The Role of Collective Efficacy in Climate Change Adaptation in India

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ABSTRACT

Research on adaptive capacity often focuses on economics and technology, despite evidence from the social sciences finding that socially shared beliefs, norms, and networks are critical in increasing individuals' and communities' adaptive capacity. Drawing upon social cognitive theory, this paper builds on the first author's Ph.D. dissertation and examines the role of collective efficacy—people's shared beliefs about their group's capabilities to accomplish collective tasks—in influencing Indians' capacity to adapt to drinking water scarcity, a condition likely to be exacerbated by future climate change. Using data from a national survey ($N = 4031$), individuals with robust collective efficacy beliefs were found to be more likely to participate in community activities intended to ensure the adequacy of water supplies, and this relationship was found to be stronger in communities with high levels of community collective efficacy compared to communities with low levels of community collective efficacy. In addition, community collective efficacy was positively associated with self-reported community adaptation responses. Public education campaigns aimed at increasing collective efficacy beliefs are likely to increase adaptive capacity.

1. Introduction

Several countries are already experiencing negative impacts because of climate change (IPCC 2014). Developing countries such as India are considered to be particularly vulnerable to climate change impacts because of other stressors such as high incidence of poverty, illiteracy, and lack of resources (IPCC 2014; INCCA 2010). Scientists and policymakers increasingly stress the need to urgently take measures to prepare and adapt for climate change impacts, especially in developing and underdeveloped countries facing disproportional impacts (IPCC 2014).

Adaptation to climate change refers to anticipatory or reactive actions to reduce harm and benefit from opportunities, if any, from climate change impacts (Adger et al. 2007). Adaptation to climate change depends on the social system's adaptive capacity—defined as a system's access to resources and its capacity to effectively

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use such resources (Adger et al. 2007). Adaptive capacity assessments frequently feature biophysical, economic, and technological variables (e.g., O'Brien et al. 2004), yet they often ignore the important human attributes necessary for adaptation planning and implementation (e.g., Adger et al. 2007; Grothmann and Patt 2005; Thaker 2012).

While economic resources are important in adaptation planning and implementation, they are not sufficient. For example, Aldrich (2010, p. 3) found that after the 2004 tsunami in the Indian Ocean, the state of Tamil Nadu in India, where 8000 people died and 310 000 were left homeless, recovered relatively quickly as the state ''rebuilt almost all of its schools, fixed 75% of the damaged housing stock, and put most of its fishermen back to work'' within a year of the disaster. Hurricane Katrina on the U.S. Gulf Coast provides a counterexample. Although fewer people were harmed by Katrina—1600 killed and 250 000 left homeless—many communities in coastal Louisiana and Mississippi were far from recovery even one year after the crisis, despite having much higher per capita incomes than communities in Tamil Nadu. By contrast, the low-income Vietnamese community in New Orleans was more resilient to Katrina because of its strong community organization and social capital (Airriess et al. 2008). Several studies show that people process risk information and respond in complex ways, and social and cultural factors play an important role in how individuals and communities react to risks and crises (e.g., Adger et al. 2007; Bord et al. 2000; Kahneman et al. 1982; Lorenzoni et al. 2007; Weber 2006).

Moreover, many studies that explore adaptive capacity do so at the individual level (e.g., Grothmann and Patt 2005), even though many of the most important adaptation measures require collective action and multiple levels of governance (Adger et al. 2007). For example, adaptation to drinking water scarcity not only requires individual households to use water more efficiently, but also requires communities to build water-harvesting and storage systems and local and national governments to incentivize efficiency and implement policies to increase water supply because of increasing demands from industry, agriculture, and households.

This paper builds on a Ph.D. dissertation by the first author to introduce the concept of collective efficacy—people's perception about their collective abilities to overcome challenges facing their group or community—to the climate change adaptation literature and to test if individuals with stronger perceptions of collective efficacy are more involved in community adaptation and if communities with higher levels of community collective efficacy are more likely to undertake proactive adaptation actions. This paper is based on Thaker (2012), with additional analyses and discussion included and one additional investigator added to the team. Specifically, this study tests hypotheses using multilevel models to account for nonindependence of an individual's collectivity efficacy perceptions within a geographic locale, ignored in a previous analysis, and with additional demographic control variables.

2. Literature review

a. *Collective efficacy: A conceptual analysis*

According to social cognitive theory (Bandura 1997), human behavior is regulated by personal and social factors and is primarily driven by an individual's self-efficacy, that is, the ''beliefs in one's capacity to organize and execute the courses of action required to produce given attainments'' (Bandura 1997, p. 3). Self-efficacy beliefs are primary drivers of behaviors aimed to achieve individuals' goals (Bandura 1997). Individuals, however, often face collective tasks, such as community adaptation to climate change, and may benefit from acting in coordination with others by pooling their resources for common goals (Thaker 2012). Self-efficacy may play an important role in collective tasks and is often associated with collective efficacy; however, a group of highly self-efficacious individuals may perform poorly in tasks that require group members to coordinate.

A substantial body of evidence suggests that groups with high collective efficacy are more likely to set higher goals, mobilize better resources, coordinate and perform behaviors that increase their group's chances to succeed, and persevere in spite of initial setbacks or growing opposition (Bandura 2000; Goddard et al. 2004; also see Thaker 2012). The importance of the collective efficacy construct has been demonstrated experimentally (e.g., Durham et al. 1997; Earley 1994) and through survey research in diverse domains, including educational systems (Bandura 1997; Goddard et al. 2004), athletic teams (e.g., Feltz and Lirgg 1998), combat teams (Jex and Bliese 1999), business organizations (Zellars et al. 2001; Little and Madigan 1997), and political systems (e.g., Pollock 1983; Lee 2006, 2010).

Efficacy perceptions are behavior- or behavioral-domain-specific beliefs; behavior and domain-linked indices of perceived efficacy have greater explanatory and predictive value than do generalized efficacy beliefs (Bandura 1997). A given person's efficacy beliefs may vary considerably between behaviors (e.g., reducing residential water use versus reducing residential energy use) and between behavioral domains (e.g., plumbing versus carpentry), and the difference in efficacy perceptions across domains holds true even among groups, with individuals being more efficacious about their collective abilities in reducing crime than altering economic crises or dealing with terrorism (Fernández-Ballesteros et al. 2002). In addition, the degree of interdependence between members of a group for a particular group goal also affects collective efficacy perceptions (e.g., Gully et al. 2002). Efficacy perceptions are only moderately related to people's and groups' actual abilities; indeed, it is helpful if people and groups slightly overestimate their capabilities, as it can increase their motivation to set and achieve higher targets (Bandura 1997).

b. *Measuring collective efficacy*

Three different approaches exist to measure collective efficacy (Bandura 1997; also see Thaker 2012). One approach is to aggregate the self-efficacy assessments of all members of the group (e.g., ''How confident are you that you can do [X]?''). Such measures, however, ignore the ''coordinative and interactive aspects operating within groups'' (Bandura 2000, p. 76). A better, and most often used, method to measure collective efficacy is to aggregate measures to responses to collective referent statements (e.g., ''How confident are you that you and your neighbors can work together to do [X]?''). A third approach to measuring collective efficacy is to ask group members to discuss group capabilities and reach a consensus about the group's collective efficacy; however, Bandura (1997) argues this method is susceptible to social desirability bias, as well as ignoring within-group differences of collective efficacy beliefs.

c. *Antecedents and consequences of collective efficacy*

Efficacy assessments are influenced by mastery experiences, vicarious experiences, social persuasion, and affective states. Prior experience of success is one of the most important determinants of efficacy beliefs, as personal experiences provide the most credible evidence for individuals and groups to assess their abilities. Vicarious learning—observing other people or groups successfully perform the behavior of interest—is a second powerful source of efficacy beliefs, especially when people or groups deem themselves to be as capable as the behavioral model. Verbal persuasion by trusted, insightful others—such as teachers, coaches, opinion leaders, and accomplished peers—can also have a strong influence on efficacy beliefs. Finally, at least with regard to self-efficacy (although it is less clear how, if at all, it pertains to collective efficacy) affective states can affect the judgment of competence; for example, positive moods increase perceived efficacy, whereas sad moods diminish it (Bandura 1997; Goddard 2002).

Collective efficacy beliefs regulate human behavior through four major processes: cognitive, motivational, emotional, and decisional. Perceived collective efficacy beliefs affect how people or groups assimilate and process information, what goals they set for themselves, and how they anticipate and prepare for barriers, thereby increasing their odds of group goal attainment. The stronger the perceived collective efficacy is, the higher the motivational investment of group members to mobilize resources at their command and to persist despite setbacks. Perceived collective efficacy also regulates how people or groups respond emotionally to challenging situations. Finally, collective efficacy also influences the decisions people or groups make in order to control their future (Bandura 1997, 2000; Goddard 2002).

d. *Individual-level collective efficacy and behavioral involvement in climate change–relevant adaptation activities*

Evidence across several domains of group activity show that people's beliefs about their group's collective abilities positively affect their own degree of involvement in collective tasks (Jex and Bliese 1999; Walumbwa et al. 2004; Zellars et al. 2001). For example, Goddard and Salloum (2011, p. 11) argued that, ''collective efficacy beliefs may thus foster decisions to gather health-related resources, eliminate environmental hazards to health, and promote communication among neighbors, each of which in turn could facilitate dissemination of health information, prevent disease, and increase the likelihood of treatment.'' Individuals with high levels of collective efficacy are found to persist longer in group goals and tasks than individuals with lower levels, even under difficult circumstances; they also display more job satisfaction and express less intention to quit the team even when experiencing high degrees of stress and strain (Jex and Bliese 1999; Zellars et al. 2001). Further, Lee (2006, 2010) found a positive association between collective efficacy and intentions to participate in political protests in support of more democratic reforms in Hong Kong. Benight (2004; also see Benight and Bandura 2004) found that when resource loss was high, individuals with low perceived collective efficacy experienced higher distress than individuals with high collective efficacy.

Recent studies indicate efficacy beliefs may play an important role in public engagement with climate change adaptation relevant attitudes and actions (e.g., Lorenzoni Nicholson-Cole and Whitmarsh 2007; Maibach et al. 2008; Roser-Renouf and Nisbet 2008). For example, evidence from the field of development communication indicates that a media can play an enabling role to increase community members' collective efficacy perceptions, which in turn influences individual participation in community activities. In public health and community development research, for example, communities that are more efficacious have been found to experience better outcomes over time (e.g., Papa et al. 2000; Singhal and Rogers 1999).

Based on these previous studies, this paper tests the following hypothesis (hypothesis 1): individuals' collective efficacy regarding their community's capacity to ensure the adequacy of its drinking water supply will be positively associated with their participation in community activities to address drinking water scarcity.

e. Community-level collective efficacy and community drinking water adaptation

High group collective efficacy establishes a strong normative influence of the group that affects "the diligence and resolve with which groups choose to pursue their goals" (Goddard et al. 2004, p. 8; Thaker 2012). Further, collective efficacy establishes a social norm where "collective efficacy beliefs serve to encourage certain actions and constrain others" (Goddard et al. 2004, p. 8). For example, evidence from the field of community water management projects suggests that communities with prior experience of successful interventions are more likely to seek and find opportunities to help their community members adapt to drinking water scarcity (e.g., Cohen and Uphoff 1980; Manikutty 1998; Murtinho 2010; Narayan 2005). Experience of successful management of resources in the past, or such mastery of experience in coordinating with internal stakeholders and external agencies, is an important source of efficacy for community members. By cultivating a sense of collective achievement, a community is more likely to enhance the ability of its members to pool their resources together and work toward group goals. In addition, communities with high levels of collective efficacy are more likely to form powerful collectives and put more pressure on external agencies to provide necessary resources to help their community members adapt to local vulnerabilities. For example, Murtinho (2010), in a study of water user associations (community-based organizations to manage water resources), found that community members' perceptions about water scarcity as well as the community's prior success in securing external funding was associated with implementing adaptation strategies to cope with water source degradation. Based on the above findings, the following hypothesis is proposed (hypothesis 2; Thaker 2012): aggregate community-level perceptions of collective efficacy regarding the community's ability to ensure the adequacy of its drinking water supply will be positively associated with community adaptation responses.

3. Methods

a. Data collection

The data for this study are from a national sample survey conducted in India to understand Indian citizens' perceptions about climate change (see Thaker 2012). The target population for this survey was all adults in India (18 years of age and above), drawn from urban, semiurban, and rural communities. The stratified random sampling plan was as follows: parliamentary constituencies that refer to the federal-government-level electoral units served as primary sampling units. From each randomly sampled parliamentary constituency unit, an assembly constituency was randomly selected. Then polling locations (or polling stations) within an assembly constituency were randomly selected. From each of the randomly selected polling stations, using the electoral rolls provided by the Election Commission of India, the first respondent was randomly selected, after which every tenth subsequent respondent on the list was selected. From each polling station, the target was to achieve at least 10 completed surveys.

Using the above sampling plan, 10 153 respondents were contacted, out of which 4031 completed the survey, resulting in a response rate of 39.7%, with a 1.5% margin of error. The survey was administered face to face at the home of the selected respondents and took approximately 45 min to complete. The interviews were conducted in November and December 2011 by employees of two survey companies (C-Voter and Markelytics). Interviews were conducted in Hindi, Marathi, Punjabi, Bengali, Tamil, Telugu, Urdu, Kannada, English, Malayalam, Oriya, Assamese, and Gujarati. The final data were weighted to match the age, gender, religious, and regional distribution of the target population—adults 18 years and above, using parameters from the 2001 Census of India. The demographic characteristics of the sample are listed in Table 1.

b. Measures

1) Individual collective efficacy

Two items were used to assess individuals' perceptions about their community's abilities in the domain of drinking water adaptation: "How confident are you that your community can work together to increase access to safe drinking water?" and "How confident are you that your community can work together to make sure that everyone has enough safe drinking water even during difficult times like floods or droughts?" Both items were assessed with a four-point scale, "not at all confident" (1) to "very confident" (4); "do not know" was also given as a response option (which was treated as missing data). The items were highly correlated ($r = 0.63$, $p < 0.001$) and were summed to create a seven-point collective efficacy scale [mean (M) = 5.22, standard deviation (SD) = 1.76].

2) Behavioral involvement

Four yes/no items ("no" coded as 0 and "yes" coded as 1) were used to assess behavioral involvement in community activities related to drinking water adaptation:

1) Have you encouraged other members of your community to waste less water?
2) Have you participated in community activities to increase the amount of safe drinking water?
3) Have you demanded that your community leaders or government officials improve the amount of safe drinking water for your community?
4) Have you participated in social demonstrations—such as *gheroas* (sit-ins), *rasta rokos* (blocking roads), or *bands* (blockades)—to demand more safe drinking water for your community?

Responses were summed to create an index of behavioral involvement (M = 1.65, SD = 1.46).

3) Perceived risk

Two items were used to measure perceptions of drinking water scarcity:

1) If a one-year-long severe drought happened in your local area, how big of an impact would it have on your household's drinking water supply?
2) Would you say a one-year-long severe flood would have a large impact, a medium impact, a small impact, or no impact at all on your household's drinking water supply?

Both items were assessed with a four-point scale: no impact at all (1), a small impact (2), a medium impact (3), and a large impact (4). The items were highly correlated ($r = 0.60, p < 0.01$) and were summed to create a risk perception scale (M = 6.07, SD = 1.93).

4) Control variables

Demographic variables were used as control variables to examine the unique variance in the outcome variable that can be attributed to the independent variable(s) of interest. Twelve variables were used as control variables in this study: respondent's sex, age, income levels, educational attainment, caste groups (as identified by the Government of India), source of drinking water, payment for water, time to collect water, access to sanitation, agricultural land ownership, house type, and location of the respondent's household.

For sex, dummy codes were used such that female (48%) was the reference category, coded as 0, compared to male (52%), coded as 1. The caste variable was dummy-coded into three categories, comparing upper castes with other lower castes. Income was measured using eight categories ("up to 1000 rupees a month" to "more than 20 000 rupees a month") and education was measured using 10 categories and recoded into four primary categories ("illiterate" to "postgraduate and above"). The source of drinking water variable was dummy-coded such that respondents with a tapped or piped water connection within the household premises were coded as 1, and the rest were coded as 0. Similarly, respondents who pay for drinking water access were coded as 0, and those who do not pay any monthly fee at all were coded as 1. Respondents who spent some time to collect drinking water were the reference category, coded as 0, while those who do not spend any time to collect water were coded as 1. Access to sanitation was coded such that respondents who said their household has access to public sewer system were coded as 1 and others as 0. Respondents whose households have agricultural land were the coded as 1, and those without any agricultural land ownership were coded as 0. Respondents living in independent house or living in flats were coded as 1 and others as 0. Respondents in urban areas were the reference category compared to respondents living in rural areas. The descriptive analysis of the variables is presented in Table 1.

5) Community-level collective efficacy

To compute community-level constructs, respondents' assembly constituency was used as the unit of aggregation for individual scores. An assembly constituency is a basic political unit at the state level, with one member representing a constituency at the state legislative assembly. For example, the community-level collective efficacy was computed as the aggregate mean of individuals' perceptions within an assembly constituency.

Community adaptation responses. At the individual level, two items were used to measure self-reported community adaptation responses using a dichotomous scale ("no" coded as 0 and "yes" coded as 1): "Over the past one year, has your community 1) taken steps to help people waste less water at home or 2) taken steps to increase the amount of safe drinking water for the community?" The two items were moderately correlated (r = 0.57, $p < 0.01$) and were summed to create a response variable indicating self-reported community adaptation responses (M = 0.97, SD = 0.88).

To build community-level sociodemographic profiles, median age, median education, and median household were used, in addition to four district-level variables adopted from the Census 2011 figures (Census of India 2011): sex ratio (number of females per 1000

TABLE 1. Descriptive statistics (data weighted to match target sample characteristics for age, gender, religion, and region). Note that percentages do not always add up to 100% because of missing values. Asterisks indicate where data were not available.

Variable		Unweighted (%)	Weighted (%)	Census 2001
Sample size		4031	4000	1 028 737 436
Gender				
	Male	2397 (59.5)	2090 (52)	52
	Female	1634 (40.5)	1910 (48)	48
Age groups (years)				
	18–24	378 (9.4)	791 (20)	
	25–34	1074 (26.6)	1015 (25)	
	35–44	962 (23.9)	880 (22)	*
	45–54	780 (19.4)	569 (14)	
	55–64	489 (12.1)	410 (10)	
	65+	344 (8.5)	331 (8)	
Caste groups				
	Scheduled tribe	293 (7.3)	301 (8)	8
	Scheduled caste	728 (18.1)	729 (19)	16
	Other backward classes	1153 (28.6)	1204 (32)	*
	Upper caste	1535 (38.1)	1515 (40)	*
Education levels				
	Primary education	1060 (26.3)	987 (24.7)	*
	Secondary education	1141 (28.3)	1042 (26)	
	Higher secondary	908 (22.5)	952 (23.8)	
	Graduate and above	922 (22.9)	1020 (25.5)	
Monthly household income (rupees)				
	Up to 1000	158 (3.9)	146 (3.6)	*
	1001 to 2000	241 (6)	265 (6.6)	
	2001 to 3000	236 (5.9)	223 (5.6)	
	3001 to 4000	269 (6.7)	300 (7.5)	
	4001 to 5000	482 (12)	479 (12)	
	5001 to 10 000	1093 (27.1)	1049 (26.2)	
	10 001 to 20 000	845 (21)	872 (21.8)	
	Above 20 000	707 (17.5)	667 (16.7)	
Source of drinking water				
	Tap/piped into house	2330 (57.8)	2415 (60.4)	
	Tap/piped into yard/plot	654 (16.2)	700 (17.5)	
	Public/community tap	468 (11.6)	449 (11.2)	
	Open well in dwelling	84 (2.1)	76 (1.9)	
	Open well in yard/plot/homestead	72 (1.8)	59 (1.5)	
	Open public/community well	40 (1)	32 (0.8)	
	Protected well in dwelling	22 (0.5)	14 (0.4)	
	Protected well in yard/plot	34 (0.8)	24 (0.6)	
	Protected public/community well	17 (0.4)	7 (0.2)	
	Spring	2 (0)	1 (0)	
	River/stream	7 (0.2)	4 (0.1)	
	Pond/lake	10 (0.2)	6 (0.1)	
	Dam	14 (0.3)	13 (0.3)	
	Rainwater	7 (0.2)	5 (0.1)	
	Tanker truck	69 (1.7)	65 (1.6)	
	Bottled water/water bag/sachet	67 (1.7)	43 (1.1)	
	Others	134 (3.3)	88 (2.2)	
Payment for drinking water				
	Do not pay any money	942 (26.8)	908 (26.7)	
	Less than 50 rupees	396 (11.3)	489 (14.4)	
	50–100 rupees	535 (15.2)	522 (15.3)	
	100–200 rupees	642 (18.2)	623 (18.3)	
	200–300 rupees	471 (13.4)	433 (12.7)	
	300–400 rupees	305 (8.7)	242 (7.1)	
	More than 400 rupees	229 (6.5)	187 (5.5)	
Time to collect drinking water				
	No time	190 (5.1)	173 (4.6)	

TABLE 1. (*Continued*)

Variable		Unweighted (%)	Weighted (%)	Census 2001
	Less than 30 min	1107 (29.4)	1103 (29.5)	
	30–60 min	1081 (28.7)	1124 (30.1)	
	1–2 h	707 (18.8)	684 (18.3)	
	2–3 h	333 (8.9)	328 (8.8)	
	More than 3 h	343 (9.1)	321 (8.6)	
Access to sanitation				
	Connection to a public sewer			
	Connection to a septic system	1542 (38.3)	1560 (39)	
	Pour flush latrine	879 (21.8)	771 (19.3)	
	Simple pit latrine	585 (14.5)	746 (18.7)	
	Ventilated improved pit latrine	269 (6.7)	246 (6.2)	
	Public or shared latrine	75 (1.9)	62 (1.6)	
	Open pit latrine	94 (2.3)	101 (2.5)	
	Bucket latrine	105 (2.6)	95 (2.4)	
	Other	390 (9.7)	336 (8.5)	
Agriculture land ownership				
	Yes	681 (16.9)	649 (16.2)	
	No	2850 (70.7)	2821 (70.5)	
	Refused/do not know	500 (12.4)	529 (13.2)	
House type				
	Hut	224 (5.6)	241 (6)	
	Kutcha house (if wall materials include wood/bamboo/mud and roof is thatched/wooden/tin/asbestos sheets, etc.)	322 (8)	328 (8.2)	
	Kutcha-pucca (if walls are made up of pucca materials such as burnt brick but roof is not concrete/cemented)	438 (10.9)	420 (10.5)	
	Mixed houses (if some rooms are pucca and other rooms are kutcha-pucca or kutcha)	382 (9.5)	344 (8.6)	
	Pucca independent house (both walls and roofs are made up of pucca materials and built on separate plot)	2006 (49.8)	2022 (50.6)	
	Flats	618 (15.3)	589 (14.7)	
	Other	41 (1)	54 (1.4)	
Geographic location				
Urban	Tier 1	2094 (51.9)	1810 (45)	28
	Tier 2	459 (11.4)	1076 (27)	
	Tier 3	517 (12.8)	338 (8)	
Rural		961 (23.8)	776 (18)	72

males), literacy rate, population density, and percentage of households whose drinking water source is outside household premises. The Census of India maintains exhaustive administrative-level data, with the most recent census estimates at the district level released in early 2011. Although a district is a higher-level administrative unit, whereas an assembly segment—the unit of aggregation for community adaptation responses and community collective efficacy in the dataset as mentioned above—is a state-level electoral unit, for the purposes of this study, an assembly constituency is assumed to be more or less representative of the district characteristics. While matching assembly constituencies in the dataset to their respective districts, eight pairs of assembly constituencies were located in eight districts, indicating a minor non-independence of observations.

c. Analysis

A variety of statistical tests were used to test the construct validity of collective efficacy measure and examine the hypothesis. Correlational analysis, *t* tests, and analysis of variance (ANOVA) were used to test the construct validity of collective efficacy measure used in the survey. Specifically we expected collective efficacy to be higher for males, older respondents, upper castes, higher income, and more educated individuals. Moreover, we expected that people who own the houses they live in and who feel they live in cohesive communities are more likely to have high degree of collective efficacy.

To test the two hypotheses, multilevel models were tested using the lmer function in R, available as part of lme4 package (Bates et al. 2013; Gelman and Hill 2006). A previous analysis to test the hypothesis ignored multilevel theoretical framework of collective efficacy and missing values (Thaker 2012).

4. Results

a. Psychometric analysis

To verify the construct validity of collective efficacy used in this study, the following psychometric analyses were performed. The *t* test between sex and collective efficacy scale indicated a significant difference in collective efficacy perceptions, with women ($M = 5.28$, SD = 0.04) being more efficacious compared to men ($M = 5.16$, SD = 0.04; $t = 2.20$, $p = 0.03$, Cohen's d (d) = 0.07). Further, a one-way ANOVA was conducted to compare the differences in collective efficacy perceptions among the four caste groups. As expected, there was a statistically significant difference between caste groups on collective efficacy [F (3, 3748) = 3.27, $p < 0.05$, $\eta^2(\eta_p^2) = 0.004$]. Post hoc comparisons using Gabriel's procedure test for different group sizes indicated that the mean collective efficacy for the upper castes ($M = 5.34$, SD = 1.68) was significantly higher than that of other backward castes ($M = 5.16$, SD = 1.78), scheduled castes ($M = 5.15$, SD = 1.72), and scheduled tribes ($M = 5.19$, SD = 1.55). However, collective efficacy levels of other backward castes, scheduled castes, and scheduled tribes were largely similar, suggesting that compared to upper castes, other caste groups may face similar experiences in dealing with water scarcity. The results partially suggest that collective efficacy perceptions differ between caste groups, as expected. As also expected, individuals who own their houses ($M = 5.27$, SE = 0.03) have significantly stronger perceived collective efficacy beliefs than people who live in rented houses [$M = 5.02$, SE = 0.07; t (3934) = -3.24, $p < 0.01$, $\eta_p^2 = 0.002$]. As anticipated, there is a positive association between perceived community cohesion and collective efficacy ($r = 0.13$, $p < 0.01$) as well as education and collective efficacy ($r = 0.06$, $p < 0.001$). Contrary to what was expected, collective efficacy was not significantly associated with age.

In addition, the two collective items were moderately correlated ($r = 0.63$, $p < 0.01$), indicating internal consistency. Overall, partial support was found for construct validity of collective efficacy used in this study.

b. Hypothesis 1: Collective efficacy and behavioral involvement

Three multilevel models with increasing complexity were tested: null model, random intercepts, and the random intercepts and slopes. The models were fit by restricted maximum likelihood (REML), and model fit was compared using ANOVA and was based on values of Akaike information criterion (AIC), Bayesian information criterion (BIC), and the log likelihood (logLik). Prior to analysis, the hot-deck imputation method (Myers 2011) was used to impute missing data on all the variables considered in the study using gender and age as matching variables to impute missing values (see Table 1).

The null model was specified to test the proportion of variance in behavioral involvement that can be attributed to differences at the community level and as a baseline to examine if more complex models fit the data better. Results from the null model, with no predictors except specifying random effects for each community, indicated that 46% of the variance in behavioral involvement could be attributed to differences at the community level.

The random intercept model was specified using individual-level sociodemographic (gender, age, income, education, and dummy variables for caste), risk perception, and collective efficacy predictors. Results indicated that individual perception of collective efficacy is a significant and positive predictor of behavioral involvement across communities and after holding sociodemographic and risk perception variables constant. On average, a one-point increase in perceived collective efficacy was found to increase behavioral involvement by 0.07 points. Moreover, education and income were also significantly associated with behavioral involvement. Perceived risk was negatively associated with behavioral involvement.

Next, as part of post hoc analysis, a random intercept and random slopes model was tested. The model allowed the slope of individual perceived collective efficacy to vary between two categories of communities: those with high aggregate collective efficacy and those with low aggregate collective efficacy. The two categories were assigned using a mean split. We predicted that the slope of individual collective efficacy–behavioral involvement would be steeper in communities with high levels of collective efficacy as compared to communities with low levels of collective efficacy because of a social norm effect. In other words, individuals in communities with high levels of community collective efficacy would be expected to be more motivated to be

TABLE 2. Multilevel linear regression model predicting behavioral involvement. Standard errors are in parentheses, "CE" stands for collective efficacy, $n = 4022$, and the number of communities is 138.

	Null model	Model 1 (random intercepts)	Model 2 (random intercepts and random slopes–split mean community CE)
Intercept	1.6 (0.07)	1.64[a] (0.18)	1.88[b] (0.17)
Gender (male)		0.06 (0.04)	0.06 (0.04)
Age		0.01 (0.01)	0.02 (0.01)
Education		0.07[a] (0.02)	0.06[a] (0.02)
Monthly income		−0.05[a] (0.01)	−0.04[a] (0.01)
Caste		−0.06 (0.04)	−0.06 (0.04)
Source of drinking water		0.09[c] (0.05)	0.08 (0.05)
Payment for drinking water		−0.17[b] (0.06)	−0.18[b] (0.06)
Time to collect drinking water		−0.09 (0.09)	−0.08 (0.09)
Access to sanitation		−0.09 (0.05)	−0.11 (0.05)
Agriculture land ownership		−0.03 (0.06)	−0.04 (0.06)
House type		0.01[c] (0.05)	0.08 (0.05)
Rural		−0.09 (0.16)	−0.09 (0.16)
Perceived risk		−0.05[a] (0.01)	−0.05[a] (0.01)
Individual CE		0.07[a] (0.01)	
Individual CE (high-CE communities)			0.11 (0.01)
Individual CE (low-CE communities)			−0.03(0.02)
High community CE			0.14 (0.05)
Low community CE			−0.42 (0.09)
Community-level variance	0.73	0.65	0.62
Individual-level variance	1.25	1.22	1.21
AIC	12 645	12 531	12 512
BIC	12 664	12 638	12 632
Log likelihood	−6319.5	−6248.3	−6237.2
Deviance	12 639	12 497	12 474

[a] $p < 0.001$.
[b] $p < 0.01$.
[c] $p < 0.05$.

involved in their communities, for example, by watching others similar to them succeed (Table 2).

Results indicated that the community-level random effects were significantly different at the 95% confidence level. The slope of collective efficacy–behavioral involvement in communities with high levels of community collective efficacy was slightly steeper compared to communities with low levels of community collective efficacy. On average, a one-point increase in individual perceived collective efficacy was associated with a change in behavioral involvement of 0.11 points in communities with high levels of community collective efficacy, versus a change in behavioral involvement of −0.03 points in communities with low levels of community collective efficacy (Fig. 1).

c. *Hypothesis 2: Collective efficacy and community adaptation responses*

Similarly, a set of multilevel models was used to test if self-reported community adaptation responses differ across communities. The null model—without any predictors apart from specifying community name as a random effect—indicated that 47% of the variance in community adaptation responses can be attributed to differences at the community level.

Results suggested that community collective efficacy is a positive and significant predictor of difference between communities in self-reported community adaptation responses. On average, a one-point increase in community collective efficacy was associated with an increase of an individual's self-reported community adaptation responses by 0.20 points (Table 3).

5. Discussion

The results suggest that collective efficacy is a vital component of Indians' adaptive capacity to drinking water scarcity. Based on Bandura's social cognitive theory (Bandura 1997) and previous research (Thaker 2012), two hypotheses about the potential influence of collective efficacy were tested. Results suggest that individuals' collective efficacy is significantly and positively associated with behavioral involvement to ensure drinking water adequacy in their communities.

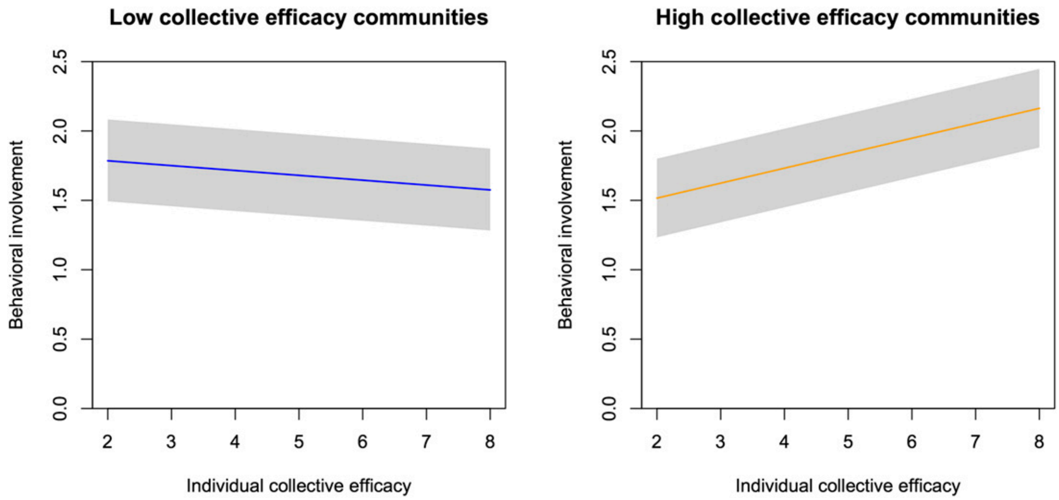

FIG. 1. Differences in the individual collective efficacy and behavioral involvement relationship between high and low levels of community collective efficacy. Shaded areas represent 95% confidence intervals based on 1000 simulations.

Moreover, post hoc analysis shows that the strength of this relationship varies among communities, such that individuals with high levels of collective efficacy living in communities where others also generally have high levels of collective efficacy are more involved in their community adaptation activities than similar individuals who live in communities with others who have low levels of collective efficacy. The second hypothesis was also fully supported: community-level collective efficacy is significantly and positively associated with community adaptation responses. Previous research (Thaker 2012) ignored clustering of individuals within communities, as well as missing values. Multilevel models, as used in this study, account for interdependence of individuals' collective efficacy perceptions within a community. Moreover, results show that the strength of the individual's collective efficacy behavior is influenced by community collective efficacy.

To our knowledge, this is the first study (see Thaker 2012) to provide evidence that, at the individual and collective levels, perceived collective efficacy predicts the capacity of communities to adapt to drinking water scarcity in India. Individuals who are most convinced of their community's ability are likely to be the most

TABLE 3. Multilevel linear regression model predicting community adaptation responses. Standard errors are in parentheses, $n = 4031$, and the number of communities is 138.

	Null model	Model 2 (random intercepts without community CE)	Model 3 (random intercepts with community CE)
Intercept	0.976 (0.05)	1.434 (0.918)	0.432 (0.891)
Median age		0.067 (0.108)	0.075 (0.102)
Median income		−0.022 (0.032)	−0.012 (0.031)
Median education		0.054 (0.071)	0.017 (0.067)
Sex ratio		−0.001 (0.001)	−0.001 (0.001)
Literacy rate		0.007 (0.005)	0.067 (0.005)
Population density		−0.001 (0.0001)	−0.001 (0.014)
Percentage households drinking Water source outside premises		−0.006 (0.004)	−0.005 (0.004)
Community collective efficacy			0.206[a] (0.04)
Community-level variance	0.29	0.28	0.24
Individual-level variance	0.49	0.49	0.49
AIC	8914	8919.5	8902.5
BIC	8932.9	8982.5	8971.9
Log likelihood	−4454	−4449.7	−4440.3
Deviance	8908	8899.5	8880.5

[a] $p < 0.001$.

motivated members in a group and are more likely to be involved in community activities. Moreover, the collective efficacy–behavioral involvement relationship is stronger in places with higher levels of community collective efficacy, probably because being part of a highly motivated community serves as an important normative cue to community members, resulting in increased involvement in community tasks. In addition, communities that foster stronger perceptions of collective capabilities among its members are more likely to collectively organize actions and to overcome obstacles and setbacks, which can increase the odds of group goal attainment (Bandura 1997; Goddard et al. 2004).

Findings from this study provide important lessons in the domain of climate change communication. Efficacy beliefs are domain-specific constructs, and people's efficacy beliefs vary in different domains of activity (water scarcity adaptation versus saving energy) and at different levels of activity (individual versus collective). While most of the research on collective efficacy has often featured academic, sport, and organizational settings, scholars have argued for a need to identify the role of collective efficacy to help explain behaviors and policy preferences at the individual and community level of analysis (e.g., Roser-Renouf and Nisbet 2008). This study provides evidence that high levels of collective efficacy are associated with greater individual behavioral involvement in community activities.

Communicating collective efficacy

Increasing public awareness about climate change risks is an important objective, but without also raising people's efficacy beliefs to act on that knowledge—to act, for example, by performing more climate adaptation actions—little change is likely to occur. For example, several public opinion surveys show that although public awareness of climate change is increasing, such an increase in knowledge levels has not resulted in proactive public engagement with practices necessary to advance adaptation and mitigation objectives (e.g., Gifford 2011; Ockwell et al. 2009; Maibach et al. 2008; Lorenzoni et al. 2007; Whitmarsh 2009; Whitmarsh and Lorenzoni 2010; also see Witte 1992).

A primary barrier to public engagement of climate change is the public's limited understanding of cause and consequences and, more importantly, the different ways to mitigate and adapt to climate change. Mass media, which is the primary source of information on climate change for most people, often reports the issue of climate change in the context of natural disasters or generally emphasizes the catastrophic connotations of climate change impacts (e.g., Carvalho 2007; Doulton and Brown 2009; Hulme et al. 2009), with little information on actions necessary to mitigate the impacts. Mass media in the United States also tends to focus on skepticism about climate science and uncertainty about climate change impacts (e.g., Boykoff 2008; Boykoff and Boykoff 2004) and skepticism about the collective will to address the issue (e.g., Gavin and Marshall 2011). Such fearful portrayals of climate change are less likely to motivate positive personal engagement with the issue (e.g., Moser and Dilling 2007; O'Neill and Nicholson-Cole 2009). A large and substantial body of literature on fear appeals attests that "an individual's perceived sense of action effectiveness and the individual's perceived sense of self-efficacy are imperative for a fear appeal to be successful" (O'Neill and Nicholson-Cole 2009, p. 361; Moser 2010; Moser and Dilling 2007; Witte 1992).

Communicating the risks of climate change impacts is important, but without also communicating individual and collective efficacy to manage those risks, it may be counterproductive. One of the unanticipated findings of this study—the negative correlation between perceived risk and behavioral involvement—is consistent with protection motivation theory (e.g., Floyd et al. 2000) and fear appeals literature (e.g., Witte 1992), which suggests that merely perceiving a high degree of threat alone will not increase positive behavioral shifts. Increasing self- and collective efficacy perceptions, for example, through mass communication campaigns, can potentially strengthen collective efficacy perceptions that may in turn result in more individual involvement in community adaptation actions. For example, Morton et al. (2011) found that efficacy perceptions mediate the effect of frames (reducing loss versus highlighting loss) on behavioral intentions. Several mass media interventions to enhance perceived individual and collective efficacy levels have resulted in substantial benefits, ranging from increasing literacy rates, promoting family planning, and changing social norms about women in traditional societies (e.g., Bandura 2001; Singhal and Rogers 1999; Singhal 2004). For example, a postcampaign evaluation of *Yeh Kahan Aa Gaya Hum* (Where have we arrived?), a campaign to promote environmental protection, found that radio listeners self-organized into groups to promote proenvironmental behaviors such as improving sanitation by building pit latrines, tree-planting campaigns, and reducing air pollution from vehicles waiting at railway crossings (Papa et al. 2000).

Several social scientists have already found that "barriers to community or individual action do not lie primarily in a lack of information or understanding alone, but in social, cultural, and institutional factors" (Tompkins and Adger 2004, p. 4). Primary among such barriers are perceived beliefs about self and collective competencies (e.g., Grothmann and Patt 2005; Lorenzoni et al. 2007). The findings of this study suggest that increasing collective efficacy beliefs through mass media channels, and providing communities with more resources to manage their local water problems, can have a positive impact in increasing Indian communities' adaptive capacity to drinking water scarcity (see Thaker 2012).

This study built on the first author's Ph.D. dissertation and tested, using more appropriate multilevel models, if collective efficacy perceptions can play a central role in increasing communities' adaptive capacity (Thaker 2012). Potential limitations of the study include an inability to establish causality because of the cross-sectional nature of the data. In addition, the study relied on self-reported community adaptation responses, which may not reflect objective assessments of adaptation. Future research should build on these findings using panel surveys and could use government data such as the number of water conservation activities undertaken in a community to decrease self-reporting bias for community adaptation responses. Moreover, in addition to perceived risk tested in this paper, future research could also include other critical variables such as values (e.g., Schultz and Zelezny 1999; Steg et al. 2012), cultural orientations (e.g., Markus and Kitayama 1991), and social capital (Aldrich 2010) to test the relative importance of collective efficacy and values in enhancing adaptive capacity.

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