Supplementary Information

Table S1: The definitions for the social system categories used as predictor variables in the GLMM for each contact network. Definitions are from (18).

Social System	**Definition**
Relatively Solitary	Infrequent aggregation or association between adults outside of the breeding period, and lack of synchronized movements in space by adults
Gregarious	Species that aggregate for one or more activities, but have unstable or temporally varying group composition
Socially Hierarchical	Species characterized by a permanent or long-term (i.e. at least over a single breeding season) stable social hierarchy

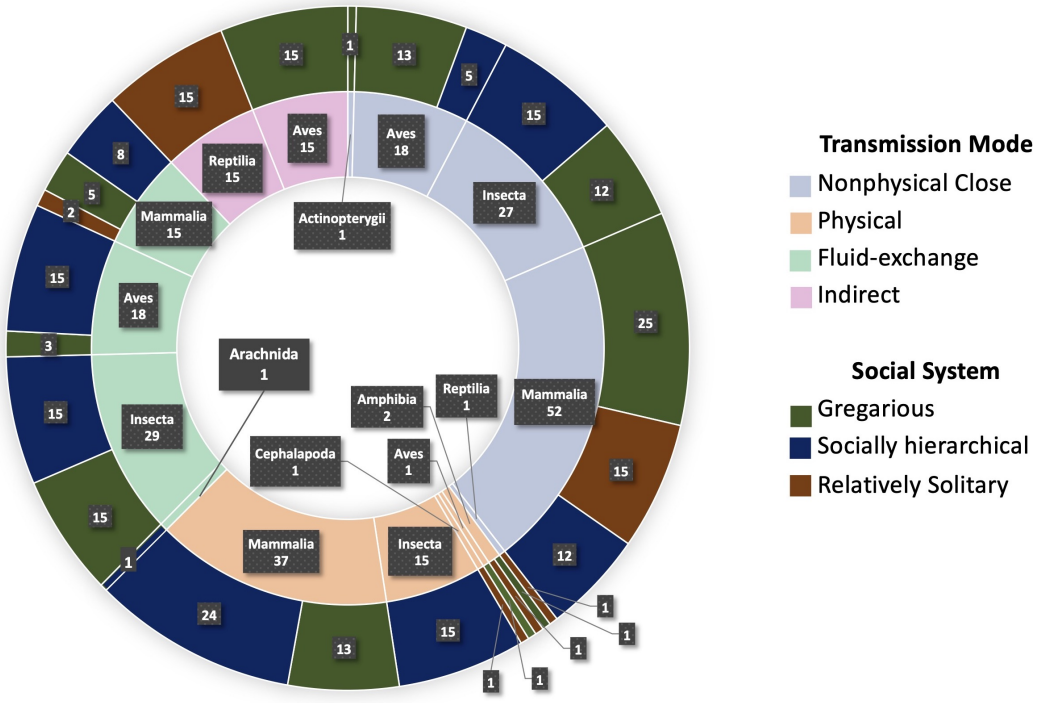

Figure S1: A breakdown of the 232 networks used in our GLMM by taxonomic class and social system. Networks were first categorized into one of four different transmission modes based on the contact event described by the network (Table 1) (inner ring colors). The inner ring also shows the number of networks in each taxonomic class for each transmission mode category. The outer ring shows the number of networks included in each social system, for each taxonomic class.

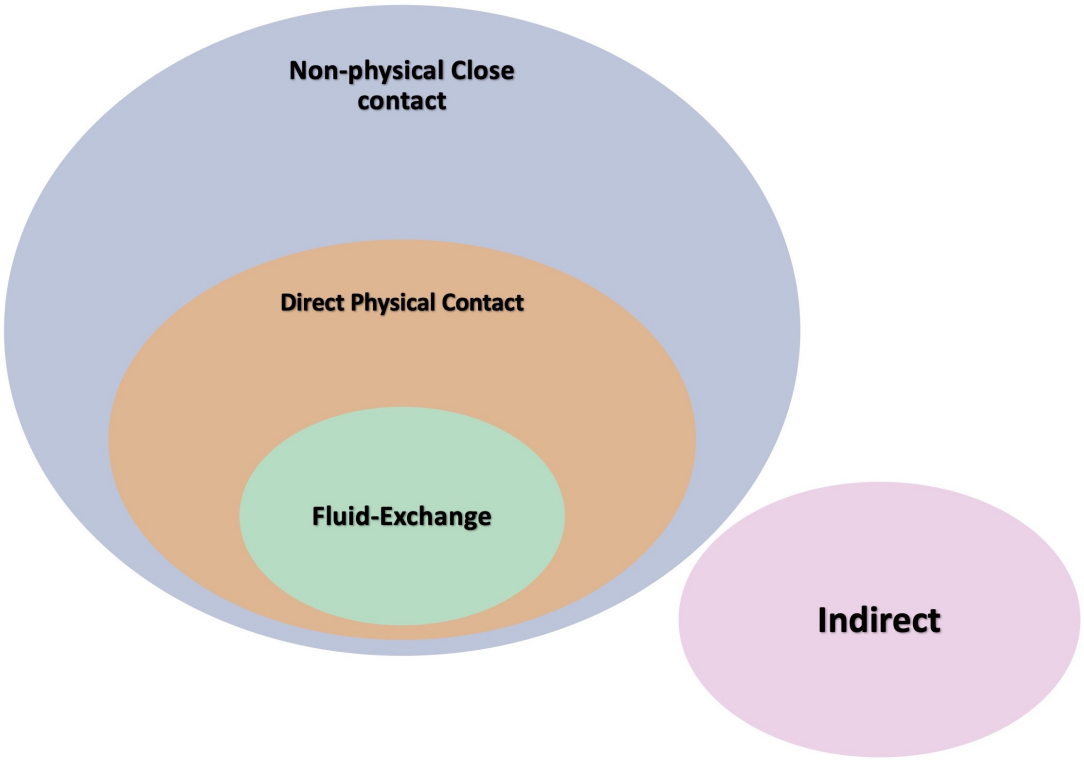

Figure S2: The nested structure of our transmission mode classification. Most networks can be classified in the non-physical close transmission category, the broadest classification on which airborne or respiratory droplet transmitted pathogens can travel. The addition of direct physical transmission is specific to pathogens that transmit via skin-to-skin contact, but airborne or droplet transmitted pathogens can still spread on these networks. Similarly, networks in the fluid exchange transmission category have contact events that involve physical contact with fluid exchange on which sexual fluid or saliva exchanged pathogens can travel, but skin-to-skin and respiratory transmitted pathogens can also still spread on these networks. Indirect contact is outside this nested transmission structure as the contact type is asynchronous (e.g. desert tortoises share burrows, but at different times and will therefore never even be spatially associated).

Table S2: The levels of evidence used in (31) to define pathogen traits. We only included pathogens from which traits came from levels of evidence I and II.

Level	**Definition**
I	Systematic review, metaanalysis or well-designed epidemilogic or experimental study with $\geq$ 50 subjects
II	Well-designed epidemilogic or experimental study with 5 - 50 subjects
III	Case reports with $<$ 5 subjects, or poorly substantiated larger study
IV	Opinion or clinical experience of experts (not supported by published data)

Table S3: Effect size estimates of the generalized linear mixed models continuous effects, network size and duration of data collection, on eight network metrics and the 95% credible intervals included in brackets. For each network metric, if the credible intervals do not overlap zero, the effect was considered significant.

Network Metric	Variable	Effect Size	95% credible interval
Density	Duration of data collection	0.004	[-0.059, 0.080]
	Network size	**-0.306**	**[-0.767, -0.221]**
Degree Heterogeneity	Duration of data collection	-0.072	[-0.141, 0.001]
	Network size	**0.183**	**[0.867, 0.467]**
Betweeness	Duration of data collection	-0.051	[-0.156, 0.049]
	Network size	-0.036	[-0.539, 0.049]
Degree Assortativity	Duration of data collection	0.034	[-0.118, 0.104]
	Network size	**0.132**	**[0.012, 0.670]**
Diameter	Duration of data collection	0.007	[-0.088, 0.075]
	Network size	**0.212**	**[0.065, 0.556]**
Clustering	Duration of data collection	0.006	[-0.080, 0.082]
	Network size	-0.043	[-0.149, 0.101]
Cohesion	Duration of data collection	0.022	[-0.121, 0.131]
	Network size	-0.175	[-0.596, 0.129]
Fragmentation	Duration of data collection	-0.079	[-0.154, 0.012]
	Network size	**0.291**	**[0.140, 0.738]**

Table S4: Model estimates for the edge weight type co-variate on eight different contact network metrics and their 95% credible intervals in brackets, where "unweighted" was the intercept. For each network metric, if the credible intervals for weighted networks overlap zero, then it was considered not different from unweighted networks.

Network Metric	Intercept	Focal:Weighted
Density	Unweighted	**0.390 [0.028, 0.747]**
Degree Heterogeneity	Unweighted	-0.157 [-0.512, 0.201]
Betweeness	Unweighted	0.023 [-0.448, 0.679]
Degree Assortativity	Unweighted	-0.074 [-0.605, 0.584]
Diameter	Unweighted	-0.049 [-0.498, 0.362]
Clustering	Unweighted	0.232 [-0.203, 0.711]
Cohesion	Unweighted	**1.136 [0.477, 1.821]**
Fragmentation	Unweighted	0.242 [-0.205, 0.651]

Table S5: Model estimates for the sampling scale co-variate on eight different contact network metrics with their 95% credible intervals in brackets. This model was run twice, once with "captive sampling" as the intercept and again with "social sampling" as the intercept. For each network metric, if the credible intervals for the focal sampling scale overlap zero, then it was considered not different from the intercept.

Network Metric	Intercept	Focal:Social	Focal:Spatial
Density	Captive	0.057 [-0.352,0.352]	**-0.521 [-0.937, -0.214]**
	Social		**-0.620 [-0.862, -0.213]**
Degree Heterogeneity	Captive	-0.034[-0.401, 0.320]	**0.336 [0.037, 0.743]**]
	Social		**0.480 [0.144, 0.794]**
Betweeness	Captive	0.474 [-0.194, 0.866]	-0.286 [-0.761, 0.237]
	Social		**-0.599 [-1.027, 0.076]**
Degree Assortativity	Captive	0.199 [-0.419, 0.680]	0.398 [-0.109, 0.929]
	Social		0.310 [-0.301, 0.760]
Diameter	Captive	0.002 [-0.391, 0.364]	0.029 [-0.329, 0.480]
	Social		0.149 [-0.302, 0.442]
Clustering	Captive	0.138 [-0.384, 0.586]	-0.309 [-0.749, 0.175]
	Social		**-0.533 [-0.867, -0.0573]**
Cohesion	Captive	0.055 [-0.555, 0.609]	-0.553 [-1.079, 0.040]
	Social		**-0.499 [-1.112, -0.032]**
Fragmentation	Captive	-0.040 [-0.378, 0.586]	-0.098 [-0.637, 0.182]
	Social		-0.180 [-0.544, 0.191]

Table S6: Model estimates for the social system co-variate on eight different contact network metrics with their 95% credible intervals in brackets. This model was run twice, once with "Relatively solitary" as the intercept and again with "Gregarious" as the intercept. For each network metric, if the credible intervals for the focal system overlap zero, then it was considered not different from the intercept.

Network Metric	Intercept	Focal:Gregarious	Focal:Socially Hierarchical
Density	Relatively Solitary	0.246 [-0.344, 1.003]	0.086 [-0.525, 0.857]
	Gregarious		-0.165 [-0.296, 0.137]
Degree Heterogeneity	Relatively Solitary	-0.335 [-0.918, 0.319]	-0.547 [-1.128, 0.187]
	Gregarious		-0.175 [-0.481, 0.078]
Betweeness	Relatively Solitary	-0.557 [-1.419, 0.315]	-0.403, [-1.369, 0.576]
	Gregarious		0.268 [-0.192, 0.595]
Degree Assortativity	Relatively Solitary	-0.429 [-1.658, 0.370]	[-0.059, 0.080]
	Gregarious		**-0.552 [-0.922, -0.038]**
Diameter	Relatively Solitary	-0.086 [-0.662, 0.680]	-0.260 [-1.092, 0.348]
	Gregarious		-0.318 [-0.590, 0.017]
Clustering	Relatively Solitary	0.250 [-0.533, 1.075]	-0.096 [-0.992, 0.754]
	Gregarious		**-0.466 [-0.766, -0.103]**
Cohesion	Relatively Solitary	-0.206 [-1.275, 0.795]	-0.825 [-1.933, 0.303]
	Gregarious		**-0.443 [-0.996, -0.038]**
Fragmentation	Relatively Solitary	0.385 [-0.384, 0.993]	-0.217 [-1.101, 0.404]
	Gregarious		**-0.594 [-0.933, -0.313]**

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Figure S3: Drop lowest 5% edgeweights

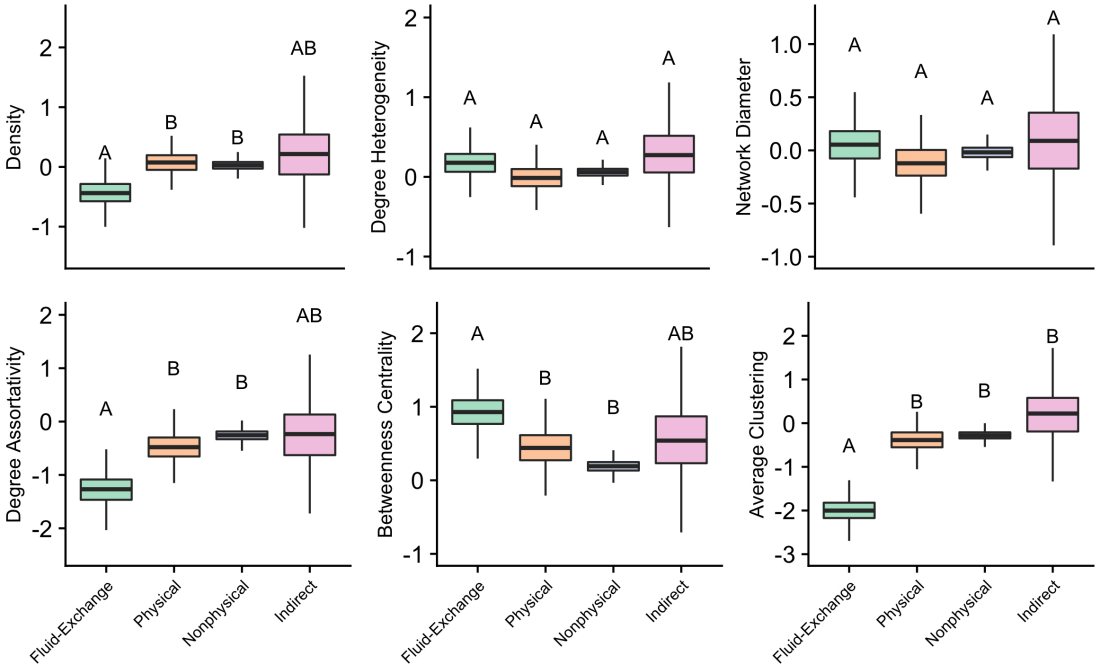

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Figure S4: Drop lowest 15% edgeweights

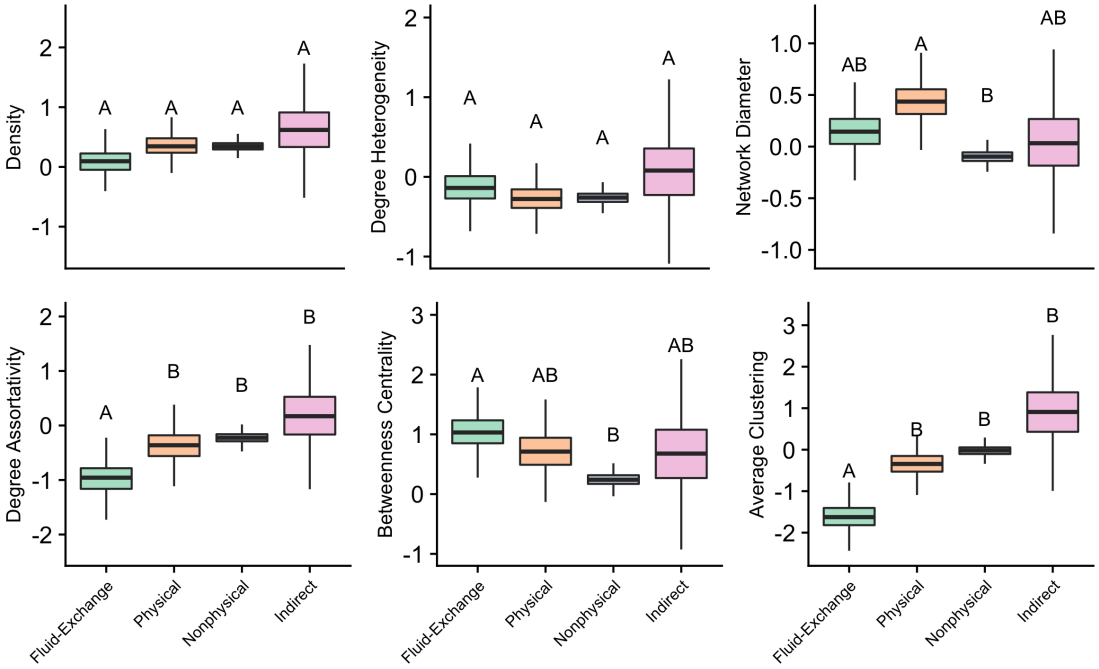

Figure S5: The predicted distributions for each network metric for contact networks in each transmission category, when the lowest 5% (a) and lowest 15% (b) of edge weights are dropped from the network. Letters represent significant differences between transmission modes.