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Beyond individual risk: social structure and the production of youth health risk behaviour in Indonesia

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ABSTRACT

Background: Adolescence and early adulthood are critical periods for the development of health behaviours, yet longitudinal evidence on how these behaviours are socially patterned in Indonesia remains limited. Drawing on life-course theory and the social determinants of health framework, this study conceptualises Social Structure as a multidimensional construct comprising economic resources, education, family conditions, and community participation.

Methods: Longitudinal data from Waves 4 (2007) and 5 (2014) of the Indonesia Family Life Survey (n=11,539) were analysed. Structural Equation Modelling was conducted across 20 multiply imputed datasets using pooled estimates to examine associations between adolescent Social Structure, health-risk behaviour in young adulthood, and behavioural change over time.

Results: More advantaged Social Structure was associated with lower health-risk behaviour in young adulthood ($\beta = -0.126, p < .001$) and with less adverse patterns of behavioural continuity and change between 2007 and 2014 ($\beta = -0.142, p < .001$).

Conclusions: Youth health-risk behaviour is socially patterned across the transition to adulthood and cannot be understood solely through individual-level explanations. They support prevention strategies that address structural inequalities alongside behavioural interventions and suggest that future research should further examine how social conditions shape behavioural trajectories across adolescence and young adulthood.

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KEYWORDS

Social structure; adolescents; health risk behaviour; longitudinal study; behaviour change

Introduction

Adolescence and young adulthood are critical stages in the life course, marked by substantial social, emotional and cognitive development. Young people gain greater autonomy, renegotiate family and peer relationships, and establish behaviours with implications for later health (Sawyer et al., 2012; Steinberg, 2005). These transitions are embedded within earlier family, socioeconomic and community circumstances. A life-course perspective therefore considers the accumulation of social advantage and disadvantage across development (Keating, 2016; Keating et al., 2013).

Public health discourse often frames youth health risk behaviours such as smoking, physical inactivity, and unhealthy dietary practices as matters of individual choice and responsibility. Such framings can obscure the unequal social, material, and institutional conditions within which behavioural risk is produced, normalised, and sustained. Social structure refers to patterned social and institutional arrangements that shape access to resources, opportunities and social norms (Bandelli, 2021). In adolescent health research, these conditions include economic resources, educational opportunity, family organisation and community contexts. Rather than treating these as isolated determinants, a multidimensional structural perspective recognises that they operate together to shape behavioural opportunities and constraints.

Evidence consistently shows that these dimensions are associated with adolescent health behaviour. Lower socioeconomic position has been linked to smoking, unhealthy eating and lower physical activity

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through reduced access to health-promoting resources and supportive environments (Amalia et al., 2019; Braveman & Gottlieb, 2014; Hanson & Chen, 2007; Marmot, 2017; Valencia et al., 2019). Family structure and relationships also matter: adolescents experiencing family disruption or weaker family support are more likely to engage in health-risk behaviours, whereas supportive family relationships can be protective (Brown & Rinelli, 2010; Parker & Benson, 2004; Rukmi, 2019). Educational opportunities may promote healthier behavioural patterns through health knowledge, structured routines and access to supportive social environments (Dolzan et al., 2015; Zajacova & Lawrence, 2018). Community and peer contexts can similarly reinforce or constrain risk behaviour, while organised youth participation may provide supportive social norms and opportunities for engagement (Littlecott et al., 2023; Risti et al., 2021; Utomo, 2003).

These structural processes are particularly important in low- and middle-income countries (LMICs), where rapid urbanisation, changing food and activity environments, educational inequality and tobacco exposure are reshaping adolescent health. Indonesia is a particularly relevant setting because it combines rapid social and epidemiological transition with substantial socioeconomic and regional inequalities. Smoking among young people remains high, while physical inactivity and unhealthy dietary patterns contribute to the growing burden of non-communicable disease (Dadras, 2024; Pengpid et al., 2019; UNICEF, 2022). At the same time, Indonesia's diverse regional, social and economic contexts may shape young people's access to education, community support and health-promoting resources in unequal ways. Despite growing evidence on social influences on adolescent health behaviour, important gaps remain. Much of the evidence from Indonesia and other LMICs is cross-sectional, limiting understanding of how earlier social conditions relate to behavioural continuity and change over time (Andriyani et al., 2020). Although longitudinal and repeated-survey studies exist, including work examining parental resources and population trends in adolescent risk behaviour (Dartanto et al., 2018; Sudarko et al., 2023), these studies commonly focus on single behaviours or individual social determinants rather than modelling social structure as a multidimensional construct. More broadly, longitudinal research on behavioural change is still dominated by high-income settings and often examines individual behaviours, particularly smoking, rather than multiple health-related behaviours across developmental transitions (Costello et al., 2008; Dutra et al., 2017; Shinde et al., 2023).

This gap is important because social structure may influence not only whether young people engage in health-risk behaviour at a particular point in time, but also whether such behaviours persist, emerge or diminish as they move into adulthood (Umberson et al., 2010). Examining behavioural change therefore provides a more dynamic account of how social inequalities may shape health behaviour across the life course. Using longitudinal IFLS data, this study models adolescent Social Structure as a multidimensional latent construct reflecting economic status, family structure, education and youth-community involvement. It examines its association with (1) health-risk behaviour in young adulthood and (2) behavioural stability and change between adolescence and young adulthood.

Methods

Study design and data source

This study used a prospective longitudinal design to examine how adolescent social structure is associated with health risk behaviour and behavioural change during the transition to young adulthood in Indonesia. Data were drawn from the Indonesia Family Life Survey (IFLS), a longitudinal panel survey covering 13 provinces and representing approximately 83% of the Indonesian population. The present analyses used Wave 4 (2007) and Wave 5 (2014), as these waves capture respondents during adolescence and young adulthood and include detailed measures of social conditions and health-related behaviours. Wave 4 was treated as the baseline, capturing respondents aged 15–23 years, while Wave 5 provided follow-up data when respondents were aged 22–30 years. Some indicators of social structure, however, referred to circumstances preceding Wave 4, including parental marital status and parental co-residence at age 12, allowing aspects of earlier developmental context to be incorporated into the analysis. The IFLS uses a multistage stratified sampling design and follows original household members as well as split-off households over time. It covers 13 provinces representing more than 80% of the Indonesian population and reflects the country's regional and urban–rural diversity (Strauss et al., 2016).

Sample selection

The analytic sample included respondents observed in Wave 4 (2007) and/or Wave 5 (2014) who were aged 15–23 years at baseline and/or 22–30 years at follow-up. A total of 11,539 individuals met the eligibility criteria, of whom 2,525 were observed at both waves. Primary analyses used the full eligible sample, with a balanced-panel sensitivity analysis conducted among these 2,525 participants.

Addressing missing data

Missingness arose from both item-level non-response and wave-level non-participation. Missing data were addressed using Multiple Imputation by Chained Equations (MICE) with Random Forest imputation, which accommodates mixed variable types and potentially non-linear relationships between predictors (Doove et al., 2014). The imputation model included variables used in the substantive analyses together with relevant observed socio-demographic, household and behavioural variables that could provide information about missing values or survey participation. The unique participant identifier was excluded as an imputation target and predictor. Variables without missing data were not themselves imputed but were retained where appropriate as predictors of variables containing missing values.

Twenty imputed datasets were generated using 50 iterations. Estimates from the substantive models were pooled across the 20 imputed datasets using Rubin's rules (Rubin, 1987). The analyses assume that missingness is conditionally missing at random given the observed information included in the imputation model. This assumption cannot be directly verified. Consistent with methodological guidance that the proportion of missing observations alone should not determine whether multiple imputation is appropriate (Madley-Dowd et al., 2019), the primary analyses used the multiply imputed full eligible sample. As an additional assessment of sensitivity to wave-level non-participation, the principal SEM was repeated among participants observed in both waves ($n=2,525$), using the same imputation and modelling strategy.

Measures

The analysis was guided by a life-course and structural determinants framework, examining how early social conditions shape later health-behaviour. Social structure and behavioural outcomes were operationalised as follows.

Social structure (Wave 4, 2007)

Social structure was modelled as a higher-order latent construct reflecting four dimensions of adolescent social position:

- Economic status, indicated by annual household income, land ownership, and vehicle ownership
- Education, indicated by the respondent's highest educational attainment and parental education
- Family structure, indicated by parental marital status at age 12, co-residence with both parents, and parent–child communication. Parental co-residence distinguished respondents who had lived with neither, one, or both parents at age 12. Parent–child communication was constructed from six available items capturing communication/contact with mothers and fathers. A total score was calculated when all six component items were available, with higher scores representing greater parent–child communication. Missing values in the resulting measure were subsequently addressed within the multiple-imputation procedure.
- Youth community involvement, indicated by participation in organised youth activities, primarily Karang Taruna, a nationally recognised community based youth organisation operating at village or urban-ward level (Ministry of Social Affairs of the Republic of Indonesia, 2005). Participation is voluntary and may vary across local contexts.

This approach was used to capture social structure as a multidimensional and interrelated set of conditions, rather than reducing it to a single proxy such as income or schooling alone.

Health risk behaviour (Wave 5, 2014)

Health risk behaviour in young adulthood was modelled as a latent construct indicated by:

- Smoking (yes/no)
- Physical inactivity, defined as no vigorous physical activity in the previous seven days
- Unhealthy diet, measured using a composite index based on sweet foods, junk/fast food, instant noodles and soft-drink consumption.

Behavioural change (Wave 4 and wave 5)

To capture behavioural stability and change across adolescence and young adulthood, smoking and physical activity were recoded into ordered categories based on status in 2007 and 2014. Dietary behaviour was not included in this longitudinal measure because comparable data were not available in Wave 4 (2007).

- Smoking: “still not smoking,” “quit smoking,” “started smoking,” “still smoking”
- Physical activity: “still active,” “started active,” “quit active,” “still not active”

These ordered categories were constructed to reflect patterns of behavioural continuity and change, with higher values corresponding to greater persistence in or movement toward health risk.

Analytical strategy

Structural Equation Modelling (SEM) was used to examine the relationships between adolescent social structure and later health risk behaviour and behavioural change as latent variables. Two structural models were specified. The first examined health-risk behaviour in 2014 as a latent construct indicated by smoking, vigorous physical activity and eating behaviour. The second examined behavioural change between 2007 and 2014, capturing patterns of continuity and change in smoking and physical activity. Social Structure was modelled as a higher-order latent construct reflected by economic status, education, family structure and youth-community involvement. In accordance with the conceptual model, parental education was additionally specified as a predictor of parent–child communication. Age and gender were included as covariates. Models were estimated in R using the lavaan/lavaan.mi framework. Model parameters were estimated separately across 20 multiply imputed datasets using robust maximum likelihood estimation (MLR), and parameter estimates and standard errors were pooled across imputations. Continuous economic indicators were standardised within each completed dataset before model estimation to improve comparability across scales, while categorical and ordinal indicators retained their analytical coding. Model adequacy was assessed using the Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardised Root Mean Square Residual (SRMR), considered jointly rather than as absolute decision rules. Sensitivity to wave-level non-participation was assessed by repeating the principal SEM among the balanced panel of 2,525 respondents using the same modelling strategy.

Results

Sample characteristics

The analytic sample comprised 11,539 Indonesian adolescents and young adults drawn from Waves 4 (2007) and/or 5 (2014) of the Indonesia Family Life Survey. Respondents were aged 15–23 years in 2007 and 22–30 years in 2014, with mean age increasing from 19.1 years (SD = 2.4) in 2007 and 26.1 years (SD = 2.4) in 2014. The sample was slightly female-majority (52.4%), and 56.7% resided in urban areas. In terms of ethnicity, 39.4% identified as Javanese, 11.9% as Sundanese, and 4.9% as Batak, while 34% represented other ethnic groups. Most respondents identified as Muslim (89.6%).

Social structure profile

Descriptive findings showed substantial variation in structural conditions. In 2007, annual household income was highly skewed, with a mean of IDR 31.3 million (SD = 65.0 million) and a median of IDR 16.4

million (IQR = 29.9 million). Land asset values were similarly skewed, with a mean of IDR 75.1 million (SD = 152.0 million) and a median of IDR 25.0 million (IQR = 75.0 million). Vehicle asset values had a mean of IDR 11.0 million (SD = 32.0 million) and a median of IDR 3.0 million (IQR = 10.5 million), indicating substantial variation in material resources across the sample.

Educational attainment also varied across respondents and was generally lower among parents than among the younger generation. Family-structure indicators suggested relative stability for many respondents: more than 90% reported that their parents were married when they were aged 12, and a similarly high proportion reported living with both parents at that age. Parent–child communication showed greater variation, with a mean score of approximately 14 on the 6–30 scale. Participation in organised youth-community activities, including Karang Taruna, was comparatively limited, with around one-quarter reporting involvement.

Health risk behaviour profile

In 2014, health-risk behaviour was characterised by smoking, physical inactivity and unhealthy eating. Smoking was reported by 36.5% of respondents. Among respondents with observed physical-activity data, 76.3% reported no vigorous physical activity in the previous seven days. Unhealthy eating also showed substantial variation across the sample, with a mean unhealthy-eating score of 2.2 (SD = 0.8) on the 0–4 scale.

Behavioural change profile

Across the two waves, smoking and physical activity showed both continuity and change. For smoking, 62.9% remained non-smokers, 14.8% initiated smoking, 21.7% remained smokers, and 0.6% quit smoking. For physical activity, 66.0% remained active, 14.5% became active, 11.8% became inactive, and 7.7% remained inactive.

Model 1: Association between social structure and health-risk behaviour

Figure 1 presents the pooled structural equation model examining the association between Social Structure and health-risk behaviour in 2014 across 20 multiply imputed datasets. The model converged

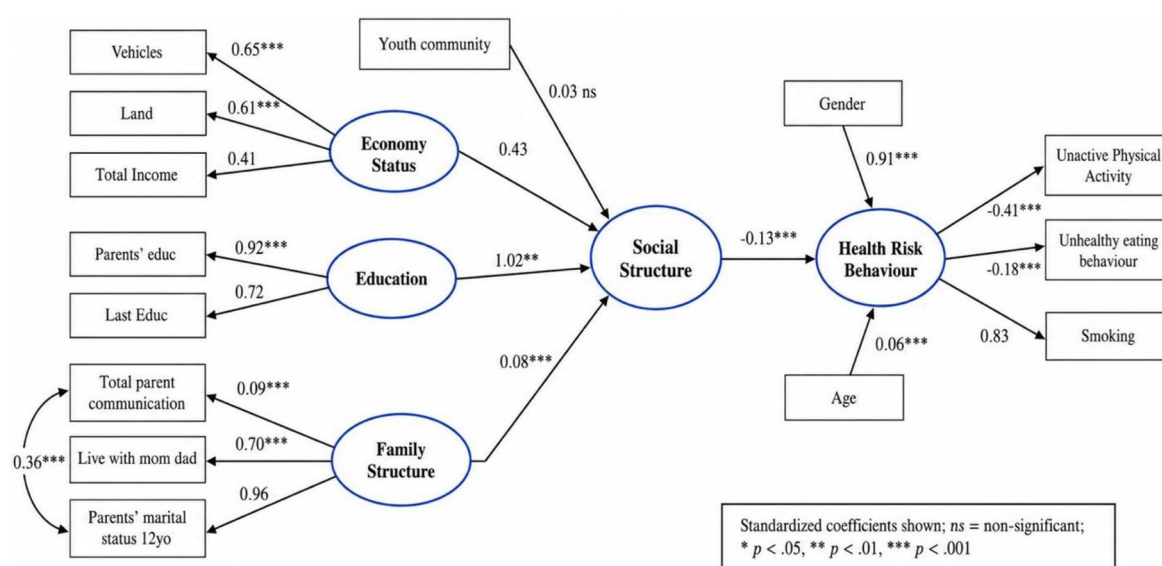


Figure 1. Model of social structure on health risk-taking behaviour. Structural equation model showing the association between adolescent Social Structure and health-risk behaviour in young adulthood in Indonesia. Social Structure is modelled as a higher-order latent construct comprising economic status, family structure, education, and youth-community involvement. Health-risk behaviour is indicated by smoking, vigorous physical activity, and unhealthy eating behaviour.

across all imputations. Overall model fit was acceptable ($\chi^2(71) = 834.56$, $p < .001$; CFI = 0.933; TLI = 0.915; RMSEA = 0.031; SRMR = 0.045).

Within the higher-order Social Structure construct, education showed the strongest standardised loading ($\beta = 1.024$, $p = .002$), followed by economic status ($\beta = 0.434$). Family structure showed a smaller but statistically significant loading ($\beta = 0.081$, $p < .001$), whereas youth-community involvement showed a small, non-significant loading ($\beta = 0.031$, $p = .104$). The standardised loading for education exceeded 1.00 and should therefore be interpreted cautiously.

For the health-risk-behaviour construct, smoking was the strongest indicator ($\beta = 0.831$), followed by the vigorous-physical-activity indicator ($\beta = -0.405$, $p < .001$) and eating behaviour ($\beta = -0.184$, $p < .001$). Higher Social Structure was significantly associated with lower health-risk behaviour ($B = -0.281$, $SE = 0.049$, $\beta = -0.126$, $p < .001$). Gender showed a strong association with health-risk behaviour ($B = 0.728$, $\beta = 0.912$, $p < .001$), whereas age showed a smaller positive association ($B = 0.010$, $\beta = 0.063$, $p < .001$). The model explained approximately 85.1% of the variance in the latent health-risk-behaviour construct ($R^2 = 0.851$).

Model 2: Association between social structure and behavioural change

Figure 2 presents the pooled structural equation model examining the association between Social Structure and patterns of behavioural change between 2007 and 2014. The model converged across all 20 multiply imputed datasets and showed acceptable overall fit ($\chi^2(59) = 854.61$, $p < .001$; CFI = 0.929; TLI = 0.907; RMSEA = 0.034; SRMR = 0.047).

The higher-order measurement pattern was similar to Model 1. Education showed the strongest standardised loading on Social Structure ($\beta = 1.057$, $p = .001$), followed by economic status ($\beta = 0.422$) and family structure ($\beta = 0.079$, $p < .001$). Youth-community involvement again showed a small, non-significant loading ($\beta = 0.031$, $p = .104$). As in Model 1, the standardised education loading exceeded 1.00 and should be interpreted cautiously.

Behavioural change was represented by smoking change and physical-activity change. Smoking change showed the stronger standardised loading ($\beta = 0.847$), while physical-activity change loaded negatively on the construct ($\beta = -0.491$, $p < .001$).

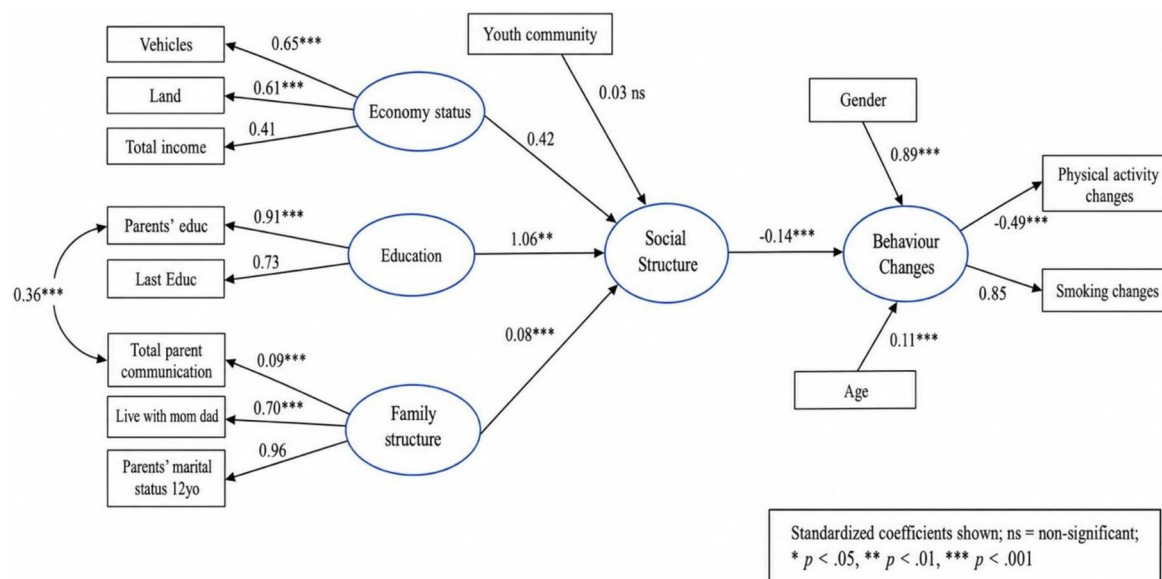


Figure 2. Model of social structure on behavioural change. Structural equation model showing the association between adolescent Social Structure and patterns of behavioural stability and change between 2007 and 2014 in Indonesia. Social Structure is modelled as a higher-order latent construct comprising economic status, family structure, education, and youth-community involvement. Behavioural change is indicated by changes in smoking and physical activity, with age and gender included as covariates.

Higher Social Structure was significantly associated with lower behavioural risk over time ($B = -0.906$, $SE = 0.154$, $\beta = -0.142$, $p < .001$). Gender showed a strong positive association with behavioural-risk patterns ($B = 1.973$, $\beta = 0.886$, $p < .001$), whereas age showed a smaller positive association ($B = 0.051$, $\beta = 0.110$, $p < .001$). The model explained approximately 81.6% of the variance in the latent behavioural-change construct ($R^2 = 0.816$).

Balanced-panel sensitivity analysis

The association remained negative and significant in the balanced panel ($\beta = -0.111$, $p = .001$), similar to the full-sample estimate ($\beta = -0.126$, $p < .001$). Gender and age estimates were also substantively similar.

Discussion

This study examined whether multidimensional Social Structure was associated with health-risk behaviour and behavioural change during the transition from adolescence to young adulthood in Indonesia. More advantaged Social Structure was associated with lower health-risk behaviour in young adulthood ($\beta = -0.126$, $p < .001$) and with less adverse patterns of behavioural continuity and change between 2007 and 2014 ($\beta = -0.142$, $p < .001$). Gender was one of the strongest predictors in both models, while age showed smaller but statistically significant associations. Together, these findings suggest that health-risk behaviour is socially patterned across the transition to adulthood rather than being explained by individual choice alone. These findings are consistent with life-course perspectives in which social inequalities accumulate across development (Elder et al., 2003; Halfon et al., 2010; Keating, 2016). Wave 4 should therefore be understood as the analytical baseline rather than the beginning of social-structural exposure. Some indicators, including parental marital status and co-residence at age 12, capture earlier developmental circumstances, supporting interpretation of the findings within a longer history of family, educational and economic conditions.

Education showed the strongest contribution to the higher-order Social Structure construct in both pooled models, consistent with its role as both an individual resource and a marker of family and institutional advantage (Cutler & Lleras-Muney, 2010; Mirowsky & Ross, 2003; Pampel et al., 2010). However, its standardised loading exceeded 1.00 and was accompanied by a small negative residual variance, so this finding should be interpreted cautiously. Economic status also contributed to Social Structure, although material advantage may provide access to both health-promoting and risk-enhancing environments in rapidly changing LMIC settings (Pampel et al., 2010; Popkin, 2006).

Family structure contributed more modestly. Parental marital status and co-residence at age 12 were more strongly represented than parent-child communication, suggesting that stable aspects of household organisation were more closely aligned with the structural family dimension. Parent-child communication may instead represent a more proximal family process, although its positive association with parental education suggests that structural and relational family resources may operate together (Brown & Rinelli, 2010; McFarlane et al., 1995). Youth-community involvement also showed a small, non-significant loading ($\beta = .031$, $p = .104$), but was retained because it was specified a priori as a distinct community dimension. Its weak loading suggests that community participation may operate relatively independently of conventional socioeconomic advantage and requires richer measurement in future research.

Smoking was the strongest indicator of the health-risk-behaviour construct in Model 1 ($\beta = 0.831$) and smoking change was also the strongest indicator of behavioural change in Model 2 ($\beta = 0.847$). This is particularly relevant in Indonesia, where smoking among men is strongly socially normalised and linked to peer interaction and masculine identity (Ng et al., 2007; Nichter et al., 2009). Smoking should also be understood developmentally, because earlier initiation may become increasingly difficult to reverse as nicotine use and smoking-related routines become established over time (Reynolds et al., 2025). These mechanisms were not directly tested here, but they provide a plausible life-course interpretation of why smoking emerged as such a strong marker of behavioural risk. Physical-activity change also contributed to the behavioural-change construct, although less strongly, and may be more sensitive to changes in education, employment, mobility and everyday routines during the transition to adulthood (Corder et al., 2019; Dumith et al., 2011; Telama, 2009).

Gender was one of the strongest predictors in both models. Exploratory gender-stratified SEMs were considered, but the female-specific HRB model produced an improper solution, likely because smoking prevalence was very low among females (1.3% versus 74.3% among males). Gender-specific estimates were therefore not interpreted, and gender was retained as a covariate. Age showed smaller significant associations with both outcomes, potentially reflecting changes in autonomy and social roles during the transition to adulthood (Ben-Shlomo & Kuh, 2002; Viner et al., 2012).

The balanced-panel sensitivity analysis provided some reassurance that the principal Model 1 finding was not driven solely by wave-level non-participation. Among the 2,525 participants observed in both 2007 and 2014, the association between Social Structure and health-risk behaviour remained negative and statistically significant ($\beta = -0.111$, $p = .001$), compared with $\beta = -0.126$ in the full eligible sample. The similarity in direction and magnitude suggests that restricting the analysis to participants observed at both waves did not materially alter the main conclusion, although attrition bias cannot be ruled out. These findings suggest that interventions focused solely on individual knowledge or responsibility are unlikely to be sufficient. Prevention should also address the social conditions that shape behavioural opportunities, including educational inequality, family support, community resources, safe environments for physical activity and regulation of harmful commercial products. The strong gender association additionally highlights the importance of recognising the gendered social meanings attached to smoking and other health behaviours.

Several limitations should be acknowledged. Multiple imputation assumes that missingness was conditionally missing at random given the variables included in the imputation model, an assumption that cannot be directly verified. Wave-level non-participation also remains a possible source of selection despite the balanced-panel sensitivity analysis. The higher-order Social Structure model showed some measurement instability, particularly the education loading above 1.00 and negative residual variance. Youth-community involvement was weakly related to the higher-order construct, peer influence was not directly measured, dietary behaviour could not be examined longitudinally, and behavioural change was measured across only two time points. Future research should incorporate more repeated measurements and richer peer, school, community and neighbourhood measures.

Conclusion

This study shows that youth health-risk behaviour in Indonesia is socially patterned across the transition from adolescence to young adulthood and is associated with unequal social conditions established earlier in life. Adolescents positioned within more advantaged social environments were less likely to be positioned toward higher health-risk behaviour in young adulthood and were also less likely to experience less favourable patterns of behavioural continuity and change over time. These findings suggest that behavioural risk cannot be understood solely as a matter of personal choice, but should also be considered in relation to unequal educational, economic, family and wider social conditions. The findings challenge individualised framings of youth health risk that focus primarily on knowledge, motivation or personal responsibility. While health-literacy and behavioural interventions remain important, they are unlikely to be sufficient if the broader conditions within which health behaviours develop remain unequal. Reducing youth health inequalities therefore requires more than encouraging healthier choices; it also requires attention to the structural conditions that enable, constrain or normalise those choices. For public health policy, this means moving beyond one-off behaviour-change messaging towards earlier and more sustained investment in the social environments of adolescence. Educational opportunity, supportive family and community contexts, and gender-responsive strategies should be considered important components of prevention. In rapidly changing LMIC contexts such as Indonesia, addressing the social conditions associated with behavioural risk is important for promoting more equitable health trajectories into adulthood.

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Author contributions

CRediT: **Gisely Vionalita**: Conceptualization, Data curation, Methodology, Writing – original draft; **Nathan Hughes**: Methodology, Supervision; **Alvaro Martinez-Perez**: Data curation, Methodology, Supervision.

Ethical approval statement

This study utilised anonymised secondary data from the Indonesia Family Life Survey (IFLS), which received ethical clearance from the Institutional Review Boards of RAND and Universitas Gadjah Mada. Further ethical approval for the present analysis was granted by the University of Sheffield through its research ethics system (Reference No. 057057).

Disclosure statement

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Data availability statement

The data analysed in this study are from the Indonesia Family Life Survey (IFLS), administered by RAND Corporation, and are publicly available for research purposes upon registration via the RAND website: <https://www.rand.org/well-being/social-and-behavioral-policy/data/FLS/IFLS.html>. Data supporting the findings of this study, including the study-specific analytical code, variable construction procedures, and model specifications, are available from the corresponding author upon reasonable request. Any sharing of derived datasets will be subject to the terms and conditions of the original IFLS data provider.

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