Abstract

The COVID-19 pandemic in the United States has had a disproportionate impact on Black, low-income, and elderly individuals. We recruited 175 predominantly white children ages 5-12 and their parents (*N*=112) and asked which of two individuals (differing in age, gender, race, social class, or personality) was more likely to get sick with either COVID-19 or the common cold and why. Children and parents reported that older adults were more likely to get sick than younger adults, but reported few differences based on gender, race, social class, or personality. Children predominantly used behavioral explanations, but older children were used more biological and structural explanations. Thus, children have some understanding of health disparities, and their understanding increases with age.

Keywords: Social categories; Understanding of illness; Structural thinking; Biological reasoning; Health disparities

The social aspects of illness: Children's and parents' explanations of the relation between social categories and illness in a predominantly white U.S. sample

Throughout history, marginalized social groups tend to be at greater risk and tend to experience more serious consequences during mass disease events such as pandemics (Athni et al., 2021). The COVID-19 pandemic in the United States is no different, having disproportionately affected Black, Latinx, Native American, and low-income communities (Clark et al., 2020; Tai et al., 2021; Vasquez Reyes, 2020) as well as the elderly (CDC, 2023). However, appreciating the reasons behind these increased risks is challenging, as they likely involve a complex assortment of structural, environmental, and/or biological factors that vary depending on the contrast in question. For example, differences in immune function might partly explain disparities associated with age (Fulop et al., 2014). In contrast, higher incidence of COVID-19 in Black, Latinx, and Native American people is likely due to structural factors such as access to medical services and working in essential sectors (CDC, 2023; Clark et al., 2020; Tai et al., 2021; Vasquez Reyes, 2020). The myriad of possible causal factors that can affect any one group and the possibility that the relevant factors differ depending on the social group, is a challenge not only for scientists, but also for children and families as they try to understand how social factors intersect with disease transmission. In this study, we examine how children and parents think about the relation between social categories and illness, and specifically how they distinguish between different sources of disparities.

Understanding illness and its relation to social categories

There is a longstanding interest in the cognitive developmental literature on how children understand illness (Au & Romo, 1996; Kalish, 1996; Lockhart & Keil, 2018; Raman & Gelman, 2008; Siegal & Petersen, 1999). However, much of this research has focused exclusively on children's understanding of biological or behavioral phenomena, such as germs or physical contact (Blacker & LoBue, 2016; DeJesus et al., 2021; Labotka & Gelman, 2023; Lockhart & Keil, 2018). Such work has advanced our knowledge of children's biological understanding of illness, but does not address their understanding of social dimensions.

However, a few studies suggest that children may at times incorporate social information into their reasoning about illness. Raman and Gelman (2008) found that 4- to 8-year-olds thought that a character was less likely to contract an illness from someone they knew, but 9- to 12-year-olds and adults did not. Li et al. (2021) found that 3- to 11-year-olds said they would avoid contaminated foods more if they belonged to an outgroup member (e.g., a speaker of a foreign language) than an ingroup member. Toyama (2019) found that children take into consideration lifestyle factors, such as nutrition, sleep, or worry, when deciding why someone got sick; thus, children may believe that groups differing in lifestyles would differ in their susceptibility to illness. However, these studies do not reveal how children think about the disproportionate impact of certain diseases on different communities or groups.

Explaining differences between groups

A critical aspect of understanding health disparities is not only noticing them but also explaining them. Although we are unaware of any studies examining how children explain health disparities, we can draw on findings from how children think about social categories more broadly. Both children and adults rely on different explanatory frameworks to explain differences between people, including *biological* (appealing to a person's insides or genes), *structural* (appealing to environmental or societal factors), and *behavioral* (appealing to individual choices in how to act) frameworks (Jayaratne et al., 2009; Meyer et al., 2020). However, people do not use the same framework for every characteristic. For example, children as well as adults think that differences in height are mainly due to biological factors like genes (Jayaratne et al., 2009; Meyer et al., 2020). But for other differences, such as intelligence or literacy, they recognize the importance of multiple frameworks (Jayaratne et al., 2009; Meyer et al., 2020). This means that children could in principle appeal to any or all of these factors when trying to explain health disparities. Below, we discuss previous work examining whether and when children use each of these explanatory frameworks.

Biological explanations appeal to causes that are innate, inside the body, or inherent, including (but not limited to) scientific concepts such as genes. They can be supported by cognitive biases and heuristics such as psychological essentialism (Gelman, 2003, 2004; Gelman & Rhodes, 2012; Medin & Ortony, 1989) and the inherence heuristic (Cimpian & Solomon, 2014). Children (particularly older children) and adults often resort to these internal biological explanations when reasoning about social categories such as gender and race (Cimpian & Steinberg, 2014; Donovan et al., 2021; Rhodes et al., 2018; Taylor et al., 2009), and U.S. parents transmit these ideas to their children (Rhodes et al., 2012). Although even preschoolers use biological explanations (Rhodes et al., 2018), children might not explicitly use scientific terminology until about age 11, when they are typically first exposed to these concepts in school.

Structural explanations prioritize factors external to the person (Schudson & Gelman, 2022; Vasilyeva et al., 2018; Vasilyeva & Lombrozo, 2020), such as social, cultural, or societal forces. Even 3-year-olds can understand (Rizzo & Killen, 2020) and use structural explanations (Vasilyeva et al., 2018), but to a lesser degree than older children and adults (Peretz-Lange et al., 2021). Children who used structural explanations to explain racial disparities were more likely to choose to play with a Black child (Rizzo, Green, et al., 2022) and had more egalitarian views (Rizzo, Britton, et al., 2022), indicating that these explanations are linked to children's attitudes.

Intentional behaviors, that is, behaviors that reflect individual choice (Meyer et al., 2020), are also construed as internal to the individual (like biological explanations) but modifiable over time (distinct from biological explanations). Children's use of a behavioral framework to explain health disparities might be supported by their understanding that certain behaviors put individuals at a greater risk of being sick (e.g., playing with a friend who is sick; Lockhart & Keil, 2018; Toyama, 2016). Behavioral explanations for how people get sick are commonly provided by parents and teachers (Toyama, 2016).

All the explanatory frameworks discussed so far could be used to explain why there are differences between groups, but they could also be used to explain why there are no differences. We have focused on explaining differences, given the documented health disparities in rates of COVID-19 infection and death, noted earlier. However, children and adults might not be aware of these disparities. Additionally, some of these disparities involve race, and white parents in the United States tend to not communicate about racial issues with their children, opting instead for communicating a color-blind ideology (Abaied et al., 2022; Perry et al., 2019). Therefore, people might also state that there are no differences between groups, instead asserting that all people are equal, or that certain social categories are irrelevant to disease.

It is also important to note that children and adults might use multiple frameworks when reasoning about health disparities. The coexistence of explanatory frameworks is common across many domains, including illness (Hernandez et al., 2020; Labotka & Gelman, 2022, 2023; Legare et al., 2012; Legare & Gelman, 2008; Shtulman, 2023). People might switch between frameworks depending on the target comparison (e.g., biological explanations to explain age differences, but structural explanations to explain racial differences). People might also combine multiple frameworks in one explanation (e.g., stating that poor people do not have good access to health care [structural] and that they have pre-existing conditions that elevate their risk [biological]).

Given that most prior research has focused on children's understanding of the biological causal frameworks of illness, it is of theoretical and practical importance to examine when and how children incorporate non-biological information when thinking about why people get sick. Examining multiple frameworks of illness will provide a more nuanced picture of how children think about illness and who is at greater risk of getting sick, and allows us to examine children's structural reasoning about real-world phenomena. This approach also allows us to examine whether children use multiple explanatory frameworks, and how they reason about their relation (e.g., as in concert or in competition). Additionally, it is of practical importance to understand how people think about health disparities and whether they attribute these disparities to internal or external factors, in order to effectively design public health messaging.

Current study

In the current study, we examined whether children and their parents thought that social categories such as age, race, and social class influence the likelihood of someone getting sick, and if so, how they explained these phenomena. We did not restrict the study to families of any particular demographic, nor did we intentionally sample families from particular communities. However, the families that participated in the study were primarily white from upper-middle class backgrounds. We focused on 5- to 12-year-olds, when there are considerable changes in: illness understanding (Labotka & Gelman, 2023), belief in the influence of social factors on illness (Raman & Gelman, 2008), and use of structural explanations (Peretz-Lange et al., 2021; Vasilyeva et al., 2018). We examined these issues in the context of either COVID-19 or the common cold. Children answered questions about each illness on separate sessions (i.e., one session about COVID-19 and one session about the common cold) at least 2 weeks apart. The order of the COVID session and the Cold session was counterbalanced. COVID-19 was the central focus of the study, given serious and well-documented disparities; the common cold served as a comparison case where differences between social groups are less evident and substantially less consequential. Prior work revealed few differences in children's understanding of the biological mechanisms underlying COVID-19 versus the common cold (Labotka & Gelman, 2023). Given the focus on these two diseases, it is relevant to detail the health disparities for each. For COVID-19, Black people are twice as likely to be hospitalized than white people, older adults (75-84 years old) are 8 times more likely to be hospitalized than young adults (18-29 years old), and people living in the poorest zip codes are 3 times more likely to be hospitalized than people living in the richest zip codes (CDC, 2023). Data for colds are less available, but there are some indications that younger adults are more likely to get a cold than older adults (CDC, 2020).

The study was approved by the ANONYMIZED Institutional Review Board. The research questions, coding, analyses, and participant exclusion criteria were preregistered in AsPredicted: https://aspredicted.org/S8N_6H8, https://aspredicted.org/S94_TDS. As we are not aware of prior work examining what children know about health disparities, we do not advance specific hypotheses. However, based on prior work, we expected that children would often use behavioral explanations to explain why someone got sick (Toyama, 2016). We also expected structural explanations to be rare, but to increase with age (Peretz-Lange et al., 2021).

Method

Participants

The study was advertised to those in a lab database of families that have participated in prior studies in our lab and through ANONYMIZED, a university resource that connects researchers and approximately 44,000 volunteer participants from across the state and country. Families with children in the eligible age range were invited to participate in the study. We recruited 175 children ages 5-12 at the first testing session (M = 8.93, SD = 2.24; 84 boys, 90 girls, and 1 non-binary): 5-6 years (n = 41, M = 5.97, SD = 0.54; 23 boys, 18 girls), 7-8 years (n = 47, M = 7.95, SD = 0.65; 26 boys, 21 girls), 9-10 years (n = 44, M = 9.86, SD = 0.62; 16 boys, 28 girls), and 11-12 years (n = 43, M = 11.87, SD = 0.51; 18 boys, 23 girls, 1 non-binary). We preregistered a goal of 160 child participants (40 in each age group) but indicated that if more participants signed up to participate in the study prior to reaching our goal, we would test all who had signed up to participate. Per parental reports, our sample was 74.28% white, 4.57% Asian or Asian American, 2.29% Hispanic or Latinx, 1.14% Black or African American, 0.57% Middle Eastern, and 17.71% multi-racial/ethnic. Twelve additional children were excluded from our analyses (see supplemental materials for demographics), due to not returning for a COVID session (n = 7), their COVID session being excluded (n = 4, two for parental interference and two for experimenter error), and parents not reporting child age (n = 1). Because we wanted all participants to have a COVID session, excluding a COVID session led to the participant being fully excluded, but excluding the cold session did not. Therefore, 7 cold sessions were dropped, due to experimenter error (n = 6) and not finishing the session (n = 1). Additionally, one child accidentally completed the COVID session twice, and thus we excluded the second (extra) session. Children were tested between July 2021 and December 2021.

In addition to the children, 112 parents or caregivers of the child participants also participated (representing 87.10% of the children, due to inclusion of siblings). Parents were 29-57 years old (M = 40.68, SD = 5.47); 104 were women, 7 were men, and 1 did not report their gender. Self-reported race/ethnicity was 75.00% white, 8.93% Asian or Asian American, 3.57% Hispanic or Latinx, 1.79% Black or African American, 0.89% Middle Eastern, 0.89% Native American, 5.36% multi-racial/ethnic, 0.89% “other”, and 2.68% did not report racial or ethnic information. Self-reported education level was 8.04% High school or GED, 5.36% Associate's degree, 33.93% Bachelor’s degree, 37.50% Master’s degree, 12.50% Doctorate or Professional degree, 1.79% reported “other”, and 0.89% did not report. Annual household income was reported in ranges: 0.89% earned $15,000-25,000, 4.46% earned $25,00-45,000, 8.04% earned $45,000-65,000, 9.82% earned $65,000-85,000, 72.32% earned more than $85,000, and 4.46% did not report income. Parents completed their surveys between July and December 2021.

Materials and Procedure

Children and their parents were asked about COVID-19 and the common cold, in two separate sessions. We counterbalanced which session children completed first (COVID first = 95; cold first = 94). Children were tested individually by a trained researcher through online videoconferencing, using Zoom software. After obtaining parental consent and child assent, the researcher shared their screen with the participating child so that they could see pictures that accompanied each question.

First, children were asked, “Do you think some kinds of people are more likely than others to get sick with [COVID/cold]?” If they said yes, they were asked to specify who is more likely. Then, participants were given a warm-up task that modeled the questions and response format of the later questions. For example, in one warm-up trial, children were shown pictures of two birds and then asked which was more likely to fly, or if they were the same. In the following trial, children were shown pictures of a bird and a pig, and asked which was more likely to fly or if they were the same. Another pair of warm-up questions asked children which was more likely to go on someone’s head or were they the same: a hat vs. a hat, and a hat vs. a sock. On each trial, children received feedback, including a correction if needed.

The main task followed the warm-up. On each of 8 trials, participants saw drawings of two individuals, each from a different social group (e.g., a younger adult vs. an older adult). Each picture was verbally labeled (e.g., "This is a younger adult and this is an older adult", with the cursor on the appropriate picture), and then children were asked who was more likely to get sick with the target disease (“Who is more likely to get sick with COVID: This one [the person on the left], this one [the person on the right], or are they the same?”). Comparisons included: older adult vs. younger adult, child vs. adult, Black person vs. White person, Asian person vs. White person, Asian person vs. Black person, poor person vs. rich person, man vs. woman, and mean person vs. nice person. Both the order of pairs and the side of the screen on which each member appeared were randomized. For each pair, the two images differed in only one of the social categories. For example, for the man-woman comparison, the images showed two white adults of approximately the same age and no markers that would indicate differences in social class. In half of the comparisons unrelated to gender both characters were women, and in the other half both characters were men. Similarly, in half of the comparisons unrelated to age both characters were adults, and in the other half both characters were children. In the comparisons unrelated to race, both characters had similar skin tones and in all the comparisons the characters could be classified as white. After each response, the participant was asked to explain why. During testing we realized that the mean character was blowing razzberries with visible saliva droplets. Some participants remarked on these droplets as increasing the likelihood that the character was going to get sick or could get someone sick. We report the results of the nice-mean comparison for transparency (i.e., in order to report all the manipulations in the study), but the results of the nice-mean comparison should be interpreted with caution in the light of this confound.

After they completed this task, children completed other tasks that are not the focus of this paper, examining how social relatedness influenced the likelihood of someone getting sick and their use of health-protective behaviors. After a child completed both sessions of the study (one per illness: COVID-19, common cold), parents received a link to an online survey where they completed the same tasks (for COVID-19 only, not the common cold). The materials for parents were the same as for children (including pictures accompanying each item), except that parents went through the survey at their own pace, without an experimenter present, and were not presented with the warm up trials. In addition, parents responded to questions about their COVID-19 beliefs, attitudes, and practices, as well as demographics.

Sessions were automatically transcribed by Zoom, and transcripts were later checked for accuracy and corrected. As a thank you for participating in the study, families received $10 for each session a child completed and $10 for completing the parent survey. Each session took between 15 and 30 minutes, and the sessions occurred at least two weeks apart.

Qualitative coding

Participants' explanations were coded in accordance with our pre-registration (with the exception that three pre-registered categories--alternative social categories, inherent/dispositional, and explicitly labeling identity--were not coded, due to low frequency or redundancy with other codes). Explanations were coded as biological, structural, behavioral, everyone equal, generic claims, and transmission event. The first four codes focus on the frameworks children used; generic claims focus on the linguistic form (rather than the content) of the claims (Gelman, 2021) and were included as they are common when people discuss social categories (Rhodes & Mandalaywala, 2017); and the coding of "transmission event" was included as it provided an explanation that focused on the proximate cause of illness. Responses could be coded into multiple categories when appropriate. Two trained coders coded 20% of the responses to assess reliability. For the category "everyone equal", three trained coders coded 20% of the responses to assess reliability. We used benchmarks by Landis and Koch (1977) and McHugh (2012) where kappa values above .60 show substantial agreement and reliability was deemed satisfactory if kappa values were above this threshold. Reliability was deemed satisfactory for all codes, and all disagreements were resolved through discussion. See Table 1 for descriptions and examples of these codes, along with reliability estimates.

We also conducted an exploratory (not pre-registered) coding of the first open-ended question, asking if “some kinds of people are more likely to get sick with [COVID/a cold]”, and if so, who. This question provides insight into participants' beliefs before they were primed with any social category. These responses were coded in three passes. First, we coded whether people said that some kinds of people were more likely to get sick. Second, if they did, we coded whether they mentioned biology, behavior, situation, social categories, cold weather, or other reasons. Third, if a response included a social category, we coded whether it mentioned any of the nine social categories included in the primary task, or if they mentioned another category. One primary coder coded all responses and a second coded 20% of the responses. Reliability was deemed satisfactory at each pass (except for two codes) and all disagreements were resolved through discussion. The two codes without satisfactory reliability were in the third pass for “children” and “alternative social categories. We do not use these codes in any analyses nor interpret their results, but present them in the supplemental materials for completeness. Table 2 includes descriptions, examples, and reliability estimates for each code.

Results

Pre-registered analyses

Children's selections

Table 3 shows how often children indicated that either group (or neither) was more likely to get sick, as well as whether these responses were different from chance (after adjusting for multiple comparisons). For all but one of the comparisons, children were above-chance (of 33%) in reporting that both people were equally likely to get sick. The one exception was older vs. younger adults, where children were above-chance (of 33%) in reporting that older adults were more likely to get sick, and also reported that older adults were more likely than younger adults to get sick (COVID: $t(173) = 11.92$, $p < .001$; cold: $t(159) = 7.84$, $p < .001$). Despite the overall tendency to report no differences, when children did select one of the two groups as more likely to get sick, they often showed systematic patterns. Specifically, children selected adults more than children (COVID: $t(172) = 2.68$, $p = .008$), Asian people more than white people (cold: $t(161) = 2.09$, $p = .039$), poor people more than rich people (COVID: $t(172) = 8.54$, $p < .001$; cold: $t(161) = 8.43$, $p < .001$), and mean people more than nice people (COVID: $t(173) = 5.71$, $p < .001$; cold: $t(161) = 4.84$, $p < .001$).

We also examined how participant age and illness condition influenced children's selection of who would get sick. Given that participants could respond that the person from either group was more likely, or that both are equally likely, we created an ordinal outcome variable (e.g., for the gender comparison, selecting men was assigned a 1, both equally a 2, and women a 3). We fit an ordinal logistic regression with age, condition, and their interaction as predictors and a by-subject random intercept. We used age as a continuous variable rather than collapse into age groups. Below we report only the significant results of each model.

Effects of age. Older children were more likely than younger children to say that an older adult would get sick, $\chi^2(1, N = 175) = 9.67, p = .002$. Older children were less likely than younger children to say that a mean person would get sick, $\chi^2(1, N = 175) = 16.33, p < .001$.

Effects of illness condition. Children were more likely to say that an older adult (rather than a younger adult) would get sick when asked about COVID-19 compared to when asked about the common cold, $\chi^2(1, N = 175) = 7.88, p = .005$. Children were more likely to say that a child (rather than an adult) would get sick when asked about COVID-19 compared to when asked about the common cold, $\chi^2(1, N = 175) = 10.25, p = .001$.

Interaction between age and illness condition. There was an interaction in children's responses regarding white and Black people, $\chi^2(1, N = 175) = 4.37, p = .036$. As shown in Figure 1, 5- to 6-year-olds said that a Black person was more likely to get sick with COVID-19 than a white person, but across both illnesses, older children were more likely to say that both people were equally likely to get sick. There was a similar interaction on children's responses to white and Asian people, $\chi^2(1, N = 175) = 3.87, p = .049$. As also shown in Figure 1, 5- to 6-year-olds said that a white person was more likely to get sick with a cold than an Asian person, but across both illnesses, older children were more like say that both people were equally likely to get sick.

Children's explanations

When examining children's explanations, a few notable patterns emerged (see Figure 2). When children said that both groups were equally likely to get sick, the most common explanation was that everyone is equal. In almost all other cases, the most common explanation involved behaviors. The only exception to this pattern was when children thought that older adults were more likely to get sick, which they typically explained by appealing to biological factors. Additionally, structural explanations were primarily given when children thought that poor people were more likely to get sick, but rare otherwise. Generic claims about social categories were most common when children selected one person as more likely to get sick, whereas mentioning transmission events was relatively rare (see supplemental materials).

We fit a mixed-effects logistic regression for each code, predicting the presence of the code for each comparison from illness condition, child age, and their interaction and including by-subject random intercepts. To avoid overfitting, we only fit the model if at least 10% of children provided the code for a given comparison.

Biological. Older children were more likely than younger children to provide biological explanations for the old adult - young adult comparison, $OR = 3.21$, $\chi^2(1, N = 171) = 14.30$, $p < .001$.

Structural. Older children were more likely than younger children to provide structural explanations for the rich - poor comparison, $OR = 1.36$, $\chi^2(1, N = 172) = 4.84$, $p = .028$.

Behavioral. Older children were less likely than younger children to provide behavioral explanations for the adult - child comparison, $OR = 1.56$, $\chi^2(1, N = 172) = 5.04$, $p = .025$, and for the man - woman comparison, $OR = 0.44$, $\chi^2(1, N = 172) = 6.52$, $p = .011$. For the man - woman comparison, we also found that children were less likely to provide behavioral explanations for COVID-19 than the cold, $OR = 0.01$, $\chi^2(1, N = 172) = 7.81$, $p = .005$, but this was qualified by an interaction showing that the difference between the two illnesses decreased as age increased, $OR = 3.20$, $\chi^2(1, N = 172) = 8.51$, $p = .003$. For the Asian - Black comparison, children were less likely to provide behavioral explanations for COVID-19 than the cold, $OR = 0.01$, $\chi^2(1, N = 171) = 6.17$, $p = .013$, but this was qualified by an interaction showing that the difference between the two illnesses decreased as age increased, $OR = 2.74$, $\chi^2(1, N = 171) = 5.92$, $p = .015$.

Everyone equal. Older children were more likely than younger children to provide "everyone equal" explanations for the white - Black comparison, $OR = 1.60$, $\chi^2(1, N = 172) =$

14.55, $p = .009$, the white - Asian comparison, $OR = 1.48$, $\chi^2(1, N = 172) = 13.67$, $p < .001$, the Asian - Black, $OR = 1.52$, $\chi^2(1, N = 171) = 10.60$, $p = .001$, the rich - poor comparison, $OR = 1.35$, $\chi^2(1, N = 172) = 6.86$, $p < .001$, the man - woman comparison, $OR = 1.48$, $\chi^2(1, N = 171) = 17.04$, $p < .001$, and the nice - mean comparison, $OR = 1.44$, $\chi^2(1, N = 172) = 11.15$, $p = .001$.

Generic claims. Older children were more likely than younger children to provide generic claims for the old adult - young adult comparison, $OR = 1.41$, $\chi^2(1, N = 171) = 12.98$, $p < .001$.

Summary of results of children's explanations

Overall, these results show that with age, children were more likely to provide "everyone equal" explanations. Additionally, there were also more likely to use other frameworks such as appealing to biological and structural factors, but applied these selectively to specific comparisons, such as age and social class, respectively.

Parents' selections

Overall, the results from parents were very similar to those of children, with parents responding above chance (33%) that both groups were equally likely to get sick for most comparisons. See Table 3. We then examined whether when parents stated that one of the groups was more likely to get sick, they consistently selected a particular group. On this analysis, parents consistently said that older adults and poor people were more likely to get sick than younger adults and rich people ($t(111) = 14.25$, $p < .001$; $t(111) = 10.35$, $p < .001$, respectively). Parents also said that a Black person was more likely to get COVID-19 than a white person, $t(111) = 6.66$, $p < .001$, a Black person was more likely than an Asian person, $t(111) = 5.50$, $p < .001$, and a man was more likely than a woman, $t(111) = 2.92$, $p = .004$. Although parents also were significantly more likely to indicate that the mean person would get sick than the nice person, $t(111) = 2.03$, $p = .045$, these responses were rare (less than 4%; by contrast, about a quarter of the children made this choice). Finally, parents thought that children would be more likely to get sick with COVID-19 than adults, $t(111) = 4.77$, $p < .001$, whereas children showed the opposite pattern.

Parents' explanations

Parents used a variety of explanations for the different comparisons (see Figure 2). Similar to children, when parents judged that both groups were equally likely to get sick, they often used "everyone equal" explanations (except for the child-adult comparison). Parents who thought that young adults, children, white people (compared to Asian people), Black people (compared to white people), and mean people were more likely to get sick most often provided behavioral explanations. Parents who thought that older adults, adults, or men were more likely to get sick most often explained this by appealing to biological explanations. Parents who thought that Black people (compared to white people), Asian people (compared to white people), and poor people were more likely to get sick most often provided structural explanations. Similar to children, parents made more generic claims when they thought that one of the groups was more likely to get sick (see supplemental materials).

We also compared parents' explanations to children's explanations for the COVID session. We fit a mixed-effects logistic regression examining for every comparison whether participants mentioned a given code. We included whether the participant was a child or parent as a predictor and we included by-subject random intercepts. We found that parents provided more biological explanations, $OR = 2.36$, $\chi^2(1, N = 179) = 25.17$, $p < .001$, more structural explanations, $OR = 2.85$, $\chi^2(1, N = 179) = 32.60$, $p < .001$, more generic claims, $OR = 1.79$, $\chi^2(1, N = 179) = 28.36$, $p < .001$, and more references to transmission events, $OR = 1.82$, $\chi^2(1, N$

= 179) = 5.71, p = .017, than children. We did not find evidence for a difference in the number of behavioral explanations OR = 0.95, $\chi^2(1, N = 179) = 0.16$, p = .686, and everyone equal explanations, OR = 1.09, $\chi^2(1, N = 179) = 0.79$, p = .373, provided by children versus parents.

Exploratory analyses

Relation between parents' and children's selections and explanations

We first examined whether children's selections were related to their parents' selections. In order to eliminate non-independence due to parents' data being used for multiple children, in the case of siblings we only used the data from the youngest child, on the assumption that younger children are more likely than older children to be more influenced by their parents' beliefs (O'Brien & Bierman, 1988). Spearman rank-order correlations suggested no relation between children's and parents' selections for any of the comparisons, rho between -0.17 and 0.11, all ps > .05. Then, we examined whether parents' explanations were related to children's explanations. To do this, we focused on children's explanations on the COVID-19 questions, as parents were only given the COVID-19 survey. The overall number of biological explanations parents provided was related to the overall number of biological explanations their child provided (r = .29, p = .003). However, we did not find evidence for this relation for behavioral (r = .02, p = .864), structural (r = -.08, p = .420), or everyone equal explanations (r = .04, p = .691). For an analysis by-question, please see supplemental materials.

Unprompted mention of social categories

At the start of the COVID and cold sessions, before social categories were introduced, we asked participants whether certain kinds of people were more likely to get COVID-19 or the cold. In the COVID-19 condition, 99.08% of parents and 70.93% of children said yes; in the cold condition, 60.25% of children said yes. We fit a mixed-effects logistic regression examining whether children said that some people are more likely to get sick. We included age, illness, and their interaction as predictors and by-subject random intercepts. There was no significant difference between COVID-19 and cold, $OR = 0.50$, $\chi^2(1, N = 174) = 0.35$, $p = .551$, nor an interaction with age, $OR = 1.18$, $\chi^2(1, N = 174) = 1.50$, $p = .221$. Older children were more likely than younger children to say that some kinds of people were more likely to get sick, $OR = 1.48$, $\chi^2(1, N = 174) = 19.91$, $p < .001$. When asked to elaborate, parents mentioned social categories (76.85%), as well as biological (72.22%), behavioral (33.33%), and situational (22.22%) factors. In the COVID-19 condition, children mentioned social categories (50.82%), as well as behavioral (27.05%), biological (21.31%), situational (11.48%), and cold weather (0.82%) factors. In the cold condition, children mentioned biological (29.90%), social categories (25.77%), behavioral (22.68%), situational (14.43%), and cold weather (7.22%) factors.

We coded whether participants mentioned the categories provided in the study. When parents mentioned social categories, they mentioned old adults (67.90%), Black people (9.88%), poor people (8.64%), Asian people (3.70%), or young adults (1.23%). When children in the COVID-19 condition mentioned social categories, they mentioned old adults (83.87%), young adults (14.52%), or poor people (3.23%). When children in the cold condition mentioned social categories, they mentioned old adults (64.00%), young adults (16.00%), or poor people (12.00%). Therefore, it appears that for children, categories related to age and class were most salient. Parents generally provided more categories, including ones not in the study (e.g., “immunocompromised,” “anti-vaxxers”).

We also conducted an exploratory analysis of how demographic factors related to children’s and parents’ responses. Correlations between their selections for each comparison and parental income, parental education, participant gender, and community voting behavior (percentage of votes for Biden in the 2020 election minus the percentage of votes for Trump, at the county level) can be seen in the supplemental materials. Overall, there were very few significant correlations after correcting for multiple comparisons. We found that parental education was related to children thinking that women were more likely to get COVID-19 than men (r = .28) and to parents thinking that Black people were more likely to get COVID-19 than Asian people (r = .21). Additionally, community voting behavior was related to parents thinking that women were more likely to the get COVID-19 than men (r = .22). However, given the large number of correlations conducted, and the exploratory nature of this analysis, these results should be interpreted with caution and should be replicated.

Use of multiple explanatory frameworks

We examined how many different explanatory frameworks participants used throughout the entire study by fitting a linear mixed-effects model with age, illness, and their interaction as predictors as well as by-subject random intercepts. We found that older children used more explanatory frameworks than younger children, $F(1, 169.17) = 62.36$, $p < .001$. Children also used more frameworks when asked about the cold (M = 0.79, SD = 0.56) than COVID-19 (M = 0.74, SD = 0.59), $F(1, 2459.06) = 4.28$, $p = .039$. There was no interaction between condition and age, $F(1, 2454.52) = 0.003$, $p = .955$. We also compared children's explanations for the COVID-19 session to those of parents by fitting a linear mixed effect model and whether the participant was a child or parent as a predictor as well as by-subject random intercepts. We found that parents (M = 2.54, SD = 1.12) used more explanatory frameworks throughout the study than children (M = 1.96, SD = 1.04), $F(1, 155.84) = 20.85$, $p < .001$.We also examined how many different frameworks participants used for each question by fitting a linear mixed-effects model with age, illness, and their interaction as predictors as well as by-subject random intercepts. We found that older children used more explanatory frameworks per question than younger children, $F(1, 168.22) = 52.24$, $p < .001$. There was no effect of illness condition, $F(1, 164.35) = 1.07$, $p = .301$, or age by condition interaction, $F(1, 163.48) = 0.48$, $p = .488$. We also compared children's explanations for the COVID-19 session to those of parents by fitting a linear mixed effect model and whether the participant was a child or parent as a predictor as well as by-subject random intercepts. We found that parents ($M = 0.89$, $SD = 0.62$) used more explanatory frameworks per question than children ($M = 0.74$, $SD = 0.59$), $F(1, 2195.63) = 28.57$, $p < .001$.

Discussion

Given documented and substantial disparities in rates of serious illness with COVID-19 as a function of age, race, and social class, an important question is how children understand and explain these differences. We investigated this issue in terms of the following more specific questions: Do children anticipate disparities on the basis of social groups? If so, which groups are these, and how do they compare to the empirical evidence? How do children explain group differences, or the lack thereof? Do children's judgments and explanations change with age? To examine these questions, we focused on children ages 5-12, who are in a period of substantial development in both biological understanding of illness and beliefs about social categories. We asked about contrasts involving age, race, social class, gender, and personality, and did so for both COVID-19 and the common cold. We also asked the parents of our child participants to report their own beliefs about these same questions, as a basis of comparison.

Relation between social categories and illness

Overall, we found that children and parents often reported that age and social class could influence the likelihood of getting sick but that most of the other social categories we tested were not believed to be related to illness. More specifically, from their unprompted responses and their selections, participants most consistently judged that older adults were more likely than younger adults to get sick, and that poor people were more likely than rich people to get sick. These judgments about age and class aligned with current COVID-19 health disparities, but the judgments about race did not. Although it is well-documented that in the U.S., Black people are roughly twice as likely to get seriously ill from COVID-19 than white people (CDC, 2023), most children and parents thought that the two groups were equally likely to get sick. Nonetheless, it is also important to note that there was some sensitivity to these disparities: When parents thought that one group was more likely to get sick, they more often selected the Black person than the white person. Parents explained this by appealing to structural factors, again aligning with factors identified by researchers (Tai et al., 2021; Vasquez Reyes, 2020). However, children explained this by appealing to behavioral factors and did not mention structural factors, and this did not change with child age. Future work should examine if and how parents discuss racial health disparities with their children, as this might influence how children think about the relation between race and illness.

We also found an interesting change in how participants reasoned about the patterns for children vs. adults regarding COVID. Our child participants thought that children were less likely than adults to get COVID-19, whereas parents thought that children were more likely. Both children and parents explained this difference by appealing to behavioral factors (one child said, “Grown-ups go places where there’s people more than kids do”, whereas one adult wrote, “Children have more difficulty engaging in hygienic behaviors, such as proper handwashing, wearing masks, and social distancing”). It is possible that both children and parents were focusing on the behaviors that make the other group more likely to get sick while ignoring the behaviors that increase the risk for their own group. Future work should examine why this is the case and if this form of in-group bias is seen for other identities.

When asked to choose between a nice person and a mean person, many children chose the mean person. However, we realized during testing that children often focused on the picture of the mean person, who was blowing razzberries, with visible droplets. Some participants mentioned that this could make the mean person more likely to get sick (“She's spitting at people and maybe they would spit back at her and then she catches a cold”) or more likely to get other people sick (“Because she's being mean and like and like [sic] she’s spitting and she might get other people sick so she might get sick”). Given this confound, these results should be interpreted with caution, as they may not reflect a more general belief about nice vs. mean people. Future research should replicate the comparison without showing one of the characters blowing razzberries.

Finally, it is also worth noting that young children rarely judged that gender would influence the likelihood of getting sick. This is of particular relevance as it is well-known that gender is a salient category throughout this age range (Rhodes & Mandalaywala, 2017). This suggests that children may not automatically assume that salient social categories link to illness, but rather are selective in such inferences.

Explanatory frameworks

When explaining differences, children of all ages mostly appealed to explanations about individuals' behaviors, but older children, similarly to adults, were more likely than younger children to use other frameworks as well, including biological, structural, and "everyone equal" explanations. The increased appeal of structural explanations in older children is in line with prior work (Vasilyeva et al., 2018; Vasilyeva & Lombrozo, 2020) on children’s structural thinking. However, children did not use structural explanations for all comparisons. Rather they used them primarily to explain differences due to social class. This could be due to children's intuitive understanding of power and social hierarchies (Gülgöz & Gelman, 2017; Heck et al., 2022), and/or parental input (i.e., note that parental structural explanations for this comparison corresponded to children's own structural explanations, see supplemental materials). Perhaps parents support children's structural reasoning about particular categories, analogous to how parents transmit essentialist ideas about social groups to their children (Rhodes et al., 2012). However, this remains to be studied more systematically.

We also found that parents and older children used more explanatory frameworks than younger children. This suggests that rather than one framework replacing another, over development children add new frameworks to their repertoire, and flexibly use them by drawing on multiple frameworks to explain a difference. This is analogous to prior research on explanatory coexistence (Legare et al., 2012; Shtulman, 2023; Shtulman & Valcarcel, 2012). Importantly, however, neither parents nor children used every framework for every comparison. For example, both parents and children selectively used biological and structural frameworks for specific comparisons such as age and social class, respectively. Future research should examine what drives people to incorporate an explanatory framework to their repertoire and how they decide when to use it.

When explaining illness disparities between younger and older adults, participants typically appealed to biological factors, such as differences in immune function. Children and parents assumed that increased age was predictive of lower overall health, more underlying conditions, or weakened immune response--all of which would then influence the likelihood of someone getting sick. Awareness of disparities related to adult age differences may also have been informed by extensive public health messaging throughout the pandemic, including (for example) high death rates in nursing homes and assisted living contexts, and higher priority given to older adults when vaccinations were first available. Even so, only roughly one-third of children mentioned biological factors, suggesting that an understanding of *why* there are these age differences is undergoing changes with age. Future work should examine when and why children start linking age to biological functions.

An issue that requires further examination is how children and adults were construing the distinction between rich and poor. We have referred to this distinction as "social class," though it should be noted that social class incorporates more than just whether someone is rich or poor, including for example income, education, and occupational prestige. Regardless, both children and adults used structural explanations most often when explaining this difference, indicating that these differences were due to external factors that placed poor individuals at a greater risk of becoming sick (e.g., “Because they don’t have [a] home and they need to sleep outside, outside they got more bacterias [sic].”). At the same time, children's structural explanations often focused simultaneously on how poor people were not able to engage in protective behaviors such as mask-wearing or keeping clean (e.g., “They might be… too poor that they can't buy a mask,” “Because like he might not have enough money to have like water so he can't like wash his hands”). Perhaps a consideration of behaviors provides a scaffold for younger children when reasoning about structural factors. Consistent with this idea is that structural explanations for social class differences increased with age, but behavioral explanations remained stable. In contrast, parents almost exclusively used a structural framework for explaining rich/poor differences. It would be interesting in future work to determine when in adolescence or adulthood people start to appreciate that structural factors per se may have a role in determining outcomes.

In contrast to the well-documented scientific evidence for racial disparities in COVID rates, the most common explanation for the race items was that everyone is equal, and that race or skin color does not matter for who gets COVID-19. Although children and adults understood that structural factors can influence the likelihood of getting an illness in the case of social class, they did not seem to use that same framework when thinking about race. It could be that participants interpreted the question as asking whether race per se (on its own, independent of external circumstances, environment, or structural factors) would influence the likelihood of being sick. Some parents alluded to this in their answers by saying that, “all other things equal”, the two choices would be equally likely. Although this is a reasonable interpretation of the question we posed, it is nonetheless notable that this was not the interpretation that parents provided for social class or age. It is also possible that parents were adopting a colorblind ideology (Plaut et al., 2009). Moreover, given that the majority of our sample was white, and prior work has shown that white parents tend to not discuss racial issues with their children (Abaied et al., 2022; Perry et al., 2019), children may not have received much information from adults about racial health disparities (and the reasons for them). These ideas are speculative but suggest that it will be valuable in future work to examine how parents discuss race, class, and age health disparities with their children, and how such discussions might be related to children's beliefs and explanations.

We also found that "everyone equal" explanations were common for both children and parents (e.g., “Because it doesn't really matter your race you still have the same chance of getting it” and “I’m not sure if gender really matters or anything but they are both human and all humans get it so I would say it’s the same”). It is unclear whether these explanations reflect a belief that illness works at the level of the species (such that individual variation is irrelevant) or instead a lack of understanding of how non-biological factors could play a role.

Although we have focused on whether participants' responses aligned with documented health disparities, we should also note that some participants selected the opposite options (e.g., selecting the younger adult, or rich person). Typically, such selections were explained in terms of behavioral choices, such as not wearing a mask or congregating in large groups. Such explanations reveal sensitivity to the complexity of making predictions, as a person's susceptibility to disease requires consideration of biological, structural, and behavioral factors, all of which may intersect.

Overall, we saw very few differences between children's reasoning about COVID-19 and the common cold, in line with prior work focused on viral transmission beliefs (Labotka & Gelman, 2023). This was somewhat surprising in this context, however, because COVID-19 disparities have received considerably more attention than cold disparities. It is possible that children generalized disparities that they learned about one illness to the other. The age-related differences in children's used of different explanatory frameworks for why people get sick also illustrates how children's reasoning about illness becomes more nuanced with age. Prior work has shown considerable development in children's understanding of illness in the age range studied here (Kalish, 1996; Labotka & Gelman, 2023). However, those studies have focused on the biological aspects of illness. Our findings indicate that children are acquiring more information not only about biology, but also about how biological factors might interact with structural or behavioral factors to determine the risk of someone getting sick.

Limitations

There are several limitations with this study. First, we asked participants to make judgments about individuals (e.g., one older adult, one younger adult) rather than categories (e.g., older adults, younger adults). This approach was taken in order to make the task more accessible to children, but it is possible that it biased people to focus on individual-level explanations, such as personal choice. Perhaps children would have used other frameworks if the focus was on groups instead. A related point is that participants might have interpreted the questions as asking whether the social category in isolation influences the likelihood of getting sick. As noted earlier, some parents explicitly adopted this perspective with regard to race (e.g., "If they are taking the exact same precautions, they are equally at risk"). It is possible that had we asked about groups rather than individuals, participants might have focused more on structural factors that correlate with race or class.

Second, in our stimuli we held all other factors constant when asking children about a particular comparison, which did not permit taking into account the intersectional nature of both social identities and health disparities. This was done in order to reduce task complexity and as a first step in examining children's use of social categories when thinking about illness. However, given the present findings that children do use social information in at least some situations, it will be important for future research to investigate how they reason about intersectional identities. There has been a growing appreciation of the need to consider intersectionality in developmental psychology (Lei et al., 2023), including in children's understanding of intersectional social categories (Lei et al., 2020; Leshin et al., 2022). This work highlights the need for follow-up work that examines how children think about health disparities in ways that embrace the complexity of social identities.

Third, most of the families in this study were white and upper-middle class. Although it was not the intention of the study to sample primarily from this group, it nonetheless limits the generality of our findings and poses challenges for how best to interpret the findings. For example, we cannot know if selection of Black or Asian people as being more susceptible to illness was due to awareness of true racial disparities, or simply an in-group preference. Conversely, children's lack of awareness of racial disparities may reveal the socialization practices of parents in white upper-middle class families, who might not have seen the need to discuss disparities related to race or class, as they did not impact their children directly. In contrast, parents might have felt the need to talk about age disparities in order to protect grandparents. This could explain why children showed knowledge of age disparities, but did not consistently select other groups. Therefore, more research is needed with families from different communities, particularly Black, Indigenous, and Latinx communities that were (and are) more affected by the pandemic, and from communities with different socio-economic backgrounds, in order to understand how children think about the relation between social categories and illness. Additionally, future research should examine whether caregivers discussed health disparities with their children. Although prior work has examined parent-child conversations about COVID-19 (Haber et al., 2022; Labotka & Gelman, 2023; Menendez et al., 2021), none have reported discussions of health disparities. This could mean that parents are not having these conversations or that they did not think to report them when asked about conversations with their children about COVID-19. Directly asking parents if they have had conversations about health disparities will help distinguish between those possibilities and will enhance our understanding of how children are socialized into thinking about health disparities.

Finally, we cannot rule out the possibility that social desirability may have influenced participants' responding. At least some participants may have answered that both characters in the comparison were equally likely to get sick, in order to not be perceived as prejudiced. We hoped to mitigate this concern by having the parents answer through an anonymous survey without an experimenter present, but this was not possible for the children. Therefore, social desirability might still play a role.

Conclusion

In this study we were interested in whether children saw a relation between social categories and illness, and if so, how they would explain them. We found that children reported that most social categories were not related to the likelihood of getting sick, except for age and (to a lesser degree) class. Children typically explained differences by appealing to behavioral explanations, but at times used biological and structural explanations for comparisons involving age and social class, respectively. Children's explanations were related to their parents' explanations, suggesting that children might be socialized to see links between social categories and illness. We also saw that children's use of explanatory frameworks that were not based on individual choice increased with age. Overall, this suggests that children can understand that health disparities are related to social categories, but their understanding of which categories are relevant and the reasons why social categories influence health undergo important changes over middle and late childhood.

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Table 1. Pre-registered codes for explanations. Note that some of these examples would also receive another code.

Code	Description	Example	% agreement	Kappa
Biological	Biological factors such as: immune system, bodies, genetics, underlying or pre-existing health conditions, healthiness/unhealthiness, or comorbidities.	"Their immune system is starting to become like less strong."	C: 99% P: 97%	C: .94 P: .85
Structural	Structural factors such as: racism, poverty, working conditions, living conditions, access to healthcare, access to food, or the environment.	"They might not have enough to pay for healthcare."	C: 99% P: 97%	C: .85 P: .86
Behavioral	Actions or behaviors.	"They are mean and so they probably they probably [sic] are gonna bring their tongue out, spit at people, and not wear masks."	C: 93% P: 91%	C: .85 P: .80
Everyone equal	Viruses or diseases do not discriminate between social categories; the two people in question are both human and thus equal.	"It doesn't matter the gender that you are." "They're the same, because, like they're both adults."	C: 87% P: 87%	C: .84* P: .83*
Generic claims	Use of a generic noun phrase about a social category.	"When you're older it's easier to get germs." "Kids' immune systems are stronger than adults."	C: 95% P: 93%	C: .63 P: .76
Transmission event	The transmission process, such as virus/illness spread, how viral infection occurs, contact with germs, and individuals exhibiting signs of illness.	"Somebody with covid could have touched the money and gave it to him."	C: 96% P: 90%	C: .82 P: .74

Note: * indicates that Fleiss' Kappa was calculated instead of Cohen's Kappa due to the presence of more than 2 coders.

Table 2. Exploratory codes for children's responses to whether certain kinds of people are more likely to get sick.

Code	Description	Example	% agreement	Kappa
First pass – Some categories are more likely	Participant said that some kinds of people were more likely to get sick	"Yeah, it depends, um well also it depends on like how good your immune system is."	C: 94% P: 100%	C: .86 P: 1.00
Second pass- Content of response				
Biological	Bodies, medical conditions, or immune system.	"The only one that I really know is people with asthma, maybe."	C: 95% P: 96%	C: .85 P: .86
Behavioral	Behaviors, like not wearing masks.	"Probably just the people who aren't taking the proper precautions."	C: 100% P: 96%	C: 1.00 P: .91
Situational	Situations that people they find themselves in.	"People who are around more germs."	C: 93% P: 92%	C: .73 P: .75
Social categories	A particular category of people.	"I'm pretty sure that it was like older people that were more like able to get it."	C: 95% P: 87%	C: .90 P: .74
Cold weather	Cold weather, getting wet, not being properly clothed or exposed to the cold.	"Maybe if they live in a cold place."	C: 100% P: 100%	C: 1.00 P: 1.00
Other	Any other response.	"Lots of people."	C: 95% P: 100%	C: .64 P: 1.00
Third pass- Social categories				
Older adults	Old people, older adults, or the elderly.	"Older people who have less strong immune system."	C: 95% P: 100%	C: .86 P: 1.00
Younger adults	Young adults.	"Younger people."	C: 91% P: 100%	C: .61 P: 1.00
Children	Babies, infants, kids, children, teenagers, or adolescents.	"Big kids."	C: 86% P: 100%	C: .58 P: 1.00
Poor people	Poor people, homeless, or low SES.	"Maybe poor people because they're like outside."	C: 100% P: 100%	C: 1.00 P: 1.00
Rich people	Rich people, affluent people, or high	"Rich people also get more people sick	C: 100%	C: 1.00

	SES.	because they don't care about others."	P: 100%	P: 1.00
Black people	Black people.	"White and Black people."	C: 100% P: 100%	C: 1.00 P: 1.00
White people	White people.	"Older people and White people."	C: 100% P: 100%	C: 1.00 P: 1.00
Asian people	Asian people.	"The Asians."	C: 100% P: 100%	C: 1.00 P: 1.00
Other social category	Any other social category.	"People with disabilities."	C: 100% P: 86.7%	C: 1.00 P: .45

Table 3. Children's and parents' selections for who was more likely to sick, separated by illness. Table provides the percentage of participants who provided that response, and the information on the t-test testing whether this percentage was different from chance (33.33%). Results were corrected for multiple comparisons such that we used an alpha level of .017 (.05/3). Cells in green were significantly above chance, and cells in red were significantly below chance.

	Children						Parents		
	COVID			Cold			COVID		
Comparison	%	*t*(173)	*p*	%	*t*(159)	*p*	%	*t*(111)	*p*
Old adult or young adult									
Old adult	60.34%	7.35	< .001	47.50%	3.66	< .001	72.32%	9.26	< .001
Both equally	33.91%	0.25	.801	44.38%	2.88	.004	25.00%	-1.95	.054
Young adult	5.75%	-15.40	< .001	8.12%	-11.48	< .001	2.68%	-19.79	< .001
Child or Adult									
Child	22.54%	-3.28	.001	31.48%	-0.41	.679	46.43%	2.84	.005
Both equally	39.31%	1.69	.092	45.68%	3.23	.001	39.29%	1.36	.178
Adult	38.15%	1.39	.166	22.84%	-3.07	.002	14.29%	-5.63	< .001
White person or Black person									
White person	1.16%	-38.83	< .001	4.35%	-17.77	< .001	0.00%	NA	NA
Both equally	94.19%	34.19	< .001	92.55%	28.68	< .001	71.43%	8.96	< .001
Black person	4.65%	-17.60	< .001	3.11%	-21.80	< .001	28.57%	-1.03	.304
White person or Asian person									
White person	2.87%	-23.72	< .001	3.09%	-21.95	< .001	4.46%	-14.56	< .001
Both equally	91.95%	28.51	< .001	88.27%	21.80	< .001	90.18%	20.24	< .001
Asian person	5.17%	-16.53	< .001	8.64%	-11.00	< .001	5.36%	-12.93	< .001
Asian person or Black person									
Asian person	5.17%	-16.27	< .001	2.47%	-24.96	< .001	0.00%	NA	NA
Both equally	86.78%	20.89	< .001	91.36%	26.35	< .001	78.57%	11.70	< .001
Black person	8.05%	-12.07	< .001	6.17%	-14.14	< .001	21.43%	-2.97	.004
Poor person or Rich person									
Poor person	40.46%	1.99	.048	41.98%	2.31	.022	49.11%	3.39	.001
Both equally	55.49%	5.95	< .001	53.70%	5.27	< .001	50.89%	3.77	< .001
Rich person	4.05%	-19.27	< .001	4.32%	-17.90	< .001	0.00%	NA	NA
Man or Woman									
Man	4.02%	-19.40	< .001	3.70%	-19.68	< .001	7.14%	-10.58	< .001
Both equally	94.83%	36.72	< .001	91.98%	27.54	< .001	92.86%	24.49	< .001
Woman	1.15%	-39.30	< .001	4.32%	-17.90	< .001	0.00%	NA	NA
Nice person or Mean person									
Nice person	5.17%	-16.53	< .001	6.17%	-14.14	< .001	0.00%	NA	NA
Both equally	66.67%	9.39	< .001	67.28%	9.27	< .001	96.42%	36.01	< .001
Mean person	28.16%	-1.41	.159	26.54%	-1.85	.065	3.57%	-16.71	< .001

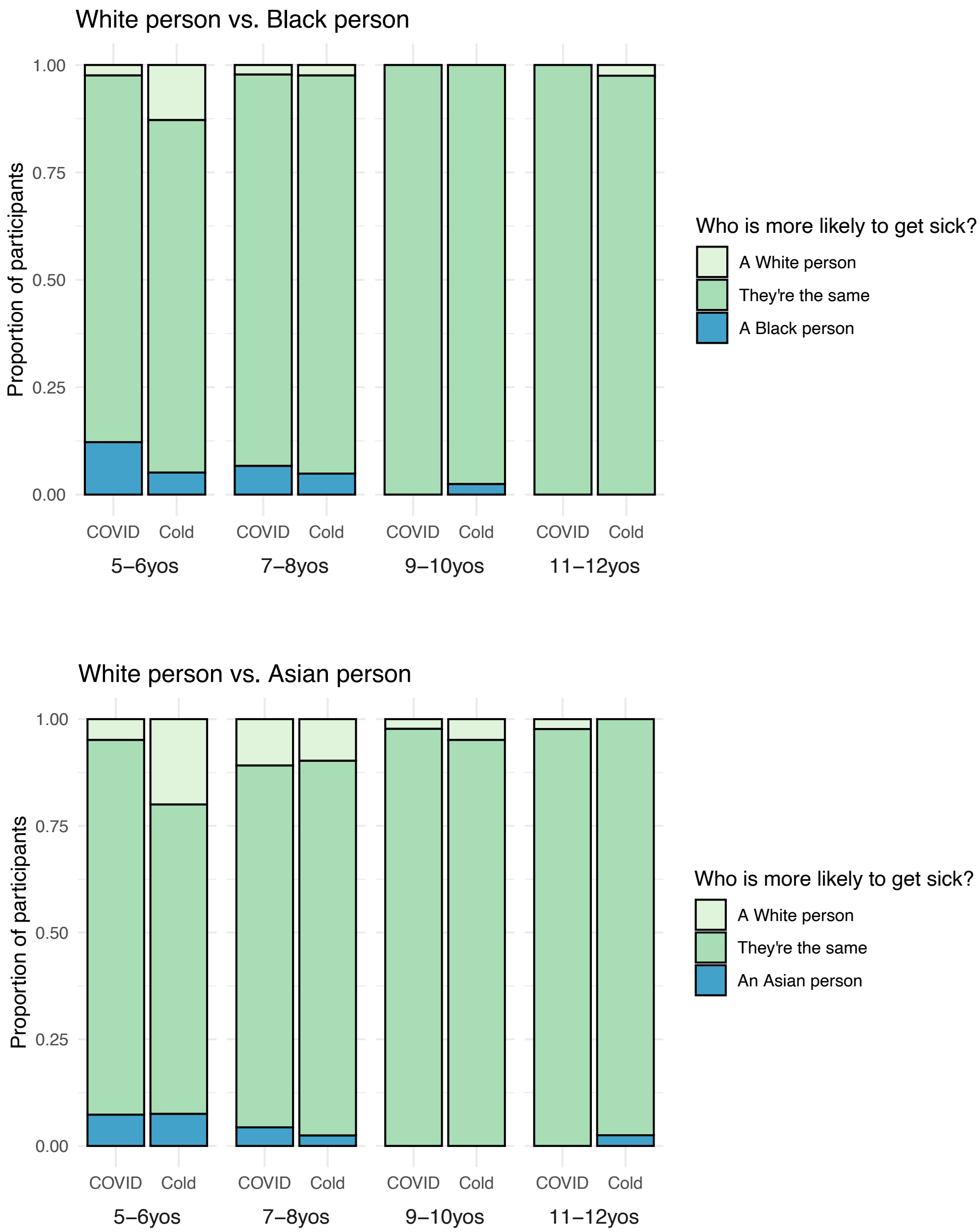

Figure 1. Proportion of children that selected each choice for the white person-Black person (top panel) and the white person- Asian person (bottom panel) comparison, divided by age group (x-axis), illness condition (x-axis), and choice (color).

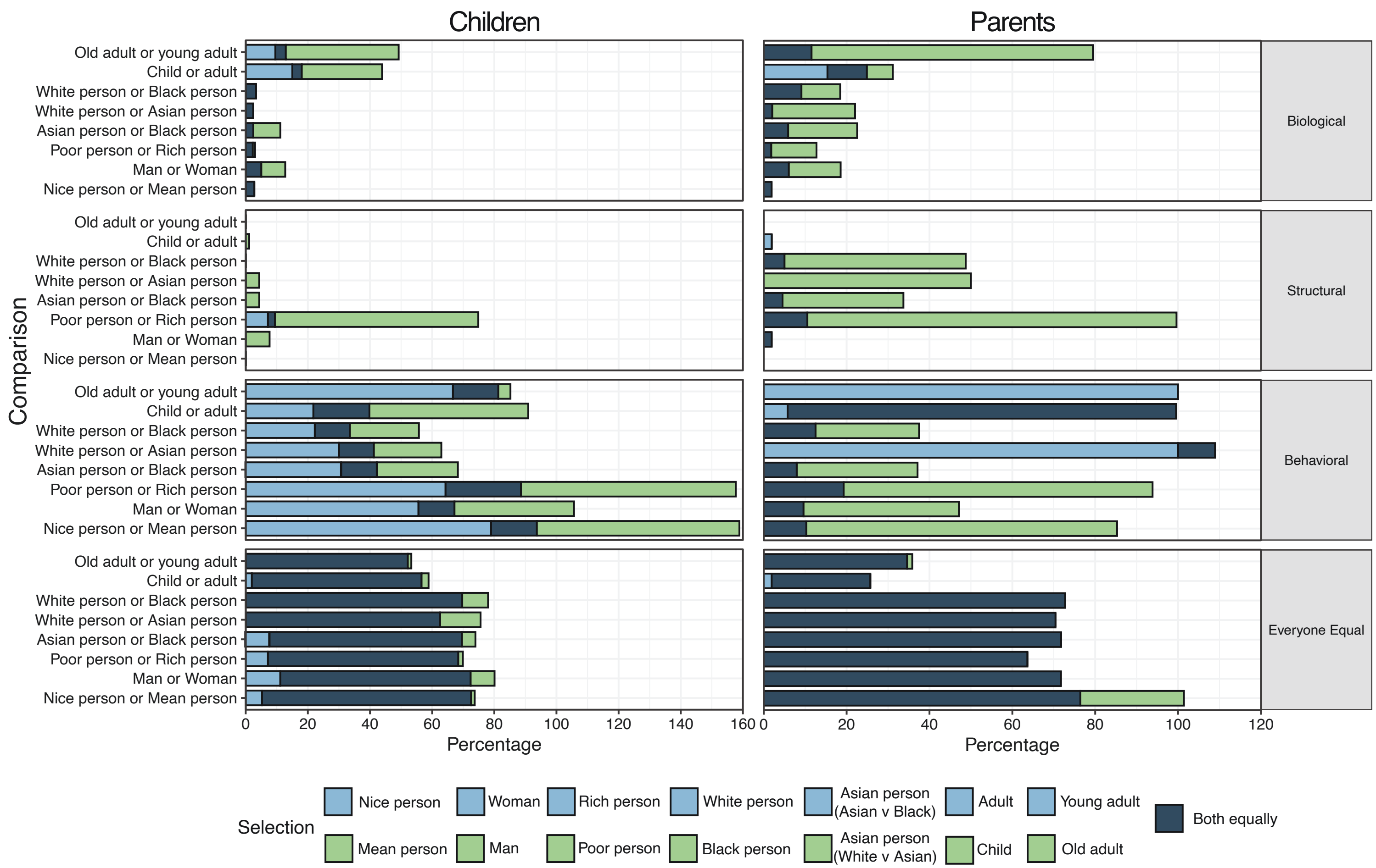

Figure 2. Percentage of children (left panels) and parents (right panels) giving a particular response type (color) who received each code for a given explanation (biological explanations in the top rows, then structural, behavioral, and everyone equal). Percentages can add to more than 100% as they reflect the *sum* of the percentage of people who provided that explanation type for each of the responses provided (e.g., 64% of children who selected that rich people were more likely to get sick provided behavioral explanations, 69% of children who selected that poor people were more likely to get sick also provided behavioral explanations, and 24% of children who selected both rich and poor equally also provided behavioral explanations; therefore that bar adds to 157%).