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Participation their way: a mixed methods study on engaging Australian adolescents in non-communicable disease prevention

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Abstract

Background Non-communicable diseases (NCDs) are a major global health burden, particularly affecting adolescents due to preventable risk factors. However, adolescents are frequently overlooked in NCD prevention efforts that directly impact them. This study aimed to evaluate adolescents' perspectives, experiences, perceptions, and preferences regarding their participation in NCD prevention activities.

Methods To enable both breadth and depth, a mixed-methods study design was selected comprising cross-sectional online survey and focus groups, underpinned by community-based participatory research approach. Participants were 13–18 years and residing in Australia. Methodological integration through merging quantitative and qualitative data was employed. A weaving approach through narrative was used to report the findings. Adolescent researchers were actively engaged throughout all phases.

Results Five hundred one survey participants (mean 16.0 years, SD 1.2) and 19 focus group participants (mean 17.0 years, SD 0.9) contributed to this study. Mental health disorders were identified as the most significant health concern. Those with prior volunteer experience showed greater engagement in health-promoting activities. Participants recognised their pivotal role in NCD prevention, highlighting 'influence' as crucial for health improvements. They emphasised the importance of visibility, flexibility, and authenticity in engagement methods. Despite a strong willingness to participate in future NCD prevention activities, participants cited barriers such as limited opportunities.

Conclusion This study highlights the importance of adolescent involvement in NCD prevention and suggests strategies to overcome participation barriers. Recommendations include promoting meaningful engagement, improving accessibility, and fostering collaboration with decision makers. These insights are crucial for guiding future efforts to tackle NCD challenges among adolescents.

Keywords Adolescent health, Public Health Policy, Mixed methods, Non-communicable disease, Youth Engagement, Participatory Research

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Background

Non-communicable diseases (NCDs), such as cardiovascular disease, type 2 diabetes, and some types of cancer, cause the most burden of disease in the Western Pacific region, including Australia [1, 2]. Coronary heart disease is the leading specific cause of burden across the region [1]. Risk factors associated with coronary heart disease and other cardiovascular conditions, such as high body mass index (BMI), inadequate diet, physical inactivity, sedentary behaviours, psychological distress, and vaping, are increasing in prevalence in Australia [3]. Addressing this complex burden of NCDs necessitates a multifaceted approach, with comprehensive, multisectoral initiatives spanning all levels of society [4]. Strategies geared towards prevention must simultaneously target multiple risk factors and various life stages, while also addressing the social determinants of health [5]. Furthermore, these strategies must integrate engagement from key beneficiaries including consumers and community members, which is a central focus of the Australian National Preventive Health Strategy [5, 6].

Adolescence, defined as ages 10–24 [7], is a fundamental life stage when preventable risk factors for NCDs can impact health outcomes in adulthood [8, 9]. Over recent decades, Australia, like several Western countries, has seen rising overweight and obesity rates, projected to continue until 2030 [10, 11]. In 2017–18, 16% of 10–17-year-olds and 46% of 18–24-year-olds were overweight or obese [10]. High levels of poor diet, physical inactivity, and sedentary behaviour persist among Australian adolescents. Available population data has shown only 3% of 12–17-year-olds met fruit and vegetable intake guidelines [12], with 41% of their dietary intake from discretionary foods [13]. Only 5% of 15–17-year-olds meet physical activity guidelines [14]. Data from 2022/23 showed 2% of 12–15-years-olds and 3% of 16–17-year-olds were current smokers [15], 28% of 14–17-year-olds have tried e-cigarettes and vaping devices [16], and 34% of 15–17-year-olds experienced high or very high levels of psychological distress [17, 18]. Adolescents have also grappled with the effects of the COVID pandemic, with longitudinal survey data from 983 Australian adolescents finding increases in screen time (86% to 94%), inadequate fruit intake (20% to 30%), and alcohol (2% to 10%) and tobacco use (1% to 4%) over the period [19]. With 4.6 million adolescents, nearly one-fifth of Australia's population, the nation faces a significant risk of an increasing future health burden [20]. Addressing these risks in adolescence is vital, not only for adolescents' health but also for society at large [21, 22].

Public health researchers have the potential to investigate NCD risk factors among adolescents and develop policy-relevant solutions. Despite adolescents being integral to the future, they are often excluded from research that affects them [23]. Emerging evidence shows limited adolescent engagement in research over the last three decades [24], despite their right to participate as per United Nations Convention on the Rights of the Child [25, 26] and their motivations to be involved [27]. For example, the Longitudinal Study of Australian Children suggests that over 40% of 12–13 year olds and over 50% of 16–17 year olds were involved in some form of volunteering [28], indicating adolescents' willingness to contribute to society more broadly.

Some guidance exists on engaging adolescents in research [29], health services initiatives [30] and policy [31] through grass roots initiatives [32] and youth advisory boards.[33] Many of these strategies focused on specific health conditions like chronic illnesses [34], mental illness [35], or sexual and reproductive health [36]. However despite this, a significant evidence gap persists regarding effective engagement strategies in NCD prevention across research, schools, communities, and policy development. For example, a systematic scoping review on NCD prevention research identified only 71 studies over 25 years involving adolescents in research decision-making, with few studies allowing adolescents to identify their concerns independently by having adults as facilitators rather than leaders [37]. Similarly, another review found only 12 studies involved young people in school- and community-based NCD prevention interventions, yet these studies demonstrated positive effects through well-defined participatory approaches [38]. Furthermore, a review on adolescent engagement in NCD policy and guideline development identified only nine instances of meaningful engagement, primarily in initial consultation phases rather than throughout the policy development process [39].

Overall, there is limited empirical research on adolescents'participatory experiences and preferred modes of engagement in NCD prevention activities affecting them. Our study seeks to determine and provide recommendations about how adolescents want to be engaged in NCD prevention activities that impact them, by drawing on their perceptions, preferences, and experiences, and understanding barriers and facilitators to their participation. We explored four inter-related aims related to NCD prevention activities to identify adolescents': (i) perspectives of NCD prevention; (ii) experiences of participation; (iii) perceptions of participation; and (iv) preferences for future participation.

Methods

Study design

Our study employed a mixed-methods design guided by the community-based participatory research approach

[40]. We incorporated a cross-sectional observational survey and qualitative focus groups to assess adolescents'perspectives of NCD prevention, experiences of participation, perceptions of participation, and preferences for future participation. This mixed-methods research approach was chosen as it facilitated the exploration of the study's aims in exploring the multidimensionality of adolescents'involvement in NCD activities using multiple methods and sources of data [41]. The data were collected concurrently, a strategy conducive to integration, thereby enriching insights available to researchers [41]. The study took place virtually (online survey and focus groups) from January to August 2022, with ethics approval obtained from the University of Sydney Human Research Ethics Committee (approval number 2021/864). This study occurred after the COVID-19 lockdowns had ended and the stay-at-home orders from state governments across Australia were lifted.

To recognise and challenge potential power dynamics in research processes, young people were actively engaged in this study through three key strategies guided by the community-based participatory research approach [40]. Firstly, an Australian young person (SW) was integrated as a co-researcher within the research team from the project's inception, ensuring that the survey, focus group questions, and data collection were framed in a'youth-friendly'manner. Secondly, a diverse range of adolescents were sampled for both the survey and focus groups. Lastly, collaboration occurred with representatives from an established youth advisory group, the Health Advisory Panel for Youth at the University of Sydney (HAPYUS) [42, 43]. A HAPYUS member was included in each focus group session and HAPYUS members were involved as co-authors to analyse the data, discuss the findings, and co-write key recommendations from the research.

Development of the survey and focus group discussion guide

The study specific survey questions and focus group discussion guide were developed by the research team in alignment with the research aims and based on current public health evidence [44]. The survey comprised questions using 5-point Likert scales, drop-down list questions, multiple-response formats, and open-ended questions. Where applicable, multiple-response items including an'other'option were incorporated to encourage participants to provide free-text responses, thereby enhancing understanding of adolescents'participation experiences or lack thereof. The focus group sessions were guided by a purpose-built schedule featuring open-ended questions and prompts aimed at fostering discussion. Both the survey and focus group discussion guide underwent pilot testing with our youth co-researcher (SW) to ensure their suitability for young participants. Minimal adjustments were necessary.

Basic demographic questions, including age, gender identity, language spoken at home, highest level of education completed by the participant and each parent or guardian, postcode of residence, and school attendance were drawn from standardised national questionnaires [45]. Postcodes were used to derive participants' socio-economic position (Index of Relative Socio-economic Advantage and Disadvantage, IRSAD) and remoteness (Modified Monash Model) [46].

To determine perspectives of NCDs we provided two lists – one regarding health issues (including mental health disorders, alcohol use, drug use etc.) and the other on socio-environmental risk factors and influences relevant to adolescents (including diet, physical activity, social media/technology etc.). These lists were selected based on known risk factors for chronic disease [47] and the top issues of personal concern identified in a large survey of young Australians ([48]. To inform the development of questions assessing perceptions of health, NCDs, and associated risk factors, we consulted the Australian Burden of Disease study [1] and the National Obesity Strategy [49] For assessing volunteering activities and time spent volunteering, we utilised questions from the Longitudinal Study of Australian Children, adapted from the Australian Bureau of Statistics General Social Survey [28]. Since no pre-existing questions were available for sections regarding experiences, perceptions, or preferences related to adolescent participation and NCDs, we developed questions based on the features, modes, and social ecology of meaningful participation, as well as participatory outcomes outlined in the Conceptual Framework for Measuring Outcomes of Adolescent Participation [50]. An overview of the broad concepts covered in the survey and focus groups is presented in Table 1 (refer to Supplementary Tables S1 and S2 for the full survey and focus group discussion guide, respectively).

Participants

Participants were included in the study if they met the specified inclusion criteria (see Table 2). For the survey, participants were recruited through convenience sampling, facilitated by paid advertising on Meta Platforms Inc (Facebook and Instagram) and disseminating information through secondary schools via newsletters, established youth networks (e.g. national youth advocacy networks like Youth Action) and a database of adolescents from previous studies, who had expressed interest in participating in future research [51]. Individuals who completed the survey and expressed interest in further

Table 1 Overview of study aims mapped to example survey and focus group questions[a]

Overview	Example questions
Perspectives of NCDs	What do you think is the biggest health issue facing young people?
	Do you notice NCDs in society?
Experience of participation	Have you or one of you friends ever participated in the decision-making for activities or strategies that promote young people to eat better, be more physically active or prevent NCDs?
	If you haven't had the experience of participating in decision-making for health promoting activities, were there any barriers to participation?
Perceptions of participation	How do you think young people can be involved in improving health promoting activities?
	Of the participatory methods listed, which do you feel would give youth the most influence (questionnaire, focus/discussion group, interview, co-design activities, youth/peer advocacy, peer leader/mentor, youth advisory group, social media/marketing or other)?
Preferences for future participation	If given the opportunity, how would you like to participate in activities that promote young people to eat better, be more physically active or prevent NCDs?
	If given the opportunity to participate in health promoting activities, what would you like to gain out of the experience?

NCD non-communicable disease

[a] See Supplementary Tables S1 and S2 for the full survey and focus group discussion guide, respectively

Table 2 Participant inclusion criteria for survey and focus groups

Inclusion criteria
• Aged 13–18 years (inclusive) to coincide with the age range of secondary education in Australia, which is a common setting for health promotion interventions by governments and aligns with definitions of adolescents used by the Australian Institute of Health and Welfare
• Access to a digital device with internet connection
• Currently living in Australia
• Provided informed e-consent

research were invited to participate in the focus groups. A non-probability quota sampling methodology was employed to determine a sample size of 500 for the survey, aiming to obtain meaningful data. Quota sampling involved setting targets for different demographic groups to align with national demographic proportions, including: 50% identifying as female, 30% residing in regional, rural, or remote areas, 40% residing in more disadvantaged areas, and 20% speaking a language other than English at home. Focus groups were conducted until thematic saturation was achieved [52]. Survey participants were given the option to enter a prize draw to win one of 20 online gift vouchers valued at AUD $50 each, while all focus group participants received an AUD $25 online gift voucher as reimbursement.

Procedure

All participants provided informed e-consent prior to commencing the survey or participating in the focus groups. Parental or legal guardian consent was not required for participation for those under 16-years. It is widely acknowledged that for health research characterised as low-risk or minimally harmful, adolescents over the age of 13 are typically considered competent to comprehend the nature and implications of the study and this approach was approved by University of Sydney Human Research Ethics Committee [53]. Participants were reminded of their right to withdraw from the study at any point. At the start of the survey and focus groups, participants were provided with a definition for 'health promoting activities' that referred to 'activities or strategies that promote young people to eat better, be more physically active or prevent chronic diseases such as obesity, type 2 diabetes, and heart disease.' Furthermore, 'youth participation' or 'engagement' was defined as 'young people (individually or together) forming and expressing their views and influencing matters of importance to them.'

Survey and demographic questionnaire data for the focus groups were collected and managed using Research Electronic Data Capture (REDCap) tools hosted at the University of Sydney [54, 55]. The ReCAPTCHA service was used to prevent fraudulent entries from bots. The survey took approximately 10 to 15 min to complete. The focus groups were facilitated by a female postgraduate researcher (MM) undertaking a PhD level qualification, who had prior experience in conducting qualitative research. She had no prior relationship with any study participants. Additionally, each focus group included a young person from HAPYUS, who assisted in notetaking and facilitating discussion using the provided guide. Focus groups ranged in duration from 45 to 60 min and were conducted online via Zoom (Zoom Video Communications Inc. Version: 5.17.11). Audio recordings were retained for transcription. Neither survey responses nor

focus group transcripts were returned to participants for review or comment.

Analyses

Methodological integration through merging of quantitative and qualitative approaches was employed to comprehensively assess the data collected through different methods. A weaving approach through narrative was used to report the findings and align with the research aims [41, 56]. Quantitative survey data were analysed using the Statistical Package for the Social Sciences (IBM SPSS version 28.0). Qualitative data from open-ended survey questions and focus groups were analysed using the Framework Analysis approach [57]. Details of the analytical methods for each data source are provided below.

For quantitative survey data, normality was assessed, and data are presented as mean and standard deviations (SD), medians (range) and frequencies and percentages. A multivariable binary logistic regression model was used to identify participant characteristics that were associated with NCD activity participation. Responses regarding NCD participation were coded as'yes,''no,'and'unsure/can't remember.'The'no/unsure'category was created by combining responses of'no'and'unsure/can't remember,'as they are conceptually related, indicating a lack of significant participation. The first step was to regress NCD participation against each participant characteristic separately (such as age, gender, language spoken at home, socioeconomic status, geographical location, current school year, highest education level, parental educational attainment, and previous volunteer work) using a univariate modelling approach. Any variables with P-value <0.20 was considered for inclusion in the final model [58]. Next, a forward stepwise approach was used to consecutively add variables based on the lowest univariate P-value. A significance level of P-value <0.05 was used for both univariable associations and the final multivariable model. Non-significant variables were re-tested in the final model to confirm their non-significance.

Open-ended survey questions and focus group data underwent analysis using the Framework Analysis approach [57], employing an inductive approach based on the research aims (perspectives of NCD prevention, experiences of NCD participation, perceptions of participation, and preferences for future participation) to complement and enhance the quantitative data. Verbatim transcriptions were produced for qualitative focus group data. Both open-ended survey responses and focus group transcripts were imported into NVivo 14 for analysis.

Upon completion of the survey and focus groups, MM, ART, AL, JF, and SRP familiarised themselves with the data and independently conducted thematic analysis using an inductive approach. MM, ART, AL, and JF developed coding labels based on the research questions and identified emerging themes. Following systematic coding of all transcripts, the research team (MM, ART, and SRP) engaged in discussions to refine and develop themes through an iterative and reflexive process. Consensus on final themes was agreed upon by all researchers.

Results

Participant demographic characteristics

A total of 501 participants completed the survey (mean age 16.0 years, SD 1.2), while 19 participants completed the focus groups (mean age 17.0 years, SD 0.9) (Table 3). Five online focus group discussions were conducted, with group sizes ranging from two to six participants (mean duration 50 min; range 25 to 80 min). Participants predominantly identified as female in both the survey (61.5%; 308/501) and focus groups (57.9%; 11/19) with 8.4% (42/501) of survey participants identifying as gender diverse. Moreover, 67.3% (337/501) of survey participants and 73.7% (14/19) of focus group participants resided in areas with a IRSAD score in quintile 4 or 5 (reflecting more advantage). Most participants lived in metropolitan areas (80.8% and 84.2% of responses from survey and focus group data, respectively). A language other than English was spoken at home by 36.3% (182/501) of survey participants and 57.9% (11/19) of focus group participants. Parental or guardian educational attainment was asked in the survey only, revealing that the majority had completed tertiary education.

Perspectives of NCD risk factors and prevention strategies

Overall, 79% (394/501) of survey participants perceived mental health disorders to be the biggest health issue facing adolescents (Fig. 1). An unhealthy diet (77%, 385/501), low physical activity (72%, 361/501), mental wellbeing (53%, 266/501), and cost of or access to healthy food (36%, 178/501) were perceived to be the biggest risk factors or influences for NCDs facing adolescents. Additionally, 92% (463/501) of survey participants considered health interventions important for young people to reduce NCD and improve risk factors. Survey participants justified their responses within the context of lifestyle behaviours such as nutrition and physical activity being protective factors for mental health, and interventions aiding in establishing a foundation for good health into adulthood.

> *Maintaining a healthy lifestyle is an essential protective factor for young people. I have experienced firsthand that simply going for a walk, or playing sport, can benefit my own mental health – male, 17-years*

Table 3 Participant demographic characteristics from survey data (n = 501) and focus groups (n = 19)

Demographics	Survey		Focus groups
Age (years), mean (SD)	16.0 (1.2)		17.0 (0.9)
13–14 years, n (%)	63 (12.6)		0 (0.0)
15–16 years, n (%)	238 (47.5)		5 (26.3)
17–18 years, n (%)	200 (39.9)		14 (73.7)
Gender identity, n (%)			
Female	308 (61.5)		11 (57.9)
Male	151 (30.1)		8 (42.1)
Non-binary or gender diverse or other[a]	42 (8.4)		0 (0.0)
IRSAD quintiles[b], n (%)			
Quintile 1 (most disadvantaged)	38 (7.6)		1 (5.3)
Quintile 2	49 (9.8)		1 (5.3)
Quintile 3	69 (13.8)		2 (10.5)
Quintile 4	84 (16.8)		5 (26.3)
Quintile 5 (most advantaged)	253 (50.5)		9 (47.4)
Modified Monash Model Suburb Classification[c], n (%)			
Metropolitan areas	405 (80.8)		16 (84.2)
Regional centres	27 (5.4)		1 (5.3)
Large, medium, or small rural towns	57 (11.4)		0 (0.0)
Remote communities or very remote communities	5 (1.0)		1 (5.3)
Language spoken at home, n (%)			
English	319 (63.7)		8 (42.1)
Arabic	20 (4.0)		0 (0.0)
Cantonese	24 (4.8)		1 (5.3)
Hindi	12 (2.4)		1 (5.3)
Mandarin	29 (5.8)		4 (21.1)
Tamil	6 (1.2)		2 (10.5)
Vietnamese	11 (2.2)		0 (0.0)
Other[d]	80 (16.0)		3 (15.8)
Parent/guardian highest level of education, n (%)	***Parent/guardian A***	***Parent/guardian B***[e]	
Some high school	57 (11.4)	29 (5.8)	-
Completed high school	49 (9.8)	70 (14.0)	-
Currently studying for degree or diploma	9 (1.8)	10 (2.0)	-
Completed a trade or technical qualification	37 (7.4)	43 (8.6)	-
Completed a degree or diploma	208 (41.5)	204 (40.7)	-
Completed a post graduate degree	115 (23.0)	91 (18.2)	-
Other	26 (5.2)	46 (9.2)	-
Currently attending secondary school, n (%)			
Yes	458 (91.4)		-
No[f]	43 (8.6)		-

IRSAD Index of Relative Socio-economic Advantage and Disadvantage; *N* number; *SD* standard deviation

[a] Other inclusive of demi girl/boy or prefer not to say

[b] 1 representing most disadvantaged, 5 representing most advantaged; Eight postcodes with no matching IRSAD data

[c] Eight postcodes with no matching Modified Monash Model Suburb Classification

[d] Inclusive of 36 other languages

[e] Eight participants did not report Parent/guardian B highest education level

[f] Of 43 participants not at school: 28 enrolled in university undergraduate degree; four enrolled in diploma/technical course; and 11 reported other

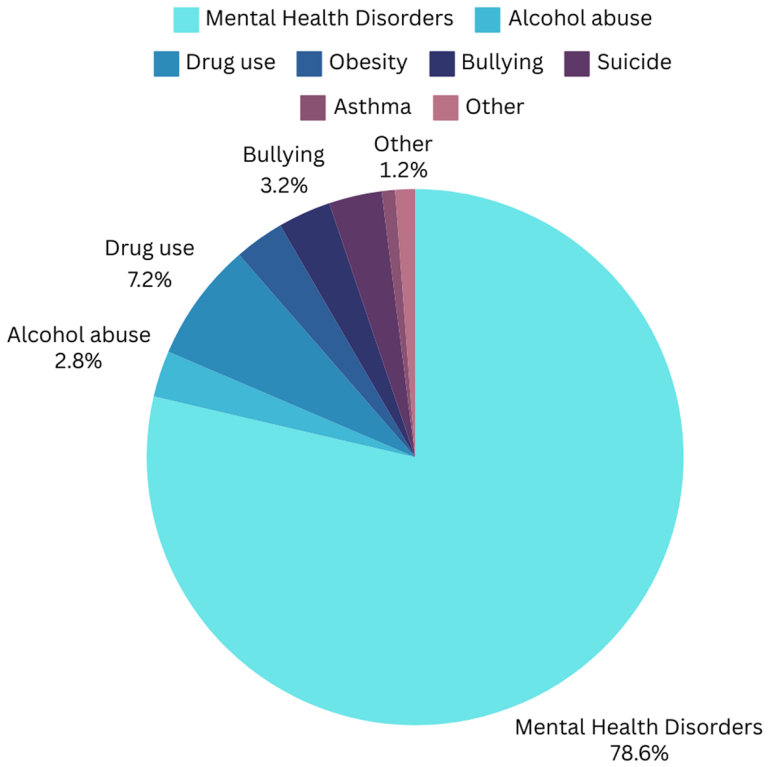

Fig. 1 Biggest health issue facing adolescents (n = 501)

Having a healthy lifestyle makes all other areas of your life better from mental health to physical health and improves your relationships – female, 16-years
Establishing good health habits in order to prevent further health issues in the future is vital - non-binary or gender diverse, 17-years.
…our generation will struggle in the future if we are suffering from mental and physical health issues and may be unable to contribute to a properly functioning society – male, 15-years

However, survey participants also acknowledged that unequal access to resources affects interventions, as well as the potential detrimental and challenging aspects of some interventions (refer to Table S3 for supporting quotes).

Some people may not have access to the proper resources to stay healthy, so it's important to give those people equal access – non-binary or gender diverse, 18-years
However, since most teens are unexperienced and may also lack incentive to eat healthy, many choose to not do so. Many unhealthy foods are just more convenient, cheaper, and more accessible to most than healthy food that may be time-consuming or too costly – non-binary or gender diverse, 17-years
I believe that every young person should consider having a healthier diet although, it [shouldn't] be too worried about. Younger people worrying about their weight is a cause of unstable mental health. Tracking your weight through a diet when [you're] a teenager [shouldn't] be done unless it is helping you and making you feel better – male, 14-years
If [an] intervention is done improperly, it can be taken the wrong way and negatively affect young people – male, 15-years

Themes identified from focus group data were aligned with the themes from the survey data, with participants discussing the socioeconomic factors influencing access to resources and emphasising the significance of stigma in NCD interventions. Adolescents recognised the importance of socioeconomic factors underlying behavioural choices, which may pose challenges for individuals to modify their behaviours, particularly for young people who rely on family or parental behavioural choices.

…Socioeconomic status, and factors come into mind for me, and then also sort of links on to education for me. And I wonder if the different levels of education…has a role to play in the distribution of these

chronic health problems across all communities – female, 17-years

…Sometimes when you don't have the resources, or your family don't have the resources, this sort of from a young age force into these eating habits that grow onto them…And then that habits sort of just sticks with you as you grow into your independence – female, 18-years

Especially for young people, one of the main factors would definitely be the health of their family member…like, children…They kind of like eat, what they get packed, or like what they have access to. And if their family can't like [to] afford more healthy food, or even if they can and they just like choose not to, I think that's a key starting point of like, chronic health issues in young people – female, 18-years

Obesity emerged as the most visible chronic disease in society, as acknowledged by participants. They also recognised that many other chronic diseases (e.g., type 2 diabetes) were not as visible in society or in their everyday lives. Participants acknowledged the stigma associated with obesity and other chronic diseases, often attributing blame to the individual, despite understanding that many causes of chronic diseases were beyond individual control.

…Some of them are more noticeable, like, I guess, obesity, but then some of them like, osteoporosis or something is harder to notice in a person - female, 16-years

…if I see an obese person, like indulging in something that is typically seen as like unhealthy, …like a fast food, I feel like I would take notice…And stigma plays a part in that as well… – female, 17-years

For me, like when I think of chronic diseases, such as diabetes type two, obviously, it's, you know, like, a lifestyle sort of related disease. So, I think of, you know, people maybe not making healthy choices. And that sort of makes me maybe unconsciously you know, think about, okay…maybe they're not super healthy. And there's a bit of sort of stigma attached to that, especially for young people… – male, 17-years

Experience of youth participation

Among the surveyed participants, 54.9% (275/501) reported engaging in volunteer work, with the most common frequency being once a week (38.9%; 107/275) (Table 4). Community engagement emerged as the predominant type of volunteer work reported (51.5%; 139/275). In terms of health-promoting activities, 20.0% (100/501) of participants reported some type of involvement, with sports participation (23.0%; 23/100) and health education (19%; 19/100) being the most prevalent. Peer leadership or mentorship was the primary method of participation (40%; 40/100), with secondary schools serving as the main setting (64%; 64/100). The majority described their participation as meaningful (87%; 87/100), with adult-led (40%; 40/100) and equal partnership (27%; 27/100) approaches being the most common. Common reasons cited for non-participation included a lack of opportunity (49.3%; 137/278), lack of interest (25.2%; 70/278), and prioritisation of other activities (20.9%; 58/278).

Univariable logistic regression revealed a significant association between participation in health-promoting activities and previous volunteer work, with 73% of participants who reported previous volunteer experience also engaging in health promoting activities. There was no statistically significant relationship between no previous volunteer experience and participation in health promoting activities. Socioeconomic status showed some indication of a relationship, with 43% of youth participating in health-promoting activities residing in areas with higher relative advantage. Upon inclusion of these two variables, only volunteer experience was statistically significant in the final multivariable model, with participants having prior volunteer experience showing 2.74 times the odds of engaging in health-promoting activities compared to their non-volunteering counterparts ($P < 0.001$; 95% confidence intervals [1.691, 4.445]). The multivariable model explained 5.60% of the variance in participation (Nagelkerke R^2) and accurately classified 80.10% of cases (refer to Table S4).

Perceptions of youth participation in NCD prevention

Overall, survey participants perceived participation in activities promoting health as beneficial (Fig. 2). Most participants reported that participation was'likely'to enhance their sense of self-worth, self-esteem, and self-efficacy (75.4%; 378/501), their sense of being taken seriously (60.0%; 299/501), their confidence in decision-making (70.0%; 349/501), and their confidence in public and community engagement (73%; 366/501). Furthermore, over 80% of participants believed that participation added value to and improved various health domains, including research, intervention development, policy development, healthy diet and behavioural awareness, health-promoting environments, behaviours, and health outcomes.

Perceptions of youth participation in NCD prevention were explored during the focus groups, revealing two main themes: 'role' and 'influence.'Role'was associated with the sub-themes:'visibility,''flexibility,'and'authenticity,' while'influence'was related to the sub-themes of'acceptab

Table 4 Experiences of youth participation from survey data: volunteer work and health-promoting activities (n = 501)

Variable	Categories	N (%)
Volunteer work		
Volunteer work[a] in the last 12-months	Yes	275 (54.9)
	No	226 (45.1)
Frequency of volunteer work *(For those who reported volunteer work n = 275)*	At least once a week	107 (38.9)
	At least once a fortnight	46 (16.7)
	At least once a month	53 (19.3)
	At least once a year	69 (25.1)
Nature of volunteer work *(For those who reported volunteer work n = 270)*[b]	Community engagement[c]	139 (51.5)
	Coaching, tutoring or mentoring[d]	58 (21.5)
	School activities[e]	45 (16.7)
	Other activities[f]	28 (10.4)
Health-promoting activities		
Participation in health-promoting activities	Yes	100 (20.0)
	No	278 (55.5)
	Unsure or cannot remember	123 (24.6)
Nature of health-promoting activities *(For those who reported participation in health promoting activities, n = 100)*	Sports participation	23 (23.0)
	Health education	19 (19.0)
	Physical activity promotion	15 (15.0)
	School initiatives	12 (12.0)
	Community events	10 (10.0)
	School projects	6 (6.0)
	Peer support	4 (4.0)
	Research	2 (2.0)
	Other	9 (9.0)
Participation method[g] *(For those who reported participation in health promoting activities, n = 100)*	Peer leader, mentor or educator	40 (40.0)
	Community event	39 (39.0)
	Youth or peer advocacy	26 (26.0)
	Focus or discussion group	24 (24.0)
	Questionnaire	22 (22.0)
	Social media	18 (18.0)
	Youth advisory group, board or committee	14 (14.0)
	Other	9 (9.0)
	Co-design workshop	8 (8.0)
	I cannot remember or I do not know	7 (7.0)
	Interview	3 (3.0)
	Photovoice or photography	1 (1.0)
Participation setting[g] *(For those who reported participation in health promoting activities, n = 100)*	Secondary school	64 (64.0)
	Social clubs	24 (24.0)
	Community	23 (23.0)
	Primary school	17 (17.0)
	Other	5 (5.0)
	Tertiary education (college, TAFE, university)	4 (4.0)
Contribution *(For those who reported participation in health promoting activities, n = 100)*	Meaningful	87 (87.0)
	Not meaningful	11 (11.0)
	Unsure	2 (2.0)
Participation description *(For those who reported participation in health promoting activities, n = 100)*	Adult-led	40 (40.0)
	Equal partnership	27 (27.0)
	Youth-led	27 (27.0)
	Opinions not considered and no influence	6 (6.0)

Table 4 (continued)

Variable	Categories	N (%)
Reason for no participation *(For those who reported no participation in health promoting activities, n = 278)*	Lack of opportunity	137 (49.3)
	Lack of interest	70 (25.2)
	Prioritisation of other activities	58 (20.9)
	Other	13 (4.7)

[a] Volunteer work was defined as unpaid as per the question that was used from the Longitudinal Study of Children

[b] Of the 275 responses, 5 were non-serious responses

[c] Community engagement included activities such as Clean Up Australia or helping disadvantaged children

[d] Coaching, tutoring, or mentoring included supporting younger students

[e] School activities included peer support activities or volunteering at school canteen

[f] Other included activities such as Scouts

[g] Multiple responses allowed, participants instructed to 'select all that are relevant'

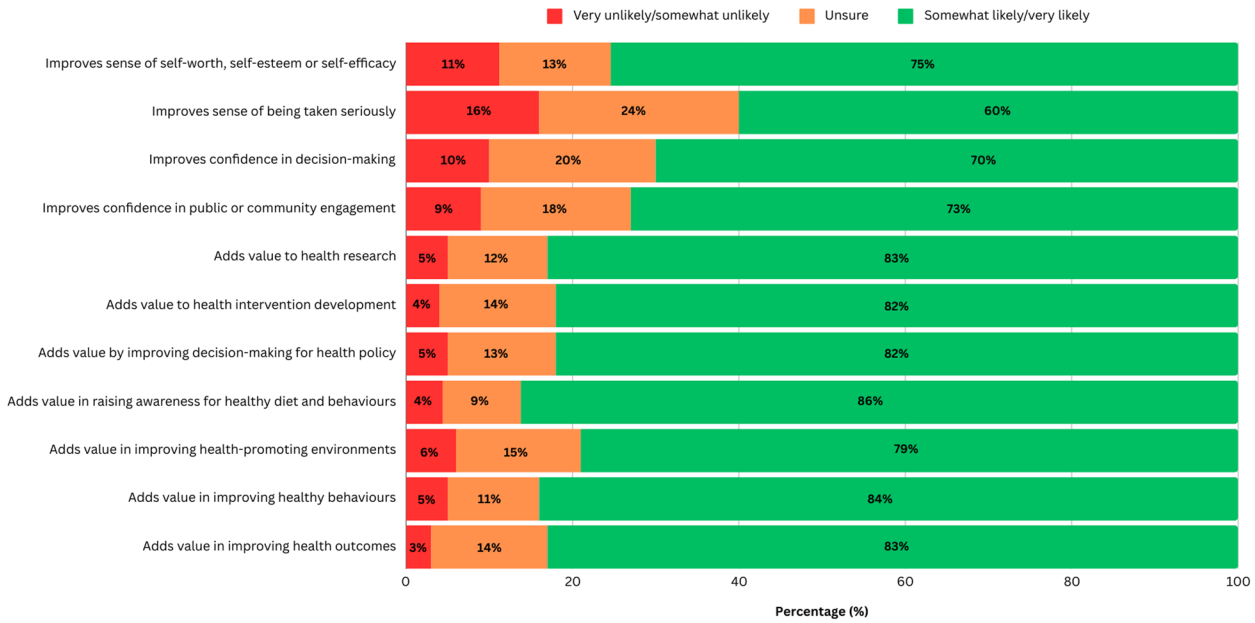

Fig. 2 Perceptions of outcomes of youth participation in NCD prevention

ility,"relevance,'and'empowerment.'Quotes supporting the main themes and sub-themes are available in Table 5.

Participants recognised the importance of their role in shaping health promotion and NCD prevention processes and outcomes. There was a strong willingness to take on various types of roles, such as leadership roles, as an advisor or as part of a research team, in health promotion activities to raise awareness of NCD prevention among peers and within society more broadly. Participants emphasised that opportunities for roles need to be widely'visible'to young people. Additionally, they emphasised the importance of'flexibility'within their role, level of commitment, and choice in engagement methods. Finally, participants agreed that roles should be'authentic'to ensure that NCD prevention activities are relevant and useful for young people.

'Influence'was perceived by participants as a key enabler for prompting change in adolescent health trajectories. Participants recognised youth engagement in NCD prevention decision-making as having the potential to yield health-promoting activities that are'acceptable'and'relevant'to young people, thus positively influencing behavioural choices. Moreover, it was agreed that youth engagement extends further by'empowering'youth on a personal level through involvement in the decision-making process. Youth

Table 5 Themes and sub-themes identified within focus group discussions relating to perceptions of youth participation in NCD prevention

Themes	Sub-themes	Supporting Quotes
Role	Visibility	*Opportunities should be broadcasted more, and there should be more active roles for the youth to participate in these kinds of major decisions* – male, 17-years
		Raising awareness is quite important and something that young people and only young people can really do. So that other youth listen and understand – female, 17-years
	Flexibility	*I think it can depend on the type of health-promoting activity, and it could also depend on the youth, like a willingness to be involved in various levels* – male, 15-years
		It should also depend on opening it up to everyone so that youth can decide what kind of role they would like to take, and the level of participation will not always necessarily be the same – male, 16-years
		The most effective are programs that treat you like an adult and sort of go; not everyone might be ready or willing to take on this level, but it is there, and if you want to come and do it, we are prepared to give you the absolute full experience, we are prepared to enable you to have all the control and to learn and take from it as much as you want – male, 17-years
	Authenticity	*It would be helpful to have young people as the face of the campaign because if young people identify more with a campaign, they're more likely to feel like it applies to them, instead of some corporate campaign they do not care about* – female, 18-years
		In final implementation, it is important to bounce ideas off a bunch of young people and see how they feel about the campaign. Because if those young people do not connect with the campaign, it is unlikely that other young people would care about it – female, 17-years
		It would be useful to have more programmes that we are working with young people to sort of establish working on the knowledge of what they need to do to improve their health, and then work with them to establish how they are going to do that – male, 17-years
Influence	Acceptability	*If the young people themselves are doing the advocacy work, then in those health-promoting activities, it will be more likely that other young people will take part and sort of trust those activities* – female, 18-years
		The influence is big, and when you see your peers in those kinds of things, the mutual like encouraging each other to go into like physical activities, it is beneficial for health promotion – female, 17-years
		If my peers were participating in healthy decision-making activities, then I would be more likely to follow in their footsteps. I would not want to be excluded. I take them as role models – male, 17-years
	Relevance	*Young people can do something about it if they get the opportunity to advise on how to make it a little bit more relevant to young people* – male, 16-years
		If someone can connect to us in any similar way, I think it is more efficient than someone completely different to us, not involved in anything we do, and cannot relate to us, informing us that we should live our lives in a certain way – male, 15-years
		If you have young people involved in making health promotion strategies, like in whatever level, school, government or whatever, if you have young people, then that helps make the programme more relevant. Input from people from the group that you are targeting, then this is how we can make it more effective, or this is how we can help it reach more people – male, 17-years
	Empowerment	*It was empowering to have an entire group of people work towards events that actually happened. It was nice to see something come out of our efforts* – female, 18-years
		It was a good feeling that you could help out more disadvantaged people and helped me build my leadership portfolio – female, 17-years
		Whenever you get an opportunity to make a change, it does feel a bit empowering, and it gives you a bit of confidence – male, 17-years

engagement was affirmed to empower adolescents by fostering the development of leadership skills and self-confidence, both fundamental elements for future influence.

Preferences for future youth participation in NCD prevention

Nearly two-thirds (308/501, 61.5%) of survey participants expressed willingness to participate in future activities related to NCD prevention (Table 6). Preferred participatory activities included research (340/501, 67.9%), consultation for guideline development (263/501, 52.5%), policy development (189/501, 37.7%), or a learning role (174/501, 34.7%). Almost half of the participants preferred a hybrid setting (225/501, 44.9%) for engagement. Social media or marketing (131/501, 26.1%) and focus groups (84/501, 16.8%) were reported as participatory methods with the most influence. The preferred gains from the participatory experience were skill development (156/501, 31.1%), research experience (112/501, 22.4%), and payment (107/501, 21.4%).

Themes identified from the focus group data complemented the survey findings, with participants discussing enablers and barriers for future youth participation in NCD prevention. Despite their willingness to participate, very few participants had direct experience in engaging with NCD prevention research or policy development, particularly at a decision-making level. Most of those who participated in health promotion were involved as

Table 6 Preferences for participation in activities that promote young people to eat better, be more physically active, or prevent chronic disease (n = 501)

Preference	Categories	N (%)
Willingness to participate	Yes	308 (61.5)
	No	50 (10.0)
	Unsure	143 (28.5)
Preferred participatory activity[a]	Participate in research	340 (67.9)
	Be consulted in guideline development	263 (52.5)
	Be consulted in policy development	189 (37.7)
	A learning role	174 (34.7)
	Other	17 (3.4)
Preferred participatory setting	Hybrid	225 (44.9)
	In-person	143 (28.5)
	Online	128 (26.1)
	Other	5 (1.0)
Participatory methods with the most influence	Social media/marketing	131 (26.1)
	Focus/discussion group	84 (16.8)
	Youth/peer advocacy	61 (12.2)
	Co-design activities	56 (11.2)
	Peer leader/mentor	49 (9.8)
	Questionnaire	48 (9.6)
	Youth advisory group	46 (9.6)
	Interview	18 (3.6)
	Other	8 (1.6)
Preferred gains from the participatory experience	Skill development	156 (31.1)
	Research experience	112 (22.4)
	Payment	107 (21.4)
	Networking	59 (11.8)
	A gift voucher	54 (10.8)
	Other	13 (2.6)

[a] Multiple responses allowed, participants instructed to 'select all that are relevant'

volunteers implementing existing health programs. The most common barrier identified was the lack of opportunities (refer to Table S5 for supporting quotes).

> *I haven't really personally seen any instances where, like, youth are being invited to, like work on the development of these sort of projects. I didn't really know that was an option until very recently – male, 17-years*
> *I guess it's kind of hard to find something to participate in…I don't think there are many things for youth people to really do in from what I've seen – female, 17-years*
> *I don't actually recall there being any opportunity to do anything like that at my school – male, 15-years*

Participants were motivated to be involved in NCD prevention research, policy, and development by the opportunity to gain skills and experience and building social networks. Financial reward was also attractive but generally not as important to participants as the skills and experience that could be used in the future and included on resumes.

> *So getting lots of things is good. But in terms of priorities, it's probably learning new things first, or getting experienced more experiencing in things. And then it's the social networking thing. And then any kind of compensation thing is great after that – female, 18-years*
> *I feel like payment and the like, the ability to put that experience and skill development on your CV. So that I feel like that's like a very important thing that young people consider heavily – male, 15-years*

Participants had varied preferences regarding the level of engagement and stages of involvement in NCD prevention research, policy, and development. Consulting and collaborative roles were commonly preferred, although some participants felt adolescents should be

involved in the entire decision-making process. There was recognition that expert adult input may be required in many instances, making an advisory or consultative role more suitable for adolescents. A team environment with people of different ages and experiences working collaboratively was also a preferred mode of engagement. However, many felt that the level of engagement should depend on the project or planned intervention. Smaller-scale projects, such as those in schools, were considered more suitable for adolescent-led decision-making, whereas larger-scale projects, such as those at a state or national level, would be more suitable for an advisory or consultative role. Participants felt young people should be provided with opportunities to participate but have a choice in how they want to participate and at what level, as preferences would vary among different individuals.

> *I think they should be engaged through the entire process, because that's actually paramount, from the input from the startup to the implementation to, you know, designing the process – male, 16-years*
> *I think, especially for young people who don't have that kind of knowledge about health or, like the specific knowledge or scientific knowledge about, like health or diseases. I think that just having people of that age group, be it like advisors, I guess, and just offer their information and their input on like, how you can improve it, because it just offers more perspective – female, 17-years*
> *I feel adolescent led would be good on a small scale, like in in the community, like in the suburbs, or something. But when it comes to like a larger scale, like in the state, I feel like it would be more effective to have it to have like, young people who just as like in a consultant role, just to provide feedback on it – female, 18-years*
> *…Having a consultative role is important, because then you're actually contributing to whatever health promotion programme strategy is made. But then it also depends on the situation. Like maybe if it's just a local school thing, and the students might end up taking, like a more like a different role, like actually making the programme itself – male, 18-years*
> *But I know, tonnes of people who would, who would love to take on a more active role and to have control. I know a lot of people that wouldn't and who couldn't do that. But there are certainly heaps that could; so have it open and allow people to take that opportunity and sort of have a process for saying, you know, there are people out there that want to do this. So, let's select them and let them have that opportunity – female, 17-years*

Discussion

Our study identified Australian adolescents' previously unheard perspectives of, experiences with, and preferences for participating in NCD prevention activities. In the context of increasing NCD prevalence amongst adolescents throughout the Western Pacific region, this is crucial to develop prevention strategies that are effective in practice. Conventional health research has largely overlooked adolescents' preferences and opinions on their own engagement, making it difficult to ensure that research and policy agendas meaningfully engage with adolescents. Adolescents want to be involved in NCD prevention efforts – by listening to them, this study reveals *how*.

Effectively supporting adolescents necessitates a comprehensive understanding of their perceptions regarding health, NCD risk factors, and prevention strategies. In our study, adolescents identified mental health disorders as the primary health concern impacting their peers, supported by global and national Australian data revealing significant rates of mental illness among adolescents [59, 60]. Additionally, our findings show the perceived influence of unhealthy diet, low physical activity, mental well-being, and cost or access to healthy food on chronic disease risk, aligning with existing evidence. For instance, studies have established links between poor dietary habits and mental health issues in adolescents, and the positive impact of increased physical activity on mental health indicators like anxiety and depressive symptoms. [61, 62] Moreover, research demonstrates the association between food insecurity and adverse mental and physical health outcomes in various populations [63, 64], including young people attending youth mental health services in Australia [65]. Adolescents in the present study recognise the importance of factors like nutrition, physical activity, and social determinants (like food access) in protecting mental health and setting foundations for lifelong health. Emerging research, such as the Health4Me study, a text message intervention for adolescents aged 13–18 years in Australia, demonstrates that during co-design, a key finding was that highly rated text messages provided practical examples, included links, and addressed topics beyond just physical health [66, 67]. Despite this, they are often not taken into consideration together in official strategies in the Western Pacific region. For example, existing Australian government strategies often address mental health and NCD prevention separately, leading to fragmented management approaches [5, 49, 68]. Consequently, our study emphasises the importance of adopting holistic, intersectoral approaches to adolescent health and well-being, integrating NCD prevention and mental health within unified guidelines, frameworks, and policies.

Recent discourse on NCD prevention in both adults and adolescents underscores the pivotal role of adolescent engagement in developing effective programs and policies, altering health-related behaviours, and fostering long-term results and capacity-building among adolescents [26, 69–71]. We found adolescents highly value their involvement, and that of their peers, in various NCD prevention activities, including research, guideline and policy development, and decision-making processes. Adolescents perceived such participation as being beneficial in improving health outcomes for themselves and broader society, recognising their 'role' in NCD prevention, and its 'influence' on positive behavioural choices and empowering youth. Furthermore, our findings revealed a strong willingness among adolescents to engage in future activities related to NCD prevention, highlighting their potential as active contributors to public health initiatives.

Though our study shows that adolescents perceive participation as beneficial across multiple domains, meaningful youth engagement in NCD prevention decision-making remains uncommon in adolescents living in Australia, which is consistent with global trends found in systematic reviews of peer-reviewed research, and policy and guideline literature [37, 39]. Moreover, a recent umbrella review of adolescent involvement in health research has highlighted the limited empirical evidence on effectively facilitating positive participation among adolescents, indicating a need for further research in this area [24].

We found that when opportunities to engage in NCD prevention are available, they should be flexible and authentic to accommodate adolescents' varying preferences and needs. This is crucial for their meaningful inclusion in health-promoting activities. Our findings suggest that adolescents may experience uncertainty about their skills or feel overwhelmed by engagement expectations. Thus, providing adolescents with the flexibility to choose their roles, participatory methods, delivery, and level of engagement is recommended for maintaining equity and autonomy throughout the process. This resonates with recent initiatives like the Australian Government Office of Youth Engage! Strategy, which emphasises adolescents'desire for meaningful involvement in decision-making and the reflection of their perspectives in policies and programs [72]. The recent global 1.8 Billion Young People for Change Campaign exemplifies this approach by offering various engagement options, including surveys, forums, co-authorship opportunities, and speaking roles, catering to different adolescent preferences and interests [73]. Furthermore, all activities took place virtually, considering young people's concerns on the climate impact of travel and the desire to reach as large and diverse a group of stakeholders as possible.

For how these opportunities should be provided in relation to adults, our study emphasises fostering a collaborative working environment with individuals of diverse ages and experiences, while accommodating adolescents' varying preferences. This aligns with previous strategies. For example, a recent study conducted in Indonesia emphasised the significance of establishing intergenerational partnerships to enhance adolescent engagement and connectivity within mentorship networks [74]. Moreover, offering skill-building opportunities and capacity-building experiences that are appropriately resourced with supportive adults are essential for their personal growth. This finding is aligned with recommendations to improve First Nations adolescent health in Australia [75].

However, the relative lack of opportunities emerged as the most common barrier to adolescent participation in NCD prevention activities. We need broad access across the Western Pacific region to participation opportunities to engage diverse groups of adolescents, particularly from priority populations. This need is emphasised in many LMICs beyond Australia, where such opportunities may not exist at all. A qualitative study of Australian adolescents found adolescents want to act on public health issues that affect them, but commonly felt a lack of empowerment, support, and opportunities to do so [44]. This calls for initiatives seeking to engage adolescents to promote opportunities widely and equitably. Although our study did not find significant associations between demographic characteristics and adolescent engagement in health-promoting activities, potentially due to the sample selected (e.g., most with parent or guardian with tertiary education) a relationship was observed between prior volunteer experience and the likelihood of engagement in these activities. Previous research suggests that certain demographic factors, like identifying as female, older adolescents (16–17 years), attending independent or Catholic schools, and having parents or guardians with degrees, may influence adolescents'likelihood of volunteering. For example, adolescents with parents holding higher education degrees demonstrated a greater likelihood to volunteer, particularly for community or welfare organisations and youth-related activities. Additionally, engaging in volunteering during adolescence is linked to a reduced likelihood of experiencing poor mental health, highlighting broader benefits of community engagement during this developmental stage. Thus, across the region it is vital to create equitable opportunities for adolescent engagement.

The importance of providing these opportunities in the Western Pacific transcends NCD prevention. By giving voice to adolescents, our findings show that adolescents

perceive the benefits of youth engagement to extend beyond reducing NCD risk factors, recognising the positive impacts on decision-making influence, empowerment, and health advocacy platforms, as well as the implementation of relevant health-promoting activities for their peers. There is emerging evidence on initiatives with positive impact on adolescent skill development. Regional initiatives such as the"Wake Up: Engaging Youth to address NCDs"program in collaboration with Pacific Island countries and territories have demonstrated the transformative potential of youth involvement, empowering trained youth to take on leadership roles in community health promotion campaigns [32]. Similarly in Australia, adolescents participating in a 12-month youth advisory group focused on NCD prevention have shown positive participatory outcomes, including influence, empowerment, and meaningful contribution to intervention strategies [43]. These examples show the importance of fostering adolescent engagement in NCD prevention, highlighting the potential for impactful outcomes when adolescents are given meaningful opportunities to participate in decision-making processes.

A strength of our study was the deliberate prioritisation of adolescent engagement throughout the research process. We included a youth researcher as an integral part of the research team, and young people actively participated in focus groups and co-wrote recommendations and future directions. These young people brought valuable insights grounded in their roles in NCD prevention, including as youth advisors or research assistants. Their involvement ensured the study findings were contextually grounded and aligned with the needs of those who may seek to translate this research into action.

Furthermore, integrating quantitative and qualitative data was another strength of this study. This approach allowed us to examine research questions from different perspectives harnessing the depth of qualitative evidence and breadth of quantitative evidence, providing a more comprehensive understanding of the needs and priorities of a diverse sample of adolescents. As well, the mixed-methods research strengthened the validity and reliability of the findings by providing a more comprehensive understanding of the needs of a diverse sample of adolescents.

However, it is important to acknowledge several limitations. While efforts were made to reach quotas, we were unable to achieve representation from all target demographics. Future research is needed to understand the perspectives of adolescents from priority populations disproportionately affected by NCDs. Priority populations identified in the National Action Plan for the Health of Children and Young People [68] include adolescents from rural and remote areas, Aboriginal and Torres Strait Islander adolescents, adolescents born into poverty, and adolescents from culturally and linguistically diverse backgrounds (including from refugee

Table 7 Recommendations for future research and practice

Recommendations for future research:
1. Conduct research in collaboration with young people targeting shared protective factors for physical and mental health, with a focus on robust reporting and evaluating youth participation methods
2. Investigate current levels of youth participation from priority populations in NCD prevention programs, comparing their engagement with non-priority groups and identifying factors that enhance participation and improve health outcomes
3. Undertake longitudinal studies to assess the long-term impacts of NCD prevention interventions designed and implemented with youth participation
4. Explore how different types of youth engagement (e.g., adolescent-led vs. adult-led), settings (e.g., school, community, digital), and demographic factors (e.g., age, gender) influence the effectiveness of NCD interventions
5. Examine the correlation between skill development in youth participants and their ability to apply these skills in NCD intervention programs over time
Recommendations for practice
1. Adopt an intersectoral approach in developing youth-focused NCD prevention programs to address the interconnectedness of various health risk factors
2. Promote volunteering experiences among young people, as prior volunteering correlates with increased participation in NCD intervention decision-making. Volunteer organisations could facilitate access to opportunities in NCD prevention programs throughout adolescence, leveraging schools and clubs as key settings and ensuring opportunities across all years and levels
3. Improve access to participation by reducing barriers and increasing visibility of opportunities for young people, particularly from priority populations, to engage in decision-making roles within NCD prevention programs. Provide flexibility in selecting health-promoting activities and ensure authenticity in youth-driven initiatives
4. Involve young people in program design to enhance relevance and acceptance among their peers, fostering skills, self-confidence, and leadership capabilities
5. Encourage youth participation in NCD prevention research, leveraging digital media and participatory methods to align with the preferences and communication styles of today's youth

and asylum seeker families). Recruitment through social media advertising, while effective in reaching a broad audience, may have introduced biases in sample representativeness. Additionally, from 2025, the Australian Government has banned individuals under 16 from accessing social media sites, introducing further complexities for recruitment in future studies.

Additionally, this study's findings may not be generalisable beyond the Australian context. Self-selection bias is important to note as a limitation as adolescents who are more interested in NCD related issues may have been more likely to volunteer to participate. However, we did have strategies in place to overcome barriers to participation, including conducting all research online and providing reimbursement for their time. Moreover,, the proportion who reported volunteering in our study (55%) was aligned with national data [28] so we were able to understand the motivations and experiences of those not yet involved in volunteering or participation activities. Despite these limitations, many issues and recommendations identified by our participants are consistent with findings from other global and regional studies on adolescent engagement in NCD prevention.

Conclusions

Our findings highlight the importance of meaningful adolescent engagement in NCD prevention activities, and the potential for positive outcomes when adolescents are given opportunities to participate. Moving forward, we must prioritise adolescents' preferences for engagement and ensure opportunities are flexible and accessible to adolescents from diverse backgrounds (Table 7). Enhancing intersectoral collaboration and addressing critical data gaps will be vital for achieving comprehensive NCD prevention strategies that effectively resonate with the needs and priorities of adolescents living in Australia and throughout the Western Pacific.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-025-22969-w.

Supplementary Material 1.

Supplementary Material 2.

Supplementary Material 3.

Supplementary Material 4.

Supplementary Material 5.

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Authors' contributions

SRP and MM conceptualised this study. SRP, MM, SW, PP, JR, HLC, SM, and RR developed the study protocol. SRP, MM, and RR developed the data collection tools, with expert feedback from SW. SRP, MM, DM, FY, SW, and RR supported implementation of the study, with focus groups led by MM and assisted by DM and FY. SRP, MM, ART, AL, and JF led the data analyses. Specific expertise for this study was sort from MB and AD (adolescent engagement in research), ART, SW, DM, and FY (youth researchers) and all authors contributed to the interpretation and drafting of the manuscript. All authors approved the final manuscript and were responsible for the decision to submit the manuscript.

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Data availability

Quantitative survey data and qualitative focus group transcripts are not available for sharing due to the risk of identifying individuals. De-identified data may be shared on a case-by-case basis upon requests to the corresponding author.

Declarations

Ethics approval and consent to participate

All participants provided written and informed consent. Ethics approval obtained from the University of Sydney Human Research Ethics Committee (approval number 2021/864). Parental or legal guardian consent was not required for participation for those under 16-years. It is widely acknowledged that for health research characterised as low-risk or minimally harmful, adolescents over the age of 13 are typically considered competent to comprehend the nature and implications of the study and this approach was approved by University of Sydney Human Research Ethics Committee.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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