

Supporting Information

**Ingestion of fecal bacteria along multiple pathways by young children in rural Bangladesh participating in a cluster-randomized trial of water, sanitation and hygiene interventions (WASH Benefits)**

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Table S1. Input parameters and associated distributions for modeling fecal ingestion of rates of the fecal indicator bacteria, *E. coli*, among young children in rural Bangladesh

Parameter symbol	Parameter	Units	Age group	Form	v1; v2	Min	Mean	Median	Max	Reference
<i>HMTE</i>	Hand-to-mouth transfer efficiency	—	NA	beta	5.20; 2.6	0.11	0.67	0.69	0.99	<sup>1</sup>
<i>PTE</i>	Peri-oral transfer efficiency from the hand to the lips to the mouth	—	NA	beta	5.20; 2.6	0.00	0.30	0.28	0.93	<sup>2</sup>
<i>EC.hand<sub>c,4</sub></i>	<i>E. coli</i> concentration on child's hand	MPN/hand	6 months	empirical		1.25	87.08	1.25	6050.00	<sup>3,4</sup>
<i>EC.hand<sub>c,9</sub></i>	<i>E. coli</i> concentration on child's hand	MPN/hand	6-11 months	empirical		0.25	1816.95	10.25	24999.99	<sup>3,4</sup>
<i>EC.hand<sub>c,18</sub></i>	<i>E. coli</i> concentration on child's hand	MPN/hand	12-23 months	empirical		0.25	3518.12	425.00	24999.99	<sup>3,4</sup>
<i>EC.hand<sub>c,30</sub></i>	<i>E. coli</i> concentration on child's hand	MPN/hand	24-35 months	empirical		0.25	1685.54	215.91	24999.99	<sup>3,4</sup>
<i>HM.nd<sub>c,4</sub></i>	Frequency of child's hand-to-mouth contact while not eating [non-dietary]	times/hr	6 months	empirical		2.26	17.60	11.70	59.13	This study
<i>HM.nd<sub>c,9</sub></i>	Frequency of child's hand-to-mouth contact while not eating [non-dietary]	times/hr	6-11 months	empirical		0.85	13.04	10.23	45.57	<sup>5,6</sup>
<i>HM.nd<sub>c,18</sub></i>	Frequency of child's hand-to-mouth contact while not eating [non-dietary]	times/hr	12-23 months	empirical		0.00	10.58	10.15	31.36	<sup>5,6</sup>
<i>HM.nd<sub>c,30</sub></i>	Frequency of child's hand-to-mouth contact while not eating [non-dietary]	times/hr	24-35 months	empirical		0.49	11.70	8.75	36.29	<sup>5,6</sup>
<i>HM.d.episode<sub>c,4</sub></i>	Frequency of episodes when child feeds self by hand [dietary episodes]	episodes/hr	6 months	empirical		0.00	0.01	0.00	0.25	<sup>5,6</sup>
<i>HM.d.episode<sub>c,9</sub></i>	Frequency of episodes when child feeds self by hand [dietary episodes]	episodes/hr	6-11 months	empirical		0.00	0.17	0.00	5.23	<sup>5,6</sup>
<i>HM.d.episode<sub>c,18</sub></i>	Frequency of episodes when child feeds self by hand [dietary episodes]	episodes/hr	12-23 months	empirical		0.00	1.58	0.48	6.36	<sup>5,6</sup>
<i>HM.d.episode<sub>c,30</sub></i>	Frequency of episodes when child feeds self by hand [dietary episodes]	episodes/hr	24-35 months	empirical		0.66	2.72	2.57	5.15	<sup>5,6</sup>
<i>HM.o<sub>c</sub></i>	Fraction of child's hand-to-mouth contacts that are oral	—	NA	empirical		0.00	0.50	0.58	0.89	<sup>1</sup>
<i>HF.o<sub>c</sub></i>	Fraction of child's hand that contacts the mouth in an oral hand-to-mouth contact	—	NA	empirical		0.06	0.19	0.19	0.63	<sup>1</sup>
<i>HF.po<sub>c</sub></i>	Fraction of child's hand that contacts the mouth in a peri-oral contact	—	NA	empirical		0.01	0.02	0.02	0.05	<sup>1</sup>
<i>EC.hand<sub>m,4</sub></i>	<i>E. coli</i> concentration on caregiver's hand	MPN/hand	6 months	empirical		1.25	104.99	1.25	6050.00	<sup>3,4</sup>
<i>EC.hand<sub>m,9</sub></i>	<i>E. coli</i> concentration on caregiver's hand	MPN/hand	6-11 months	empirical		0.25	1890.41	10.25	24999.99	<sup>3,4</sup>
<i>EC.hand<sub>m,18</sub></i>	<i>E. coli</i> concentration on caregiver's hand	MPN/hand	12-23 months	empirical		0.25	3542.16	425.00	24999.99	<sup>3,4</sup>
<i>EC.hand<sub>m,30</sub></i>	<i>E. coli</i> concentration on caregiver's hand	MPN/hand	24-35 months	empirical		0.25	1745.61	227.27	24999.99	<sup>3,4</sup>
<i>HM.nd<sub>m,4</sub></i>	Frequency of non-dietary hand contacts between caregiver's hand and child's mouth	times/hr	6 months	empirical		0.19	2.61	2.01	9.42	<sup>5,6</sup>
<i>HM.nd<sub>m,9</sub></i>	Frequency of non-dietary contacts between caregiver's hand and child's mouth	times/hr	6-11 months	empirical		0.13	1.88	1.08	10.36	<sup>5,6</sup>
<i>HM.nd<sub>m,18</sub></i>	Frequency of non-dietary contacts between caregiver's hand and child's mouth	times/hr	12-23 months	empirical		0.00	0.95	0.39	7.15	<sup>5,6</sup>
<i>HM.nd<sub>m,30</sub></i>	Frequency of non-dietary contacts between caregiver's hand and child's mouth	times/hr	24-35 months	empirical		0.00	0.48	0.00	2.17	<sup>5,6</sup>
<i>HM.d.episode<sub>m,4</sub></i>	Frequency of dietary episodes when caregiver feeds child by hand	episodes/hr	6 months	empirical		0.00	0.07	0.00	1.50	<sup>5,6</sup>
<i>HM.d.episode<sub>m,9</sub></i>	Frequency of dietary episodes when caregiver feeds child by hand	episodes/hr	6-11 months	empirical		0.00	0.23	0.00	3.85	<sup>5,6</sup>
<i>HM.d.episode<sub>m,18</sub></i>	Frequency of dietary episodes when caregiver feeds child by hand	episodes/hr	12-23 months	empirical		0.00	0.72	0.21	4.97	<sup>5,6</sup>
<i>HM.d.episode<sub>m,30</sub></i>	Frequency of dietary episodes when caregiver feeds child by hand	episodes/hr	24-35 months	empirical		0.00	0.72	0.46	3.76	<sup>5,6</sup>
<i>HF.o<sub>m,4</sub></i>	Fraction of caregiver's hand mouthed in an oral contact	—	6 months	empirical		0.01	0.06	0.06	0.25	<sup>1</sup>
<i>HF.o<sub>m,9</sub></i>	Fraction of caregiver's hand mouthed in an oral contact	—	6-11 months	empirical		0.01	0.06	0.06	0.28	<sup>1</sup>
<i>HF.o<sub>m,18</sub></i>	Fraction of caregiver's hand mouthed in an oral contact	—	12-23 months	empirical		0.02	0.07	0.07	0.34	<sup>1</sup>
<i>HF.o<sub>m,30</sub></i>	Fraction of caregiver's hand mouthed in an oral contact	—	24-35 months	empirical		0.02	0.08	0.07	0.36	<sup>1</sup>
<i>HF.po<sub>m,4</sub></i>	Fraction of caregiver's hand mouthed in a peri-oral contact	—	6 months	empirical		0.00	0.01	0.00	0.02	<sup>1</sup>
<i>HF.po<sub>m,9</sub></i>	Fraction of caregiver's hand mouthed in a peri-oral contact	—	6-11 months	empirical		0.00	0.01	0.00	0.02	<sup>1</sup>

<i>HF.po<sub>m,18</sub></i>	Fraction of caregiver's hand mouthed in a peri-oral contact	—	12-23 months	empirical		0.00	0.01	0.01	0.02	<sup>1</sup>
<i>HF.po<sub>m,30</sub></i>	Fraction of caregiver's hand mouthed in a peri-oral contact	—	24-35 months	empirical		0.00	0.01	0.01	0.03	<sup>1</sup>
<i>EC.obj</i>	<i>E. coli</i> concentration on object	MPN/cm <sup>2</sup>	NA	empirical		0.00	5.12	0.08	154.19	<sup>3,4</sup>
<i>OM<sub>c,4</sub></i>	Frequency of child's object-to-mouth contacts	times/hr	6 months	empirical		0.25	17.75	8.17	77.41	<sup>5,6</sup>
<i>OM<sub>c,9</sub></i>	Frequency of child's object-to-mouth contacts	times/hr	6-11 months	empirical		0.33	19.01	12.67	115.87	<sup>5,6</sup>
<i>OM<sub>c,18</sub></i>	Frequency of child's object-to-mouth contacts	times/hr	12-23 months	empirical		0.34	17.40	11.16	74.10	<sup>5,6</sup>
<i>OM<sub>c,30</sub></i>	Frequency of child's object-to-mouth contacts	times/hr	24-35 months	empirical		1.46	24.07	18.83	58.70	<sup>5,6</sup>
<i>SAM.obj</i>	Surface area of object mouthed	cm <sup>2</sup>	NA	exponential	0.11	1.00	9.90	7.33	49.60	<sup>7</sup>
<i>EC.food<sub>c,4</sub></i>	<i>E. coli</i> concentration in food fed to children	MPN/dry g	6 months	empirical		0.06	60.29	0.68	1055.63	<sup>3,4</sup>
<i>EC.food<sub>c,9</sub></i>	<i>E. coli</i> concentration in food fed to children	MPN/dry g	6-11 months	empirical		0.07	114.24	2.05	952.93	<sup>3,4</sup>
<i>EC.food<sub>c,18</sub></i>	<i>E. coli</i> concentration in food fed to children	MPN/dry g	12-23 months	empirical		0.50	24467.01	18.32	493075.62	<sup>3,4</sup>
<i>EC.food<sub>c,30</sub></i>	<i>E. coli</i> concentration in food fed to children	MPN/dry g	24-35 months	empirical		0.50	23652.03	18.32	493075.62	<sup>3,4</sup>
<i>F<sub>c,4</sub></i>	Mass of food consumed	dry g/day	6 months	empirical		0.00	1.93	0.00	12.91	This study
<i>F<sub>c,9</sub></i>	Mass of food consumed	dry g/day	6-11 months	empirical		0.03	30.90	30.80	74.82	<sup>8,9</sup>
<i>F<sub>c,18</sub></i>	Mass of food consumed	dry g/day	12-23 months	empirical		0.39	102.43	101.97	258.46	This study
<i>F<sub>c,30</sub></i>	Mass of food consumed	dry g/day	24-35 months	empirical		0.97	173.46	173.33	381.40	<sup>9</sup>
<i>EC.water<sub>c,4</sub></i>	<i>E. coli</i> concentration in stored water	MPN /100 mL	6 months	empirical		0.50	211.07	7.40	2420.00	<sup>3,4</sup>
<i>EC.water<sub>c,9</sub></i>	<i>E. coli</i> concentration in stored water	MPN /100 mL	6-11 months	empirical		0.50	140.92	9.60	2420.00	<sup>3,4</sup>
<i>EC.water<sub>c,18</sub></i>	<i>E. coli</i> concentration in stored water	MPN /100 mL	12-23 months	empirical		0.50	63.79	19.00	200.00	<sup>3,4</sup>
<i>EC.water<sub>c,30</sub></i>	<i>E. coli</i> concentration in stored water	MPN /100 mL	24-35 months	empirical		0.50	70.78	28.00	200.00	<sup>3,4</sup>
<i>W<sub>c,4</sub></i>	Volume of water consumed	100 mL/day	6 months	empirical		0.00	2.62	0.00	6.25	This study
<i>W<sub>c,9</sub></i>	Volume of water consumed	100 mL/day	6-11 months	empirical		6.13	6.47	6.47	6.88	This study
<i>W<sub>c,18</sub></i>	Volume of water consumed	100 mL/day	12-23 months	empirical		6.60	7.12	7.11	7.67	This study
<i>W<sub>c,30</sub></i>	Volume of water consumed	100 mL/day	24-35 months	empirical		7.71	8.18	8.18	8.70	This study
<i>EC.soil</i>	<i>E. coli</i> concentration in soil	MPN/dry g	NA	empirical		0.44	682.90	177.81	2403.18	<sup>4</sup>
<i>SM<sub>c,4</sub></i>	Frequency of direct soil mouthing	times/day	6 months	empirical		0.00	1.03	0.00	6.24	<sup>5,6</sup>
<i>SM<sub>c,9</sub></i>	Frequency of direct soil mouthing	times/day	6-11 months	empirical		0.00	6.76	2.38	64.62	<sup>5,6</sup>
<i>SM<sub>c,18</sub></i>	Frequency of direct soil mouthing	times/day	12-23 months	empirical		0.00	5.08	2.81	26.01	<sup>5,6</sup>
<i>SM<sub>c,30</sub></i>	Frequency of direct soil mouthing	times/day	24-35 months	empirical		0.00	0.30	0.00	7.00	<sup>5,6</sup>
<i>SW.DI</i>	Mass of soil ingested per direct ingestion event	dry mg	NA	beta	5.30; 158.6	7.04	31.78	30.06	69.78	<sup>1</sup>
<i>EC.feces</i>	<i>E. coli</i> concentration in animal feces	MPN/wet – weight mg	NA	empirical		53.70	375931.65	47134.22	81507621.01	This study
<i>FM<sub>c,4</sub></i>	Frequency of direct feces mouthing	times/day	6 months	empirical		0.00	0.00	0.00	0.00	<sup>5,6</sup>
<i>FM<sub>c,9</sub></i>	Frequency of direct feces mouthing	times/day	6-11 months	empirical		0.00	0.51	0.00	12.66	<sup>5,6</sup>
<i>FM<sub>c,18</sub></i>	Frequency of direct feces mouthing	times/day	12-23 months	empirical		0.00	0.00	0.00	0.00	<sup>5,6</sup>
<i>FM<sub>c,30</sub></i>	Frequency of direct feces mouthing	times/day	24-35 months	empirical		0.00	0.00	0.00	0.00	<sup>5,6</sup>
<i>MC.feces</i>	Moisture content of feces	—	NA	empirical		0.06	0.57	0.57	0.94	This study
<i>FW.DI</i>	Mass of feces ingested per direct ingestion event	dry mg	NA	empirical		7.04	31.88	30.18	69.72	This study
<i>awake<sub>c,4</sub></i>	Duration child is awake	hr/day	6 months	normal	12.9; 1.3	6.20	10.40	10.39	14.60	<sup>10</sup>
<i>awake<sub>c,9</sub></i>	Duration child is awake	hr/day	6-11 months	normal	12.6; 1.3	8.20	11.15	11.15	14.60	<sup>10</sup>
<i>awake<sub>c,18</sub></i>	Duration child is awake	hr/day	12-23 months	normal	12.0; 1.2	8.80	11.42	11.43	14.00	<sup>10</sup>
<i>awake<sub>c,30</sub></i>	Duration child is awake	hr/day	24-35 months	normal	12.9; 1.3	9.80	12.01	12.01	14.30	<sup>10</sup>

The subscript 'c' refers to children, while the subscript 'm' refers to caregivers. The number after the subscript (*i* in the equations) refers to the child age group: 3–5 months (*i* = 4), 6–11 months (*i* = 9), 12–23 months (*i* = 18), and 24–35 months (*i* = 30). V1 refers to the value of alpha (beta distribution); mean (normal distribution), or lambda (exponential distribution). V2 refers to the value of beta (beta distribution) or standard deviation (normal distribution).

Table S2. Modeled log<sub>10</sub> *E. coli* MPN ingestion/day among children in the WASH Benefits Bangladesh control and WSH arms

Log <sub>10</sub> <i>E. coli</i> MPN/day						
Arm	Age group	Min	25th percentile	50th percentile	75th percentile	Max
Control	<6 months old	1.4	3.1	3.6	4.3	6.2
	6-11 months old	2.7	4.2	4.7	5.2	10.2
	12-23 months old	3.2	4.6	5.0	5.5	8.0
	24-35 months old	3.0	4.3	4.7	5.1	8.3
WSH	<6 months old	1.2	3.2	3.7	4.3	6.0
	6-11 months old	2.4	4.3	4.7	5.2	10.2
	12-23 months old	3.2	4.6	4.9	5.4	7.9
	24-35 months old	3.1	4.3	4.6	5.0	8.1

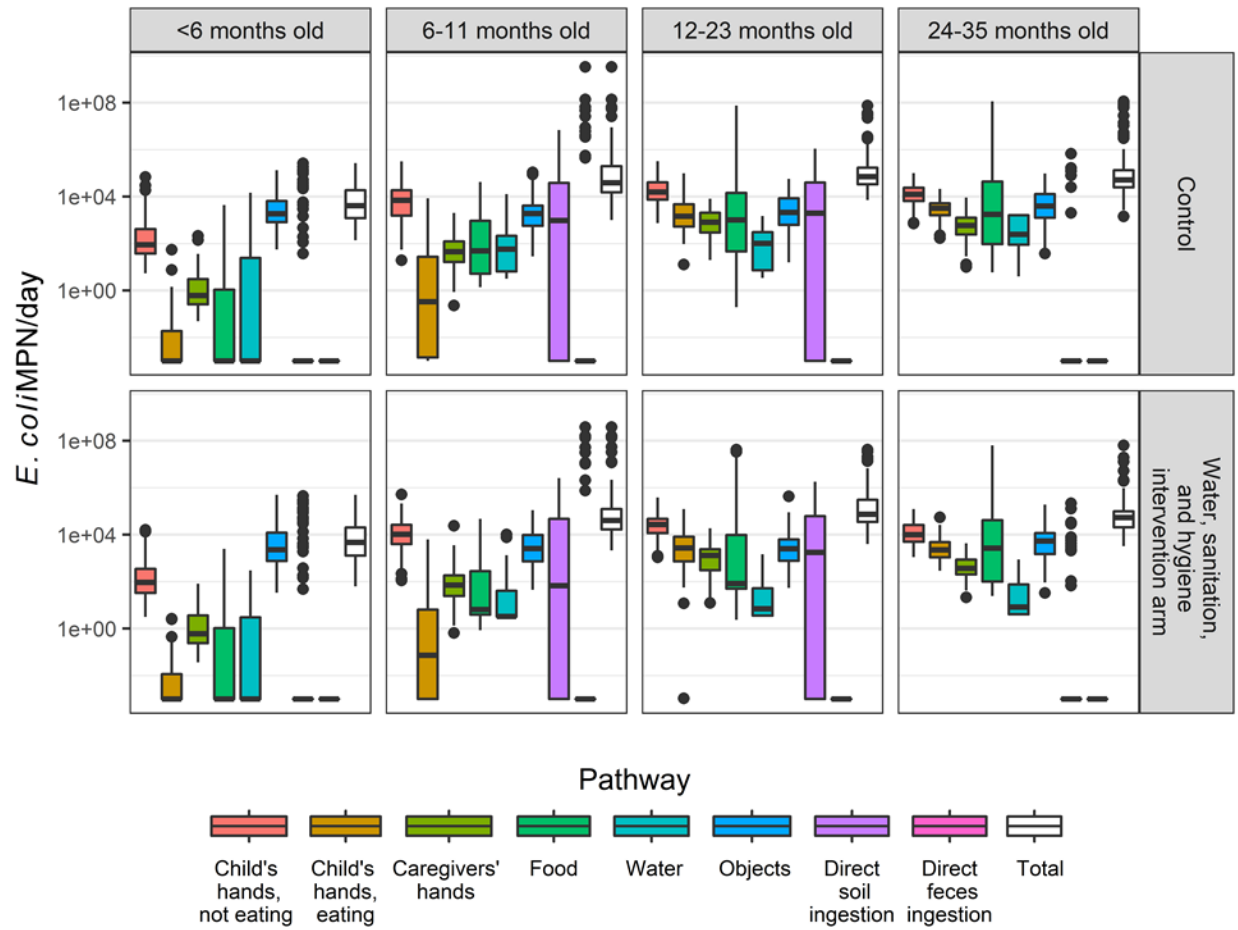


Figure S1. Modeled fecal bacteria ingestion by young children in rural Bangladesh. The median is denoted by the line in the middle of the box, with the bottom of the box marking the 25<sup>th</sup> percentile and the top of the box marking the 75<sup>th</sup> percentile. The whiskers extend past the box to 1.5 times the range between the 25<sup>th</sup> and 75<sup>th</sup> percentile. Outliers are marked with black circles.

Table S3. Sensitivity of fecal bacteria ingested by Bangladeshi children to model input parameters

Parameter	Unit	Age group	25th	50th	75th	Ratio of result using 75th percentile to 25th percentile
			percentile	percentile	percentile	
Frequency of direct soil ingestion	times/day	6 months	0.00	0.00	0.00	1.00
<b><u>Frequency of direct soil ingestion</u></b>	<b><u>times/day</u></b>	<b><u>6-11 months</u></b>	<b><u>0.00</u></b>	<b><u>2.38</u></b>	<b><u>7.75</u></b>	<b><u>153.86</u></b>
Frequency of direct soil ingestion	times/day	12-23 months	0.00	2.81	7.28	6.77
Frequency of direct soil ingestion	times/day	24-35 months	0.00	0.00	0.00	1.00
<i>E. coli</i> concentration in soil	MPN/dry mg	6 months	23.47	180.67	1365.16	1.00
<b><u><i>E. coli</i> concentration in soil</u></b>	<b><u>MPN/dry mg</u></b>	<b><u>6-11 months</u></b>	<b><u>23.47</u></b>	<b><u>179.13</u></b>	<b><u>1351.16</u></b>	<b><u>49.66</u></b>
<b><u><i>E. coli</i> concentration in soil</u></b>	<b><u>MPN/dry mg</u></b>	<b><u>12-23 months</u></b>	<b><u>23.07</u></b>	<b><u>177.81</u></b>	<b><u>1351.16</u></b>	<b><u>13.91</u></b>
<i>E. coli</i> concentration in soil	MPN/dry mg	24-35 months	23.47	180.35	1365.16	1.00
<b><u><i>E. coli</i> concentration on object</u></b>	<b><u>MPN/cm<sup>2</sup></u></b>	<b><u>6 months</u></b>	<b><u>0.00</u></b>	<b><u>0.08</u></b>	<b><u>0.79</u></b>	<b><u>28.06</u></b>
<i>E. coli</i> concentration on object	MPN/cm <sup>2</sup>	6-11 months	0.00	0.08	0.77	1.04
<i>E. coli</i> concentration on object	MPN/cm <sup>2</sup>	12-23 months	0.01	0.08	0.85	1.02
<i>E. coli</i> concentration on object	MPN/cm <sup>2</sup>	24-35 months	0.01	0.08	0.79	1.13
<i>E. coli</i> concentration in food fed to children	MPN/dry g	6 months	0.18	0.67	12.60	1.00
<i>E. coli</i> concentration in food fed to children	MPN/dry g	6-11 months	0.17	2.05	28.36	1.07
<b><u><i>E. coli</i> concentration in food fed to children</u></b>	<b><u>MPN/dry g</u></b>	<b><u>12-23 months</u></b>	<b><u>0.50</u></b>	<b><u>23.60</u></b>	<b><u>361.95</u></b>	<b><u>2.90</u></b>
<b><u><i>E. coli</i> concentration in food fed to children</u></b>	<b><u>MPN/dry g</u></b>	<b><u>24-35 months</u></b>	<b><u>0.50</u></b>	<b><u>24.36</u></b>	<b><u>361.95</u></b>	<b><u>22.78</u></b>
Frequency of child's object-to-mouth contacts	times/hr	6 months	2.35	8.17	33.85	6.97
Frequency of child's object-to-mouth contacts	times/hr	6-11 months	7.50	12.67	25.49	1.01
Frequency of child's object-to-mouth contacts	times/hr	12-23 months	4.79	11.16	24.46	1.00
Frequency of child's object-to-mouth contacts	times/hr	24-35 months	12.61	18.83	35.47	1.02
<i>E. coli</i> concentration on child's hand	MPN/hand	6 months	1.25	1.25	5.00	1.79
<i>E. coli</i> concentration on child's hand	MPN/hand	6-11 months	1.25	10.25	227.00	1.15
<i>E. coli</i> concentration on child's hand	MPN/hand	12-23 months	87.50	437.50	1700.00	1.82
<b><u><i>E. coli</i> concentration on child's hand</u></b>	<b><u>MPN/hand</u></b>	<b><u>24-35 months</u></b>	<b><u>57.95</u></b>	<b><u>227.27</u></b>	<b><u>1090.91</u></b>	<b><u>3.08</u></b>
<b>Mouthed surface area of object</b>	<b>cm<sup>2</sup></b>	<b>6 months</b>	<b>3.73</b>	<b>7.32</b>	<b>13.51</b>	<b>2.54</b>
Mouthed surface area of object	cm <sup>2</sup>	6-11 months	3.77	7.47	13.79	1.01
Mouthed surface area of object	cm <sup>2</sup>	12-23 months	3.73	7.40	13.75	1.00
Mouthed surface area of object	cm <sup>2</sup>	24-35 months	3.63	7.22	13.47	1.02
Mass of soil ingested per direct ingestion	mg wet – weight	6 months	22.38	30.30	40.13	1.00
Mass of soil ingested per direct ingestion	mg wet – weight	6-11 months	22.07	30.33	40.01	1.79
Mass of soil ingested per direct ingestion	mg wet – weight	12-23 months	22.16	30.19	39.75	1.49
Mass of soil ingested per direct ingestion	mg wet – weight	24-35 months	22.15	30.25	40.38	1.00
Frequency of child's hand-to-mouth contact while not eating [non-dietary]	times/hr	6 months	4.89	11.70	31.24	1.70
Frequency of child's hand-to-mouth contact while not eating [non-dietary]	times/hr	6-11 months	4.99	10.23	18.51	1.01
Frequency of child's hand-to-mouth contact while not eating [non-dietary]	times/hr	12-23 months	5.41	10.15	13.35	1.15
Frequency of child's hand-to-mouth contact while not eating [non-dietary]	times/hr	24-35 months	6.13	8.75	16.61	1.34
<b>Volume of water consumed</b>	<b>100 mL/day</b>	<b>6 months</b>	<b>0.00</b>	<b>0.00</b>	<b>5.94</b>	<b>2.00</b>
Volume of water consumed	100 mL/day	6-11 months	6.40	6.48	6.55	1.00
Volume of water consumed	100 mL/day	12-23 months	7.02	7.12	7.22	1.00
Volume of water consumed	100 mL/day	24-35 months	8.09	8.18	8.27	1.00
Hand-to-mouth transfer efficiency	—	6 months	0.56	0.69	0.79	1.41
Hand-to-mouth transfer efficiency	—	6-11 months	0.56	0.69	0.79	1.00
Hand-to-mouth transfer efficiency	—	12-23 months	0.56	0.69	0.79	1.07
Hand-to-mouth transfer efficiency	—	24-35 months	0.56	0.69	0.79	1.13
Fraction of child's hand-to-mouth contacts that are oral	—	6 months	0.36	0.58	0.73	1.18
Fraction of child's hand-to-mouth contacts that are oral	—	6-11 months	0.36	0.58	0.73	1.00
Fraction of child's hand-to-mouth contacts that are oral	—	12-23 months	0.36	0.58	0.73	1.12
Fraction of child's hand-to-mouth contacts that are oral	—	24-35 months	0.36	0.58	0.73	1.24
Fraction of child's hand that contacts the mouth in an oral hand-to-mouth contact	—	6 months	0.13	0.19	0.24	1.16
Fraction of child's hand that contacts the mouth in an oral hand-to-mouth contact	—	6-11 months	0.13	0.19	0.24	1.00

Fraction of child's hand that contacts the mouth in an oral hand-to-mouth contact	—	12-23 months	0.13	0.19	0.24	1.11
Fraction of child's hand that contacts the mouth in an oral hand-to-mouth contact	—	24-35 months	0.13	0.19	0.24	1.22
Mass of food consumed	dry g/day	6 months	0.00	0.00	3.49	1.05
Mass of food consumed	dry g/day	6-11 months	23.36	30.55	38.20	1.00
Mass of food consumed	dry g/day	12-23 months	78.98	102.50	126.77	1.05
Mass of food consumed	dry g/day	24-35 months	132.53	173.09	214.80	1.33
Duration child is awake	hr/day	6 months	9.05	10.39	11.76	1.30
Duration child is awake	hr/day	6-11 months	10.29	11.15	12.01	1.00
Duration child is awake	hr/day	12-23 months	10.60	11.43	12.26	1.03
Duration child is awake	hr/day	24-35 months	11.25	12.01	12.75	1.05
<i>E. coli</i> concentration in stored water	MPN/100 mL	6 months	1.00	7.50	63.10	1.00
<i>E. coli</i> concentration in stored water	MPN/100 mL	6-11 months	1.00	9.60	48.20	1.02
<i>E. coli</i> concentration in stored water	MPN/100 mL	12-23 months	3.00	19.00	123.00	1.04
<i>E. coli</i> concentration in stored water	MPN/100 mL	24-35 months	8.00	30.00	171.00	1.20

Ratios in bold and underlined are above 10; the model is extremely sensitive to changes in these parameters. Ratios equal to 2 and less than 10 are bold only; the model is very sensitive to changes in these parameters.

## References

- (1) Kwong, L. H.; Ercumen, A.; Pickering, A. J.; Unicomb, L.; Davis, J.; Leckie, J. O.; Luby, S. P. Soil Ingestion among Young Children in Rural Bangladesh. *J. Expo. Sci. Environ. Epidemiol.* **2019**, *xx* (xx), xx. <https://doi.org/10.1038/s41370-019-0177-7>.
- (2) Christopher, Y.; Semple, S.; Hughson, G.; Cherrie, J. *Inadvertent Ingestion Exposure in the Workplace*; RR551; Institute of Occupational Medicine: Edinburgh, UK, 2007; p 196.
- (3) Ercumen, A.; Mertens, A.; Arnold, B. F.; Benjamin-Chung, J.; Hubbard, A. E.; Ahmed, M. A.; Kabir, M. H.; Rahman Khalil, Md. M.; Kumar, A.; Rahman, Md. S.; Parvez, S. M.; Unicomb, L.; Rahman, M.; Ram, P. K.; Clasen, T.; Luby, S. P.; Colford, J. M. Effects of Single and Combined Water, Sanitation and Handwashing Interventions on Fecal Contamination in the Domestic Environment: A Cluster-Randomized Controlled Trial in Rural Bangladesh. *Environ. Sci. Technol.* **2018**, *52* (21), 12078–12088. <https://doi.org/10.1021/acs.est.8b05153>.
- (4) Ercumen, A.; Pickering, A. J.; Kwong, L. H.; Mertens, A.; Arnold, B. F.; Benjamin-Chung, J.; Hubbard, A. E.; Alam, M.; Sen, D.; Islam, S.; Rahman, Md. Z.; Kullmann, C.; Chase, C.; Ahmed, R.; Parvez, S. M.; Unicomb, L.; Rahman, M.; Ram, P. K.; Clasen, T.; Luby, S. P.; Colford, J. M. Do Sanitation Improvements Reduce Fecal Contamination of Water, Hands, Food, Soil, and Flies? Evidence from a Cluster-Randomized Controlled Trial in Rural Bangladesh. *Environ. Sci. Technol.* **2018**, *52* (21), 12089–12097. <https://doi.org/10.1021/acs.est.8b02988>.
- (5) Kwong, L. H.; Ercumen, A.; Pickering, A. J.; Unicomb, L.; Davis, J.; Luby, S. P. Hand- and Object-Mouthing of Rural Bangladeshi Children 3–18 Months Old. *Int. J. Environ. Res. Public Health* **2016**, *13* (6), 563. <https://doi.org/10.3390/ijerph13060563>.
- (6) Kwong, L. H.; Ercumen, A.; Pickering, A. J.; Unicomb, L.; Davis, J.; Luby, S. P. Age-Related Changes to Environmental Exposure: Variation in the Frequency That Young Children Place Hands and Objects in Their Mouths. *J. Expo. Sci. Environ. Epidemiol.* **2020**, *30*, 205–216. <https://doi.org/10.1038/s41370-019-0115-8>.
- (7) Leckie, J. O.; Naylor, K. A.; Canales, R. A.; Ferguson, A. C.; Cabrera, N. L.; Hurtado, A. L.; Lee, K.; Lin, A. Y.-C.; Ramirez, J. D.; Vieira, V. M. *Quantifying Children's Microlevel Activity Data from Existing Videotapes. Reference No. U2F112OT-RT-99-001182*; Reference No. U2F112OT-RT-99-001182; Stanford University: Stanford, California, 2000.
- (8) Kimmons, J. E.; Dewey, K. G.; Haque, E.; Chakraborty, J.; Osendarp, S. J. M.; Brown, K. H. Low Nutrient Intakes among Infants in Rural Bangladesh Are Attributable to Low Intake and Micronutrient Density of Complementary Foods. *J. Nutr.* **2005**, *135* (3), 444–451. <https://doi.org/10.1093/jn/135.3.444>.
- (9) Arsenault, J. E.; Yakes, E. A.; Hossain, M. B.; Islam, M. M.; Ahmed, T.; Hotz, C.; Lewis, B.; Rahman, A. S.; Jamil, K. M.; Brown, K. H. The Current High Prevalence of Dietary Zinc Inadequacy among Children and Women in Rural Bangladesh Could Be Substantially Ameliorated by Zinc Biofortification of Rice. *J. Nutr.* **2010**, *140* (9), 1683–1690. <https://doi.org/10.3945/jn.110.123059>.
- (10) Galland, B. C.; Taylor, B. J.; Elder, D. E.; Herbison, P. Normal Sleep Patterns in Infants and Children: A Systematic Review of Observational Studies. *Sleep Med. Rev.* **2012**, *16* (3), 213–222. <https://doi.org/10.1016/j.smr.2011.06.001>.