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Dialogue intervention to youth amidst intractable conflict attenuates stress response to outgroup

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ABSTRACT

Encounter with outgroup has been shown to elicit physiological stress response and when outgroup is perceived as threatening to one's own family and community, stress is higher. In such contexts, becoming familiar and learning to empathize with the other side may reduce stress. Building on the long-lasting Israeli-Palestinian conflict, we developed an eight-week group intervention focused on dialogue and empathy and tested it within a randomized controlled trial. Eighty-eight Israeli-Jewish and Arab-Palestinian adolescents (16-18 years) were randomly assigned to intervention or control groups. Before(T1) and after(T2) intervention, one-on-one interaction with outgroup member was videotaped, cortisol levels assessed five times during a 2.5-hour session involving exposure to outgroup stimuli, and adolescents were interviewed regarding national conflict. Intervention reduced cortisol response to social contact and reminders of outgroup ($F = 4.92$, $p = .032$, $Eta^2 = 0.109$). This HPA-activity suppression was defined by two pathways. First, intervention had a direct impact on cortisol decrease; and second, intervention increased youth's behavioral empathy during one-on-one interaction with outgroup member and this empathic response mediated the effect of intervention on cortisol reduction. Adolescents' belief in the potential for reconciliation at T1 predicted greater empathy at T2. Our study provides the first evidence-based intervention for youth growing up amidst intractable conflict and demonstrates its impact on adolescents' physiological stress response to outgroup. Results contribute to research on the neurobiology of ingroup/outgroup relations, highlight the key role of dialogical empathy and social interactions for interventions targeting youth, and emphasize the importance of enhancing motivation for social inclusion for initiating positive behavioral and physiological processes.

Clinical Trials Registry (NCT02122887; https://clinicaltrials.gov).

1. Introduction

Humans are a highly social species evolved to form social groups. From early life humans learn to identify and collaborate with members of their ingroup (Dovidio et al., 2010) and to quickly identify and protect from outgroup (Penner et al., 2005). Social encounters with outgroup increase behavioral markers of stress and reduce helping behaviors. During interactions with members of outgroup, participants fidget, blink excessively, increase interpersonal space, and reduce eye contact, even when encounters are brief (Crocker et al., 1998; Dovidio et al., 1997; Fazio et al., 1995; McConnell and Leibold, 2001) and tend to offer less help even when the "outgroup" is defined only by wearing a different color shirt (Levine et al., 2005). Conceptual models suggest that ingroup relationships are marked by empathy, conformity, trust, and cooperation, whereas interactions with outgroup are characterized by vigilance and suspicion, particularly when outgroup is perceived as potentially threatening (De Dreu and Kret, 2016). Such ingroup/outgroup distinction is supported by neurobiological systems that underpin stress and affiliation. Oxytocin is involved with outgroup derogation and ingroup trust (De Dreu, 2012; Castelli et al., 2004) and the HPA stress response is greater following interactions with outgroup, particularly in the context of outgroup prejudice (Page-Gould et al., 2008).

Growing up in the context of a long-term and violent inter-group conflict amplifies the neurobiological and behavioral mechanisms of

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intergroup relationship (Stephan and Stephan, 2000) and the effect is strongest during the adolescence period (Taylor et al., 2016). The Israeli-Palestinian conflict is among the most intractable national conflicts, with a history of over a century of rivalry, aggression, and unsuccessful attempts at resolution (Bar-Tal, 2001). The ongoing political conflict among Arabs and Jews in Israel increases inter-group hatred (Gal, 1996), hostility (Bruneau and Saxe, 2010), and prejudice (Besser and Neria, 2009) and minimize the opportunities for interpersonal encounters among members of the two groups. When such contacts do occur, they are marked by anxiety, tension, and suspicion (Abu-Saad et al., 2000), thus leading to further avoidance and demonization of the other side and rendering interpersonal contacts stressful and threatening (Bar-Tal, 2001). The lack of opportunities for interpersonal encounters creates a cascade of prejudice and fear, which intensify during periods of political crisis (Maoz, 2005), times when the need for dialogue is paramount (Halperin et al., 2012; Crisp et al., 2010).

To reduce inter-group prejudice and stress, several intervention programs have been developed between Jews and Arabs in Israel (Hertz-Lazarowitz et al., 1999; Maoz, 2004; Yablon, 2007); yet, very few targeted adolescents (Bargal, 2008) and none, to our knowledge, was conducted within a randomized controlled trial (RCT). Numerous programs were based on Allport's (1954) contact hypothesis, which contends that structured face-to-face encounters between members of conflict groups increase familiarity and reduce tension (Pettigrew, 1998), but application of this approach yielded mixed results (Galily et al., 2013; Hammack, 2006). Another approach, the mixed-model approach (Maoz, 2004; Salomon, 2004) integrated components of confrontation from social-identity theory (Tajfel and Turner, 1986) with the formulation of terms for coexistence and showed reduction of fear (Shani and Boehnke, 2017). Other interventions focused on changing adults' attitudes toward outgroup members (Bruneau and Saxe, 2012), reducing prejudice (Walther et al., 2015), minimizing hostility (Maoz, 2000), or increasing knowledge of the other side (Kampf and Stolero, 2015). Numerous interventions focused on the prevention and treatment of psychopathology in Arab and Jewish children in Israel (see Miller-Graff and Cummings, 2017) and were found effective in reducing war-related stress (Berger et al., 2016) or enhancing understanding of the other side (Lustig, 2003). Yet, we are aware of no evidence-based intervention for youth growing up amidst conflict that has been shown to impact both social behavior toward outgroup and biological markers of the stress response.

Children reared in regions of long-standing conflict are born into stress and despair, learn to automatically mistrust members of the other group, and experience minimal empathy to the pain of outgroup (Cikara et al., 2011). In the case of the Israeli-Palestinian conflict, diminished empathy toward outgroup has been repeatedly found (Levy et al., 2016; Shamay-Tsoory et al., 2013) and attribution of negative intentions are reported from a young age (Cole et al., 2003). Adolescence in Israel is the period most vulnerable to divisive ideologies and practices, as Jewish youth prepare for army service (Levy and Sasson-Levy, 2008) and Arab-Palestinian adolescents often identify with Intifada activities (Berko et al., 2017). Such developments occur on the backdrop of a marked global increase in youth participation in acts of political violence and increased adolescents' involvement in armed conflict, often within civilian locations (Pauwels and Schils, 2016; Kohrt et al., 2016). Notably, however, while adolescence is the period of greatest vulnerability to hatred propaganda, it is also a time when the capacity to perceive multiple perspectives and experience emotional empathy toward “unlike-me” others increase (Davis and Franzoi, 1991; Eisenberg et al., 2005), underscoring the need to target interventions to the adolescence period.

Several authors described pathways to enhance motivations and alter cognitions in zones of conflict. For instance, direct attempts to alter attitudes toward outgroup members typically worsened, rather than improved attitudes toward the other side (Bar-Tal and Rosen, 2009). Belief in change, however, appears to have better impact. In encounters between blacks and whites in the US, informing participants that their anxiety will decrease after inter-racial encounters reduced anxiety, increased non-verbal engagement, and enhanced motivation to interact with outgroup members (Schultz et al., 2015). In the context of the Israeli-Palestinian conflict, promoting beliefs that outgroup members are capable of changing their behaviors improved attitudes toward the other side and increased motivation for peace (Halperin et al., 2011). Overall, it has been suggested that belief in the power of dialogue and the potential for change reduced the level of stress and anxiety following interpersonal encounters with outgroup members.

Research has repeatedly shown that interpersonal contact with outgroup members elicits stress and anxiety (Greenland and Brown, 1999; Trawalter and Richeson, 2008). Members of a majority group often avoid contact with minorities due to discomfort and unease in inter-group interactions and fear to offend the other side (Gaertner and Dovidio, 1986; Stephan and Stephan, 1985). Unfamiliarity and a history of intergroup conflict enhance intergroup anxiety (Stephan and Stephan, 1985), stereotyping (Islam and Hewstone, 1993) and tendency to avoid contact (Tausch et al., 2005). At the same time, positive intergroup contact reduces stress and anxiety. For instance, American and Mexican college students who experienced contact with outgroup members that helped reduce their negative perceptions also showed reduced anxiety (Stephan et al., 2000) and sense of threat (Blascovich et al., 2001). When interventions enhanced the quality of interaction among outgroup members by increasing equality and cooperation, inter-group anxiety was reduced (Islam and Hewstone, 1993). Furthermore, social contact that affords familiarity and dialogue between outgroup members is particularly important when natural opportunities for such encounters are rare (Turner et al., 2008; Wright et al., 1997).

Intergroup contact increases cortisol production. While very few studies used hormonal measures in research on intergroup interventions, the importance of assessing HPA-axis regulation in intergroup contexts has been emphasized. Few studies found associations between cortisol and inter-group prejudice and anxiety. Implicit prejudice and concerns of race-based rejection during intergroup interactions increased cortisol levels whereas prior positive contact with outgroup linked with lower cortisol reactivity (Page-Gould et al., 2008). Experimental manipulations of threat to social identity resulted in cortisol increase (Sampasivam et al., 2016). In a devaluation manipulation of college students that involved prejudice, individuals with problem-focused coping strategies evaluated the threat as controllable and showed lower cortisol reactivity (Matheson and Cole, 2004). Females interacting with males introduced as sexists showed cortisol elevation pending their attitudes toward sexism (Townsend et al., 2011). Similarly, following a computerized interaction with out-group member, levels of prejudice predicted the degree of cortisol response (Bijleveld et al., 2012); more stereotypical attitudes of white American students toward blacks predicted greater cortisol reactivity to inter-racial interaction (Amodio, 2009); implicitly prejudiced whites showed cortisol increase following intergroup interaction with a black evaluator (Mendes et al., 2007); and white American students who found intergroup contact as threatening showed increased cortisol reactivity following interaction with a minority Latino group member (Page-Gould et al., 2008). These findings suggest that interventions focused on promoting contact and dialogue and reducing prejudice toward outgroup may reduce cortisol response following encounter with outgroup.

The current study applied a manualized eight-week dialogue intervention based on our *biobehavioral synchrony* model (Feldman, 2012, 2015, 2016) to Israeli and Palestinian youth within a randomized clinical trial and examined its effects on the youths' stress response from baseline (T1) to post-intervention (T2) (see Fig. 2 for topic and description of each session). Additionally, we measured the participants' behavioral empathy toward an outgroup member during one-on-one interaction at pre- and post-intervention, combined with cortisol measurement, in light of studies showing associations between empathy and cortisol (Miller, 2011; Buchanan et al., 2012), and in order to collect

objective measures of both empathy and the stress response, instead of the typical use of self-reports (Mendes, 2009). To address cognitions, we assessed youths' belief in the potential to resolve the national conflict and expected such attitude to be linked with lower cortisol production.

The study was conducted during a period of heightened stress between Jews and Arabs in Israel, beginning after a 2012 military operation and continuing during 2014, when constant acts of terrorisms, missile attacks, and military operations took place, leading to a climate of violence, divisive attitudes, and increased tension throughout the country. Three hypotheses were formulated. First, we expected the dialogue intervention to induce mean-level changes in hormones, behavior, and attitudes. That is, we expected that among those who received the 8-week dialogue intervention we would find a decrease in their cortisol response following interaction with outgroup members, increased behavioral empathy toward an outgroup member during one-on-one social contact, and greater belief in the possibility of resolution for the long-standing conflict as compared to the matched control group. The second hypothesis considered associations among variables. We expected to find correlations between global cortisol levels evaluated pre and post-intervention. We also expected that cortisol levels would be predicted by individual differences in empathy and cognitions at baseline. Finally, we charted two pathways to the reduction in cortisol response at T2; the first, a direct pathway, through the experience of the eight-week intervention, and the second, an indirect pathway via the increase in empathy. As such, we expected that the reduced stress response following intervention would be mediated by the increase in behavioral empathy toward outgroup.

2. Experimental procedure

2.1. Participants

Eighty-eight healthy Israeli-Jewish and Palestinian teenagers participated in the study, with equal number of Jews, Arabs, boys, and girls. Participants lived in rural and urban areas in the center of Israel. Participants of both groups diverged in their living communities (urban, rural) and religious commitment (religious, secular). Participants were without any serious medical or neurodevelopmental conditions and attended regular national high-schools.

Participants were recruited through social networks, school principals, and youth centers. Adolescents were between 16 and 18 years ($M = 16.54$, $SD = 0.77$). Subjects were randomly assigned to experimental and control groups using computer-generated list of random numbers, controlling for gender, nationality, and geographic locations within Israel (rural vs. urban). The RCT is registered with the U.S. Clinical Trials Registry (NCT02122887; https://clinicaltrials.gov). Flow chart of group assignment, allocation, and follow-up appears in Fig. 1. The study was conducted between February 2013 and November 2015, approved by local IRB, conducted according to ethical guidelines, and all participants and their parents signed informed consent. Study was supported by the Fetzer Foundation, with no involvement in the collection, analysis, interpretation of data, writing of the report or submitting the article for publication.

2.2. Dialogue intervention for youth growing in conflict zones

We applied the **Tools of Dialogue©** Intervention to groups of Israeli and Palestinian youth. The intervention is based on our *biobehavioral synchrony* conceptual model (Feldman, 2012, 2015, 2016, 2017), which contends that joint social action during moments of actual social encounter can impact physiological systems of the interacting partners and impact stress and affiliative neurobiology. The intervention was constructed following extensive experience of the authors in leading Israeli-Palestinian groups and extensive consultations with Israeli-Jewish and Palestinian professionals who are leaders in the field of Jewish-Arab co-existence youth groups. The overall frame and session topics of the intervention appear in Fig. 2. Four groups were conducted –two boys groups and two girls groups. We conducted same-gender groups in light of our consultants' recommendation to avoid inconvenience for religious Islamic participants and to prevent cross-gender issues from interfering with recruitment and behavior during sessions. Each group was led by two professionals, Israeli-Jewish and Arab-Palestinian, with many years of experience in such groups. Sessions were held weekly for eight consecutive weeks and each lasted for 2 h. All sessions were structured and were conducted according to our intervention manual. In the beginning of each session, the session topic was introduced and a song or poem related to the topic in Arabic and/or Hebrew were introduced followed by translation to the other language. This is consistent with our biobehavioral synchrony model and its emphasis on joint rituals, synchronous motor activities, and cultural activities in processes of bonding (Feldman, 2016). Following the introduction, leaders introduced group discussion on the session topic (e.g., session on “conflict” – how to resolve conflict respectfully from conflicts within the family to among the nations; session on “empathy” – what is empathy and how it is expressed in close relationships and among warring societies) as well as activities, games, and guided imagery. Each session included opportunities for dyadic dialogues between participants from the two groups, as well as whole group interactions and group activities in which participants shared their family history, personal suffering related to the conflict, and the impact of the national conflict on their daily life. During the sessions we attempted to reduce tension through acquaintance and one-on-one interactions and increase empathy and perspective-taking, through the leaders' guidance and via the understanding that all youth share similar interests (e.g. sports, music), problems (with parents, teachers) and aspirations (future hopes). We also elicited empathy to the other side using role playing, songs, and videos. The intervention ended with two summary sessions in which youth expressed their “needs” from the other side, formulated practical suggestions for inter-group communication, described their personal experience in the group, and expressed future hopes at the personal and community levels. The last activity in the intervention was a metaphorical “gift giving” to the group. Sessions were videotaped, and the same two group leaders conducted all four groups. The developers of the intervention *attended all sessions* and conducted weekly meetings before and after each session with group leaders to assure fidelity and reliability.

2.3. Pre-and post-intervention assessment

Identical visits were conducted at baseline (T1) and after intervention or after 3 months for controls (T2), with a similar time-lag between T1 and T2 for the two groups. The control group did not receive any intervention and changes in study variables may be attributed to maturation or the T1 encounter. Each assessment included one-on-one interactions, hormonal collection, MEG, in-depth interview, and self-reports. To assure blind assessment, intervention leaders or assistants did not participate in data collection, coding, or analysis and all information was kept masked until the end of trial and data analysis stage. Prior studies from this sample addressed adolescents' neural response at T1 (Levy et al., 2016) and oxytocin (Influs et al., 2018). The current study utilized the following measures.

Dyadic interaction on a positive theme: Youth participated in one-on-one dialogue with outgroup member for 7 min. Participants participated in a “fun day” paradigm developed and validated in our lab. Instructions were “plan a fun day to spend together” and we employed the CIB coding scheme (Feldman, 1998) adolescent manual, which has been validated for this paradigm at this age in studies of healthy and high-risk youth (Feldman et al., 2014; Feldman, 2010; Feldman et al., 2013; Halevi et al., 2017; Levy et al., 2017). We utilized the *empathy* construct of the CIB, which has previously shown to predict the brain basis of empathy in Israeli and Palestinian youth (Levy et al., 2016).

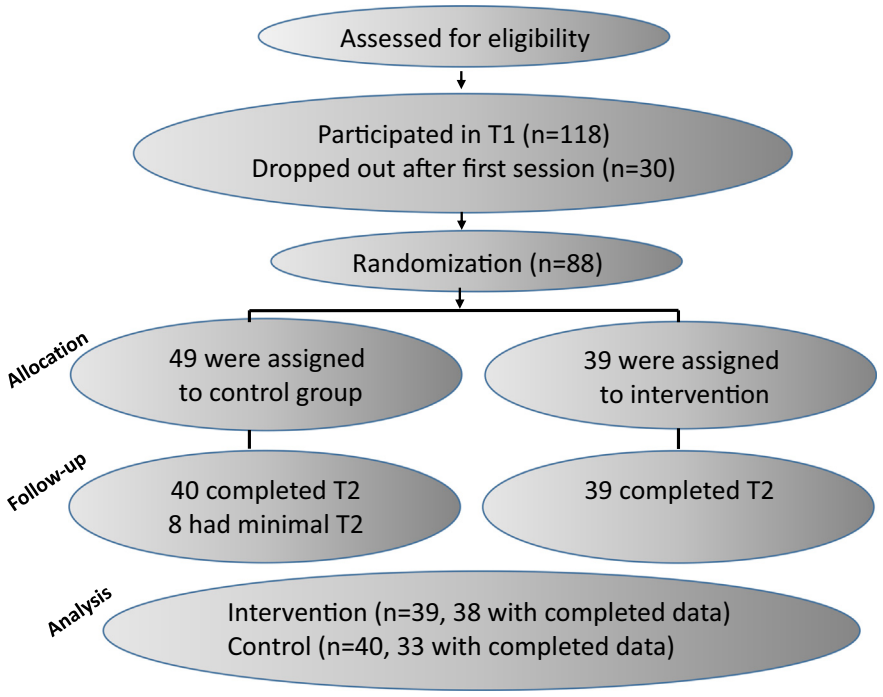

Fig. 1. Flow chart of group assignments, allocation, and follow-up assessment.

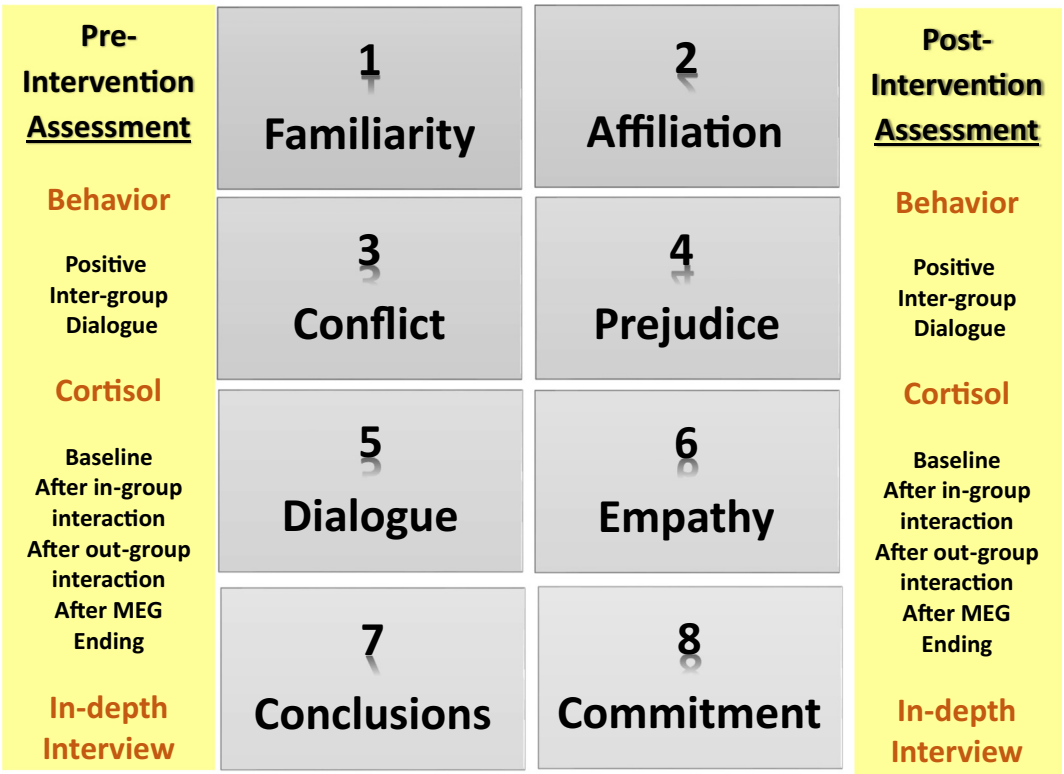

Fig. 2. Tools of dialogue intervention sessions.

The empathy construct includes the following codes: acknowledgement of partner's communication, warm affect, positive vocalization, elaboration of partners' communication, empathy, synchrony, fluency of interaction, and adaptation/regulation (alpha = 0.83).

Cortisol: Five saliva samples were collected at each assessment (T1 and T2), in order to evaluate the participants' overall cortisol production during the entire experiment. Saliva samples were collected using Salivettes® (Sarstedt, Rommelsdorft, Germany) at baseline (10 min after arrival at the lab), and right after each empirical paradigm as follows: after interaction with ingroup and out-group members (lasting 15 min, 30 min after arrival), after in-depth interview on the national conflict (lasting 30 min, 60 min after arrival), after MEG scanning (lasting 1.5 h, 2.5 h after arrival. MEG session included two paradigms that present outgroup stimuli; empathy to the pain of outgroup and prejudice in the

context of the Israeli-Palestinian conflict), and at recovery (15 min after the fourth assessment). Because cortisol response is complex, depends on time, duration, and context and there may be momentary variations in response to different stressors (Shirtcliff et al., 2014), we measured the participants' overall cortisol production over a 3.5 h lab visit that involved continuous and multi-measure exposure to social interaction with outgroup members and presentation of outgroup stimuli, which allowed a wide scope and lengthy period for a variable cortisol response. Furthermore, since our study uniquely involved a test-retest design within an RCT (we are aware of no such design in studies of cortisol response to outgroup), it was possible to compare how the cortisol response of each participant differed to the same stressors between T1 and T2. All paradigms were expected to impact cortisol levels in youth as the Israeli-Palestinian conflict is constantly evoking stress among all Israeli residents and any reminder of this conflict, particularly in the context of inter-group encounters is likely to increase stress. Moreover, all participants reported that this was their first one-on-one encounter with age-mates of the other group and that that the encounters were stressful. All samples were then stored at −20 °C. The tubes were centrifuged twice, at 4 °C at 1500 ×*g* for 30 min, aliquots stored at −20 °C.

Cortisol concentrations were determined using a commercial ELISA kit (Salimetrics, USA). Measurements were performed in duplicates according to the kit's instructions. In addition to the manufacture low and high controls: 1060 + 270, 9700 + 2430 pg/ml, three in-house controls were included in each plate (250, 900, 1200 pg/ml). Cortisol concentrations were calculated by using MatLab-7 according to relevant standard curves. The intra-assay coefficient of variance (CV %) of manufacture and in-house controls low and high range controls is < 14.02%. The inter-assay CV of low and high range samples are 23.16% and 13.08%, respectively. Measurements from experimental sessions that place before 1:00 pm or after 6:00 pm were excluded, to avoid diurnal variations (< 10% of samples); however, the vast majority of the experiments were conducted at the same time in afternoon hours, the same time when the group sessions were conducted. To compute the individual's overall cortisol production, and consistent with prior research, we used the area under the curve in respect to ground (AUCg) measure (Pruessner et al., 2003). The AUCg was calculated when at least three valid samples were available for that participant and was standardized.

Attitudes toward national conflict: Participants were interviewed individually on their attitudes toward the Israeli-Palestinian conflict, potential solution, and the possibility of national conflicts to ever be resolved. Belief in dialogue, the measure used here, addressed the degree to which adolescents believed that the conflict has the potential to be resolved and endorsed the solution of using an outside mediator is the way to reconciliation.

SCL-90-R -The Symptom - Checklist-90-Revised (Derogatis and Unger, 2010) is a well-validated instrument for assessing psychopathology that measures 90 symptoms during the past week on a 5-point scale ranging from 0 ‘not at all’ to 4 ‘extremely’. The symptoms are assigned to 9 dimensions reflecting various types of psychopathology, including somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, phobia, paranoid ideation, and psychosis. The instrument is widely-used and shows adequate psychometric properties (Derogatis, 2000).

2.4. Statistical analysis

Repeated measure ANOVA with group (intervention, control), gender (male, female), and nationality (Jewish, Arab-Palestinian) as the between-subject factors, was used to measure change in cortisol, behavioral empathy, and attitudes from pre- to post-intervention. Pearson's correlations examined associations between study variables. Finally, mediational analysis examined the mediating role of behavioral empathy on the relation between intervention and cortisol at T2.

3. Results

As a first step we tested differences in youth's psychopathological symptoms between the two groups (intervention, control) and found no differences (Fs > 0.10) in any of the SCL-90 scales. No differences were found between Jewish and Arab youth and means were below the cutoff and unrelated to cortisol levels. This suggests that the results reported here are unrelated to group differences in psychopathology and the lack of correlation with cortisol is probably due to the low-risk nature of our sample and the restricted range of psychopathology scores. It also suggests that the inter-group stress measured here in the context of the national conflict, stress that is shared by all citizens of the country, is distinct from the stress and reorganization of the HPA system that accompany a distinct psychiatric disorder.

Repeated measure ANOVA with group, gender and nationality as the between-subject factors showed an interaction effect of time and group Wilks' F (8, 64) = 4.92, p = .032, Eta^2 = 0.109. No gender or nationality effects were found and no other two- three-or four-way interactions. Among controls, no difference was found between cortisol at T1 (M = 0.15 SEM =0.26) and T2 (M = 0.23, SEM = 0.19), t (1,36) = 0.68, p > .10, whereas among the intervention group, cortisol markedly decreased from T1 (M = 0.17, SEM = 0.22) to T2 (M = −0.32, SEM = 0.16) t (1,35) = −3.85, p = .012. Results are presented in Fig. 3a.

A similar repeated measure ANOVA examined changes in behavioral empathy. A similar interaction effect of time and group was found; Wilks' F (8, 66) = 5.09, p = .027, Eta^2 = 0.069 Among controls,

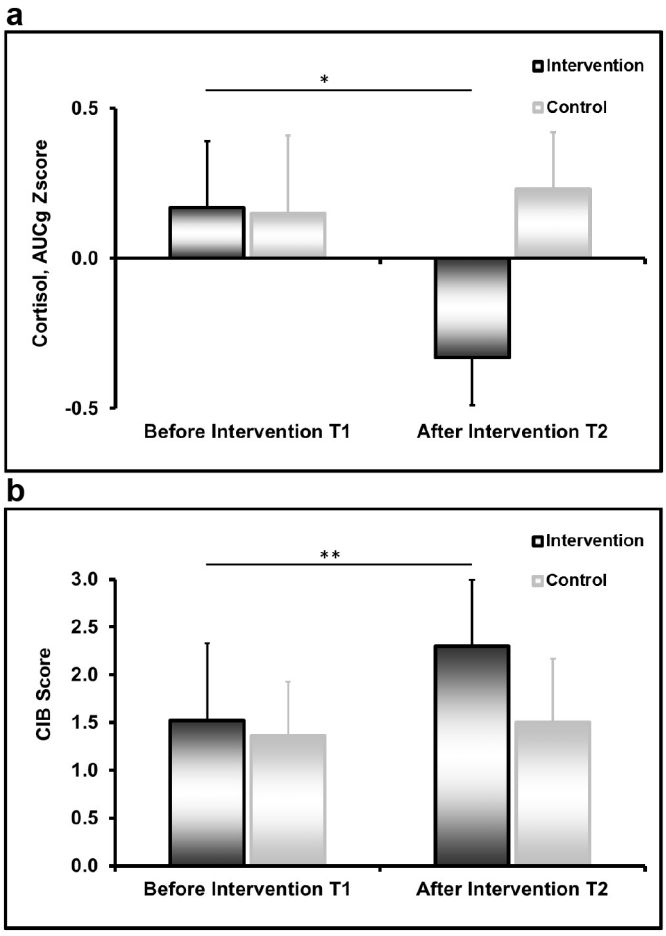

Fig. 3. a: Cortisol before and after intervention in the intervention and control groups.
b: Behavioral empathy before and after intervention in the intervention and control groups.

Table 1
Correlations among study variables.

	2	3	4	5	6
1. Cortisol T1	0.37**	0.16	0.06	0.10	0.01
2. Cortisol T2		−0.32**	−0.38**	−0.04	−0.27*
3. Behavioral empathy T1			0.35**	0.23*	0.22*
4. Behavioral empathy T2				0.23*	0.19
5. Belief in potential solution T1					0.08
6. Belief in potential solution T2					

* p < .05
** p < .01

no difference was found in behavioral empathy toward outgroup from T1 (M = 1.36, SD = 0.86) to T2 (M = 1.51, SD = 0.91), $t = -97$, $p > .10$. However, among the intervention group, behavioral empathy significantly increased from T1 (M = 1.51, SD = 0.89) to T2 (M = 2.22, SD = 0.81), $t = -5.31$, $p < .001$. Results are presented in Fig. 3b.

No significant main or interaction effects were found for attitudes.

Pearson's correlations between study variables appear in Table 1. As seen, cortisol and behavioral empathy were individually stable. Lower cortisol at T2 was associated with greater behavioral empathy at T1 and more belief in resolution at T1 was related to greater behavioral empathy at T2 and vice versa, more empathy at T1 correlated to more believing attitudes at T2.

Finally, we examined predictors of adolescents' cortisol response at T2 (Fig. 4) As seen in Fig. 4, the intervention had a direct effect on cortisol (R^2 change = 0.089 Fchange = 4.56, $p = .038$) as well as a mediated path, via Empathy (R^2 change = 0.15 Fchange = 5.98, $p = .029$, R^2 change = 0.20, Fchange = 4.74, $p = .041$), supporting our two-pathway hypothesis on the effects of dialogue intervention on suppressing cortisol response to outgroup.

4. Discussion

Inter-group encounters elicit stress, anxiety, and tension and the response is not only behavioral but also physiological. When the interactions among outgroup members occur in the context of an intractable conflict and involves youth, stress is measurably higher. Yet, such conditions are highly prevalent and the number of youth impacted by racial, tribal, religious, and national conflicts is estimated by a recent UNICEF report to approximate 530 million (JULY 2018). Among these, the Israeli-Palestinian conflict is a long-lasting sociopolitical conflict that increases fear of outgroup members from an early age and limits opportunities for contact. Such climate of fear and suspicion are detrimental to the well-being of any society, and war-exposed youth around the globe typically exhibit increased aggression, violence, and quest for revenge (Garbarino and Kostelny, 1993). Research has shown that when exposure to political strife is high, individuals reduce the tendency to endorse non-violent forms of conflict resolution (Shamai and Kimhi, 2006; Solomon and Lavi, 2005), emphasizing the need for dialogue interventions that enable interpersonal familiarity among outgroup members. Ours is the first manualized randomized controlled trial (RCT) that targets youth, focuses on concrete social behavior among outgroup members, and measures physiological stress. Several insights emerged from our study. First, the *Tools of Dialogue* intervention was found to enhance behavioral empathy during one-on-one interaction with an outgroup member, enhancing the non-verbal, as well as verbal markers of dialogue, cooperation, and reciprocity. Second, our dialogue intervention reduced cortisol production in the - intervention group, but not among controls, indicating marked decrease in youths' physiological stress response when exposed to stimuli of the outgroup. This post-intervention decrease in cortisol production was both direct and mediated by the increase in behavioral empathy. Finally, while our intervention did not alter attitudes toward the conflict, adolescents who believed in the possibility for non-violent solution at pre-intervention also showed greater empathy at T2. Overall, our findings highlight the need to focus on physiological and behavioral processes as bottom-up mechanisms that may reduce fear of outgroup among youth. Such modulations in youth's stress physiology may lead to a more adaptive stress response, reduction in allostatic load, and better capacity to manage stressful encounters with outgroup members (McEwen, 1998). Alongside, dialogue interventions and opportunities for one-on-one encounters may lead to a more local regulation of the stress response and physiological readiness to meet members of the other side without triggering the body's alarm response.

Intergroup interactions typically elicit tension and anxiety (Stephan and Stephan, 1985), which are characterized not only by conscious feelings but also by nonconscious physiological stress. Although intergroup contact has been shown to reduce feeling of stress and tension, very little effort has been directed to assess physiological markers of stress in the context of youth and ingroup conflict. Such scarcity of research is surprising as the benefits of neuroendocrinological assessments in the field of inter-group relations have been emphasized (Page-Gould and Akinola, 2015). It is important to note that our findings on cortisol reactivity require much further research and future studies should disentangle one stressful relationship from another and examine in which settings an increased or attenuated cortisol response is more adaptive (Shirtcliff et al., 2014). For instance, following conflict interactions within close relationships lower cortisol reactivity was found to characterize more stressful relationships (Shirtcliff et al., 2005; Kiecolt-Glaser et al., 2003). However, in the context of outgroup relationships, studies have consistently shown an elevated cortisol response to contact with outgroup (Amodio, 2009; Mendes et al., 2007), and we believe that this response may be even greater when the outgroup is perceived as threatening and youth are growing in the context of a continuous political struggle between the two groups. Furthermore, our findings are the first to show that an eight weeks of dialogue intervention was sufficient to reduce physiological stress, findings that lend support to the utility of our intervention and its potential to reduce stress in other

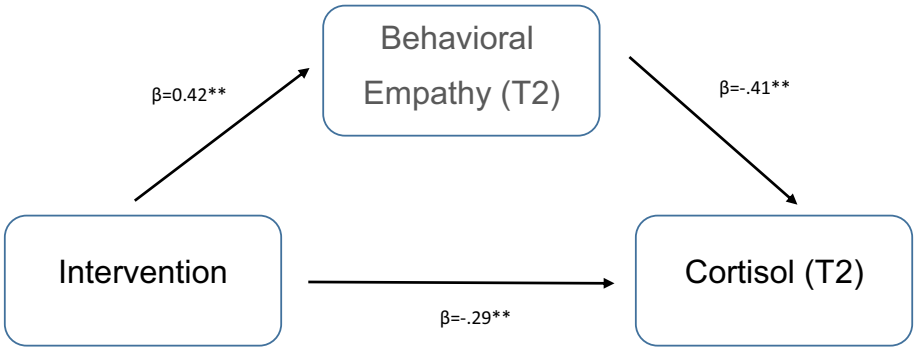

Fig. 4. Direct and mediated effects of intervention on cortisol reduction at T2.

groups across racial, national, or class-related divides. Our results are consistent with previous studies within an inter-racial context, for instance, the reduction in cortisol among Latinos and Caucasian students following three cross-group friendship encounters (Page-Gould et al., 2008), which was theorized to stem from the development of friendships and the increase in familiarity with outgroup (Paolini et al., 2004). The *Tools of Dialogue* similarly emphasized greater familiarity with the culture, family, and religious rituals of the other side, but also with the personal habits, hobbies, affiliation matrix, and aspirations of each adolescent, particularly during the first two meetings that were devoted to acquaintance and anxiety reduction.

Results indicate that change in cortisol was not only the result of increased familiarity and reduced tension but was also mediated by the increase in empathic behaviors and the consolidation of a behavioral style that acknowledges the other's communications, suggestions, feelings, and non-verbal social signals. These findings accord with prior models suggesting that in the context of inter-group conflict, contact is not sufficient and positive change only follows qualitative improvement in person-to-person relationships (Islam and Hewstone, 1993). We suggest that through one-on-one encounters, adolescents may turn the fear-provoking outgroup member into a familiar social partner and such familiarity may function as a "social buffering" of the stress response that moderates the perception of the stressor (Hostinar et al., 2014). We further suggest that such change is behavior-based and occurs via concrete synchronous interactions with the partner during moments of social contact that is positive in its tone and safe in atmosphere. These findings are also consistent with our conceptual model on *biobehavioral synchrony* and the neurobiology of affiliation (Feldman, 2012, 2016, 2017), which suggest that the neurobiology of attachment is built on concrete experiences within the parent-infant bond during early sensitive periods and, over time, extends to include a wider circle of affiliates from close family to friends to communities and to national in-groups. Our model further suggest that empathy and synchronous social behavior function to contain the stress involved in social relationships with unfamiliar, potentially threatening partners. Thus, an intervention focused on affiliation and empathy may suppress the formation of negative emotional memories activated by the SAM axis via catecholamines (e.g., epinephrine and norepinephrine) and their impact on the amygdala (McEwen, 2004), thereby enabling youth to activate lower anticipatory allostatic responses to encounters with outgroup members in the future. encounters. Much further research is needed to test the long-term effects of dialogue-promoting interventions and whether they generalize and are effective in reducing stress in future encounters with unfamiliar outgroup members.

Empathy is a key social ability that enables humans to take part in social relationships, form attachments, and develop group affiliation and national identity. Empathy has ancient evolutionary roots, is observed in a primitive form in rodents and in primates (Decety and Lamm, 2011), and the neural basis of empathy undergoes significant maturation from childhood to adolescence to adult life (Levy et al., 2018). Behavioral empathy during social interactions includes both non-verbal coordination of gaze, affective expressions, posture, and movement, and verbal indices of understanding and acknowledgement (Feldman, 2007, 2012) and integrates emotional resonance with cognitive understanding and mentalization. The capacity for empathy develops within early attachment relationships (Abraham et al., 2017; Feldman, 2007, 2015), early relationships shape the brain basis of empathy (Pratt et al., 2017), and empathy is supported by the oxytocin system, (Feldman et al., 2016). We have previously shown that when viewing the pain of an outgroup member, Jewish and Arab Israeli youth shut down the brain's automatic resonance to the pain of outgroup via top-down mechanisms and behavioral hostility and prejudicial attitudes (Levy et al., 2016). Furthermore, it has been shown that cognitive empathy increases interpersonal liking during inter-group conflict (Gutenbrunner and Wagner, 2016) and dialogue increased motivation to bridge differences (Nagda et al., 2009). Thus, our findings that eight weeks of dialogue intervention focusing on the practice of conflict resolution, synchrony, and sharing were able to increase empathy and that such increased empathy provided a pathway to the reduction of youths' stress response are noteworthy. Our results should be used to guide future interventions for immigrant and disposed youth as well as for youth growing in conflict zones or in areas marked by inter-racial biases, prejudice, hatred, and political violence.

Research has repeatedly shown that individual differences in HPA activity and cortisol reactivity are associated with social behaviors (Granger et al., 1994; Klimes-Dougan et al., 2001). The relations between cortisol production and empathy have been studied in cases of stress contagion, the matching between partners' cortisol response that is thought to occur via empathic process when individuals observe a stranger (Miller, 2011; Buchanan et al., 2012), a partner (Engert et al., 2014) or one's own child (Ostfeld-Etzion et al., 2015; Saxbe et al., 2017) in stressful situations. Yet, the relationship between empathy and cortisol in the context of inter-group conflicts, particularly as a result of intervention, has not been studied. Our findings are the first to show that greater behavioral empathy at pre-intervention was associated with lower cortisol levels at T2 for all participants, underscoring the capacity for empathy as a key component in the containment of intergroup fear and tension. Another aspect, not previously researched, is the associations between attitudes of optimism and belief in the potential for resolution at T1 with greater empathy at T2. It has been argued that dialogue increases the participants' motivation to bridge differences and understand the other side (Nagda et al., 2009) and our findings add the notion that such belief in positive change is also related to an increase in empathy over time, regardless of intervention. Cortisol levels were stable over time, as seen in the correlation found between the T1 and T2 assessments, consistent with prior research in affiliative and non-affiliative contexts (Lovallo and Thomas, 2000; Feldman et al., 2007; Schneiderman et al., 2014). This suggests that HPA reactivity marks a trait-like characteristic of the individual and thus, our findings indicating that an eight-week intervention was able to suppress cortisol reactivity in youth may suggest that the participants underwent an important psychological and biological experience that impacted not only overt behaviors but also automatic physiological processes.

In sum, our *Tools of Dialogue* intervention describes the first RCT for youth growing in a zone of political violence. We found that a dialogue-focused, behavior-based intervention was effective in reducing adolescents' physiological stress and enhancing their behavioral empathy toward an outgroup member during one-on-one encounter. The effect of our intervention on the decrease in cortisol level was both direct and indirect, mediated by the increase in empathy. Our findings highlight the key role of empathy in reconciliation efforts, the importance of targeting interventions to the adolescence period, and the need to build interventions for disposed youth that focus on dialogue between outgroup members within a safe and equal environment. As such, our study has important translational implications for enhancing empathy and reducing physiological stress during a period when millions of youth are exposed to terror, violence, derogation, hatred, and conflict.

Our study clearly requires further replication in other contexts of intergroup conflict across the world and in a variety of races, religions, and cultures before generalizations can be made. The integrated assessment of the physiological stress response via stress hormones should be complemented by electrophysiological measures, such as heart rate, vagal tone, and skin conductance, or intracranial measures, such as EEG/ERP for a fuller assessment. For further understanding of the cortisol stress response, much further research is needed to examine the timing of response, relationships to other neurobiological systems, and whether increased or attenuated cortisol response following specific stimuli is associated with more accepting attitudes and empathic interactions. One important limitation is that we did not compare our intervention to another intervention and thus, it is not possible to rule out that familiarity, rather than our specific intervention, caused the effects. Nonetheless, this is the first major empirical effort in youth

intervention and much further research, theory-building, and intervention efforts must be directed to assist youth amidst conflict. Much further research is needed to describe the biobehavioral mechanisms by which interventions translate to positive outcome, impact brain, alter behavior, and shape attitudes in youth living within ongoing conflict and to help the citizens of tomorrow's world to increase dialogue, enhance belief in co-existence, and develop the capacity for empathy.

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