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Staying smoke-free: Factors associated with nonsmoking among urban Aboriginal adolescents in the Study of Environment on Aboriginal Resilience and Child Health (SEARCH)

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TITLE: Staying smoke-free: factors associated with non-smoking among urban Aboriginal adolescents in the Study of Environment on Aboriginal Resilience and Child Health (SEARCH)

ABSTRACT:

Issue addressed

To examine factors associated with preventing regular smoking among Aboriginal adolescents.

Methods

Cross-sectional analysis of data from 106 Aboriginal adolescents aged 12-17, and their caregivers, from four Aboriginal Community Controlled Health Services in urban New South Wales, 2008-12. The relation of individual, social, environmental and cultural factors to having 'never' smoked tobacco regularly was examined using Poisson regression.

Results

Overall, 83% of adolescents had never smoked regularly; 13 reported current and 5 past smoking. Most lived in smoke-free homes (60%) despite 75% reporting at least one current smoker caregiver. Participants were significantly more likely to have never smoked regularly if they had good mental health (PR=1.4, 95% CI:1.1-1.9), their mother as their primary caregiver (1.3, 1.0-1.6), good family relationships (1.2, 1.0-1.5), stable housing (1.3, 1.1-1.7), had never used alcohol (1.8, 1.3-2.4), were not sexually active (3.1, 1.3- 7.2) and had no criminal justice interactions (1.8, 1.2-2.8).

Conclusions

Most participants lived in smoke-free homes and the vast majority had never smoked regularly. Promoting good mental health and strengthening social connections may be protective against smoking as those experiencing less social disruption were more likely to have never smoked regularly. Smoking may be an indicator of psychosocial conditions and a prompt for screening and simultaneous treatment.

So what?

Organisations should be resourced to deliver holistic adolescent health promotion programs. Programs and policies should support positive family relationships and stable housing as this may protect against the uptake of regular smoking.

SUMMARY: Smoking is a major cause of poor health for Aboriginal peoples that mostly begins in adolescence. Understanding smoking among young people is important. This study of Aboriginal adolescents found the majority had never smoked regularly, particularly those with good mental health and stable social environments.

KEY WORDS: Smoking, Aboriginal and Torres Strait Islanders, adolescents

INTRODUCTION

Tobacco use continues to be a major cause of preventable ill health for all Australians, accounting for 9% of the total disease burden.[1] It is the largest contributing risk factor to the gap in disease burden between Aboriginal and Torres Strait Islander people (hereafter referred to as Aboriginal peoples[i]) and non-Aboriginal Australians.[2] Between 2002 and 2014-15 there were significant declines in daily smoking prevalence among Aboriginal and Torres Strait Islander people 15 years and older, from 49% to 39%, , with declines among 15-24 year olds in particular.[3] International data indicate most smoking begins in adolescence[4], thus preventing smoking initiation among young people is key to further reductions in smoking prevalence.

The likelihood of taking up smoking increases as individuals move through adolescence and is more common among females, those with mental health challenges, substance use, exposed to peer and family smoking and experiencing disadvantage.[4-11] It is less common among those engaged academically, in sport, with positive family relationships and awareness of smoking harms.[5, 6, 9, 11, 12] Some studies with Indigenous populations internationally have identified the protective role of cultural identity and participation against smoking uptake, and the negative impact of discrimination and historical trauma.[8, 11-14]

There is a small but developing evidence base from exploratory qualitative[15-18] and quantitative[19] studies conducted with Aboriginal adolescents. These have identified similar influences for smoking to other populations including family, peer and wider community smoking; increasing age and wishing to act older; stress and boredom.[15-20] Whereas knowledge of harms; negative smoking attitudes; concerns about decreased fitness; positive relationships; academic engagement; increased price; and pregnancy deterred smoking.[16-18, 20] These findings are made in the broader context of the introduction of smoked tobacco to Aboriginal people, its provision in rations and commercial

promotion; as well as the entrenched socio-economic disparities from ongoing colonisation processes and social policies.[21, 22]

Understanding how risk and protective factors are related to smoking initiation is critical for designing contextually relevant tobacco control policies and local community prevention programs. The majority (81%) of Aboriginal and Torres Strait Islander people live in non-remote settings.[23] While some relevant work has been conducted[15-20] there is limited recent, detailed quantitative data for Aboriginal people living in urban and regional areas. The aim of this study was to identify individual, social, cultural and environmental factors that prevent regular smoking among urban Aboriginal adolescents to inform policies and programs.

METHODS

SEARCH study

A SEARCH study protocol has been published previously.[24] Briefly, SEARCH is a cohort study of children and young people aged 0-17 years, and their caregivers, living in the urban and regional NSW cities of Sydney, Wagga Wagga and Newcastle. It is the largest cohort study of urban Aboriginal children and has a focus on health priorities identified by Aboriginal community organisations.

Eligible adolescent participants and/or their caregivers were recruited from the four participating Aboriginal Community Controlled Health Services (ACCHSs): Tharawal Aboriginal Corporation, Awabakal Ltd, Riverina Medical and Dental Aboriginal Corporation and Aboriginal Medical Service Western Sydney when they attended for an appointment, either approached by a SEARCH Research Officer in the waiting room or informed about the study by their GP.[24] Caregivers provided consent for their participation and on behalf of their children. Data collection involves clinical measurements and self-report surveys covering health and social domains. Baseline survey data were collected between November 2008 and March 2012 using paper questionnaires.

Caregivers completed a questionnaire for themselves and a separate survey for each of their children (aged 4-17 years). Adolescents aged 12-17 years completed a separate survey with some questions (sexual activity, illicit drug use) restricted to those aged 16-17 years. Surveys completed by caregivers provided additional contextual data about the child and the home environment not included in the adolescent survey. The findings presented here are a cross-sectional analysis of the baseline self-reported responses from adolescents and their caregivers.

Measures

Adolescent smoking behaviours and smoke exposure were measured according to self-reported response from the adolescent and their caregiver. The included questions, and how they were

categorised, are detailed in Supplementary File 1. The primary outcome measure was regular youth smoking from the question "Have you ever smoked cigarettes regularly?" with those responding 'no' categorised as 'never smoked regularly', 'yes' as 'ever smoked regularly' and all other responses excluded. Potential exposure variables were identified using the Theory of Triadic Influence[25] framework. The selected variables are described briefly below, and further in Supplementary File 1.

1. Individual factors: age (12-15, 16-17 years); sex, substance use, physical activity, sexual activity, suicidal ideation, mental health (with good mental health defined as a Strengths and Difficulties Questionnaire (SDQ) total score of 0-13 'close to average', compared with 14+ 'elevated'), knowledge of Aboriginal culture and history.
2. Social factors: school attendance and attitudes, racial discrimination, justice system interactions, stressful life events (SLE) (for the study child or siblings). Two individual SLEs are also reported: school exclusion, upset by family arguments (as a measure of family relationships).
3. Socio-demographic and environmental factors: relationship to primary caregiver, current parent or caregiver smoking, maternal smoking during pregnancy, smoke-free homes, caregiver employment, qualifications and income, housing stability, sense of community, access to recreational activities.

Statistical analyses

A total of 120 adolescents aged 12-17 completed the questionnaire. The analyses were restricted to those with complete smoking data (n=106: Figure 1). Matched caregiver responses were available for 97-99 adolescents. For some analyses the sample size is smaller due to incomplete data for exposure variables and/or the question was only asked of a subset of the cohort. Characteristics of the 106 adolescents are presented as proportions by subgroups with 95% confidence intervals for binomial proportions.

Frequencies and percentages of having never smoked regularly are reported. Multi-level mixed effects Poisson regression was conducted to explore associations between exposures and having never smoked regularly, accounting for within-family clustering, and reported as Prevalence Ratios (PR), a preferred approach over Odds Ratios when the outcome of interest is common.[26, 27] Estimates of PRs are reported for each exposure adjusted for age (continuous variable) and sex. Age and sex as individual exposures were adjusted for each other. Analyses for questions asked only of 16-17 year olds (sexual activity, illicit drug use) were not adjusted for age. The number of included co-variates was limited by the number of participants with the outcome of interest. To avoid over-fitting the

models, adjustment for age and sex was prioritised. Models were restricted to those with data on the exposure of interest. Analyses were conducted in Stata 14.

Ethics

Approval for the overall study, this analysis and publication was granted by the Aboriginal Health and Medical Research Council (AHMRC) HREC (reference 568/06). The findings were presented to the participating ACCHSs for assistance with interpretation and final approval.

RESULTS

Participant characteristics

The 106 adolescents were recruited from all four sites, 53% female, with mean age 14.5 years (Table 1). Caregivers were predominantly of Aboriginal and Torres Strait Islander descent (77%); engaged in employment/study (43%) or home duties (42%); held tertiary (non-school) qualifications (58%) and lived in households with a fortnightly income of $800 or more (54%).

Smoking behaviour and environmental exposure

Most participants 12-17 years had never taken up regular smoking (81%, 86/106) with only 13 reporting that they were regular smokers at the time of interview, and five in the past (Table 2). There were higher proportions of having never smoked regularly among the younger sub-group (12-15 years) but little difference by gender. The median age of commencing regular smoking was 13 years. More than half of caregivers (60%) reported smoke-free homes and 52% were regular smokers at time of interview. A majority of adolescents (75%) reported that at least one of their parents smoked. Over half of caregivers (59%) reported that the adolescent had been exposed to smoke *in-utero*.

Relationship between individual level factors and smoking status

Having never smoked regularly was significantly associated with having never drunk alcohol (PR 1.76, 95% CI 1.28, 2.41), never having had sex (PR 3.08, 95% CI 1.32, 7.18), and having good versus poor mental health (PR 1.44, 95% CI 1.12, 1.85) (Table 3). While the magnitude of the association between having never smoked regularly and cannabis use was large, it did not reach statistical significance (never versus ever used cannabis PR 2.43, 95% CI 0.86, 6.88).

Relationship between social level factors and smoking status

A greater proportion (89%, 76/85) of those who had never smoked regularly currently attended school, compared to ever regular smokers (70%, 14/20). But we did not detect a significant association between never smoking regularly and school attendance (PR 1.35, 95% CI 0.83, 2.19), or school engagement in terms of stating it was very important to attend regularly (PR 1.74, 95% CI 0.90, 3.34) and get good marks (PR 1.20, 95% CI 0.80, 1.70) (Table 4).

Participants who had not interacted with the justice system (police, court or juvenile detention) were significantly more likely to have never smoked regularly (PR 1.78, 95% CI 1.15, 2.76) as were those without friends who had been in prison or juvenile detention (PR 1.55, 95% CI 1.14, 2.10).

We did not detect an association between smoking regularly and the total number of 'Stressful Life Events' in the previous year (PR 1.08, 95% CI 0.91, 1.29 for ≤2 versus 3 or more events), but there was a potential significant or approaching significant relationship between some individual events and smoking. Adolescents were more likely to have never smoked regularly if their caregiver reported none of their children had been upset by family arguments in the previous year (good family relationships) (PR 1.24, 95% CI 1.03, 1.49) or suspended or expelled from school (PR 1.29, 95% CI 0.98, 1.71).

Relationship between carer socio-demographic and environmental level factors and smoking status

Adolescents whose primary caregiver was their mother (versus other family, step parents or foster carers) were significantly more likely to have never smoked regularly (PR 1.26 95% CI 1.02, 1.56) and if they had lived in fewer than four houses in their lifetime (versus four or more) (PR 1.33, 95% CI 1.09, 1.62) (Table 5).

We did not identify a significant association between adolescent smoking status and non-smoking carers (PR 1.16, 95% CI 0.97, 1.38), no smoke exposure in-utero (PR 1.09, 95% CI 0.91, 1.31) or having smoke-free homes (PR 1.10, 95% CI 0.88, 1.36). However, in all cases, the point estimate for the PR was greater than one, consistent with a protective effect of the exposure. Similarly, where the carer reported a strong sense of community where they lived, (PR 1.31, 95% CI 0.94, 1.82) and fortnightly household income of $800 or more (compared to <$800) (PR 1.21, 95% CI 1.00, 1.47).

DISCUSSION

We found that the majority of SEARCH adolescents aged 12-17 had never smoked regularly at the time of survey. The analysis identified several protective factors that may be important for preventing uptake of regular smoking, ranging from having good mental health and a stable home

environment to the absence of risk behaviours and justice interactions. Our study also identified other factors that viewed collectively may be important, although were not statistically significant here (at $p<0.05$), likely due to the limitations of the sample size. These include cannabis use, school engagement, smoking status of caregivers, smoke-free homes, household income and community connection.

The prevalence of non-smoking in our study (81% had never smoked regularly), is broadly in line with national figures. The 2008 National Aboriginal and Torres Strait Islander Social Survey (NATSISS) found 80% of 15-17 year old Aboriginal adolescents living in non-remote areas were non-smokers (never and ex-smokers).[28] However, as this ABS measure is of 'current smoking' in 15-17 year olds, it is not directly comparable to SEARCH which estimates 'ever smoked regularly' in 12-17 year olds.

We found an association between having good mental health and having never smoked regularly. While we did not find a relationship between regular smoking and the survey measure of experiencing multiple 'stressful life events', a number of individual indicators of life stress had a significant or close to significant relationship including family arguments, housing instability, household income and interactions with the justice system. Although it used different smoking measures, the 2008 NATSISS also found that Aboriginal people aged 15 and over who reported being happy were less likely to be daily smokers and those who had experienced at least one stressor were more likely to be.[29] Stress is regularly reported as a reason for smoking initiation and maintenance among young people and the relationship between mental health (including stress, depression, anxiety and suicidal ideation) and youth smoking has been well documented.[5, 9, 12, 15, 20, 30-36] This could be targeted by including mental health promotion alongside school-based smoking programs[31] and if prevention programs also screen for mental health symptoms and refer for simultaneous treatment.[36] ACCHSs may be particularly well placed to deliver these programs and reach adolescents in their communities, including those not in contact with mainstream schooling or health services.

Many studies have demonstrated that adolescent risk behaviours cluster and smoking may occur alongside drinking, cannabis use, becoming sexually active and misbehaviour.[5, 7-9, 16, 30-35, 37] Our results support this with a significant relationship between smoking and alcohol use, sexual activity, and interactions with the justice system. Our findings were consistent with a potential association between smoking and cannabis use or if they/one of their siblings had been excluded from school, although these latter two did not reach statistical significance. While the cross-sectional nature of the analysis limits exploration of the direction of the relationship, it is likely that these risk behaviours have common determinants. As such, health promotion that builds social influence skills

and addresses smoking alongside other substance use and sexual health will likely be more effective for individual level behaviours than health information/education focused school-based tobacco prevention programs, and with broader benefit.[30, 38] However, these will need to be supported by interventions that address the systemic social and economic determinants that contribute to individual risk behaviours by reducing poverty, family violence, incarceration, racial discrimination and improving child safety.

This is supported by our study as factors within the family and home environment appeared to be important. Stable housing, good family relationships and being in the care of their mother were all significantly associated with having never smoked regularly. Positive family and community connections are an identified protective factor providing emotional strength and resilience, and the absence of these connections has been associated with smoking in other studies and with poor mental health in previous SEARCH analyses.[5, 6, 9, 18, 30, 31, 39-41] In our study, a larger proportion of adolescents who had never smoked regularly lived in places their caregivers described as having a sense of community. Although this was not a statistically significant relationship, its likely importance is indicated by the existing literature and the related measure of housing stability.

School engagement is regularly cited as protective and educational attainment recognised as an important social determinant of health.[9, 12, 30, 37, 42, 43] The 2008 NATSISS found those who completed Year 12 less likely to be daily smokers than those who had left by Year 9.[29] Although our results did not reach statistical significance, in line with the literature there was a greater proportion of adolescents who had never smoked regularly for measures of current attendance, positive attitudes and no school exclusion in the family.

Evidence indicates that young people whose caregivers smoke, including in the home and during pregnancy, are more likely to become smokers themselves due to perceived norms, modelling, access and potential physiological changes when *in-utero*.[16, 30, 38, 44] Importantly more than half of caregivers stated their homes were smoke-free. However, many SEARCH adolescents will have had some exposure to tobacco use, if not second-hand smoke, through caregiver smoking including during pregnancy and in the home. While associations were not statistically significant, the direction of effect in our findings is consistent with greater likelihood of having ever smoked regularly among those exposed to tobacco smoke. Our analysis may have been underpowered or may reflect the limitations of using a 'regular smoking' measure with a young population. Smoking uptake increases with age and the transition from first experimenting with cigarettes to smoking regularly (or not) can occur over several years.[4, 30, 45] As most of the sample were in the younger 12-15 age group and more likely to have never smoked regularly, comparisons to the SEARCH follow-up wave will be important

to investigate uptake later in adolescence and whether this is mediated by reductions in adult smoking prevalence and more smoke-free homes.[28]

Finally, there was no statistically significant relationship between regular smoking and cultural identity and participation or racial discrimination. While similar null findings have been reported for Aboriginal adults[41], more nuanced cultural measures may be required. Further, this sample of existing clients of ACCHSs leading a Community-controlled study, may have a different sense of identity and participation to others not accessing this sector.

Strengths and Limitations

To our knowledge this is one of the only studies to quantitatively examine factors associated with regular smoking among adolescents in an urban NSW Aboriginal population and to include broader social and environmental factors such as the role of community and culture, and exposure of risk factors not just to the individual but their siblings and peers. The important findings reported here are limited by the cross-sectional data. As such, causality cannot be inferred. But the findings may be validated in future SEARCH follow-up data and planned qualitative interviews which will provide greater context. Further, multiple hypotheses were tested, increasing the possibility of a significant association being observed by chance.[46] To reduce this risk the factors were predetermined based on existing literature and interpreted in this context.

The encouraging finding of few adolescent smokers overall, within a small total sample, limited statistical power and the number of control variables that could be included in the regression analysis, with possible impacts on precision. It is possible that some of the relationships identified in the current study may be confounded by socioeconomic status, and lack of adjustment for this potential confounder is a limitation.

This study also aggregated data from four urban communities in NSW using a small non-random sample. Although there are likely similarities, it cannot be assumed that the adolescent smoking experience will be uniform across NSW or other jurisdictions. As shown in Table 1, the caregivers in our sample included fewer on higher household incomes and more with post-school qualifications than the national and NSW Aboriginal and Torres Strait Islander populations. Therefore, the findings of this study may reflect the socioeconomic status of the sample and may not be generalisable to the Aboriginal and Torres Strait Islander population as a whole. However, evidence suggests that exposure-outcome relationships from non-representative samples can be generalisable to other study populations.[47] Further, substantial tobacco control measures have been introduced since baseline data collection and so the findings may not reflect the contemporary adolescent smoking

experience. Future research through qualitative interviews and analysis of the follow-up survey will be important.

The main outcome was obtained via self-report. Although self-reported smoking status has been validated elsewhere, including with Aboriginal adults, it has limitations.[48] No definition was provided when adolescents were asked, "Have you ever smoked regularly?"; the ambiguous wording may have also impacted precision of measurement, under or overestimating actual smoking and is challenging to compare to other studies with clearer time-based definitions. The question has been amended in follow-up. Further, the participants completed the paper questionnaire at the ACCHS, possibly in the presence of their carer and/or the SEARCH research officer who may have assisted. This setting, method and wording may have contributed to the 14 adolescents not answering the smoking question. Differences between those with and without complete smoking data is available (Supplementary File 2).

CONCLUSION

Most adolescents aged 12-17 in SEARCH had not taken up regular smoking at time of interview. Although smoking was common among caregivers, homes were more likely to be smoke-free.

Several factors were associated with having ever smoked regularly across individual, social and environmental levels with some common risk factors. Health promotion programs targeting young people may address smoking prevention alongside other substance use and sexual health and focus on promoting good mental health. For health professionals smoking may also serve as an indicator of mental health and prompt for screening and support. Our findings suggest that broader policies that address upstream determinants of risk behaviours are important, including those that support positive relationships and stable housing, as these may be protective against smoking uptake among Aboriginal adolescents, while likely to have further, wider benefits for families and communities.

Despite some limitations to the generalisability of these findings, they provide important guidance for communities, health services and policy makers about the range and complexity of influences for youth smoking that should be considered when designing adolescent health programs and the impact broader social and economic policies may have on individual risk behaviours. Program development should be undertaken in partnership with ACCHSs who if sufficiently resourced are particularly well-placed to reach this population and address the broader determinants of smoking through a self-determining approach**.**

[i] In this paper, the term Aboriginal, rather than Aboriginal and Torres Strait Islander, is used (unless referring to specific data sources of both Aboriginal and Torres Strait Islander populations) as this is a NSW based study where this is the accepted terminology.

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TABLES

Table 1: Sample characteristics for adolescents aged 12-17 years and their parents/carers with comparison to national data for Aboriginal and Torres Strait Islander peoples

	% [95% CI] (n/total N=106)	**2011 Census comparison Aboriginal & Torres Strait Islander people: Australia[49]/NSW[50]**
AMS		
Western Sydney	17.0 [10.4, 25.5] (18/106)	

Tharawal	14.2 [8.1, 22.3] (15/106)	
Awabakal	42.5 [32.9, 52.4] (45/106)	
Riverina	26.4 [18.3, 35.9] (28/106)	
Age		
12-15	80.2 [71.3, 87.3] (85/106)	
16-17	19.8 [12.7, 28.7] (21/106)	
Mean (SD)	14.5 (1.6)	
Sex		
Female	52.8 [42.9, 62.6] (56/106)	
Male	47.2 [37.4, 57.1] (50/106)	
Carer		
Mother	75.5 [66.2, 83.3] (80/106)	
Father	7.6 [3.3, 14.3] (8/106)	
Grandparent	6.6 [2.7, 13.1] (7/106)	
Other relative, step parent or foster carer	10.4 [5.3, 17.8] (11/106)	
Currently attend school		
Yes	85.7 [77.5, 91.8] (90/105)	
No	14.3 [8.2, 22.5] (15/105)	
Carer Aboriginality		
Aboriginal and/or Torres Strait Islander	77.3 [67.7, 85.2] (75/97)	
Non-Aboriginal	22.7 [14.8, 32.3] (22/97)	
Carer's Employment Status		42%/43% of people 15 years and over employed
Employed/Studying	43.3 [33.3, 53.7] (42/97)	
Home duties	42.3 [32.3, 52.7] (41/97)	
Unemployed/Unable to work due to health	14.4 [8.1, 23.0] (14/97)	
Fortnightly household income		Fortnightly household income <$400: 4%/4% $400-$799: 12%/13% $800 or more: 84%/83%
<$400	9.0 [4.0, 16.9] (8/89)	
$400-$799	37.1 [27.1, 48.0] (33/89)	
$800 or more	53.9 [43.0, 64.6] (48/89)	
Carer Highest Tertiary Qualifications		24%/23% of people 15 years and over have a non-school qualification
None	41.8 [31.5, 52.6] (38/91)	
Trade/Certificate/Diploma/Other	48.3 [37.7, 59.1] (44/91)	
Bachelor's degree/Post-Graduate Degree	9.9 [4.6, 17.9] (9/91)	
Number of houses adolescent has lived in		
<4 houses	48.3 [35.2, 61.6] (29/60)	

4+ houses	51.7 [38.4, 64.8] (31/60)	

Table 2: Summary of youth smoking behaviour and environmental exposure

	% [95% CI] (n/total N)†	National Comparisons
Ever smoked regularly		
Yes	18.9 [11.9, 27.6] (20/106)	2005 (ever tried smoking)
No	81.1 [72.4, 88.1] (86/106)	12-15 47%, 16-17 66%[51]
Current smoking status		
Current regular smoker	12.5 [6.8, 20.4] (13/104)	2008 current smoking
Former regular smoker	4.8 [1.6, 10.9] (5/104)	15-17 20% (non-remote)[28]
Never smoked regularly	82.7 [74.0, 89.4] (86/104)	
One or both parents smoke (youth report)		2008 68% of people aged
Yes	74.8 [65.2, 82.8] (77/103)	15+ lived in a household with
No	25.2 [17.2, 34.8] (26/103)	a current daily smoker[29]
Primary caregiver currently smokes regularly		2008 47% of people aged 15+ currently smoked (45% daily)[29, 52]
Yes	52.1 [41.6, 62.4] (50/96)	
No	47.9 [37.6, 58.4] (46/96)	
Mother smoked during pregnancy		
Yes	59.4 [46.4, 71.5] (38/64)	
No	40.6 [28.5, 53.6] (26/64)	
Smoking allowed in home		2008 26% of people aged
Yes	40.5 [30.2, 51.4] (36/89)	15+ lived in a household
No	59.6 [48.6, 69.8] (53/89)	where someone usually smoked inside[29]
Smoking characteristics of those who had ever smoked regularly		
Age started smoking (years) (n=17)		
Median [IQR] (Range)	13 [12-14] (2-15)	
<13 years	29.4 [10.3, 56.0] (5/17)	
13+ years	70.6 [44.0, 89.7] (12/17)	
Number of cigarettes smoked/day (n=16)		
Mean [SD] (Range)	6.4 [4.8] (1-20)	
1-4 cigarettes	43.8 [19.8, 70.1] (7/16)	
5-9 cigarettes	25.0 [7.3, 52.4] (4/16)	
10+ cigarettes	31.3 [11.0, 58.7] (5/16)	

Table 3: Relationship between individual factors and having never smoked regularly

	Adolescent smoking behaviour		
	Proportion never smoked regularly % (n/total)	**Prevalence Ratio (95% CI) of 'Never Smoked Regularly'**	**p-value**
Age (continuous)‡		0.95 (0.89, 1.02)	0.131
12-15	84% (71/85)	1	
16-17	71% (15/21)	0.85 (0.64, 1.14)	0.274
Sex†			
Female	82% (46/56)	1	
Male	80% (40/50)	0.97 (0.80, 1.16)	0.719
Alcohol			
Ever	53% (17/32)	1	
Never	93% (67/72)	1.76 (1.28, 2.41)	<0.0001
Cannabis‡			
Ever	40% (2/5)	1	
Never	81% (13/16)	2.43 (0.86, 6.88)	0.095
Sexual activity‡			
Ever	33% (3/9)	1	
Never	92% (11/12)	3.08 (1.32, 7.18)	0.009
Physically active in last 7 days			
No	81% (17/21)	1	
Yes	80% (66/82)	1.00 (0.78, 1.27)	0.970
Suicidal thoughts			
Yes	64% (7/11)	1	
No	83% (74/89)	1.31 (0.82, 2.09)	0.266
SDQ score (continuous)		0.97 (0.96, 0.99)	0.007
Elevated (14+)	63% (22/35)	1	
Close to average (0-13)	90% (61/68)	1.44 (1.12, 1.85)	0.005
Knowledge of Aboriginal culture/history			
Nothing at all	75% (3/4)	1	
At least a little	82% (83/101)	1.11 (0.67, 1.86)	0.684

Prevalence ratios of association with never having smoked regularly adjusted for age and sex. †Adjusted for age only. ‡Adjusted for sex only.

Table 4: Relationship between social factors and having never smoked regularly

	Adolescent smoking behaviour		
	Proportion never smoked regularly % (n/total)	**PR (95% CI)**	**p-value**
Currently attending school			
No	60% (9/15)	1	
Yes	84% (76/90)	1.35 (0.83, 2.19)	0.228
Consider school attendance important (continuous 5 pt scale)		1.12 (0.97, 1.28)	0.121
Not at all – a little	50% (5/10)	1	
Some – quite a lot	86% (30/35)	1.70 (0.91, 3.17)	0.095
Very much	87% (58/67)	1.74 (0.90, 3.34)	0.098
Consider school marks important (continuous 5 pt scale)		1.07 (0.97, 1.17)	0.165
Not at all – a little	71% (10/14)	1	
Some – quite a lot	84% (37/44)	1.16 (0.84, 1.59)	0.366
Very much	87% (27/31)	1.20 (0.85, 1.70)	0.307
Treated badly/refused service for being Aboriginal (6mths)			
Yes	80% (4/5)	1	
No	82% (72/88)	1.07 (0.69, 1.66)	0.767
Questioned by police (6mths)			
Yes	50% (11/22)	1	
No	89% (74/83)	1.76 (1.11, 2.79)	0.016
Any interaction with justice (police/court/detention)			
Any	50% (12/24)	1	
None	90% (74/82)	1.78 (1.15, 2.76)	0.010
Friends sentenced to prison/juvenile justice (ever)			
Yes	58% (18/31)	1	
No	92% (61/66)	1.55 (1.14, 2.10)	0.005

Stressful life events (12mths)			
Continuous (0-16)		1.01 (0.98, 1.03)	0.580
More than 2	80% (56/70)	1	
2 or fewer	88% (23/26)	1.08 (0.91, 1.29)	0.359
Child/ren upset by arguments			
Yes	73% (33/45)	1	
No	92% (46/50)	1.24 (1.03, 1.49)	0.026
Child/ren expelled or suspended from school			
Yes	67% (18/27)	1	
No	88% (60/68)	1.29 (0.98, 1.71)	0.070

Prevalence ratios of association with never having smoked regularly adjusted for age and sex.

Table 5: Relationship between carer socio-demographic and environmental factors and having never smoked regularly

	Adolescent smoking behaviour		
	Proportion never smoked regularly % (n/total)	**PR (95% CI)**	**p-value**
Relationship to primary caregiver			
Other (Other family, step parent, foster)	69% (18/26)	1	
Mother	85% (68/80)	1.26 (1.02, 1.56)	0.036
Primary caregiver currently smokes			
Yes	76% (38/50)	1	
No	89% (41/46)	1.16 (0.97, 1.38)	0.113
Mother smoked during pregnancy			
Yes	82% (31/38)	1	
No	89% (23/26)	1.09 (0.91, 1.31)	0.359
Smoking allowed in home			
Yes	78% (28/36)	1	
No	85% (45/53)	1.10 (0.88, 1.36)	0.404
Caregiver employed			

No (unemployed, unable, home duties, student)	80% (44/55)	1	
Yes (full/part time, working and studying)	86% (36/42)	1.10 (0.91, 1.32)	0.328
Caregiver qualifications			
None	76% (29/38)	1	
Post-school qualifications	85% (45/53)	1.13 (0.91, 1.40)	0.266
Family income (fortnight)			
<$800	76% (31/41)	1	
$800 or more	92% (44/48)	1.21 (1.00, 1.47)	0.055
Neighbourhood has strong sense of community			
Strongly disagree/disagree	68% (13/19)	1	
Neutral/agree/strongly agree	88% (57/65)	1.31 (0.94, 1.82)	0.106
Lived in <4 houses in child's lifetime			
4 or more houses	74% (23/31)	1	
Less than 4 houses	100% (29/29)	1.33 (1.09, 1.62)	0.005
Satisfaction with leisure activities			
Very unhappy/little bit unhappy/neutral	85% (17/20)	1	
A little bit happy/very happy	79% (62/78)	0.92 (0.74, 1.14)	0.443

FIGURE LEGENDS

Figure 1: Participant inclusion process

SUPPORTING MATERIAL (separate files)

Supplementary File 1: Summary of survey questions used in analysis

Supplementary File 2: Comparison of key characteristics and exposures between those with and without complete smoking data

Figure 1: Participant inclusion process