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Measuring Community Risk and Protective Factors for Adolescent Problem Behaviors: Evidence from a Developing Nation

Edward R. Maguire[1], William Wells[2], and Charles M. Katz[3]

Abstract

Most published research on community risk and protective factors for adolescent problem behaviors has been carried out in developed nations. This article examines community risk and protective factors in a sample of more than 2,500 adolescents in Trinidad and Tobago, a developing Caribbean nation. The authors examine the construct and concurrent validity of five community risk factors and two community protective factors. The findings of this study suggest that existing measures of risk and protective factors have weak construct validity when applied to a sample of youth from Trinidad and Tobago. The revised model specifications this study developed

[1] Department of Justice, Law & Society, American University, Washington, DC, USA
[2] Sam Houston State University, Huntsville, TX, USA
[3] Arizona State University, Phoenix, AZ, USA

Corresponding Author:
Edward R. Maguire, American University, Washington, DC, 20016, USA
Email: maguire@american.edu

fit the data better than the original models developed in the United States. However, the concurrent validity of both sets of measures is weak. Our findings suggest the need for caution when transplanting measures of risk and protective factors from developed to developing nations.

Keywords
risk factors, protective factors, social development model, Caribbean criminology, factor analysis

Introduction

This article examines the validity of the community risk and protective factor measures developed by researchers in the Communities that Care program ([CTC] Arthur et al. 2002, 2007). The CTC program is based on the social development model, an "integrative or synthetic" theory of antisocial behavior that combines ideas from social learning, control, and differential association theories (Brewer et al. 1995; Catalano and Hawkins 1996:155; Hawkins and Catalano 1992). The social development model posits four domains of risk and protective factors shown to influence adolescent problem behaviors: community, school, family, and peer/individual. Each domain contains a series of observed indicators that measure risk and protective factors using a number of separate scales. This study focuses on the community domain, which contains 2 protective factors measured using 6 items and 5 risk factors measured using 19 items. We examine the construct validity and criterion-related (or concurrent) validity of these measures using data from the Trinidad and Tobago Youth Survey (TTYS).

Studies have examined the construct and criterion-related validity of CTC scales in the United States, but little is known about the properties of these scales elsewhere, particularly in developing nations (Arthur et al. 2002, 2007; Glaser et al. 2005). Scholars have pointed out important differences between developed and developing nations (e.g., Beyers et al. 2004; Ohene, Ireland, and Blum 2005). Even in economically vibrant[1] developing nations like Trinidad and Tobago, cultural and structural differences make it important to test measures created and validated elsewhere, especially in developed nations like the United States (Tandon et al. 2003).

This article offers four primary contributions. First, we validate some existing community risk and protective factors and question others. Second, in contrast with most previous research, we use statistical methods that account for the categorical nature of the observed variables. Third, this is

the only study that examines the measurement of community risk and protective factors for adolescent problem behaviors in a developing nation. Fourth, we examine the influence of these risk and protective factors on drug use, gun ownership, and gang membership.

Measuring Risk and Protective Factors

With its grounding in prevention science and the social development model, CTC seeks to identify risk and protective factors for adolescent problem behaviors (Hawkins, van Horn, and Arthur 2004). Research shows that communities vary in terms of risk and protective factors as well as adolescent substance use and delinquency (Hawkins et al. 2004). CTC depends on valid, reliable measurement of risk and protective factors as a precursor to implementing appropriate interventions. The CTC Youth Survey has been used to monitor risk and protective factors in several developed nations, including Australia, the Netherlands, the United Kingdom, and the United States (Arthur et al. 2007; Beyers et al. 2004; Fairnington 2004; Glaser et al. 2005; Jonkman, Junger-Tas, and van Dijk 2005). The survey's strengths include the ability for students to complete it during one class period, the measurement of several subscales within four risk and protective factor domains and behavioral and health outcomes, and applicability to a wide age range (11-18). Researchers have concluded the CTC survey possesses desirable psychometric properties (Arthur et al. 2002, 2007; Glaser et al. 2005; Schmitt et al. 2005). For these reasons, we chose items from this survey to examine risk and protective factors in Trinidad and Tobago.

The original CTC measurement model for the community domain consisted of five risk and two protective factors (Arthur et al. 2002). This model was modified in two empirical tests. Arthur et al. (2002) tested a measurement model of CTC risk and protective factors using data gathered from a sample of Oregon youths. They eliminated the "opportunities for prosocial involvement" scale because of "weak factor structures and unacceptable reliabilities" (p. 588). For the remaining scales, items loaded as expected and scale reliabilities were strong. They also found that measures of problem behaviors were positively associated with risk factors and negatively associated with problem behaviors. They concluded that the risk and protective factor scales had good measurement properties. These results are routinely cited to support the validity of risk and protective measures derived from the CTC survey.

Glaser et al. (2005) also assessed the measurement properties of the CTC risk and protective factor scales. Like Arthur et al. (2002), they eliminated

the "opportunities for prosocial involvement" scale, in this case because the items were dichotomous. Glaser et al. (2005) reported that their final confirmatory model fit the data. They also found that the measurement properties of the four domains were invariant by race/ethnicity, gender, and age/grade. This study represents the most solid support for the construct validity of the CTC community domain scales.

Hawkins and colleagues (2004) used the Glaser et al. (2005) model to gauge risk and protective factors across 41 communities in 7 U.S. states and to measure community-level correlations with adolescents' lifetime substance use. They reported that seven community domain scales were related to lifetime substance use, with correlations ranging from .17 to .82. For example, the scale measuring the extent to which laws are favorable to drug use closely correlated with lifetime smoking (.72), alcohol use (.71), binge drinking (.64), and marijuana use (.71). On the other hand, the transitions and mobility scale exhibited lower correlations with these problem behaviors (.10 to .34), a finding similar to that of Arthur et al. (2002).

In addition, research has demonstrated that risk and protective factors exhibit different relationships with problematic youth behaviors in different nations (Beyers et al. 2004). Although no one has explicitly compared risk and protective factors in developed and developing nations, good reasons suggest such differences may be pronounced. For instance, research commonly shows schools are a potent protective factor for youth (e.g., Anteghini et al. 2001). Yet, compulsory education laws in developing nations often allow children to exit school much younger than in developed nations. As cross-national evidence on risk and protective factors and their relationships with health and behavior outcomes grows, it is likely to generate vital insights into the ways these correlates operate in different settings (e.g., Beyers et al. 2004; Ohene et al. 2005). Identifying and understanding risk and protective factors are especially important in developing nations, where advancements depend on targeting scarce resources where they can generate the largest dividends (Blum et al. 2003; Blum and Ireland 2004). Thus, it is important to understand whether the strong measurement properties of risk and protective factor measures from the CTC survey hold up outside the United States.

Data and Methods

Data for this study were collected from the TTYS, which was administered to 2,552 students from 22 urban public schools in 5 districts between March and June 2006. Students surveyed were in "forms" three and five, roughly the equivalent of American eighth and tenth grades. Students ranged in age

from 10 to 19, with a mean age of 15.4. Nearly 60 percent were female. About 41 percent were African and 23.7 percent were East Indian (compared with national population totals of 37.5 percent African and 40 percent East Indian).[2] English was the primary language spoken at home for 94.2 percent of respondents.

Students completed 2,552 surveys, though we excluded a number of surveys because of missing or invalid 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 data set.

The Research Setting

The Republic of Trinidad and Tobago is a two-island nation located in the eastern Caribbean, about 7 miles northeast of Venezuela. After the discovery of oil in Trinidad in 1910, the nation became one of the most prosperous in the Caribbean. Trinidad and Tobago obtained its independence from Great Britain in 1962, though it remains a member of the Commonwealth of Nations and British influence is evident in many sectors.

From 1999 to 2005, Trinidad and Tobago suffered a 315 percent increase in homicides, from 93 to 385. Maguire et al. (2008) found the increase was largely due to homicides by firearm associated with the spread of gang warfare. This increasing violence resulted in a corresponding rise in residents' fear. In one distressed community, Johnson (2006:1) found that "fifty-six percent of residents think the risk of being injured or killed because of crime is high, and many feel unsafe in their own neighborhood." The TTYS was one of several data collection initiatives the government undertook to diagnose the nation's crime problem.

Instrumentation

The TTYS was 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 now distributed widely throughout the United States and has been used in other nations (Beyers et al. 2004; Fairnington 2004; Jonkman et al. 2005), though we are unaware of any tests of its construct validity outside the United States. We are also unaware of its use in any developing nations, though similar studies have been carried out in the

Caribbean (Blum et al. 2003; Blum and Ireland 2004). Although Trinidad and Tobago is an English-speaking nation, officials from the Ministry of Education helped modify the survey to reflect local jargon and culture. The final survey contained 238 items, including items designed to measure 16 risk factors and 13 protective factors falling within 4 domains: community, school, family, and peer/individual. The survey also measured levels of alcohol use, drug use, and delinquent behavior (including gang involvement, gun use, gambling, theft, and fighting).

Analytical Strategy

We treated respondents' answers on 25 questions as indicators of a smaller set of latent or unobserved variables representing different dimensions of community risk and protection. The indicators are ordinal variables with either two or four categories representing greater or lesser levels of risk or protection. Table 1 presents descriptive statistics for these 25 items.

We adopted a three-step approach for examining the latent structure and validity of the items, testing and refining measurement models in the first two steps and examining their concurrent validity in the third. The first two steps were performed on separate randomly selected (without replacement) calibration samples, each consisting of 25 percent of the full sample; the final step was performed on the remaining 50 percent. We adopted this split-sample approach to minimize the extent to which our model-fitting efforts capitalized on statistical chance.

The first step was to complete an exploratory factor analysis (EFA) on the 25 items. The EFA imposes no structure on the data and assesses dimensionality and detects items that discriminate poorly (such as those that do not load on any factors or load on multiple factors). We could have drawn on theory to impose a structure on the data a priori and test the model using confirmatory factor analysis (CFA). We chose not to do this for two reasons. First, although some research examines the measurement properties of community risk and protective factors in *developed* nations (primarily the United States), we know little about these measures in *developing* nations. Second, if we began with a CFA and the model did not fit the data, we would have been forced to work *backward* from an incorrectly specified model, repeatedly modifying it to find a model that fit. It is typically more efficient to work *forward* from an EFA, using the results to specify an initial CFA model instead (Brown 2006:159). For the sake of illustration, we attempted to fit a CFA model consistent with the original CTC risk and protective factor model, but we encountered numerous estimation problems.[3]

Table 1. Frequencies for 25 Community Risk and Protective Items

Item	Coding Scheme	1	2	3	4
Opportunities for prosocial involvement					
Q32. Are sports activities for people your age available in your community?	2	30.7%	69.3%		
Q33. Are club activities for people your age available in your community?	2	50.7%	49.3%		
Q44J. There are lots of adults in my neighborhood I could talk to about something important.	1	36.1%	20.0%	20.6%	23.3%
Rewards for prosocial involvement					
Q44H. My neighbors notice when I am doing a good job and let me know about it.	1	34.2%	15.6%	23.3%	26.9%
Q44L. There are people in my neighborhood who are proud of me when I do something well.	1	25.0%	16.5%	29.8%	28.6%
Q44M. There are people in my neighborhood who encourage me to do my best.	1	20.0%	10.6%	31.5%	37.9%
Low neighborhood attachment					
Q44G. If I had to move I would miss the neighborhood I now live in.	1	25.1%	9.9%	21.0%	44.0%
Q44I. I like my neighborhood.	1	16.2%	11.2%	30.0%	42.6%
Q44K. I'd like to get out of my neighborhood.	1	46.4%	22.2%	15.7%	15.6%
Community disorganization: How much does each of the following statements describe your neighborhood?					
Q44A. Crime and/or drug selling.	1	39.1%	16.4%	20.1%	24.4%
Q44B. Fights.	1	30.9%	23.6%	29.1%	16.4%
Q44C. Lots of empty or abandoned buildings.	1	61.8%	26.8%	7.7%	3.7%
Q44D. Lots of graffiti.	1	60.1%	22.9%	10.5%	6.5%
Q44N. I feel safe in my neighborhood	1	17.2%	16.5%	29.1%	37.3%
Transitions and mobility					
Q31. Have you changed homes in the past year (the last 12 months)?	2	79.9%	20.1%		
Q34. Have you changed schools in the past year?	2	89.3%	10.7%		

(continued)

Table 1 (continued)

Item	Coding Scheme	1	2	3	4
Law enforcement and norms favorable to drug use and firearms					
Q12A. How wrong would most adults (over 21) in your neighborhood think it is for young people your age to use marijuana?	3	67.3%	15.3%	10.3%	7.0%
Q12B. How wrong would most adults (over 21) in your neighborhood think it is for young people your age to drink alcohol?	3	38.0%	22.9%	26.1%	13.0%
Q44O. If a kid smoked marijuana in your neighborhood, would he or she be caught by the police?	1	38.0%	29.1%	17.2%	15.7%
Q44P. If a young person drank some beer, wine, or hard liquor (for example vodka, whiskey, or gin) in your neighborhood, would he or she be caught by the police?	1	50.6%	29.8%	11.0%	8.7%
Q44Q. If a kid carried a handgun in your neighborhood, would he or she be caught by the police?	1	34.3%	25.2%	17.1%	23.4%
Perceived availability of drugs and firearms					
Q23A. If you wanted to, how easy would it be for you to get some beer, wine, or hard liquor (for example vodka, whiskey, or gin)?	4	26.7%	12.6%	19.1%	41.7%
Q23B. If you wanted to, how easy would it be for you to get some marijuana?	4	50.6%	8.2%	12.2%	29.0%
Q23C. If you wanted to, how easy would it be for you to get drugs like cocaine or crack?	4	69.1%	8.4%	7.0%	15.4%
Q23D. If you wanted to, how easy would it be for you to get a handgun?	4	58.4%	9.8%	10.2%	21.7%

Note.
Coding scheme 1: 1 = NO!, 2 = no, 3 = yes, 4 = YES!
Coding scheme 2: 1 = no, 2 = yes.
Coding scheme 3: 1 = very wrong, 2 = wrong, 3 = a little bit wrong, 4 = not wrong at all.
Coding scheme 4: 1 = very hard, 2 = sort of hard, 3 = sort of easy, 4 = very easy.

Based on findings from the initial EFA, our second step was to specify and test a CFA model on an independent sample containing 25 percent of respondents. 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. Our concurrent validity analysis used structural equation modeling and drew on data from the remaining 50 percent of respondents not chosen in the first two subsamples.

We treat the ordinal survey responses as crudely categorized approximations of underlying continuous random variables. We make no assumptions about the population distributions of these 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 outcomes (indicators) are categorical, we used a robust mean- and variance-adjusted weighted least squares (WLS) estimator available in the commercial structural equation modeling software Mplus (Muthén and Muthén 1998–2007). Monte Carlo simulations have found the robust WLS estimator performs well in models with categorical outcomes, including those with skewed distributions (Flora and Curran 2004; Muthén, du Toit, and Spisic 2008).

When using the TTYS data and other school-based samples, one complication is the samples' nested nature. Thomas and Heck (2001:520) argue that complex sampling strategies can produce a sample that is "a severe distortion of the population from which it was drawn." First, unequal probability of selection can result in incorrect parameter estimates. Unfortunately, we could not address this issue because insufficient data exist to create sampling weights. Second, in school-based research, where students are nested within a set of hierarchical units from classrooms to schools to districts, the data cluster: students within each unit tend to be more similar to one another than students in different units. Muthén and Satorra (1995) show that failing to account for these clustering effects results in biased estimates of standard errors and chi-square test statistics, most typically underestimating standard errors and overestimating chi-square. In turn, biased standard errors "produce misleading results of parameter significance" (Thomas and Heck 2001:529). We adjusted the standard errors and model chi-squares for school-based clustering using the methods available in Mplus.[4]

Findings

Step 1: EFA

Using test sample 1, we performed an EFA with oblique rotation on the 25 items listed in Table 1. We drew on multiple criteria for determining the

number of factors to retain. These included the Kaiser–Guttman (KG) criterion and a scree plot of the eigenvalues (Cattell 1966; Guttman 1954; Kaiser 1960), the root mean square error of approximation (RMSEA),[5] the standardized root mean square residual (SRMR),[6] and the Comparative Fit Index (CFI). A CFI of 0.9 or greater indicates reasonable fit, while a CFI of 0.95 or greater indicates close fit. We also examined the *p* value associated with the mean and variance adjusted chi-square. A nonsignificant chi-square ($P > .05$) is an indicator of good fit, though the test is often considered too strict and minor deviations often result in poor fit. Finally, we checked for negative residual variance estimates as a sign the model is mis-specified (Muthén and Muthén 2000).

In addition to these criteria, we also checked the factor solutions for interpretability. We eliminated items with low loadings (below 0.3) on all factors. We either eliminated or retained for closer examination in the next stage of analysis items that cross-loaded at 0.3 or higher on one factor and at more than half that value on one or more other factors. Finally, we also eliminated factors if they had no items with loadings of 0.3 or higher. Based on these considerations, we chose the seven-factor solution in Table 2.

The CTC model specifies two community protective factors, rewards for prosocial involvement and opportunities for prosocial involvement, each measured with three items. All three items measuring rewards for prosocial involvement (*factor 1*) appear to be good measures. Two items measuring opportunities for prosocial involvement (*factor 2*) appear to be good measures with strong loadings. The third (''there are a lot of adults in my neighborhood I could talk to about something important'') loads strongly on a different factor: rewards for prosocial involvement (*factor 1*). Aside from one item loading on a different factor than it was intended to measure, the community protection factors appear to be measured well using the theoretical model developed in the United States.

The CTC model specifies five community risk factors, three of which appear to be measured well with few or no modifications necessary: low neighborhood attachment, community disorganization, and availability of drugs and firearms. Three items are meant to measure low neighborhood attachment (*factor 5*), and all three appear to be good measures. Five items are meant to measure community disorganization (*factor 7*), four of which appear to be good measures. One item (''I feel safe in my neighborhood'') does not appear to load cleanly on any factor, so we dropped it from subsequent analyses. Four items are meant to measure the availability of drugs and firearms (*factor 3*), and all appear to be good measures.

We experienced problems in measuring two community risk factors: transitions and mobility, and laws and norms favorable to drug use and firearms. Two variables are meant to measure transitions and mobility. Neither loads strongly on any factors, and therefore we dropped these two items in subsequent analyses.[7] Five items are meant to measure laws and norms favorable to drug use and firearms. Three load strongly on one factor and two on another. The three items that load together all address the risk of getting caught by the police with either drugs or guns. We will refer to this factor from this point forward as "risk of apprehension" (*factor 6*). The two remaining items address how most neighborhood adults would view alcohol and drug use. We refer to this factor as "community norms favorable to drug use" (*factor 4*).

In summary, of the seven factors we attempted to measure, we measured five with minor or no modifications. We could not measure one (transitions and mobility), and we split one (laws and norms favorable to drug use and firearms) into two dimensions, much like Glaser et al. (2005). Of the 25 original indicators, we dropped 1 item because it did not load on the factor it was supposed to measure and it had a cross-loading. We dropped two additional items because they did not load on any factor. Thus, proceeding to the next step, we had 22 indicators measuring 7 factors.

Step 2: CFA

We estimated a CFA model to test and possibly refine the initial seven-factor EFA model. To do so, we used subsample 2, an independent random sample of approximately 25 percent of the cases ($n = 589$). The initial seven-factor CFA model containing five community risk factors and two community protective factors did not converge. We traced the convergence problem's source to the attachment factor and attempted to reestimate the model three times, each time dropping one of the three indicators. This approach did not solve the problem, so we dropped the three items measuring low neighborhood attachment. We then estimated the remaining 6-factor model with 19 indicators. The model fit the data well according to multiple criteria. Of the seven modification indices with a value greater than one, only one made sense substantively and theoretically.[8] Based on this index, we allowed item q44a ("how much does the following statement describe your neighborhood?" "crime and/or drug selling") to load on the availability of drugs factor in addition to the community disorganization factor, where it was originally specified in the CTC model. The model fit statistics suggest the revised model fits the data

Table 2. Factor Loadings for 7-Factor EFA Solution

Question	1	2	3	4	5	6	7
Q12A. How wrong would most adults (over 21) in your neighborhood think it is for young people your age to use marijuana?	−0.047	0.021	−0.065	0.040	−0.028	**0.746**	−0.081
Q12B. How wrong would most adults (over 21) in your neighborhood think it is for young people your age to drink alcohol?	0.003	−0.026	0.001	−0.005	0.014	**0.982**	0.011
Q23A. If you wanted to, how easy would it be for you to get some beer, wine, or hard liquor (for example, vodka, whiskey, or gin)?	−0.066	0.044	**−0.685**	0.056	0.150	0.168	0.013
Q23B. If you wanted to, how easy would it be for you to get some marijuana?	0.003	−0.009	**−0.918**	0.015	−0.050	0.079	−0.009
Q23C. If you wanted to, how easy would it be for you to get drugs like cocaine or crack?	0.018	0.022	**−0.936**	−0.015	−0.120	−0.076	0.019
Q23D. If you wanted to, how easy would it be for you to get a handgun?	−0.010	−0.045	**−0.893**	0.013	0.101	−0.018	−0.075
Q31. Have you changed homes in the past year (the last 12 months)?	−0.126	−0.080	−0.055	−0.013	0.041	−0.085	−0.124
Q32. Are sports activities for people your age available in your community?	0.000	**−1.291**	0.007	0.002	−0.009	0.008	0.001

(continued)

Table 2 (continued)

Question	1	2	3	4	5	6	7
Q33. Are club activities for people your age available in your community?	0.032	−**0.541**	−0.103	−0.003	0.041	−0.034	−0.027
Q34. Have you changed schools in the past year?	0.134	−0.038	0.036	0.029	−0.101	−0.189	−0.226
Q44A. Crime and/or drug selling.	0.056	0.047	−0.075	0.109	−0.030	0.130	−**0.684**
Q44B. Fights.	0.087	−0.028	−0.005	0.032	−0.044	0.065	−**0.745**
Q44C. Lots of empty or abandoned buildings.	−0.067	0.017	−0.003	−0.070	0.047	0.022	−**0.679**
Q44D. Lots of graffiti.	−0.088	−0.031	−0.077	−0.023	0.059	−0.050	−**0.762**
Q44G. If I had to move I would miss the neighborhood I now live in.	0.017	−0.013	0.108	−0.045	**0.715**	0.039	−0.229
Q44H. My neighbors notice when I am doing a good job and let me know about it.	**0.566**	−0.033	−0.079	−0.024	0.244	−0.146	−0.113
Q44I. I like my neighborhood.	0.237	0.022	−0.024	−0.037	**0.739**	0.019	0.047
Q44J. There are lots of adults in my neighborhood I could talk to about something important.	**0.503**	−0.095	−0.043	−0.154	0.137	0.021	0.086
Q44K. I'd like to get out of my neighborhood.	0.167	0.061	−0.006	−0.133	−**0.590**	0.119	−0.269
Q44L. There are people in my neighborhood who are proud of me when I do something well.	**0.963**	−0.001	0.019	0.032	−0.055	−0.011	−0.007

(continued)

Table 2 (continued)

Question	1	2	3	4	5	6	7
Q44M. There are people in my neighborhood who encourage me to do my best.	**0.746**	−0.028	0.037	−0.078	0.084	0.014	0.046
Q44N. I feel safe in my neighborhood.	0.221	−0.014	−0.106	−0.163	**0.415**	0.059	0.294
Q44O. If a kid smoked marijuana in your neighborhood, would he or she be caught by the police?	−0.021	−0.013	0.003	**−0.841**	0.006	−0.055	−0.041
Q44P. If a young person drank some beer, wine, or hard liquor (for example, vodka, whiskey, or gin) in your neighborhood, would he or she be caught by the police?	−0.004	−0.021	−0.012	**−0.848**	−0.073	0.020	−0.010
Q44Q. If a kid carried a handgun in your neighborhood, would he or she be caught by the police?	0.020	0.048	0.042	**−0.793**	0.062	0.022	0.068

Note. Factor loadings with an absolute value greater than .30 are shown in bold
Factor 1: Rewards for prosocial involvement
Factor 2: Opportunities for prosocial involvement
Factor 3: Perceived availability of drugs and firearms
Factor 4: Laws and norms favorable to drug use and firearms
Factor 5: Low neighborhood attachment
Factor 6: Perceived risk of apprehension
Factor 7: Community disorganization.

well, $\chi^2 = 23.06$, $p = .041$, $df = 13$; CFI and Tucker Lewis Index (TLI) = 0.992; RMSEA = 0.036; WRMR = 0.754.

One indicator of these measures' validity is how they relate to one another. If the protective factors have strong convergent validity, they should positively correlate with one another. The same holds for the risk factors. Moreover, if the factors have strong discriminant validity, then the risk factors should negatively correlate with the protective factors. Previous research showed the CTC risk and protective factors have good convergent and discriminant validity (Arthur et al. 2002). Table 3 shows the correlations between the final six factors. We focus only on the signs and statistical significance of the coefficients.

The last column of Table 3 shows the ratio of correlation coefficients whose signs are in the expected direction.[9] For three factors, all signs are in the expected direction; for two of them, four out of five correlations have the expected sign. By examining Table 3, we can see the only correlation with the "wrong" sign (between factors 1 and 6) is not significantly different from zero. The only two nonsignificant correlations between factors are associated with the opportunities for prosocial involvement factor. To summarize, our brief examination of the correlations between the six final factors reveals that all but one have strong convergent and discriminant validity. The opportunities for prosocial involvement factor shows some evidence of weak discriminant validity.

Step 3: Structural Equation Model (SEM)

Now that we have identified a final 6-factor model of community risk and protective factors measured with 19 indicators, we examined the impact of these factors on 3 binary variables measuring serious adolescent problem behaviors: drug use, gun ownership, and gang membership. We did not intend this exercise to provide a comprehensive test of any particular theory: we simply wanted to examine the effects of these factors on adolescent problem behaviors. To test the models, we used subsample 3, an independent random sample of approximately 50 percent of the cases (n = 1,178). 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:

Table 3. Correlations between Final Six Factors

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	# Signs in the Correct Direction
Factor 1: Opportunities for prosocial involvement	1						4/5
Factor 2: Rewards for prosocial involvement	0.311**	1					5/5
Factor 3: Community disorganization	−0.003	−0.090*	1				5/5
Factor 4: Laws and norms favorable to drug use and firearms	−0.075**	−0.192**	0.438**	1			5/5
Factor 5: Perceived risk of apprehension	0.202**	0.454**	−0.191**	−0.254**	1		5/5
Factor 6: Perceived availability of drugs and firearms	0.005	−0.149**	0.369**	0.458**	−0.397**	1	4/5

*$p < .05$.
**$p < .01$.

Table 4. Probit Results for the Effects of the Six Factors on Three Problem Behaviors

	Drug Use	Gun Ownership	Gang Membership
Opportunities for prosocial involvement	0.127	0.035	0.000
Rewards for prosocial involvement	0.038	−0.066	−0.061
Community disorganization	0.079	0.102*	0.109*
Laws and norms favorable to drug use and firearms	0.108	0.049	0.012
Perceived risk of apprehension	−0.073	0.101	0.176**
Perceived availability of drugs and firearms	0.401**	0.324**	0.463**
Explained variance (R^2)	0.289	0.147	0.232

*$p < .05$.
**$p < .01$.

12.3 percent for drug use, 14.6 percent for gun ownership, and 14.8 percent for gang membership.

We regressed these three binary variables on the six community risk and protective factors using a single SEM.[10] The model fit the data well without any modifications, $\chi^2 = 48.03$, $df = 14$, $p = .000$; CFI = 0.982; TLI = 0.982; RMSEA = 0.045; WRMR = 1.064. Our interpretation of model parameters is limited to the signs and statistical significance levels of the coefficients. Table 4 lists standardized probit coefficients for the effect of each risk or protective factor on each outcome variable.

Two community protective factors (opportunities/rewards for prosocial involvement) did not have a statistically significant relationship with any problem behaviors. The two studies that paid serious attention to the CTC community protective factors could not measure the opportunities for prosocial involvement scale (Arthur et al. 2002; Glaser et al. 2005). Thus, further research on the measurement and effects of these protective factors is needed. Little is known about the community characteristics that promote resilience among youth in the presence of the risk factors they face, particularly in distressed communities. Measuring community protective factors is even more challenging in developed nations, where capacity and infrastructure problems are endemic.

The results for the four risk factors were mixed. Community disorganization had a significant positive relationship with gun ownership and gang membership, but not with drug use; gun use and gang membership are higher in more socially disorganized communities. Laws and norms favorable to drug use and firearms did not have a significant effect on any of the

problem behaviors. Risk of apprehension did not have a significant relationship with either drug use or gun ownership, but it had a positive effect on gang membership, which is opposite the expected effect. One possibility might be that neighborhoods with more gangs have more police enforcement and therefore a greater risk of apprehension. If this is the case, then the causal order we posit here between gang membership and risk of apprehension is backward. The perceived availability of drugs and firearms had statistically significant effects across the board. Respondents who reported that drugs and firearms were available in their neighborhoods were the most likely to report using drugs, owning a gun, and belonging to a gang.

One question is why the improved measures we developed do not have greater concurrent validity. Of the 18 regression coefficients in Table 4, only 6 had a statistically significant effect and 1 was opposite the expected direction. If they are valid, then perhaps the causal mechanisms regulating the effects of these factors on problem behaviors are not universal. Measures of community risk and protective factors may require adaptation for use in developing nations. One way to answer this question is to see whether additive indices consistent with the original CTC model (recalling we modified some items to fit the local context) fare any better at explaining variation in these problem behaviors than the measures we developed using EFA and CFA. We examined this possibility by constructing additive indices measuring two protective factors and five risk factors based on the original CTC scales. Due to space constraints, we describe our findings without presenting the results of the statistical analysis.

The CTC measure of opportunities for prosocial involvement had no effect on drug use or gang membership, but it had a *positive* effect on gun ownership, which is opposite the predicted effect. The CTC measure of rewards for prosocial involvement had a negative effect on gun ownership and gang membership but no effect on drug use. Earlier we reported that the CTC measures of two protective factors, opportunities and rewards for prosocial involvement, had poor construct validity in our sample. In addition, the CTC opportunities factor has poor concurrent validity both in its original and revised forms. More work is necessary to determine what to do with the opportunity factor because its measurement properties have not been adequately investigated (see Arthur et al. 2002; Glaser et al. 2005). The CTC rewards factor has significant negative effects on two problem behaviors in spite of its weak construct validity. This factor requires additional work since it has weak construct validity but good concurrent validity.

The CTC measure of social disorganization had no effects in any models, though our improved measure emerged as a significant predictor of gun ownership and gang membership. The CTC measure of laws and norms favorable to drug use and guns also had no effects in any models. Recall that we split the original version of this scale into two parts and found no effects of laws and norms but some effects of risk of apprehension (on gang membership). The CTC measure of perceived availability of drugs and firearms had a strong positive effect on all three problem behaviors, which is consistent with our findings.

Four of the five CTC measures of risk factors have significant problems with construct validity and some problems with concurrent validity. We were unable to measure attachment or mobility at all, given their poor measurement properties in the TTYS data. The CTC measure of attachment had no effects on the three problem behaviors. Thus, the attachment factor appears to have both weak construct and concurrent validity. The CTC measure of mobility had one significant positive effect. It is unclear what to do with a measure that has poor construct validity but some concurrent validity. The original CTC measure of disorganization had weak construct and concurrent validity. It did not have significant effects on any of our three problem behavior measures. Our improved measure had effects on two of the three problem behaviors. The original CTC factor measuring laws and norms favorable to drug use and guns had weak construct and concurrent validity. We split it successfully into two measures: one measuring laws and norms and one measuring risk of apprehension. The laws and norms factor had no effects on the problem behaviors. The perceived risk of apprehension factor had one significant positive effect. We believe there is some conceptual fuzziness in the original CTC measure of laws and norms. The perceived risk of apprehension items we separated out are coded backward—higher scores reflect an environment *less* favorable to drug use and firearms (because they indicate a greater risk of being caught by police), not *more* favorable. Significant work needs to be invested in improving the measure of laws and norms. The only CTC measure with high construct and concurrent validity in its original format was the availability of drugs and firearms this measure had a strong, positive impact on all problem behaviors. Our measure had the same effects.

In short, our six-factor model considerably improved the construct validity of the measures of risk and protective factors. It also improved their concurrent validity, explaining a greater proportion of the variance in drug use, gun ownership, and gang membership than a seven-factor model consistent

with the original CTC specification. At the same time, more work is needed to bolster the construct and concurrent validity of measures of risk and protective factors.

Discussion and Conclusion

CTC has invested substantially in developing measures of risk and protective factors for adolescent problem behaviors. Two assessments of the measurement properties of the CTC risk and protective factor scales concluded they are reliable and valid. Arthur et al. (2002:593) identified some measurement concerns but concluded overall that the survey "measures reliably a broad range of risk and protective factors in multiple ecological domains. The factor structures of the scales are coherent. Reliability values for most scales are good." Glaser et al. (2005:93) concluded the CTC survey "allows efficient measurement of a large number of empirically derived risk and protective factors in a single survey instrument ... [and] provides reliable measures of risk and protective factors." The U.S. Substance Abuse and Mental Health Services Administration (2008) described 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."

We applaud the efforts of the CTC designers and view the youth survey as beneficial for communities. At the same time, the scales many communities widely use have not been subjected to extensive validation, and existing evidence about the community risk and protective factor scales suggests they may need additional refinement. Instruments and scales need to be subjected to a wide variety of validation practices in different contexts and on different populations before we can truly understand their measurement properties. Furthermore, much of the research has not used the appropriate factor analytic procedures to account for the ordinal measurement of the observed indicators (for an exception, see Glaser et al. 2005).

The research reported here suggests the CTC measures of community risk and protective factors may need further work, especially before being implemented in developing nations. Six of the seven original CTC scales had problems with construct validity. We were unable to develop valid measures of two factors: transitions and mobility and low neighborhood attachment. We had to split one factor (laws and norms favorable to drug use and firearms) into two parts (norms favorable to drug use and firearms and perceived risk of apprehension), one of which (norms) had weak concurrent validity. We were able to construct more valid measures of three

additional concepts (opportunities/rewards for prosocial involvement and community disorganization), but overall, only two of the nine coefficients for these factors significantly affected problem behaviors. Current findings and previous research suggest additional validation and refinement is especially needed on the opportunities for prosocial involvement and the transition and mobility scales.[11] Only the measure of perceived availability of drugs and firearms appeared to have high construct and concurrent validity across the board.

Readers are urged to use caution in interpreting these findings. Survey-based measures of community risk and protective factors present some inferential challenges because the relationship between individual perceptions and objective community conditions is unknown. For instance, when a student reports coming from a neighborhood where guns and drugs are widely available, does this survey response represent an individual perception (which may be more or less idiosyncratic) or an objective rating of community conditions? One partial method for addressing this question is to examine variability in perceptions across communities. Using data from sample 3, we computed the mean percentage of students reporting drug use, gun ownership, and gang membership. Drug use ranged from 4.1 percent to 31.6 percent across the 22 schools, with a mean of 12.2 percent. Gun ownership ranged from 3.6 percent to 33.3 percent, with a mean of 14.3 percent. Gang membership ranged from 0 percent to 25 percent with a mean of 12.7 percent. These findings suggest substantial community variation in perceptions. Unfortunately, we lack sufficient data to determine the relationship between these perceptions and more objective measures of community conditions.

With these cautions in mind, four strong conclusions, two methodological and two substantive, are evident. First, we should not assume "validated" measures—even those widely implemented like the CTC—are necessarily valid in other contexts. Second, we should not assume measures developed in the United States are valid elsewhere, particularly in developing nations. Third, socially disorganized communities place youth at greater risk for gun ownership and gang membership. Research suggests a primary reason adolescents carry guns or join gangs is for protection. If socially disorganized communities drive adolescents to these behaviors, then preventive efforts need to focus on ameliorating this risk factor. Fourth, our research confirms the obvious: the availability of drugs and guns is a robust risk factor for adolescent problem behaviors. While this conclusion is evident from research in developed nations, we believe this is the first quantitative empirical research in English to confirm this finding in a developing nation.

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Authors' Note

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Notes

1. Trinidad and Tobago is one of the Caribbean's wealthiest nations due to its oil and natural gas reserves. The World Bank classifies it as a developing nation with an "upper-middle income economy" (1993:239).
2. Local authorities explained that our sample may underrepresent East Indian children because the East Indian population is wealthier on average than the African population and therefore more likely to send their children to private schools.
3. Despite multiple efforts using minor re-specifications and adjustments, we were unable to generate parameter estimates. In some cases, the model would not converge. In others, the theta (residual covariance) matrix was not positive definite. These problems tend to result from one of two issues: data problems or incorrect model specification. We doubt that data problems are the cause since we carefully screened the data and we were able to generate estimates using different model specifications. Thus, we believe the specification of the original CTC risk and protective factor model may not be valid in this research setting.
4. Mplus makes two adjustments for clustering due to complex sampling (Asparouhov, 2005; Asparouhov and Muthen, 2006; Muthén and Muthén 1998-2007). It adjusts the chi-square test of model fit using a correction factor similar to the approaches proposed for robust chi-square testing by Satorra and

Bentler (1988) and Yuan and Bentler (2000), and it adjusts the standard errors of the parameter estimates using a Huber-White sandwich procedure.

5. RMSEA values of 0.06 to 0.08 constitute acceptable fit, while values of 0.01 to 0.06 constitute close fit (Browne and Cudeck, 1993; Hu and Bentler 1999).
6. Muthén and Muthén (2000) suggest SRMR should be below 0.05 or 0.06, while Brown (2006) and Hu and Bentler (1999) recommend an upper threshold of 0.08.
7. Feinberg, Ridenour, and Greenberg argue the items used to measure the transitions and mobility scale are "qualitatively different from the other five community scales" because the items refer to an individual's history and background, not community characteristics (2007:509). They also excluded this scale from their analysis of community domain factors.
8. Modification indices are computed for all fixed and constrained parameters in the model. They provide an approximation of how much the overall model χ^2 would change if the parameter were freely estimated. Modification indices can be useful for detecting sources of strain in the model. However, they should only be used to alter the original model if they make sense substantively and theoretically (Brown 2006).
9. Note that there is some confusion in Table 3, with regard to factor 4: perceived risk of apprehension. Recall that we split the original CTC factor purporting to measure laws and norms favorable to drug use and firearms into two dimensions, one of which was perceived risk of apprehension. The items in this new factor ask respondents how likely that the police would catch a young person who drank alcohol, smoked marijuana, or carried a gun. While a higher score on these items is intended to reflect an environment more favorable to drug use and firearms, the coding scheme the CTC uses results in this item being reverse coded. Thus, a higher score on this item reflects an environment less favorable to drug use and firearms. As a result, the correlations between this factor and other factors are reversed. For example, ordinarily we would expect the correlation between this factor and other risk factors to be positive (since they are all risk factors), but with the reversed coding, we would instead expect a negative correlation.
10. Because the observed variables comprising the measures of community risk and protective factors (as well as the outcome variables) are ordinal categorical, we use the same mean- and variance-adjusted weighted least squares estimator we used earlier for the EFA and CFA. The structural parameters linking the latent risk and protective factors to the observed binary outcome variables (drug use, gun ownership, and gang membership) are probit coefficients.
11. One question worth exploring as research on risk and protective factors moves into the international arena is whether transitions and mobility are qualitatively

different in different environments. For instance, in developing nations where some residents live in shantytowns or squatter communities like the Brazilian *favelas*, moving to new housing might represent a significant improvement in quality of life accompanied by decreased risk and increased protection. The "stability" that would accompany remaining in a squatter property might not represent the kind of positive feature in the lives of young people that it could represent in other contexts. Although Trinidad and Tobago is a wealthy nation by Caribbean standards, several communities the TTYS covers are shantytowns where some people live in makeshift homes with illegal electrical connections (made by tapping into power lines) and no sewage or running water.

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Bios

Ed Maguire is an associate professor and chair of the Department of Justice, Law, and Society at American University in Washington, DC. His research focuses on police organizations, violent crime, and social science measurement. For 6 years, he led a team of researchers in diagnosing an outbreak of violence in Trinidad and Tobago.

William Wells is an associate professor of criminal justice at Sam Houston State University in Texas. His research interests include firearms, police innovation, and evaluation research.

Charles Katz is the director of the Center for Violence Prevention and Community Safety and associate professor in the School of Criminology and Criminal Justice at Arizona State University. His research involves collaborating with police agencies to improve their capacity for responding strategically to crime.