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Disease avoidance motives trade-off against social motives, especially mate-seeking, to predict social distancing: Evidence from the Covid-19 pandemic

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Abstract

Many studies have sought to understand why people's compliance with social distancing varied during the Covid-19 pandemic. Recent theory suggests that pathogen avoidance behavior is not based only on perceived risk, but on a trade-off between the perceived costs of pathogen exposure and the perceived benefits of social contact. We hypothesized that compliance with social distancing may therefore be explained by a trade-off between pathogen avoidance and social motives, especially mate-seeking. Two studies conducted during the Covid-19 pandemic gave results consistent with this proposition: compliance with social distancing was positively associated with disease avoidance motives but negatively associated with social, especially mating, motives. These associations remained after controlling for predictors identified by previous research, including risk perception and personality. Findings indicate that people who are more interested in seeking new romantic partners (e.g., young men) may be less inclined to socially distance and be more at risk of pathogen transmission.

Keywords: Covid-19, infectious disease prevention, social distancing, mate seeking, disease avoidance

Behaviors such as social distancing (e.g., staying at home, avoiding crowds or public transport) and good hygiene (e.g., hand washing), are the most effective way to mitigate pandemic outbreaks, especially when pharmaceutical interventions (e.g., vaccination) are limited (Ahmed et al., 2018; Fong et al., 2020; Warren-Gash et al., 2013). However, the success of these non-pharmaceutical measures depends on the public voluntarily adopting them (Anderson et al., 2020; Maharaj & Kleczkowski, 2012).

Many studies have sought to explain variation in people's adherence with social distancing and hygiene guidelines. Several relevant variables have been identified, including empathy (Pfattheicher et al., 2020), personality (Brouard et al., 2020), and prosocial motivation (Pedersen & Favero, 2020). Multiple studies have shown that another important psychological predictor is perceived infection risk: people who perceive lower health risk from infectious diseases are less likely to adopt social distancing and hygiene behaviors during pandemics (Tang & Wong, 2003; Leppin & Aro, 2009; Kwok et al., 2020; Xu & Feng, 2015). Accordingly, adherence with social distancing during the Covid-19 pandemic is positively associated with measures of the fear of catching Covid-19 (Harper et al., 2020) and with measures of motives to avoid pathogens in general, including germ aversion (Makhanova & Shepherd, 2020; Shook et al., 2020) and pathogen disgust (McKay et al., 2020; Olivera-La Rosa et al., 2020).

Recent theoretical developments suggest that pathogen avoidance behavior is not only dependent on perceived risk of infection, but on a trade-off between the perceived costs of pathogen exposure and the perceived benefits of social contact (Tybur et al., 2013; Tybur & Liebermann, 2016; Tybur et al., 2020). Therefore, we hypothesize that people's compliance with social distancing can be explained by a trade-off between pathogen avoidance motives and social motives, especially mate-seeking motives.

Studies conducted during pandemics, including the Covid-19 pandemic, have found that men and younger adults are less compliant with social distancing recommendations (Moran & Del Valle, 2016; Brouard et al., 2020; Pedersen & Favero, 2020; Tomczyk et al., 2020). And rebounding Covid-19 infection rates in the summer of 2020 have been partly attributed to younger people being less likely to socially distance (Goldstein & Lipsitch, 2020), and there have been frequent reports of young people attending illegal parties and raves. One explanation for these patterns is that young people perceive lower susceptibility and less risks from Covid-19 (Oosterhof & Palmer, 2020), and from infectious disease in general (Ko et al., 2019). And young males in particular are less averse to risk in general (Baker & Maner, 2008; Oksuzyan et al., 2008). However, social motives, including mate-seeking motives, vary across sex and age (Ko et al., 2019; Penke & Asendorpf, 2008). We therefore hypothesized that the trade-off between pathogen avoidance and social motives would also explain lower adherence with social distancing among men and young people.

The costs and benefits of disease avoidance

According to recent perspectives, the psychology of pathogen avoidance is designed to integrate the costs of pathogen exposure, and the costs of avoiding contact, when producing avoidance behavior (Schaller et al., 2017; Tybur et al., 2013; Tybur & Liebermann, 2016). Avoiding contact with pathogens increases survival and reproductive success but avoiding other potentially infectious people also comes with costs because physical contact and proximity with people can provide benefits, such as working together, sharing food, looking after children and other kin, and romantic interaction. Motives to avoid disease, and resultant behaviors such as social distancing, may not depend only on the perceived level of threat from pathogen transmission, but on a trade-off with these other fitness-relevant social motives which require contact or proximity with other, potentially infectious, people.

The intensity of each of these social motives, and the trade-offs faced by investing effort in them, vary among individuals based on their sex, age, and other life history variables (e.g. relationship status; Ko et al., 2019; Neel et al., 2016). These sex and age differences in motive trade-offs may explain the observed lower adherence to social distancing and contact avoidance among men and young people.

Social motives and social distancing

Mate-seeking. Seeking new mating opportunities requires proximity and physical contact. People who are highly motivated to seek mates should therefore be expected to tolerate risks of pathogen exposure, and be more opposed to rules denying them the opportunity to seek new mates. Evidence has shown that individuals who are more inclined toward casual sex report lower disease avoidance motives (Murray et al., 2013; Neel et al., 2016; Tybur et al., 2015), and sexual arousal leads men to show reduced disgust, reduced judgments of disease risk, and enhanced willingness to have sex with opposite-sex targets (Oaten et al., 2019).

Studies have found sex differences in mating-related motives. Men on average have higher mate seeking motives (Ko et al., 2019), and report more desire for casual sex, whereas women report more interest in committed long-term relationships (Buss & Schmitt, 1993; Clark & Hatfield, 1989; Gangestad & Simpson, 2000; Kenrick et al., 1993; Li et al., 2002; Schmitt, 2005). Thus, men's lower compliance with social distancing may result not only from lower pathogen avoidance motives, but also from greater interest in seeking new romantic or sexual partners. Younger people also report more interest in mate seeking (Ko et al., 2019; Neel et al., 2016) which may explain lower adherence to social distancing among young people.

Mate retention. Conversely, keeping a mate may be helped by adhering to social distancing by reducing the frequency of social encounters that could lead to extra-pair

courtship and mating opportunities. People who are high in mate retention motives may therefore be more likely to adhere to social distancing. Women on average have higher mate retention motives (Ko et al., 2019), which might contribute to increased social distancing.

Social affiliation. People vary in their desire to affiliate with others by, for example, initiating and maintaining friendships or engaging in group activities (Neel et al., 2016). Individuals who are temporarily (Sacco et al., 2014) or dispositionally (Kupfer & Tybur, 2017) more motivated to affiliate with others show lower pathogen avoidance motives. Thus, lower compliance with social distancing measures may also result from greater interest in affiliating with other individuals and groups. This may apply in particular to younger individuals, as older people report less concern about social exclusion (Neel et al., 2016) possibly because as people age, their relationships become more stable and long-lasting, making social exclusion a less salient concern (Ko et al., 2019).

Kin-care. Evidence suggests that people trade-off pathogen avoidance with kin care. For example, Case et al. (2006) found that parents showed less disgust towards their own children's diapers but not towards unrelated children's diapers. In the case of a pandemic such as Covid-19, people who have strong kin care motives might adhere more to social distancing and hygiene practices to protect their family members. Studies have shown that compared to men, women have stronger motives to care for offspring and family (Buckels et al., 2015; Ko et al., 2019; Neel et al., 2016). Men's lower compliance with hygiene and social distancing behavior may also result from their lower interest in kin care.

Overview of Studies

In two studies conducted between April-June 2020 during the Covid-19 pandemic (Study 1: $N = 266$ participants from Turkey, Study 2: 498 participants from Western countries), we tested our main proposal that people's compliance with social distancing and hygiene practices results from a trade-off between pathogen avoidance and social motives

such as mate-seeking. Because satisfying these social motives require physical proximity and contact with others, we expected association to be stronger with social distancing measures than with more privately conducted hygiene measures such as hand washing. We also tested whether young people's (Studies 1 and 2) and men's (Study 2) lower adherence to social distancing can be explained by the trade-off between disease avoidance and social motives, especially mating motives. All questionnaires, data, and analysis scripts are publicly available on Open Science Framework (<https://osf.io/tg592/>).

Study 1

Method

Participants. Inputting a small effect size ($r = .30$ or $f^2 = .09$) into G*Power determined a sample size of 239 at 80% power for an 18-predictor multiple regression analysis. The recommended sample was increased by approximately 30% to allow for exclusions based on incomplete responses. A snowball sample of 300 consenting individuals from Turkey were recruited from a Turkish university (in return for course credit) as well as researchers' social network through social media (no compensation). The survey was distributed in Turkish after translating the study materials from the English original to Turkish by the authors who are bilingual speakers.¹ Excluding 44 participants who did not pass the two simple attention checks left data from 266 participants used in the analyses (200 women, 66 men; age range: 18-74 years, $M_{\text{age}} = 31.80$, $SD_{\text{age}} = 13.87$). All outcomes of null hypothesis significance testing (i.e., $p < .05$) remain when no exclusions were made.

Measures and Procedure

Adherence to social distancing and hygiene behavior. Respondents indicated how much they performed 19 different health-protective behaviors in response to the Covid-19

¹ Except that there were already existing Turkish translations for the Fundamental Social Motives Inventory (Neel et al., 2016) and Pathogen Disgust domain of the Three Domain Disgust Scale (Tybur et al., 2009), and thus we used these existing translations.

outbreak during the past four weeks on a 1 (not at all) to 7 (very much) scale. These behaviors consisted of social distancing behaviors (12 items, e.g., “avoided meeting with friends”, “avoided going to public areas”, “maintained at least 1 meter distance from people”), hygiene behaviors (5 items, e.g., “washed my hands more often and longer than usual”, “used sanitizing hand gel or other products to clean your hands more often than usual”), and two additional items (e.g., “worn a face mask when going out in public”, “worn gloves when going out in public”).²

When items were entered into a principal-axis factor analysis with oblique rotation, the scree plot indicated a 2 or 3-factor solution (eigenvalues = 5.87, 1.90, 1.21, 1.10, 1.02). After excluding two items (mask and glove wearing), and setting the number of factors extracted at two, the items formed two interpretable groups, which were consistent with the a priori predicted two-factor structure: social distancing and hygiene behavior. Loadings for the first factor (12 social distancing items) ranged between 0.31 and 0.80, and loadings for the second factor (five hygiene behavior items) ranged between 0.39 and 0.65. All had cross-loadings below .32. We created composite measures of compliance with social distancing ($\alpha = .83$) and hygiene behavior ($\alpha = .770$) by averaging the respective items. The social distancing and hygiene behavior clusters were moderately correlated, $r = .44$.

Social motives. Participants’ *motivation to avoid disease, motivation to protect themselves from dangers, and mating-related motives (mate seeking and mate retention), affiliation-related motives (group affiliation and social exclusion concern) and kin care motives (family and children)* were measured using the motivational domains from the Fundamental Social Motives Inventory (Neel et al., 2016). Each motive subscale included 6 items. Example items were “I avoid places and people that might carry diseases” (disease

² During the time the study was conducted there was a general recommendation that face masks should only be worn by infected people. This recommendation changed after the project was terminated.

avoidance; $\alpha = .75$), “I think a lot about how to stay safe from dangerous people” (self-protection; $\alpha = .79$), “I am interested in finding a new romantic or sexual partner” (mate seeking; $\alpha = .77$), “It would not be that big a deal to me if my partner and I broke up; reverse-coded” (mate retention; two items removed for scale reliability; $\alpha = .70$), “Being part of a group is important to me” (group affiliation; $\alpha = .80$), “I would be extremely hurt if a friend excluded me” (social exclusion concern; $\alpha = .87$), “Caring for family members is important to me.” (kin care-family; $\alpha = .81$), “I help take care of my children” (kin care-children; $\alpha = .82$). Participants rated each item on a 1 (strongly disagree) to 7 (strongly agree) scale. As done by the original authors (e.g., Ko et al., 2019), mate retention and kin care (children) items were asked only to participants who reported being in a relationship and being a parent, respectively; participants who reported being single and who did not have children were automatically assigned a value of 1 on the mate retention and kin care (children) items.

Sociosexual orientation. As an additional measure of mate seeking motivation, we used the 9-item Revised Sociosexual Orientation Inventory (SOI-R; Penke & Asendorpf, 2008) which measures the extent to which participants are interested in seeking uncommitted sexual relationships. Ratings were done on 9-point scales. Based on a principle-axis factor analysis (and similar to Weeden et al., 2008), we divided the nine items into two subscales – one containing three items regarding past sexual experience (SOI behavior, $\alpha = .79$) and the other containing six items relating to sociosexual attitudes and sexual fantasies (SOI attitudes, $\alpha = .85$). We also obtained global sociosexual orientation by computing the mean of all nine items (SOI total, $\alpha = .86$). Higher scores indicate a higher interest in seeking casual sexual relationships.

Pathogen disgust sensitivity. As an additional measure of disease avoidance, we used the seven-item pathogen domain of the Three Domain Disgust Scale (Tybur et al., 2009), which asks participants to rate seven items (e.g., “Stepping in dog poop”) on a 0 (not at all

disgusting) to 6 (extremely disgusting) scale ($\alpha = .69$). Higher scores correspond with greater motivations to avoid exposure to pathogens.

Demographic and control variables. Participants reported demographic information (e.g., sex, age, relationship status), and completed two items measuring *perceived risk of being infected* ($r_s = .61$) and two items measuring *perceived level of knowledge about the Covid-19 pandemic* ($r_s = .56$). We also measured participants' big-5 personality traits with the 10-item TIPI (Gosling et al., 2003; for Turkish translation see Atak, 2013), and *trait risk-taking* ($\alpha = .67$) with the 6 items taken from the Risk-taking scale of the Jackson Personality Inventory-Revised (JPI-R; Jackson, 1994). Each big-5 personality trait was measured with two items. The two items used for *extraversion* showed sufficient degree of correlation ($r_s = .55$), but the correlations between items for *neuroticism* ($r_s = .19$), *agreeableness* ($r_s = .07$), *openness to experience* ($r_s = .22$), *conscientiousness* ($r_s = .33$) were weak, therefore a single-item scales were used for traits except extraversion. These measures were used as control variables in testing our predictions as studies have found each of these variables to be related to compliance with social distancing (Brouard et al., 2020; Clark et al., 2020).³

Results

We first examined zero-order correlations among all variables included in this study. A correlation matrix is shown in Figure 1 (see Table S1 in online supplementary materials for the exact p values), and descriptive statistics are presented on Table 1.

³ Participants also completed additional items (status seeking motives, perceived responsibility and support for tight governmental control, and number of contacts with friends, family, colleagues, strangers) which were not used in the current research.

Figure 1. N = 266 (200 women, 66 men). Correlation matrix indicating zero-order correlations. Positive correlations are displayed in blue and negative correlations in red. The intensity of the color is proportional to the correlation coefficient so the stronger the correlation, the darker the boxes. A white box in the correlation matrix indicates that the correlation is not significant at $\alpha = .05$. Sex is coded as 1 = male, 2 = female. SOI = sociosexual orientation (i.e., willingness to engage in uncommitted sex).

As expected, adherence to social distancing and hygiene practices were positively associated with disease avoidance motives, disgust sensitivity, and kin care motives, and

negatively associated with mate-seeking motives and willingness to engage in uncommitted sex (SOI). However, adherence to social distancing and hygiene practices was not significantly associated with affiliation motives.

As shown in Table 1, men were less likely to adhere to both social distancing and hygiene practices. Men had lower mate retention and, unexpectedly, also higher kin care (children) motives. Men were also less disgust sensitive and more willing to engage in uncommitted sex. Regarding age differences, younger individuals were lower in disease avoidance, self-protection, group affiliation and kin care motives, but higher in mate-seeking, mate retention, and social exclusion motives, and were more disgust sensitive. Younger people were less likely to adhere to hygiene practices, but no relationship was found with social distancing (see Figure 1).

Table 1

Means and standard deviations in the total sample and by participant sex

	Total (<i>N</i> = 266)	Men (<i>n</i> = 66)	Women (<i>n</i> = 200)	Sex differences			
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>t</i>	<i>df</i>	<i>p</i>	<i>d</i>
Social distancing	6.36 (.73)	6.08 (.92)	6.45 (.64)	-3.07	86.79 ^a	.003	0.515
Hygiene behaviour	5.94 (.92)	5.64 (.99)	6.05 (.88)	-3.20	264	.002	0.451
Disease avoidance	5.49 (.96)	5.38 (.96)	5.52 (.96)	-1.08	264	.280	0.146
Disgust sensitivity	4.45 (1.05)	4.10 (1.06)	4.57 (1.03)	-3.20	264	.002	0.453
Mate seeking	3.00 (1.27)	3.17 (1.44)	2.94 (1.21)	1.27	264	.205	0.181
SOI total	2.45 (1.44)	3.57 (1.70)	2.09 (1.13)	6.66	84.69 ^a	.000	1.144
SOI attitude	2.82 (1.76)	4.19 (2.06)	2.36 (1.37)	6.73	84.76 ^a	.000	1.167
SOI behaviour	1.71 (1.20)	2.30 (1.63)	1.52 (.94)	3.67	78.63 ^a	.000	0.679
Mate retention	6.30 (.92)	6.06 (.87)	6.38 (.93)	-2.44	264	.016	0.350
Self-protection	5.14 (1.02)	5.15 (.94)	5.13 (1.04)	.17	264	.866	0.020
Affiliation (group)	5.19 (.97)	5.28 (1.06)	5.16 (.94)	.86	264	.393	0.124
Affiliation (social excl.)	4.30 (1.34)	4.12 (1.36)	4.36 (1.34)	-1.26	264	.210	0.178
Kin care (family)	5.79 (.99)	5.74 (.98)	5.81 (.99)	-.44	264	.657	0.071
Kin care (children)	3.83 (1.45)	4.21 (1.56)	3.70 (1.39)	2.34	101.11 ^a	.021	0.356

Risk perception	4.55 (1.23)	4.59 (1.22)	4.54 (1.23)	.31	264	.760	0.041
Knowledge	5.57 (.99)	5.47 (1.02)	5.61 (.98)	-.98	264	.329	0.141
Trait risk-taking	4.14 (.99)	4.15 (1.07)	4.14 (.96)	.07	264	.945	0.010
Openness	4.68 (1.65)	4.58 (1.65)	4.72 (1.66)	-.61	264	.540	0.084
Conscientiousness	5.12 (1.61)	5.70 (1.35)	4.93 (1.65)	1.10	264	.274	0.487
Extraversion	4.92 (1.45)	5.09 (1.34)	4.87 (1.49)	-1.07	264	.287	0.151
Agreeableness	4.30 (1.74)	4.11 (1.62)	4.37 (1.78)	-3.03	264	.003	0.149
Neuroticism	4.06 (1.87)	3.47 (1.79)	4.26 (1.85)	-3.07	86.79 ^a	.003	0.430

Notes. SOI = sociosexual orientation (i.e., willingness to engage in uncommitted sex) ^a df reported is for equal variances not assumed.

Next, we conducted hierarchical regression analyses to test whether social distancing and hygiene measures were associated with disease avoidance and social motives even after controlling for various other variables that have been shown to predict social distancing and hygiene, including personality and risk taking. We added the control variables in Step 1, and social motives, SOI and disgust sensitivity in Step 2. As expected, disease avoidance motives predicted higher compliance, and willingness to seek uncommitted sexual relationships predicted lower compliance with social distancing (Table 2a) and hygiene measures (Table 2b), above and beyond personality traits, perceived risk of infection and knowledge.

Table 2a

Hierarchical regression results on adherence to social distancing

Steps		<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	95% CI
1	Risk-taking	-.094	.053	-.127	-1.789	.075	-.198, .010
	Openness	-.014	.032	-.031	-.441	.660	-.076, .048
	Extraversion	-.002	.034	-.005	-.071	.943	-.069, .065
	Conscientiousness	.044	.034	.096	1.267	.206	-.024, .112
	Agreeableness	.041	.027	.097	1.487	.138	-.013, .095
	Neuroticism	.036	.029	.092	1.228	.220	-.022, .094
	Perceived risk	.019	.037	.032	.529	.597	-.053, .092
	Knowledge	.034	.045	.046	.752	.453	-.055, .124
2	Risk-taking	-.098	.051	-.131	-1.919	.056	-.198, .003
	Openness	-.004	.030	-.009	-.126	.899	-.064, .056
	Extraversion	-.001	.034	-.002	-.037	.971	-.068, .065
	Conscientiousness	.058	.033	.127	1.738	.083	-.008, .124
	Agreeableness	.028	.027	.067	1.036	.301	-.026, .082
	Neuroticism	.025	.030	.063	.813	.417	-.035, .084
	Perceived risk	.051	.036	.086	1.441	.151	-.019, .121
	Knowledge	.017	.044	.023	.396	.693	-.069, .103
	Disease avoidance	.221	.052	.289	4.258	.000	.119, .323
	Disgust sensitivity	.026	.044	.037	.589	.556	-.060, .112
	Mate seeking	-.019	.040	-.032	-.464	.643	-.098, .060
	SOI total	-.096	.035	-.188	-2.772	.006	-.164, -.028
	Mate retention	.053	.053	.066	1.001	.318	-.051, .157
	Self-protection	-.022	.051	-.030	-.424	.672	-.122, .079
	Group affiliation	-.020	.054	-.027	-.381	.703	-.126, .085
	Social exclusion	.019	.041	.035	.466	.642	-.062, .100
	Kin care (family)	.018	.050	.024	.351	.726	-.081, .116
	Kin care (children)	-.064	.034	-.126	-1.868	.063	-.131, .003

Notes. SOI = sociosexual orientation (i.e., willingness to engage in uncommitted sex)

Table 2b

Hierarchical regression results on adherence to hygiene practices

Steps		<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	95% CI
1	Risk-taking	-.039	.065	-.042	-.607	.545	-.167, .088
	Openness	-.105	.039	-.188	-2.712	.007	-.181, -.029

	Extraversion	.051	.042	.079	1.210	.227	-.032, .133
	Conscientiousness	.020	.042	.034	.463	.644	-.064, .103
	Agreeableness	.042	.034	.078	1.230	.220	-.025, .108
	Neuroticism	.030	.036	.060	.829	.408	-.041, .101
	Perceived risk	.113	.045	.150	2.505	.013	.024, .201
	Knowledge	.095	.056	.102	1.705	.089	-.015, .205
2	Risk-taking	-.002	.062	-.002	-.031	.975	-.124, .120
	Openness	-.069	.037	-.122	-1.841	.067	-.142, .005
	Extraversion	.027	.041	.042	.650	.516	-.054, .108
	Conscientiousness	.012	.041	.021	.294	.769	-.068, .092
	Agreeableness	.010	.033	.020	.313	.755	-.055, .076
	Neuroticism	.007	.037	.015	.199	.842	-.066, .080
	Perceived risk	.139	.043	.185	3.205	.002	.054, .225
	Knowledge	.060	.053	.064	1.124	.262	-.045, .165
	Disease avoidance	.220	.063	.228	3.466	.001	.095, .345
	Disgust sensitivity	.046	.054	.053	.863	.389	-.059, .152
	Mate seeking	-.042	.049	-.058	-.853	.394	-.139, .055
	SOI total	-.102	.042	-.159	-2.418	.016	-.185, -.019
	Mate retention	.005	.064	.005	.075	.940	-.122, .132
	Self-protection	.081	.063	.089	1.300	.195	-.042, .205
	Group affiliation	.031	.066	.032	.467	.641	-.099, .160
	Social exclusion	-.018	.050	-.026	-.358	.720	-.117, .081
	Kin care (family)	.081	.061	.087	1.335	.183	-.039, .202
	Kin care (children)	.001	.042	.002	.027	.978	-.081, .083

Notes. SOI = sociosexual orientation (i.e., willingness to engage in uncommitted sex)

Despite a non-significant correlation between age and social distancing, we still proceeded with the test of indirect effects of age on social distancing and hygiene measures through social motives, as these motives might still exert more influence on young people's social distancing than older people's. Toward this end, we conducted a mediation analysis (PROCESS Model 4 with 10,000 bootstrap samples for 95% CIs; Hayes 2018) to examine

whether disease avoidance and SOI⁴ explain younger (vs. older) individuals' compliance with social distancing and hygiene measures (due to the small sample size of men, we could not conduct mediation analyses to examine sex differences in social distancing and hygiene measures). As Table 3 shows, younger (vs. older) individuals' lower disease avoidance, but not higher interest in seeking causal sexual partners, mediated their compliance with social distancing and hygiene measures. The mediating effect of disease avoidance remained significant when we controlled for risk-taking, big-5 traits, risk perception and knowledge.

Table 3

Total, direct and indirect effects of the mediation model examining age differences on social distancing and hygiene behavior via disease avoidance and SOI

	Coeff.	SE	95% CI
<i>Total effects</i>			
Age ⇒ Social distancing	.000	.003	-.005, .008
Age ⇒ Hygiene behavior	.012*	.004	.004, .020
<i>Direct effects</i>			
Age ⇒ Disease avoidance	.009*	.004	.001, .017
Age ⇒ SOI total	.004	.006	-.009, .017
Age ⇒ Social distancing	.000	.003	-.006, .006
Disease avoidance ⇒ Social distancing	.207***	.044	.119, .294
SOI total ⇒ Social distancing	-.122***	.029	-.180, -.065
Age ⇒ Hygiene behavior	.010**	.004	.003, .018
Disease avoidance ⇒ Hygiene behavior	.273***	.055	.165, .382
SOI total ⇒ Hygiene behavior	-.143***	.036	-.215, -.072
<i>Indirect effects</i>			
Age ⇒ Social distancing via Disease avoidance	.002	.001	.000, .004
Age ⇒ Social distancing via SOI total	.000	.001	-.002, .001
Age ⇒ Hygiene behavior via Disease avoidance	.002	.001	.001, .005
Age ⇒ Hygiene behavior via SOI total	-.001	.001	-.002, .001

⁴ Given that only disease avoidance motives and SOI turned out to be significant predictors of social distancing and hygiene measures in the multiple regression analyses, we used only these two variables as mediators in our analysis.

Note. SOI = sociosexual orientation (i.e., willingness to engage in uncommitted sex).

* $p < .05$ ** $p < .01$ *** $p < .001$.

Study 2

The aim of Study 2 was to replicate Study 1 findings with a Western sample, and to recruit a larger sample to test whether men's (vs. women) and younger (vs. older) individuals' lower compliance with social distancing and hygiene behavior can be explained by these groups' lower disease avoidance and higher mate seeking motives.

Method

Participants. A sample of 498 consenting individuals from Western countries were recruited from the researchers' and participants' social network through social media, Social Psychology Network (no compensation), a Dutch university (in return for course credit), and Prolific Academic (monetary compensation). The survey was distributed in English. Excluding 11 participants who did not pass the two simple attention checks left data from 487 participants used in the analyses (219 men, 268 women; age range: 16-83 years, $M_{\text{age}} = 29.52$, $SD_{\text{age}} = 11.16$; location: 62.8% UK, 22.8% Europe; 13.4% North America; 1% Other). All outcomes of null hypothesis significance testing (i.e., $p < .05$) remain when no exclusions were made.⁵

Measures and Procedure

⁵ The sensitivity power analysis for an alpha of 0.05 (one-tailed), power of 0.80, and sample size of 487 revealed a minimum f^2 of 0.02 ($r = .14$) for the multiple regression analysis with number of 2 tested predictors (disease avoidance and mate seeking) and total number of 18 predictors. The actual effect size for disease avoidance predicting social distancing was f^2 of 0.13 ($r = .34$) and mate-seeking predicting social distancing was f^2 of 0.06 ($r = .23$) (Faul et al., 2013), which were larger than those of the sensitivity analysis, indicating that our sample size was sufficient to establish stable results.

Participants rated the same items as in Study 1: *disease avoidance* ($\alpha = .86$), *self-protection* ($\alpha = .86$), *mate seeking* ($\alpha = .92$), *mate retention* (two items removed for scale reliability; $\alpha = .72$), *group affiliation* ($\alpha = .82$), *social exclusion concern* ($\alpha = .86$), *kin care-family* ($\alpha = .89$), *kin care-children* ($\alpha = .86$), *sociosexual orientation* (SOI-total: $\alpha = .85$; SOI attitude: $\alpha = .78$; SOI desire = $\alpha = .87$; SOI behavior: $\alpha = .79$)⁶, *pathogen disgust sensitivity* ($\alpha = .74$), *compliance with social distancing measures* ($\alpha = .86$), *compliance with hygiene measures* ($\alpha = .76$).⁷ Again, for use as control variables, we measured *perceived risk of being infected* ($r_s = .63$), *perceived level of knowledge about the Covid-19 pandemic* ($r_s = .56$), *risk-taking* ($\alpha = .80$), *openness to experience* (1 item used due to weak correlation), *extraversion* ($r_s = .55$), *conscientiousness* ($r_s = .42$), *agreeableness* (1 item used due to weak correlation), *neuroticism* ($r_s = .51$).

Results

First, we examined the zero-order correlations among all variables included in this study. A correlation matrix is shown in Figure 2 (see Table S2 in online supplementary materials for the exact p values), and descriptive statistics are presented in Table 4.

⁶ In the Study 2 sample, when all the SOI items were entered into a principal-axis factor analysis with oblique rotation, three clear factors emerged corresponding to the attitude, desire and behavior facets of sociosexual orientation.

⁷ When all the health protective behavior items were entered into a principal-axis factor analysis with oblique rotation, the scree plot appeared to suggest a 2-factor solution (eigenvalues = 6.67, 2.16, 1.29, 1.02). After excluding two items (mask and glove wearing), and setting the number of factors extracted at two, the items formed two interpretable groups, which were consistent with the a priori predicted two-factor structure: social distancing and hygiene behavior. Loadings for the first factor (12 social distancing items) ranged between 0.40 and 0.84, and loadings for the second factor (five hygiene behavior items) ranged between 0.41 and 0.76. All had cross-loadings below .25. The social distancing and hygiene behavior clusters were moderately correlated, $r = .48$.

Figure 2. N = 487 (219 men, 268 women). Correlation matrix indicating zero-order correlations. Positive correlations are displayed in blue and negative correlations in red. The intensity of the color is proportional to the correlation coefficient so the stronger the correlation, the darker the boxes. A white box in the correlation matrix indicates that the correlation is not significant at $\alpha = .05$. Sex is coded as 1 = male, 2 = female. SOI = sociosexual orientation (i.e., willingness to engage in uncommitted sex).

As expected, adherence to social distancing and hygiene were positively associated with disease avoidance motives, pathogen disgust, and mate retention motives, and negatively associated with mate seeking motives and interest in casual sex (SOI). Men were less likely

to adhere to both social distancing and hygiene practices. Age was not related to social distancing or hygiene practices in this sample. Compared to women, men had lower disease avoidance, self-protection, mate retention, kin care (family), and disgust sensitivity, but higher mate seeking and willingness to seek uncommitted sexual partners. Younger individuals had lower disease avoidance and kin care (children) motives, but higher mate-seeking, mate retention, group affiliation, and social exclusion concern.

Table 4

Means and standard deviations in the total sample and by participant sex

	Total (<i>N</i> = 487)	Men (<i>n</i> = 219)	Women (<i>n</i> = 268)	Sex differences			
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>t</i>	<i>df</i>	<i>p</i>	<i>d</i>
Social distancing	6.07 (1.05)	5.93 (1.11)	6.19 (.99)	-2.65	443.24	.008	0.249
Hygiene behaviour	5.30 (1.24)	5.10 (1.30)	5.47 (1.17)	-3.30	444.01	.001	0.301
Disease avoidance	4.81 (1.22)	4.63 (1.19)	4.96 (1.23)	-3.05	485	.002	0.272
Disgust sensitivity	4.78 (1.01)	4.64 (1.05)	4.90 (.96)	-2.83	485	.005	0.260
Mate seeking	2.86 (1.73)	3.20 (1.68)	2.58 (1.73)	3.96	485	.000	0.363
SOI total	3.59 (1.56)	4.12 (1.46)	3.16 (1.49)	7.19	485	.000	0.650
SOI attitude	5.33 (2.30)	6.02 (2.05)	4.77 (2.34)	6.29	482.67	.000	0.564
SOI desire	2.28 (1.61)	2.37 (1.66)	2.21 (1.57)	1.07	484.00	.285	0.099
SOI behaviour	6.06 (.84)	5.85 (.88)	6.21 (.78)	-3.63	248.52	.000	0.436
Mate retention	4.84 (1.15)	4.61 (1.12)	5.03 (1.14)	-4.17	485	.000	0.371
Self-protection	4.84 (1.02)	4.78 (.92)	4.89 (1.09)	-1.11	484.41	.265	0.108
Affiliation (group)	4.45 (1.28)	4.33 (1.18)	4.56 (1.36)	-1.95	483.11	.052	0.179
Affiliation (social excl.)	5.59 (1.16)	5.33 (1.14)	5.81 (1.14)	-4.60	485	.000	0.421
Kin care (family)	6.42 (.75)	6.25 (.90)	6.58 (.51)	-2.35	83.75	.021	0.463
Kin care (children)	4.39 (1.36)	4.34 (1.44)	4.42 (1.29)	-.59	485	.554	0.059
Risk perception	5.29 (1.02)	5.21 (1.05)	5.35 (1.00)	-1.40	485	.161	0.137
Knowledge	4.04 (1.10)	4.16 (1.11)	3.95 (1.09)	2.06	485	.040	0.191
Trait risk-taking	5.33 (1.27)	5.33 (1.26)	5.34 (1.28)	-.02	485	.983	0.008
Openness	5.07 (1.28)	4.97 (1.25)	5.16 (1.30)	-1.60	485	.110	0.149
Conscientiousness	3.74 (1.51)	3.49 (1.38)	3.94 (1.58)	-3.33	482.62	.001	0.301
Extraversion	3.99 (1.66)	4.01 (1.71)	3.97 (1.63)	.26	485	.797	0.024
Agreeableness	3.80 (1.43)	3.48 (1.38)	4.05 (1.42)	-4.51	485	.000	0.407

Neuroticism	6.07 (1.05)	5.93 (1.11)	4.96 (1.23)	-2.65	443.24	.008	1.398
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Notes. SOI = sociosexual orientation (i.e., willingness to engage in uncommitted sex). ^a df reported is for equal variances not assumed.

Next, we conducted hierarchical regression analyses to test whether social distancing and hygiene measures were predicted by disease avoidance and mate seeking motives even after controlling for multiple other variables. We added the control variables in Step 1, and social motives, SOI and disgust sensitivity in Step 2. Disease avoidance motives predicted higher, and mate seeking motives (though not SOI, unlike Study 1) predicted lower compliance with social distancing (Table 5a). Compliance with hygiene practices were predicted by disease avoidance, self-protection, and group affiliation motives, but not by mate seeking motives (Table 5b).

Table 5a

Hierarchical regression results on adherence to social distancing

Steps		<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	95% CI
1	Risk-taking	-.141	.054	-.147	-2.590	.010	-.247, -.034
	Openness	-.007	.044	-.009	-.166	.868	-.094, .080
	Extraversion	-.062	.032	-.090	-1.940	.053	-.126, .001
	Conscientiousness	.082	.038	.100	2.133	.033	.006, .158
	Agreeableness	-.004	.030	-.006	-.138	.890	-.062, .054
	Neuroticism	.038	.035	.051	1.071	.285	-.031, .107
	Perceived risk	.054	.034	.069	1.585	.114	-.013, .120
	Knowledge	.217	.045	.211	4.840	.000	.129, .305
2	Risk-taking	-.091	.053	-.096	-1.732	.084	-.195, .012
	Openness	.017	.043	.021	.402	.688	-.068, .103
	Extraversion	-.057	.031	-.081	-1.804	.072	-.118, .005
	Conscientiousness	.030	.038	.037	.798	.426	-.044, .105
	Agreeableness	.017	.029	.027	.600	.549	-.039, .073
	Neuroticism	-.007	.036	-.009	-.184	.854	-.078, .065
	Perceived risk	.034	.033	.044	1.053	.293	-.030, .098
	Knowledge	.122	.045	.118	2.712	.007	.034, .210

Disease avoidance	.169	.048	.197	3.560	.000	.076, .263
Disgust sensitivity	-.050	.047	-.048	-1.073	.284	-.142, .042
Mate Seeking	-.121	.028	-.199	-4.291	.000	-.176, -.066
SOI total	.056	.033	.083	1.688	.092	-.009, .121
Mate retention	.093	.050	.082	1.852	.065	-.006, .191
Self-protection	.125	.053	.136	2.333	.020	.020, .230
Group affiliation	.044	.052	.043	.851	.395	-.058, .147
Social exclusion	.071	.040	.087	1.765	.078	-.008, .150
Kin care (family)	-.013	.042	-.014	-.302	.763	-.096, .070
Kin care (children)	-.003	.031	-.004	-.101	.920	-.064, .058

Notes. SOI = sociosexual orientation (i.e., willingness to engage in uncommitted sex).

Table 5b

Hierarchical regression results on adherence to hygiene practices

Steps		<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	95% CI
1	Risk-taking	-.040	.064	-.036	-.630	.529	-.165, .085
	Openness	-.058	.052	-.060	-1.123	.262	-.161, .044
	Extraversion	.019	.038	.023	.491	.624	-.056, .093
	Conscientiousness	.163	.045	.168	3.610	.000	.074, .252
	Agreeableness	.006	.035	.008	.176	.860	-.062, .074
	Neuroticism	.139	.041	.159	3.355	.001	.058, .220
	Perceived risk	.052	.040	.057	1.320	.188	-.026, .131
	Knowledge	.301	.053	.247	5.702	.000	.197, .404
2	Risk-taking	.045	.058	.040	.762	.446	-.070, .159
	Openness	-.024	.048	-.024	-.494	.622	-.118, .071
	Extraversion	.002	.035	.003	.064	.949	-.066, .071
	Conscientiousness	.037	.042	.038	.868	.386	-.046, .120
	Agreeableness	.032	.032	.042	1.000	.318	-.031, .094
	Neuroticism	.090	.040	.103	2.218	.027	.010, .169
	Perceived risk	.031	.036	.034	.868	.386	-.040, .102
	Knowledge	.141	.050	.116	2.819	.005	.043, .239
	Disease avoidance	.223	.053	.219	4.218	.000	.119, .326
	Disgust sensitivity	.077	.052	.063	1.494	.136	-.024, .179
	Mate Seeking	-.041	.031	-.057	-1.298	.195	-.102, .021
	SOI total	.021	.037	.026	.574	.566	-.051, .093
	Mate retention	.021	.055	.016	.375	.708	-.088, .130
	Self-protection	.289	.059	.267	4.876	.000	.172, .405

Group affiliation	.116	.058	.095	2.006	.045	.002, .229
Social exclusion	-.066	.045	-.068	-1.479	.140	-.154, .022
Kin care (family)	.090	.047	.084	1.914	.056	-.002, .182
Kin care (children)	.009	.035	.010	.254	.800	-.059, .077

Notes. SOI = sociosexual orientation (i.e., willingness to engage in uncommitted sex).

Despite non-significant correlations with age, we still proceeded with the test of indirect effects of age on social distancing and hygiene measures through social motives, as these motives might still exert more influence on young (vs. older) people's social distancing. Next, we conducted a mediation analysis (PROCESS Model 4 with 10,000 bootstrap samples for 95% CIs; Hayes 2018)⁸ to examine whether social motives (disease avoidance, mate seeking, self-protection, and group affiliation)⁹ explain men's (vs. women's) and younger (vs. older) individuals' compliance with social distancing and hygiene measures. We expected that the trade-off between disease avoidance and mate seeking motives to explain social distancing more strongly than hygiene practices because the latter do not interfere with social interaction to the same extent. As expected (see Tables 6a), men's (vs. women) lower compliance with social distancing was driven by their lower disease avoidance (and self-protection) motives, but also their higher mate seeking motives, with or without controls. Whereas men's lower compliance with hygiene practices was only driven by their

⁸ We also conducted moderated mediation analyses (Hayes 2018, Model 8 using PROCESS in SPSS) on social distancing and hygiene measures with sex as IV, age as the moderator, and social motives as the mediators. However, no significant sex $\times$ age interaction effects emerged on compliance with social distancing or hygiene practices.

⁹ Given that only disease avoidance, mate seeking, self-protection, and group affiliation motives turned out to be significant predictors of social distancing and hygiene measures in the multiple regression analyses, we used only these four social motive variables as mediators in our analysis.

lower disease avoidance and self-protection motives, not by higher mate-seeking motives (with control variables, the mediating effect of disease avoidance was non-significant).

Regarding age (see Table 6b), younger (vs. older) individuals' lower disease avoidance, but also their higher mate seeking motives mediated their compliance with both social distancing and hygiene practices (with controls, only the mediating effects of mate seeking was significant, but the mediating effect of disease avoidance was non-significant).

Table 6a

Direct and indirect effects of the mediation model examining sex differences on social distancing and hygiene behavior via social motives

	Coeff.	SE	95% CI
<i>Total effects</i>			
Sex ⇒ Social distancing	.255***	.095	.442, .242
Sex ⇒ Hygiene behavior	.373***	.112	.594, .300
<i>Direct effects</i>			
Sex ⇒ Disease avoidance	.337***	.111	.120, .555
Sex ⇒ Mate seeking	-.615***	.155	-.920, -.309
Sex ⇒ Self-protection	.429***	.103	.227, .636
Sex ⇒ Group affiliation	.102	.093	-.080, .284
Sex ⇒ Social distancing	.052	.090	-.126, .230
Disease avoidance ⇒ Social distancing	.188***	.046	.097, .280
Mate seeking ⇒ Social distancing	-.111***	.026	-.162, -.060
Self protection ⇒ Social distancing	.151**	.050	.053, .249
Group affiliation ⇒ Social distancing	.064	.044	-.022, .149
Sex ⇒ Hygiene behavior	.101	.100	-.094, .297
Disease avoidance ⇒ Hygiene behavior	.249***	.051	.149, .350
Mate seeking ⇒ Hygiene behavior	-.046	.029	-.102, .011
Self-protection ⇒ Hygiene behavior	.338***	.055	.230, .446
Group affiliation ⇒ Hygiene behavior	.143**	.048	.049, .238
<i>Indirect effects</i>			
Sex ⇒ Social distancing via Disease avoidance	.063	.027	.019, .124
Sex ⇒ Social distancing via Mate seeking	.068	.025	.027, .123
Sex ⇒ Social distancing via Self-protection	.065	.029	.015, .127
Sex ⇒ Social distancing via Group affiliation	.006	.009	-.009, .028
Sex ⇒ Hygiene behavior via Disease avoidance	.084	.034	.024, .156
Sex ⇒ Hygiene behavior via Mate seeking	.028	.021	-.008, .074

Sex ⇒ Hygiene behavior via Self-protection	.145	.045	.067, .241
Sex ⇒ Hygiene behavior via Group affiliation	.015	.014	-.012, .046

Note. Sex is coded as 1 = male, 2 = female. SOI = sociosexual orientation (i.e., willingness to engage in uncommitted sex). * $p < .05$ ** $p < .01$ *** $p < .001$.

Table 6b

Total, direct and indirect effects of the mediation model examining age differences on social distancing and hygiene behavior via social motives

	Coeff.	SE	95% CI
Total effects			
Age ⇒ Social distancing	.006	.004	-.002, .015
Age ⇒ Hygiene behavior	-.005	.005	-.015, .005
Direct effects			
Age ⇒ Disease avoidance	.010*	.005	.001, .020
Age ⇒ Mate seeking	-.030	.007	-.043, -.016
Age ⇒ Self-protection	.003	.005	-.006, .012
Age ⇒ Group affiliation	-.009*	.004	-.017, -.001
Age ⇒ Social distancing	.001	.004	-.007, .009
Disease avoidance ⇒ Social distancing	.188***	.047	.097, .280
Mate seeking ⇒ Social distancing	-.112***	.026	-.163, -.061
Self protection ⇒ Social distancing	.155**	.050	.057, .252
Group affiliation ⇒ Social distancing	.066	.044	-.019, .152
Age ⇒ Hygeine behavior	-.010*	.004	-.018, -.001
Disease avoidance ⇒ Hygeine behavior	.261***	.051	.160, .361
Mate seeking ⇒ Hygeine behavior	-.062*	.029	-.118, -.005
Self-protection ⇒ Hygeine behavior	.338***	.054	.231, .444
Group affiliation ⇒ Hygeine behavior	.140**	.048	.046, .234
Indirect effects			
Age ⇒ Social distancing via Disease avoidance	.002	.001	.000, .004
Age ⇒ Social distancing via Mate seeking	.003	.001	.002, .005
Age ⇒ Social distancing via Self-protection	.001	.001	-.001, .002
Age ⇒ Social distancing via Group affiliation	-.001	.001	-.002, .000
Age ⇒ Hygiene behavior via Disease avoidance	.003	.001	.000, .006
Age ⇒ Hygiene behavior via Mate seeking	.002	.001	.000, .004
Age ⇒ Hygiene behavior via Self-protection	.001	.002	-.002, .004
Age ⇒ Hygiene behavior via Group affiliation	-.001	.001	-.003, .000

Note. Sex is coded as 1 = male, 2 = female. SOI = sociosexual orientation (i.e., willingness to engage in uncommitted sex). * $p < .05$ ** $p < .01$ *** $p < .001$.

General Discussion

We hypothesized that adherence to social distancing results from a trade-off between motives to avoid infection, and motives to socially interact with others, especially for mating. People who are more motivated to interact with new or existing romantic partners would not be able to do so effectively if they were to follow social distancing rules diligently. As predicted, disease avoidance motives were positively associated, and mating motives negatively associated, with adherence to social distancing in two studies. Moreover, after conducting regression analysis to control for several variables, including personality and general risk perception, disease avoidance motives were the only consistent positive predictor, and mating motives were the only significant negative predictor, of social distancing.

Mating motives and disease avoidance motives vary across sex and age (Ko et al., 2019). We therefore also hypothesized that the trade-off between these motives could explain findings that men and young people may adhere less with social distancing. In Study 1 only disease avoidance motives mediated the effect of age on social distancing, whereas in Study 2 mediation analyses showed that men's (vs. women's) lower compliance with social distancing was produced by both their lower disease avoidance motives and their higher mate seeking motives. Similarly, younger (vs. older) peoples' social distancing was produced by their lower disease avoidance and higher mate seeking motives. These findings support the hypothesis that the trade-off between disease avoidance and mate seeking shapes social distancing behavior, which can in turn shape demographic patterns of adherence with social distancing rules.

Following hygiene guidelines is not subject to the disease avoidance and mating trade-off to the same extent as social distancing because hygiene can be done private or with or

without having social contact. This may explain why, in Study 2, adherence with hygiene practices was not negatively associated with mating motives in the regression analyses.

We also made predictions regarding other social motives. Mate retention motives were positively correlated with social distancing in both studies (though not after controlling for other variables in the regression analyses), consistent with the suggestion that social distancing might benefit individuals who are particularly concerned about mate retention, because social distancing reduces the chances that their mate will encounter courtship opportunities with other people. We expected higher motives to affiliate (e.g., with friends or groups) would be associated with lower social distancing, however, associations were non-significant (Study 1) or small (Study 2). We predicted that individuals more strongly motivated to care for offspring or other kin would be more adherent with social distancing because avoiding Covid-19 infection would protect their kin, not only themselves. Although kin-care motives were positively associated with social distancing, correlations were not consistently significant. Overall, these findings suggest that mating motives are the most important of the social motives we measured in shaping social distancing behavior.

One limitation is that the two measures of mating motives we employed were not equally predictive across Studies 1 and 2. In Study 1, regression analysis revealed that socio-sexuality (SOI) was the only significant negative predictor of social distancing, whereas in Study 2, the mating motives scale was the only significant negative predictor. Although the reason for this difference is not obvious, both scales negatively correlated with social distancing in both studies, and that in both studies one of these two mating motive measures was the only significant negative predictor after controlling for multiple other variables in regression analyses.

Our findings have important theoretical implications. Recent perspectives on the functioning of the human *behavioral immune system* have emphasized that pathogen

avoidance motives and behavior are the outcome of a trade-off between the costs of pathogen exposure and the costs of avoiding pathogen exposure (Tybur & Lieberman, 2016). Our findings extend this account by emphasizing the importance of mating motives in the trade-off with pathogen avoidance, and by showing that the trade-off can explain social distancing behavior, in addition to other outputs such as affective responses (Case, Repacholi & Stevenson, 2006) and discomfort with physical contact (Tybur et al., 2020).

Our findings also have implications for the design of effective interventions. People who are more interested in seeking romantic partners (e.g., young men) may find it harder to follow social distancing rules and be more at risk of pathogen transmission. Moreover, interventions seeking to motivate people to comply with infectious disease prevention behaviors may be maximally effective if the intervention content is tailored to evolved sex- and age-specific psychologies.

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