

**Supplementary Table 1.** Results from individual-level mixed effects logistic regression analyses using a different transmission definition of 2-14 days following illness onset of index cases

Characteristic	Influenza A Virus Model***			Respiratory Syncytial Virus Model****		
	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value
Category 2: Not infected with another virus, exposed to coinfecting index*	0.41 (0.24-0.71)	-3.172	0.00152	0.30 (0.14-0.66)	-3.030	0.002449
Category 3: Infected with another virus, exposed to singly infected index*	3.29 (1.81-5.95)	3.923	8.75e-05	5.51 (2.19-13.87)	3.619	0.000296
Category 4: Infected with another virus, exposed to coinfecting index*	1.09 (0.46-2.55)	0.189	0.85036	1.56 (0.55-4.43)	0.827	0.408116
Sex (male)	1.29 (0.90-1.84)	1.399	0.16167	0.86 (0.51-1.46)	-0.560	0.575661
Index case <18	2.76 (1.72-4.40)	4.234	2.29e-05	1.62 (0.68-3.84)	1.094	0.273886
Age 6-11**	0.58 (0.34-0.99)	-2.003	0.04521	0.44 (0.21-0.93)	-2.162	0.030599
Age 12-17**	0.52 (0.27-0.99)	-2.005	0.04495	0.23 (0.08-0.69)	-2.637	0.008368
Age 18-49**	0.52 (0.32-0.84)	-2.659	0.00783	0.26 (0.14-0.51)	-3.931	8.45e-05
Age 50+**	0.56 (0.21-1.49)	1.161	0.24556	0.43 (0.09-2.03)	-1.061	0.288671
Seasonal influenza vaccination >14 days prior to exposure	1.47 (0.98-2.19)	1.872	0.06127	1.98 (1.03-3.80)	2.051	0.040220

P values were computed using two-sided asymptotic Wald tests.

\*Reference group: Category 1 - Contact not infected with another virus, exposed to singly infected index case

\*\*Reference group: Age 0-5

\*\*\*N=1745 individuals

\*\*\*\*N=1237 individuals

**Supplementary Table 2.** Results from individual-level mixed effects logistic regression analyses including additional covariate representing Ct value of the virus of interest for index cases

Characteristic	Influenza A Virus Model***			Influenza B Virus Model****			Respiratory Syncytial Virus Model*****		
	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value
Category 2: Not infected with another virus, exposed to coinfecting index*	0.49 (0.29-0.84)	-2.596	0.00944	0.62 (0.22-1.71)	-0.922	0.356517	0.30 (0.14-0.64)	-3.123	0.001793
Category 3: Infected with another virus, exposed to singly infected index*	4.19 (2.36-7.44)	4.880	1.06e-06	2.14 (0.59-7.78)	1.159	0.246402	6.46 (2.70-15.48)	4.186	2.84e-05
Category 4: Infected with another virus, exposed to coinfecting index*	1.84 (0.84-4.03)	1.514	0.13001	5.49 (1.40-21.58)	2.440	0.014683	2.58 (1.02-6.51)	2.011	0.044374
Sex (male)	1.39 (1.00-1.95)	1.944	0.05185	0.78 (0.41-1.49)	-0.743	0.457583	0.86 (0.52-1.41)	-0.606	0.544458
Index case <18	2.06 (1.32-3.20)	3.199	0.00138	1.28 (0.49-3.38)	0.505	0.613508	1.51 (0.64-3.54)	0.945	0.344808
Age 6-11**	0.59 (0.36-0.98)	-2.028	0.04256	0.43 (0.18-1.02)	-1.906	0.056611	0.33 (0.16-0.65)	-3.178	0.001485
Age 12-17**	0.54 (0.30-0.99)	-1.994	0.04615	0.15 (0.04-0.52)	-2.945	0.003228	0.15 (0.05-0.43)	-3.533	0.000411
Age 18-49**	0.54 (0.34-0.85)	-2.642	0.00825	0.20 (0.09-0.46)	-3.803	0.000143	0.19 (0.10-0.36)	-5.243	1.58e-07
Age 50+**	0.54 (0.21-1.35)	-1.328	0.18430	0.10 (0.01-0.92)	-2.038	0.041586	0.30 (0.07-1.32)	-1.595	0.110813
Seasonal influenza vaccination >14 days prior to exposure	1.11 (0.77-1.62)	0.563	0.57319	1.27 (0.60-2.71)	0.624	0.532643	2.00 (1.08-3.72)	2.199	0.027846
Ct value of virus of interest for index case	0.91 (0.88-0.94)	-6.092	1.11e-09	0.97 (0.91-1.03)	-1.010	0.312493	0.96 (0.92-1.01)	-1.510	0.131086

P values were computed using two-sided asymptotic Wald tests.

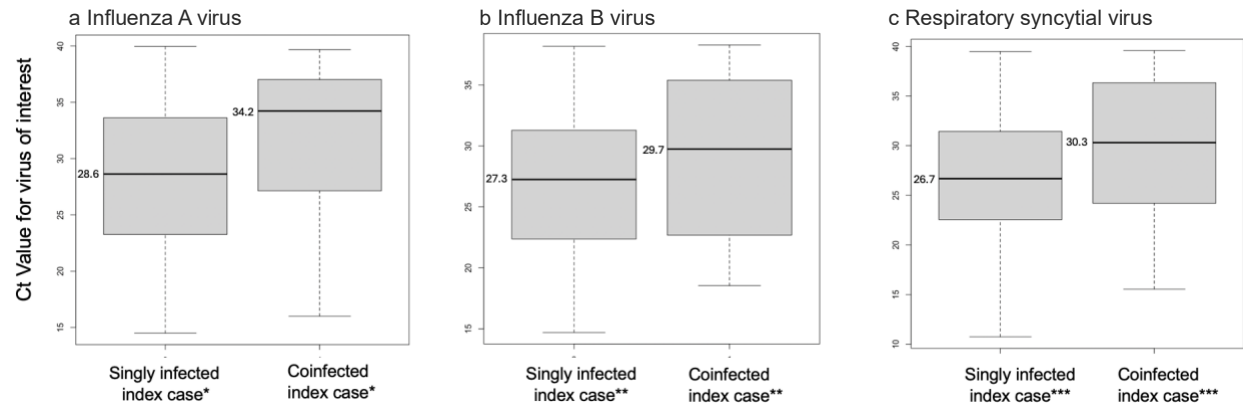
\*Reference group: Category 1 - Contact not infected with another virus, exposed to singly infected index case

\*\*Reference group: Age 0-5

\*\*\*N=1749 individuals

\*\*\*\*N=748 individuals

\*\*\*\*\*N=1256 individuals



Supplementary Figure 1. **Box and whisker plot comparing Ct value of primary virus for coinfecting versus singly infected index cases involved in: a Influenza A virus illness clusters, b Influenza B virus illness clusters, and c respiratory syncytial virus illness clusters**

The distribution of Cycle threshold (Ct) values of the primary virus of interest were compared between coinfecting and singly infected index cases using Mann Whitney U tests. For each graph, the horizontal lines in the boxes represent the medians, the upper and lower limits of the boxes represent the 25th and 75th percentiles, and whiskers indicate all data points within 1.5 IQR of the upper and lower quartiles.

\* $P=3.726 \times 10^{-10}$

\*\* $P=0.009349$

\*\*\* $P=6.852 \times 10^{-5}$

**Supplementary Table 3.** Results from individual-level mixed effects logistic regression analyses stratifying by age groups 0-5, 6-17, and 18+ for influenza A virus household illness events

Characteristic	0-5**			6-17***			18+****			Total		
	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value
Category 2: Not infected with another virus, exposed to coinfecting index*	0.25 (0.08 – 0.82)	-2.289	0.022 09	0.42 (0.17-0.99)	-1.975	0.048 241	0.47 (0.23-0.96)	-2.062	0.039 3	0.39 (0.23-0.64)	-3.722	0.0001 98
Category 3: Infected with another virus, exposed to singly infected index*	5.02 (1.75-14.35)	3.009	0.002 62	3.60 (1.35-9.58)	2.566	0.010 294	2.43 (0.80-7.42)	1.564	0.1178	3.49 (2.02-6.03)	4.488	7.18e- 06
Category 4: Infected with another virus, exposed to coinfecting index*	0.60 (0.11-3.42)	-0.570	0.568 83	3.54 (1.17-10.66)	2.243	0.024 866	0.86 (0.21-3.54)	-0.209	0.834 8	1.33 (0.64-2.75)	0.757	0.4493 38
Sex (male)	2.01 (0.89 – 4.52)	1.683	0.092 33	1.71 (0.95-3.10)	1.776	0.075 711	1.20 (0.73-1.97)	0.724	0.469 2	1.40 (1.01-1.93)	2.024	0.0429 63
Index case <18	3.80 (1.58 – 9.16)	2.977	0.002 91	4.15 (1.97-8.73)	3.754	0.000 174	1.14 (0.59-2.21)	0.391	0.695 6	2.58 (1.70-3.93)	4.420	9.89e- 06
Seasonal influenza vaccination >14 days prior to exposure	1.28 (0.58 – 2.79)	0.612	0.540 67	0.91 (0.49-1.68)	-0.297	0.766 217	1.36 (0.79-2.35)	1.106	0.268 8	1.14 (0.79-1.63)	0.698	0.4849 48

P values were computed using two-sided asymptotic Wald tests.

\*Reference group: Category 1 - Contact not infected with another virus, exposed to singly infected index case

\*\*N=319 individuals

\*\*\*N=684 individuals

\*\*\*\*N=785 individuals

**Supplementary Table 4.** Results from individual-level mixed effects logistic regression analyses stratifying by age groups 0-17 and 18+ for respiratory syncytial virus household illness events

Characteristic	0-17**			18+***			Total		
	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value
Category 2: Not infected with another virus, exposed to coinfecting index*	0.17 (0.05-0.60)	-2.750	0.00595	0.60 (0.23-1.58)	-1.041	0.2977	0.28 (0.13-0.60)	-3.313	0.000922
Category 3: Infected with another virus, exposed to singly infected index*	9.65 (2.38-39.12)	3.174	0.00150	6.04 (1.26-28.94)	2.250	0.0245	6.05 (2.55-14.35)	4.086	4.38e-05
Category 4: Infected with another virus, exposed to coinfecting index*	3.16 (0.93-10.70)	1.851	0.06420	1.77 (0.30-10.27)	0.635	0.5251	2.29 (0.93-5.68)	1.795	0.072647
Sex (male)	0.67 (0.32-1.39)	-1.072	0.28370	0.98 (0.45-2.14)	-0.047	0.9628	0.84 (0.51-1.39)	-0.680	0.496274
Index case <18	2.18 (0.72-6.55)	1.385	0.16593	1.30 (0.32-5.25)	0.373	0.7095	1.76 (0.77-4.01)	1.344	0.178939
Seasonal influenza vaccination >14 days prior to exposure	2.63 (1.03-6.72)	2.015	0.04386	1.94 (0.79-4.81)	1.439	0.1501	2.06 (1.11-3.81)	2.303	0.021291

P values were computed using two-sided asymptotic Wald tests.

\*Reference group: Category 1 - Contact not infected with another virus, exposed to singly infected index case

\*\*N=649 individuals

\*\*\*N=607 individuals

**Supplementary Table 5.** Results from individual-level mixed effects logistic regression analyses stratifying by age groups 0-5 and 6+ for respiratory syncytial virus household illness events

Characteristic	0-5**			6+***			Total		
	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value
Category 2: Not infected with another virus, exposed to coinfecting index*	0.14 (0.04-0.52)	-2.956	0.00312	0.39 (0.16-0.94)	-2.098	0.0359	0.28 (0.13-0.60)	-3.313	0.000922
Category 3: Infected with another virus, exposed to singly infected index*	5.98 (1.35-26.54)	2.354	0.01860	5.78 (1.97-16.97)	3.194	0.0014	6.05 (2.55-14.35)	4.086	4.38e-05
Category 4: Infected with another virus, exposed to coinfecting index*	1.20 (0.34-4.23)	0.291	0.77093	3.36 (1.01-11.12)	1.981	0.0476	2.29 (0.93-5.68)	1.795	0.072647
Sex (male)	0.68 (0.28-1.64)	-0.859	0.39015	0.94 (0.52-1.71)	-0.189	0.8504	0.84 (0.51-1.39)	-0.680	0.496274
Index case <18	2.58 (0.73-9.10)	1.476	0.14005	1.62 (0.58-4.51)	0.919	0.3580	1.76 (0.77-4.01)	1.344	0.178939
Seasonal influenza vaccination >14 days prior to exposure	4.26 (1.49-12.18)	2.705	0.00684	1.41 (0.68-2.91)	0.933	0.3506	2.06 (1.11-3.81)	2.303	0.021291

P values were computed using two-sided asymptotic Wald tests.

\*Reference group: Category 1 - Contact not infected with another virus, exposed to singly infected index case

\*\*N=230 individuals

\*\*\*N=1026 individuals

**Supplementary Table 6.** Results from a multivariable regression using Poisson mixed effects models to associate household factors with the incidence of virus transmission when the index case was coinfectd with rhinovirus/enterovirus compared to singly infected with a virus of interest

Characteristic	IRR (95% CI)	z value	P value
Influenza A Virus Model*			
Coinfected index Case	0.20 (0.09 – 0.43)	-4.079	4.53e-05
No. Household Members	0.95 (0.77 – 1.17)	-0.506	0.612560
Index case <18	2.09 (1.37 – 3.19)	3.405	0.000662
Influenza B Virus Model**			
Coinfected index Case	0.34 (0.07 – 1.53)	-1.405	0.160
No. Household Members	1.23 (0.90 – 1.68)	1.282	0.200
Index case <18	1.11 (0.47 – 2.60)	0.242	0.809
Respiratory Syncytial Virus Model***			
Coinfected index Case	0.44 (0.19 – 1.01)	-1.928	0.0539
No. Household Members	0.95 (0.73 – 1.24)	-0.358	0.7207
Index case <18	1.54 (0.69 – 3.42)	1.062	0.2882

P values were computed using two-sided asymptotic Wald tests.

\*N=464 households

\*\*N=200 households

\*\*\*N=282 households

**Supplementary Table 7.** Results from individual-level mixed effects logistic regression analyses, restricted to only rhinovirus/enterovirus as the coinfecting/co-circulating viruses

Characteristic	Influenza A Model***			Influenza B Model****			Respiratory Syncytial Virus Model*****		
	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value
Category 2: Not infected with another virus, exposed to coinfecting index*	0.20 (0.09-0.46)	-3.771	0.000163	0.19 (0.02-1.55)	-1.555	0.119924	0.28 (0.10-0.79)	-2.401	0.016348
Category 3: Infected with another virus, exposed to singly infected index*	1.78 (0.76-4.15)	1.336	0.181436	2.61 (0.52-13.18)	1.161	0.245642	4.12 (1.27-13.33)	2.363	0.018132
Category 4: Infected with another virus, exposed to coinfecting index*	0.17 (0.02-1.44)	-1.625	0.104194	1.85 (0.13-25.32)	0.459	0.646022	0.22 (0.02-3.04)	-1.127	0.259868
Sex (male)	1.53 (1.08-2.17)	2.375	0.017530	0.67 (0.33-1.34)	-1.139	0.254795	1.07 (0.63-1.83)	0.252	0.801004
Index case <18	2.43 (1.54-3.85)	3.793	0.000149	1.21 (0.47-3.16)	0.397	0.691418	1.76 (0.77-4.01)	1.315	0.188351
Age 6-11**	0.49 (0.29-0.83)	-2.659	0.007834	0.47 (0.19-1.14)	-1.669	0.095026	0.28 (0.13-0.59)	-3.338	0.000844
Age 12-17**	0.39 (0.20-0.73)	-2.931	0.003380	0.09 (0.02-0.47)	-2.892	0.003833	0.09 (0.03-0.29)	-4.030	5.58e-05
Age 18-49**	0.46 (0.29-0.75)	-3.167	0.001539	0.20 (0.09-0.49)	-3.560	0.000370	0.14 (0.07-0.29)	-5.527	3.27e-08
Age 50+**	0.51 (0.20-1.32)	-1.389	0.164890	0.12 (0.01-1.12)	-1.859	0.063024	0.12 (0.02-0.72)	-2.314	0.020661
Seasonal influenza vaccination >14 days prior to exposure	1.03 (0.69-1.54)	0.161	0.872396	1.65 (0.76-3.57)	1.261	0.207137	2.07 (1.05-4.08)	2.090	0.036640

P values were computed using two-sided asymptotic Wald tests.

\*Reference: Category 1 - Contact not infected with another virus, exposed to singly infected index case

\*\*Reference group: Age 0-5

\*\*\*N=1523 individuals

\*\*\*\*N=667 individuals

\*\*\*\*\*N=968 individuals



**Supplementary Table 8.** Results from multivariable regression analyses using Poisson mixed effects models to associate household factors with the incidence of virus transmission when the index case was coinfectd with a human coronavirus compared to singly infected with a virus of interest

Characteristic	IRR (95% CI)	z value	P value
Influenza A Virus Model*			
Coinfectd index Case	0.55 (0.29 – 1.03)	-1.868	0.0618
No. Household Members	0.89 (0.73 – 1.09)	-1.093	0.2744
Index case <18	2.35 (1.53 – 3.60)	3.911	9.2e-05
Influenza B Virus Model**			
Coinfectd index Case	1.98 (0.74 – 5.32)	1.352	0.176
No. Household Members	1.23 (0.90 – 1.67)	1.286	0.199
Index case <18	1.27 (0.54 – 2.96)	0.544	0.587
Respiratory Syncytial Virus Model***			
Coinfectd index Case	0.42 (0.16 – 1.12)	-1.734	0.0829
No. Household Members	1.08 (0.83 – 1.39)	0.577	0.5638
Index case <18	1.69 (0.76 – 3.79)	1.283	0.1996

P values were computed using two-sided asymptotic Wald tests.

\*N=454 households

\*\*N=191 households

\*\*\*N=279 households

**Supplementary Table 9.** Results from individual-level mixed effects logistic regression analyses, restricted to only human coronaviruses as the coinfecting/co-circulating viruses \*\*\*

Characteristic	Influenza A Virus Model****			Influenza B Virus Model*****		
	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value
Category 2: Not infected with another virus, exposed to coinfecting index*	0.30 (0.13-0.69)	-2.850	0.004369	2.72 (0.88-8.39)	1.738	0.082278
Category 3: Infected with another virus, exposed to singly infected index*	1.87 (0.75-4.69)	1.333	0.182492	2.89 (0.56-14.80)	1.271	0.203673
Category 4: Infected with another virus, exposed to coinfecting index*	5.16 (1.16-22.96)	2.153	0.031282	-	-	-
Sex (male)	1.39 (0.98-1.96)	1.855	0.063554	0.78 (0.41-1.50)	-0.742	0.458208
Index case <18	2.76 (1.74-4.38)	4.326	1.52e-05	1.40 (0.54-3.59)	0.695	0.487055
Age 6-11**	0.47 (0.28-0.80)	-2.787	0.005315	0.37 (0.16-0.88)	-2.261	0.023790
Age 12-17**	0.44 (0.24-0.81)	-2.640	0.008282	0.12 (0.03-0.48)	-3.018	0.002541
Age 18-49**	0.43 (0.27-0.69)	-3.496	0.000472	0.19 (0.08-0.43)	-3.982	6.82e-05
Age 50+**	0.53 (0.22-1.32)	-1.360	0.173848	0.09 (0.01-0.81)	-2.151	0.031506
Seasonal influenza vaccination >14 days prior to exposure	1.05 (0.71-1.55)	0.225	0.822101	1.58 (0.75-3.34)	1.200	0.230256

P values were computed using two-sided asymptotic Wald tests.

\*Reference group: Category 1 - Contact not infected with other virus, exposed to singly infected index case

\*\*Reference group: 0-5

\*\*\*The respiratory syncytial virus model did not converge

\*\*\*\*N=1479 individuals

\*\*\*\*\*N=641 individuals

**Supplementary Table 10.** Results from multivariable regression analyses using Poisson mixed effects models to associate household factors with the incidence of influenza A virus transmission when the index case was coinfectd compared to singly infected with influenza A virus, by subtype

Characteristic	IRR (95% CI)	z value	<i>P</i> value
Influenza A H3N2 Model*			
Coinfected index Case	0.54 (0.29—1.00)	-1.954	0.0507
No. Household Members	0.74 (0.58 – 0.95)	-2.366	0.0180
Index case <18	1.78 (1.03 – 3.07)	2.075	0.0380
Influenza A H1N1 Model**			
Coinfected index Case	0.91 (0.47—1.74)	-0.299	0.7649
No. Household Members	1.32 (0.96 – 1.81)	1.716	0.0862
Index case <18	2.01 (1.02 – 3.95)	2.016	0.0438
Grouped Influenza A Virus			
Coinfected Index Case	0.44 (0.29—0.66)	-3.895	9.81e-05
No. Household Members	0.91 (0.76 – 1.10)	-0.942	0.346
Index case <18	2.13 (1.46 – 3.10)	3.934	8.37e-05

*P* values were computed using two-sided asymptotic Wald tests.

\*N=301 households

\*\*N=159 households

**Supplementary Table 11.** Results from individual-level mixed effects logistic regression analyses by influenza A virus subtype

Characteristic	H3N2***			H1N1****			Grouped Influenza A Virus		
	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value	OR (95% CI)	z value	P value
Category 2: Not infected with another virus, exposed to coinfecting index*	0.34 (0.15-0.79)	-2.535	0.0113	0.61 (0.22-1.71)	-0.938	0.34808	0.39 (0.23-0.64)	-3.722	0.000198
Category 3: Infected with another virus, exposed to singly infected index*	4.12 (1.88-9.02)	3.540	0.0004	3.81 (1.19-12.26)	2.246	0.02471	3.49 (2.02-6.03)	4.488	7.18e-06
Category 4: Infected with another virus, exposed to coinfecting index*	2.55 (0.82-7.90)	1.618	0.1056	3.04 (0.53-17.54)	1.244	0.21351	1.33 (0.64-2.75)	0.757	0.449338
Sex (male)	1.39 (0.91-2.13)	1.528	0.1266	1.59 (0.81-3.12)	1.340	0.18023	1.40 (1.01-1.93)	2.024	0.042963
Index case <18	2.16 (1.15-4.05)	2.395	0.0166	3.43 (1.35-8.70)	2.592	0.00954	2.58 (1.70-3.93)	4.420	9.89e-06
Age 6-11**	0.60 (0.31-1.17)	-1.501	0.1333	0.67 (0.26-1.71)	-0.838	0.40184	0.59 (0.36-0.95)	-2.164	0.030477
Age 12-17**	0.72 (0.34-1.53)	-0.857	0.3913	0.11 (0.02-0.62)	-2.483	0.01302	0.54 (0.30-0.97)	-2.048	0.040555
Age 18-49**	0.58 (0.32-1.09)	-1.701	0.0889	0.52 (0.21-1.25)	-1.464	0.14309	0.56 (0.36-0.86)	-2.605	0.009175
Age 50+**	0.74 (0.24-2.30)	-0.517	0.6053	0.42 (0.05-3.20)	-0.839	0.40163	0.62 (0.26-1.51)	-1.044	0.296570
Seasonal influenza vaccination >14 days prior to exposure	0.95 (0.57-1.57)	-0.198	0.8430	1.04 (0.47-2.32)	0.107	0.91483	1.14 (0.79-1.63)	0.698	0.484948

P values were computed using two-sided asymptotic Wald tests.

\*Reference group: Category 1 - Contact not infected with another virus, exposed to singly infected index case

\*\* Reference group: Age 0-5

\*\*\*N=1014 individuals

\*\*\*\*N=516 individuals

**Supplementary Table 12.** Comparison of results from multivariable regression analyses using Poisson mixed effects models to associate household factors with the incidence of transmission when the index case was coinfectd compared to singly infected when person-time at risk was included in the model versus not

Virus	Excluding Person-Time at Risk (Sensitivity Analysis)			Including Person-Time at Risk (Main Analysis)		
	$\beta$ Coefficient	z value	P value	$\beta$ Coefficient	z value	P value
Influenza A Virus*	-0.64228	-3.360	0.000780	-0.83218	-3.895	9.81e-05
Influenza B Virus**	-0.11148	-0.291	0.77108	-0.16803	-0.423	0.672
Respiratory Syncytial Virus***	-0.6481	-2.593	0.00952	-0.67788	-2.548	0.0108

P values were computed using two-sided asymptotic Wald tests.

\*N=546 households

\*\*N=231 households

\*\*\*N=370 households

**Supplementary Table 13.** Summary of alternative statistical models considered but not selected

Analysis	Type of Model / Variable	Rationale for Not Selecting
Household-level	Poisson GEE	This model produced similar estimates to the mixed effects models with wider confidence intervals. For IAV, the IRR was slightly smaller and the 95% confidence interval (CI) was tighter for the mixed effects model [0.45 (95% CI: 0.30 – 0.68) compared to 0.53 (95% CI: 0.27 – 1.03) for the GEE model]. For IBV, the IRR and CI were similar for the mixed effects model and the GEE model. For RSV, the IRR was similar and CI slightly tighter: 0.51 (95% CI: 0.30 – 0.86) for mixed effects compared to 0.50 (95% CI: 0.26 – 0.98) for the GEE model.
Household-level	Negative Binomial	We tested a negative binomial model for the household-level analyses because there was overdispersion of the Poisson model for IAV with a dispersion ratio of 0.999 using ' <i>dispersion_glmmer()</i> '. Underdispersion was detected for the negative binomial, with a dispersion ratio of 0.939. Both models resulted in similar estimates: IRR 0.45 (95% CI: 0.29 – 0.68) for the negative binomial vs. IRR 0.44 (95% CI: 0.29 – 0.66) for the Poisson. For the IBV and RSV analyses, no overdispersion was detected in the Poisson models.
Household-level	Zero-inflated	No zero-inflation was detected in the Poisson models for the IAV, IBV, and RSV analyses and therefore, the use of zero-inflated models was not appropriate.
Individual-level	Mixed effects logistic regression with interaction term for sex*age group of susceptible contact	This model did not converge.
Individual-level	Mixed effects logistic regression with interaction term for sex*age group of index case	This model did not converge.
Individual- and household-level	Age of the index case as a continuous (versus dichotomous variable)	We ran all of the models (household- and individual-level for all three viruses of interest) using a continuous variable for age of the index case and received very similar estimates and confidence intervals for our main predictors. We also compared model performance using AIC and BIC for each analysis, comparing the model with age as a continuous variable versus the one with age as a dichotomous variable. For all but two models (4/6) the AIC and BIC were quite similar. For the IAV household-level Poisson mixed effects models, the model that included age as a continuous variable had lower AIC and BIC than the model with age as a dichotomous variable. On the other hand, for the household-level RSV analysis, the AIC and BIC were lower for the model that included age as a dichotomous variable. We have chosen to include the dichotomous variable to improve interpretability (e.g., “having an index case under the age of 18 was associated with an increased risk of transmission...”) and maintain consistency across models.

**Supplementary Table 14. Model Equations**

Model equation 1: estimating the household risk of virus transmission within households ( $j$ ) with coinfecting index cases while accounting for total person-time at risk. Co-infection versus single infection among index cases was the primary predictor ( $X_1$ ), and the outcome,  $\mu_j$ , represents the expected number of virus transmissions for household  $j$ . This model was adjusted for household size ( $X_2$ ) and age (<18 and  $\geq 18$  years) of the index case ( $X_3$ ). Random intercepts ( $b_{0j}$ ) were included to account for household clustering.

$$\ln(\mu_j) = \beta_0 + \beta_1 X_{1j} + \beta_2 X_{2j} + \beta_3 X_{3j} + b_{0j} \ln(\text{person days at risk})$$

Model equation 2: estimating an individual's ( $i$ ) risk of infection when multiple viruses circulated simultaneously within their household ( $j$ ). The main predictor ( $X_1$ ), was a four-category variable with different combinations of exposure to a coinfecting index case and infection with a virus other than the primary virus of interest. Random intercepts were included to account for household clustering ( $b_{0j}$ ). The outcome was acquisition of the virus of interest ( $Y$ ). The age (<18 and  $\geq 18$  years) of the index case was included as a household-level covariate ( $X_2$ ). Individual-level covariates included sex ( $X_3$ ), age group (0-5, 6-11, 12-17, 18-49, and 50+) ( $X_4$ ), and vaccination status.

$$\text{Logit}(\Pr(Y_{ij})) = \beta_0 + \beta_1 X_{1ij} + \beta_2 X_{2j} + \beta_3 X_{3ij} + \beta_4 X_{4ij} + \beta_5 X_{5ij} + b_{0j}$$

**Supplementary Table 15.** Source data for Figure 3a – Viruses coinfecting with influenza A virus

Virus	Index Cases	Secondary Cases	Non-cases	Total
Adenovirus	15	7	10	32
Bocavirus	6	1	5	12
Human coronaviruses	56	12	40	108
Human metapneumovirus	11	3	7	21
Influenza B virus	6	2	16	24
Parainfluenza virus	7	3	3	13
Parechovirus	2	0	2	4
Respiratory syncytial virus	21	6	15	42
Rhinovirus/enterovirus	61	11	63	135



**Supplementary Table 16.** Source data for Figure 3b – Viruses coinfecting with influenza B virus

Virus	Index Cases	Secondary Cases	Non-cases	Total
Adenovirus	6	2	1	9
Bocavirus	0	0	1	1
Human coronaviruses	13	4	11	28
Human metapneumovirus	4	1	5	10
Influenza A virus	8	0	7	15
Parainfluenza virus	4	0	1	5
Parechovirus	0	0	0	0
Respiratory syncytial virus	5	2	1	8
Rhinovirus/enterovirus	23	4	21	48

**Supplementary Table 17.** Source data for Figure 3c – Viruses coinfecting with respiratory syncytial virus

Virus	Index Cases	Secondary Cases	Non-cases	Total
Adenovirus	21	3	6	30
Bocavirus	7	1	4	12
Human coronaviruses	43	11	38	92
Human metapneumovirus	15	0	5	20
Influenza A virus	22	5	14	41
Influenza B virus	4	2	10	16
Parainfluenza virus	9	0	6	15
Parechovirus	9	1	1	11
Rhinovirus/enterovirus	52	10	34	96