"Hero," a virtual program for promoting prosocial behaviors toward strangers and empathy among adolescents: A cluster randomized trial

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Abstract

This study aimed to explore the effectiveness of the virtual Hero program on the promotion of empathy (emotional contagion, emotional recognition, and perspective taking) and prosocial behavior toward strangers. Moreover, we studied whether promoting empathy strengthened the program's impact on adolescents' prosocial behavior. The study included 431 adolescents in the intervention group (M_{age} = 13.64, 47% of participants identified as cisgender men, and 53% of participants identified as cisgender women) and 325 participants in the waitlist control group (M_{age} = 13.22, 47% of participants identified as cisgender men, and 53% of participants identified as cisgender women). The adolescents lived in the urban zone of Buenos Aires, Argentina. Participants completed measures of prosocial behavior and empathy. The intervention included seven weekly online sessions (a pretest evaluation, five intervention sessions, and a posttest evaluation) of approximately 40 minutes each, while the control group completed only the pretest and posttest evaluations. The research findings show that the Hero virtual program was effective in promoting prosociality directly (when not mediated by emotional contagion and emotional recognition) and indirectly through emotional contagion and emotional recognition. In addition, the Hero program promoted emotional contagion and emotional recognition, but it was not effective at promoting perspective taking. In

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conclusion, internet-based interventions could play a prominent role in promoting positive behavior among young adolescents.

Introduction

Empathy and prosocial behavior are two critical aspects of human social interactions. The overall purpose of the paper is to study the effectiveness of the Hero intervention for improving empathy and prosocial behavior toward strangers in adolescents. We hope to determine whether a direct promotion of empathy through the Hero program in turn promotes prosocial behavior toward strangers.

A description of the Hero program

The Hero program was created to promote prosocial behavior, which refers to voluntary actions directed at helping others (Eisenberg et al., 2015; Mesurado et al., 2019c). The program was tested among Latin American participants by Mesurado and colleagues; the program targets adolescents aged 12–15 years, and it is available in Spanish (Mesurado et al., 2019a, 2019, 2020). It is a brief online program that includes five intervention sessions. The first session aims to stimulate emotional recognition and empathy. This session includes a brief psychoeducational video about cognitive and emotional empathy. The video presents a situation in which the main character (an adolescent woman) misunderstands an event, which makes her feel high levels of negative emotions toward another person. The conflict is resolved when the adolescent is able to put herself in the place of the other character and understand the situation from another point of view. The video ends by sharing some ideas about the importance of emotional and cognitive empathy and offers some suggestions about how to promote empathy in daily life (e.g., ask yourself what others are thinking or feeling). Other activities are included in the Hero program to promote emotional recognition. For example, the program asks adolescents to identify and distinguish different emotions expressed by adults and children from different racial groups. Specifically, in the first activity, the program asks adolescents to identify what an adult is thinking or feeling based on what the adult expresses with his or her eyes, and the program provides feedback to adolescents about the right or wrong options chosen. In the second activity, the program asks adolescents to distinguish basic emotions (e.g., happiness, surprise, fear, anger, sadness, disgust, and neutrality) expressed on the faces of young children of different racial groups. In this activity, the Hero program also provides automatic feedback indicating the right answer in case participants chose an incorrect option. The adult and child photos used in the program were previously validated (Baron-Cohen et al., 2001; LoBue & Thrasher, 2015).

The second session aims to stimulate a specific positive emotion, namely, gratitude, through exercises with recognized efficacy, such as the book of life. The book of life is an activity in which the program asks adolescents to remember and describe in writing events, situations, or people for which they were/are grateful during different stages in their lives (i.e., infancy, childhood, and adolescence). This activity provides adolescents with a time to stop and reflect on their lives and other people around them. These types of activities were used in previous studies and were shown to be effective in promoting gratitude and positive emotions such as happiness (Emmons et al., 2003; Lyubomirsky, 2008). The objective of the third session is to stimulate other types of positive emotions, such as joy and relaxation, using music and pictures. The fourth session aims to promote forgiveness among adolescents. The Hero program tries to help adolescents reflect on negative personal experiences, identify aggressors and work on reasons to forgive them. This reflection activity also tries to promote emotional contagion and perspective taking toward the person who is perceived as an aggressor. Finally, the last session aims to foster feelings of sympathy toward people in need and promote prosocial behavior. The activity consists of watching two motivational videos, and then the program presents a series of questions to adolescents to help them reflect on these life stories. The activity includes discussion about the importance of helping others in a material (e.g., giving things to needy people) or emotional (e.g., comforting, giving advice, and accompanying) way. Moreover, the program uses videos to show to adolescents several social realities and specific actions of nongovernmental organizations (NGOs), foundations, and persons engaged with social well-being. Each intervention session lasts approximately 30–40 minutes. For more detail, see Mesurado et al. (2019b).

Adolescents who participated in the Hero program reported higher levels of acceptance and enjoyment; moreover, the program was effective at promoting different types of prosocial behavior, but mostly helping strangers (Mesurado et al., 2019b). In addition, the program was shown to promote prosociality and emotional and cognitive empathy in Uruguayan and Argentinean adolescents, and these effects persisted 3 months later (Mesurado et al., 2020). Consequently, the Hero program seems to be promising for the positive development of adolescents.

Prosocial behavior and empathy

Research has consistently shown that prosocial behavior differs depending on the relationship that the child (Blake, 2018), adolescent (Padilla-Walker et al., 2018), or adult (Lotti, 2020) has with the aid receiver. Indeed, prosocial behavior toward strangers (someone with whom a person does not have an established relationship) is less frequent and more challenging than prosocial behavior toward relatives or friends in early adolescents (Padilla-Walker et al., 2018). This is likely because adolescents may feel less obliged to help strangers than a friend or family member. Along the same lines as these findings, a recent neuroscientific study showed that adolescents had a robust activation of the nucleus accumbens (the area linked to reward processing) when they won money for themselves or their parents during an economic game. However, nucleus accumbens activation was not associated with the rewards for a stranger (Brandner et al., 2021). These

findings may indicate that different brain areas are associated with different types of prosocial behaviors.

There is a strong association between empathy and prosocial behavior (Kamas & Preston, 2021; Van der Graaff et al., 2018). There is no consensus regarding the definition of empathy; however, most authors have stated that empathy includes emotional and cognitive aspects (Telle & Pfister, 2016). Richaud and colleagues affirmed that emotional contagion (experiencing the same or a similar feeling as another), perspective taking (understanding the point of view of others) and emotional recognition (recognizing one's own and others' emotional states) are three central dimensions of empathy (Richaud et al., 2017). This distinction is essential because previous studies have shown that different aspects of empathy are associated with different types of prosocial behaviors (Mesurado et al., 2019d). Padilla-Walker and Fraser (2014) found that prosocial behavior toward strangers is fostered by dispositional traits in early adolescence. Specifically, these authors showed that sympathy, which is an emotional aspect of empathy, predicts low-cost prosocial behavior (Padilla-Walker & Fraser, 2014). Moreover, a recent longitudinal study conducted with adolescents from 12 to 20 years old showed that the level of perspective taking and the emotional aspect of empathy were also positively associated with the initial levels of prosocial behavior toward strangers (Padilla-Walker et al., 2018). Other studies indicated that the emotional aspect of empathy was associated with prosocial behavior toward strangers, family members and friends, while perspective taking was related to prosocial behavior toward strangers and friends only in late adolescence (Mesurado et al., 2019d).

In addition, studies performed with Italian preadolescents found that early adolescents were highly successful at emotion recognition in Western adults (Mancini et al., 2018). Indeed, more than 92% of the preadolescents included in the study conducted by Mancini et al. (2018) were able to properly recognize emotions. However, it is important to highlight that a person can more accurately recognize emotions among individuals from their own racial group than among individuals from a different racial group (Elfenbein & Ambady, 2002); consequently, it is very important to promote the recognition of emotions in individuals of different races.

Mancini et al. (2018) showed that happy facial expressions triggered more pleasant reactions than negative and neutral emotions. Experimental studies have found that emotional recognition of fear and sadness expressions are related to higher levels of willingness to help strangers (Marsh & Ambady, 2007; Marsh et al., 2007). Furthermore, accurately recognizing emotions was reported to be associated with higher levels of prosocial behaviors, such as donating money or time to help strangers in need, and to be associated with making more positive judgments about others (Marsh et al., 2007). Although Marsh and colleagues have conducted studies with college students, the result of a meta-analysis with 63 different samples of children and early adolescents showed a positive association between emotional recognition and social competence. Moreover, the same meta-analysis showed a negative association between emotional recognition and internalization problems in 19 independent samples and a negative association between emotional recognition and externalization problems in 34 independent samples (Trentacosta & Fine, 2010). Another study with male early adolescent offenders indicated

a negative relation between emotional recognition in children's faces and violent behavior (Carr & Lutjemeier, 2005).

The present study

In a recent paper, Mesurado and colleagues showed that the Hero program was effective in directly promoting prosociality toward strangers and the cognitive and emotional aspects of empathy in early adolescents from Argentina and Uruguay (Mesurado et al., 2020). They also stated that the Hero program was designed to promote not only prosociality but also empathy because there is strong and consistent evidence regarding the predictive effects of empathy on prosociality (Mesurado et al., 2020). Consequently, they suggested that promoting empathy would likely strengthen the program's impact on adolescents' prosocial behavior. Nevertheless, the hypothesis about the indirect effect of the Hero program on prosocial behavior through empathy has not yet been tested. Our paper aims to fill this gap. Moreover, this paper also focuses on prosocial behavior toward strangers during early adolescence because this type of prosociality is less frequent than prosocial behavior toward relatives or known people. The promotion of empathy and prosocial behavior toward strangers is considered highly necessary in adolescence because social interaction with outgroups gradually becomes more relevant at this stage of life.

Therefore, our aim is to study the effectiveness of the Hero intervention for improving empathy (emotional contagion, emotional recognition, and perspective taking) and prosocial behavior toward strangers in adolescents. Moreover, we hope to determine whether emotional contagion, emotional recognition and perspective taking mediate the effect of the intervention on prosocial behavior promotion.

Because previous researchers found that girls in early and middle adolescence reported higher levels of prosocial behavior toward strangers than boys (Harper et al., 2016) and because levels of empathy and prosociality may change with age (Allemand et al., 2015; Padilla-Walker et al., 2018; Van der Graaff et al., 2018), we use gender and age as control variables.

Materials and method

Participants

The study initially included 431 participants in the intervention group and 325 partic-ipants in the waitlist control group. A total of 20% of the participants in the control group and 26% of the participants in the experimental group did not respond to the posttest evaluation (see the participant flow chart in Figure 1). Participants' ages ranged from 12 to 15 years old, with average ages of 13.64 (SD = .95) and 13.22 (SD = .97) for the ex-perimental and control groups, respectively. Moreover, in each group, 47% of participants identified as cisgender men, and 53% of participants identified as cisgender women. The intervention group included one hard-of-hearing person. The adolescents were Latin American, and they lived in the urban zone of Buenos Aires, Argentina.
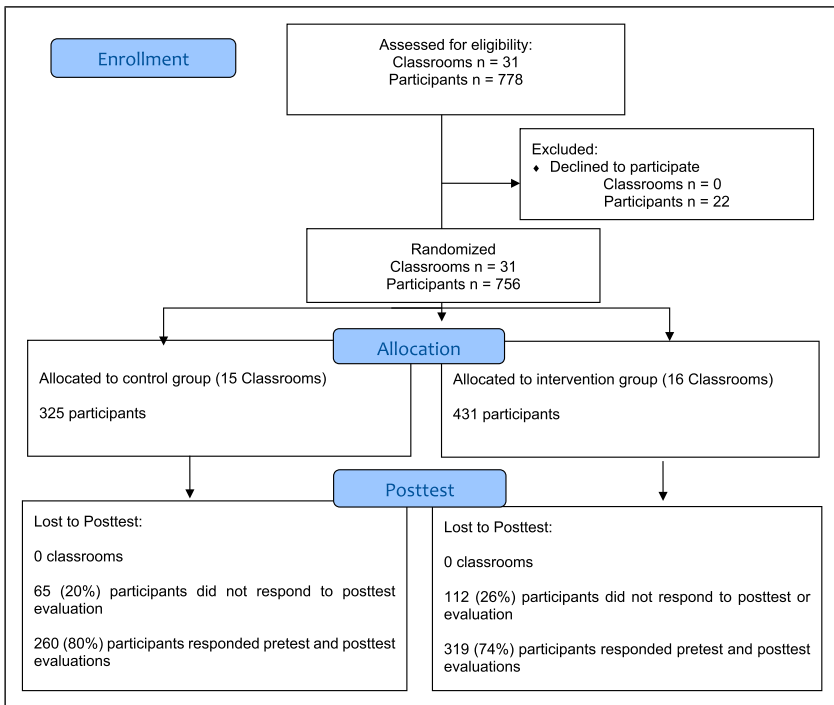
Figure 1. Participant flow chart.

Regarding the highest educational level achieved by the mothers of the adolescents who participated in the study, 9% finished elementary school, 33% finished secondary school, 47% finished university education, and 11% did not want to report this information. Moreover, for the highest educational level achieved by the fathers of the adolescents who participated in the study, 12% finished elementary school, 38% finished secondary school, 42% finished university education, and 8% did not want to report this information. There were no differences in the highest educational level reached by the mothers and fathers between the intervention and control groups.

The study and procedures were approved by the Institutional Review Board at Centro Interamericano de Investigaciones Psicolo´gicas y Ciencias Afines (CIIPCA) [19–03].

Procedure

We used a pretest-posttest control group design. We contacted different educational institutions in Argentina and held meetings with the directors and teachers of these institutions; we explained the objectives of the study, the program and its characteristics, and the duration of the sessions. Once the institutions had agreed to participate in the study, the adolescents' parents were informed via email of the possibility of their children participating in the research. Each adolescent's family received a document with all the

information about the program and the research (e.g., objectives and characteristics of the interventions). Informed consent of the parents and assent of the adolescents were requested for adolescents to be included in the study. Five Argentinean schools with a total of 31 classrooms were included in the study. Only 22 of a total of 778 students declined the invitation to participate in the study.

We used a cluster randomized trial at each school to randomly select classrooms that were later included in the experimental group or waitlist control group. Not the schools but rather the classrooms were considered the clusters in this study. This cluster composition was appropriate in this research because the students who belonged to the same classroom (1) received similar education from their teachers and (2) may have had a common pattern of relationships between them, which could be associated with their levels of empathy and prosociality. Consequently, the adolescents' classrooms should not be considered independent, so a cluster randomized trial was an appropriate solution (Lorenz et al., 2018).

The educational institutions, participants and their families did not receive any compensation to participate in the research. The intervention program was implemented in the computer room of each educational institution during school time. The intervention included seven weekly online sessions (a pretest evaluation, five intervention sessions and a posttest evaluation) of approximately 40 minutes each, while the control group completed only the pretest and posttest evaluations. One or two health professionals who were trained in the program were present during each session and were available for any questions. We included in the study only adolescents who wanted to participate in the Hero program; other adolescents continued with regular school activities.

Measures

Prosocial behavior toward strangers. We used nine items from the Spanish questionnaire that evaluates prosocial behavior toward different targets developed by Mesurado et al. (2019c). The original English questionnaire was developed by Padilla-Walker and Christensen (2011) based on one subscale of the Values in Action Inventory of Strengths (Peterson & Seligman, 2004). A sample item is "I help people I do not know even if it is not easy for me," and the response options ranged from 1 (not like me at all) to 5 (very much like me). The Cronbach's alpha coefficients were .87 at pretest and .85 at posttest. Some authors have suggested that Cronbach's alpha coefficient can provide misleading reliability estimates; for example, it could be affected by the number of items and may not be related to the internal structure of the measuring instrument (Flora, 2020; Sijtsma, 2009). Consequently, McDonald's omega coefficient was also calculated, with values of .87 at pretest and .85 at posttest. Both reliability indexes indicated good levels of internal consistency.

Empathy. We used three subscales of the Empathy Questionnaire developed by Richaud et al. (2017) to measure emotional contagion, emotional recognition, and perspective taking. Sample items are "When I am with someone who is sad, it makes me feel sad too" (emotional contagion), "I immediately notice when someone feels bad" (emotional

recognitions) and "I find it easy to understand other people's different ways of thinking" (perspective taking). The response options ranged from 1 (never) to 4 (always). The Cronbach's alpha coefficients in the pretest and posttest evaluations were .74 and .74 for emotional contagion, .80 and .77 for emotional recognition, and .76 and .75 for perspective taking, respectively. Additionally, the McDonald's omega coefficients in the pretest and posttest evaluations were .80 and .81 for emotional contagion, .86 and .83 for emotional recognition, and .86 and .82 for perspective taking, respectively. Both reliability indexes indicated adequate levels of internal consistency.

Statistical analysis

Descriptive analysis was used to calculate the mean and standard deviation for the experimental and control groups using SPSS 24. We explored the direct and indirect effects of the Hero intervention on the change in prosocial behavior toward strangers using analysis of covariance (ANCOVA), as previously proposed (Luengo Kanacri et al., 2020; Valente & MacKinnon, 2017). Valente and MacKinnon (2017) compared four different models of change to evaluate the mediated effect in intervention design and found that ANCOVA is the best procedure "for estimating the mediated effect in terms of Type 1 error rates, bias, confidence interval coverage, and power" (p. 448). This statistical procedure is appropriate for the pretest-posttest control group design. The ANCOVA technique allows adjustment for the pretest score to dependent and mediating variables. Indeed, the pretest evaluation of the mediating variable and the dependent variable were used in the estimations of the mediated effect of the independent variable (the intervention) on the dependent variable through the mediating variable at the posttest evaluation. In detail, we measured the direct effect of the Hero intervention on the change in empathy scores (emotional contagion, emotional recognition, and perspective taking) and the change in scores of prosocial behavior toward strangers in three different models. Moreover, we studied the indirect effect of the Hero intervention on prosocial behavior toward strangers through emotional contagion (Model 1), emotional recognition (Model 2) and perspective taking (Model 3). Finally, we also studied whether adolescents' age and gender moderated the effects of the Hero program on empathy and prosocial behavior toward strangers (Figure 2). The analyses were carried out using the Mplus program, version 8.5 (Muthén & Muthén, 2021).

Results

Preliminary results

As indicated in the Materials and method section, a total of 20% of the adolescents in the control group and 26% of the adolescents in the experimental group did not respond to the posttest evaluation. Consequently, the differences in sociodemographic information and baseline variables were studied between those who did not participate in the posttest sessions and those who completed the posttest sessions. The results indicated that participants who did not complete the study were slightly older than the participants who
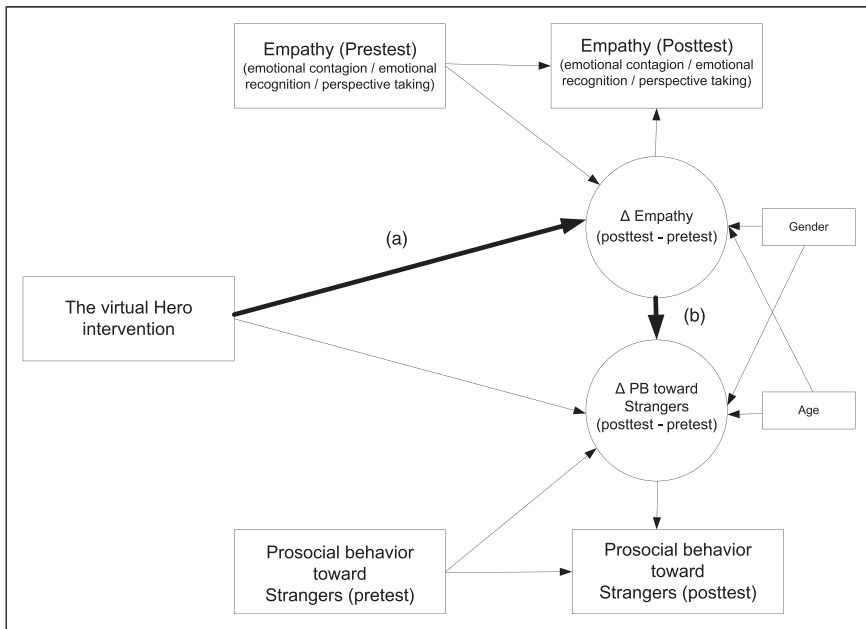
Figure 2. Mediational model.

finished the study [$M_{\text{average age of participants who dropped out of the study}} = 13.91$, $SD = .98$; $M_{\text{average age of participants who completed the study}} = 13.45$, $SD = .97$; $F(1, 754) = 25.66$, $p \leq .001$]. Moreover, those who did not complete the study initially reported lower levels of prosocial behavior toward strangers (pb_s) than the participants who finished the study [$M_{\text{pb\_s of participants who dropped out of the study}} = 2.67$, $SD = .06$; $M_{\text{pb\_s of participants who completed the study}} = 3.01$, $SD = .04$; $F(1, 754) = 33.55$, $p \leq .001$]. However, the two groups did not differ regarding empathy at the pretest evaluation (emotional contagion, emotional recognition, and perspective taking), gender or parental educational levels. Consequently, the missing data were categorized as "missing at random" (MAR) because it is assumed that the missingness could depend on the age and prosocial behavior score differences (Pedersen et al., 2017). In other words, MAR means that missingness could be a function of the measured covariate (e.g., age) and measured outcome variable (e.g., prosocial behavior toward strangers) (Muthén & Muthén, 2021). Multiple imputation was implemented in three models using the Mplus program under the MAR assumption with the intention of "providing unbiased and valid estimates of associations based on information from the available data – i.e., yielding estimates similar to those calculated from full data" (Pedersen et al., 2017, p. 165). Bootstrap analysis was performed for the three models using 1000 replicates.

Table 1 shows the means and standard deviations of prosocial behavior toward strangers and empathy (emotional contagion, emotional recognition, and perspective taking) for the experimental and control groups.

Table 1. Mean and standard deviation of empathy (emotional contagion, emotional recognition, and perspective taking) and prosocial behavior toward strangers in the pretest and posttest evaluations.

| | Control group | | | | Experimental group | | | |
| | Pretest | | Posttest | | Pretest | | Posttest | |
Variables	M	SD	M	SD	M	SD	M	SD
Emotional contagion	2.18	.73	2.14	.73	2.31	.79	2.56	.85
Emotional recognition	3.18	.54	3.11	.57	3.06	.70	3.17	.66
Perspective taking	2.93	.57	2.92	.60	2.93	.65	2.93	.73
PB toward strangers	3.09	.72	3.09	.75	3.07	.66	3.23	.79

Direct and indirect effects of the Hero intervention on the change in scores of prosocial behaviors toward strangers using emotional contagion as a mediator (Model 1)

The results show that the intervention group reported an increase in emotional contagion ($\beta = .49, p < .001$, 95%, CI [0.34 to 0.62]; Cohen's $d = 1.14$, CI [0.98 to 1.29]); however, they did not report an increase in prosociality toward strangers ($\beta = .12, p = .11$, 95% CI [−0.03 to 0.27]). Furthermore, the results suggest that the Hero intervention had an indirect effect on prosociality through emotional contagion ($\beta = .08, p < .001$, CI [0.04 to 0.11]; Cohen's $d = .16$, 95%, CI [0.02 to 0.31]). In other words, the Hero intervention increased emotional contagion, which in turn promoted prosociality. Therefore, emotional contagion fully mediated the effect of the intervention on increasing prosociality. Finally, gender had a direct effect on emotional contagion, with girls being more sensitive to the effects of the intervention on promoting emotional contagion than boys ($\beta = .25, p < .01$, 95%, CI [0.08 to 0.43]; Cohen's $d = .52$, 95%, CI [0.38 to 0.67]). However, age and gender did not affect the changes in scores of emotional contagion and prosocial behaviors toward strangers. Model 1 explained 20% of the change in the emotional contagion score (R^2 coefficients $= .20$) and 20% of the change in the prosocial behavior score (R^2 coefficients $= .20$) (Table 2).

Direct and indirect effects of the Hero intervention on the change in scores of prosocial behaviors toward strangers using emotional recognition as a mediator (Model 2)

The results show that the intervention group reported an increase in emotional recognition ($\beta = .22, p < .001$, 95%, CI [0.08 to 0.35]; Cohen's $d = .46$, CI [0.31 to 0.60]) and an increase in prosocial behavior toward strangers ($\beta = .19, p < .01$, CI [0.04 to 0.33]; Cohen's $d = .39$, 95% CI [0.25 to 0.54]). Furthermore, the results suggest that the Hero intervention had an indirect effect on prosociality through emotional recognition ($\beta = .02, p < .05$, 95%, CI [0.004 to 0.036]; Cohen's $d = .16$, 95%, CI [0.02 to 0.30]). In other

Table 2. Intervention effects on change scores (Δ) of empathy (emotional contagion, emotional recognition, and perspective taking) and prosocial behavior toward strangers (PB_S).

	ΔEC			ΔPB_S		
Model 1	β	SE	p-value	β	SE	p-value
Intervention	.49	.07	<.001	.12	.08	.12
Gender	.25	.09	<.01	.08	.08	.29
Age	−.01	.05	.79	−.01	.04	.96
Pretest scores	−.57	.05	<.001	−.52	.04	<.001
Mediation				.08	.02	<.001

	ΔER			ΔPB_S		
Model 2	β	SE	p-value	β	SE	p-value
Intervention	.22	.07	<.01	.19	.08	<.01
Gender	.18	.07	<.01	.04	.08	.64
Age	−.09	.03	<.01	−.00	.04	.98
Pretest scores	−.85	.05	<.001	−.54	.05	<.001
Mediation				.08	.01	<.05

	ΔPT			ΔPB_S		
Model 3	β	SE	p-value	β	SE	p-value
Intervention	.02	.07	.82	.21	.07	<.01
Gender	.16	.07	<.05	.03	.08	.76
Age	−.01	.04	.79	.00	.04	.90
Pretest scores	−.77	.05	<.001	−.53	.05	<.001
Mediation				.01	.01	.82

Note: ΔPB_S change scores of prosocial behavior toward strangers, ΔEC change scores of emotional contagion, ΔER change scores of emotional recognition, and ΔPT change scores of perspective taking. Standardized β-coefficients (unstandardized p-values). Model 1: R^2 coefficients for ΔEC was .20 and R^2 coefficients for ΔPB_S was .20. Model 2: R^2 coefficients for ΔER was .31 and R^2 coefficients for ΔPB_S was .17. Model 3: R^2 coefficients for ΔPT was .23 and R^2 coefficients for ΔPB_S was .22.

words, the Hero intervention increased emotional recognition, which in turn promoted prosociality. Therefore, emotional recognition partially mediated the effect of the intervention on the increase in prosociality. Finally, age and gender had a direct effect on emotional recognition, such that girls and younger participants were more sensitive to the effects of the intervention on promoting emotional recognition than boys and older participants (age $\beta = -.06$, $p < .01$, 95%, CI [−0.16 to −0.03]; gender $\beta = .12$, $p < .01$, 95%, CI [0.04 to 0.31]). However, age and gender did not affect the change in scores of prosocial behaviors toward strangers. Model 2 explained 31% of the change in scores of emotional recognition (R^2 coefficients = .31) and 17% of the change in scores of prosocial behavior (R^2 coefficients = .17) (Table 2).

Direct and indirect effects of the Hero intervention on the change in scores of prosocial behaviors toward strangers using perspective taking as a mediator (Model 3)

The results show that the intervention group reported an increase in prosocial behavior toward strangers ($\beta = .21$, $p < .01$, 95%, CI [0.06 to 0.35]; Cohen's $d = .43$, 95%, CI [0.29 to 0.58]); however, they did not report an increase in perspective taking ($\beta = .02$, $p = .81$, 95% CI [-0.13 to 0.16]). Furthermore, the results suggest that the Hero intervention did not have an indirect effect on prosociality through perspective taking ($\beta = .01$, $p = .82$, 95%, CI [-0.02 to 0.03]). Finally, gender had a direct effect on perspective taking, such that girls were more sensitive to the effects of the intervention on promoting perspective taking than boys. However, age and gender had no effect on the change in scores of perspective taking and prosocial behaviors toward strangers. Model 3 explained 23% of the change in perspective taking scores (R^2 coefficients = .23) and 22% of the change in prosocial behavior scores (R^2 coefficients = .22) (Table 2).

Discussion

There is important and consistent evidence that supports the relation between empathy and prosociality; however, to our knowledge, no study has investigated the mediating role of empathy in an intervention program aimed at promoting prosocial behavior. Consequently, this paper aimed to fill this gap by testing the effect of a virtual program on prosocial behavior toward strangers and by determining whether emotional contagion, emotional recognition and perspective taking mediate this effect. Therefore, in Model 1, we explored the direct effect of the Hero intervention on the change in the scores of emotional contagion and prosocial behavior. This model also explored the indirect effect of the intervention on the change in the scores of prosocial behavior toward strangers through emotional contagion. The results showed the presence of a full mediation model, which means that the intervention had a direct effect on the change in the scores of emotional contagion but not on the change in the scores of prosocial behavior. Furthermore, a change in the scores of emotional contagion led to a change in the scores of prosocial behavior. The emotional aspect of empathy (emotional contagion) was directly promoted by the Hero program, which in turn promoted prosocial behavior toward strangers. This result highlights the relevance of the emotional dimension of empathy as a "channel" through which to evoke helping behavior toward strangers. Most likely, the emotional aspect of empathy toward strangers does not emerge in a natural way without knowledge of the specific circumstance of the people in need. Consequently, the Hero program likely helped participants in the virtual environment focus their attention on specific situations of others' suffering, thereby promoting compassion and sorrow for others, which in turn developed prosocial behavior among participants. In other words, the virtual Hero program fostered the skill of sharing an emotional experience with strangers, thereby increasing prosocial behaviors. This finding is in line with a previous study, in which Mesurado and colleagues found that emotional states such as enjoyment and emotional empathy are more strongly associated with prosocial behavior toward

strangers than with other types of prosocial behavior, such as prosocial behavior toward family members or friends. Indeed, that research suggested that when young people have positive experiences during helping behavior, it is more likely that they will repeat the prosocial action (Mesurado et al., 2019d).

Model 2 of this paper explored the direct effect of the Hero intervention on the change in the scores of emotional recognition and prosocial behavior. This model also explored the indirect effect of the intervention on the change in the scores of prosocial behavior toward strangers through the change in the scores of emotional recognition. The results indicated that the virtual program had a direct effect on the change in the scores of emotional recognition and prosocial behavior. In addition, the change in the scores of emotional recognition had a direct effect on the change in the scores of prosocial behavior. These results indicate that emotional recognition partially mediated the effect of the virtual Hero program on the promotion of prosocial behavior toward strangers. Moreover, emotional recognition, which is a cognitive aspect of empathy, and prosocial behavior toward strangers were promoted by the Hero program. In addition, emotional recognition promoted prosocial behavior. This finding is in line with prior research, in which Marsh and colleagues showed with three different experimental studies that emotional recognition (specifically fearful facial expressions in the general population) is strongly associated with prosocial behavior (Marsh et al., 2007). The youth included in that study who distinguished fear facial more accurately also had higher intentions to donate money and time to people in need, and they were more benevolent when judging other people (Marsh et al., 2007). Moreover, another recent experimental study showed that the ability to acknowledge sad and fearful facial expressions is related to prosocial and cooperative actions (Kaltwasser et al., 2017). Similarly, Côté and colleagues found that the emotional recognition accuracy of emotional distress (e.g., afraid, scared, and nervous) is also linked with prosocial behavior (Côté et al., 2011). Consequently, because prosocial people are more skillful at recognizing distressing facial expressions, such as sadness and fear, it is essential that intervention programs focused on promoting prosocial behavior also include training in emotional recognition.

The third model explored the direct effect of the Hero intervention on the change in the scores of perspective taking and prosocial behavior. This model also explored the indirect effect of the intervention on the change in the scores of prosocial behavior toward strangers through perspective taking. The results indicated that the virtual program had a direct effect on the change in prosocial behavior scores but not on the change in perspective taking scores. These results indicate that the Hero program was not effective in promoting perspective taking. Consequently, perspective taking did not mediate the effect of the virtual Hero intervention on prosocial behaviors toward strangers. A possible explanation could be that activities included in the Hero program are directly associated with training in emotional recognition (e.g., recognizing basic emotions in adults and children from different ethnic groups) and with stimulating the emotional aspects of empathy using videos and reflections about people or victims in need. However, the Hero program includes only one specific activity related to understanding a potential offender's point of view while trying to promote forgiveness. We asked participants to identify someone who had offended them and to try to reflect on the reasons and circumstances of

the event. We also asked them to try to understand the aggressor's point of view to lead them to forgiveness. Perhaps this activity was not strong enough to stimulate the ability to take perspectives in Argentine adolescents, probably because they focused more on forgiveness situations than on perspective-taking strategies.

Limitations and future research

The main limitation is that the results can be generalized only to Argentinean adolescents with similar characteristics as the study sample, specifically, early adolescents of middle socioeconomic level who live in urban zones and attend school. Consequently, it could be necessary to implement the Hero program in other cultural contexts and in other zones of this large country, such as other Argentinean provinces or rural zones. Another important limitation of this study is that it used only self-reports to measure the program's impact on adolescents. In the future, the inclusion of reports from teachers or parents and objective behavioral measurement may improve the accuracy of the evaluations about the Hero program's efficacy. In addition, in the future implementation of the Hero program, it could be very interesting to study the mediating role of other variables, such as positive emotions. Moreover, it would be interesting to examine whether the Hero program is effective at mitigating aggressiveness or disruptive behaviors.

Conclusion

In conclusion, the findings of this research provide support that the Hero virtual program was effective in promoting prosociality directly (when it was not mediated by emotional contagion) and indirectly through emotional contagion and emotional recognition. In addition, the Hero program promoted emotional contagion and emotional recognition, but it was not effective at promoting perspective taking.

Open research statement

As part of IARR's encouragement of open research practices, the authors have provided the following information: This research was not pre-registered. The data used in the research can be obtained at: https://riu.austral.edu.ar/handle/123456789/884

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