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The Adolescent Risk-Taking Questionnaire: Development and Psychometric Evaluation

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Compared to other life periods, adolescence is characterized by a heightened potential for risky behaviors. This study reports the systematic development and psychometric evaluation of a comprehensive Adolescent Risk-Taking Questionnaire (ARQ). It was developed using reports of 570 adolescents and was psychometrically evaluated with a sample of 925 adolescents between 11 and 18 years of age. Principal components analyses yielded a four-factor risk structure, and these factors were substantiated via a confirmatory factor analysis. One week test-retest and internal consistency indices were demonstrated to be sound. Age and gender differences were found to be consistent with reported trends in accident data. Older adolescents and boys reported lower risk perceptions and a higher frequency of risky behaviors than younger adolescents and girls, respectively, supporting the validity of the ARQ. Furthermore, consistent with past research, perceiving higher levels of risk typically related to lower levels of engaging in the respective behaviors.

Adolescent behaviors that have potentially dangerous or even fatal outcomes have received a substantial amount of research attention (e.g., Arnett, 1992; Flannery, Vazsonyi, & Rowe, 1996; Gonzalez et al., 1994; Lavery, Siegel, Cousins, & Rubovits, 1993; Levitt, Selman, & Richmond, 1991). Studies have consistently reported that, in comparison to other life periods,

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the adolescent years are characterized by a heightened potential for recklessness, thrill-seeking, and risk-taking behavior (Arnett, 1992).

Statistics relating to adolescent engagement in risky behaviors indicate that adolescents drive faster than adults (Jonah, 1986), have the highest rates of sexually transmitted diseases (Irwin, 1993), have the highest rates of self-reported drug use, and commit the vast majority of crimes (Arnett, 1996). In Canada, young people between 16 and 21 years of age comprise 21% of all licensed drivers but account for 58% of traffic accidents (Quadrel, Fischhoff, & Davis, 1993). Quadrel et al. (1993) also report that the initiation of smoking, drinking, and illicit drug use peaks between the ages of 16 and 18 years, with 17% of senior secondary school students reporting that they have tried cocaine and approximately 1 in 25 reporting that they smoke marijuana every day.

Statistics published for the United States by the National Center for Health Statistics (1989, 1990) indicated an increase in mortality of 214% from early to late adolescence. Furthermore, adolescent boys die at more than twice the rate of girls (Irwin, 1993). The statistics on adolescent accidents and morbidity also indicate that primary causes of morbidity during adolescence are behavioral in origin with violence and intentional and unintentional injuries producing nearly 75% of all adolescent deaths per year (Crunbaum & Basen-Engquist, 1993; Irwin, 1993).

Arnett (1992) describes risk-taking behavior as involving economic calculations, thrill-seeking behavior as having recognized but deliberately minimized dangers, and reckless behaviors as those that carry strong connotations of serious negative consequences, including serious personal injury or death, conviction by the legal system, or other events that may have a long-term impact, such as an unwanted pregnancy. In line with common views about what constitutes risk-taking behavior, Moore and Gullone (1996) defined adolescent risk taking as "behavior which involves potential negative consequences (loss) but is balanced in some way by perceived positive consequences (gain)" (p. 347). If the positives far outweigh the negatives, the behavior is rarely perceived to be risky, whereas when the negatives outweigh the positives, the behavior is generally regarded to be extremely risky or even foolish. Thus, the level of perceived risk can predictably be determined by the balance between these two types of consequences. Incorporating Arnett's (1992) definitions (as described above) serves to further refine Moore and Gullone's definition because it acknowledges the strength of the outcomes in addition to their negativity versus positivity. Thus, within this conceptualization, extremely risky behaviors are those for which the probability of occurrence of the negative consequences far outweighs the potential positive consequences and the severity or negativity of such consequences is strong or

severe. An additional and more relevant criterion (with regard to this investigation) for the adequate definition of risk-taking behavior is that it be perceived and reported as such by the target individual or group of individuals.

However, different definitions and conceptualizations about what constitutes risk taking and what underlies it have resulted in a literature that has little commonality, particularly with regard to assessment techniques and instruments. Furthermore, the existing research is dominated by studies that have focused on a select and limited number of risks, usually determined by the researcher (Moore & Gullone, 1996). Thus, little is known about the structure of risk-taking behavior. Determining the structure of risk behaviors is important given some indication from the data available that certain risk behaviors appear to be related with others. Thus, determining the structure of risk will enable the investigation of mechanisms and processes underlying related risk behaviors (Irwin, 1993).

The work of Lavery et al. (1993) represents one of the few studies to investigate different categories of adolescent risk-taking behavior within one study. Using a Q-sort technique, 23 behaviors were classified by 10 graduate students into five categories, including criminal (e.g., shoplifting, driving after drinking, vandalism), vehicle (e.g., accepting a ride with a stranger, driving or riding without a seat belt, riding with a drunk driver), health (e.g., having sex, bingeing/purging, having sex without a condom, crash dieting, sunbathing), status (e.g., running away from home, cheating on an exam, physical fights with peers, cutting school), and drug use (e.g., drinking alcohol, smoking marijuana, getting drunk, smoking cigarettes). The resulting scale was reported to have good test-retest reliability. The authors also reported a negative relationship between risk-taking involvement and risk perception.

A second study that attempted to determine factors or categories of adolescent risk taking is the one by Alexander et al. (1990). These researchers also noted the potential limitations of applying adult conceptualizations of risk to the study of adolescent behavior. They argued that, given the different social contexts experienced by adults and adolescents, it cannot be assumed that behaviors defined by adults as risky are necessarily perceived in the same way by adolescents.

Alexander et al. (1990) report the development of a six-item scale to measure adolescent risk taking based on adolescent reports of risk-taking behaviors. The adolescents in their sample lived in rural areas and were between 13 and 14 years of age. When the sample was in eighth grade, factor analysis of the scale items formed two factors, the first of which was described as antisocial behaviors (e.g., stealing, sneaking out, riding with a dangerous driver) and the second of which was described as characterizing physical feats (e.g.,

racing on a bike or boat). In ninth grade, risk behaviors factored into thrill-seeking and deviant behaviors.

Using quite a different focus, Arnett's work has been based on researcher-defined reckless behaviors. According to Arnett (1992), reckless behaviors during the adolescent years are most likely to be driven by increased levels of testosterone and monoamine-oxidase inhibitors (MAO), particularly for boys. This rise in testosterone and MAO, in turn, leads to an increase in sensation-seeking behaviors. Arnett (1996) investigated his proposals through the administration of a questionnaire that he developed and reported as being psychometrically adequate (i.e., has a good 3-month test-retest reliability; most of the questionnaire items were found to correlate moderately with aggression and sensations seeking). Representative items include drunken driving, speeding, racing, sex with and without contraception, and the use of illegal drugs. Arnett (1996) concluded that his research has provided support for the proposal that sensation seeking is part of the developmental basis for reckless behavior. He also claimed support for the proposal that reckless behavior is hormonally driven through his finding that such behavior was more common among boys than girls and in later adolescence as compared to early adulthood. Arnett's work has made a significant contribution to the adolescent risk-taking literature, but it is limited by the fact that the risk behaviors assessed relate only to the reckless category.

Despite the existence of questionnaires such as those reported above, the assessment of adolescent risk taking remains largely idiosyncratic across individual studies. Such a state of affairs can only impede the development of our understanding in this area. It is not surprising, given the nature of existing instruments, that they have not been widely used. Several limitations are evident, including the fact that procedures implemented for developing the instruments have been far from optimal. For example, in addition to the narrow focus (i.e., only reckless risk behaviors) of Arnett's (1996) questionnaire, its items were researcher nominated. Although Alexander et al. (1990) acknowledged the need to base the content of their questionnaire on adolescent reports of risk taking, their sample was limited to rural and younger adolescents (those who are less likely to engage in high levels of risk-taking behavior). Furthermore, their questionnaire, being only six items in length, was not sufficiently comprehensive. Lavery et al.'s (1993) instrument appears to be much broader. Unfortunately, however, these researchers fail to report its psychometric properties.

Clearly, there is a need for an adolescent risk-taking measure that is based on the conceptualization of risk taking held by a broadly based sample of adolescents, particularly with regard to age and gender, given that such variables have been noted to be central in predicting levels of engagement in risky

behavior. Furthermore, to be widely applicable and therefore promote some consistency across studies, any measure of risk taking needs to be comprehensive in its coverage. This study reports on the development and psychometric evaluation of such a risk-taking instrument.

METHOD

Participants

Two independent samples of participants were involved in this study. The first sample, which was involved in Phase 1 of this study (i.e., the development of the Adolescent Risk-Taking Questionnaire [ARQ]), was composed of 570 school-based adolescents (291 boys, 279 girls) between 12 and 17 years of age. This sample was recruited from six co-educational government secondary schools in Melbourne, Australia. Schools were deliberately selected to obtain a representative sample with regard to socioeconomic status; hence, schools from both working- and middle-class areas were included (for more details regarding this sample, see Moore & Gullone, 1996).

The second sample, which was involved in Phase 2 of the study (i.e., the psychometric evaluation of the ARQ), was composed of 925 (460 boys, 461 girls, 4 with unspecified gender) adolescents (age: $M = 14.56$ years, $SD = 1.61$ years). Younger adolescents between 11 to 14 years of age totaled 450 (238 boys, 211 girls, 1 with unspecified gender), and older adolescents between 15 to 18 years of age totaled 472 (221 boys, 248 girls, 3 with unspecified gender). There were 3 adolescents for whom age was unspecified. Data for this sample were collected from eight secondary government schools and one primary school in Melbourne.

The schools for both study phases were systematically selected to approximate a representative sample of Melbourne adolescents attending regular schools, particularly with regard to geographic location. Thus, although specific sociodemographic information (e.g., ethnicity, socioeconomic status) was not obtained, the consideration given to school location, to some extent, reduced the probability of sociodemographic bias.

The classes to be involved in the research were determined by the school administration, including the principal, school counselor, year-level coordinators, and classroom teachers. A parent consent form was distributed to students for completion by their parents. Approximately 1,100 questionnaires were distributed, resulting in an approximate overall response rate of 86%. In addition, approximately 20 questionnaire sets with significant portions of missing responses were discarded.

One-week retest data for the ARQ were collected from 156 of the 925 adolescents in the second sample (84 boys, 72 girls). The retest sample was recruited from two of the eight secondary schools and ranged in age from 12 to 18 years. There were 72 adolescents 12 to 14 years of age and 84 15 to 18 years of age.

Procedure

In developing the instrument (Phase 1), we strived to ensure that it was a comprehensive measure of adolescent risk taking. In addition, we attempted to devise a measure that constituted an accurate reflection of adolescent notions of risk-taking behavior.

As part of a larger study (Moore & Gullone, 1996), a questionnaire was distributed to the first sample of respondents, requiring that they nominate up to four behaviors that they believed to be risky. This procedure generated more than 2,000 different responses. These responses were examined for conceptual overlap by the researchers and collapsed accordingly. For example, "car racing" and "stock car racing" were collapsed into one item—"car racing," and responses including "picking on people," "teasing people," and "being mean to people" were collapsed into one item—"teasing people." To further cull the list, only those items that had been nominated by at least five adolescents were included as items in the initial version of the ARQ. This procedure yielded 77 risk items.

To enable the assessment of adolescents' perceptions regarding the risk of, and their level of engagement in, the 77 different behaviors, a two-part questionnaire was constructed. For one part, participants evaluated the level of risk associated with each of the 77 items, hereafter referred to as *perceptions*, on a 5-point Likert scale, ranging from 0 (*not at all risky*) to 4 (*extremely risky*). For the second part, participants estimated the frequency with which they engage in each of the 77 items (i.e., behavior) on a 5-point scale, ranging from 0 (*never*) to 4 (*very often*).

Phase 2 of the study involved administering these two parts of the questionnaire to the second sample of students in counterbalanced order so that approximately half the sample first endorsed their risk perceptions for each of the 77 items followed by their behaviors and the other half completed the ratings in reverse order. Students were grouped according to their regular school classes. To fulfil university ethics requirements and to minimize social desirability in responding, questionnaire completion was voluntary and anonymous. Data were collected by two registered psychologists, with some assistance from the classroom teachers. For each item on the questionnaire, the adolescents were directed to select the response that most accurately rep-

resented themselves. Any questions that arose were clarified by the administering psychologist. It was emphasized to the adolescents that there were no right or wrong answers and that, in responding to each item, they should not be concerned with other students' responses. Indeed, the sharing of responses was firmly discouraged.

Given that the information was obtained anonymously, it was necessary to match test-retest questionnaires on the basis of other information. All respondents were required to indicate their school, class, date of birth, and gender. This information, in conjunction with handwriting, was used to match questionnaires.

RESULTS

To ascertain the factor structure that underpins the ARQ, two phases were undertaken. First, two principal components analyses were undertaken. One of these analyses corresponded to the behaviors, and the other analysis corresponded to the perceived risk of these behaviors. The output of these procedures was then substantiated with a confirmatory factor analysis. Before undertaking these analyses, respondents who disregarded more than 20% of the items were discarded. Eleven respondents satisfied this criterion. All other instances of missing data were interpolated using linear regression. On average, each item was answered by about 99% of the respondents.

Only 47 of the original set of 77 items were subjected to the principal components analysis. The remaining items were discarded for a variety of reasons. For instance, items in which the degree of skewness exceeded 2 or the degree of kurtosis exceeded 5 were rejected. In addition, items that were disregarded by more than 2% of the respondents were deleted. These items may not have been fully comprehended by all of the participants. Moreover, items that seemed to correlate inordinately with other items were also discarded to ensure that the factors would be unidimensional. Finally, items in which the corrected item-total correlation was less than .4 were also discarded.

Principal Components Analysis

The entire sample was split into two parts. The first subsample was composed of 269 participants (age: $M = 14.7$ years, $SD = 1.6$ years). The data derived from these individuals were used for the principal components analysis. The second subsample was composed of 645 participants (age: $M = 14.7$ years, $SD = 1.6$ years). These data were subjected to the confirmatory factor analysis.

An initial principal components analysis was then undertaken using the 47 selected items. Components in which the eigenvalues exceeded 1 were subjected to an oblimin rotation, and delta was set to -1 . This preliminary analysis was conducted for the behaviors and then the perceptions. On the basis of these analyses, a further 25 items were deleted. Specifically, items in which the communality was below 0.4 were discarded. Furthermore, items that generated two or more coefficients above 0.32 in the pattern matrix were deleted. Likewise, items that yielded no coefficients above 0.32 were deleted. Finally, items that exhibited a different pattern across behaviors and perceptions were rejected. For instance, the running-away-and-leaving-home behavior related to one set of items, whereas the running-away-and-leaving-home perception of risk related to another set of items.

The final 22 items were then subjected to another pair of principal components analyses, with one pertaining to the behaviors and the other pertaining to the perceptions. Again, an oblimin rotation was implemented. For the ratings of behavior, four factors in which the eigenvalue exceeded 1 were generated. These factors explain more than 50% of the variance in the items. Table 1 displays the pattern matrix that emerged from this analysis. The final column relates to the confirmatory factor analysis and will be addressed later. To enhance readability, coefficients that do not exceed 0.32 are omitted. The four factors are respectively designated as *thrill-seeking behaviors*, *rebellious behaviors*, *reckless behaviors*, and *antisocial behaviors*. These factors will be delineated more precisely in a later section.

The ratings of risk perception also generated four factors. Taken together, these factors explained 53% of the variance. Table 2 presents the pattern matrix that was generated. The pattern of loadings associated with risk perception mirrors the pattern of loadings associated with behaviors. The only complication concerns the item "sniffing gas or glue." This item appears to pertain to both reckless behaviors and antisocial behaviors. For the ensuing analyses, however, this item was categorized as an antisocial behavior, partly to equate the breadth of each factor; this decision is vindicated by the confirmatory factor analysis below.

Confirmatory Factor Analysis

To substantiate the reliability of these factors, the data generated by the second subsample of respondents were subjected to confirmatory factor analysis. This process was first applied to the ratings of behaviors. For these items, four models were assessed in sequence. First, an independence model was examined. This model assumes that all of the items are uncorrelated and

TABLE 1: Pattern Matrix That Emerged From the Principal Components Analysis of the 22 Behavior Items Following an Oblimin Rotation

<i>Item</i>	<i>Factor 1</i>	<i>Factor 2</i>	<i>Factor 3</i>	<i>Factor 4</i>	<i>CFA^a</i>
Factor 1: thrill-seeking behaviors					
Snow skiing	.78				.82
Tao Kwon Do fighting	.72				.81
Inline skating	.71				.54
Parachuting	.69				.79
Entering a competition	.67				.63
Flying a plane	.65				.63
Leaving school	.52				.72
Factor 2: rebellious behaviors					
Underage drinking		.80			.86
Smoking		.80			.69
Getting drunk		.75			.91
Taking drugs		.67			.74
Staying out late		.66			.69
Factor 3: reckless behaviors					
Drinking and driving			.81		.65
Stealing cars and going for joy rides			.68		.75
Having unprotected sex			.65		.59
Speeding			.59		.74
Driving without a license			.53		.73
Factor 4: antisocial behaviors					
Overeating				.76	.50
Teasing and picking on people				.59	.65
Cheating				.57	.72
Talking to strangers				.50	.68
Sniffing gas or glue			.32 ^b	.47	.55
Eigenvalues	8.60	2.26	1.51	1.06	
Prerotation variance explained	37.4	9.8	6.6	4.6	
Postrotation variance explained	13.7	14.4	12.4	9.6	

a. This column presents the standardized coefficients that emerged from the confirmatory factor analysis (CFA).

b. This item has a loading of greater than .3 on a factor other than that to which it belongs.

is the standard control in confirmatory factor analysis. Second, a one-factor model, which presupposes that all of the items pertain to the same factor, was assessed. Third, a four-factor orthogonal model was scrutinized. This model assumes the pattern of loadings that emerged from the principal components analysis, except the factors are designated as independent of one another.

TABLE 2: Pattern Matrix That Emerged From the Principal Components Analysis of the 22 Risk Perception Items Following an Oblimin Rotation

<i>Item</i>	<i>Factor 1</i>	<i>Factor 2</i>	<i>Factor 3</i>	<i>Factor 4</i>	<i>CFA^a</i>
Factor 1: thrill-seeking behaviors					
Snow skiing	.78				.77
Tao Kwon Do fighting	.68				.75
Inline skating	.71				.51
Parachuting	.75				.82
Entering a competition	.71				.69
Flying a plane	.70				.64
Leaving school	.58				.73
Factor 2: rebellious behaviors					
Underage drinking		.80			.85
Smoking		.76			.86
Getting drunk		.82			.88
Taking drugs		.67			.76
Staying out late		.61			.62
Factor 3: reckless behaviors					
Drinking and driving			.75		.60
Stealing cars and going for joy rides			.74		.67
Having unprotected sex			.62		.53
Speeding			.62		.72
Driving without a license			.56		.73
Factor 4: antisocial behaviors					
Overeating				.68	.43
Teasing and picking on people				.72	.66
Cheating				.55	.69
Talking to strangers				.55	.59
Sniffing gas or glue			.45 ^b	.32	.56
Eigenvalues	7.83	2.90	1.43	1.10	
Prerotation variance explained	34.1	12.6	6.2	4.8	
Postrotation variance explained	17.6	13.9	12.7	8.8	

a. This column presents the standardized coefficients that emerged from the confirmatory factor analysis (CFA).

b. This item has a loading of greater than .3 on a factor other than that to which it belongs.

Finally, a factor-factor oblique model was examined, which, unlike the orthogonal model, allows intercorrelation among the factors. Generalized least squares was the method used to estimate the parameters.

Three indices were invoked to assess the efficacy of these models, including the goodness-of-fit index (GFI), the adjusted goodness-of-fit index

TABLE 3: Goodness-of-Fit Indices Generated by the Confirmatory Factor Analysis of the Behavior Ratings

<i>Model</i>	χ^2	<i>df</i>	<i>GFI</i>	<i>AGFI</i>	<i>RMS</i>	<i>AIC</i>
Independence	1,031	231	0.86	0.84	0.07	1,075
One factor	735	209	0.89	0.88	0.06	823
Four-factor orthogonal	653	209	0.91	0.89	0.06	741
Four-factor oblique	468	203	0.93	0.92	0.05	568

NOTE: GFI = goodness-of-fit index. AGFI = adjusted goodness-of-fit index. RMS = root mean square of the standardized residuals. AIC = Akaike Information Criterion.

TABLE 4: Goodness-of-Fit Indices Generated by the Confirmatory Factor Analysis of the Risk Perception Ratings

<i>Model</i>	χ^2	<i>df</i>	<i>GFI</i>	<i>AGFI</i>	<i>RMS</i>	<i>AIC</i>
Independence	1,094	231	0.85	0.83	0.08	1,139
One factor	803	209	0.89	0.86	0.07	892
Four-factor oblique	551	203	0.92	0.90	0.05	651

NOTE: GFI = goodness-of-fit index. AGFI = adjusted goodness-of-fit index. RMS = root mean square of the standardized residuals. AIC = Akaike Information Criterion.

(AGFI), and the root mean square (RMS) of the standardized residuals. Models were deemed as reasonable when the GFI and AGFI exceeded 0.9 and the RMS was below 0.05 (Arbuckle, 1997; Browne & Cudeck, 1993). In addition, the Akaike Information Criterion (AIC) was used to help identify the best model, where lower values represent a better representation of the data. Note that chi-square values were not used to assess the models; the sample size is relatively large, and hence, the null hypothesis will almost inevitably be rejected.

Table 3 presents the fit indices associated with each model. Only the four-factor oblique model surpasses the criteria of a reasonable model. The four-factor orthogonal model generated a reasonable GFI, but an inadequate AGFI and RMS. Accordingly, the oblique model was deemed as preferable. The standardized coefficient associated with each item is given in the final column of Table 1. All of these coefficients exceed 0.5, providing additional support for the efficacy of this model.

The same process was then applied to the ratings of risk perception. Unfortunately, the four-factor orthogonal model could not be estimated successfully, perhaps reflecting the inadequacy of this representation. Table 4 displays the fit indices associated with the remaining models. Again, only the

four-factor oblique model fulfils the criteria of a reasonable model. The standardized coefficient that pertains to each item is provided in the final column of Table 2. All of the coefficients exceed 0.4; indeed, apart from the item "overeating," all of the coefficients exceed 0.5.

Factor Structure Across Gender and Age

Unfortunately, the sample size was not sufficient to repeat this process with each gender and age group in sequence. Instead, a principal components analysis was applied to all the boys and then all the girls. In addition, this analysis was applied to all the young adolescents (11- to 14-year-olds) and then all the older adolescents (15- to 18-year-olds). The behavior and risk perception ratings were subjected to separate analyses. In general, the same factor structure emerged in each group. The only exceptions concerned five instances in which the item loaded on more than one factor. These results are encouraging, but they need to be replicated with larger samples before the invariance of this factor structure can be confidently proclaimed. Because of space restrictions, the details of these analyses are not reported here, but they can be obtained from the authors on request.

To reiterate, the previous analyses uncovered four factors or subscales of the ARQ associated with the behavior ratings. Four analogous subscales associated with the ratings of risk perception were also identified. For each of the eight subscales, the ratings associated with the constituent items were averaged within participants. These averages represented the participants' scores on each subscale and were used in subsequent analyses.

The next set of analyses establishes the reliability and validity of these subscales. First, Cronbach's coefficient alpha was computed for each subscale to assess internal consistency. Second, a subset of respondents was reassessed to establish test-retest reliability. Third, the correlation between behaviors and risk perceptions was undertaken. Finally, the degree to which these subscales vary across age and gender was investigated.

Reliability

To evaluate the internal consistency of each subscale, Cronbach's alpha was computed for males, females, young adolescents, older adolescents, and the entire sample, yielding 40 (8×5) coefficients. Only two of these coefficients were less than 0.7: antisocial behaviors in girls (0.66) and antisocial perceptions in older adolescents (0.67). For the antisocial subscales, Cronbach's alpha ranged from 0.7 to 0.79. For the remaining subscales, Cron-

bach's alpha generally exceeded 0.8. These coefficients are promising, especially when the small number of items is considered.

To assess test-retest reliability, a subset of the participants was retested 1 week later ($n = 156$). Pearson's correlation was then computed as an index of the test-retest reliability of each subscale. Again, this process was applied to males, females, young adolescents, older adolescents, and the entire sample. All of the coefficients significantly exceed 0 at the .001 level. Two of the coefficients were less than 0.5: thrill-seeking perception in girls (0.35) and reckless perception in girls (0.44). The remaining coefficients exceed 0.5, with the vast majority ranging from 0.6 to 0.8. Hence, these findings suggest that all of these subscales are reasonably, but not exceptionally, stable.

Correlations Between Risk Perceptions and Risk Behaviors

Next, the correlation between each behavior subscale and the corresponding perception subscale was ascertained. This process was undertaken for each gender and age group and for the entire sample. For the thrill-seeking subscales, the behaviors and perceptions were positively correlated, these coefficients varying from 0.59 to 0.74. For the remaining subscales, the behaviors and perceptions were always inversely related. In particular, the correlations associated with the rebellious subscales varied from $-.51$ to $-.57$. For the reckless subscales, the correlations ranged from $-.2$ to $-.38$, and for the antisocial subscales, the correlations ranged from $-.14$ to $-.19$. All of these correlations significantly differed from 0 at the .01 level.

Age and Gender Differences for the Risk Subscales

Finally, the extent to which these subscales vary across age and gender was examined using a MANOVA. The eight subscales were designated as the dependent measures; age group (11 to 14 years old vs. 15 to 18 years old) and gender were designated as the independent factors. The Pillais criterion was used to generate an approximate F value for each effect.

The effect of age on the subscales did not significantly differ between the two genders. Nonetheless, the main effect of age attained significance, $F(8, 893) = 17.64, p < .001$. A series of univariate tests revealed that all of the subscales significantly differed between the age groups at the .001 level. Table 5 reveals the mean scores on each subscale as a function of age and gender. Relative to the young adolescents, the older adolescents were more likely to undertake the various behaviors. In addition, the older adolescents regarded the thrill-seeking behaviors as more risky, but the other behaviors as less risky, than the younger group.

TABLE 5: Mean Scores for Each Subscale as a Function of Age Group and Gender

	Age				Gender			
	11 to 14 Years Old		15 to 18 Years Old		Boys		Girls	
	M	SD	M	SD	M	SD	M	SD
Behaviors								
Thrill seeking	1.59	1.03	1.83	1.07	1.80	1.09	1.62	1.01
Rebellious	1.04	0.96	1.60	1.00	1.34	1.04	1.32	1.00
Reckless	0.46	0.70	0.67	0.79	0.72	0.88	0.42	0.58
Antisocial	1.29	0.77	1.59	0.80	1.51	0.88	1.37	0.70
Perceptions								
Thrill seeking	2.13	1.00	2.39	1.04	2.27	1.03	2.26	1.04
Rebellious	2.88	0.89	2.35	1.01	2.65	1.03	2.58	0.95
Reckless	3.50	0.65	3.34	0.79	3.27	0.82	3.57	0.60
Antisocial	2.72	0.81	2.49	0.73	2.57	0.79	2.64	0.76

The main effect of gender also reached significance, $F(8, 893) = 13.46, p < .001$. Univariate tests revealed that only four of the subscales differed between males and females: thrill-seeking behaviors, $F(1, 900) = 7.49, p < .01$; reckless behaviors, $F(1, 900) = 42.76, p < .001$; antisocial behaviors, $F(1, 900) = 9.85, p < .01$; and perceptions of reckless behaviors, $F(1, 900) = 42.57, p < .001$. As Table 5 reveals, and it is concordant with past studies, boys are more likely to undertake these behaviors. In addition, boys perceive the reckless behaviors as less risky.

DISCUSSION

The Structure of Adolescent Risk-Taking Perceptions and Behavior

One of the major aims of this investigation was to identify the underlying structure of adolescent risk-taking behavior. Given the nature of the ARQ scales, it was possible to determine whether the same structure could be found for adolescent-reported risk behaviors and for perceptions of risk related to those same behaviors. In fact, almost identical factor solutions were found for the two sets of ratings. Specifically, our data yielded four factors, which we have referred to as (a) thrill-seeking behaviors, (b) rebellious

behaviors, (c) reckless behaviors, and (d) antisocial behaviors. The thrill-seeking behavior factor clearly is composed of behaviors that could otherwise be referred to as positive risk-taking behaviors because they are generally socially accepted. In addition, for these behaviors, the possible negative consequences are usually not as severe. For instance, the most likely negative consequence of entering a competition is the loss of pride. Other behaviors in this factor represent challenging, or possibly anxiety-arousing, activities such as inline skating and parachuting, where risks are managed to some extent through safety constraints. The second factor, referred to as the rebellious risks factor, and the fourth factor, referred to as the antisocial risks factor, both are composed of behaviors for which adverse social or legal consequences would be most likely, rather than consequences of a life-threatening nature. In contrast, the third factor, referred to as reckless risks, includes behaviors that best fit stereotyped notions of risk taking, such as speeding, stealing cars and going for joy rides, and having unprotected sex, and are those for which the most dangerous outcomes are likely. Other researchers (e.g., Arnett, 1992, 1996) have also referred to such behaviors as reckless.

The robustness of the risk structure that our data yielded was demonstrated via the confirmatory factor analysis and the factorial invariance of each solution across age and gender groups. In addition to being encouraging with respect to the psychometric properties of the instrument, these findings have implications for the conceptualization of adolescent risk taking, as they indicate a strong correspondence between the perceptual structure that adolescents hold for the risks depicted in the ARQ and their actual behavior. Such findings suggest that adolescent behaviors are, to some extent, cognitively and rationally guided rather than being largely impulsively driven, hormonally driven, or both.

The confirmatory factor analysis revealed that these subscales are intercorrelated. This finding is not surprising given past findings and theoretical proposals about risk taking. For example, Irwin (1993) noted that there appears to be an association between risk-taking behaviors. Similarly, Dryfoos (1993) has reported that young people who engage in one form of delinquent behavior are very likely to engage in them all. Dryfoos also argues that the overlap between high-risk behaviors is reportedly substantial. Consistent with the above claims, Chassin, Presson, and Sherman (1989) have proposed that young people who engage in negative forms of risk taking may also be more likely to engage in, or at least have the potential for engaging in, more positive or constructive forms of risk taking that promote independence. They argue that traits such as impulsivity and sensation seeking (cf. Arnett, 1996) may provide the link between adaptive (positive) and maladaptive (negative) forms of risk-taking behavior.

The Psychometric Properties of the ARQ Scales

In addition to finding a meaningful and robust factor structure for each of the ARQ scales, thereby demonstrating construct validity (see Anastasi, 1988), other psychometric analyses indicated the ARQ scales to be valid and reliable. Of relevance, internal consistency analyses for each of the subscales indicated sound reliability. However, test-retest reliability or stability over time was found to be only moderate. Whether this latter finding is a function of the ARQ scales or a reflection of actual risk behaviors and perceptions is a question for future research.

Supporting the validity of the information obtained using the ARQ, and as it would be expected on the basis of past research, for the most part, relationships between risk behavior subscales and risk perception subscales were of moderate size and inverse. Benthin, Slovic, and Severson (1993) also found an inverse relationship between adolescent-reported risk behavior and risk perception. Similarly, Lavery et al., (1993) reported that risk involvement was significantly negatively related with risk perception at around .30 with a sample of clinic-referred adolescents.

In contrast to the above trend, the relationship between thrill-seeking behaviors and thrill-seeking perceptions was found to be positive and of larger magnitude (i.e., approximately .6 compared with approximately .3). This finding emerged for the overall sample and for each of the age and gender groups. Given that, for the thrill-seeking behaviors, in contrast to the other factors, the higher the perceived risk, the more likely it was that the adolescent would engage in the behavior, a sensation-seeking motivation is implicated. This latter finding provides strong support for Arnett's (1992) proposal that adolescence is marked by higher levels of sensation seeking.

The investigation of age differences for the risk subscales indicated that the older adolescents were more likely to undertake the various behaviors than were the younger adolescents. In addition, the older adolescents tended to regard the behaviors as less risky than the younger adolescents did, with the exception of thrill-seeking behaviors. This last finding is interesting in that adults, too, are less likely to perceive thrill-seeking behaviors as risky when compared to other types of risks. Perhaps this finding is an indication that, by late adolescence, adolescents' perceptions of risk begin to resemble those of adults.

With regard to gender differences, it was found that boys engaged in the various risk behaviors more frequently than did girls. In contrast, perceptions of risk were more consistent across boys and girls, with the exception of reckless behaviors, which boys perceived as less risky. Support for the validity of

these findings is evident through their consistency with the accident statistics presented in the introduction of this article (e.g., Irwin, 1993; Quadrel et al., 1993), which show that older adolescents and adolescent boys are involved in a higher frequency of accidents. These findings are also consistent with past research (e.g., Irwin, 1993; Quadrel et al., 1993; Smith & Rosenthal, 1996).

CONCLUSIONS

This study reports on the development and psychometric evaluation of a questionnaire that enables the assessment of adolescent risk-taking behaviors in addition to perceptions of the risk of these behaviors. In contrast to the overwhelming majority of investigations in this area, the ARQ is composed of behaviors nominated by adolescents themselves. The information obtainable through the ARQ is not only consistent with the adolescent perspective, it is also more comprehensive than has typically been the case in past research of this nature. Most studies have selected between one and a small number of related behaviors for investigation. This restriction has prevented a sound investigation of the structure of adolescent risk taking. Previous research has also been limited in its ability to determine the ways in which different types of risk taking relate with each other. In contrast, as it has been demonstrated in this paper, the comprehensive content of the ARQ provides the data to make such analysis possible. In addition, the factor structure of this instrument was shown to be robust, as demonstrated via confirmatory factor analysis, invariance across sample age and gender groups, and the concordance between behaviors and perceptions. Moreover, not only is the ARQ able to provide a wealth of information relating to adolescent risk taking, it has also been demonstrated to be reliable and valid.

Also of significance, this study has indicated that risk-taking behavior is most likely to occur when the risks are not perceived as being too great. This supposition was most clearly demonstrated through the inverse relationships between risk perception and behavior for all subscales with the exception of the thrill-seeking behaviors subscale.

Although the questionnaires were completed anonymously, the adolescents may have been concerned about confidentiality, given that they completed the questionnaires in their classroom with peers close by and with the administrator supervising them. This problem may have distorted the findings slightly, particularly if students who were concerned about revealing their behavior were those engaging in high levels of risk. On the other hand,

the number of adolescents falling into this category would not be expected to be high. Given the large size of the remaining sample, it is unlikely that the overall results were significantly affected. Second, some adolescents may have felt that certain items were not applicable to them, particularly the younger adolescents or girls (e.g., leaving school, stealing cars and going for joyrides, drinking and driving).

It is also important to note that conclusions about the validity of the ARQ scales are limited. To strengthen claims about validity, studies need to be conducted in which the instrument is validated against some other measure (i.e., convergent validity) or construct known to be related with risk-taking behavior. This process is certainly recommended for future research.

Despite its limitations, this study is the first to report the systematic development and psychometric evaluation of a comprehensive adolescent risk-taking instrument. A major aim of the researchers in developing the instrument was that it be widely applicable in future studies investigating adolescent risk taking. Convergence on assessment instruments and methods is required so that findings can be validly compared across investigations and so that significant advances can be made.

Future research should focus on determining patterns of responding on the ARQ scales that relate with adolescent psychological well-being. Such research would be invaluable in providing information about adaptive versus maladaptive patterns of adolescent risk taking and, as such, would provide some direction with regard to the focus of intervention strategies aimed at reducing reckless and dangerous risk-taking behaviors in adolescents.

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