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Evaluating climate change behaviors and concern in the family context

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ABSTRACT

Although research suggests that family dynamics likely play a role in shaping children's behaviors, few studies focus on environmental behaviors, and none to our knowledge investigate how parents shape climate change mitigation behaviors among their children. We begin to fill this gap through a quantitative case study using matched household-level survey data from 182 coastal North Carolina families ($n = 241$ parents aged 29–77; $n = 182$ students aged 11–14) associated with 15 middle school science teachers. Family climate change discussions, parent behaviors, and children's climate change concern levels predicted the degree to which children will participate in individual-level climate mitigation behaviors. These results provide evidence that promoting climate-related conversations within households may promote climate action even when parents are apathetic about climate change. Similarly, parental behaviors, but not their concern levels, were important predictors of adolescent behaviors. This study highlights novel ways that family dynamics may promote climate change mitigating behaviors and a new pathway to promoting climate mitigation at familial, and ultimately, societal levels.

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Introduction

Recent technological advances have generated solutions to many climate-change-related challenges, but social barriers to action continue to prevent a collective response to climate change. Although innovative strategies such as disease and drought resistant crops (Godfray et al. 2010), subsurface water desalinization techniques (Zuurbier et al. 2016), and community smart grids (Stephens, Wilson, and Peterson 2015) continue to make important contributions to future adaptations, the success of these approaches hinges on broad societal support. Among adults, building support remains difficult for a variety of reasons. The complexity of climate science makes climate change difficult for many to grasp, including those who are scientifically literate (Cornforth 2011; Sterman 2011; Stoutenborough and Vedlitz 2015). Further, although scientific understanding of climate change has been linked to climate change concern (Shi et al. 2016), a

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robust body of research suggests political ideology and cultural worldview are the largest drivers of climate change perceptions (Hamilton 2011; Hornsey et al. 2016). Some research suggests increasing the public's scientific literacy tends to further polarize climate change perceptions, both because individuals tend to seek out information sources that fit within their personal ideologies (Hamilton 2011) and because people who are scientifically literate are more adept at using new information to reinforce their worldview-driven beliefs (Kahan et al. 2012). Combined with the prevalence of climate communication efforts designed to foster climate change denial (Boykoff 2013; Medimorec and Pennycook 2015), climate communication efforts among adults have largely failed to encourage a collective response to climate change.

Climate change perceptions among young adults

Engaging with younger audiences provides a promising approach to overcoming social barriers to widespread adoption of climate change mitigation behaviors (heretofore 'climate behaviors'), such as energy conservation. Children are an age group that is particularly important as they are developing cognitively, socially, and emotionally (Keating 2004), which may explain why they approach climate change differently than older generations. For example, recent research with adolescents suggests that although worldviews may drive polarization at low levels of climate change understanding (Stevenson et al. 2014), climate change specific education results in a greater consensus in climate change beliefs and concern, regardless of worldview (Bofferding and Kloser 2015; Flora et al. 2014; Reinfried, Aeschbacher, and Rottermann 2012; Stevenson et al. 2014). This emerging research is encouraging because collective climate action among future generations will be imperative, as recent studies have shown that the effects of climate change will be widespread by 2030, when today's children will be entering adulthood (IPCC 2014; McMichael 2014). Collective action on climate change among voters, decision makers, and consumers will be critical to generating adaptive strategies and mitigating future impacts.

Research on climate behaviors among adolescents suggests that impacts of interactions with others is a key factor to investigate. Communication from trusted messengers, such as scientists and teachers (Arnold, Cohen, and Warner 2009; Feldman et al. 2010), or those within a close social circle, such as friends and family (Arnold, Cohen, and Warner 2009; Vreede Warner, and Pitter 2017), seems to encourage adolescent engagement with climate change issues. For instance, teachers are noted to not only raise awareness about issues such as climate change but also provide examples for their students about ways to take action in their day-to-day lives (Arnold, Cohen, and Warner 2009). Although teachers seem to shape climate change perceptions, their influence may be somewhat limited. While Stevenson, Peterson, and Bradshaw (2016) found that teachers who believe that climate change is happening predicted students' beliefs that it is both happening and anthropogenic, they also found that teachers' views on anthropogenic causes had no relationship with the views of their students. In addition, Feldman et al. (2010) found that although adolescents trusted scientists as a source of scientifically accurate information about climate change, adolescents did not expect scientists to be responsible for taking action and instead placed that charge on the government. In terms of their social circles, children who perceived their friends and family accepted anthropogenic climate change were more likely to be concerned themselves (Stevenson, Peterson, and Bondell 2016), and those who discussed climate change with their friends and family were more likely to be concerned (Mead et al. 2012; Stevenson et al. 2016) and engage in climate behaviors (Valdez, Peterson, and Stevenson 2017).

Potential of family dynamics in shaping climate change perceptions

Unique familial characteristics may play a pivotal, yet understudied, role in explaining climate behaviors among adolescents. There is a large body of research showing clear links between

parent and child behaviors in the developmental psychology literature, with notable examples including eating behaviors (Scaglioni, Salvioni, and Galimberti 2008), sexuality (Slater and Tiggemann 2016), and academic habits (Hofferth and Sandberg 2001). However, less research has related parent and child behaviors within the realm of the environment or climate change. Studies highlight links between perceived parental climate change beliefs and adolescent climate change concern (Stevenson et al. 2016), and find that children appear to mirror parents' information-seeking behaviors when gathering information on climate change (Mead et al. 2012). Looking broadly to literature on general environmental engagement, parents seem to play a significant role in shaping their children's environmental perceptions (Corner et al. 2015). Yet, to our knowledge, none of these studies have explored how parental climate concern or behaviors related to climate change predict children's behaviors. Further, only one study of which we are aware utilized matched household level data of both parents and children (Mead et al. 2012), and this study did not directly address climate behaviors. More research investigating familial influences within the realm of climate change is needed, particularly with matched household level data, as it will allow researchers to begin understanding the relative importance of variables that cannot be easily changed (e.g., family dynamics) compared to those variables that may be changed through education interventions with children (e.g., climate change knowledge and concern).

Study objective

In this study, we address the need for research linking climate change related views and behaviors within families through a case study in North Carolina (NC), USA, using matched parent and child level data. We examined a random sample of 182 unique families consisting of one or two parents and one child in early adolescence (i.e., 11–14 years old). For the purposes of this paper, 'parent' refers to parents, parental figures, and/or guardians (e.g., grandparents, foster parents). We hypothesized: (1) child climate change concern would be positively related to child climate behaviors, (2) parent climate change concern would be positively related to child climate change behaviors, and (3) parent climate behaviors would be positively related to child climate behaviors. As research supports the importance of climate change discussions among families for influencing family engagement in climate issues (Corner et al. 2015; Mead et al. 2012; Stevenson et al. 2016), we also predicted (4) a positive relationship between child and parent behaviors strengthens when families discuss climate change with greater frequency, and (5) a positive relationship between parent climate concern and child behaviors strengthens when families discuss climate change with greater frequency. In addition, we controlled for sex, ethnicity, and political identity of both children and parents; as all three variables have been positively associated with belief in anthropogenic climate change (Brownlee, Powell, and Hallo 2013; McCright 2010; McCright and Dunlap 2011; Stevenson et al. 2014).

Methods

Sampling

We chose to focus on early adolescents as this age group is developmentally capable of understanding complex topics such as climate change (Mason and Scirica 2006) while also still forming opinions on controversial topics and constructing their worldviews (Vollerberg, Iedema, and Raaijmakers 2001). We used a hierarchical sampling design (Ericson and Gonzalez 2003) through public schools, as this affords access to a diverse sample of children. First, we sampled middle school teachers (grades 6–8) and then students (ages 11–14); and through the students, we were able to gain access to and sample their parents. To begin, we compiled a sample frame of all middle school science teachers in a region that included the 20 coastal counties in North

Carolina (NC), and confirmed the accuracy of the sample frame by phone calls to each school to ensure teacher employment. We chose to use the coastal counties for this study as they are particularly vulnerable to climate change impacts such as sea level rise, storm surges, and salt water intrusion (Riggs et al. 2011). We randomly selected 200 of the 432 teachers to recruit through email invitation. Of those 200 teachers, 43 responded as interested (21.5% response rate), and 20 committed to the study (46.5% compliance). Over the course of the project, five teachers withdrew from the study, citing missed instructional time because of lost school days from Hurricane Matthew in October 2016, which resulted in 15 participating teachers. The participating teachers' students were included in the study based on their assignment to consenting teachers by school administrators following standard methods. Similarly, we invited parents to participate in the study through distributing invitation letters distributed from the teachers through their students.

Our child sample consisted of 284 sixth-grade students, 353 seventh-grade students, and 328 eighth-grade students. Children respondents' ages ranged from 11 to 14 years of age, and were 49.1% male, and 56.5% Caucasian. Our parent sample consisted of 241 responses, representing a 24.9% response rate assuming a possible sample of at least one parent per child ($n = 965$). In most households, only one parent responded, although 61 households had two parents respond, resulting in 180 unique family units. Parent respondents ranged from 29 to 77 years of age, were 30.9% male, and 78.3% Caucasian.

Questionnaire development and deployment

In creating our parent and child instruments, we relied on previously published scales that have been used with adolescents. To measure concern for global climate change on both the child and parent instruments, we drew on scales utilized in the 2011 nation-wide climate change adolescent survey (Leiserowitz, Smith, and Marlon 2011). Our climate behaviors scales for both parents and children were modified from the Climate Change Behavior scale utilized by Stevenson and Peterson (2015) and contained both individual (e.g., 'I turn off the lights at home while they are not in use'), and collective action behaviors (e.g., 'I talk with my family about how to do something about environmental problems'). We asked both children and parents the same questions, except for one question concerning a child's behaviors in school (i.e., 'I choose an environmental topic when I can choose a topic for an assignment in school'), which we omitted for parents. Lastly, family level of climate change discussion was measured through a single item used in past studies (Leiserowitz, Smith, and Marlon 2011; Valdez, Peterson, and Stevenson 2017) on the student instrument that asked, 'How often have you discussed climate change at home with your family?'

We pilot tested the child and parent instruments with two classes of coastal NC middle school students ($n = 62$) and a group of adults accessed through social media (i.e., Facebook) and email ($n = 83$), respectively. For middle school students, we sent a Qualtrics survey link to three middle school teachers who agreed to administer the online survey to their students. For adults, we posted the link to the survey on social media outlets managed by the researchers and sent individual invitation emails to gather responses. On the Qualtrics surveys, both children and parents were given the opportunity to comment on which questions or parts of questions they felt were confusing, through open-ended guided questions (e.g., 'Did any parts of this question not make sense to you?' and 'In your opinion, what is this question asking?'). We conducted follow-up cognitive interviews (Desimone and Le Floch 2004), with 11 children and 12 adults to further refine items to improve clarity and face validity. We analyzed each scale within the pilot test, and found each to have acceptable internal consistency (Cronbach 1951) ($\alpha = .90$ for parent climate concern, $\alpha = .77$ for parent climate behaviors, $\alpha = .79$ for child climate concern, $\alpha = .76$ for child climate behaviors), and be single factor scales (all items in each of the four scales had factor loadings of at least 0.4 (Comrey and Lee 2009).

Following the pilot testing, we collected child and parent responses from September to November 2016. We provided teachers with a detailed data collection protocol and links to the survey through Qualtrics, and teachers administered the survey to students during class time. We asked teachers to email all parents invitation letters with a URL and QR code that linked to the parent survey. Two weeks after teachers contacted parents by email, we followed up with parents who had not responded by sending a paper version of the survey. We provided teachers with sufficient copies of a paper survey along with addressed stamped return envelopes, and teachers sent home these survey packets with students.

Analysis

We used multiple linear regression analyses to model child climate behaviors as a function of child climate concern, parent climate concern, parent climate behaviors, and discussion of climate change in the family setting. We tested for an interaction between family discussions and parent behaviors, as well as an interaction between discussions and parent concern. We also included control variables of sex (male vs. female), race/ethnicity (white vs. people of color), and political identity of both parents and children. Prior to statistical analysis, we collapsed both child and parent ethnicity into dichotomous variables (white = 1, people of color = 0) due to small sample size. We included school level development status (rural = 1, non-rural = 0), and Title 1 Status (Title 1 = 1, Non-Title = 0) as a measure of income level. Title I status is a commonly used measure in the United States of school-level socioeconomic status. Title I schools receive additional funding from the federal government based on a high percentage of students that fall into low-income categories (107th Congress 2002). We conducted data analysis using STATA 14.2.

Results

Climate behavior scales and climate concern scales for both children and parents represented a spectrum of concern and behavior from unconcerned (–8) to concerned (8), and climate unfriendly behaviors (–15) and climate friendly behaviors (15). All scales displayed acceptable reliability and validity, with Cronbach's alpha levels at acceptable levels (child behavior: 0.76; parent behavior 0.76; child concern at 0.70, parent concern at 0.90; Tables 1–3, respectively) and loaded to one factor as expected (Tables 1–3). On average, children were found to be somewhat unconcerned with climate change overall with a mean score of –0.957 and a standard deviation of 3.352. Child climate behaviors had a mean of 0.717, and a large standard deviation of 5.967. Parent's climate concern was found to be similar to children, with a mean of –0.188 and a standard deviation of 4.050. Parents were found to act more climate-friendly in their behaviors, with a mean of 5.594, and a standard deviation of 4.336. Political orientation of parents and parent climate concern were related ($r = .45$, $p < .001$), as were political orientation of the children and child climate concern ($r = .11$, $p = .03$). Although the correlations between these variables were statistically significant, the magnitude of the correlations were below the threshold for

Table 1. Item factor loadings for the parent climate behavior scale ($n = 241$, $\alpha = .77$).

Item	Mean	SD	Factor loadings
Talk with my family about how to do something about environmental problems	–0.29	0.96	.61
Turn off the lights at home when they are not in use	1.50	0.69	.41
Ask my family to recycle some of the things we use	0.98	1.11	.86
Research things that I can do about environmental problems	–0.51	1.04	.61
Ask the people in my family to turn off the water when it is not in use	1.59	0.73	.42
Close the refrigerator door while I decide what to get out of it	1.40	0.90	.40
Recycle at home	0.92	1.20	.82

Each item associated with a 5-point Likert scale ranging from (–2) never to (2) always.

Table 2. Item factor loadings for the child climate behavior scale ($n = 180$, $\alpha = .76$).

Item	Mean	SD	Factor loadings
Talk with my parents or guardians about how to do something about environmental problems	−0.75	1.03	.54
Ask others about things I can do about environmental problems	−1.09	0.99	.46
Turn off the lights at home when they are not in use	0.87	1.17	.55
Ask my family to recycle some of the things we use	0.11	1.48	.80
Ask other people to turn off the water when it is not in use	0.45	1.47	.46
Close the refrigerator door while I decide what to get out of it	0.54	1.52	.50
Recycle at home	0.59	1.54	.64

Each item associated with a 5-point Likert scale ranging from (−2) never to (2) always.

Table 3. Item factor loadings for the child & parent climate change concern scale (Child: $n = 180$, $\alpha = .79$; Parent: $n = 241$, $\alpha = .90$).

Question	Child mean	Child SD	Child factor loadings	Parent mean	Parent SD	Parent factor loadings
How worried are you about climate change? a. Not at all worried (2) b. A little worried (1) c. Moderately worried (0) d. Very worried (−1) e. Extremely worried (−2)	−0.817	0.998	.71	−0.483	1.120	.79
How much do you think climate change will negatively affect you personally? a. Not at all (−2) b. A little (−1) c. Somewhat (0) d. A lot (1) e. A great deal (2)	−0.739	1.099	.67	−0.406	1.170	.81
How much do you think climate change will negatively affect people in the United States? a. Not at all (−2) b. A little (−1) c. Somewhat (0) d. A lot (1) e. A great deal (2)	0.213	1.012	.70	0.114	1.147	.89
How much do you think climate change will negatively affect future generations of people? a. Not at all (−2) b. A little (−1) c. Somewhat (0) d. A lot (1) e. A great deal (2)	0.387	1.146	.67	0.587	1.189	.79

Numbers beside each answer choice represent coding used.

autocorrelation ($r = .80$), so we chose to leave both in the model (Keith 2015). Furthermore, VIF tests were considered acceptable (variable levels < 1.5, and total variance inflation factor of < 1.5) (Keith 2015).

Results from hypothesis testing are displayed in Table 4. We found support for Hypothesis 1 that children's climate change concern was positively related to children's climate behaviors. We rejected Hypothesis 2 as parents' climate change concern was not related to children's climate behaviors. We found support for Hypothesis 3, as parents' climate behaviors were positively related to children's' climate behaviors. We found partial support for Hypothesis 4. Although children in families who discuss climate change were more likely to engage in climate behaviors, we did not find an interaction effect between parent behaviors and discussion of climate change. Hypothesis 5 was similarly only partially supported, as we did not find an interaction effect

Table 4. Regression results of model predicting child climate behavior based on climate scales and control variables.

	Child climate behavior		
Variable	*B*	SE	*β*
Family climate change discussion	1.070***	0.278	0.269
Parent climate behavior	0.370***	0.088	0.268
Child climate concern	0.479***	0.119	0.240
Parent climate concern	–0.037	0.107	–0.025
Control variables			
Child sex	0.631	0.703	0.053
Parent sex	0.274	0.752	0.021
Child race	0.368	0.866	0.031
Parent race	–0.008	1.055	–0.001
Child political identity	0.382	0.316	0.073
Parental political identity	–0.488	0.358	–0.092
School rural/urban status	0.301	0.754	0.025
School title I status	–0.644	0.814	–0.048
Constant	–4.255		
N	241		
R^2	.272		

Note. Data were collected between October and November 2016 from coastal NC middle school students.
Sex was coded 0 = Female and 1 = Male. Race was coded 0 = People of Color and 1 = White. School Title 1. Status = 1, Non-Title 1 Status = 0.
*** $p < 0.001$.
$N = 229$.

between parent climate concern and discussion of climate change. Frequency of climate change discussion was positively related to children's climate behaviors regardless of the behaviors or climate concern of the parents. Frequency of discussion was the strongest predictor of child climate behaviors, followed by parent climate behaviors and child climate concern ($\beta = .269$, .268, .240, respectively; see Table 4).

Discussion

This research builds on previous studies of how parent and adolescent climate change behaviors may relate to one another in two ways. First, our findings provide the first evidence of household effects on adolescent climate change related behaviors measured using input from adolescents and their parents. These findings support previous work identifying household level relationships in environmental attitudes based on parental guesses of attitudes among their adolescent children (Clark et al. 2017). Similarly, research using adolescents to guess parental attributes identified shared household level climate change concern, from the perspective of the children (Stevenson, Peterson, and Bondell 2016). In this study, children's climate change concern predicted their own behavior independent from parent concern levels, but there were multiple household level effects. Family level of climate change discussion was found to be the strongest predictor of children's climate behaviors, followed closely by a parent's likelihood to engage in those same climate behaviors. Previous research has found that during adolescence, a child's attitudes and norms start to become more engrained, and resistant to the influence of a parent or other family member (Vollerberg, Iedema, and Raaijmakers 2001). This may help explain why although children are able to apply their concern levels to behavior independently of parents, their behaviors are influenced by those of their parents.

Second, this study begins unraveling the relative importance of factors explaining parental influence on adolescent climate change perceptions and behaviors with levels of family discussion being more important than parent climate behaviors and child climate concern, respectively. This hierarchy may be explained by Socio-Cultural Theory (SCT), which posits that learning occurs through socialization and interaction with others, and learned behaviors are many times copied

from those that are closest to an individual in their social network (Vygotsky 1978). As parents are typically among the closest individuals in a child's personal network, SCT would predict parental climate change behaviors directly relate to those of their children. This is reflected in our results, because family discussions on climate change and parent climate behaviors are the two biggest predictors of child climate behaviors, and are more important than demographics. Demographic predictors of climate change perceptions and behaviors (i.e., race, sex), are likely a result of gender socialization and racial/ethnic culturalization (see below), processes which are only beginning among children. Parental behaviors being more important than demographic attributes of children seems reasonable given the nascent stages of gender socialization and culturalization at adolescent ages (Carter 2014) as compared to the immediate and daily interactions between children and parents. This new understanding contributes to the greater literature on SCT and climate change, and can be used in future climate change education programs, focusing on promoting familial conversations on climate change as well as continuing to encourage appropriate climate behaviors. Future research is needed to better understand which climate behaviors are likely to be emulated by adolescents, and how the influence varies by parental figure (e.g., mom vs. dad, or parent vs. grandparent).

Although family level variables are important predictors of child climate behaviors, our results suggest children's concern about climate change is a second and independent factor. Research by Stevenson et al. (2016) suggests that adolescents' personal climate change concern was more powerful than the descriptive norms modeled by friends and family members. Furthermore, recent studies suggest family discussion of climate change was key for increasing the climate literacy of youth, and personal climate change concern is a critical secondary factor (Shealy et al. 2017; Valdez, Peterson, and Stevenson 2017). By controlling for parental views and testing for potential interactions with them, which were not found, our study adds to this research by suggesting adolescent concerns operate on climate behaviors independently from parental drivers. This independent effect may be explained by adolescent cognitive developmental changes reflecting the development of a more self-directed and self-regulating mind (Keating 2004). Similarly, we did not detect interactions between levels of discussion and parent concern or behavior, suggesting family discussions of climate change prompt behavior change among adolescents regardless of the climate change views of parents. These two findings together may point to adolescents' abilities to both form and act on their own perceptions of climate change independently of the views of their closest, and likely most important role models, parents. Future research is needed to understand the specific nuances of how a child's perceptions on climate change are formed in family settings, particularly at different ages.

This study suggests previously identified relationships between a child's sex and climate change behaviors may emerge from underlying family dynamics. Previous research on adolescents suggests that females are more likely to be concerned about climate change than males (Christensen and Knezek 2018; Stevenson et al. 2014). However, our results seem to suggest otherwise. Children's sex was not related to climate change concern in this study after accounting for how often families discuss climate change and the degree to which parents engage in climate change behaviors (see Table 4). This suggests that other factors, such as family dynamics (e.g., level of conversation with children of different sexes), may provide an intuitive causal mechanism for associations found between sex and environmental behaviors in other studies. The Cycle of Socialization (which begins in families [Harro 2000]) likely explains this phenomenon, as children are socialized to act according to their demographics (e.g., gender) in the family setting. This socialization process extends from and is reinforced by societal norms (MacGregor 2017). In the case of climate change and environmental perceptions in general, socialization into the female role through familial interactions may manifest in higher concern among female children, and subsequently women (McCright and Dunlap 2011). Explanations for this dynamic include that through a life-long process of socialization, women often perceive or experience lower positions of power (Carli and Eagly 2001), which can lead to perceiving more

risk in general (Finucane et al. 2000; Sunblad, Biel, and Gärling 2007). Similarly, gender socialization practices often encourage girls to recognize and address threats to safety (Harris and Jenkins 2006), and this eventually emerges with women coordinating and leading environmental justice efforts (Bell 2016). Because socialization begins in families, it is possible that family dynamics associated with gender socialization account for differences in climate concern and behaviors as opposed to one's gender itself. Future research is needed to determine how this relationship varies at different ages (e.g., elementary age (4–10) vs. adolescence (10–15)), or potentially different patterns of gender socialization in families (e.g., intentional gender-neutral parenting [Martin 2005]).

Similarly, previous research suggesting different levels of climate change engagement among individuals of different races or ethnicities (McCright and Dunlap 2011) may not hold when accounting for familial interactions. As with gender, child and parent race were not significant predictors of climate change behaviors after accounting for family dynamics (e.g. discussion), even though other research indicates people of color typically have higher levels of climate change concern than their white counterparts (Kreslake et al. 2018; Stevenson et al. 2014). Some scholars have pointed out that people of color are more likely to experience the actual risks of climate change (e.g., diminished air quality, flood risk [Akerlof et al. 2015; Crimmins 2016]), which likely makes greater levels of personal concern reasonable. If concern is driven by actual risks, these risks are likely felt at the family level, which may help explain why family dynamics (e.g., discussion, parent behavior) are more predictive of adolescents' behavior than race or ethnicity. As in the context of gender, differences in climate change perceptions and behaviors may be less about the demographics themselves (e.g., being a person of color) and more about the shared family experience with climate change. As such, our study not only supports the tenets of the Cycle of Socialization, but also suggests that experimental studies are needed to identify causal relationships among these correlations, as well as consider family dynamics when exploring links between demographics and climate change engagement.

Conclusions and future research

In summary, this study highlights novel ways that family dynamics may promote climate change mitigation behaviors and points to a new pathway toward promoting more responsible climate behavior at familial, and ultimately, societal levels. It must be acknowledged that there are potential weaknesses of a self-report survey (e.g., threats to external validity) and a case study design (limited generalizability), and future research would be improved through direct observations of behaviors and studies that cover a wider area (e.g., national scale). However, this study makes several key contributions. First, we add to studies suggesting climate change education may be effective at fostering climate change concern among young audiences (Askit et al. 2017; Flora et al. 2014; Stevenson et al. 2014), by suggesting climate change education may foster climate change action among adolescents. Second, more family-based climate change discussion predicted more climate change mitigating behaviors among children regardless of parents' levels of concern. Thus, encouraging discussions among individuals who either accept or deny the science of climate change is likely a beneficial strategy for impacting engagement in climate change issues among adolescents. Although parent and child behaviors are linked, it may be possible that they influence one another; from parent to child or from child to parent through intergenerational learning (Lawson et al. 2018). Third, we found these family discussions may hold the potential to overcome barriers to climate change engagement such as political ideology, as political affiliation was not predictive of climate change concern despite having relatively strong relationships in previous studies that did not account for family discussions (Valdez, Peterson, and Stevenson 2017). Education efforts that aim to promote intergenerational learning from child-to-parent through parent engagement in activities and family-level conversations,

have proven effective at building environmental engagement among parents through their children (Boudet et al. 2016; Duvall and Zint 2007; Williams McEwen, and Quinn 2017). Based on the results of this study, suggesting similar strategies with climate change may prove to be an avenue for greater societal level engagement with climate change mitigation. Especially as children have been shown to influence parent perceptions around controversial topics (e.g., views on sexual orientation [LaSala 2000]), education efforts aimed at influencing children's climate concern and behaviors may prove to be a pathway for overcoming significant ideological barriers to climate change engagement among adults. Targeting behavior changes and increased conversation through intergenerational learning will go beyond the call of increasing knowledge, and instead will increase the collective climate action needed to help mitigate the growing effects of climate change (IPCC 2014).

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