Exploring Family Risk and Protective Factors for Adolescent Problem Behaviors in the Caribbean

Edward R. Maguire

Abstract This paper develops measures of family risk and protective factors for adolescent problem behaviors and tests the effects of these measures on three health risk behaviors in a Caribbean nation: illegal gun ownership, gang membership, and drug use. Data are drawn from a sample of 2,376 adolescents in Trinidad and Tobago, a developing nation in the eastern Caribbean. Descriptive statistics are reported, as well as findings from exploratory and confirmatory factor analyses and structural equation models. Existing measures of family risk and protective factors have weak construct and concurrent validity when applied to a sample of youth from Trinidad and Tobago. The revised measures developed in this study have stronger construct validity and some of them have a significant influence on one or more health risk behaviors. From a methodological perspective, the findings are useful for thinking about the validity of existing measures of family risk and protective factors, especially for use in settings distant from where they were developed. From a substantive perspective, the findings outline the family correlates of three health risk behaviors known to exert a strong influence on morbidity and mortality among adolescents.

Keywords Risk and protective factors · Families · Adolescents · Caribbean

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Introduction

Morbidity and mortality among adolescents often result from a handful of preventable health risk behaviors [1]. While a long line of research has examined adolescent health risk behaviors in developed nations, little systematic knowledge is available about these behaviors or their antecedents in the developing world. A major emphasis of existing research involves identifying, measuring, and testing the effects of risk and protective factors on health compromising behaviors among adolescents [2–12]. While a handful of studies have focused on these issues in the Caribbean, the research in this region is still in its infancy and many questions remain unanswered. Evidence suggests that Caribbean adolescents engage in a variety of health-risk behaviors at alarming rates [13–17]. Little is known about the risk and protective factors that influence these behaviors in the developing world generally, and in the Caribbean specifically. Moreover, much remains to be learned about whether research on adolescent risk and protection in developed nations is generalizable to developing nations.

A vibrant body of research from developed nations focuses on risk and protective factors for health compromising behaviors among adolescents. This research is motivated by the simple premise that decreasing risk factors and increasing protective factors can promote resilience among youth. The most widely used measures of risk and protective factors were developed by researchers in the Communities that Care (CTC) program [2, 3]. The CTC program is based on the social development model, an integrative theory of antisocial behavior that outlines four domains of risk and protective factors thought to influence adolescent problem behaviors: community, school, family, and peer/individual [4–6]. Survey-based measures of risk and protective factors have been developed within each

domain. This study focuses on the family domain, which in its original formulation contains five risk factors measured using 27 items and three protective factors measured using eleven items. The validity of these measures is examined using data from the Trinidad and Tobago Youth Survey (TTYS). While studies have examined the validity of CTC scales in the United States, little is known about their validity elsewhere, particularly in developing nations [2, 7]. Validating these well-established measures is important for understanding adolescent health risks and the factors that influence them.

This paper offers two primary contributions. First, it tests and refines the CTC family risk and protective factors for the first time in a developing nation. Second, it examines the influence of these risk and protective factors on three serious adolescent health-risk behaviors: drug use, illegal gun ownership, and gang membership. The Caribbean region has experienced dramatic increases in violence in recent years, as well as a number of other serious social and public health problems, most of which have a direct or indirect effect on youth. The World Bank considers more than half of all young people in Latin America and the Caribbean to be at risk [18]. Understanding the risk and protective factors that influence health compromising behaviors among adolescents in this region is an important step with implications for research and policy.

Measuring Risk and Protective Factors

The CTC program relies on valid measures of risk and protective factors as a precursor to implementing appropriate interventions for adolescent problem behaviors [2, 3]. CTC measures have been used to monitor risk and protective factors in several developed nations, including Australia, Canada, the Netherlands, the United Kingdom, and the United States [3, 7–11]. The original CTC measurement model for the family domain consisted of five risk factors (poor family management; family conflict; parental attitudes favorable toward antisocial behavior; parental attitudes favorable toward alcohol, tobacco, and drug use; and family history of antisocial behavior) and three protective factors (family attachment; family opportunities for prosocial involvement; and family rewards for prosocial involvement)[2]. US studies have concluded that some of the CTC family risk and protective factor scales have solid construct validity, while others require additional refinement [2, 7, 12]. One study found strong associations between family risk and protective factors and measures of lifetime substance abuse [7].

Although no research has compared family risk and protective factors in developed and developing nations, there are good reasons to expect differences. The nature of families varies widely throughout the world, and social scientists have documented a number of distinct characteristics of Caribbean families. Women tend to play a dominant role in domestic relations, and there is some evidence of "male absenteeism" characterized by weak relationships between husbands and wives and between fathers and children [19–21]. Thus, family risk and protective factors in Caribbean nations may differ from those in the US and other developed nations. Understanding these contextual variations is important for the design of effective interventions, particularly in developing nations where resources are often scarce [13, 14, 17, 22].

Methods

This study relies on data from the TTYS, which was administered by the Ministry of Education to 2,552 students from 22 urban public schools in five districts between March and June 2006. Students surveyed were in "forms" three and five, roughly the equivalent of the eighth and tenth grades in the US. The mean age of respondents was 15.4, with a range of 10–19 (though 96.3 % of respondents were between 14 and 17). About 41 % were African and 23.7 % were East Indian, and nearly 60 % were female. English was the primary language spoken at home for 94.2 % of respondents. A number of cases were excluded because of missing or problematic data. At the end of the survey, all respondents were asked "How honest were you in filling out this survey?" If respondents did not answer the question (n = 63) or indicated "I was not honest at all" (n = 22), their responses were excluded. If respondents admitted using the nonexistent drug phenoxydine, their surveys were also excluded (n = 91). Afterward, 2,376 surveys remained in the dataset.

Setting

Trinidad and Tobago is a two-island nation in the eastern Caribbean, about seven miles northeast of Venezuela. The nation became one of the most prosperous in the Caribbean after the discovery of oil in Trinidad in 1910. Trinidad and Tobago gained independence from Great Britain in 1962, though it remains a member of the Commonwealth of Nations and British influence is ubiquitous. Over the past decade, Trinidad and Tobago experienced a significant increase in homicides, due largely to the spread of gang warfare [23]. The dramatic increase in violence heightened fear among residents [24]. The TTYS was used to gather the perspectives of the nation's youth on these and other issues.

Instrumentation

The TTYS was originally modeled after the 2006 Arizona Youth Survey, which borrowed its measures of risk and

protective factors from the CTC Youth Survey. The CTC survey is used commonly throughout the United States and has been used in other developed nations [8, 9, 11]. No published research, to our knowledge, has tested its construct validity outside the United States. Studies of adolescent health risk behaviors have been carried out in the Caribbean using other instruments [13–15, 17, 25]. Trinidad and Tobago is an English-speaking nation, but the Ministry of Education modified the instrument slightly to reflect local vernacular. The final instrument contained 238 items, measuring risk and protective factors and health risk behaviors, including alcohol and drug use and various forms of delinquent or antisocial behavior [23]. This analysis examines only a subset of the available TTYS data. This research was approved by the Human Subjects Protection committee at Arizona State University (IRB Protocol #0702001609).

Analytical Strategy

Respondents' answers on 35 survey questions were treated as indicators of a smaller set of latent variables representing different dimensions of family risk and protection.[1] The indicators contained between two and five ordinal categories representing greater or lesser levels of risk or protection. Table 1 presents descriptive statistics for these 35 items.

The latent structure and validity of the items were examined in three steps, using a different random subsample of the data at each step. This split-sample approach minimized the extent to which successive model-fitting efforts capitalized on statistical chance [26]. The first step involved estimating an exploratory factor analysis (EFA) using the 35 items and a random 25 % subsample. The EFA is useful for assessing dimensionality and detecting items that discriminate poorly. One possibility was to impose a structure on the data and test the model using confirmatory factor analysis (CFA), but there were two reasons not to pursue this path: [1] Although some research examines the measurement properties of family risk and protective factors in *developed* nations, little is known about these measures in *developing* nations; [2] When researchers begin with an ill-fitting CFA model, they must then work *backward* from an incorrectly specified model, modifying it repeatedly until it fits. It is typically more efficient to work *forward* from an EFA, using the results to specify an initial CFA model instead [27, 28]. The second step involved testing a CFA model based on findings from the EFA, using another independent random 25 %

subsample. The third step was to examine the concurrent validity of these risk and protective factors by estimating their effects on drug use, gun ownership, and gang membership. This analysis used structural equation modeling and drew on data from the remaining 50 % of respondents.

The analysis treats the ordinal survey responses as crudely categorized approximations of underlying continuous random variables while making no assumptions about the population distributions of the observed variables. Although the indicators are categorical, the latent variables are assumed continuous. Many procedures used in normal theory CFA with continuous indicators require adaptation for use with categorical indicators. Because the indicators are categorical, the robust mean- and variance-adjusted weighted least squares (WLS) estimator available in Mplus[2] was chosen as the best estimation option [29]. Monte Carlo simulations have found that this estimator performs well in models with categorical outcomes [30, 31]. The standard errors and model Chi-squares were adjusted for school-based clustering using the methods available in Mplus [32–34].

Results

Step 1: Exploratory Factor Analysis (EFA)

Using subsample 1 (n = 589), the first step involved estimating an EFA with oblique (geomin) rotation on the 35 items listed in Table 1. The goals at this stage were to examine dimensionality and the performance of the items. Based on multiple criteria for determining the number of factors to retain, the eight-factor solution was the best option ($\chi^2 = 29.27$, df = 15, $p < 0.015$; CFI = 0.986; TLI = 0.986; RMSEA = 0.04; SRMR = 0.029).[3] Factor loadings are shown in Table 2.

The original CTC model specified five family risk factors. *Poor family management* is measured well by the eight intended items in factor 1 with no cross-loadings. *Family conflict* is measured well by the three intended items in factor 3 with no cross-loadings. *Family history of*

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[1] The original CTC model contained 38 survey questions addressing family risk and protective factors, but three of those items were not used in the TTYS.

[2] Unlike many of the well-known statistical packages, Mplus provides numerous options for estimating measurement models with categorical outcomes [27, 29].

[3] The goodness of fit measures presented here are the ones most commonly used when evaluating models with categorical observed variables [27, 29]. The measures include Chi-square (χ^2) together with its associated degrees of freedom (df) and p value; the comparative fit index (CFI); the Tucker-Lewis index (TLI); the root mean square error of approximation (RMSEA); and the standardized root mean square residual (SRMR). In later models, the SRMR is replaced with the weighted root mean square residual (WRMR) because it is known to work well in confirmatory factor analysis and structural equation models with categorical outcomes.

Table 1 Frequencies for 35 Family Risk and Protective Items

Item	Coding scheme	0	1	2	3	4
Poor family management						
Q47R. My parents ask if I've done my homework.	1		14.0 %	13.4 %	29.5 %	43.1 %
Q47T. Would your parents know if you did not come home on time?	1		13.9 %	13.3 %	28.3 %	44.6 %
Q47C. When I am not at home, one of my parents knows where I am and who I am with.	1		8.8 %	11.1 %	23.8 %	56.3 %
Q47A. The rules in my family are clear.	1		11.4 %	13.6 %	23.8 %	51.2 %
Q47F. My family has clear rules about alcohol and drug use.	1		12.1 %	11.9 %	18.8 %	57.2 %
Q47E. If you drank some beer, wine, or hard liquor (for example vodka, whisky, or gin) without your parents' permission, would you be caught by your parents?	1		29.0 %	24.4 %	17.6 %	28.9 %
Q47H. If you skipped school would you be caught by your parents?	1		18.2 %	15.3 %	17.0 %	49.5 %
Q47G. If you carried a handgun without your parents' permission, would you be caught by your parents?	1		19.3 %	11.2 %	11.4 %	58.0 %
Family conflict						
Q47B. People in my family often insult or yell at each other.	1		26.9 %	24.7 %	25.4 %	23.0 %
Q47S. People in my family have serious arguments.	1		29.9 %	26.3 %	21.9 %	21.8 %
Q47D. We argue about the same things in my family over and over.	1		26.2 %	22.4 %	25.4 %	26.0 %
Family history of antisocial behavior						
Have any of your brothers or sisters ever:						
Q26A. Drank beer, wine or hard liquor (for example vodka, whiskey, or gin)?	2	37.6 %	62.4 %			
Q26B. Smoked marijuana?	2	77.6 %	22.4 %			
Q26C. Taken a handgun to school?	2	97.0 %	3.0 %			
Q26D. Been suspended or expelled from school?	2	71.6 %	28.4 %			
Family history of antisocial behavior						
About how many adults (over 21) have you known personally who in the past year have:						
Q24A. Used marijuana, crack, cocaine, or other drugs?	3	29.9 %	10.6 %	9.0 %	9.0 %	41.5 %
Q24B. Sold or dealt drugs?	3	40.1 %	10.9 %	8.4 %	9.1 %	31.5 %
Q24C. Done other things that could get them in trouble with the police, like stealing, selling stolen goods, mugging, or assaulting others, etc.?	3	39.9 %	12.2 %	8.7 %	8.5 %	30.7 %
Q24D. Gotten drunk or high?	3	17.7 %	11.4 %	8.3 %	10.0 %	52.7 %
Parental attitudes favorable toward alcohol or drug use						
How wrong do your parents feel it would be for YOU to:						
Q13A. Drink beer, wine, or hard liquor (for example vodka, whiskey, or gin) regularly?	4		66.5 %	16.0 %	13.3 %	4.1 %
Q13B. Smoke marijuana?	4		94.3 %	4.1 %	1.1 %	0.6 %
Parental attitudes favorable toward antisocial behavior						
How wrong do your parents feel it would be for YOU to:						
Q13C. Steal something worth more than $30?	4		88.5 %	9.5 %	1.4 %	0.6 %
Q13D. Draw graffiti, write things, or draw pictures on buildings or other property (without the owner's permission)?	4		66.5 %	22.8 %	6.9 %	3.9 %
Q13E. Pick a fight with someone?	4		62.4 %	26.1 %	9.6 %	1.9 %
Family attachment						
Q47I. Do you feel very close to your mother?	1		13.0 %	10.6 %	22.3 %	54.1 %

Table 1 continued

Item	Coding scheme	0	1	2	3	4
Q47J. Do you share your thoughts and feelings with your mother?	1		20.5 %	18.9 %	26.2 %	34.5 %
Q47P. Do you feel very close to your father?	1		25.8 %	17.2 %	25.5 %	31.5 %
Q47L. Do you share your thoughts and feelings with your father?	1		38.5 %	21.7 %	19.8 %	20.1 %
Opportunities for prosocial involvement						
Q47Q. My parents give me lots of chances to do fun things with them.	1		17.9 %	20.0 %	27.8 %	34.4 %
Q47K. My parents ask me what I think before most family decisions affecting me are made.	1		24.5 %	22.6 %	27.2 %	25.6 %
Q47O. If I had a personal problem I could ask my mother or father for help.	1		20.0 %	13.4 %	24.9 %	41.6 %
Rewards for prosocial involvement						
Q35. My parents (or those who you consider to be your parents) notice when I am doing a good job and let me know about it.	5	12.5 %	35.0 %	21.1 %	31.4 %	
Q36. How often do your parents tell you they're proud of you for something you've done?	5	18.5 %	38.3 %	21.4 %	21.8 %	
Q47M. Do you enjoy spending time with your mother?	1		11.0 %	9.1 %	31.3 %	48.6 %
Q47N. Do you enjoy spending time with your father?	1		20.1 %	13.2 %	28.4 %	38.3 %

Coding scheme 1: 1 = NO!, 2 = no, 3 = yes, 4 = YES!

Coding scheme 2: 0 = No, 1 = Yes

Coding scheme 3: 0 = 0, 1 = 1, 2 = 2, 3 = 3–4, 4 = 5+

Coding scheme 4: 1 = Very wrong, 2 = Wrong, 3 = A little bit wrong, 4 = Not wrong at all

Coding scheme 5: 0 = Never or almost never, 1 = Sometimes, 2 = Often, 3 = All of the time

antisocial behavior split into two factors. Four of its intended items loaded on factor 2 and four items on factor 4, in both cases with no cross-loadings.[4] Factor 2 appears to measure history of anti-social behavior among adults whom the respondent knows, whereas factor 4 measures history of anti-social behavior among siblings. The two items intended to measure *parental attitudes favorable toward antisocial behavior* and the three items intended to measure *parental attitudes toward alcohol and drug use* all loaded together on factor 5 without cross-loadings. Factor 5 appears to measure parental attitudes favorable toward alcohol, drugs, and anti-social behavior.

The original CTC model specified three family protective factors. Four items were intended to measure *family attachment*. Two of them (q47i and q47j) loaded on factor 6 along with items intended to measure *family rewards for prosocial involvement* and *family opportunities for prosocial involvement*. Two others (q47l and q47p) loaded on factor 7 along with items from the other two protective factors. All three items intended to measure *family*

opportunities for prosocial involvement loaded on factor 6 along with items intended to measure the other two protective factors. Finally, four items were intended to measure *family opportunities for prosocial involvement*. Two of them (q35 and q36) loaded on factor 8. Of the other two items, one (q47m) loads on factor 6 and one (q47n) loads on factor 7. Factor 6 appears to measure maternal attachment, factor 7 paternal attachment, and factor 8 family rewards for prosocial involvement.

Based on the EFA findings, three items were dropped (q47q, q47k, and q47o) from the next stage of analysis. These items were intended to measure family opportunities for prosocial involvement, but they no longer make sense given the EFA findings. The 32 remaining items measure five family risk factors and three family protective factors that are somewhat different from those in the original CTC model specification.

Step 2: Confirmatory Factor Analysis (CFA)

The next step involved estimating a CFA on subsample 2 (n = 589) to test the revised eight-factor model using the 32 remaining items. The model fit the data well ($\chi^2 = 33.14$, $p = 0.0071$, df = 16; CFI = 0.976;

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[4] Loadings greater than 0.3 were considered meaningful if there were no cross-loadings (items that loaded at more than half the value of the primary loading). Meaningful loadings and cross-loadings are shown in bold in Table 2.

Table 2 Factor loadings for eight-factor EFA solution

Question	1	2	3	4	5	6	7	8
Q47R. My parents ask if I've done my homework.	**0.313**	0.012	0.062	−0.027	0.023	0.253	0.113	0.120
Q47T. Would your parents know if you did not come home on time?	**0.522**	−0.096	−0.012	−0.043	0.018	0.136	0.081	0.043
Q47C. When I am not at home, one of my parents knows where I am and who I am with.	**0.488**	0.024	0.035	0.033	−0.121	0.249	−0.065	0.020
Q47A. The rules in my family are clear.	**0.389**	0.004	−0.185	0.049	−0.103	0.197	−0.048	0.121
Q47F. My family has clear rules about alcohol and drug use.	**0.564**	0.052	0.003	−0.045	−0.195	−0.006	0.078	0.005
Q47E. If you drank some beer, wine, or hard liquor (for example vodka, whisky, or gin) without your parents' permission, would you be caught by your parents?	**0.510**	0.010	−0.128	−0.102	0.063	0.033	0.104	−0.106
Q47H. If you skipped school would you be caught by your parents?	**0.768**	−0.047	−0.028	0.017	0.011	0.017	−0.017	0.039
Q47G. If you carried a handgun without your parents' permission, would you be caught by your parents?	**0.856**	−0.057	0.036	−0.019	0.013	−0.030	−0.049	−0.048
Q47B. People in my family often insult or yell at each other.	−0.021	−0.014	**0.698**	0.062	−0.032	−0.040	−0.013	−0.034
Q47S. People in my family have serious arguments.	0.076	0.027	**0.684**	0.052	−0.002	−0.036	0.063	0.030
Q47D. We argue about the same things in my family over and over.	−0.035	0.014	**0.736**	−0.070	0.032	0.122	−0.029	−0.068
Q26A. Have any of your brothers or sisters ever: drank beer, wine or hard liquor (for example vodka, whiskey, or gin)?	0.123	0.163	0.009	**0.765**	0.064	−0.008	0.026	−0.013
Q26B. Have any of your brothers or sisters ever: smoked marijuana?	−0.084	0.154	−0.029	**0.802**	−0.006	0.027	0.009	0.013
Q26C. Have any of your brothers or sisters ever: taken a handgun to school?	−0.285	−0.072	0.024	**0.522**	0.209	−0.019	−0.013	0.003
Q26D. Have any of your brothers or sisters ever: been suspended or expelled from school?	−0.043	−0.018	0.058	**0.659**	0.031	0.020	−0.058	−0.032
Q24A. About how many adults (over 21) have you known personally who in the past year have: used marijuana, crack, cocaine, or other drugs?	0.034	**0.862**	0.015	0.087	−0.064	−0.039	−0.020	0.070
Q24B. About how many adults (over 21) have you known personally who in the past year have: sold or dealt drugs?	−0.016	**0.955**	0.032	−0.050	0.007	−0.013	−0.017	0.011
Q24C. About how many adults (over 21) have you known personally who in the past year have: done other things that could get them in trouble with the police, like stealing, selling stolen goods, mugging, or assaulting others, etc.?	−0.039	**0.848**	−0.022	−0.024	0.081	0.054	−0.033	−0.063
Q24D. About how many adults (over 21) have you known personally who in the past year have: Gotten drunk or high?	0.000	**0.759**	0.009	0.112	0.028	0.012	0.043	−0.017
Q13A. How wrong do your parents feel it would be for YOU to: drink beer, wine, or hard liquor (for example vodka, whiskey, or gin) regularly?	−0.097	0.026	0.134	0.171	**0.553**	0.040	−0.077	0.042
Q13B. How wrong do your parents feel it would be for YOU to: how wrong do your parents feel it would be for YOU to: smoke marijuana?	−0.029	0.090	−0.039	0.182	**0.734**	−0.107	0.195	−0.163
Q13C. How wrong do your parents feel it would be for YOU to: steal something worth more than $30?	0.124	−0.015	−0.063	0.001	**0.839**	0.048	0.028	−0.059
Q13D. How wrong do your parents feel it would be for YOU to: draw graffiti, write things, or draw pictures on buildings or other property (without the owner's permission)?	−0.038	−0.067	0.036	0.007	**0.714**	0.043	−0.072	0.050
Q13E. How wrong do your parents feel it would be for YOU to: pick a fight with someone?	0.067	0.031	0.110	−0.022	**0.789**	−0.086	−0.016	0.062
Q47I. Do you feel very close to your mother?	0.051	0.054	0.024	0.032	−0.061	**0.898**	−0.034	−0.036
Q47J. Do you share your thoughts and feelings with your mother?	0.031	−0.053	0.017	0.014	0.072	**0.815**	−0.042	0.028

Table 2 continued

Question	1	2	3	4	5	6	7	8
Q47P. Do you feel very close to your father?	−0.012	−0.009	0.016	0.003	−0.019	0.029	**0.903**	−0.012
Q47L. Do you share your thoughts and feelings with your father?	−0.004	−0.016	0.007	−0.051	0.124	0.050	**0.805**	0.032
Q47Q. My parents give me lots of chances to do fun things with them.	−0.040	0.005	−0.060	−0.095	0.037	**0.494**	**0.299**	0.108
Q47K. My parents ask me what I think before most family decisions affecting me are made.	0.062	0.041	−0.007	−0.041	0.001	**0.616**	0.054	0.079
Q47O. If I had a personal problem I could ask my mother or father for help.	−0.020	−0.006	−0.067	−0.040	0.000	**0.650**	0.281	−0.021
Q35. My parents (or those who you consider to be your parents) notice when I am doing a good job and let me know about it.	0.047	−0.026	−0.035	0.043	−0.020	−0.023	−0.005	**0.912**
Q36. How often do your parents tell you they're proud of you for something you've done?	−0.037	0.034	−0.024	−0.124	0.025	0.130	0.098	**0.686**
Q47M. Do you enjoy spending time with your mother?	0.018	−0.043	−0.007	0.115	−0.048	**0.767**	0.101	−0.015
Q47N. Do you enjoy spending time with your father?	0.129	−0.024	0.009	0.132	−0.088	−0.016	**0.865**	0.022

Key:

Factor 1: Poor family management

Factor 2: Adult history of anti-social behavior

Factor 3: Family conflict

Factor 4: Sibling history of anti-social behavior

Factor 5: Parental attitudes favorable toward anti-social behavior, alcohol, and drug use

Factor 6: Maternal attachment

Factor 7: Paternal attachment

Factor 8: Family rewards for pro-social involvement

TLI = 0.979; RMSEA = 0.042; WRMR = 0.973). Every item had a strong and statistically significant loading (not shown) on its designated factor. One indicator of the validity of these measures is how they relate to each other. If they have strong convergent validity, protective factors should positively correlate with one another. The same holds for the risk factors. Moreover, if they have strong discriminant validity, then risk and protective factors should be negatively correlated. Previous research concludes that the CTC risk and protective factors have strong convergent and discriminant validity [2]. Table 3 shows the correlations between the final eight factors. All the signs are in the correct direction and 24 of the 28 correlations are statistically significant. The risk factors are all positively correlated with each other, the protective factors are all positively correlated with each other, and the risk and protective factors are negatively correlated with each other.[5] These results suggest strong convergent and discriminant validity.

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[5] For ease of interpretation, the signs of factor 1 (poor family management) were reversed in Tables 3 and 4 because the items comprising the factor are reverse coded. A higher score on these items (as originally coded) is intended to reflect better family management.

Step 3: Structural Equation Model (SEM)

The next step involved using subsample 3 (n = 1,178) to examine the impact of these eight risk and protective factors on three binary variables measuring serious adolescent problem behaviors: drug use, gun ownership, and gang membership. For drug use, respondents were coded 1 if they had ever used either marijuana or cocaine and 0 if they had never tried either drug. For gun ownership, respondents were coded 1 if they had ever owned a firearm (for other than hunting or target shooting) and 0 if not. For gang membership, respondents were coded 1 if they had ever belonged to a gang (even if not currently in a gang) and 0 if not. A small percentage of students reported engaging in each problem behavior: 12.3 % for drug use, 14.6 % for gun ownership, and 14.8 % for gang membership.

The three binary outcome variables were regressed on the eight family risk and protective factors using a single structural equation model that fit the data well (χ^2 = 43.43, df = 15, p = 0.0001; CFI = 0.982; TLI = 0.983; RMSEA = 0.040; WRMR = 1.124). Table 4 lists standardized probit coefficients measuring the effect of each risk or protective factor on each outcome variable.

The results for the five risk factors were mixed. *Poor family management* is a clear risk factor, with consistently

Table 3 Correlations between eight CFA factors

Factor	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Factor 1: Poor family management	1							
Factor 2: Adult history of anti-social behavior	0.254***	1						
Factor 3: Family conflict	0.197***	0.314***	1					
Factor 4: Sibling history of anti-social behavior	0.286***	0.536***	0.440***	1				
Factor 5: Parental attitudes favorable toward anti-social behavior, alcohol, and drug use	0.465***	0.289***	0.180***	0.382***	1			
Factor 6: Maternal attachment	−0.561***	−0.010	−0.163**	−0.030	−0.146*	1		
Factor 7: Paternal attachment	−0.385***	−0.074	−0.162**	−0.111**	−0.166**	0.372***	1	
Factor 8: Family rewards for pro-social involvement	−0.447***	−0.133*	−0.315***	−0.119	−0.216***	0.520***	0.297***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 Probit results for the effects of the eight factors on three problem behaviors

Factor	Drug use	Gun ownership	Gang membership
Factor 1: Poor family management	0.253*	0.257**	0.358**
Factor 2: Adult history of anti-social behavior	0.232**	0.107*	0.251***
Factor 3: Family conflict	0.068	−0.058	0.066
Factor 4: Sibling history of anti-social behavior	0.123	0.237**	0.014
Factor 5: Parental attitudes favorable toward anti-social behavior, alcohol, and drug use	0.175**	0.211***	0.092
Factor 6: Maternal attachment	0.143	0.200**	0.144
Factor 7: Paternal attachment	−0.058	0.069	0.128
Factor 8: Family rewards for pro-social involvement	0.045	−0.044	−0.104

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

strong, positive effects on all three outcomes. *Sibling history of anti-social behavior* had a significant positive effect on gun ownership, but not on drug use or gang membership. It is difficult to interpret this finding with certainty, since the variable is expected to influence all three problem behaviors. One possible explanation is that adolescents with antisocial siblings may have higher levels of fear (of their siblings, or of the friends or enemies of their siblings), thus prompting them to acquire a firearm. *Adult history of antisocial behavior* has significant positive effects on all three problem behaviors. Adolescents are likely to learn from behaviors they observe among adults they know. Note that this same pattern is less evident with siblings, suggesting that adolescents are more likely to mimic the behaviors of adults than siblings.

Family conflict has non-significant effects across the board. This finding is consistent with the perspective that it may not be how *often* families fight, but *how* they fight that matters [35–37]. If this is true, future research will need to develop and test new indicators intended to measure the nature of family conflict in addition to its frequency. Finally *parental attitudes toward antisocial behavior,*

alcohol, and drug use that are more tolerant have significant positive effects on drug use and gun ownership, but not gang membership. Parents who exhibit tolerant attitudes toward drug use and gun ownership may be purposely or inadvertently encouraging these behaviors, but the same pattern does not hold for gang membership.

Only one of the nine coefficients for family protective factors had a statistically significant effect and it was opposite the intended direction. Altogether, six of the nine coefficients had signs opposite the expected direction. Adolescents who reported having stronger attachment to their mothers were *more* likely to own a gun. This finding is difficult to interpret, but one possibility for further investigation is whether fear may be confounded with maternal attachment. Based on the findings so far, it appears the CTC family protective factors have weak construct and concurrent validity in this setting. More work needs to be invested in conceptualizing and measuring the protective factors that promote resilience in the face of the various risk factors faced by adolescents [16].

Another clear pattern that emerges from this analysis is that the risk and protective factors do not appear to have

consistent effects on the outcome variables. Of the 24 regression coefficients in Table 4, only ten had a statistically significant effect and one of those was opposite the expected direction. From a methodological perspective, this finding signals a potential concurrent validity problem. From a substantive perspective, it suggests that the causal factors that influence adolescent health risk behaviors may not be universal across different contexts and behavior types.

Limitations

The study has three primary limitations. First, the Ministry of Education purposely chose school districts and schools within the nation's most troubled communities to participate in the survey. Therefore the results are not representative of the nation as a whole. Second, the sample might have missed adolescents in Trinidad who had dropped out of school or who were absent on the days the surveys were administered. Third, all data are based on self-reports. Though steps were taken to minimize errors associated with self reporting, these data were not validated using external sources.

Discussion

Understanding the effects of risk and protective factors on adolescent health risk behaviors is vital. This paper makes both methodological and substantive contributions to existing research on family and adolescent health. From a methodological perspective, the paper illustrates the importance of careful testing and validation in measuring risk and protective factors. Previous assessments of the measurement properties of the CTC risk and protective factor scales in the US concluded they are reliable and valid [2, 7]. The US Substance Abuse and Mental Health Services Administration describes the CTC survey as "a reliable and valid instrument to measure the incidence and prevalence of substance use, delinquency and related problem behaviors and the risk and protective factors that predict those problems" [38]. The CTC youth survey is beneficial for communities, but the measures have not been subjected to extensive validation across a wide range of community types. The CTC measures were not established for use in developing nations, therefore this study sought to test their validity in this context. The findings suggest the need for additional testing and refinement in different contexts.

Six of the eight original CTC scales had problems with construct validity. Valid measures of some CTC factors could not be developed; other CTC factors needed to be combined or split. Current findings and previous research suggest that additional validation and refinement is especially needed on the protective factors. Developing effective programs to address adolescent health risks requires knowledge of both risk *and* protective factors. In sum, it doesn't appear wise to assume that "validated" measures—even those widely implemented like the CTC—are necessarily valid in other contexts, particularly in developing nations.

In addition, the paper also makes substantive contributions relevant to adolescent health policy in the Caribbean. The results show clearly that parents with poor family management skills and those who expose their children to adults who exhibit antisocial behaviors (whether the parents themselves or others) increase their risk for drug use, gun ownership, and gang membership. Similarly, parents who exhibit tolerant attitudes toward their children's misbehavior place them at increased risk for drug use and gun ownership.

These findings are consistent with a growing body of research from developed nations on the effects of parenting practices on adolescent problem behaviors. Although several domains of risk and protective factors exert an influence on adolescent health risk behaviors, research shows that family dynamics have a strong influence on problem behavior throughout childhood and adolescence [39]. For instance, weak family management practices, including insufficient supervision of adolescents by parents, results in premature autonomy, which sets insufficient limits on behavior and facilitates greater influence by deviant peers. Similarly, weak or unclear behavioral expectations and insufficient disciplinary practices are also associated with problem behaviors [40, 41]. For these reasons, families represent an important area of focus for prevention and intervention efforts intended to reduce risk and enhance resilience among adolescents. Fortunately, a large body of research has shown that family based interventions that seek to improve parental monitoring, clarify parental expectations, enhance communication between adolescents and their parents, and reduce negative interaction patterns are effective in reducing adolescent problem behaviors [42–49]. The findings presented in this paper suggest that family-based interventions could potentially play an important role in reducing gang membership, drug use, and illegal gun ownership among youth in Trinidad and Tobago.

Throughout the developing world, nations continue to implement prevention and intervention programs for adolescent health risk behaviors in the absence of a clear understanding of risk and resilience. As this study shows, establishing valid measures of risk and protective factors is an important first step that can inform the development of programs and policies in these areas.

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