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The Helping Behavior Helps Lighten Physical Burden

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ABSTRACT

It is often believed that helping behaviors benefit the recipients at the expense of the performers. However, we propose that costly helping behaviors could alleviate feelings of physical burden experienced by the performers. In support of the proposal, we found in five studies that both imaginary and real helping behaviors led the performers to perceive physically challenging tasks as less demanding (Studies 1, 2, 3, 5), such as perceiving a steep mountain road as less steep (Study 2), a heavy carton as lighter (Study 4), and a long path as shorter (Study 5). These results challenge the conventional wisdom that helping behaviors always come at the cost of the helper and corroborate a growing body of literature showing that helping others could benefit the performer.

Introduction

The feeling of physical burden refers to an individual's perception of the need for greater muscular strength to control the body's movements (Turvey, Shockley, & Carello, 1999), as though that individual were being objectively burdened or tied down by a heavy object (Proffitt, 2006; Proffitt, Stefanucci, Banton, & Epstein, 2003). Many factors can affect the feeling of physical burden. On one hand, physiological changes, such as wearing a backpack or suffering from chronic pain, can influence the feeling of physical burden (Proffitt et al., 2003; Witt et al., 2009). On the other hand, psychological changes can also affect the feeling of physical burden, as demonstrated by past research. For example, people felt weighed down when they experienced guilt after inflicting harm on others (Day & Bobocel, 2013). Similarly, people behaved as though they were carrying a physical burden when they had to conceal unsavory secrets from others (Slepian, Masicampo, Toosi, & Ambady, 2012).

A commonality exists between these two preceding studies: Engaging in antisocial acts seems to increase feelings of physical burden. This observation naturally begs the question, Could engaging in prosocial acts have the opposite effect, that is, reduce feelings of physical burden? In the present study, we seek to explore the possible influence of helping behaviors on the feeling of physical burden.

The benefits of helping behaviors

At first glance, the performers of helping behaviors seem to promote the welfare of others only at the expense of their own well-being (Schwartz & Bilsky, 1990). However, the psychological literature on altruism suggests that helping behaviors could stem from selfishness and that altruistic individuals could benefit from the apparently costly acts they perform (Batson, 2010; Reykowski & Smolenska, 1980).

First, helping behaviors can help the performers recover from negative emotional states. According to the negative state relief model of altruism, when individuals are stuck in certain negative mood states, such as sadness and depression, they often engage in altruistic behaviors to regulate their mood (Baumann, Cialdini, & Kendrick, 1981). The induction of negative moods in participants could lead to an increased likelihood of helping behaviors (Cialdini, Darby, & Vincent, 1973), and people tend to perform altruistic behaviors to preempt future adverse states (Batson, 2010). Altruistic behaviors have also been shown to help maintain and promote positive feelings and moods (Carlson, Charlin, & Miller, 1988). Baumann contended that altruism is actually a form of hedonism and is functionally similar to self-gratification (Baumann, Cialdini, & Kendrick, 1981). For instance, it has been shown that spending money on others brought about greater happiness compared to spending money on oneself (Dunn, Aknin, & Norton, 2008).

Second, helping behaviors can boost performers' self-efficacy and make them feel more competitive (Crocker, Canevello, & Brown, 2017). People were more helpful and prosocial after individuals' failure to restore their self-esteem (Brown & Smart, 1991). University students' Internet altruistic behaviors can positively predict their self-efficacy (Zheng, Wang, & Xu, 2016).

Third, altruistic behaviors reduce mental stress. People often perform altruistic behaviors to fulfill responsibilities arising from social norms and avoid the risk of social pressure and social evaluation (Gebauer, Riketta, Broemer, & Maio, 2008). When participants experienced acute social stress, they would engage in substantially more prosocial behaviors compared to participants in control conditions (von Dawans, Fischbacher, Kirschbaum, Fehr, & Heinrichs, 2012). It can thus be observed that social pressure would be reduced after performing altruistic behavior.

The helping behavior helps lighten feelings of physical burden

A wealth of research has showed that evolving in helping or prosocial behaviors can be beneficial to a performer's general physical health. For example, volunteers self-report better health over time (Hong & Morrow-Howell, 2010). Altruism can also predict objective measures of health status, such as lower systolic and diastolic blood pressure (Piferi & Lawler, 2006). In the present study, we focused on an unexplored specific aspect of physical health—physical burden—and aimed to discover the benefit that altruistic behaviors bring to feelings of physical burden.

From the emotion perspective, it is reasonable to postulate that helping behavior could lighten feelings of heaviness through relieving a negative mood and promoting a positive mood. Emotional states could play a role in the feeling of physical burden. For instance, after people wrote about a negative event or listened to sad music, they would perceive a hill to be steeper (Riener, Stefanucci, Proffitt, & Clore, 2011).

From the cognition perspective, helping behavior enhances a sense of self-efficacy (Midlarsky & Kahana, 1994). When faced with the same tasks and challenges, those with a greater sense of self-efficacy felt less pressure (Bandura, 1977). To conclude, altruistic behaviors can relieve psychological pressure by reducing negative effects, such as social pressure, and can bring about positive effects, such as self-efficacy. Extant literature on altruism suggests that under some circumstances, people perform altruistic behaviors to attenuate the stress induced by witnessing the misfortune of others (Gebauer et al., 2008). Thus, helping behaviors can

probably help reduce the stress of the performers in general. Because psychological feelings can bring about corresponding physiological experiences, as shown by the growing body of research on embodiment (Meier, Schnall, Schwarz, & Bargh, 2012), it is possible that the reduction of psychological pressure can lead to a decreased feeling of physical burden.

The present research

In sum, we hypothesized that helping behaviors could benefit the performers by reducing feelings of physical burden and bringing about a more relaxed, healthy physiological state through the mood regulation, self-efficacy, and de-stress functions of helping acts. To clarify, our research is not focused on individual differences in altruism but on specific altruistic behaviors. We sought to test this hypothesis in five studies. Study 1 was a correlational study, which was designed to preliminarily examine the relationship between willingness to help and the feeling of physical burden. Study 2 attempted to identify the causal relationship between helping behaviors and feelings of physical burden through a priming procedure. Study 3 demonstrated that framing a writing task as helping behavior could make the performer experience less burden as opposed to framing it as neutral behavior. Studies 4 and 5, both field studies, sought to test our hypothesis more stringently by staging two mundane scenarios in which participants actually helped other people.

Study 1

Study 1 aimed to provide preliminary evidence for the relationship between willingness to help and feelings of physical burden in hypothetical crisis situations. Study 1 is a correlational study, and we did not manipulate willingness to help. Participants completed two questionnaires, one assessing an individual's willingness to help in crisis situations and the other measuring feelings of physical burden. We hypothesized that participants' willingness to help was negatively correlated with their perceived physical burden. In other words, we predicted that the more people were willing to help others in hypothetical crisis situations, the less physical burden they would feel.

Method

Participants

Ninety-six undergraduate and graduate students from two Chinese universities (36 male, 60 female;

$M_{\text{age}} = 21.43$ years) participated in Study 1 for chocolate as compensation.

Procedure and materials

All participants were told that they were expected to answer two unrelated questionnaires from different institutes. They were informed that the first one addressed people's responses in crisis situations and the second one was a basic physical condition survey.

The first experimenter handed the scenario questionnaire to the participants. In this questionnaire, we used three items to measure participants' willingness to help in three hypothetical crisis situations: a fire, a rainstorm, and an earthquake. Each item described a crisis based on true crisis accounts that happened in China. In these crisis situations, participants were faced with the dilemma of whether to take the risk of sacrificing themselves to help others. In the earthquake situation, for example

The classroom suddenly began to shake violently when I was in class with my classmates. We realized that it was an earthquake and started to rush out of the classroom immediately. Suddenly, I observed a classmate fall down and become trapped beneath cement blocks. At that moment, I was faced with two choices. One was to stop and help the classmate move away the cement blocks, which might place myself in danger; the other was to ignore the classmate and keep escaping.

Participants were asked to vividly imagine themselves as the protagonist in the situation and rate their willingness to help on an 11-point scale from 0 (*completely decide to help my classmate*) to 10 (*completely decide to keep escaping*). The lower the score, the higher willingness to help others.

After participants finished the first questionnaire, the second experimenter appeared and asked them to answer the other questionnaire, which was supposedly designed to measure their physical condition. Participants were asked about the amount of effort and energy required for three common activities, from 1 (*not at all*) to 7 (*very much*). This questionnaire was adapted from the original version by Slepian et al. (2012) to make the questions more applicable to Chinese students.

Afterward, participants completed demographic information (age, gender, height, weight) and the control variables, including exercise frequency, from 1 (*never exercise*) to 7 (*exercise a lot*), and self-rated physical strength condition, from 1 (*very weak*) to 7 (*very strong*). Finally, participants were asked whether they doubted that the two surveys were related and asked to state the purpose of the study.

Results and discussion

No participant was suspicious that the two surveys were related, and no one guessed the purpose. The three items regarding the willingness to help in a crisis situation ($\alpha = .61$) were averaged to create an altruistic willingness index in which lower ratings meant a higher willingness to help. We also averaged the effort ratings for the three physical activities in the second questionnaire ($\alpha = .83$).

We found that participants' willingness to help is positively correlated with their effort ratings ($r = .28$), which means that the less altruistic participants were, the more effortful they thought the physical tasks were. Then we used regression with the effort ratings of physical activity as the dependent variable and five control variables—age, gender, body mass index ($\text{BMI} = \text{weight}/\text{height}^2$), exercise frequency, and self-rated physical strength condition—as independent variables in the first step; we then put willingness to help in the second step. The analysis revealed that willingness to help in a crisis situation could positively predict effort ratings of physical activity ($\beta = .21$, $\Delta R^2 = .042$). This meant that participants who were more willing to help others perceived the same physical activity as more effortless when controlling for gender, age, BMI, exercise frequency, and self-rated physical strength.

In conclusion, Study 1 provided preliminary evidence that participants who were more likely to help others in a hypothetical crisis situation felt less physical burden. However, in Study 1, we measured willingness to help rather than experimentally manipulating it, and therefore we could not prove the causal relationship between helping behaviors and feelings of physical burden. We address this weakness in the next study.

Study 2

The results of Study 1 provided us with preliminary evidence that willingness to help was negatively correlated with feelings of physical burden. Study 2 was a lab experiment aimed to test the causal relationship between a helping behavior and feelings of physical burden.

Two improvements were made in Study 2 over Study 1. First, we manipulated the helping behavior in a hypothetical fire crisis scenario rather than measured willingness to help. Specifically, participants were asked to first imagine themselves being stuck in a burning dormitory and then imagine whether they would risk saving other people, depending on the condition to which they were assigned. Second, we added the perceived steepness of a mountain road as another indicator of the feeling of

physical burden. Past research has demonstrated that the weight people were carrying would influence the perceived steepness of a hill such that when a person is carrying a physical burden, he or she would perceive hills as being steeper (Proffitt, 2006). Thus, we hypothesized that participants who imagined themselves helping others in the dormitory fire crisis would perceive physical tasks as less effortful and hills to be gentler.

Method

Participants

Sixty-five undergraduate students from a public Chinese university were recruited using monetary compensation, and we randomly assigned them to either the altruistic group or the selfish group. Two participants failed the manipulation check question and did not follow the experiment guide, leaving us with 63 valid responses (37 male, 26 female; $M_{\text{age}} = 20.17$).

Materials and procedure

First, participants arrived at the lab and sat in front of a computer. They were informed that they would read about a life-threatening crisis situation and that they should try their best to imagine themselves as the protagonist. We emphasized that they should answer the question from the protagonist's perspective rather than their own. They read the following scenario on a laptop: "You are making a phone call in the corridor late at night and an outbreak of a fire suddenly catches your attention. You are terrified and instinctively run downstairs." Simultaneously, the laptop started to show two pictures and a video of an apartment fire to make the situation more realistic. "When you come downstairs, you suddenly realize your roommate is still inside, but the fire has become serious and the smoke is overwhelming. You are then stuck with the dilemma of whether you would run into the burning dormitory again and wake up your roommate or stay in the safe area." In the altruism-priming condition, participants were told that people should take full account of others' lives in a crisis situation and that helping each other is the best choice. So, "You finally decide to take the risk to go back and wake up your roommate." In the self-interest priming condition, participants were told that putting aside others' lives in a crisis situation and ensuring their own safety was the best choice. So, "You finally decide not to take the risk to go back and stay in the safe area."

After the scenario, participants completed the manipulation check by indicating what type of crisis they just read about and whether they decided to help others in the imagined crisis situation.

Afterward, the participants completed the measurements of the feeling of physical burden. Participants first indicated how much effort and energy each of four tasks would require on a scale ranging from 1 (*not at all*) to 7 (*very much*). Three of the tasks involved physical effort (carrying 10 kg of fire-fighting goods to the fifth floor, walking 5 kms to the safety zone, carrying an injured person with a stretcher), and another task involved no physical effort (watching the instructional video about fire escape). Then participants were showed a front view of a mountain road, displayed in a photo. Participants were instructed to estimate the slope by imaging themselves climbing the mountain road and not to use any mathematical methods.

Finally, participants completed demographic information. We also asked participants to guess the purpose of the study.

Results and discussion

None of the participants guessed the purpose correctly. We first averaged the participants' effort ratings on the three physical tasks ($\alpha = 0.69$) and then conducted a mixed analysis of variance on the effort ratings. We found an interaction of experimental manipulation and types of task ($\eta^2 = 0.07$). Specifically, participants in the altruistic group reported the physical tasks to be less effortful ($M = 4.18$, $SD = 2.05$) than the selfish group ($M = 5.28$, $SD = 2.16$; Cohen's $d = .52$). However, the two groups did not differ that much from each other in regard to the nonphysical task ($M_{\text{altruistic group}} = 1.94$, $SD_{\text{altruistic group}} = 2.31$; $M_{\text{self-service group}} = 1.61$, $SD_{\text{self-service group}} = 1.80$).

In addition, participants in the altruistic group estimated the mountain slope to be less steep ($M = 33.63$, $SD = 17.87$) than the selfish group ($M = 46.50$, $SD = 17.62$; Cohen's $d = .73$).

The first two experiments provided evidence that the altruistic behavior might lead participants to perceive the physical tasks as less effortful, no matter whether the physical tasks were related to the helping situations (Study 2) or not (Study 1). However, this conclusion is tentative at the best because the helping behaviors were not real behaviors in either study. Therefore, in the next three experiments, we test our hypothesis in daily situations in which people could actually engage in altruistic behaviors.

Study 3

Study 3 was designed to replicate our effect with real helping behavior. Study 3 extended Study 2 in three aspects. First, we added a control condition to rule

out the possibility that the difference in the feeling of physical burden between the helping condition and the selfish condition was due to selfish behavior (i.e., abandoning people in Study 1 and Study 2) tending to increase the feeling of physical burden. Second, we manipulated participants' real helping behavior in a realistic situation rather than their imagined behavior in a hypothetical scenario. Third, some may argue that different feelings of physical burden were due to different types of behaviors (i.e., running back to the burning dormitory vs. staying in the safe area in Study 2) rather than whether the behavior in question was altruistic. Therefore, in this study, we asked all participants to engage in the same writing task but framed the behavior as either altruistic or neutral to address this concern. We hypothesized that participants who engaged in the altruistic writing task would perceive the same physical tasks less effortful than participants who engaged in the neutral writing task.

Method

Participants

One hundred and seven participants (62 male, 45 female; $M_{\text{age}} = 33.45$) from Amazon Mechanical Turk took part in the study, and we randomly assigned them to either the helping group or the control group.

Materials and procedure

In the helping group, participants were first invited to take part in a charity activity that ostensibly sought to help children living in a rural area of China to learn English and experience the outside world. Each participant's task was to write a short paragraph to briefly introduce the city or town in which they lived. Afterward, they were informed that their writing would be printed and sent to the rural children. Participants in the control group completed the same writing task of describing the city or town in which they live, except that the ostensible purpose of the task was using their writing material only for research about people's writing skill.

Afterward, participants were instructed to complete an unrelated study in which they would answer how much effort and energy each of three tasks would require, on a scale ranging from 1 (*not at all*) to 7 (*very much*). Two of the tasks involved physical effort (running 1 mile and carrying 5-kg grocery bag to the fifth floor), and the other involved no physical effort (listening to a song).

Finally, participants completed demographic information.

Results and discussion

The effort ratings for the two physical tasks were highly correlated ($r = .56$), so they were averaged together. The result yielded an interaction between altruism manipulation and activity types on effort ratings with a mixed analysis of variance ($\eta^2 = 0.04$). Specifically, participants in the helping group reported the physical tasks to be less effortful ($M = 4.18$, $SD = 1.47$) than the control group ($M = 4.97$, $SD = 1.43$; Cohen's $d = 0.54$). Participants in the helping group and the control group did not differ that much on the nonphysical item ($M_{\text{helping group}} = 1.69$, $SD_{\text{helping group}} = 1.63$; $M_{\text{control group}} = 1.59$, $SD_{\text{control group}} = 1.35$).

Study 4

The purpose of Study 4 was to test the hypothesis that helping others could reduce feelings of physical burden in a naturally occurring situation. In this study, an experimenter would act as a help seeker who could not carry some heavy item upstairs and therefore asks the participants for help. We predicted that if helping others could lighten the actor's physical burden, the participants would feel more energetic and perceive the item they carried to be lighter. Existing literature suggested that perceived weight would serve as a reliable indicator of feelings of physical burden (Day & Bobocel, 2013, Doerrfeld, Sebanz, and Shiffrar, 2012). We hypothesized that participants who helped the experimenter carry the item upstairs would perceive the item to be lighter.

Method

Participants

Forty-eight undergraduate and graduate students from a public Chinese university took part in the study. One participant refused to help, one participant guessed that the help-seeker was the confederate at the beginning, and one participant was interrupted by an unexpected event, leaving us with 45 valid participants (29 female, 16 male; $M_{\text{age}} = 21.80$ years).

Procedure

First, we put a recruiting advertisement for cognition research on the campus computer bulletin board system, which informed the participants that the study location was not yet decided due to ongoing renovation work. Thus, participants knew only the building in which the experiment would take place, and they needed to call the experimenter when they arrived in the lobby of the building to find out which room they

should go to. In the helping group, a female confederate waited in the lobby, and once the participant appeared, she pretended to have difficulty carrying two cartons of beverages upstairs and accidentally dropped one. The confederate asked the participant for help by saying, “Hi, could you help me carry this carton upstairs?” Then, the participant helped the female experimenter carry a carton to the third floor. In the control group, the participants were told that the first part of the experiment was carrying a carton to the third floor. After carrying the carton to the destination, participants went to the room in which the experiment was supposed to take place and completed an unrelated questionnaire. Then we asked the participants to recall the weight of the carton they carried. We did not ask participants to estimate the weight right after carrying it upstairs because we wanted to make the experimental procedure less obtrusive to prevent participants from figuring out the purpose of the study. At the end of the study, we asked the participants in the altruism group whether they suspected that the female confederate was part of the experiment at the beginning.

To control the effect of time and diet on each individual’s physical strength condition, we paired one participant of the altruism group and one of the control group in each hour.

Results and discussion

The altruism group estimated the carton ($M = 7.80$, $SD = 3.90$) to be lighter than the control group ($M = 10.89$, $SD = 5.18$; Cohen’s $d = .67$). The results of Study 4 showed that real helping behavior in a daily situation could lighten the actor’s physical burden. Compared to those who thought the carton-carrying activity was part of the experiment task, participants who thought they were helping a stranger by carrying the carton perceived the carton to be lighter. In this study, we manipulated the helping behavior, which means the participants did not spontaneously perform the helping behavior. In Study 5, we test our hypothesis in a context in which helping behavior was spontaneous in nature.

Study 5

Study 5 was a field study conducted to increase the external validity of our hypothesis. It addressed two shortcomings in the preceding studies. First, we examine the effect of spontaneous helping behaviors. Second, we add distance perception as a new measure of the feeling of physical burden. When a person feels

weighed down, the distance would appear farther due to the cost of walking (Witt, Proffitt, & Epstein, 2004). If altruistic behavior could make actors feel less physically burdened, we predicted that they would perceive the physical tasks effortful and underestimate distance compared to people who did not perform the altruistic behavior.

Method

Participants

A total of 143 people participated in the study, including students, teachers, and administrative staff of a Chinese university, as well as some visitors (81 male, 61 female, 1 unreported; $M_{\text{age}} = 25.88$ years).

Materials and procedure

A fund-raiser, which was held on campus by the China Foundation of Poverty Alleviation over two weekends (4 days), aimed to collect money for poor children in rural areas. We collected data from 10:00 a.m. to 3:00 p.m. We recruited people who donated money as the altruistic group and the ones who just passed by and did not donate money as the control group. To avoid the possibility that different times would have an effect on people’s feelings of physical burden, we tried to pair participants of the two groups at the same time. Specifically, we had two experimenters involved in this study. Once a person donated money, one experimenter would approach him or her. At the same time, the other experimenter would approach a passerby who observed the charity activity but did not donate money.

First, participants were asked to fill out a short questionnaire ostensibly about perception. The first part involved rating the effort required to perform each of the three physical tasks, which were climbing mountain, running 400 m, and carrying 10 kg of goods to the fifth floor. The second part was a distance estimation; we chose two well-known landmarks at the university and asked participants to estimate the distance between the two sites. We also noted on the questionnaire that if the participants were not familiar with the two sites, they should skip the question.

At the end of the questionnaire, demographic information was collected.

Results and discussion

We averaged the effort ratings for the three physical activities ($\alpha = .68$). Compared to participants who just passed by the donation desk and did not donate money ($M = 4.00$, $SD = 1.43$), participants who donated money ($M = 3.42$, $SD = 1.38$) felt that less effort and energy

Table 1. Results of all five studies.

Study	Altruistic behaviors	Measurements of physical burden	Condition	Response <i>M</i> (<i>SD</i>)
1	Willingness to help in hypothetical crisis situations	Perceived effort required by physical tasks	NA	NA
2	Saving others in a hypothetical fire situation	Perceived effort required by physical tasks	Helping	4.18 (2.05)
			Selfish	5.28 (2.16)
		Perceived steepness of mountain road	Helping	33.63 (17.87)
			Selfish	46.50 (17.62)
3	Writing a letter to help strange children	Perceived effort required by physical tasks	Helping	4.18 (1.47)
			Control	4.97 (1.43)
4	Helping carrying a carton upstairs	Estimation of the carton's weight	Helping	7.80 (3.90)
			Control	10.89 (5.18)
5	Donation	Perceived effort required by climbing mountain	Helping	3.65 (1.73)
			Control	4.01 (1.66)
		Perceived effort required by running 400 m	Helping	2.97 (1.74)
			Control	3.60 (1.90)
		Perceived effort required by carrying 10 kg of goods to the fifth floor	Helping	3.65 (1.87)
			Control	4.39 (1.95)
		Perceived distant in campus	Helping	401.70 (287.90)
			Control	561.67 (322.64)

would be required to perform the three physical tasks (Cohen's $d = .41$). Participants' ratings of each physical task were showed in Table 1.

The landmark distance estimation item was completed by 113 participants, and we found that people who donated money ($M = 401.70$, $SD = 287.90$) thought the distance between the two landmarks was shorter than people who did not donate money ($M = 561.67$, $SD = 322.64$; Cohen's $d = .52$).

As a field study, we could not directly manipulate participants' altruistic behavior, so as the donation itself was not randomly assigned, this study alone cannot conclusively demonstrate that the donation behavior caused the differences in the feeling of physical burden. However, it did provide more ecologically valid evidence in support of our hypothesis.

General discussion

In the present research, we found that helping behaviors can positively affect the performers by reducing their feeling of physical burden. Through five studies, we used surveys, lab and online experiments, and field experiment/field study to prove and support our effect in both hypothetical crisis and real daily-life situations. We used different methods to measure and manipulate helping behaviors: In Study 1, we measured participants' willingness to help in hypothetical crisis situations; in Study 2, we manipulated participants' imagined helping behaviors by using priming; in Study 3, we manipulated participants' helping behaviors by framing a writing task as a helping behavior or a neutral one; and in Studies 4 and 5, we choose two typical helping behaviors—helping others carrying things upstairs and donation. Similarly, we used different indicators for feelings of physical burden, which included ratings of physical tasks (Studies 1, 2, 3, 5), perceived distance of a walking

path (Study 5), perceived slope of a mountain road (Study 2), and estimation of the weight of a carton (Study 4). Helping behaviors can reduce performers' perceived physical burden not only in the same crisis situation (Study 2) but also in unrelated situations (Study 1). Study 1 and Study 5 are correctional studies in which we measured participants' helping willingness and behavior. In Studies 2, 3, and 4, we manipulated imagined and real helping behaviors and proved the causal relationship between helping behaviors and feelings of physical burden. We also included BMI, exercise frequency, self-rated physical strength condition, gender, and age as our potential control variables to ensure the accuracy of our results. In sum, the results from all five studies showed the generalization of our hypothesis that helping behavior could lighten performers' feelings of physical burdens.

Improving physical states through changing psychological states

When physiological resources cannot be directly replenished, the individual can indirectly restore and improve his or her physiological system via a changing psychological system. For instance, Kok et al. (2013) found that the increase of positive emotion and social connections could increase vagal tone, which is a proxy index of physical health. Thus, in this case, positive emotion served as a psychological nutrient to physical health. We believe that the present research can provide another piece of evidence to this concept.

The results of present research also provide a possible psychological intervention to release physical burden. It might not always be possible to reduce the feeling of physical burden via physiological interventions (e.g., drinking an energy drink or having a full-body massage). Under these circumstances, reducing the

feeling of physical burden by mobilizing psychological resources may be a more effective strategy because psychological resources are more plastic and dynamic. Past research has shown that solving creative problems, confessing one's sins, forgiving others' affronts, and establishing social connections can all effectively reduce the feelings of physical burden (Goncalo, Vincent, & Krause, 2015; Slepian, Masicampo, & Ambady, 2014; Zheng, Fehr, Tai, Narayanan, & Gelfand, 2014). Our research adds the performance of helping acts to this list of psychological interventions that can help decrease the feeling of physical burden.

Immediate self-reward of helping behavior

In *The Selfish Gene*, Richard Dawkins (1989) mentioned that humans do indeed possess "selfless" or "kind" genes, which manifest as human compassion, but that these selfless genes would still selfishly pursue their own interest. On the surface, helping behavior implies a net loss for the performer, which is detrimental to survival and reproduction. However, altruistic traits have not been eliminated in the long course of human evolution. Early scholars of evolution attempted to explain this apparent paradox in terms of the adaptive significance of gene retention (Hamilton & Axelrod, 1981) and the formation of a long-term, mutually beneficial relationship through altruistic behaviors (Trivers, 1971). These benefits are externally provided and are predicated on future probabilistic events. In contrast, the present research indicates that helping behaviors can immediately benefit the performers in terms of reducing feelings of physical burden. Unlike kin altruism and reciprocal altruism, this benefit is provided internally by the individual and is immediate and deterministic (Hu, Li, Jia, & Xie, 2016). The results of the present research provided direct evidence for immediate self-reward of helping behaviors by demonstrating that if someone conducts helping behaviors, he or she could alleviate his or her perceived physical burden spontaneously.

Limitations and future directions

Past research has discovered that helping acts offer many psychological benefits to the performers. Helping behaviors help improve tonal mood (Carlson, Charlin, & Miller, 1988), self-efficacy (Midlarsky & Kahana, 1994), and self-evaluation (Post, 2005). However, prior to the current work, little attention was paid to the physical benefits brought by the altruistic behavior. The present study showed that altruism could help lighten physical burdens, thereby providing initial

evidence that helping behavior can benefit the performer physiologically.

Although the current research supported the effect that helping behaviors could lighten perceived physical burden, the underlying mechanism of this phenomenon is still waiting to be explored. In our reasoning, mood, self-efficacy, and stress might serve as mediators. However, we did not directly measure and manipulate these variables to test their potential mediation role. In addition, the boundaries of our effect are worth exploring. For example, we measured participants' feelings of physical burden right after they conducted helping behaviors. But how long can the lightening effect last? If an extremely selfish person is forced to conduct helping behavior at the cost of his or her own, would the lightening effect still happen? We used different manipulations of helping behaviors and measurements of physical burden across studies to prove the generalization of our effect. However, if one manipulation of independent variable and one measurement of dependent variable could have been consistently used across all the five studies, it would provide some useful information, such as which kind of helping behavior in our research could most effectively alleviate people's feelings of physical burden.

Other possible physiological benefits are still waiting to be explored. For example, can altruistic behavior reduce performers' physical pain? Dealing with pain is a critical topic. Past studies have shown that altruistic behaviors can help establish and maintain social relations (Taylor, 2006), and social support could serve as a buffer against physical pain (Zhou & Gao, 2008). Therefore, it is possible that altruistic behavior may help people alleviate physical pain by promoting social connections.

In addition, future research could examine whether different altruistic motivations could bring about different physiological benefits. Our results showed that both helping intentions (Studies 1 and 2) and actual helping behaviors (Studies 3, 4, and 5) can lighten physical burdens. However, we did not measure the voluntariness of the helping motivations and behaviors. Previous studies demonstrated that helping behaviors can be motivated by different considerations (Hubbard, Harbaugh, Srivastava, Degras, & Mayr, 2016), and different types of motivation can lead to different psychological experiences (Batson & Oleson, 1991; Cialdini et al., 1987). Weinstein and Ryan (2010) found that autonomous motivation for prosocial behavior brings about greater need satisfaction, thus yielding more benefits. Therefore, a question that awaits future exploration is whether helping behaviors' impact on the feeling of physical burden is a function of the voluntariness of

the underlying motivation. For example, will people who volunteer to help others derive more physiological benefits than those who are coerced to help others?

The practical implication

The results of the present research show that helping behavior can serve as an effective way to lighten physical burden. An individual can achieve a healthy physical state by helping others. The results also provide more justification for promoting the value of helping behaviors: Helping behaviors not only improve the welfare of the recipient and promote effective social cooperation but also bring about immediate and effective physiological benefits to the helping performer.

In our research, we assumed that in most cases reduced physical burden is beneficial to people. It should be noted that in some special situations, reduced physical burden might have some disadvantages. For instance, does perceiving less physical burden possibly make a person more likely to take risks or engage in potentially harmful behaviors? We should use helping behavior to reduce physical burden at the appropriate time.

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