INTRODUCTION

Adolescent health experts have identified that the most significant threat to the well-being of adolescents is their engagement in risky behaviours. The increase in prevalence of such behaviours among this age group is a major concern for public health officials. These behaviours are characterised as harmful and maladaptive, but has a high appeal or excitement for adolescents. They can negatively impact the psychosocial aspects of development, becoming the leading cause of mortality and morbidity. Adolescents tend to engage in risky behaviours as a means of self-discovery, exploring the world around them, gaining acceptance from peers, coping with stress, reducing psychosocial pressure and negativity, and asserting their independence from their families. The worldwide occurrence of risk-oriented behaviours among adolescents is concerning. Studies suggest that many adolescents engage in risky behaviours, including smoking, drinking, substance abuse, physical confrontations, criminal activities, close physical interactions, and pre-marital intimacy. Such tendencies are especially prominent in older adolescents and males. It is not uncommon for adolescents to exhibit multiple risky behaviours simultaneously, with most showing at least two risk factors and a substantial group displaying three or more. Typical risk factors encompass sedentary lifestyles, minimal consumption of fruits and vegetables, tobacco use, alcohol...
consumption, and poor dietary habits. Both urban and rural settings witness these behaviours. Earlier studies have pinpointed gender variations in risk behaviours. Young females elevate their HIV risk due to early and unprotected intimate relations, yet fewer females indulge in these behaviours compared to males. Conversely, young males often engage in dangerous driving, especially under the influence of cannabis or other substances. Studies among Malaysian adolescents indicate alarming trends in high-risk behaviours. Johari et al. reported that 66.8% to 83.7% of these adolescents engage in risky activities, with 7.8% showing suicidal ideation—a finding corroborated by Kadir et al., which reported a similar 8.7% rate.

Common high-risk behaviours such as physical inactivity, smoking, and alcohol consumption were highlighted by Cheah et al. Further, another study reported 14.6% smoking rate linked to underachievement in school and parental smoking habits. The issues extend to mental health too; Chan et al. found that 6.2% of adolescents, especially females of Indian descent, attempted suicidal thoughts. Likewise, Nik Daliana et al. noted that 4.7% are involved in other high-risk behaviours, including tobacco use and accessing inappropriate online content. These behaviours and their profound impact on adolescents could be better understood using the biopsychosocial model proposed by Sales and Irwin. However, past studies have examined these behaviours in isolation. We aimed to understand how adolescents engage in multiple risk behaviours simultaneously. In this context, we conducted a study to determine the prevalence and pattern of these behaviours among adolescents and identify the associated factors. The findings would contribute to a better understanding of the complex nature of adolescent risk behaviours.

**MATERIALS AND METHODS**

**Setting and Sample Size Determination**

A community-based cross-sectional study was conducted to ascertain the prevalence and patterns of risk-taking behaviours among adolescents in Sarawak, a multi-ethnic state. This comprehensive study was crucial for a holistic understanding of the behaviours across diverse ethnicities and varied living areas within the state. We utilised a precision-based approach to decide the necessary sample size, considering variables such as estimated mental health disorder prevalence (16.9%), confidence level (95%), absolute precision (3%), design effect (here, 2), and non-response rate. By this method, we determined that we needed responses from 1439 adolescents for the research, which included a 20% attrition rate. However, we managed to collect 1344 adolescents between the ages of 10 and 19 who resided in housing areas, villages, or longhouses with Internet access who were included in this study. However, those with reported mental or cognitive impairment, inability to speak English, Bahasa Malaysia, or Mandarin, or those without a matching partner of the opposite gender from the same housing area, village, or longhouse were excluded.

**Sampling Procedure**

We employed a multi-stage cluster sampling method, randomly selecting two districts from each of the 12 administrative divisions, resulting in 22 districts. We obtained a list of housing areas, villages, or longhouses from the relevant district offices or local councils. We randomly select these areas based on the number of adolescents required. In each housing area, village, or longhouse, 10 pairs of adolescents were selected, representing the balance of gender in the community.

**Measurements**

Risky behaviours are activities that can negatively impact adolescents' physical, mental, or social well-being. We utilised a scoring system to evaluate the level of engagement in certain behaviours among adolescents. We assigned a score of '0' for no engagement, 1 for involvement within the past month, 2 for involvement during the past 1-6 months, and 3 for involvement beyond the last six months. The data from these three time periods allowed us to assess the extent of adolescent risky behaviour and determine the potential impact on their health. A 21-item questionnaire (i.e. 21 types of risky behaviour) was administered to assess risky behaviours. The total score range was between 0 to 63. We classified risky behaviours into three levels: no risky behaviour (0), low-medium risky behaviour (1-3), and high risky
behaviour (≥4). The classification was based on an equal percentile of scanned data using IBM SPSS. This classification method is objective, consistent, and useful for identifying individuals who have a high tendency to engage in risky behaviours.

**Data Collection**

We adopted the 21-item questions based on the Youth Risk Behaviours Surveillance System (YRBSS) developed by the Centers for Disease Control and Prevention. Data were collected by face-to-face interviews using a validated, pre-tested questionnaire. We sought voluntary participation from adolescents during the data collection process. We obtained written informed consent from both the parent/guardian and the adolescents themselves. The information obtained was treated as confidential and kept anonymous to protect the privacy of our participants. Before initiating the main survey, a questionnaire pre-test was conducted to determine its feasibility and reliability, especially since some portions were adapted and modified from existing questionnaires.

The pre-test was conducted from February to March 2017 with adolescents in a non-sampled area. The pre-test assessed the clarity, applicability, and relevance of the questionnaire. The questionnaire was tested among 72 participants, constituting 5% of the main study’s sample size. After the pre-test, a content analysis was done, leading to necessary alterations based on feedback. Statistical analysis confirmed the reliability of Likert-scale questions with Cronbach’s alpha values between 0.704 and 0.953. We professionally conducted this study and maintained the highest level of ethical standards.

**Data Entry and Analysis**

We used Statistical Package for Social Science version 28.0 for data analysis. Firstly, the collected data were checked and cleaned. We analysed data from a total of 1344 respondents with a response rate of 93.4%. In the descriptive analysis, we calculated frequency, percentage, mean, median, and standard deviation for numeric data. Categorical data were presented in the form of frequency and percentage. We conducted multinomial logistic regression to investigate the factors influencing adolescent risk behaviours. We used the results of the analysis to determine the factors contributing to such behaviours. We examined several predictor variables that could impact an adolescent’s risk behaviour. They were age, gender, religious practices, importance of religion, relationship quality with parents, family size, school grade, number of friends, presence of comorbidity, and history of mental abuse. The risky behaviours were then categorised into three groups: no risky behaviour (0), low-medium risky behaviour (1-3), and high risky behaviour (≥4). The reference category was no risky behaviour, and adjusted odds ratios were calculated for each predictor. These ratios provided information on the association between exposure and outcome, representing the odds that an effect will happen given a particular exposure compared to the odds of it occurring without that exposure.

**Ethical Issues**

The study was granted ethical approval by the Universiti Malaysia Sarawak Ethics Committee [Ref # UNIMAS/NC-21.02/03-02 Jld.2 (64)]. The research was also registered with the National Institutes of Health, Ministry of Health, Malaysia (Ref # NMRR-17-346-34067) to ensure compliance with national regulations. Obtaining ethics approval from the two authorities ensured that the study was conducted ethically, with due consideration given to the safety and well-being of all participants.

**RESULTS**

**Characteristics of Adolescents**

The average age of the adolescents in the study was 15.02 years old, with a standard deviation of 2.60 years. The relative majority were Chinese (29.2%) and Malay (26.0%), while the remaining 44.8% were made up of other ethnicities. The largest proportion of respondents identified themselves as Christian (57.6%), followed by Islam (33.2%), with 9.2% having other religious affiliations or no religion. Most adolescents were single (98.5%), and most were students (95.0%). Regarding education, 21.6% had completed primary education, 66.2% had completed secondary education, and 12.2% had other educational backgrounds. The average daily pocket money was MYR 7.31, with a standard deviation of MYR 8.21 and a median of MYR 5.00 (Table 1).
The distribution of risky behaviours among adolescents is presented in Table 2, with the most common being loitering, followed by fighting, drinking alcohol, and smoking or vaping. Taking illegal drugs was found to be the least common behaviour.

Overall, 43.7% of adolescents engaged in risky behaviours in the last six months, with males being more likely to engage in such behaviours than females. Specifically, half of male (50.1%) adolescents were involved in risky behaviours in the last six months, compared to just under two-fifths of females. Interestingly, more females (62.6%) reported no risky behaviours than males (49.9%). Additionally, male adolescents were twice as likely as females to engage in high level of risky behaviours (27.8% versus 14%). (Figure 1).

Factors Affecting Adolescent’s Risk Behaviours: Multinomial Logistic Regression Analysis

Our analysis revealed that for low-medium level of risky behaviour, adolescents aged 15-19 are 1.52 times more likely to engage in these behaviours than those aged 10-14. Those who rarely (AOR=1.70) or occasionally (AOR=1.56) practice religion and those who do not have a good relationship with their parents (AOR=2.02) also show higher odds of low-medium level of risky behaviour. However, the quality of the father-mother relationship and the importance of religion do not significantly affect low-medium level of risky behaviours. Having comorbidities (AOR=1.81) or a history of mental abuse (AOR=3.02) also seems to increase the odds of low-medium level risky behaviour. However, among family size (5-9 members) (AOR=0.39), 61% less likely risky behaviour than small family size (1-4 members). The

Adolescents Risky Behaviours

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odds for high level of risky behaviour are significantly higher for older adolescents (AOR=2.65), males (AOR=2.75), and those who rate religion as unimportant (AOR=3.55). Those with larger families (more than ten members) (AOR=2.03) or lower academic grades (AOR=1.74), also, physical ailments (AOR=2.63) or mental abuse (AOR=3.85) strongly affect high level of risky behaviour. However, religious practice frequency does not significantly affect the odds of high level risky behaviour (Table 3). The model fit measures indicated that the goodness-of-fit of the model was statistically significant (p< .001) with Chi-square (df)=252.87(34), suggesting that the model significantly deviates from a null model. Several Pseudo R-squared values estimate the proportion of variance explained by the model. R² McFadden value was 0.10, indicating that the model explains approximately 10% of the variance in the outcome variable. The R² Cox & Snell was 0.06, suggesting that the model explains around 6% of the variance, and R² Nagelkerke was 0.13, indicating that the model explains approximately 13% of the variance. Overall these measures help to evaluate the model's goodness-of-fit and explanatory power.

**DISCUSSION**

Adolescents are known to engage in various risky behaviours, but the prevalence of each behaviour varies from study to study. There is no specific documented prevalence of risky behaviours as a combination of behaviours. Each study differs due to the range of risky behaviours of adolescents involved.21-23 Our study found that adolescents were engaged in at least two risky behaviours on average. Ahmed et al.1 report that adolescents who engage in risky behaviours are more likely to be involved in multiple risk behaviours.

Our analysis found that male adolescents were 2.75 times likely to engage in risky behaviours compared to female. Previous studies have shown that more male adolescents are involved in risky behaviours compared to female adolescents.24, 25 This difference might be due to biological and social influences, where male adolescents perceive behaviours as less risky and take more risks than females.18, 26 Another explanation might be that male adolescents are more prone to aggressive and violent activities such as anti-social, criminal, and vehicle-related behaviours. This finding is consistent with a previous study.25 Age and religion are significant predictors of adolescent risk-taking behaviour. Older adolescents were 2.65 times more likely to engage in risky behaviour. Male adolescents tend to perceive a higher level of risk linked with specific behaviours during their developmental stage, which tends to increase with age.27 In contrast, older adolescents tend to be more inclined to engage in risky activities.2 Our analysis revealed that individuals who infrequently practised or did not consider religion important were more likely to engage in risky behaviour. Past studies reported that active religious practice and the perceived importance of religion are also associated with decreased risk behaviours.28, 29 However, risk-taking behaviour is a complex phenomenon influenced by various factors,
such as psychological, sociocultural, economic, and environmental factors. Our findings indicate that individuals lacking a robust bond with their parents (AOR=2.02) are more likely to engage in low-medium levels of risky behaviour. On the other hand, a strained relationship between parents can also influence these risky behaviours. This finding is consistent with past studies' findings.

It is argued that if the parental relationship is poor, adolescents are more likely to engage in risky behaviours to escape the uncomfortable home environment. Our research shows that adolescents from families with 5–9 members have a 61% reduced likelihood of partaking in risky behaviour compared to those from smaller families with fewer than five members. Conversely, families with over ten members are twice as likely to engage in high levels of risky behaviour.

The relationship between family size and adolescents' propensity for risk-taking is multifaceted and influenced by various factors. Although some research suggests that having more siblings may increase the likelihood of risky behaviour due to peer influence, others emphasise the potential for greater parental supervision and positive family dynamics to mitigate such behaviour. It is crucial to consider the interplay of these factors and not attribute risk-taking solely to family size. Our analysis revealed that adolescents with lower academic grades are more likely to engage in high level of risky behaviour (AOR=1.74) and are 1.53 times more inclined to exhibit low-medium level of risky behaviour. This is consistent with previous studies.

This might be due to the fact that adolescents who perform well academically, have good school attendance and are not in romantic relationships are less likely to engage in risky behaviour. Peer relationships might also protect adolescents from risky behaviour. However, it depends on friendship quality. Friendship quality encompasses several dimensions, including companionship, intimacy, support, and conflict. Our analysis revealed that adolescents having multiple friends had engaged in risky behaviour. Understanding the complex relationship between these factors is pertinent for developing effective interventions to prevent adolescent risk behaviour. Our study found that male adolescents with comorbidity might exhibit higher level of risky behaviour than their healthy peers. This finding could be attributed to the complex medico social and environmental factors that impact adolescents' developmental stages. Illness specific risk-taking and nonadherence to treatment might be interconnected, but this hypothesis needs to be explored through further research. Adolescent friendships tend to be more intimate and emotional, which could influence their involvement in risky behaviours. Female adolescents are more likely to experience mental abuse, and those with a history of abuse are more likely to engage in delinquent behaviour. Our study indicates that mental abuse (AOR=3.85) significantly impacts high level of risky behaviour. These findings highlight the importance of addressing adolescents' challenges, especially those with health conditions or a history of abuse, in promoting positive behaviour and well-being.

**STRENGTH AND LIMITATION**

Even though this study was conducted on adolescents in Sarawak, the findings could be applied to the entire region since the participants were from diverse socio-economic backgrounds in both urban and rural areas, and the sample size was large. We employed multinomial logistic regression to understand how different predictors impact the likelihood of falling into a specific risk category of low-medium and high levels of risky behaviours compared with no risky behaviour group in accommodating both continuous and categorical predictors. The study findings provide a foundation for identifying the factors contributing to multiple risk behaviours among adolescents.

This could be an aid in creating effective policies to reduce such behaviours. However, it is important to note that the study could serve as a guide and cannot confirm the exact factors that lead to risk behaviours. Furthermore, response and recall bias are possible since the study relied on self-reports from adolescents. We ensured anonymity, used clear and neutral questions, and shorter recall periods to minimise response and recall biases. Proper pilot testing of the study instruments also enhances the accuracy and reliability of responses. Despite these limitations, the
research offers valuable information to promote healthy
behaviours among adolescents in Sarawak.

CONCLUSION

This study found that a significant number of adolescents
engage in risky behaviours, with loitering being the most
common. Risky behaviours were more common among
males and older adolescents. Religious practice frequency
did not significantly impact risky behaviours, but the
importance of religion was associated with a higher
likelihood of engaging in high level of risky behaviours.
Family size, comorbidities, and history of mental abuse
also influenced the odds of having low-medium level of
risky behaviours. In conclusion, this study highlights the
complexity of risky behaviours among adolescents.
Several factors could influence whether or not an
adolescent engages in risky behaviours, and these factors
can vary depending on the type of risky behaviour.

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COMPETING INTERESTS

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