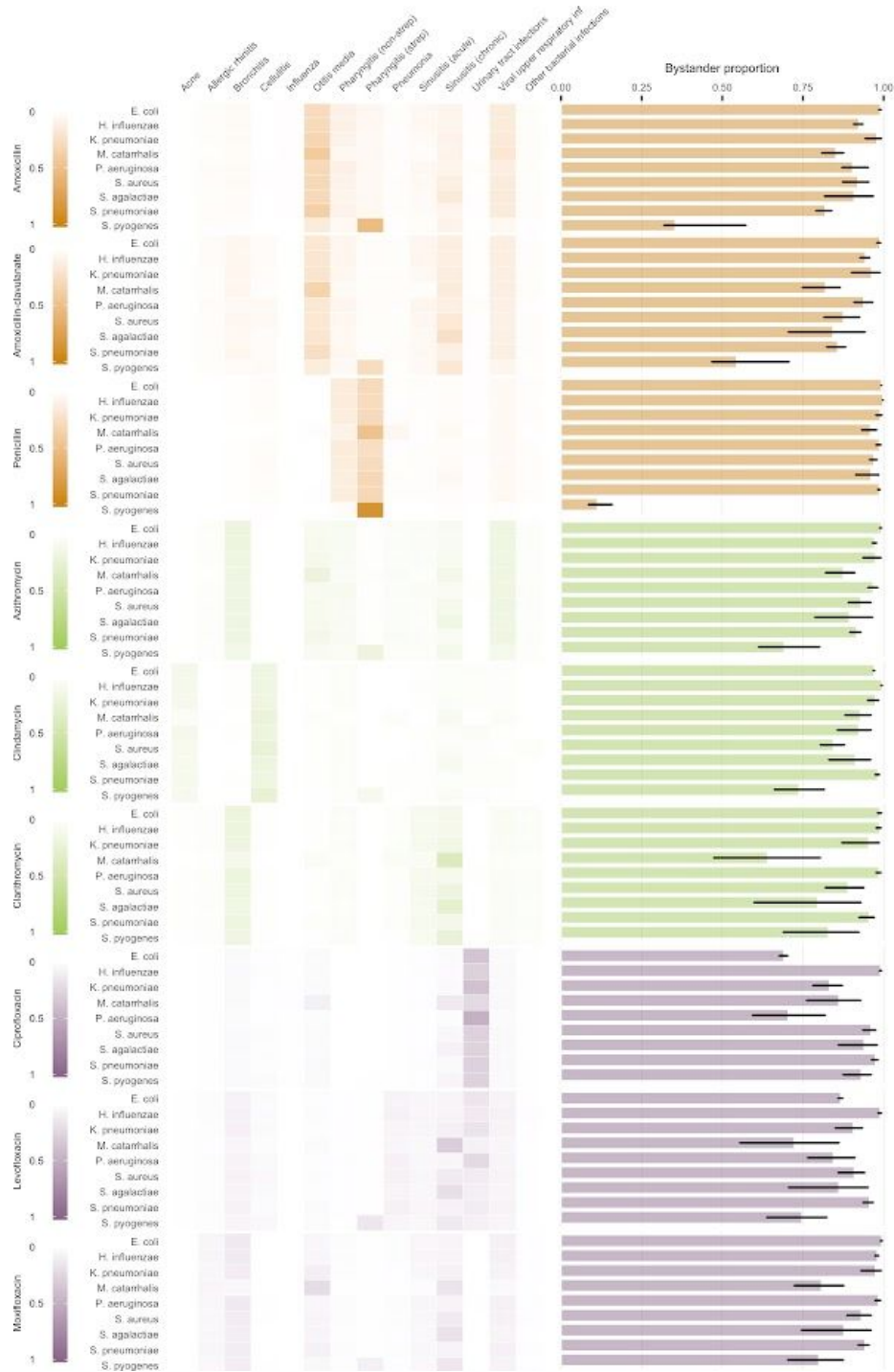
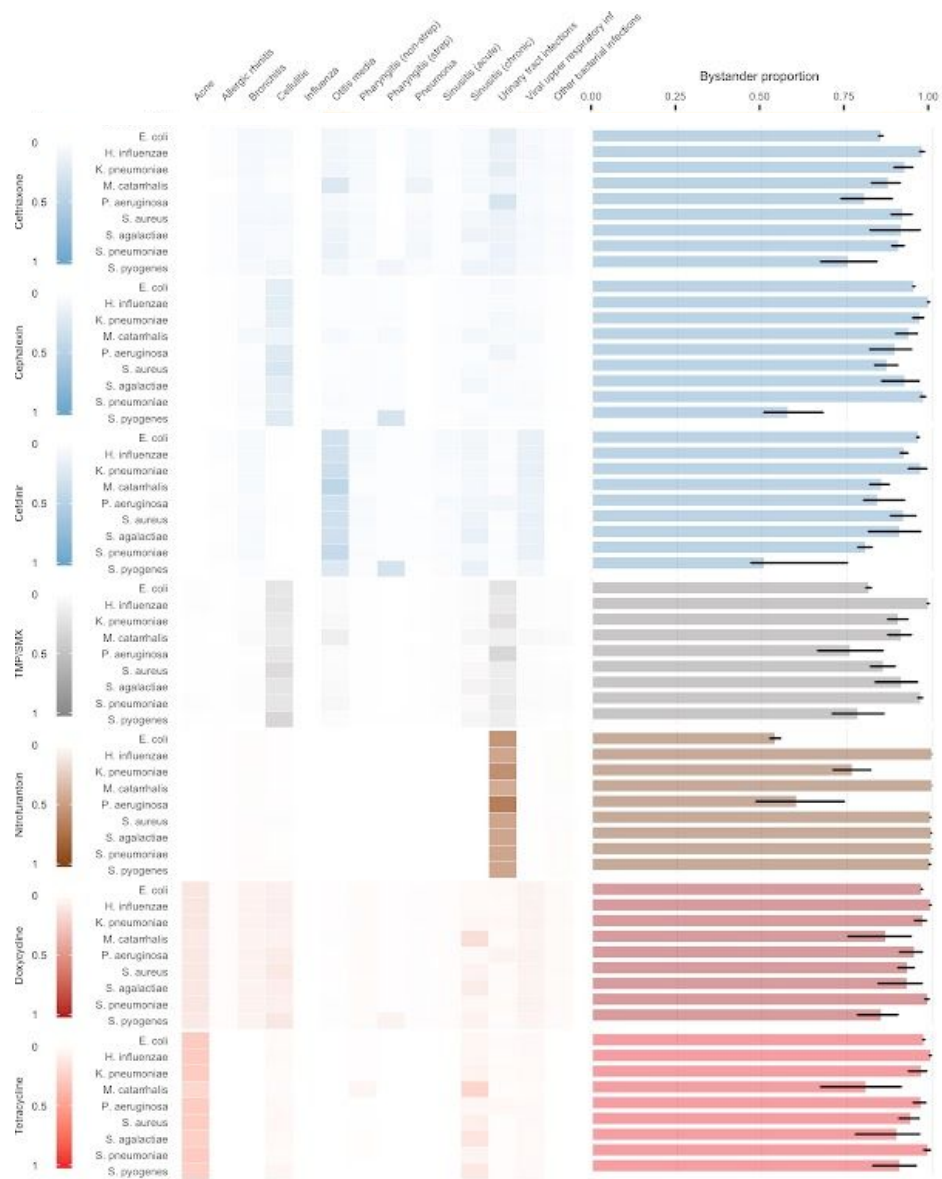


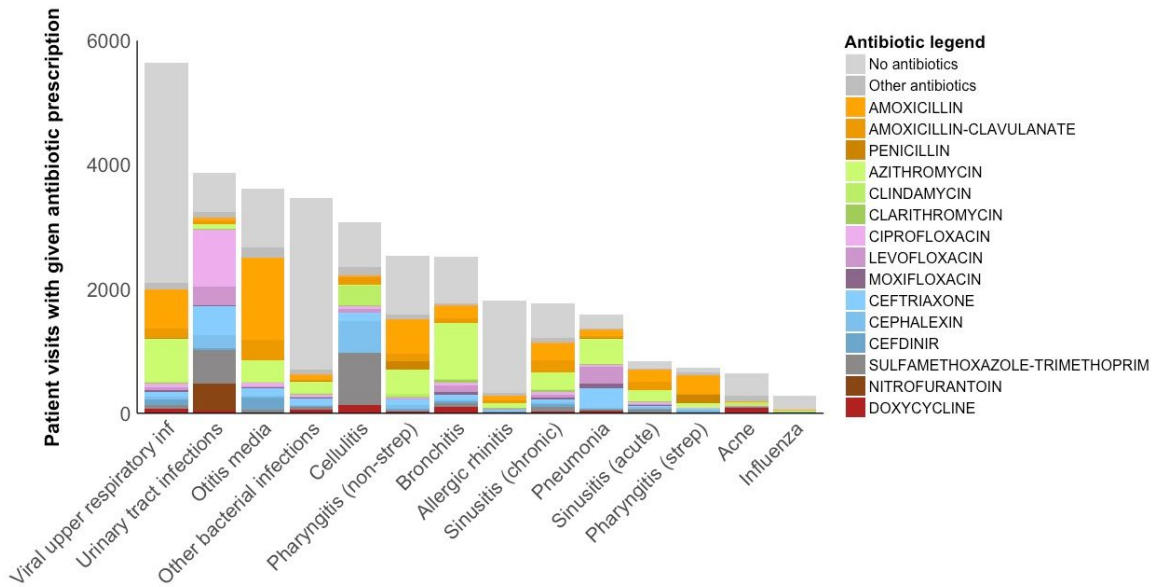
## Supporting information

**Figure S1.** *Heatmap:* proportion of total antibiotic exposures by antibiotic, species, and condition ( $R_{ac*s}$ ). Darker shading indicates a larger proportion of total antibiotic exposures associated with the respective condition on the x-axis. *Bar chart:* proportion of bystander exposures by antibiotic and species ( $B_{as}$ ) with 95% confidence intervals.





**Figure S2.** Number of sampled outpatient visits (unweighted) from NAMCS/NHAMCS 2010-2011 with given diagnosis and antibiotic prescription.



**Table S1.** Carriage studies used to characterize microbial prevalences for which HMP data was unavailable. In addition to prevalences among children <5 years old, additional carriage studies were also used for *S. pyogenes* and *S. pneumoniae* in the >5-year-old age group as taxonomic profiling of HMP data via MetaPhlan2 does not distinguish between these and similar species. Specific studies were not identified for *P. aeruginosa* and *S. agalactiae* for children from 1 to 5 years old; the prevalences among children under 1 year old were imputed in these cases.

Article	Age group	Body site	Organisms
Bäckhed et al. 2015 (39)	<1 year old	Gastrointestinal	<i>P. aeruginosa</i> <i>S. agalactiae</i>
Bogaert et al. 2011 (40)	1-5 years old	Nasopharyngeal	<i>H. influenzae</i>
Mainous et al. 2006 (41)	1-5 years old	Nasopharyngeal	<i>S. aureus</i>
Regev-Yochay et al. 2004 (42)	<1 year old 1-5 years old	Nasopharyngeal	<i>S. aureus</i> <i>S. pneumoniae</i>
Verhaegh et al. 2010 (43)	<1 year old 1-5 years old	Nasopharyngeal	<i>M. catarrhalis</i>
Pettigrew et al. 2012 (44)	<1 year old 1-5 years old	Upper respiratory tract	<i>H. influenzae</i> <i>M. catarrhalis</i> <i>S. pneumoniae</i>

Holgerson et al. 2015 (45)	<1 year old 1-5 years old	Oral	<i>E. coli</i> <i>H. influenzae</i> <i>K. pneumoniae</i> <i>S. aureus</i> <i>S. pyogenes</i>
Yassour et al. 2016 (46) (DIABIMMUNE cohort)	<1 year old 1-5 years old	Gastrointestinal	<i>E. coli</i> <i>H. influenzae</i> <i>K. pneumoniae</i> <i>S. aureus</i>
Ginsburg et al. 1985 (47)	All	Throat	<i>S. pyogenes</i>
Gunnarsson et al. 1997 (48)	All	Throat	<i>S. pyogenes</i>
Hammit et al. 2006 (49)	All	Nasopharyngeal	<i>S. pneumoniae</i>
Huang et al. 2009 (50)	All	Nasopharyngeal	<i>S. pneumoniae</i>

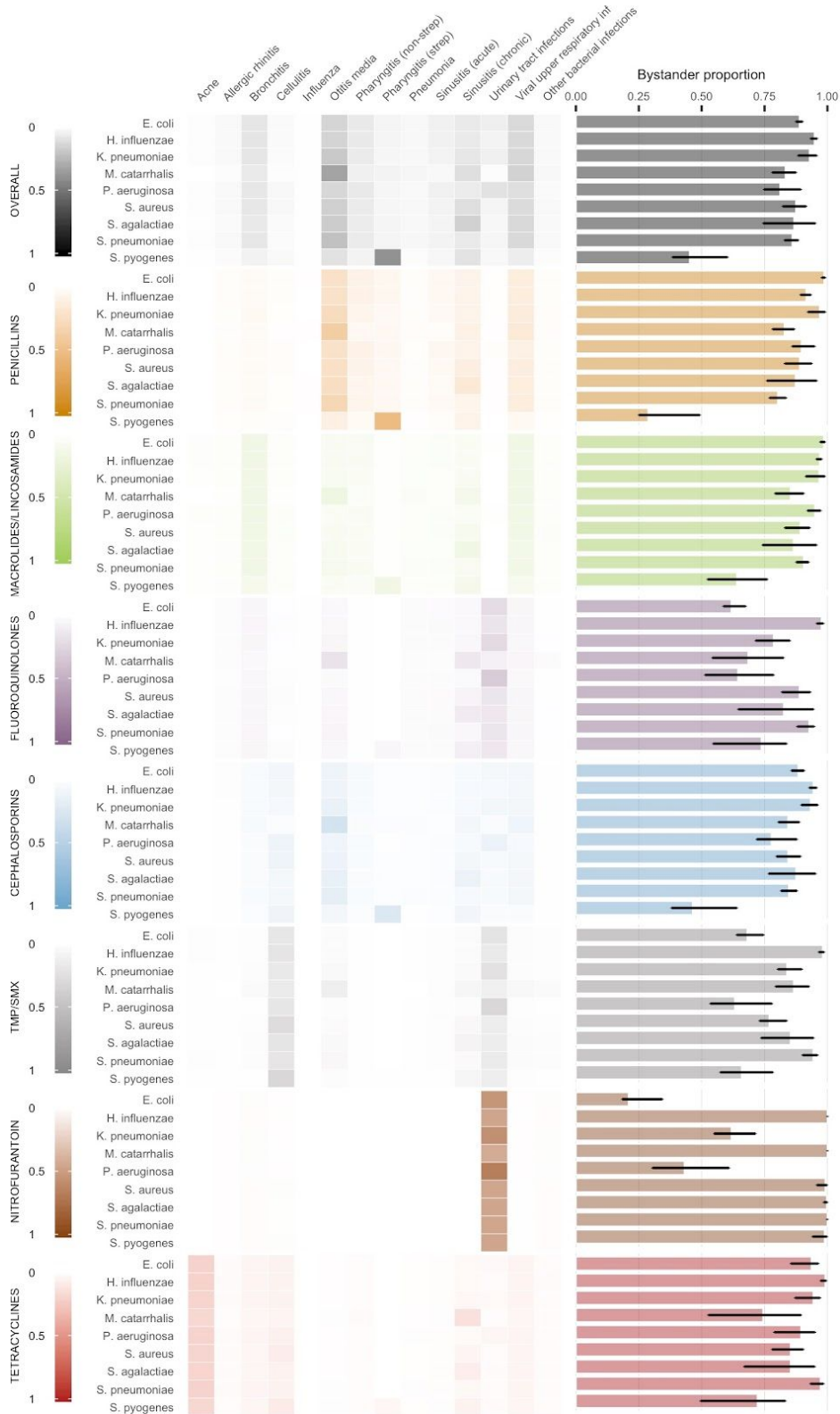
**Table S2.** Carriage prevalence estimates by age group and species from HMP and carriage studies.

Species	<1 year old	1-5 years old	>5 years old
<i>E. coli</i>	94.9%	100%	66.3%
<i>H. influenzae</i>	100%	95.9%	68.6%
<i>K. pneumoniae</i>	39.1%	15.0%	7.4%
<i>M. catarrhalis</i>	45.5%	50.8%	2.3%
<i>P. aeruginosa</i>	1.4%	1.4%	1.9%
<i>S. aureus</i>	35.0%	19.1%	12.4%
<i>S. agalactiae</i>	8.2%	8.2%	2.7%
<i>S. pneumoniae</i>	64.3%	64.6%	25.2%
<i>S. pyogenes</i>	1.1%	4.4%	4.7%

**Table S3.** Estimated etiologies by condition. Conditions in which none of our species of interest are causative agents are excluded. If two numbers are shown, the number to the left was applied to children under 5 years old, and the number to the right was applied to individuals over 5. Diagnoses with etiology specified by ICD-9CM code (e.g. 481: pneumococcal pneumonia) were attributed to the appropriate organism.

Species	Cellulitis (51)	Pneumonia (unidentified cause) (52, 53)	Sinusitis (acute) (54)	Sinusitis (chronic) (55)	Strep throat	Otitis media (suppurative) (56, 57)	UTI (58, 59)
<i>E. coli</i>	0.4%	-	-	2.9%	-	-	75%   78.5%
<i>H. influenzae</i>	0.1%	-   0.6%	0.7%	4.4%	-	23%   26%	-
<i>K. pneumoniae</i>	-	-	-	2.9%	-	-	4.7%   4.8%
<i>M. catarrhalis</i>	-	-	0.1%	11.8%	-	14%   3%	-
<i>P. aeruginosa</i>	0.5%	-   0.4%	-	-	-	-	2.3%   2.7%
<i>S. aureus</i>	8%	-   1.6%	0.1%	11.8%	-	1%   3%	-
<i>S. agalactiae</i>	0.5%	-	-	5.9%	-	-	-
<i>S. pneumoniae</i>	-	27%   5.1%	0.8%	5.9%	-	35%   21%	-
<i>S. pyogenes</i>	4.3%	-   0.3%	-	7.4%	100%	3%   3%	-

**Figure S3.** Modified version of Figure 1, excluding term  $\sum_{g=1}^G d_{acg} \times p_{sg}$  from denominator of the proportion of bystander exposures (bar chart).



**Figure S4.** Modified version of Figure S1, excluding term  $\sum_{g=1}^G d_{acg} \times p_{sg}$  from denominator of the proportion of bystander exposures (bar chart).

