



Social Ecological Model Analysis of Individual, Family, Peer, and Digital Environment Factors Associated with Cyberbullying Behavior among Adolescents

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ABSTRACT

Background: Globally, the incidence of cyberbullying remains considerably high. In Indonesia, approximately 45% of adolescents have experienced cyberbullying. The impact of cyberbullying can trigger mental health problems among adolescents who have experienced it. **Objective:** To develop a comprehensive understanding of cyberbullying behavior among adolescents through a social ecological model analysis integrating individual, family, peer, and digital environment factors. **Methods:** This study employed a quantitative design with a cross-sectional approach. Sampling was conducted using the proportional random sampling technique, with a sample size of 284 respondents calculated using the Slovin formula. Data collection was carried out from February to March 2026. **Results:** The findings showed a significant association between individual, family, peer, and digital environment factors and cyberbullying behavior ($p < 0.05$). In the multivariate analysis, peer and digital environment factors remained significantly associated with cyberbullying behavior. The peer factor had an adjusted odds ratio of 2.644 (95% CI: 1.583–4.415; $p < 0.000$), while the digital environment factor had an adjusted odds ratio of 3.102 (95% CI: 1.881–5.117; $p < 0.000$). Based on the adjusted odds ratio values, the digital environment factor showed the strongest association with cyberbullying behavior in the final model. **Conclusions:** The social ecological approach is highly relevant for explaining cyberbullying as a multidimensional phenomenon. These findings are expected to serve as a basis for developing effective and contextual interventions.

KEYWORDS

Cyberbullying, Adolescents, Social ecological model, Digital environment, Community nursing

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1. BACKGROUND

The phenomenon of cyberbullying among adolescents has become an increasingly complex issue amid the rapid advancement of digital technology and the high intensity of social media use in daily life (Zhu et al., 2021). Unlike traditional bullying,

cyberbullying possesses distinct characteristics that render it more insidious and harmful, including perpetrator anonymity, an extensive and rapid audience reach, and the persistence of digital traces, whereby negative content is often difficult to remove entirely (Palladino, 2017). The

severity of this problem is reflected in the high prevalence rates reported across regions worldwide.

A UNESCO (2021) report indicated that approximately 50% of children in Europe, 60% in the United States, and one-third of children in South Africa have experienced cyberbullying. At the national level, conditions in Indonesia likewise show alarmingly high figures. A UNICEF (2020) report noted that approximately 45% of adolescents in Indonesia have experienced cyberbullying, and more recent projections indicate a surge to as high as 48% (Safaria & Ariani, 2024). This trend is corroborated by data from the 2024 National Survey on Children's and Adolescents' Life Experiences (SNPHAR), which revealed that approximately 14.49% of boys and 13.78% of girls aged 13–17 years were victims of cyberbullying (KemenPPPA, 2024).

This high incidence carries serious clinical and psychological consequences for adolescent development, including triggering anxiety, depression, reduced academic motivation, and the emergence of self-harming behavior (Doty et al., 2017). Adolescents' involvement in this form of deviant digital behavior does not occur in a vacuum; rather, it is shaped simultaneously by the interaction of multiple factors. These

factors include individual characteristics such as levels of empathy and self-regulation, the family environment (including parenting style and communication quality), peer dynamics, and exposure to the digital environment (Zhang et al., 2022). Consequently, the social ecological model is highly relevant as an analytical framework, as it can comprehensively integrate the various levels of influence within these social systems (Sitthi, 2022).

Although the urgency of this issue is markedly high at both the global and national levels, a significant research gap remains in the local context. In regions such as DKI Jakarta Province, the center of urbanization and the epicenter of digitalization in Indonesia, adolescents are presumed to be considerably more vulnerable to cyberbullying. Nevertheless, up-to-date prevalence data that specifically and comprehensively depict the actual condition of adolescents in the DKI Jakarta region remain unavailable. This absence of locally specific data, coupled with the pressing need for an appropriate foundation for intervention, constitutes the primary justification for researching the social ecological model analysis of cyberbullying behavior among adolescents in this region.

Furthermore, although this study was conducted in an urban setting, the issue under investigation is broader in relevance and not confined to urban areas. This is because internet access and smartphone use in rural areas continue to increase as digital technology advances. DKI Jakarta, as an urban region with a high level of digital technology use, can provide insight into the trajectory of cyberbullying behavior that adolescents in rural areas are likely to face as well. Therefore, understanding the factors associated with cyberbullying among adolescents in urban settings can serve as a foundation for community nurses to develop early prevention and intervention efforts in rural areas undergoing digital transformation, so that the severity of cyberbullying can be mitigated before it reaches levels comparable to those observed in urban environments.

2. METHODS

Design

This study was designed using a quantitative approach with an analytical observational design to evaluate the social ecological model.

Sample and Setting

The population in this study comprised all adolescents enrolled at SMAS 1 Muhammadiyah Jakarta, SMAS 2 Muhammadiyah Jakarta, and SMAS 16 Muhammadiyah Jakarta during the study period. The total population across the three schools was 982 students, consisting of 402 students at SMAS 1 Muhammadiyah Jakarta, 376 students at SMAS 2 Muhammadiyah Jakarta, and 204 students at SMAS 16 Muhammadiyah Jakarta.

The sample size was determined using the Slovin formula with a margin of error of $e = 5\%$, yielding a sample size of 284 respondents. The sample size calculation is as follows: $n = N / (1 + Ne^2) = 982 / (1 + 982(0.05)^2) = 284$.

Subsequently, the sample was proportionally distributed across schools based on each school's student population. The sampling technique employed was proportional random sampling, with the sample comprising 116 students from SMAS 1 Muhammadiyah Jakarta, 109 students from SMAS 2 Muhammadiyah Jakarta, and 59 students from SMAS 16 Muhammadiyah Jakarta. Accordingly, every member of the population who met the inclusion criteria had an equal opportunity to be selected as a respondent.

Variable

The variables in this study consisted of individual, family, peer, and digital environment factors as independent variables, and adolescent cyberbullying behavior as the dependent variable.

Instrument

To measure the social ecological factors and respondent behavior quantitatively, the research instrument used a 5-point Likert scale with a score range of 1–5 for each item. The score for each variable was calculated as the total score across all items comprising that variable. The individual factor variable consisted of 15 items with a theoretical score range of 15–75, the family factor consisted of 10 items with a score range of 10–50, the peer factor consisted of 5 items with a score range of 5–25, the digital environment factor consisted of 5 items with a score range of 5–25, while cyberbullying behavior consisted of 5 items with a score range of 5–25.

The total score for each variable was subsequently categorized into two groups for bivariate and logistic regression analyses. The categorization cutoff points were established based on the results of normality testing, using the median value of each variable as the cutoff. For the individual

factor, a score < 61 was categorized as poor and a score $\geq$ 61 as good; for the family factor, a score < 40 was categorized as poor and a score $\geq$ 40 as good; for the peer factor, a score < 19 was categorized as influential and a score $\geq$ 19 as not influential; for the digital environment factor, a score < 17 was categorized as not influential and a score $\geq$ 17 as not influential; and for cyberbullying behavior, a score < 19 was categorized as engaging in cyberbullying and a score $\geq$ 19 as not engaging in cyberbullying.

Prior to data collection, the questionnaire was tested for validity using the product-moment correlation test, comparing the calculated r-value with the r-table value, based on a try-out sample of 30 respondents ($n = 30$) at $\alpha = 0.05$, with an r-table value of 0.361. An item was considered valid if the calculated r-value exceeded 0.361, and all items were found to be valid (calculated r-values ranging from 0.402 to 0.812). Reliability was assessed using Cronbach's alpha to assess the instrument's consistency. All Cronbach's alpha values exceeded 0.60, with reliability coefficients of 0.742 for the individual factor, 0.718 for the family factor, 0.756 for the peer factor, 0.773 for the digital environment factor, and 0.781 for the cyberbullying variable.

Multivariate analysis was performed using binary logistic regression to examine the association between individual, family, peer, and digital environment factors and the occurrence of cyberbullying. Variables with a $p\text{-value} \leq 0.25$ in the bivariate analysis were considered for inclusion in the multivariate model.

Model building was carried out using the Backward Likelihood Ratio method. Variables meeting the initial criteria were entered into the model simultaneously, after which variables not meeting the criteria were considered for stepwise removal according to the backward likelihood ratio procedure until the final model was obtained.

The results of the logistic regression were presented as the adjusted odds ratio (AOR), 95% confidence interval (95% CI), regression coefficient, standard error, Wald statistic, and $p\text{-value}$. Interpretation was based on the predetermined reference groups.

Model fit was evaluated using the Hosmer–Lemeshow test. In contrast, the model's ability to explain outcome variation was reported using the -2 Log Likelihood, Cox & Snell R Square, and Nagelkerke R Square values. In addition, multicollinearity among the independent variables was

assessed using tolerance and Variance Inflation Factor (VIF) values. The criterion for statistical significance was set at $\alpha = 0.05$, corresponding to a 95% confidence level.

Data Collection

The data for this study were obtained directly from respondents through the distribution of a structured questionnaire. The construct of the social ecological model comprised individual factors (self-regulation, empathy, and self-control), family factors (parenting style and communication), peer factors, and digital environment factors associated with adolescent cyberbullying behavior. The questionnaire was developed based on the social ecological model.

Data Analysis

The collected data subsequently underwent editing, coding, entry, and cleaning to ensure data quality prior to analysis. Data analysis was conducted in stages, comprising univariate, bivariate, and multivariate analyses.

Univariate analysis was used to describe the distribution of respondent characteristics and each study variable in terms of frequency and percentage. Bivariate analysis was conducted using the

chi-square test to determine the association between individual, family, peer, and digital environment factors and adolescent cyberbullying behavior, with a significance level (α) of 0.05.

Multivariate analysis was performed using multiple logistic regression to identify the most dominant factors influencing cyberbullying behavior. Variables with a p -value ≤ 0.25 in the bivariate analysis were entered as candidates in the logistic regression model. Model building was carried out using the Backward Likelihood Ratio (Backward LR) method until the best-fitting model was obtained.

The results of the analysis were presented as Odds Ratio (OR) values, 95% Confidence Intervals (CI), and p -values to determine the strength and significance of the associations among variables within the social ecological model of adolescent cyberbullying behavior.

Ethical Consideration

This study obtained ethical approval from the Health Research Ethics Committee,

Faculty of Nursing, Universitas Muhammadiyah Jakarta, under ethical approval number 0109/F.9-UMJ/I/2026, dated 26 January 2026. Prior to the study, the researcher provided prospective participants with an explanation of the research objectives, procedures, potential benefits and discomforts, data confidentiality, and their right to refuse or withdraw from participation at any time without consequence.

As the research participants were adolescents, some of whom were under the age of 18 years, written informed consent was obtained from the parents/guardians of the participants prior to data collection. In addition, the researcher obtained written assent from the adolescent participants after the study was explained in language appropriate to their age and level of understanding. Participation in the study was voluntary. Participant identities were not disclosed in either the research instrument or the reporting of findings, and all research data were kept confidential and used solely for research purposes.

3. RESULTS

Respondent Characteristics

Table 1. Frequency Distribution of Respondents by Age, Grade, and Duration of Internet Use

Characteristics	Frequency	Percentage (%)
age		
15	24	8.5
16	108	38
17	78	27.5
18	65	22.8
19	9	3.2
Grade		
10	139	48.9
11	58	20.5
12	87	30.6
Duration of internet use		
< 2 hours	12	4.2
2-4 hours	64	22.5
4- 6 hours	84	29.6
> 6 hours	124	43.7
Total	284	100

Table 1 shows the frequency distribution of respondents by age, grade, and duration of internet use. Regarding age, the largest proportion of respondents were 16 years old ($n = 108$; 38%), while the smallest proportion were 19 years old ($n = 9$; 3.2%). Regarding grade, the largest proportion

were in Grade 10 ($n = 139$; 48.9%), while the smallest proportion were in Grade 11 ($n = 58$; 20.5%). Regarding duration of internet use, the largest proportion used the internet for more than 6 hours per day ($n = 124$; 43.7%), while the smallest proportion used it for less than 2 hours per day ($n = 12$; 4.2%).

Table 2. Frequency Distribution of Respondents by Individual Factor

Individual Factor	Frequency	Percentage (%)
Poor	132	46.5
Good	152	53.5
Total	284	100

Table 2 shows that, based on the individual factor, the majority of respondents were categorized as having a

good individual factor ($n = 152$; 53.5%), while the remainder were categorized as having a poor individual factor ($n = 132$; 46.5%).

Table 3. Frequency Distribution of Respondents by Family Factor

Family Factor	Frequency	Percentage (%)
Poor	138	48.6
Good	146	51.4
Total	284	100

Table 3 shows that, based on the family factor, the majority of respondents were categorized as having a good family

factor ($n = 146$; 51.4%), while the remainder were categorized as having a poor family factor ($n = 138$; 48.6%).

Table 4. Frequency Distribution of Respondents by Peer Role

Peer Role	Frequency	Percentage (%)
Influential	109	38.4
Not influential	175	61.6
Total	284	100

Table 4 shows that, based on peer role, the majority of respondents reported that peers were not influential ($n = 175$; 61.6%),

while the remainder reported peers as influential ($n = 109$; 38.4%).

Table 5. Frequency Distribution of Respondents by Digital Environment

Digital Environment	Frequency	Percentage (%)
Influential	139	48.9
Not influential	145	51.1
Total	284	100

Table 5 shows that, based on the digital environment factor, the majority of respondents reported the digital

environment as not influential ($n = 145$; 51.1%), while the remainder reported it as influential ($n = 139$; 48.9%).

Table 6. Frequency Distribution of Respondents by Cyberbullying Behavior

Cyberbullying	Frequency	Percentage (%)
Engaged in cyberbullying	130	45.8
Did not engage in cyberbullying	154	54.2
Total	284	100

Table 6 shows that the majority of respondents did not engage in cyberbullying

($n = 154$; 54.2%), while the remainder engaged in cyberbullying ($n = 130$; 45.8%).

Association between Individual Factor and Cyberbullying Behavior

Table 7. Association between Individual Factor and Cyberbullying Behavior

Variable	Cyberbullying (Yes)		Cyberbullying (No)		Total		P Value	OR (95% CI)
	n	%	n	%	N	%		
Individual Factor								
Poor	71	53.8	61	46.2	132	100	0.016	1.835 (1.144–2.944)
Good	59	38.8	93	61.2	152	100		
Total	130	45.8	154	54.2	284	100		

Table 7 shows that, among the 130 respondents who engaged in cyberbullying, 71 (53.8%) had a poor individual factor and 59 (38.8%) had a good individual factor. Among the 154 respondents who did not engage in cyberbullying, 61 (46.2%) had a poor individual factor and 93 (61.2%) had a good individual factor. The chi-square test yielded

a p-value of $0.016 < \alpha (0.05)$; thus, H_0 was rejected and H_a accepted, indicating a significant association between the individual factor and cyberbullying behavior. The OR of 1.835 indicates that respondents with a poor individual factor were 1.835 times more likely to engage in cyberbullying than those with a good individual factor.

Association between Family Factor and Cyberbullying Behavior

Table 8. Association between Family Factor and Cyberbullying Behavior

Variable	Cyberbullying (Yes)		Cyberbullying (No)		Total		P Value	OR (95% CI)
	n	%	n	%	N	%		
Family Factor								
Poor	72	52.2	66	47.8	138	100	0.047	1.655 (1.034–2.650)
Good	58	39.7	88	60.3	146	100		
Total	130	45.8	154	54.2	284	100		

Table 8 shows that, among the 130 respondents who engaged in cyberbullying, 72 (52.2%) had a poor family factor and 58 (39.7%) had a good family factor. Among the 154 respondents who did not engage in cyberbullying, 66 (47.8%) had a poor family factor and 88 (60.3%) had a good family factor. The chi-square test yielded a p-value

of $0.047 < \alpha (0.05)$; thus, H_0 was rejected and H_a accepted, indicating a significant association between the family factor and cyberbullying behavior. The OR of 1.655 indicates that respondents with a poor family factor were 1.655 times more likely to engage in cyberbullying than those with a good family factor.

Association between Peer Role and Cyberbullying Behavior

Table 9. Association between Peer Role and Cyberbullying Behavior

Variable	Cyberbullying (Yes)		Cyberbullying (No)		Total		P Value	OR (95% CI)
	n	%	n	%	N	%		
Peer Role								
Influential	67	61.5	42	38.5	109	100	0.000	2.836 (1.730–4.648)
Not influential	63	36.0	112	64.0	175	100		
Total	130	45.8	154	54.2	284	100		

Table 9 shows that, among the 130 respondents who engaged in cyberbullying, 67 (61.5%) reported peers as influential and 63 (36.0%) reported peers as not influential. Among the 154 respondents who did not engage in cyberbullying, 42 (38.5%) reported peers as influential and 112 (64.0%) reported peers as not influential. The chi-square test

yielded a p-value of $0.000 < \alpha (0.05)$; thus, H_0 was rejected and H_a accepted, indicating a significant association between peer role and cyberbullying behavior. The OR of 2.836 indicates that respondents who reported peers as influential were 2.836 times more likely to engage in cyberbullying than those who reported peers as not influential.

Association between Digital Environment and Cyberbullying Behavior

Table 10. Association between Digital Environment and Cyberbullying Behavior

Variable	Cyberbullying (Yes)		Cyberbullying (No)		Total		P Value	OR (95% CI)
	n	%	n	%	N	%		
Digital Environment								
Influential	84	60.4	55	39.6	139	100	0.000	3.287 (2.018–5.353)
Not influential	46	31.7	99	68.3	145	100		
Total	130	45.8	154	54.2	284	100		

Table 10 shows that, among the 130 respondents who engaged in cyberbullying, 84 (60.4%) reported the digital environment as influential and 46 (31.7%) reported it as not influential. Among the 154 respondents who did not engage in cyberbullying, 55 (39.6%) reported the digital environment as influential and 99 (68.3%) reported it as not influential. The chi-square test yielded a p-

value of $0.000 < \alpha (0.05)$; thus, H_0 was rejected and H_a accepted, indicating a significant association between the digital environment and cyberbullying behavior. The OR of 3.287 indicates that respondents who reported the digital environment as influential were 3.287 times more likely to engage in cyberbullying than those who reported it as not influential.

Results of Independent Variable Candidate Selection for Logistic Regression

Table 11. Candidate Independent Variables for Logistic Regression

No.	Independent Variable	P Value
1	Individual factor	0.016
2	Family factor	0.047
3	Peer role	0.000
4	Digital environment	0.000

Table 11 shows that the independent variables — individual factor ($p = 0.016$), family factor ($p = 0.047$), peer role ($p = 0.000$), and digital environment ($p = 0.000$)

— qualified as candidate variables for the multivariate analysis, as they met the criterion of $p \leq 0.25$.

Logistic Regression Modeling

Table 12. Logistic Regression Modeling

No.	Step	Variable	P Value	Adjusted OR	95% CI for Exp(B)	
					Lower	Upper
1	Step 1	Individual Factor	0.303	1.325	0.775	2.263
		Family Factor	0.508	1.194	0.706	2.017
		Peer Role	0.001	2.402	1.412	4.085
		Digital Environment	0.000	3.000	1.810	4.975
2	Step 2	Individual Factor	0.217	1.386	0.825	2.327
		Peer Role	0.001	2.424	1.426	4.120
		Digital Environment	0.000	3.066	1.856	5.064
3	Step 3	Peer Role	0.000	2.644	1.583	4.415
		Digital Environment	0.000	3.102	1.881	5.117

Table 12 presents the results of the logistic regression analysis using the Backward LR method, in which variables with a p -value > 0.05 were automatically removed, beginning with the variable with the highest p -value. The family factor was removed at the second step ($p = 0.508$), followed by the removal of the individual factor at the third step ($p = 0.303$). At the third step, the candidate variables that remained significantly associated with cyberbullying ($p < 0.05$) were peer role ($p = 0.000$) and the digital environment ($p = 0.000$). In the multivariate analysis, the peer and digital environment factors remained statistically significantly associated with cyberbullying behavior after being

controlled simultaneously with the other candidate variables. The peer factor had an adjusted odds ratio of 2.644 (95% CI: 1.583–4.415; $p < 0.000$), indicating that respondents in the peer-influenced category had 2.644 times the odds of engaging in cyberbullying compared with those not influenced by peers, after controlling for the other variables in the model.

The digital environment factor had an adjusted odds ratio of 3.102 (95% CI: 1.881–5.117; $p < 0.000$), meaning that respondents in the digital-environment-influenced category had 3.102 times the odds of engaging in cyberbullying compared with those not influenced by the digital

environment, after accounting for the other variables in the model.

Thus, based on the adjusted odds ratio values, the digital environment factor showed the strongest association with cyberbullying behavior in the final model. This finding indicates an association between the digital environment factor and cyberbullying behavior; however, it cannot be interpreted as a causal relationship, given the cross-sectional design of the study.

4. DISCUSSION

An Integrative Model of Individual, Family, Peer, and Digital Environment Factors in Adolescent Cyberbullying

The findings of this study indicate that cyberbullying behavior among adolescents is a complex phenomenon influenced by multiple interacting factors. Descriptively, 45.8% of respondents were found to have engaged in cyberbullying, indicating a relatively high prevalence of this phenomenon within the study population. Moreover, the high intensity of internet use—exceeding 6 hours per day among the majority of respondents—suggests substantial adolescent exposure to the digital environment. This finding reinforces the argument that digital spaces have become the primary arena for adolescent

social interaction today. From a theoretical perspective, cyberbullying cannot be understood merely as individual behavior, but rather as the outcome of an interaction between the individual and their social environment ([Livingstone & Smith, 2014](#)). This is further supported by research demonstrating that cyberbullying is closely associated with various psychological consequences, such as depression and anxiety, among adolescents ([Borka Balas, 2023](#)). Accordingly, an integrative model grounded in social ecological theory is relevant for comprehensively explaining this phenomenon, as it enables the simultaneous analysis of the relationships among individual, family, peer, and digital environment factors. This discussion, therefore, addresses each factor within that integrative framework.

Individual Factor

The findings show that the individual factor was significantly associated with cyberbullying behavior, with respondents in the poor individual-factor category exhibiting a higher tendency to engage in cyberbullying than those in the good individual-factor category. This suggests that psychological attributes such as empathy and self-regulation play an

important role in shaping adolescent behavior in the digital sphere. Empathy is the capacity to understand others' feelings, while self-regulation is a control mechanism for aggressive behavioral impulses (Doty et al., 2024). Adolescents with low levels of empathy tend to disregard the negative consequences of their actions, making them more prone to engaging in cyberbullying. In addition, poor self-control renders individuals more impulsive in responding to conflict in the digital environment.

Nevertheless, the individual factor alone cannot fully account for cyberbullying behavior. This is consistent with social ecological theory, which posits that individual behavior results from interaction with the social environment (Livingstone & Smith, 2014). In this study, although a proportion of respondents exhibited good individual characteristics, some of them still engaged in cyberbullying. This suggests that pressures from the surrounding social environment may influence the individual factor. Consequently, an approach that focuses solely on individual psychological aspects is insufficient to fully explain the phenomenon of cyberbullying, underscoring the need also to consider external factors such as peers and the digital environment in the analysis.

Family Factor

The findings show that the family factor was significantly associated with cyberbullying behavior. Respondents in the poor family-factor category exhibited a higher tendency to engage in cyberbullying than those in the good family-factor category, indicating that the family serves as the primary environment shaping adolescents' values and behavior. From the perspective of social ecological theory, the family functions as a microsystem that directly influences individual development (Nichols, 2022).

Open communication between parents and children, along with monitoring of digital activity, can serve as protective factors against cyberbullying. Conversely, a lack of communication and supervision may increase the risk of aggressive behavior in the digital sphere. Family support has also been shown to mitigate the psychological effects of cyberbullying, such as stress and anxiety (Doty et al., 2024). Nevertheless, the findings indicate that not all adolescents from supportive family environments are protected from cyberbullying, suggesting that the influence of the family may be moderated by other factors, particularly peers and the digital environment. The family is therefore an important factor, but

not the sole determinant, of cyberbullying behavior.

Peer Factor

The findings show that the peer factor was very significantly associated with cyberbullying behavior. Respondents influenced by their peers exhibited a higher tendency to engage in cyberbullying than those not influenced, indicating that peers are a highly dominant factor in shaping adolescent behavior. In adolescent developmental theory, the peer group serves as the primary agent of socialization, shaping individual norms and behavior ([Kwiatkowska & Rogaza, 2019](#)).

Adolescents tend to align their behavior with that of their peer group in order to gain social acceptance. When cyberbullying is perceived as normative within the group, individuals become more likely to engage in such behavior. Furthermore, group pressure can diminish an individual's capacity to resist negative behavior. Within the integrative model, peers function as a mediator between the individual factor and the broader social environment. This suggests that group-based interventions, such as peer education, may be an effective strategy for preventing cyberbullying. The role of peers should

therefore be a primary focus of intervention programs.

Digital Environment

The findings show that the digital environment was significantly associated with cyberbullying behavior. The digital environment possesses unique characteristics, including anonymity, extensive reach, and minimal social control, which enable individuals to engage in aggressive behavior without immediate consequences ([Livingstone & Smith, 2014](#)). These conditions make cyberbullying more likely to occur than conventional bullying.

In addition, high-intensity internet use increases the likelihood of digital social interactions that may give rise to conflict. Prior research indicates that longer durations of internet use are associated with a greater risk of cyberbullying ([Zhu et al., 2021](#)). Within the integrative model, the digital environment represents the principal context in which cyberbullying occurs. Interventions focusing on digital literacy and monitoring technology use are therefore essential, making the strengthening of digital literacy and the regulation of social media use key strategies for cyberbullying prevention.

The findings indicate that individual, family, peer, and digital environment factors are all associated with adolescent cyberbullying behavior. In the multivariate analysis, the peer and digital environment factors remained significantly associated after simultaneous control for other variables.

The digital environment factor showed the highest adjusted odds ratio in the final model (AOR = 3.102; 95% CI: 1.881–5.117), indicating the strongest association with cyberbullying behavior among the variables retained. However, this result should not be interpreted as evidence that the digital environment causes cyberbullying. This finding can instead be understood from a social ecological perspective, whereby cyberbullying behavior is linked to the interaction of multiple contexts surrounding adolescents' lives, including the peer and digital environments.

Furthermore, the findings indicate that the digital environment is the most dominant factor associated with the occurrence of cyberbullying (OR = 3.102). This suggests that cyberbullying is not confined to any particular region, as it can occur wherever adolescents have access to the digital environment. The nature of digital media, which allows users to interact

anonymously and reach large audiences, means that adolescents in both urban and rural areas may face similar risks of cyberbullying. As internet and smartphone use in rural areas continue to grow, this risk is increasingly likely to materialize. Community nursing practice in rural areas, therefore, needs to broaden its bullying-prevention efforts beyond direct or physical bullying to include enhancing digital literacy among adolescents, families, schools, and communities.

Synthesis of the Integrative Model

The findings show that the associations between individual, family, peer, and digital environment factors and cyberbullying behavior do not operate independently of one another. In the bivariate analysis, each of the individual, family, peer, and digital environment factors was significantly associated with cyberbullying behavior. However, once all variables were analyzed simultaneously using logistic regression with the Backward Likelihood Ratio procedure, only the peer and digital environment factors remained significantly associated with cyberbullying behavior. In contrast, the individual and family factors were no longer significant in the final model. In the final model, adolescents in the peer-influenced group

had 2.644 times the odds of engaging in cyberbullying compared with the reference group (95% CI: 1.583–4.415), while the digital environment factor was associated with 3.102 times the odds (95% CI: 1.881–5.117).

These findings indicate that, within the context of the adolescents studied in these Indonesian schools, the social contexts of peers and the digital environment are more consistently associated with cyberbullying behavior once the individual and family factors are considered jointly. This does not mean that individual and family factors can be disregarded; rather, their associations with cyberbullying in this study did not persist after controlling for peer and digital environment factors. This may suggest that adolescents' experiences and interactions within their peer group, together with their exposure to and use of the digital environment, represent contexts more proximally related to the occurrence of cyberbullying. These findings further imply that cyberbullying prevention efforts should integrate strengthening positive peer relationships with digital literacy and behavior management in digital environments, in addition to sustaining family support and reinforcing individual-level factors.

Implications for Community Nursing Practice

Although this study was conducted in an urban setting, the findings confirming the dominant influence of the digital environment (OR = 3.102) and peer role (OR = 2.644) on cyberbullying behavior carry crucial implications for community nursing practice in rural areas. Rural regions are currently undergoing accelerated digital transformation, and the rapidly increasing penetration of internet access and smartphone ownership in remote villages poses a risk of cyber exposure whose probability will soon approach that observed in urban areas. Given that the social protection infrastructure for online safety in rural communities is not yet fully established, community nurses are required to undertake proactive, concrete primary prevention interventions that integrate local wisdom.

First, in response to the strong influence of peers on cyberbullying, community nurses should optimize and revitalize the role of the Adolescent Posyandu (Posyandu Remaja) at the village level. The Adolescent Posyandu should no longer focus solely on basic physical health screening but should expand its function into a peer-support group ecosystem.

Community nurses can empower and train adolescent health cadres in rural areas to serve as peer educators, tasked with promoting positive social norms, fostering empathy in digital interactions, and acting as early-detection agents for conflicts or indications of cyberbullying within the village social environment.

Second, to mitigate exposure to the digital environment, interventions need to be institutionalized through the School Health Program (Usaha Kesehatan Sekolah, UKS). Community nurses (through Puskesmas, or community health centers) can collaborate with teachers to design basic digital health literacy modules for rural schools. This UKS program should systematically educate students on social media ethics, digital footprint awareness, emotional regulation in response to online provocation, and reporting mechanisms for victims. Education in rural schools serves as the frontline in equipping adolescents with digital resilience from an early age.

Third, the success of interventions based on the social ecological model requires engaging the microsystem through a Collaborative Family–School Digital Literacy Program. In rural settings, the digital divide—the gap in technological understanding between parents and their

children—tends to be wider. Community nurses are therefore required to proactively organize community-based outreach programs (such as through village hall forums, religious study groups, or PKK [Family Welfare Movement] meetings) to equip parents with digital literacy skills. Parents can be taught to monitor their children's digital activity through an assertive, supportive communication approach, rather than through repressive prohibitions alone. This tripartite synergy among community nurses, school institutions, and families will create a comprehensive social ecological safety net, enabling the effective prevention of a surge in cyberbullying cases in rural areas.

Limitations

Although this study provides important insights into the determinants of cyberbullying through a social-ecological model analysis, several methodological limitations should be acknowledged. First, the use of a quantitative cross-sectional design limits the researchers' ability to draw definitive causal conclusions about the relationships among individual, family, peer, and digital environment factors and cyberbullying behavior. Second, the study population was drawn exclusively from

adolescents at SMAS 1 Muhammadiyah Jakarta, SMAS 2 Muhammadiyah Jakarta, and SMAS 16 Muhammadiyah Jakarta, all located within urban DKI Jakarta. This urban sample characteristic limits the generalizability of the findings, meaning that the strategic implications for community nursing practice in rural areas still require further empirical testing. Third, data were collected directly through a structured Likert-scale questionnaire; as a self-report method, this approach is highly susceptible to social desirability bias. Given that cyberbullying is a sensitive issue, respondents may have been inclined to provide normative responses and conceal their actual aggressive behavior.

5. CONCLUSIONS

This study demonstrates an association between individual, family, peer, and digital environment factors and adolescent cyberbullying behavior. In the final logistic regression model, the peer and digital environment factors remained significantly associated with cyberbullying behavior, with the digital environment factor showing the largest adjusted odds ratio (AOR = 3.102; 95% CI: 1.881–5.117), indicating the strongest association in the final model.

These findings support the use of a social ecological approach in understanding cyberbullying behavior as a phenomenon connected to multiple contexts in adolescents' lives. Nonetheless, these results cannot be used to infer a causal relationship given the study's cross-sectional design.

Overall, this study demonstrates that adolescent cyberbullying behavior results from a multidimensional interaction among individual, family, peer, and digital environment factors, with the digital environment and peer role identified as the most dominant determinants. For the science and practice of community nursing—particularly in rural areas currently facing a massive wave of digitalization—these findings provide a strategic foundation for designing systematic cyberbullying prevention efforts. Community nurses should take a leadership role in integrating digital literacy modules and peer conflict-resolution skills into existing community-based health programs. Optimizing the Adolescent Posyandu as a peer-support hub, revitalizing the School Health Program (UKS) for digital resilience education, and engaging families through community outreach are essential concrete steps. Through such a collaborative and

contextual approach, the psychological well-being of adolescents in the digital era across both urban and rural settings can be sustainably protected.

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AUTHOR CONTRIBUTIONS

All authors contributed to the conception and design of the study. N and AP collected the data and drafted the manuscript. N and LH supervised the study, performed the statistical analysis and critically revised the manuscript. N, R, and DDKL contributed to the methodology and revised the manuscript. All authors read and approved the final version.

CONFLICT OF INTEREST

The authors declare no conflict of interest in this study.

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DATA AVAILABILITY

All research data are managed by the researchers and are not publicly available, in order to uphold research ethics and protect respondent confidentiality.

DECLARATION OF USE OF AI

In preparing this manuscript, the authors made limited use of Artificial Intelligence (AI)-based tools for language and readability refinement. AI was used to assist in improving grammar, sentence structure, cohesion, and the readability of the academic text. The entire research process, including conceptualization, data collection, statistical analysis using the social ecological model, and the interpretation of results and nursing implications, was carried out by the authors. The authors take full responsibility for reviewing, verifying, and revising all AI-assisted output, and for ensuring the accuracy, validity, originality, and integrity of the manuscript's content.

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