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Reconciling the Contradictory Effects of Cross-Ethnic Contact on Health: A Coalitional Psychological Perspective

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by

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ABSTRACT OF THE THESIS

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by
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University of California, Riverside, June 2022
Dr. Bruce G. Link, Chairperson

Studies on the effects of ethnic diversity in neighborhoods and cross-ethnic contact on individual health outcomes have had mixed results regarding whether this effect is positive or negative. The Coalitional Safety Index (CSI) model (Boyer et al. 2015) proposes that these inconsistent results are related to differences in the perceived level of safety and its regulatory function to the stress sensitivity during cross-ethnic contact. Using the American quota samples of the Coalitional Psychology Survey (Boyer and Firat 2015), I found that the level of in-group cohesion, one of the two factors for judging the perceived safety level, moderated the direction of the moderation effect of cross-ethnic contact on the association between neighborhood diversity and health outcomes in the following way: low levels of in-group cohesion lead to negative health outcomes, while high levels of in-group cohesion lead to positive health outcomes. The perceived level of out-group threat, another factor of CSI, did not show this significant effect. These results suggest that, despite some limitation, the basic concept of CSI model (Boyer et al. 2015) may provide an integrated framework encompassing macro-scale (neighborhood diversity), meso-scale (cross-ethnic contact), and micro-scale (individuals' cognitive processes involving the coalitional sense of safety).

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Introduction

Intergroup tensions and conflicts based on race and ethnicity have played a part in human history for a long time, but it is a relatively recent phenomenon that these conflicts and tensions have become commonplace (Li et al. 2021). Due to globalization and increasing immigration, it has become common in many countries, including the United States, to have fellow citizens who are immigrants or refugees belonging to various ethnic groups as one's neighbors or colleagues. This ethnic diversity and the resulting increase in cross-ethnic contact plausibly affect several factors, including social trust (Gundelach and Freitag 2014) and social cohesion (Glas, Jennisen, and Engberson 2021), as well as the health and well-being of those involved (Ramos et al. 2019).

The literature has shown inconsistent findings regarding the impact of neighborhoods' ethnic diversity on individual health and well-being. A series of studies based on contact theory (Allport et al. 1954) has found that cross-ethnic contact reduced racial prejudice and threats, that it reduced the negative association between neighborhood diversity and health and well-being (Firat and Boyer 2015), and that it can be changed in a positive direction (Li et al. 2021; Ramos et al. 2019). However, other research shows that cross-ethnic contact can sometimes induce negative emotions and stress responses (e.g., Brenick Schachner, and Jugert 2018; Chang and Samson 2018).

The Coalitional Safety Index (CSI) model (Boyer et al. 2015) proposes that these inconsistent results are related to differences in the perceived level of safety and its regulatory function to the stress sensitivity during cross-ethnic contact. In this model, the safety index is represented by cognitive processing related to in-group cohesion, which

can provide social support during critical situation, along with the out-group threat level. Compared to in-group cohesion, the higher the out-group threat, the lower the safety index is and, as a result, the stress sensitivity toward and avoidance of out-group members are heightened.

Another point of this model is that an in-group can be ethnically homogenous or diverse depending on an individual's past cross-ethnic contact experience and preference. Therefore, the effectiveness of cross-ethnic contact can be verified by combining the difference in the level of cross-ethnic stress response according to the safety index and the diversity of the in-group.

Furthermore, the CSI model (Boyer et al. 2015) can be applied to studying the relationship between neighborhood diversity and individual health outcomes. Existing studies of the association between neighborhood diversity and health outcomes have found that cross-ethnic contacts function as moderators (Laurence 2014). If CSI moderates the directionality (positive or negative) of the effects of cross-ethnic contact, CSI can also be a moderated moderator of the association between neighborhood diversity and individual health outcomes. Moderated moderation models can provide an integrated framework encompassing macro-scale (neighborhood diversity), meso-scale (cross-ethnic contact), and micro-scale (individuals' cognitive processes involving coalitional sense of safety) factors. Therefore, using the American quota samples of the Coalitional Psychology Survey (Boyer and Firat 2015), I tested this moderated moderation model.

Background

Race/ethnic diversity in neighborhood community and health outcomes

Due to the increase in mobility brought about by globalization, racial and ethnic diversity in the United States continues to increase (US Census Bureau 2021). This phenomenon has led to changes in public opinion and awareness about racial diversity: over the past few decades, support for ethnic minority groups and opposition to school and neighborhood segregation have increased. Nevertheless, implicit prejudice, discrimination, and aversion toward ethnic minorities persist (For review, see Samson and Bobo 2014). In this changing context, social science has invested significant research into the relationship between ethnic diversity within neighborhood communities and the level of individual health and well-being, but a general consensus has not yet been reached.

Several studies in this field have reached a negative opinion of neighborhood diversity's impact on the community. Justifying this view, they claim that the proximity of neighbors with different ethnic backgrounds is a source of potential threat based on uncertainty (Samson and Bobo 2014). As a result, the residents of the community 'hunker down,', and social cohesion and trust decrease (Putnam 2007). In addition, since interactions between out-group members are accompanied by the risk of social rejection (Mendoza-Denton, Downey, and Davis 2002), repeated cross-ethnic interactions induce a stress response, and such stress may accumulate over a time, affecting health negatively (Boyer et al. 2015). In other words, since the racial diversity of a community reduces

communication and increases social isolation, the well-being and public health of the community will decline.

However, scholars inspired by contact theory (Allport et al. 1954) support the opposite view. They argue that, in an ethnically diverse community, cross-ethnic contact inevitably increases over time, thereby reducing prejudice and threat against other ethnic groups and improving health and well-being (For review, see MacInnis and Page- Gould 2015). These studies distinguish simple exposure from contact accompanied by social interaction (Laurence 2014). In other words, if cross-ethnic contact, not exposure, is held periodically and repeatedly, general social trust increases (Gundelach and Freitag 2014) and perceived out-group threat decreases (Laurence 2014).

In this respect, cross-ethnic contacts can be moderators in the relationship between neighborhood diversity and general health. Immediately after an ethnic group is introduced into the community, the perceived health level inevitably decreases because tension, anxiety, and stress based on prejudice and threat accumulate (Ramos et al. 2019). However, as the frequency of cross-ethnic contact increases over time, prejudice and tension toward ethnic groups may decrease, and more people may enjoy the broad social capital and social support that interracial contact provides (Wood et al. 2022). This suggests that, in the long term, neighborhood diversity will benefit the health and well-being of community residents (MacInnis and Page-Gould 2015).

However, from the opposite point of view, studies that argue cross-ethnic contact can have a negative effect on general trust and health are also being published

continuously. Koopmans and Veit (2014) found that Germans sometimes perceived cross-ethnic contact with immigrant groups as a negative experience, and in this case, general trust can be lowered. Cernat (2019) found that Romanian students tend to have negative out-group attitudes when the perceived quality of cross-ethnic friendship with Hungarian ethnics—surveyed through descriptors such as 'lasting,' 'honesty,' and 'harmony'— is low. In other words, whether cross-ethnic contact is positive or negative for a specific individual depends on a variety of contextual factors.

Similarly, studies documenting the negative effects of cross-ethnic contact on health and well-being are also emerging. Chang and Samson (2018) discovered that cross-ethnic friendships could exacerbate depressive symptoms and anxiety symptoms of Filipino Americans by increasing friendship discords (e.g., how often their friends criticize them). Bernick, Schachner, and Jugert (2018) found in Germany that cross-ethnic contact of Turkish-heritage ethnic minorities with ethnic majority peers increased perceptions of ethnic discrimination. As Tropp (2019) pointed out, these inconsistent findings raise questions about the validity of the basic assumption of the contact theory(Allport et al. 1954) that the societal process involving diversity will lead to negative intergroup outcomes, and that dyadic intergroup contact experience will lead to positive outcomes in a linear fashion, and in the long run, the positive effects of contact outweigh the negative effects of diversity.

Generalizing from the studies published to date, most scholars agree that a high level of neighborhood diversity increases the likelihood of cross-ethnic contact and that increased contact affects well-being and health (MacInnis and Page-Gould 2015), but

research results have been mixed on whether the effect is positive or negative. These studies have various factors in common related to differences in the situation or research subjects' interpretation, including respective social environments (Gundelash 2014), classroom climate (Bernick, Schachner, and Jugert 2018), and discriminative climate (Chang and Samson 2018). In other words, depending on how positive or negative the situation and the perception on the situation are, the effect of cross-ethnic interaction on individual stress and health may appear beneficial or harmful.

Coalitional Psychological Perspective

Theories and research from evolutionary and cognitive anthropology offer a new framework for interpreting these conflicting results. According to Kurzban, Tooby, and Cosmides (2001), the perception of race is only a by-product of the evolution of cognitive mechanisms for detecting coalitional alliance. In order to quickly distinguish between in-group allies and out-group enemies, it is necessary to explore commonalities and differences between oneself and others, and, in this process, differences in physical appearance according to race or ethnicity are detected among various social cues. Since race/ethnicity is not an absolute and unique criterion, it is possible for an ethnically diverse in-group to be formed if other cues (e.g., gender, social class) are more salient. In that regard, what matters in social contact is not fixed norms such as race, nationality, or religion, but whether someone belongs within flexible and context-dependent in-group or out-group boundaries.

Furthermore, Boyer, Firat, and van Leeuwen (2015) asserted that this cognitive mechanism is not limited to the establishment of in-group/out-group boundaries but can be extended to safety-level evaluation based on in-group/out-group cohesion and aggressiveness. The Coalitional Safety Index (CSI; see Figure 1) model they developed consists of the following elements: in-group cohesion, out-group threat, and safety index. The first element, in-group cohesion, is related to the perceived level of available social support. In general, social support has a positive effect on stress and health levels. Social support is most often defined as social interactions that provide individuals with (1) actual assistance, (2) perceived feeling that support is loving, caring, and readily available, and (3) embedded into a network of caring individuals in times of need (Kaniastry and Norris 2008). High levels of social support provide a buffer against social stress (Thoits 2009). In the CSI model (Boyer et al. 2015), the level of available social support is the criterion for judging in-group cohesion.

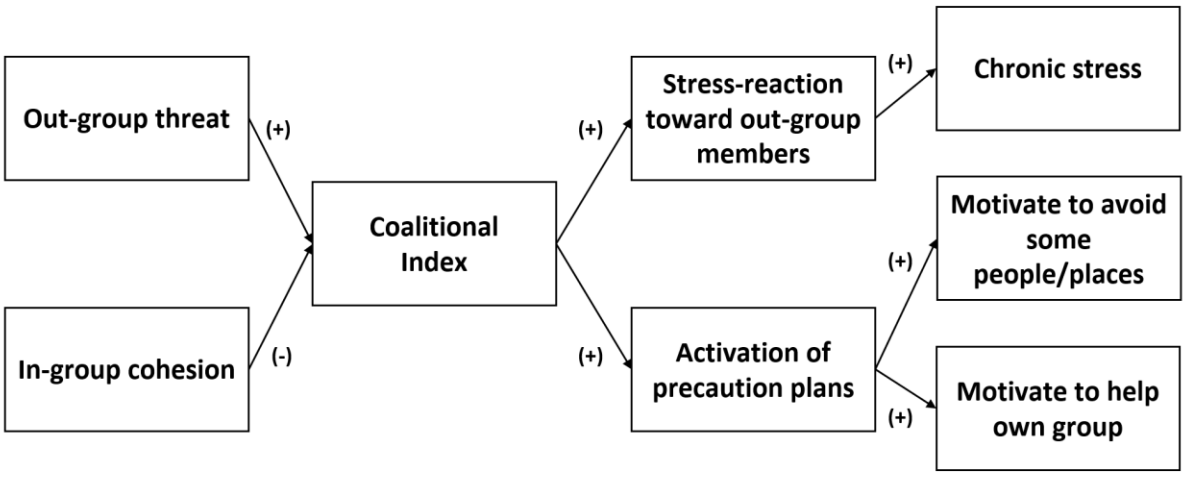

Figure 1. Coalitional Safety Index (CSI) Model (Boyer et al. 2015)

Another element of CSI, out-group threat, refers to the perceived level of the aggressiveness and cohesiveness of the out-group rather than abstract fear based on stereotype or prejudice. The last element, safety index functions like a kind of balance scale. It is a cognitive mechanism that compare the level of the aforementioned two elements, in-group cohesion and out-group threat, and determines the safety level. When the in-group cohesion exceeds the out-group threat, the perceived safety level increases, and conversely, when the out-group threat exceeds the in-group cohesion, the perceived safety level decreases. When the level of CSI is low, the body raises the level of stress sensitivity when contacting out-group members. Repeated experience and accumulation of such "coalitional stress" develops into chronic stress and adversely affects health in the long run.

The CSI model (Boyer et al., 2015) can be applied to interpret existing inconsistent studies on the association between neighborhood diversity and health and between cross-ethnic contact and health. For example, suppose that someone perceives a low-level out-group threat and a relatively high level of in-group social support. Such a person may enjoy interacting with out-group members from different ethnic backgrounds without much stress, and the accumulation of such positive experiences will positively affect his health. On the other hand, in the case of a person who perceives low levels of in-group social support and high levels of out-group threat, interactions with out-group members with different ethnic backgrounds will be stressful, and the accumulation of these stresses will likely lead to long-term health issues.

In addition, a low level of CSI also affects motivation related to cross-ethnic contact. People with low levels of CSI activate precautionary plans that avoid contact with out-group members and commit more to relationships with in-group members. In this case, people may lose access to the social capital provided by relationships with people of diverse backgrounds and may become socially isolated, but, in doing so, they reduce the chance of experiencing the stress of cross-ethnic contact and increase their contribution to in-group social support. Increasing opportunities to give and receive can help to promote health and well-being. This interpretation may be useful in explaining the so-called Latino health paradox (Dubowitz et al. 2010) and the Black-White health paradox (Keyes 2009), phenomena in which ethnic minority groups experiencing low socio-economic status and persistent discrimination sometimes experience higher levels of health and well-being than majority groups.

The CSI model (Boyer et al. 2015) provides an interpretation of why prior studies on the effects of cross-ethnic contact have had inconsistent results, but the only empirical study that has applied this model is Firat and Boyer (2015). In an ethnically diverse community, the pursuit of coalitional safety through forming in-group cohesion requires a choice between two possible strategies: ethnically diverse in-group social ties or ethnically homogeneous in-group social ties. Based on their analyses of the European Social Survey (Round 1, 2002-2003), Firat and Boyer found that subjects living in neighborhoods with high ethnic diversity experienced different levels of well-being according to in-group composition. Those who formed an ethnically homogeneous in-group experienced a low level of well-being, while those who formed an ethnically

diverse in-group experienced a high level of well-being. These results imply that people who form an ethnically diverse in-group are less likely to perceive others as out-group members in the process of cross-ethnic contact and, as a result, experience a lower level of stress than those with an ethnically homogeneous in-group.

Although this interpretation is consistent with the CSI model (Boyer et al. 2015), some limitations make it difficult to generalize these results. First, this study did not measure out-group threat, another factor in the CSI model. Also, since the responses to the number and ethnic diversity of friends were used as a proxies instead of directly measuring in-group cohesion and diversity, the validity of the measurement could be raised as a potential issue.

The Present Study

To overcome these limitations, I analyzed the questionnaire data called Coalitional Psychology Survey(Boyer and Firat 2015), which is specially designed and collected to study CSI model (Boter et al. 2015). This questionnaire consists of items asking about subjects' perceptions of neighborhood diversity, health, and the two factors of CSI model (in-group cohesion and out-group threat; Boyer et al. 2015). The items are presented in the Appendix.

To analyze the three factor of CSI (in-group cohesion, out-group threat, and safety index) and its influence on health, I performed two moderated moderation analyses (See Figure 2). The effect of CSI was analyzed in two ways: by simultaneously putting two variables (in-group cohesion and out-group threat) into a model (Figure 2a), and by

adding safety index (Figure 2b), which subtracting out-group threat from in-group cohesion.

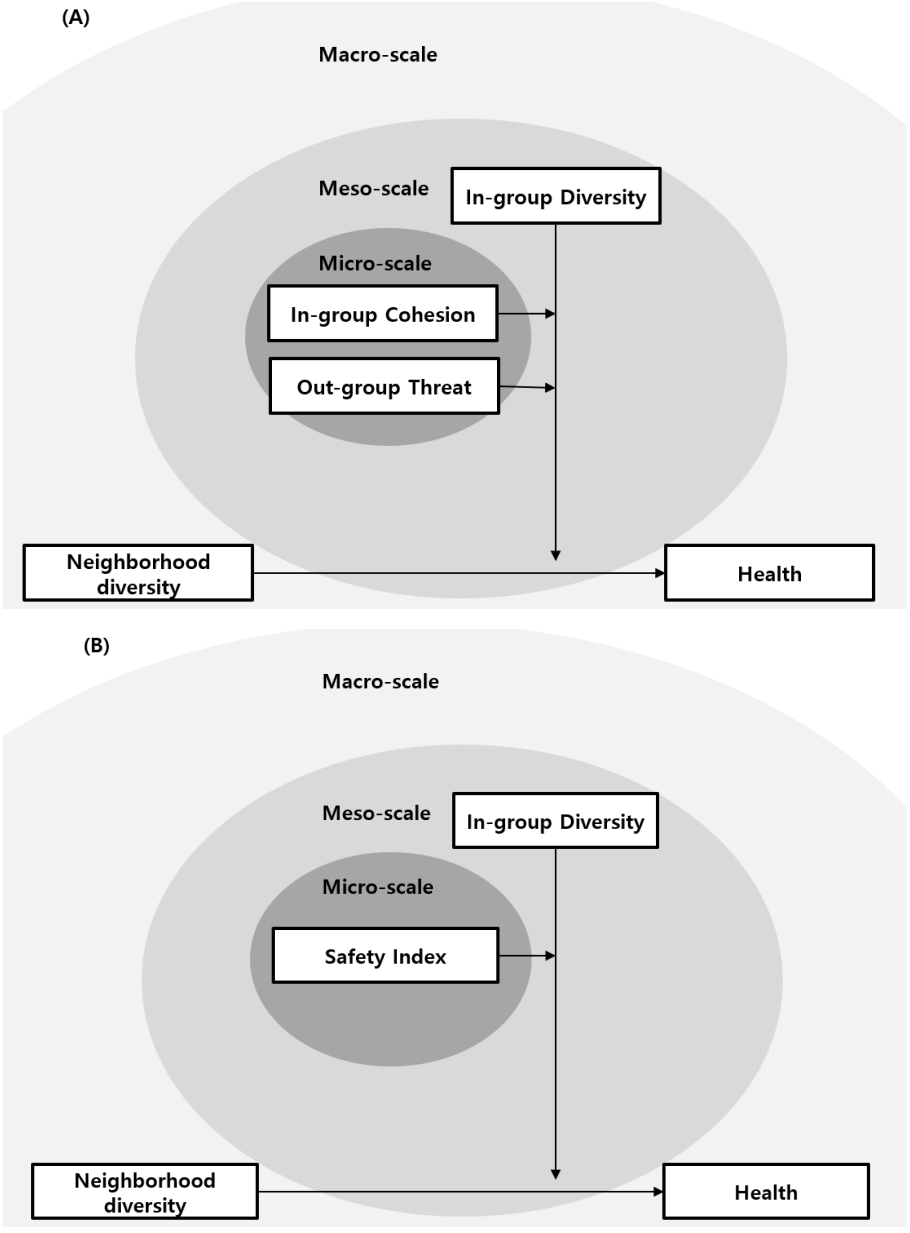

Figure 2. Conceptual Research Models

Second, it is possible to distinguish the effects of in-group cohesion and out-group threat from the effects of CSI. In-group cohesion and out-group threat have their own

main effects in addition to the regulation of physiological responses and motivation by CSI. The perceived level of in-group cohesion is based on the level of available social support, which in itself provides emotional sustenance and an active coping assistant to relieve stress (Thoits 2011). Prejudice against out-group threats can also have a negative impact on health (Laurence 2014). Moderated moderation analysis makes it possible to capture the interaction effect of CSI that is distinct from these main effects.

Methods

Sample

I analyzed 525 individuals in the United States who took part in the Coalitional Psychology Survey dataset (Boyer and Firat 2015). Descriptive statistics, including means and standard deviations of all variables, are summarized in Table 1.

Table 1. Descriptive Statistics (*N*=525)

VARIABLES	mean	std.dev	min	Max
Birth year (centered)	0.00	0.00	-62.03	23.97
Male	0.49	0.49	0.00	1.00
Education	6.36	6.36	1.00	9.00
Class	3.05	3.05	1.00	6.00
Income	4.72	4.72	1.00	10.00
Health	3.90	3.90	1.00	5.00
Race	0.73	0.73	0.00	1.00
Neighborhood Diversity (centered)	0.00	0.00	-2.97	5.03
In-group Diversity (centered)	0.00	0.00	-3.29	4.71
In-group Cohesion (centered)	0.00	0.00	-4.03	1.97
Out-group Threat (centered)	0.00	0.00	-2.88	3.12
Safety Index (centered)	0.00	0.00	-7.15	4.85

This dataset is the output of a survey for cross-cultural studies on personal opinions about social issues and attitudes like equality, diversity, and confidence in

institutions in the United States, China, South Africa, and Brazil. Respondents in these four countries were recruited through Qualtrics panel. The representativeness was ensured by quota sampling on age, sex, and race/ethnicity of each country. In the present study, only data from the United States were used among the data from four countries.

Measures

Health. The outcome variable, perceived level of health, was measured by an item: How is your health in general? This item is rated on a 5-point Likert scale (1=very good; 5=very poor). For analysis, the score of this item was reverse-scaled so that higher values indicate better health.

Neighborhood diversity. Four items measure the neighborhood diversity (e.g., just your best guess. How many of the people who live in your neighborhood would say are of a different race or ethnicity from you?; For detail, see Appendix). These items are rated on a 9-point scale (1=none (0%); 9=all (100%)). The composite measure score (the average of four items) ranges from 1 to 9, with a higher score representing a higher level of perceived neighborhood diversity (Cronbach's $\alpha = 0.88$).

In-group Cohesion. Eleven items capture the in-group cohesion: the perceived level of available social support and alliances (e.g., If I am in danger, there would be people I could count on; For detail, see Appendix). These items are rated on a 7-point scale (1=strongly disagree; 7=strongly agree), with a higher average score representing a higher level of perceived social support (Chronbach's $\alpha = 0.92$).

In-group Diversity. The perceived in-group diversity was measured by nine-items asking race-ethnicity of the subject's coalitional allies (e.g., How many of these people would you say are of different race from you?; For detail, see Appendix). The items are rated on a 9-point scale (1=none; 9=all). The composite measure score (the average of nine items) ranges from 1 to 9, with a higher average score representing the greater cross-ethnic diversity of perceived social support (Chronbach's $\alpha = 0.88$).

Out-group Threat. Seven items capture the perceived level of out-group threat (e.g., As some people prosper, my community gets poorer; For detail, see Appendix). The items are rated on a 9-point scale (1=strongly disagree; 7=strongly agree). The composite measure score (the average of seven items) ranges from 1 to 7, with a higher average score representing a higher level of perceived out-group threat (Cronbach's $\alpha = 0.92$).

Safety Index. Safety Index was calculated by subtracting the coalitional out-group threat from the In-group Cohesion of each subject. A positive value of this index means that the subjects feel high level of safety because their perceived in-group cohesion level is higher than their out-group threat level. Conversely, if this index is negative, it means that subjects perceived low level of safety because their perceived out-group threat level is greater than their in-group cohesion level. This index is ranged from 1 to 7, with a higher score representing a greater level of perceived safety.

Control Variables. Following previous studies on public mental health and well-being (Firat and Boyer 2015; Cichy et al. 2014), I controlled following variables: age, gender (0=men, 1=women), race/ethnicity (1=whites, 0=non-whites), and perceived

social class (1=Lower class, 2=working class, 3=lower middle class, 4=middle class, 5=upper middle class, 6=upper class).

Analysis

Data was cleaned and analyzed using STATA 16. Because only one Likert scale item was used as an outcome variable, both ordinary least squares (OLS) and ordered logistic regression models were applied. These approaches produced similar results, so the OSL results were presented. All continuous variables were grand-mean centered before being entered into the models to ease interpretation and minimize multicollinearity. Before starting statistical analysis, cases with any missing values were dropped. 512 cases (97.5% of original data) were used for the statistical analysis.

I conducted two hierarchical regression analyses with the same independent variable (neighborhood diversity), outcome variable (health), and moderator (coalitional in-group diversity), but use different variables as moderated moderators: coalitional in-group cohesion and coalitional out-group treat (see Table 3), and coalitional safety index (See Table 4).

Results

Table 2 presents correlations between study variables. As the Table shows In-group Cohesion, coalitional in-group diversity, coalitional out-group threat, and coalitional safety index were significantly associated with health at the bivariate level (all $p < .05$).

Table 2. Pairwise Correlations among variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Health	1.000											
(2) Neighborhood Diversity	0.074	1.000										
(3) In-group Cohesion	0.277**	0.027	1.000									
(4) In-group Diversity	0.157**	0.562**	0.068	1.000								
(5) Out-group Threat	-0.095*	0.289**	-0.061	0.242**	1.000							
(6) Safety Index	0.256**	-0.177**	0.737**	-0.122**	-0.720**	1.000						
(7) Male	0.029	0.077	-0.152**	0.122**	0.067	-0.152**	1.000					
(8) Birth Year	0.176**	0.183**	0.019	0.125**	0.054	-0.024	0.219**	1.000				
(9) Race	-0.051	-0.228**	-0.025	-0.224**	-0.028	0.001	-0.172**	-0.216**	1.000			
(10) Education	0.045	-0.072	0.096*	-0.076	-0.029	0.086	-0.068	-0.289**	0.056	1.000		
(11) Class	0.171**	-0.045	0.135**	-0.019	-0.062	0.135**	0.038	-0.067	0.001	0.310**	1.000	
(12) Income	0.241**	0.284**	0.202**	0.266**	0.111*	0.064	0.119**	0.062	-0.043	0.114**	0.467**	1.000

*** p<0.01, * p<0.05*

Table 3 shows the results of hierarchical OLS analysis using the two components of CSI (in-group cohesion and out-group threat) as moderated moderators. Model 1 tested the effects of the control variables, and showed the significant effect of birth year (β = .009, p < .01) and income (β = 072, p < .01), but they accounted for only 9.2 percent of the variance in health. As presented in Model 2, neighborhood diversity and health's association were not significant. However, the main effects of CSI related factors on health were significant: in-group diversity (β=.07, p < .05), in-group cohesion (β=.127, p < .01), out-group threat (β=-.08, p < .01). The inclusion of these variables increased the variance explained in health to 17.4 percent.

These results show that, independent of the function of CSI, the effects of in-group cohesion and out-group threat on health are significant. That is, the more diverse the in-group social ties the subjects have, the higher the expectation that they will provide a high level of social support to the subjects in difficult situations, and the lower the perceived threat that the out-group poses to the subjects' community, subjects are experiencing higher level of perceived health.

Regarding the functioning of CSI related factors, adding moderators (Model 3) did not show significant interaction effects, but the inclusion of moderated moderators (Model 4) showed a significant three-way interaction effect of in-group cohesion, in-group diversity, and neighborhood diversity on health (β=.03, p < .05). The inclusion of these moderators and moderated moderators increased the variance explained in health to 19 percent.

Table 3. Hierarchical Regression Results (moderated moderators: In-group Cohesion and Out-group Threats)

	model 1	model 2	model 3	model 4
Race	-0.0161	0.0423	0.0440	0.0346
	(0.0776)	(0.0760)	(0.0764)	(0.0762)
Male	-0.0554	0.00623	0.00463	-0.00534
	(0.0676)	(0.0659)	(0.0667)	(0.0666)
Birth Year	0.00883**	0.00803**	0.00788**	0.00814**
	(0.00220)	(0.00213)	(0.00216)	(0.00215)
Urban	0.00163	-0.0105	-0.0173	-0.0141
	(0.0299)	(0.0295)	(0.0301)	(0.0301)
Education	0.0127	0.00893	0.00948	0.00929
	(0.0144)	(0.0138)	(0.0141)	(0.0141)
Class	0.0476	0.0461	0.0446	0.0408
	(0.0329)	(0.0322)	(0.0325)	(0.0326)
Income	0.0728**	0.0509**	0.0490**	0.0509**
	(0.0181)	(0.0187)	(0.0190)	(0.0190)
Neighborhood Diversity		-0.00936	-0.0112	-0.0139
		(0.0258)	(0.0265)	(0.0267)
In-group Diversity		0.0733*	0.0745*	0.0704*
		(0.0291)	(0.0300)	(0.0303)
In-group Cohesion		0.159**	0.156**	0.127**
		(0.0275)	(0.0281)	(0.0301)
Out-group Threat		-0.0684*	-0.0766**	-0.0844**
		(0.0270)	(0.0290)	(0.0297)
Neighborhood diversity X In-group diversity			0.00289	-0.0112
			(0.0143)	(0.0167)
Neighborhood diversity X In-group Safety			0.00411	-0.00490
			(0.0202)	(0.0206)
In-group diversity X In-group Cohesion			-0.0171	-0.0302
			(0.0235)	(0.0241)
Out-group Threat X In-group diversity			-0.0211	-0.0339
			(0.0224)	(0.0238)
Out-group Threat X In-group Cohesion			0.0116	0.00882
			(0.0239)	(0.0245)
Neighborhood diversity X In-group diversity X In-group Cohesion				0.0294*
				(0.0123)
Neighborhood diversity X In-group diversity X Out-group Threat				0.00287
				(0.00920)
Constant	3.367**	3.448**	3.469**	3.486**
	(0.155)	(0.151)	(0.152)	(0.152)
Observations	512	512	512	512
R-squared	0.092	0.174	0.177	0.190

** p<0.01, * p<0.05

To investigate the significant three-way interaction of in-group cohesion, in-group diversity, and neighborhood diversity on health, slope difference analysis (Dawson and Richter 2006) for high (>1 standard deviation) and low (<1 standard deviation) levels of in-group cohesion was conducted. As presented in Figure 3B, the slope depicting the level of health in the low in-group cohesion condition increased when in-group diversity was at a high level and decreased when the level of in-group diversity was low ($p < .05$).

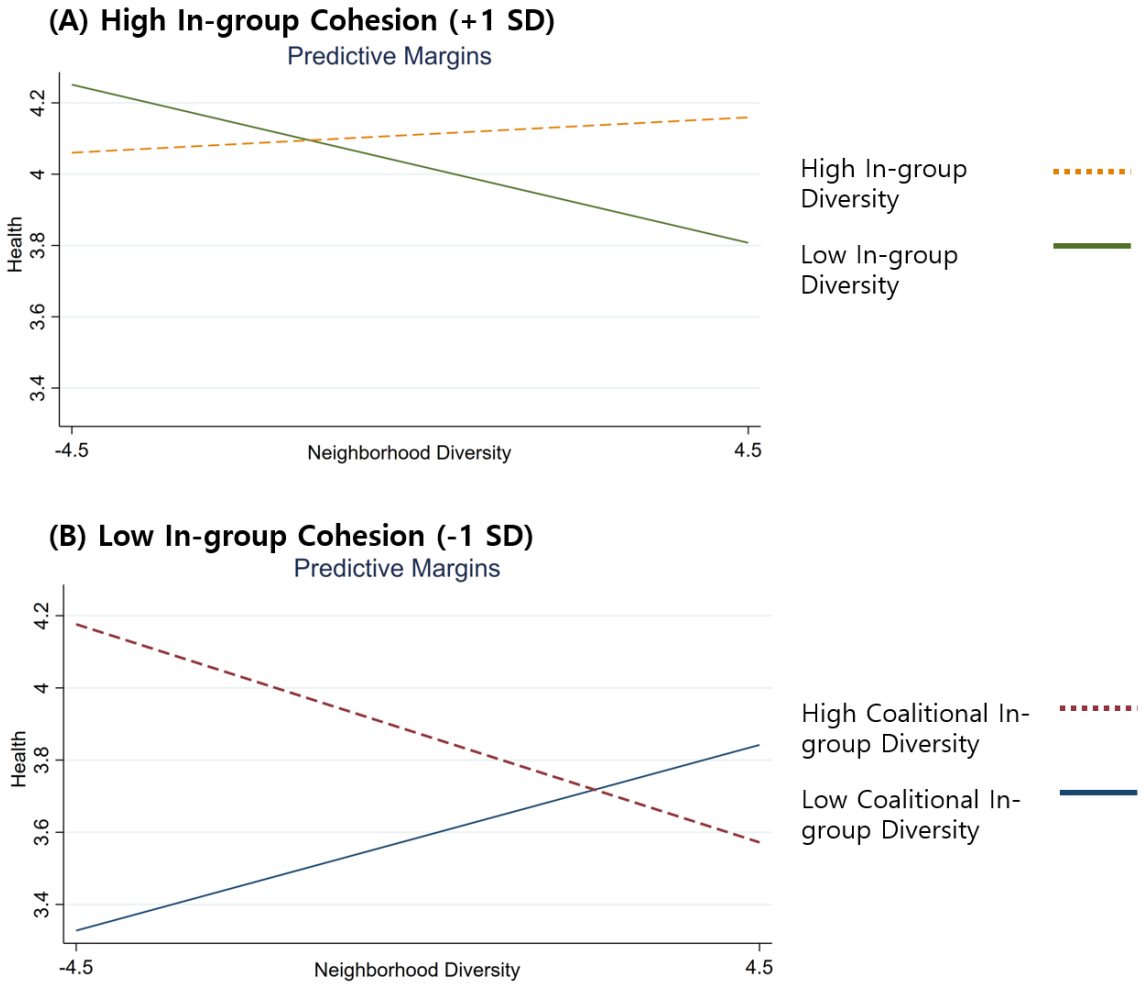

Figure 3. Plots of the three-way interaction for health in (A) high in-group cohesion and (B) low in-group cohesion.

This result is consistent with the previous studies on the inter-ethnic interactions in unfriendly environments induce friendship discords (Chang and Samson 2018), perceived ethnic discrimination (Bernick et al. 2018), and stress on race-based rejection (Page-Gould et al. 2008).

By contrast, when the level of in-group cohesion was high, although the difference was not significant, opposite directions of slopes were identified (See Figure 3A). under the conditions of low in-group social support, high levels of in-group diversity are positively associated with health. On the other hand, under conditions of high in-group social support, high levels of in-group diversity are negatively associated with health. This result is consistent with previous studies that cross-ethnic interaction promotes health and well-being (e.g., Firat and Boyer 2015; Graham et al. 2014).

Furthermore, these results are consistent with the explanation of CSI model (Boyer et al. 2015) that low levels of in-group cohesion lower the level of safety index, which in turn increases stress sensitivity in cross-ethnic contacts, and that the accumulation of stress adversely affects health.

Table 4 shows the results of hierarchical OLS analysis using safety index as moderated moderators. Because model 5 input the same samples and variables as model1, it showed the same results as model 1: the significant effect of birth year (β = .009, p < .01) and income (β = 072, p < .01). They accounted for only 9.2 percent of the variance in health.

Table 4. Hierarchical Regression Results (moderated moderator: Coalitional Safety Index)

	model 5	model 6	model 7	model 8
Race	-0.0161	0.0408	0.0406	0.0404
	(0.0776)	(0.0763)	(0.0762)	(0.0765)
Male	-0.0554	-0.00787	0.00801	-0.0148
	(0.0676)	(0.0659)	(0.0666)	(0.0664)
Birth Year	0.00883**	0.00833**	0.00764**	0.00809**
	(0.00220)	(0.00213)	(0.00216)	(0.00215)
Urban	0.00163	-0.0103	-0.0122	-0.0142
	(0.0299)	(0.0296)	(0.0298)	(0.0299)
Education	0.0127	0.0108	0.00806	0.0128
	(0.0144)	(0.0138)	(0.0140)	(0.0140)
Class	0.0476	0.0438	0.0474	0.0402
	(0.0329)	(0.0323)	(0.0325)	(0.0327)
Income	0.0728**	0.0574**	0.0502**	0.0564**
	(0.0181)	(0.0185)	(0.0189)	(0.0190)
Neighborhood Diversity		-0.00596	-0.0107	-0.00855
		(0.0259)	(0.0264)	(0.0267)
In-group Diversity		0.0814**	0.0715*	0.0807**
		(0.0290)	(0.0295)	(0.0299)
Safety Index		0.113**	0.0623*	0.108**
		(0.0186)	(0.0285)	(0.0197)
Neighborhood diversity X In-group diversity			0.00186	0.0114
			(0.0113)	(0.0127)
Neighborhood diversity X Safety Index			-0.00812	-0.00901
			(0.0137)	(0.0137)
In-group Diversity X Safety Index			0.00259	0.00244
			(0.0153)	(0.0154)
Neighborhood diversity X In-group diversity X Safety Index				0.00620
				(0.00823)
Constant	3.367**	3.422**	3.428**	3.424**
	(0.155)	(0.151)	(0.152)	(0.151)
Observations	512	512	512	512
R-squared	0.092	0.166	0.177	0.168

** p<0.01, * p<0.05

As presented in Model 6, the main effect of safety index on health was significant (β=.11, $p < .01$). In other words, the higher the level of in-group cohesion than the level of out-group threat of the subjects, the higher their perceived health of level. The inclusion of safety index increased the variance explained in health to 16.6 percent. However, there were no significant moderation effect (Model 7) and moderated moderation effect (model 8) using the coalitional safety index as a moderated moderator.

In summary, looking at the results of two moderated moderation analyzes, only in-group cohesion showed a significant moderated moderation effect on health; out-group threat and safety index did not show a significant moderated moderation effect. These results can be interpreted that CSI is a cognitive process specialized in in-group cohesion calculations rather than comparing in-group cohesion and out-group threat.

Discussion

The purpose of this study was (1) to reconcile inconsistent findings regarding the effects of ethnic diversity in community neighborhoods and cross-ethnic contact on general individual health using the CSI model (Boyer et al. 2015), and (2) to present an integrated stress-processing model encompassing macro-scale (neighborhood diversity), meso-scale (cross-ethnic contact), and micro-scale (individuals' cognitive processes involving a coalitional sense of safety) factors. For these, I conducted a moderated moderation analysis using variables reflecting the three variables in each scale.

The results provide some support for the hypothesis of the effect of the CSI. As presented in Figure 3, according to the level of in-group cohesion, the moderation effect

of cross-ethnic interaction on the association between neighborhood diversity and individual health showed an opposite pattern. That is, a low level of in-group cohesion lowers the perceived safety level, which, in turn, induces a strong stress response in cross-ethnic contact. As a result, people who frequently make cross-ethnic contact within an ethnically diverse community of out-group members may have experienced low levels of health. On the other hand, people with a high level of in-group safety experience good health because they experience the advantages of cross-ethnic contacts, such as increased social capital and broader friendship networks, without these stressors. This interpretation can be used to reconcile why existing studies on neighborhood diversity and in-group cohesion have found inconsistent results.

Interestingly, this effect was not observed in the two other CSI-related variables—out-group threat and safety index. Although in-group cohesion, out-group threat, and safety index all have significant main effects on individual health, only coalitional in-group safety moderated the direction of the moderation effect of coalitional in-group diversity. One interpretation of this result is that the CSI is likely to measure a process in the calculation of in-group cohesion only, rather than weighing the levels of in-group cohesion and out-group threat. Another alternative interpretation is that the measure of out-group in the present study may not fully reflect the respondents' perceived level of threat. In the questionnaire used in this study, compared with the questions about in-group cohesion levels that asked about the respondents' judgment of themselves (e.g., "I can easily pool resources with others to work towards a common cause"), the questions about out-group threats (e.g., "Some people threaten the well-being of my community")

require a relatively abstract perception of and judgment about others, and the perception of others' threat level may have been influenced by the level of in-group cohesion (Boyer et al. 2015).

The limitations of this study are as follows. First, the sample used in this study was comparatively small (N=525) and collected through a Qualtrics panel. Although online panel companies, including Qualtrics, are conducting quota sampling based on the demographic information of each target country (Boas et al. 2020), many researchers frequently use it (Roulin 2015). However, some researchers raise the possibility that data representativeness using online panels, such as Qualtrics, is overestimated (Landers and Behrend 2015). Furthermore, those registered as online panel participants and conducting the online surveys likely have a relatively open attitude to technology and diversity compared to other populations. If this interpretation is valid, it may be slightly challenging to say that the results observed in the present study fully represent the current trends across the United States. Also, in relation to statistical analysis, only one item (health) was used as a dependent variable, and the low effect size (R-squared value of Model 4 shown in Table 4 = .19) can limit the generalizability of the results. Second, although this study elucidated the association between neighborhood diversity and health, the mechanism detailed to explain this association remains unclear. This study did not directly measure stress sensitivity and motivation to avoid out-group members and commit to one's in-group, which are the main mechanisms triggered by a low-level CSI. Therefore, it is possible that unmeasured variables other than the CSI were also involved.

In order to overcome these limitations and better understand the mechanism by which the function of the CSI model (Boyer et al. 2015) affects social interaction and health, replication using various methodologies and the expansion of research subjects are required. For future research, questionnaires related to stress and motivation for cross-ethnic contact should be included in study instruments to overcome these limitations. In addition, it is necessary to consider conducting mixed-method studies on stress-reactivity related to cross-ethnic interaction using the daily diary method (e.g., Cichy et al. 2014) or experiments using physiological measurements (e.g., Genevon et al. 2016). In addition, it is necessary to examine whether the CSI is a useful framework for measuring conflicts and intergroup interactions within other multiracial nations (e.g., in Europe) besides the United States, or other settings, such as religious or sub-culture groups.

The present study has implications for public health policy. If the level and direction of the impact of community-level diversity on health depend on the level of in-group cohesion, simply increasing the opportunity for cross-ethnic interaction may adversely affect the well-being and health of the community. To promote psychological well-being, policies aimed at increasing the chances of cross-ethnic contact and increasing the level of in-group cohesion should be implemented simultaneously.

In conclusion, although there are some limitations, this study is meaningful in that it provides a clue for the integration of the prior contradictory findings regarding the effects of neighborhood diversity and cross-ethnic social interaction on the perceived level of health using the CSI model (Boyer et al. 2015).

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Appendix. Questionnaire items

In-group Cohesion: Please indicate to what extent you agree/disagree with the following statements

Item	Loading
(1)I can easily pool resources with others to work towards a common cause.	.69
(2) If someone attacks me, there would be people to defend me.	.75
(3) If I lost my job, there would be people willing to help me financially while I got back on my feet.	.69
(4) If I got very sick, somebody would help to take care of me such as by making sure I had food or had a ride to the doctor.	.78
(5) If I was feeling lonely, there would be people willing to spend time with me.	.84
(6) If I was feeling sad, somebody would be willing to talk with me about it.	.84
(7) If I am in danger, there would be people I could count on.	.81
(8) If I needed personal advice, someone would be willing to advise me.	.79
(9) If I had trouble finding a job, there would be people I could get help from.	.73
(10) I often work together with others to accomplish goals.	.62
(11) I have strong ties with many people.	.68
Chronbach's α= .92	

In-group Diversity: In the previous page, you indicated that you might receive support from or work together with some people. Now we would like to ask some questions about these people. How many of these people would you say...

Item	Loading
... are of a different race from you? (1)	.77
... speak a different language than you? (2)	.75
... are of a different ethnic origin than you? (3)	.77
... are of a different gender than you? (4)	.55
... are of a different age group than you? (5)	.57
... are of a different religion than you? (6)	.66
... have a different political orientation than you? (7)	.67
... are of a different social class than you? (8)	.69
... have a different education level than you? (9)	.62
Chronbach's α= .88	

Out-group Threat: People have different ways of living, traditions and values. Some of these different ways could be in conflict with how you or members of your community go about their everyday lives. Now, we would like to ask some questions about these types of situations. Please indicate to what extent you agree/disagree with the following statements.

Items	Loading
Some people threaten the well-being of my community. (1)	.77
As some people prosper, my community gets poorer. (2)	.57
There are people out there who are trying to take advantage of me or members of my community. (3)	.73
I don't feel safe interacting with some people. (4)	.67
I don't feel safe walking in certain neighborhoods because there are many people who are discomforting. (5)	.62
There are some people who would try to hurt me or members of my community, given the chance. (6)	.71
There are some people who take away jobs from members of my community. (7)	.63
Chronbach's α= .92	

Neighborhood Diversity: Just your best guess. How many of the people who live in your neighborhood would you say...

Items	Loading
... are of a different race or ethnicity from you? (1)	.88
... speak a different language than you? (2)	.83
... are of a different nationality than you? (3)	.86
... are of a different social class than you? (8)	.62
Chronbach's α= .88	