 2012. Uptake of pharmaceuticals, hormones and paragon into vegetables grown in soil fertilized with municipal biosolids. *Sci. Total Environ.* 431, 233–236.
- Shenker, M., Harush, D., Ben-Ari, J., Chefetz, B., 2011. Uptake of carbamazepine by cucumber plants — a case study related to irrigation with reclaimed wastewater. *Chemosphere* 82, 905–910.
- United States Food and Drug Administration, 2014. Food additives permitted for direct addition to food for human consumption. Code of Federal Regulations Title 21 ed. United States Food and Drug Administration, Washington, District of Columbia, United States.
- Wu, X., Conkle, J., Ernst, F., Gan, J., 2014. Treated wastewater irrigation: uptake of pharmaceuticals and personal care products by common vegetables under field conditions. *Environ. Sci. Technol.* 48, 11286–11293.

Ryan S. Prosser  
Paul K. Sibley  
School of Environmental Sciences University Guelph Guelph,  
Ontario, Canada