FINAL REPORT

Economic evaluation of the Active Kids program

Prepared for
NSW Office of Sport

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Summary

The New South Wales (NSW) Active Kids Program (the Program) provides excellent value for money by universally supporting children and young people in NSW to be engaged in physical activity outside of the school environment.

By the end of the funded period of the Program (January 2018 to June 2023), Active Kids will have generated $0.59 billion in benefits in present value terms, at a cost of $0.57 billion, returning $1.04 for every dollar invested. This is based on detailed economic modelling of quantifiable benefits, without accounting for valid benefits that have not been amenable to measurement.

Results are conservative and based on statistical modelling of linked longitudinal data of over 100 000 children each year who have participated between 2018 and 2021 to ensure their validity and significance. Sensitivity testing across multiple variables primarily shows that Program costs are outweighed by Program benefits. Children and young people that benefit the most include those from lower socio-economic areas, children with a disability, overweight children, and those aged 9-11.

Looking forward, more can be done to improve Program engagement in areas where Active Kids is most effective, with key beneficiary groups being under-represented in the pool of participants relative to their share in the NSW population.

This report has been prepared to inform the continuous improvement of the Program and provides evidence to support its extension.

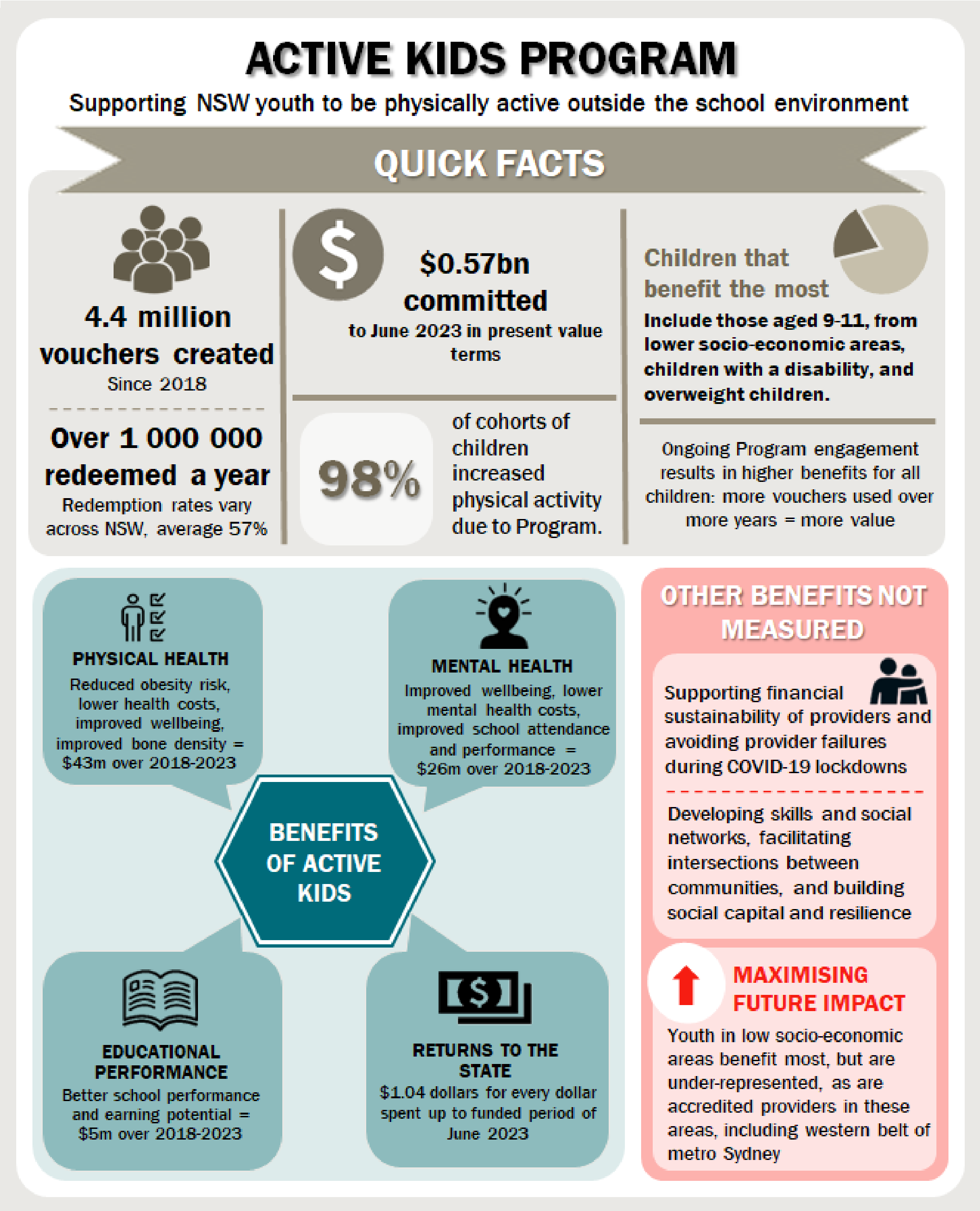
Context for the Active Kids Program

The NSW Active Kids Program is a key pillar of the NSW Government's strategy to instil healthy lifestyle habits in children and young people in NSW. It is offered universally across the State, providing maximum program reach to achieve the direct goal of increasing physically active behaviours, as well as social goals associated with promoting stronger, more integrated, and inclusive communities.

The cost of the Program includes the payment of vouchers to families, and staff and administration costs, valued at $0.57 billion (2018 to 2023) in present value terms.

Over 4.4 million vouchers have been created since 2018, with around one million vouchers redeemed annually. The registration rate (per cent of eligible children registered) has grown from 46 per cent in 2018 to 57 per cent in 2021, although it varies across the State. The proportion of registered children is higher in larger population centres than some regional and remote areas, with the belt west of the State between Parramatta and Fairfield having a notably lower level of registrations and redemptions than other postcodes with similar population density.

1 Snapshot of economic evaluation results for the Active Kids Program



Note: To maintain participant confidentiality, participants were organised into cohorts that represented significant groupings of characteristics, such as combinations of age, gender, ethnicity, First Nation status, disability status, socio economic status, and English-as-a-first-language status. There were approximately 6 000 cohorts of children derived. Results in this report reflect statistically significant findings at the cohort, rather than individual, level.

Data source: CIE.

The redemption rate (per cent of vouchers redeemed) is high, with 91 per cent of postcodes redeeming over 80 per cent of vouchers, including during the COVID-19 pandemic when the timing and duration of community sport was disrupted. Redemption rates are highest in eastern and northern regions of Sydney. There are also more registered providers in these postcodes to service the local area than in Western Sydney, where the redemption rate is lower.

Comparing the population of children registered for Active Kids to all eligible children:

- males are slightly overrepresented, although the difference has diminished over time
- there are more younger children (4 to 8 and 9 to 11) and less adolescents registered, reflecting the more active behaviours of younger children, and diminishing active behaviours of young persons
- First Nations children are registered in line with their population rate
- children with an identified disability have a higher rate of registration than their representation among all children
- there is an overrepresentation of children with obesity in Program and a higher propensity for families to register children that are obese
- in 2021, children from regional and remote regions registered in line with their distribution across NSW, having previously been overrepresented since 2018, and
- there is a strong socio-economic gradient among Active Kids participants. Children from more disadvantaged areas register and redeem the *least*, while the least disadvantaged areas are overrepresented.

Key findings of the economic evaluation

This economic evaluation measures the benefits of the Program relative to costs. This includes the increase in community sport participation and physical activity that can be directly attributed to the Program, and the impacts of that change. A range of potential benefits of increased activity have been explored, ranging from health and wellbeing, individual development, community development, and economic activity.

Successful uplift in physically active behaviour

Engagement with the Active Kids Program has led to increases in physical activity for the 92 per cent of over 6 000 cohorts (98 per cent of participants).[1] The biggest change was among children that undertook physical activity 7 days a week, which increased by 2.1 percentage points for boys and 1.7 percentage points for girls:

- children aged between 9 and 11 experienced the largest increase in days gained, followed by ages 12 to 14, with a significant decrease for children aged between 15 to 18. The age pattern of days gained was consistent across all SEIFA quartiles
- physical activity increases where higher for those using a voucher for a new activity rather than an existing one
- the greatest increase in physical activity is experienced by children with a disability (approximately 2.06 times higher than those without) and more socioeconomically disadvantaged children (SEIFA 2 followed by SEIFA 1)[2], and

1 Cohorts are groups of children defined by a combination of demographic characteristics. Two per cent of children have been omitted from this analysis because their cohort size was too small to ensure individual confidentiality.

2 SEIFA 1 comprises the lowest 25 per cent of scores for the most disadvantaged areas, and SEIFA 4 contains the highest 25 per cent of scores for the most advantaged areas.

- overweight children benefit substantially more than those that are obese, thin, or of normal weight, as they have a larger increase in days active per week.

Participants that used more vouchers (two per year and over multiple years) experienced higher uplifts in physical activity, indicating that ongoing participation in the Program leads to increased benefits.

Quantified benefits

Health benefits gained

The increase in physical activity attributed to the Program is estimated to have had a measurable impact on physical and mental health, wellbeing, and reduced risk of obesity and other poor physical health outcomes later in life. Physical health benefits (reduced risk of obesity, associated reduced health costs and improved wellbeing, and improved bone health) are valued at $42.7 million over the 2018-2023 evaluation period, and are experienced by 92 per cent of Program cohorts. The impact of the Program on preventing mental health disorders is valued at $25.8 million over the 2018-2023 evaluation period (improved wellbeing, reduced health costs, and improved school attendance and performance), with benefits accruing to 60 per cent of cohorts.

Educational benefits gained

Educational benefits of increased physical activity attributed to the Program (not associated with improved physical and mental health) are valued at $4.5 million, driven by increased school performance and associated higher earnings potential.

Qualitative benefits

Economic benefits

During COVID-19 lockdowns, community sport providers had a substantial reduction in income. Small clubs had an average reduction in revenue of $11 262 (including $3 536 in membership fees) and large clubs had a reduction of $77 549 (including $30 211 in membership fees).

While some services were cancelled, Active Kids vouchers were not required to be repaid, with $8.7 million in vouchers redeemed during 2020 and 2021 lockdowns in NSW. This provided a much-needed financial stimulus to help mitigate the reduction in membership fee revenue. This is expected to have avoided provider closures, although the number of avoided closures cannot be estimated.

Community benefits

Community sport builds resilience in communities and contributes to the development of social capital. Since the beginning of the Active Kids Program, there have been a number of major challenges facing the NSW community, including the Black Summer bushfires in 2019, and COVID-19 related lockdowns and risks in 2020 and 2021. People have had to depend on one another to overcome these challenges and rebuild.

Sport provides protective factors for youth during their years of development and is aided by the network of family and community. In this way, the Active Kids Program has been an important contributor to the development of skills and social networks for children during a difficult period in NSW history.

Community sport also facilitates intersections between communities, networking children and communities across ages, ethnicities, and socio-economic backgrounds. These community benefits are deemed to be attributable to the Active Kids Program but are not amenable to measurement.

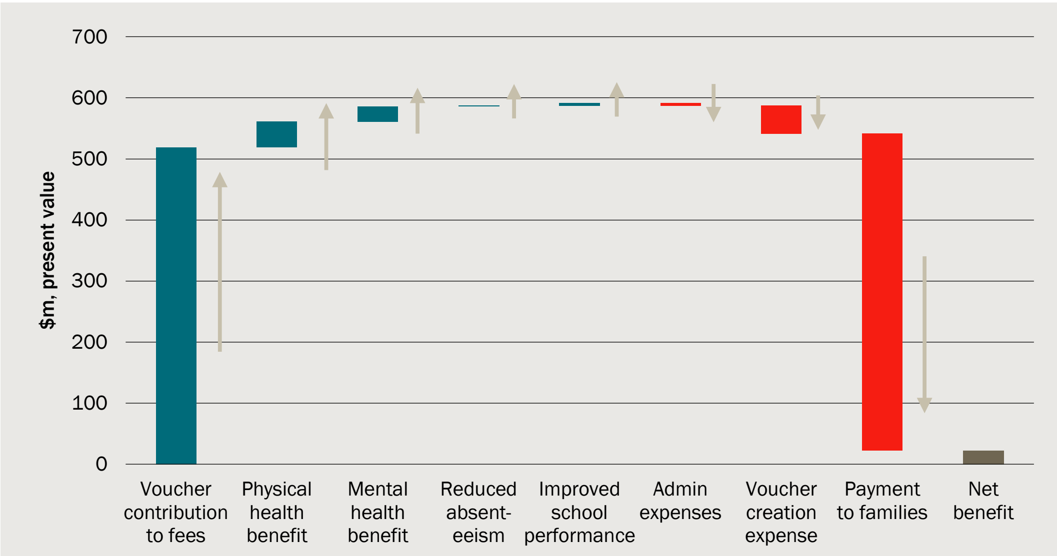
Economic evaluation results

This economic evaluation finds that it has delivered a positive return to the people of NSW to date, and its value is expected to increase over time. For the funded period, $1.04 is returned for every dollar spent.

The largest benefit is the financial relief provided to families to cover membership costs, followed by the benefits of improved physical health, mental health, reduced student absenteeism, and improved school performance. For males and females, benefits per participant are highest for those aged 9 to 11, which is driven by avoided healthcare costs of adult obesity and improved wellbeing outcomes.

Benefits are higher for females than males aged 4 to 8 years old, but for other age groups are higher for males, reflecting a higher increase in total days active.

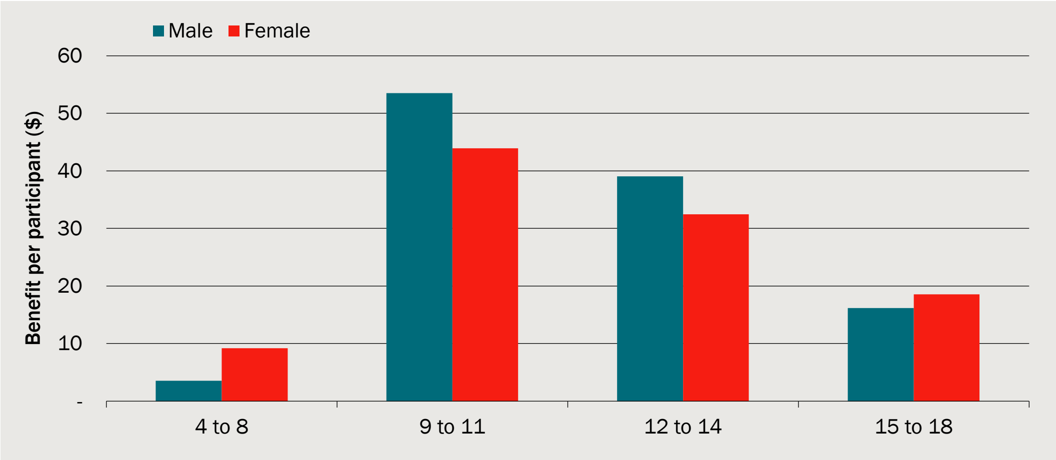
2 Breakdown of net benefit (present value 2018 to 2023)



Note: Discount rate 7 per cent, $2021

Data source: CIE.

3 Benefit per participant (excl. the transfer from the voucher)



Note: Discount rate 7 per cent, $2021. Annual benefit for 2021

Data source: CIE.

These estimates include the longer-term impacts for children that have, or will, participate up until June 2023 by accounting for the lifecycle effects of their participation as children. The key assumptions underpinning these results are summarised in table 4.

4 Key drivers of Active Kids program benefits

Variable	Finding	Source
Increase in physical activity		
Proportion of children that increase physical activity due to the Program per cohort	Over 92 per of cohorts (representing 98 per cent of participants) increased activity due to the Program from 2018 to 2021	Statistical modelling based on Active Kids registration, redemption and survey data
Increase in duration of physical activity per week per cohort	The number of days active per week per cohort increased, with the biggest change among children that undertook physical activity 7 days a week, which increased 2.1 percentage points for boys and 1.7 percentage points for girls	Statistical modelling based on Active Kids registration, redemption and survey data
Physical health benefits		
Decrease in risk of overweight and obesity due to physical activity days	We assume a 7 per cent reduction in risk of overweight and obesity for each activity day gained based on a cross-sectional study by Hong I. et al. (2016)	Hong I. et al. (2016), Relationship Between Physical Activity and Overweight and Obesity in Children: Findings From the 2012 United States National Health and Nutrition Examination Survey National Youth Fitness Survey
Reduction in healthcare costs	$21.4 million in healthcare costs are avoided though reducing the likelihood of children experiencing overweight and obesity due to engaging with the Program	CIE calculations based on: Black N. et al. (2018), The health care costs of childhood obesity in Australia: An instrumental variables approach, Economics & Human Biology, Volume 31, Pages 1-13 Colagiuri S. et al. (2010), The Cost of Overweight and Obesity in Australia

Variable	Finding	Source
Healthcare cost savings	11-17 per cent reduction applied to health care costs for overweight and obese children and 26-44 per cent reduction for overweight and obese adults aged 25-34 . For the ages 6-13 years, annual costs range from $34-$90 per person for overweight and $54-$160 per person for obese. For adults, annual costs range from $1 488 for overweight to $2 547 for obese	Black N. et al. (2018), The health care costs of childhood obesity in Australia: An instrumental variables approach, Economics & Human Biology, Volume 31, Pages 1-13 Colagiuri S. et al. (2010), The Cost of Overweight and Obesity in Australia
Improvement in health wellbeing associated with reduced overweight and obesity	87 equivalent Disability Adjusted Life Years (DALYs) related to overweight and obesity for children and adults aged between 25-34 who participated between 2018 and 2023 are avoided	CIE calculation based on ABS (Australian Bureau of Statistics) 2018. National Health Survey: first results, 2017–18. ABS cat. No. 4364.0.55.001. Canberra: ABS.
Avoided health wellbeing costs associated with overweight and obesity	Wellbeing costs experienced in childhood are measured in DALYs and valued using willingness to pay value of a statistical life. The annual DALY cost per person ranges between $321-$1 469	Office of Best Practice Regulation (2021), Best Practice Regulation Guidance Note: Value of statistical life, https://obpr.pmc.gov.au/sites/default/files/2021-09/value-of-statistical-life-guidance-note-2020-08.pdf
Bone density growth accrual per activity day gained	Bone density growth increases approximately 1 per cent for boys and 2.2 per cent for girls per activity day gained. We assume increased bone density during pre-pubertal years decreases the likelihood of experiencing costs associated with Osteoporosis and Osteopenia from age 65 onwards	Alwis G. et al. (2008), A 2-year school-based exercise programme in pre-pubertal boys induces skeletal benefits in lumbar spine Linden C. et al. (2006), School Curriculum–Based Exercise Program Increases Bone Mineral Accrual and Bone Size in Prepubertal Girls
Avoided Osteoporosis and Osteopenia costs	People suffering from Osteoporosis and Osteopenia incur healthcare costs which approximate to $359-$1 343 per year over the age of 65	Osteoporosis Australia (2013), Osteoporosis costing all Australians A new burden of disease analysis – 2012 to 2022
Mental health benefits		
Risk reduction in psychological distress from increasing physical activity	Increasing activity is associated with a risk reduction of psychological distress (anxiety and depression) from 11 to 54 per cent in adolescents aged 9 to 18	Guddal M. et al. (2019), Physical activity and sport participation among adolescents: associations with mental health in different age groups
Avoided healthcare costs	Children experiencing psychological distress incur higher healthcare costs, ranging between $360 per year for anxiety to $430 per year for major depressive disorder	Khang-Dao Le et al. (2021), The cost of Medicare-funded medical and pharmaceutical services for mental disorders in children and adolescents in Australia
Avoided wellbeing costs associated with psychological distress	Wellbeing costs for children experiencing psychological distress are measured using DALYs and valued using willingness to pay. They range between $6 660 - $22 600 per person per year for mild to moderate anxiety to $31 900 - $55 722 per person per year for mild to moderate depression. Mild experiences of anxiety are 60 per cent of prevalence and mild experiences of depression are 80 per cent of prevalence. In the population of children aged 12-17, anxiety prevalence is 4.4 per cent for boys and 5.5 per cent for girls, while depression is 3.0 per cent for boys and 4.2 per cent for girls	Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019, Human Resources for Health 1990-2019. United States of America: Institute for Health Metrics and Evaluation (IHME), 2022. Australian Government (2020), The Mental Health of Children and Adolescents - Report on the second Australian child and adolescent survey of mental health and wellbeing Supplement to the Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. Lancet 2021

Variable	Finding	Source
Reduced absenteeism		
Reduced absenteeism due to improved physical and mental health	Children experiencing psychological distress miss approximately 20 days per year while children experiencing obesity miss 1.12 days per year. The value of a school day is measured by return on investment from primary/secondary education.	Australian Government (2015), The Mental Health of Children and Adolescents Carello J. et al (2021), Relationship between obesity and school absenteeism in Australian children: Implications for carer productivity
Education benefits		
Increased educational performance	Increasing days physically active is associated with higher Program for International Student Assessment (PISA) scores, increasing from 1 day active with 1.07 points up to 10.78 points for 6 days active (7 days active decreases PISA by 11.81 points). Educational improvement is valued through increased likelihood of employment and a higher wage. A single PISA point increase will increase future earnings by 0.06 per cent and decrease the unemployment rate by 0.04 per cent for males and 0.02 per cent for females	OECD PISA 2018 ABS Employee Earnings and Hours, Australia, May 2021, Table 2 ALL EMPLOYEES, Number of employees, Average weekly total cash earnings–Age category, Employment status by Sex (21 to 34 years old)

Source: CIE.

Looking forward, each year, more registration, redemption and survey data becomes available, which can be used to update the statistical modelling that measures the increase in physical activity attributable to the Program by cohort. It is recommended that this be done by at least the end of the current funded period (June 2023) to update and confirm the Program's impact.

Robustness of results

This evaluation draws on a linked dataset of registration and voucher redemption data paired with participant survey information over 2018-2021. Statistical analysis has been used to pinpoint changes in physical activity attributable to the Program, and associated outcomes for children of a particular age, gender, weight range, location, and various other characteristics. Benefits are calculated across various impact domains in line with the Human Services Outcomes Framework of the NSW Government.

In total, the linked dataset upon which this economic evaluation is based contains 956 957 observations of 168 321 unique children. On average, the linked dataset contains data of over 100 000 children per year, ensuring a consistent and comprehensive longitudinal dataset to track individual children over multiple years.

Output of the statistical model was a primary input to the cost-benefit analysis (CBA) model, providing information on 6 000 population cohorts, defined as a unique combination of demographic characteristics and individual physical activity levels before and after engaging with the Program.

Sensitivity analysis has been undertaken to test how results change when:

- alternative parameter values are chosen

- the time period of the Program is extended, and
- the number of beneficiaries (but not costs) of the Program is reduced in some way.

It finds that the benefits of the Program outweigh the Program costs in almost all cases.

It is noted that the Headline results draw on parameter values that are considered conservative and the most appropriate. These comparisons are provided for information only. It is also noted that Sensitivity 5 that extends Program duration (extending costs, and the number of children that participate) increases the benefit cost ratio to 1.08.

5 Results of sensitivity analysis of underlying parameters

Sensitivity Case	Phys. health	Mental health	Absent-eeism	Educ-ation	Voucher contrib.	Total benefit	Total costs	Net benefit	BCR
	$m	$m	$m	$m	$m	$m	$m	$m	
Headline results	42	25	1	4	519	**592**	**-570**	**22**	**1.04**
1. Low discount rate (3%)	42	25	1	4	506	**579**	**-555**	**24**	**1.04**
2. High discount rate (10%)	42	25	1	5	530	**602**	**-582**	**21**	**1.04**
3. Inclusion of the deadweight loss of taxation	42	25	1	4	519	**592**	**-678**	**-86**	**0.87**
4. Reduction in the value of a disability adjusted life year	29	8	1	4	519	**561**	**-570**	**-9**	**0.98**
5. Extension of program costs and beneficiaries for 10 years from current dataset (2031)	116	67	3	11	1 093	**1 291**	**-1 195**	**95**	**1.08**
6. Limiting beneficiaries to those undertaking a 'new' activity	33	20	1	3	519	**576**	**570**	**7**	**1.01**
7. Limiting beneficiaries to only those participating for financial reasons	28	16	1	2	519	**565**	**570**	**4**	**0.99**
8. Scaling down benefits to the % for which the voucher covered membership fees	24	14	1	2	519	**560**	**570**	**10**	**0.98**

Note: $2021. BCR = Benefit Cost Ratio.

Source: CIE.

It is also noted that this analysis includes the $100 voucher value as a cost to the Program, and a benefit payment to families. Removing this transfer from the analysis would result in a substantial increase in the BCR.

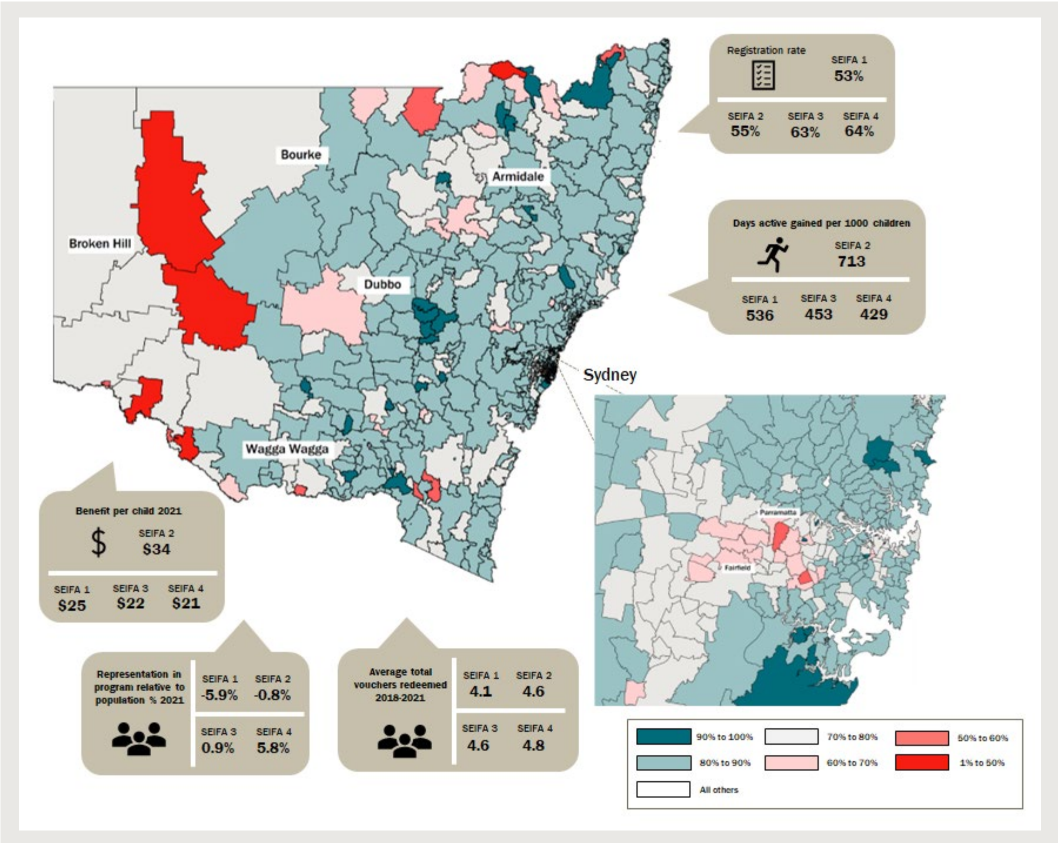
Profile of distributional impacts

This economic evaluation reveals that children from lower socio-economic areas benefit more from Program engagement because they:

- **display a higher number of active days due to participation in the Program** relative to those from higher socio-economic areas — participants from Socio-Economic Indexes for Areas (SEIFA) 2 gained 713 days active per 1 000 children, compared to 429 days active per 1 000 children from SEIFA 4
- **are at higher risk** of being overweight or obese, and therefore obtain a greater benefit from an increase in physical activity by addressing underlying health issues, and
- **face higher financial barriers** to participating in community sport and are more encouraged to participate due to the voucher.

However, the registration rate for SEIFA 1 is 11 per cent lower than SEIFA 4. Of those that redeemed at least one voucher, there are 5.9 per cent less participants than would be indicated by the share of SEIFA 1 children in the population. When redeeming, children in SEIFA 1 redeem 4.1 vouchers per participant, compared with 4.8 vouchers redeemed for children in SEIFA 4. Interventions that encourage uptake in these areas should maximise the value of the Program.

6 Snapshot of distributional impacts



Data source: CIE.

1 Overview of the Active Kids program

The Active Kids Program is a universal voucher program providing payments to families to promote the engagement of children in community sport and increase their physical activity. This economic evaluation of the Program assesses the benefits of the program since 2018, relative to its cost.

About the Active Kids program

The Active Kids Program was launched on 31 January 2018 by the NSW Government.

It aims to increase participation of school-enrolled children in structured sport and physical activity, and to instil healthy lifestyle habits. The program provides $100 vouchers to parents and carers and can be used to reduce the cost of registration, participation, and membership costs for sport with registered providers.

Since 2018, over 4.4 million vouchers have been created, with 1.2 million created since the start of 2021 alone.

In the first year, parents, carers, and guardians of school-enrolled children could register for one $100 voucher per child each calendar year. In 2019, the program was extended to two $100 vouchers, with voucher one valid from January to December and the second voucher valid from July to December in the same calendar year. With this change, the NSW Government Budget commitment to the program was $291 million over four years (within the 2019-20 budget).[3]

To be eligible for the Program, a child must be between the ages of 4.5 and 18, have a current Medicare card, reside in NSW, and be enrolled in school from Kindergarten to Year 12, including home-schooling and secondary school education at TAFE NSW. To register for an Active Kids voucher, adults/caregivers must register online through the NSW Government online platform each year.

Eligible activities must be provided as part of an organised program of at least 8 weeks' duration and involve moderate or vigorous levels of physical activity. These activities include recognised sports, swimming lessons, structured fitness programs, outdoor recreation programs, and approved active recreation (e.g., dance).

The program is the first universal voucher program of its kind in Australia. It is an innovative approach to promoting participation in structured physical activity and sport outside-of school among all school-enrolled children in NSW.

3 See NSW Budget: Active Kids the winners in this year's sports budget, http://NSWliberal.org.au/ACTIVE-KIDS-THE-WINNERS-IN-THIS-YEAR'S-SPORT-BUDGET.

Targeting an arrest in declining physical activity among children

To achieve health benefits from physical activity, latest available evidence indicates that children and young people need to achieve the minimum level of activity set out in Australia's evidence-based Physical Activity and Sedentary Behaviour Guidelines.

Activity targets by age are summarised in table 1.1.

1.1 Summary of Australian Physical Activity and Sedentary Behaviour Guidelines

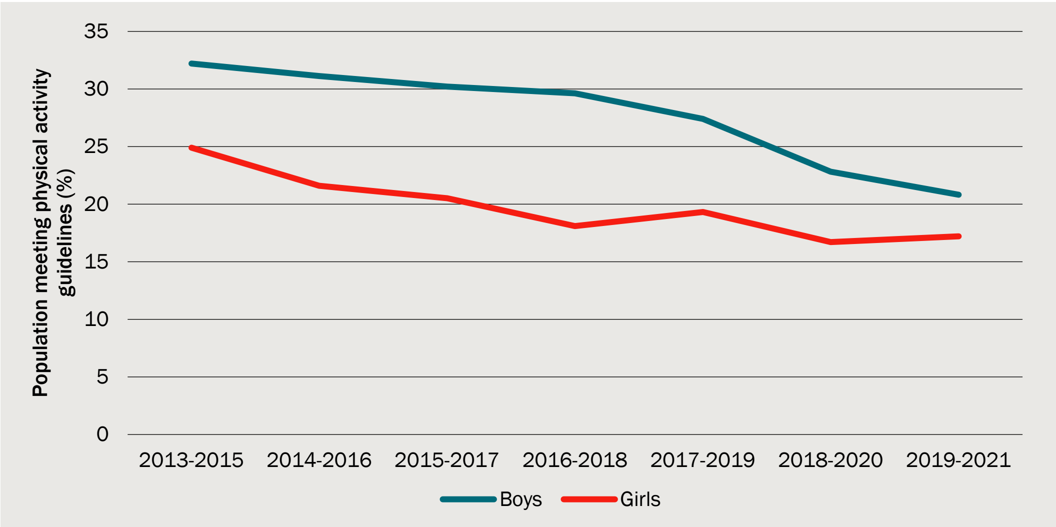
	Ages 2-5[a]	Ages 5-12[b]	Ages 13-17	Ages 18-64	Ages 65 and over
Physical activity	At least 180 minutes per day	At least 60 minutes per day	At least 60 minutes per day	At least 150 minutes over 5 sessions per week	At least 30 minutes per day
Sedentary of screen-based activity	Should not be restrained for more than 60 minutes at a time, and no more than 60 minutes of sedentary screen time per day	No more than 120 minutes of screen use. Break up long periods of sitting	No more than 120 minutes of screen use. Break up long periods of sitting	Minimise and break up prolonged periods of sitting	Be as active as possible
Strength	N/A	Muscle strengthening activities 3 times a week	Muscle strengthening activities 3 times a week	Muscle strengthening activities 2 times a week	Incorporate muscle strengthenin g activities

[a] Includes those aged 5 that are not yet in full-time schooling. [b] Includes those aged 5 that are in full-time schooling.

Source: Australian Institute of Health and Welfare (AIHW) 2018. Physical Activity Across the Life Stages. Cat. no. PHE 225, Canberra, AIHW.

Prior to the Program, the percent of boys and girls in NSW meeting physical activity guidelines had been decreasing, with girls consistently less active than boys (chart 1.2).

1.2 Children aged 5-15 meeting physical activity guidelines



Note: Adequate physical activity: For children (5-15), it is defined as 1 hour or more of vigorous or moderate physical activity outside of school hours each day. Multiple survey years have been combined each year to allow for more granular reporting.

Data source: NSW Population Health Survey, SAPHaRI. Centre for Epidemiology and Evidence, NSW Ministry of Health.

The NSW Health Survey reported that between 2013-15 and 2019-2021, there was a 11.4 percentage point decline in boys aged between 5 and 15 undertaking 1 hour or more of vigorous or moderate physical activity outside of school hours each day. Girls experienced a 7.7 percentage point decline over the same period.[4]

In 2018, the Australian Institute of Family Studies Longitudinal Study of Australian children reported that:

- just one in seven children met the physical activity guidelines (15 per cent on weekdays and 16 per cent on weekends)
- children recorded an average of 32 minutes of physical activity on weekdays and 30 minutes per day on weekends, and
- girls were less likely to meet the physical activity guidelines than boys (93 per cent of girls where not meeting the guidelines on weekdays, and 89 per cent were not meeting the guidelines on weekends, compared to 76 per cent and 79 per cent for boys respectively.[5]

Engagement of children with the program

Registrations and redemptions

The Active Kids Program has been widely embraced across NSW since its inception. Since 2018, registrations have increased from over 665 000 to over 855 000 in 2021. Program reach (voucher redemptions) climbed strongly after the first year, and has been maintained at a high level (chart 1.1):

The majority (over 70 per cent) of registrations occur in the first quarter. While Covid 19-related restrictions had an impact on monthly registrations over the course of the year (chart 1.2), on an annual basis registrations have climbed consistently.

Redemptions peaked in 2019 (1.1 million redemptions) but remained high in the Covid-19 pandemic years with approximately 1 million vouchers redeemed annually. On average, over 65 per cent of the first vouchers are redeemed in the first quarter, and second vouchers are more evenly redeemed throughout the second half of the year.

The marginal reduction in voucher redemptions in 2020 and 2021 is attributed to lockdowns in NSW. For instance, first voucher use from March to June 2020 (when NSW locked down after the Victorian outbreak) was lower than the same period in 2019, and second voucher use from July to September 2021 (when NSW experienced the Delta wave) was lower than the same period in 2019 and 2020.

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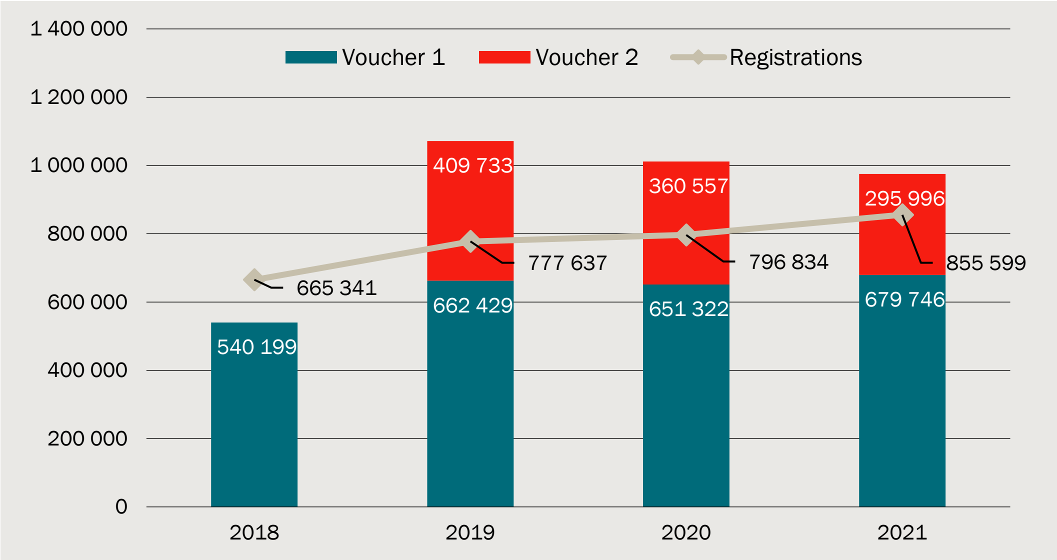
4 NSW Population Health Survey, SAPHaRI. Centre for Epidemiology and Evidence, NSW Ministry of Health, *Table 4: Adequate physical activity by age group and sex, persons aged 5-18 years, NSW 2013-2015 to 2019-2021,* Data provided by NSW Health

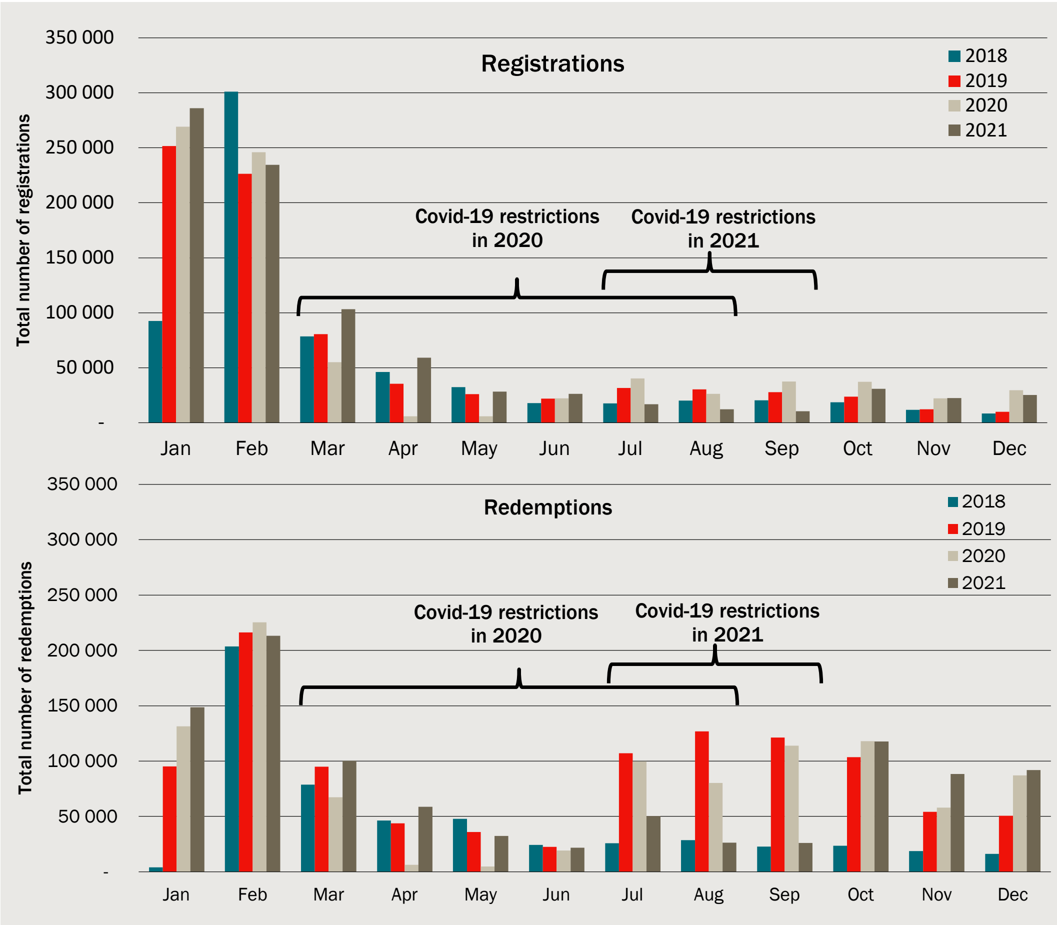
5 Gasser, C., Evans-Whipp, T. and Terhaag, S. (2018), 'The Physical Health of Australian Children' in G. Daraganova and N. Joss (Eds.), Growing Up In Australia – The Longitudinal Study of Australian Children, Annual Statistical Report 2018. Melbourne: Australian Institute of Family Studies, p.12

1.3 Registrations and voucher redemptions from 2018 to 2021



Data source: Office of Sport, Active Kids Registration and Redemption data 2018-2021, CIE

1.4 Monthly registrations and voucher redemptions from 2018 to 2021



Data source: Office of Sport, Active Kids Registration and Redemption data 2018-2021, CIE

Program reach

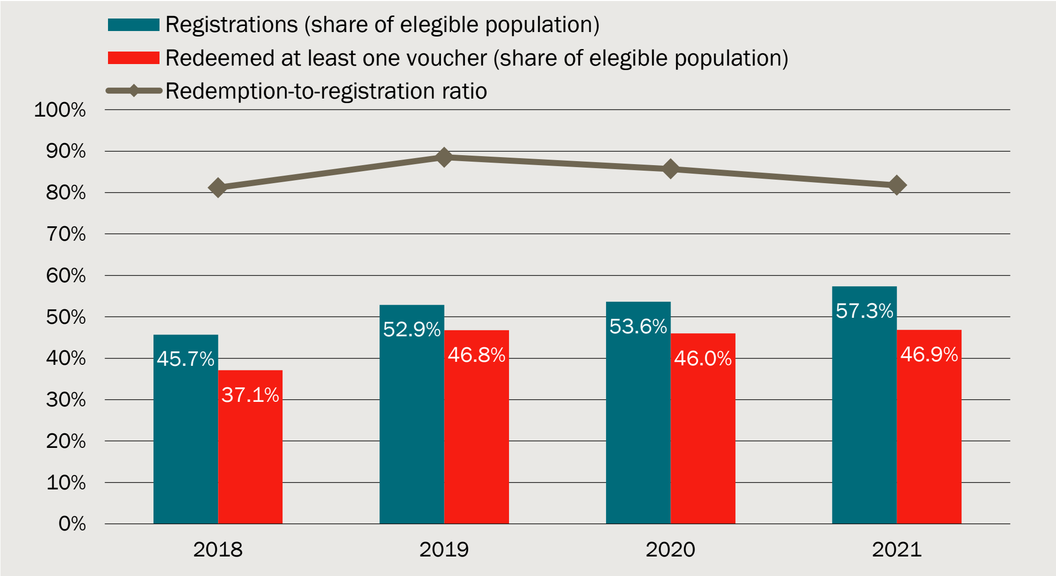
The Program has a wide reach across NSW.

In its first year, the program achieved a 46 per cent registration rate, which increased to over 57 per cent of the total eligible NSW population in 2021.

While there was a marginal softening in annual redemptions in both years of the pandemic, the share of the eligible population redeeming at least one voucher was highest in 2021 (over 47 per cent), representing a 10-percentage point increase since the first year of the Program.

The Program has maintained a high redemption-to-registration ratio of over 80 per cent.

1.5 Registrations and redemptions as a share of eligible population



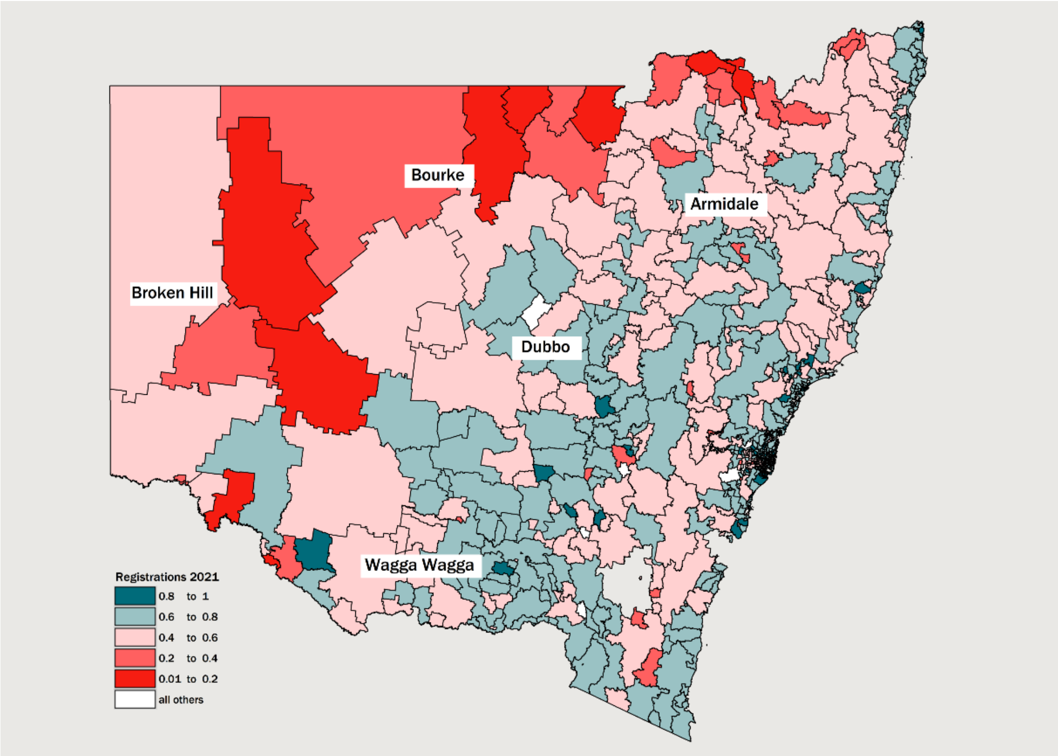
Data source: Office of Sport, Active Kids Registration and Redemption data 2018-2021; ABS Census 2016, ABS Quarterly Population Estimates (ERP), by State/Territory, Sex and Age; CIE.

Registrations by postcode

Registrations are variable across the State with close to comprehensive access in large population centres and lower, more patchy access elsewhere. Chart 1.4 shows registrations as a share of population for each postcode in 2021. Postcodes with red shading show low registration rates, with the lowest levels of engagement with the Program clustering towards the west of the State. Population centres such as Dubbo, Wagga, Bathurst, and Orange experienced substantially higher registrations than their more regional/remote neighbours. Approximately 40 per cent of postcodes across the State had registration rates below 60 per cent.

Within Sydney postcodes, registrations were generally much higher, as indicated by the number for blue shaded postcodes in chart 1.6. Registration rates are particularly high in the eastern and northern postcodes (which are generally more affluent) and are much lower in a belt that extends west between Parramatta and Fairfield (which are generally more culturally diverse and less affluent).

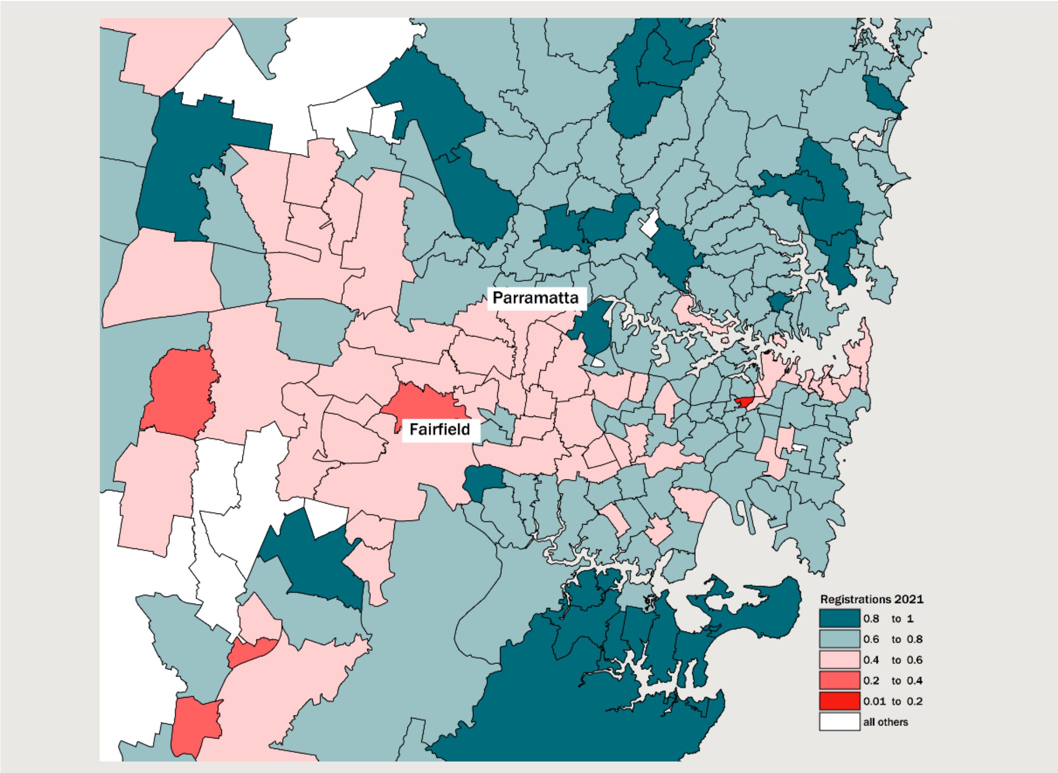
1.6 Active Kids registrations across NSW postcodes in 2021



Note: Legend shows share of registration to population 1=100%

Data source: CIE.

1.7 Active Kids registrations across Sydney postcodes 2021



Data source: CIE.

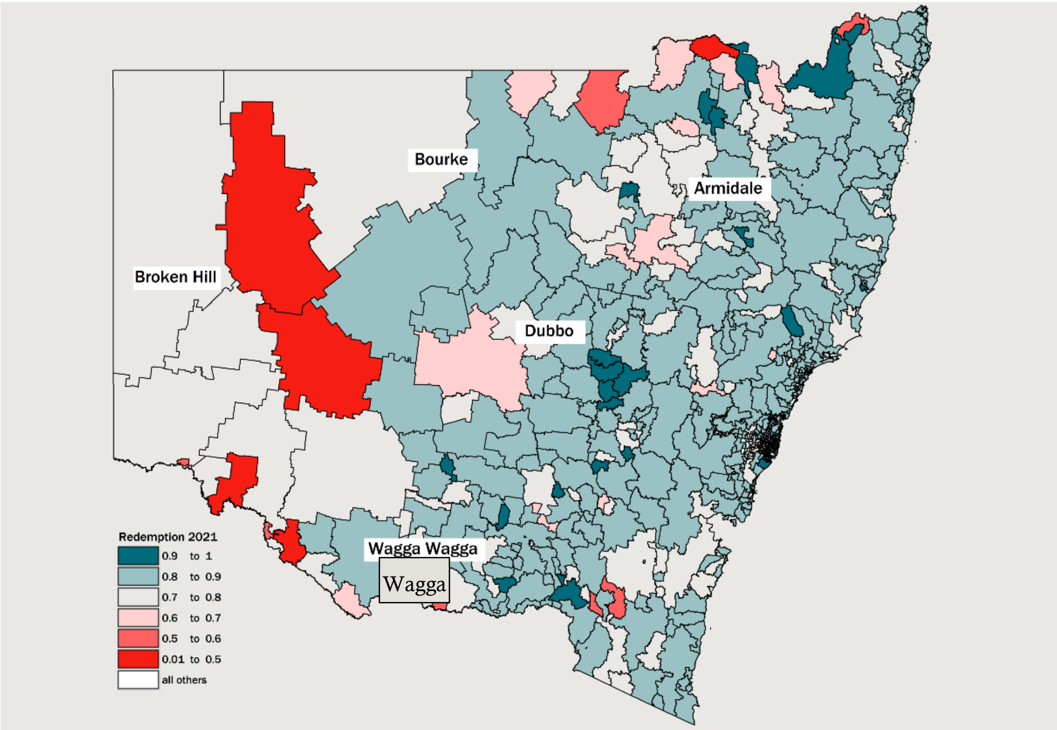
Redemptions by postcode

Across the State, voucher redemptions are high, with approximately 91 per cent of postcodes having redemption rates above 80 per cent.

However, there is a similar variation in redemption rates by postcode with the west of NSW having more postcodes redeeming less than 80 per cent of vouchers than elsewhere, and higher redemption rates clustered around more densely populated centres.

For the Sydney postcodes, the same trend applies, where the belt west of the State between Parramatta and Fairfield has the highest number of postcodes with less than 80 per cent of vouchers redeemed, and higher redemption rates in the higher socio-economic eastern and northern regions of Sydney.

1.8 Active Kids voucher redemptions across NSW postcodes 2021

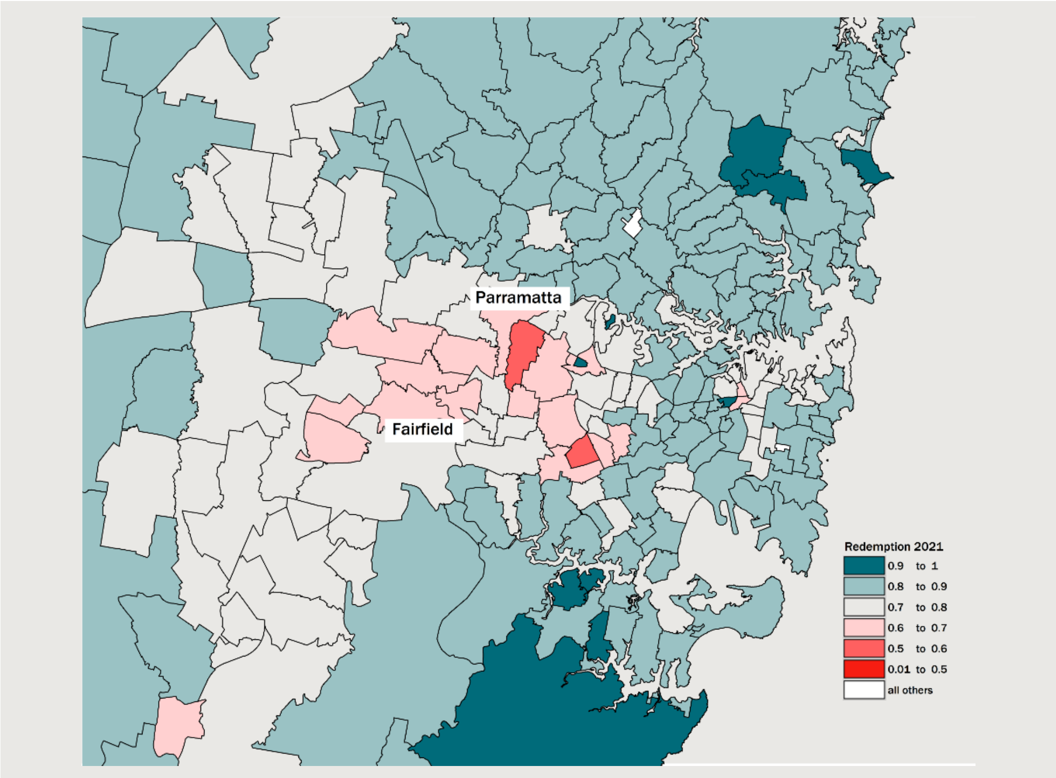


Note: Legend shows share of registration to population 1=100%
Data source: CIE.

It is noted that over the course of the COVID-19 pandemic, State and Local Governments imposed temporary restrictions that impacted on community sport, including physical distancing.

Statistical analysis has been undertaken to ensure that this has not substantially compromised the dataset for the purpose of this economic evaluation. In 2020 and 2021, registrations increased in line with previous years although voucher redemptions dipped relative to pre-Covid years. In general, we observed an average increase in physical activity levels throughout the pandemic period and relatively stable voucher redemptions.

1.9 Active Kids voucher redemptions across Sydney postcodes 2021



Note: Legend shows share of registration to population 1=100%
Data source: CIE.

Demographic characteristics of children engaging with the program

By and large, children who registered for the Program are representative of all children in NSW. Comparing children who registered with those (eligible) in all of NSW:

- there is a slight overrepresentation of males in the Program, although the difference has diminished over the years of the Program
- there are more younger children (4 to 8 and 9 to 11), and less adolescents, registered than there are eligible children, reflecting the more active behaviours of younger children, and diminishing active behaviours of young persons
- First Nations children are registered in line with their share in the NSW population
- children with an identified disability have a higher rate of registration than their representation among all children
- there is an overrepresentation of children with obesity in Program compared to all NSW children. This may reflect higher rates of younger children (who have higher rates of obesity), and a higher propensity for families to register children that are obese
- In 2021, children from regional and remote regions registered in line with their distribution across NSW, having previously been overrepresented since 2018, and
- there is a strong socio-economic gradient among Active Kids participants. Children from more disadvantaged areas register and redeem the *least*, while the least disadvantaged areas are overrepresented.

1.10 Characteristics of children registered in the Active Kids program

	2018	2019	2020	2021	NSW Reference
	%	%	%	%	%
Gender					
Female	46.1	47.3	47.5	47.7	48.6
Male	53.9	52.7	52.5	52.3	51.4
Age group					
4 to 8	40.2	41.1	40.4	40.5	34.3
9 to 11	27.6	26.8	26.2	25.5	20.7
12 to 14	20.6	20.4	20.9	20.8	20.2
15 to 18	11.6	11.7	12.5	13.2	24.9
First Nation status					
First Nation	5.4	5.4	5.5	6.1	5.6
Non-First Nation	94.6	94.6	94.5	93.9	94.4
Identified disability					
No	97.3	97.2	96.5	96.1	96.9
Yes	2.7	2.8	3.5	3.9	3.1
Primary language spoken					
English[a]	92.5	91.5	91.0	90.4	78.8
Other[a]	7.5	8.5	9.0	9.6	21.2
BMI category					
Thin/Healthy	73.4	68.3	68.4	67.0	74.9
Overweight	17.9	18.8	18.7	19.3	18.9
Obesity	8.7	12.9	12.9	13.7	6.2
Remoteness area					
Major Cities	72.4	75.1	76.3	75.9	75.3
Inner regional	19.1	18.8	18.3	18.3	19.1
Outer regional and remote	8.5	6.1	5.5	5.8	5.6
Socio-Economic disadvantage (postal area based)					
1st (least)	16.3	16.2	15.7	16.4	20.8
2nd	23.0	22.4	21.7	21.8	22.8
3rd	26.1	26.3	26.6	26.7	25.9
4th (most)	34.6	35.0	36.0	35.1	30.5

[a] Based on registration form which asks for 'main language spoken at home', which is different to the question in the ABS Census.

Note: NSW Reference is based on the estimated residential population in 2021, while demographic characteristic such as First Nation status, disability, or primary language spoken at home are based on the shares from the ABS Census 2016. It is noted that registration data on children with a disability refers to the question 'Does the student have a disability,' while the Census asks whether the person 'has need for assistance with core activities.'

Source: Office of Sport, Active Kids Registration and Redemption data 2018-2021; ABS Census 2016, ABS Quarterly Population Estimates (ERP), by State/Territory, Sex and Age; CIE analysis.

1.11 Characteristics of children redeeming at least one voucher

	2018	2019	2020	2021	NSW Reference
	%	%	%	%	%
Gender					
Female	45.2	47.0	46.9	47.0	48.6
Male	54.8	53.0	53.1	53.0	51.4
Age group					
4 to 8	41.4	42.2	41.2	41.6	34.3
9 to 11	28.3	27.3	26.7	26.4	20.7
12 to 14	20.1	19.9	20.6	20.5	20.2
15 to 18	10.3	10.6	11.4	11.6	24.9
First Nation status					
First Nation	5.2	5.2	5.3	5.7	5.6
Non-First Nation	94.8	94.8	94.7	94.3	94.4
Identified disability					
No	97.6	97.4	96.8	96.6	96.9
Yes	2.4	2.6	3.2	3.4	3.1
Primary language spoken					
English[a]	93.3	92.0	91.8	91.4	78.8
Other[a]	6.7	8.0	8.2	8.6	21.2
BMI category					
Thin/Healthy	73.9	68.8	69.0	67.9	74.9
Overweight	17.7	18.6	18.5	19.0	18.9
Obesity	8.4	12.6	12.5	13.1	6.2
Remoteness area					
Major Cities	72.5	75.0	76.3	75.6	75.3
Inner regional	19.4	19.0	18.4	18.6	19.1
Outer regional and remote	8.0	5.9	5.3	5.8	5.6
Socio-Economic disadvantage (postal area based)					
1st (least)	15.2	15.4	14.8	14.9	20.8
2nd	23.2	22.5	21.8	22.0	22.8
3rd	26.3	26.4	26.7	26.8	25.9
4th (most)	35.3	35.7	36.8	36.3	30.5

[a] Based on registration form which asks for 'main language spoken at home', which is different to the question in the ABS Census.

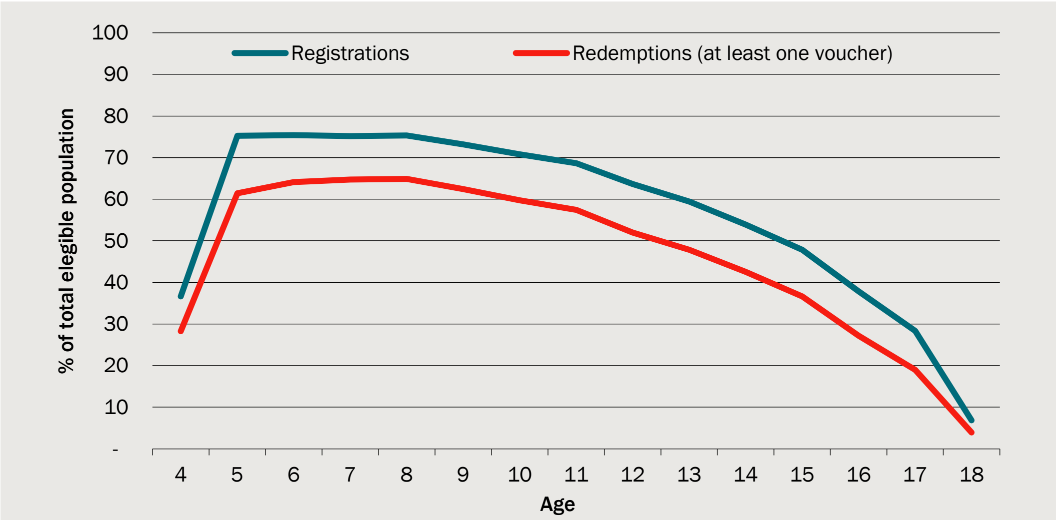
Note: NSW Reference is based on the estimated residential population in 2021, while demographic characteristic such as First Nation status, disability, or primary language spoken at home are based on the shares from the ABS Census 2016. It is noted that registration data on children with a disability refers to the question 'Does the student have a disability,' while the Census asks whether the person 'has need for assistance with core activities.'

Source: Office of Sport, Active Kids Registration and Redemption data 2018-2021; ABS Census 2016, ABS Quarterly Population Estimates (ERP), by State/Territory, Sex and Age; CIE analysis.

Participation by age

The Active Kids registration data shows that engagement with the Program remains relatively constant between the ages of 5 to 11, at a little under 80 per cent of the total eligible population, with redemptions a little over 60 per cent, with notable reductions in Program engagement from older children (chart 1.12).[6]

1.12 Program engagement by age, 2018-2021



Source: Office of Sport, Active Kids Registration and Redemption data 2018-2021; ABS Census 2016, ABS Quarterly Population Estimates (ERP), by State/Territory, Sex and Age; CIE.

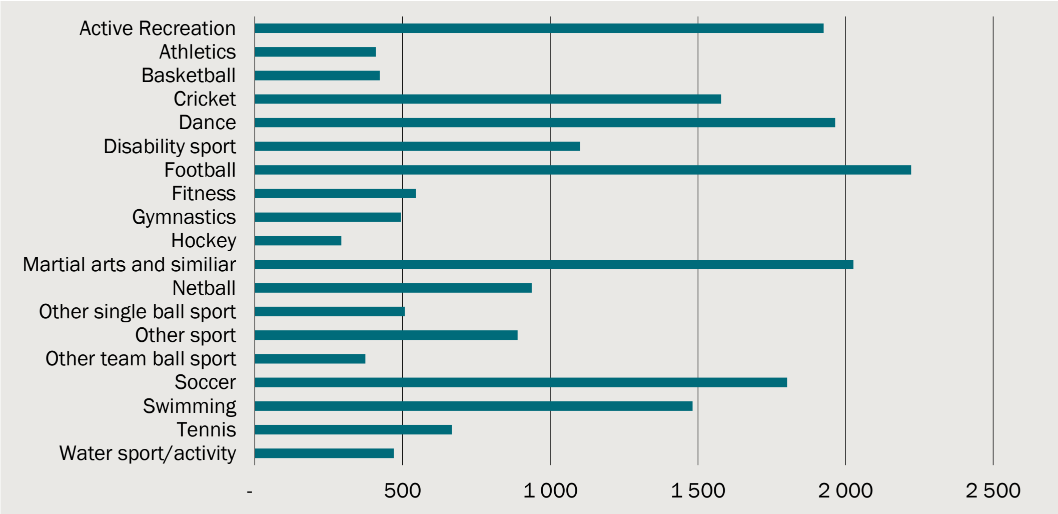
Provider engagement

Vouchers can only be redeemed at accredited providers which are registered on the Active Kids platform. To be eligible, providers need to offer eligible activities which are provided as part of a structured program of at least 8 weeks' duration and involve regular levels of physical activity. Providers can be either sporting clubs /associations affiliated with a recognised State Sporting Organisation, or for-profit or not-for-profit activity providers located in NSW.

The Active Kids platform has 12 369 accredited providers, while over 9 410 joined in 2018. From 2019 to 2021, 1 590, 817 and 552 new providers were accredited, respectively. Providers offer a variety of eligible activities. Active Recreation, Dance, Football, Martial arts and similar, and Soccer providers each make up approximately ~9 to 11 per cent of the total, followed by Cricket (8 per cent), Swimming (7 per cent), and Disability sport (5 per cent) (chart 1.13).

6 Program engagement is somewhat lower than participation rates recorded in the AusPlay survey, which indicates 79 per cent of children aged 5-8 and 86 per cent children aged 9-11 participated in sport-related physical activity in 2021. However, this partly reflects the eligibility conditions for sporting providers to register for the Program. See AusPlay (2022), National data tables - January 2021 to December 2021, *Table 13 Sport or non-sport related participation (children),* available at: https://www.clearinghouseforsport.gov.au/research/ausplay/results

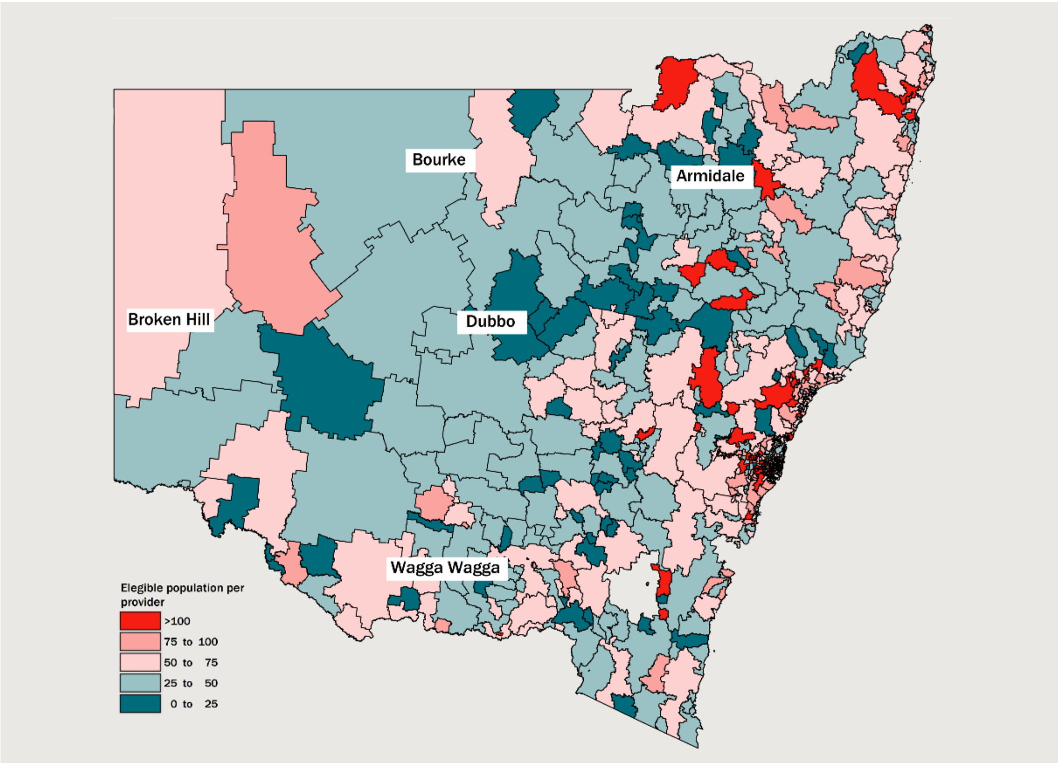
1.13 Total number of accredited providers, by activity



Data source: Office of Sport.

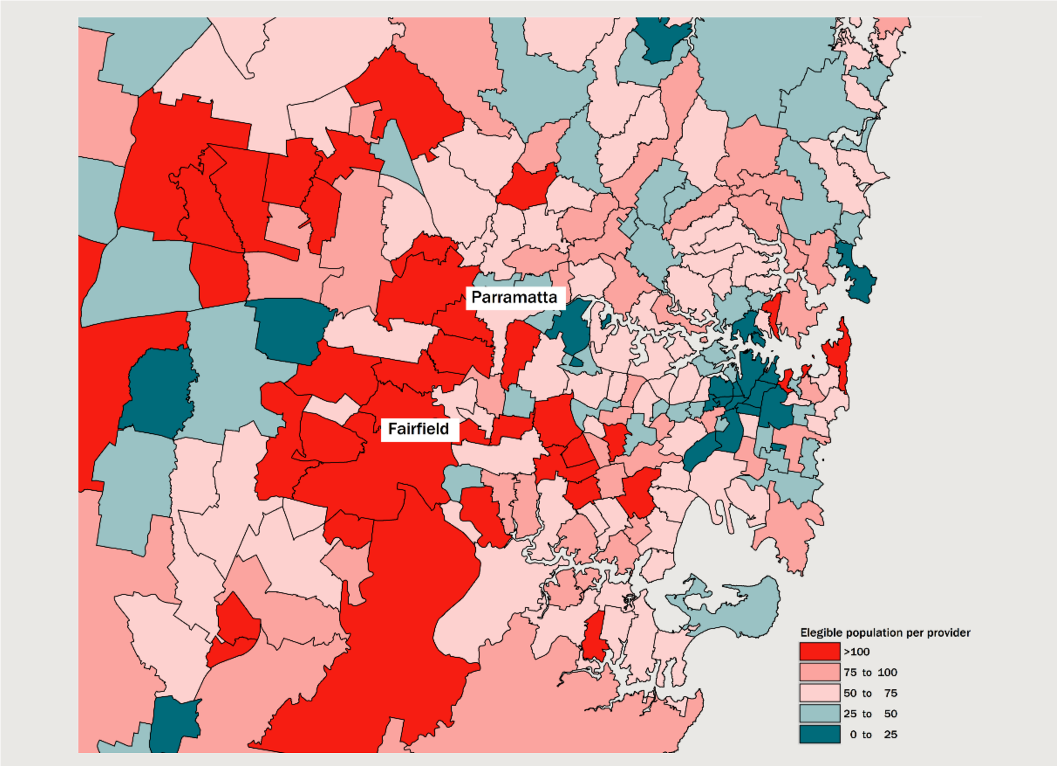
Sixty per cent of providers are registered in Greater Sydney and 70 per cent are located in a major city (charts 1.14 and 1.15). Postcodes with red shading show a high number of children per provider, with fewer registered providers clustering outside urban centres in regional areas such as Moree Plains, Mid-Western regional and Kyogle. Population per provider is lower in eastern and northern postcodes, and higher in Western Sydney.

1.14 Provider density NSW postcode (eligible population per provider), 2021



Data source: CIE.

1.15 Provider density Sydney postcodes (eligible population per provider), 2021



Data source: CIE.

Purpose of this review

This economic evaluation measures the benefits of the Program, relative to the costs. This means the increase in community sport participation and physical activity that can be directly attributed to the Program, and the impacts of that change.

A range of benefits of increased activity have been explored, ranging from health and wellbeing, individual development, community development, and economic activity.

With the Program funded until June 2023, this report informs the continuous improvement of the Program, and provides evidence to support its extension.

This economic evaluation has drawn from the existing program logic and outcome evaluation undertaken by the Sport and Active Recreation Intervention and Epidemiology Research (SPRINTER) group, and the available data gathered through the ongoing management of the Program.

2 Evaluation methodology

This evaluation draws on a linked dataset of registration and voucher redemption data paired with participant survey information over 2018-2021. Statistical analysis has been used to pinpoint changes in physical activity attributable to the Program, and associated outcomes for children of a particular age, gender, weight range, location, and various other characteristics.

Identifying costs and benefits

The program logic for the Active Kids program was developed in collaboration between SPRINTER and the NSW Government in 2017, before the launch of the Program. The model defines the inputs, activities, outputs, and key impacts that are relevant for the Program's process evaluation or outcome evaluation (chart 2.1).

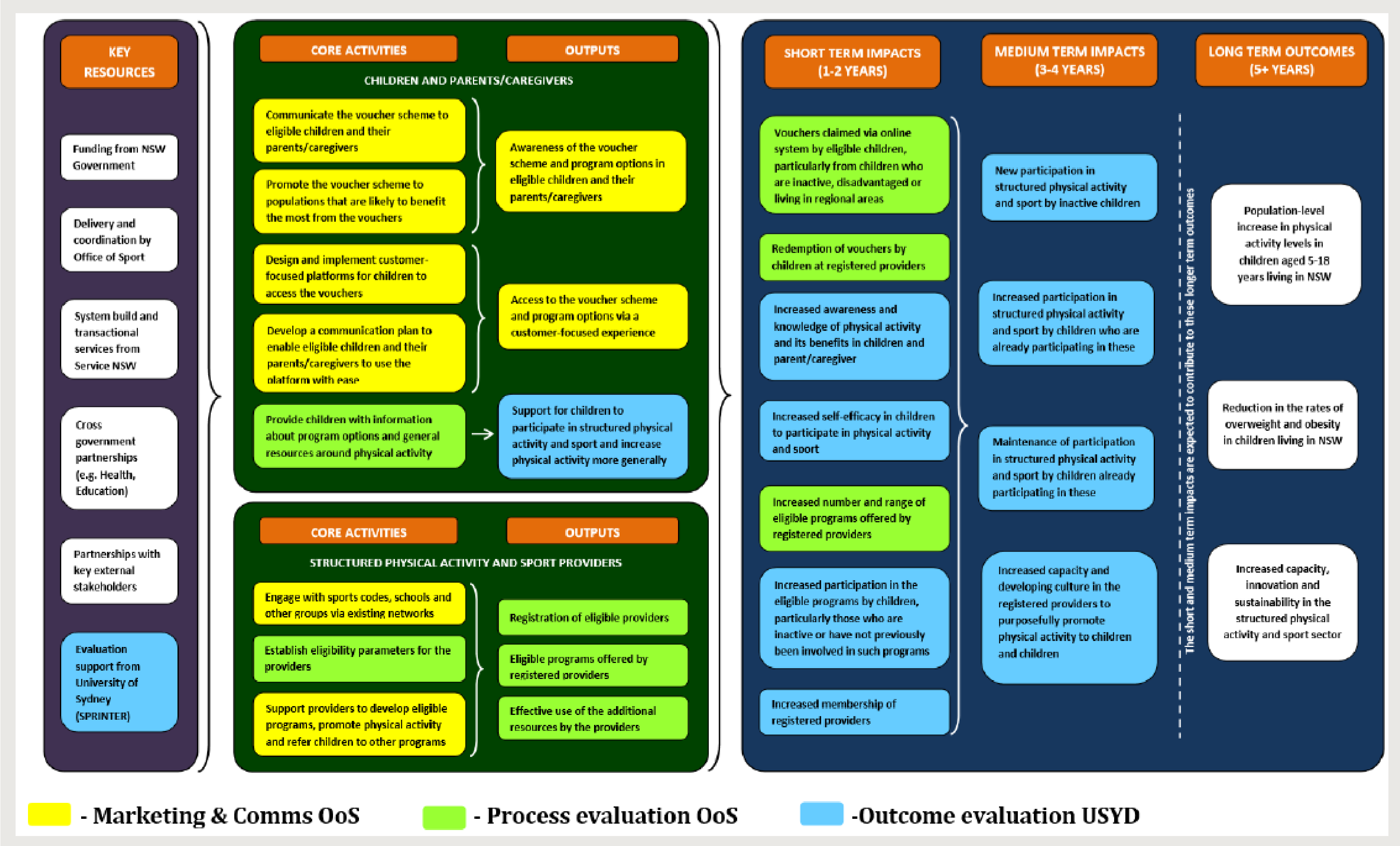
This review has extended this framework to identify the economic impact resulting from short and longer-term outcomes. For example, the 5+ year long term objective of increasing physical activity for those aged 5 to 18 has been extended to consider how it might improve quality of life and change healthcare expenditure.

Economic impacts associated with the program logic have been developed to align to the Human Service Outcome Framework (HSOF),[7] considering economic benefits across health, safety, empowerment, economic, housing, community and education domains.

Health, education, and economic outcome domains were confirmed as the predominate benefit of the Program. There are also economic, safety and community benefits, although they are considered qualitative, or not amenable to quantification, and are not included in the cost benefit analysis.

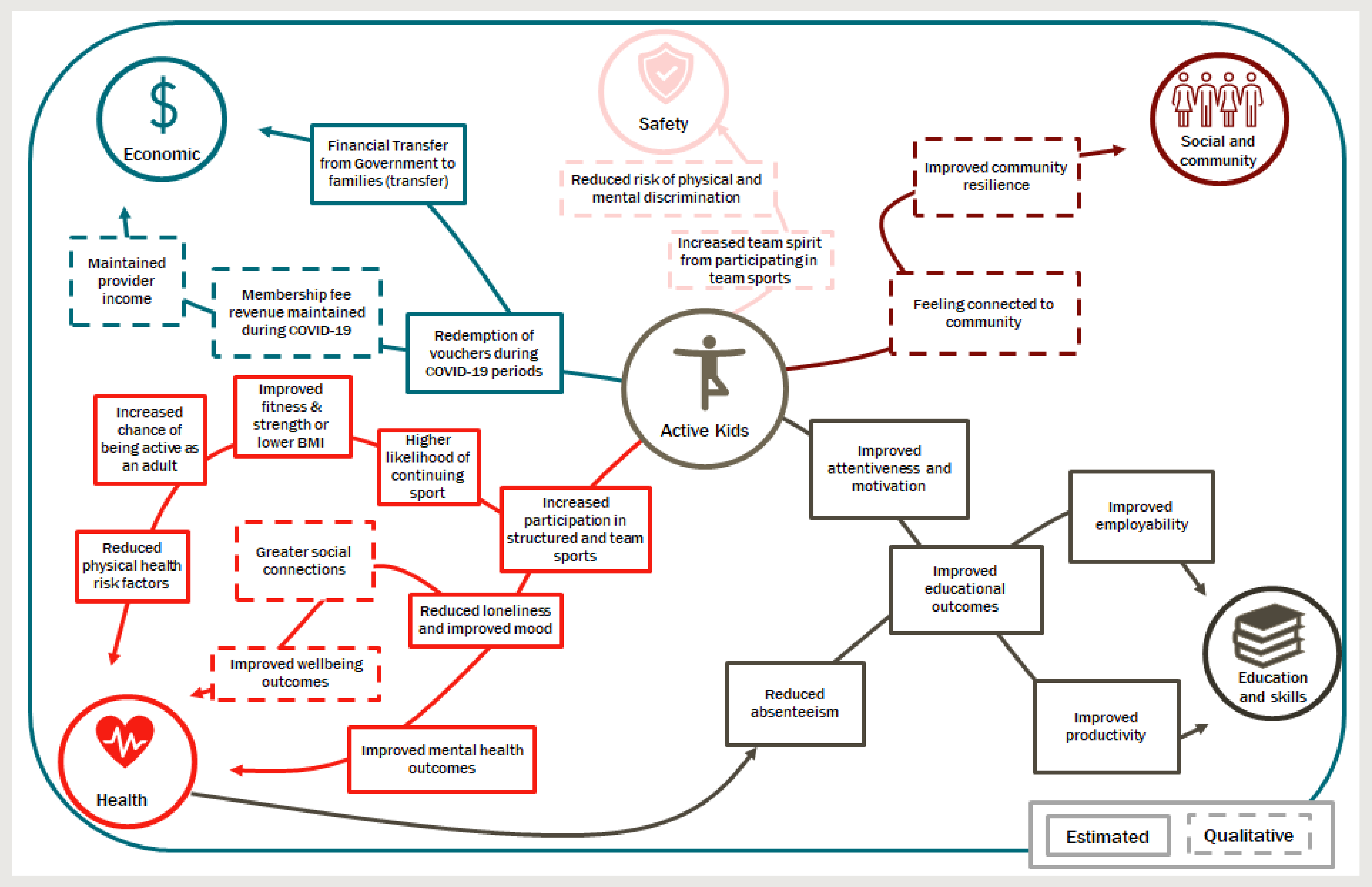
7 Communities & Justice, The NSW Human Services Outcome Framework, NSW Government, see https://www.facs.nsw.gov.au/resources/human-services-outcomes-framework/what-is-the-nsw-human-services-outcomes-framework

2.1 Active Kids program logic



Source: SPRINTER Group 2021, Active Kids Evaluation Report 2018-2019, University of Sydney.

2.2 Active Kids outcome pathways



Source: CIE.

Linked dataset used for the analysis

The economic evaluation is based on statistical analysis of a linked dataset including:

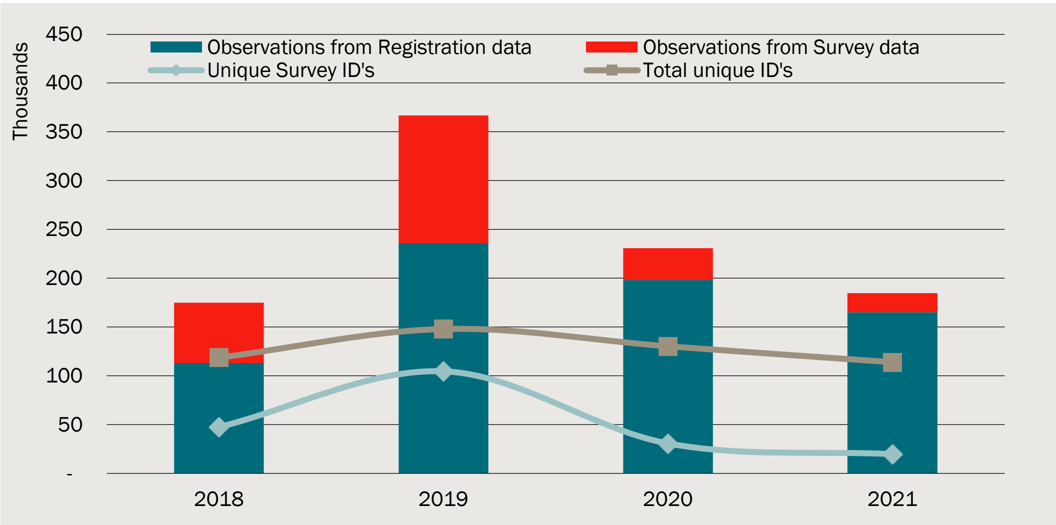
- the evaluation survey designed by SPRINTER Group (hereafter, *survey data*). This survey was sent to all participants that agreed to participate in the Active Kids research throughout 2018 to 2021. Multiple surveys were sent to all children who provided consent, irrespective of voucher use. The survey collected information on
  - physical activity levels
  - frequency and duration of sport participation
  - voucher use (activity, frequency, and duration of participation)
  - child height and weight (enabling Body Mass Index to be calculated), and
  - subjective well-being indicators
- registration data for all children and adolescents that have registered for the Program since 2018, including demographic information on height, weight, age, gender, and starting physical activity levels, and
- voucher redemption data that records when vouchers were used.

Data linkage was provided to this economic evaluation by the SPRINTER group to adhere to privacy concerns and ensure there were no linkable unique ID's in the dataset. Data management processes were also undertaken to meet the high privacy standards survey respondents agreed to. In total, the linked dataset upon which this economic evaluation is based contains 956 957 observations of 168 321 unique children (chart 2.3):

- who registered 510 508 times
- redeemed 712 121 vouchers, and
- completed 244 836 surveys from 2018 to 2021.

The linked dataset contains data of over 100 000 children per year, ensuring a consistent and comprehensive longitudinal dataset to track individual children over multiple years.

2.3 Linked dataset summary



Data source: CIE.

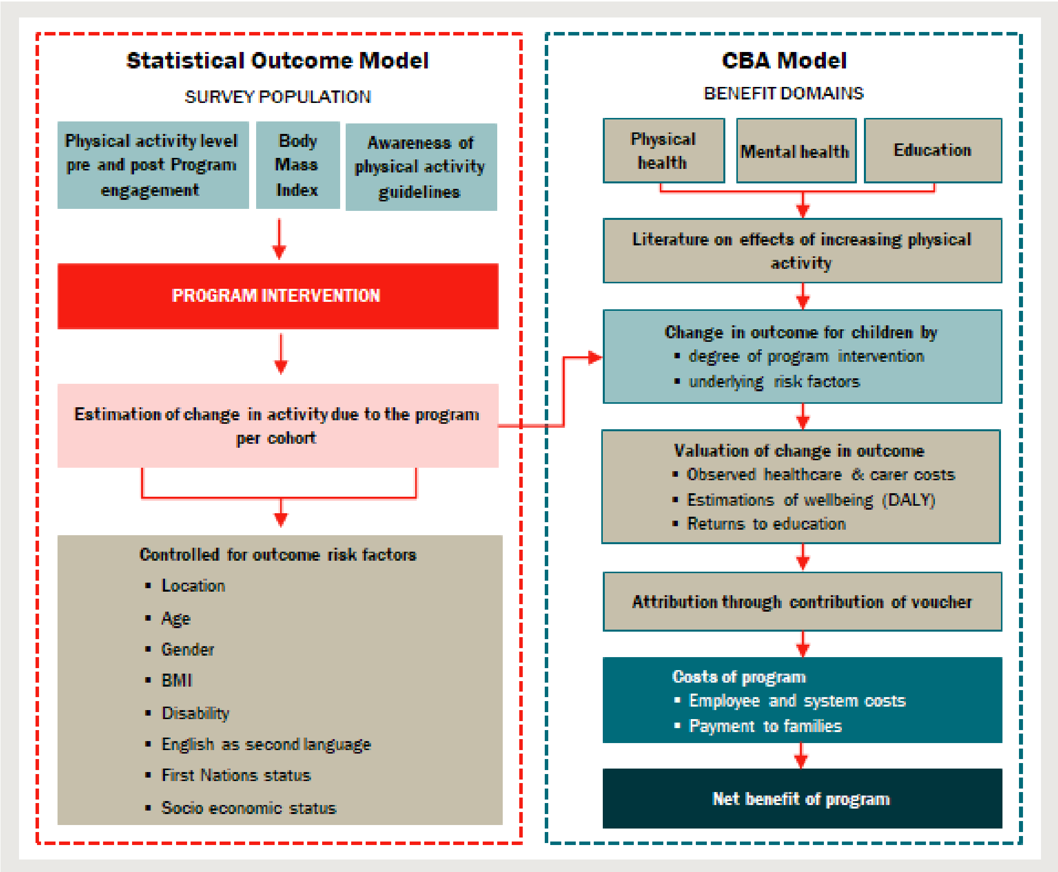
Approach to modelling benefits

The economic evaluation has involved two modelling stages:

- statistical analysis of the linked dataset to identify the impact of the Program on various outcome variables for discrete cohorts of children, and
- application of statistical modelling outputs and evidence from the literature to estimate the economic impact of the program applied to all Active Kids participants.

The application of the statistical modelling outputs to the cost benefit analysis is illustrated in chart 2.4.

2.4 Modelling overview



Data source: CIE.

Statistical outcome modelling

Statistical modelling was used to estimate the relationship between three separate *potential* outcome variables and measures of program intervention (treatment variable):

- meeting physical activity guidelines (yes, no)
- level of physical activity (0, 1 to 3, 4 to 6, and 7 days), and
- body mass index categories (thin/healthy, overweight, obese).

'Level of physical activity' was considered the main outcome variable of interest as it represents a goal of the Program as well as having strong links to the costs of physical inactivity in the literature. For privacy reasons, we used the categorical (levels) rather than the continuous (number of days per week) expressions of this variable.

The explanatory variable represents the Program's intervention and aims to explain how physical activity has changed due to the Program, which is measured in terms of:

- number of vouchers used over time (0 to 7), which measures degree of engagement
- time since first voucher used, which measures period of engagement, and
- intended use of first voucher (new or existing activity).

The control variables are a set of demographic variables to define 'child types' and provides information on:

- baseline physical activity independent of program engagement by child type, and
- how much each child type gains from the program intervention.

The full set of control variables include age groups, sex, socioeconomic status (based on quartiles of the postcode-level SEIFA index of disadvantage), First Nation status, identified disability, primary language spoken at home, BMI category, government regions, and remoteness index (ARIA).

Cost-benefit analysis modelling

Key assumptions used in the cost benefit analysis, in line with the Cost-Benefit Analysis Guidelines published by NSW Treasury,[8] include:

- **Definition of the base case:** The base case is defined as a scenario where the Program did not exist, using data on children without any voucher use at their first registration and before redeeming a voucher.
- **Defining the range of options**: Only one option is considered, which is to have the Active Kids Program. We only consider the Program as implemented, and only forecast benefits and costs based on population growth.
- **Over what period do we measure impacts**: Costs were measured from 2018 to June 2023. This included 4 years of program data (2018 to 2021) and a forecast to June 2023 based on population growth. Benefits are measured from 2018 to as long into the future as those benefits accrue for children who participate up until June 2023.
- **Whose costs and benefits count:** We measure costs and benefits for children participating, and the NSW Government.
- **How do we discount costs and benefits:** The value of costs and benefits in past and future years are discounted to report values in 2021 dollars. A real discount rate of 7 per cent is used, with sensitivity testing of 3 and 10 per cent. The nominal value of costs and benefits are converted to real values by adjusting estimates of costs and benefits in different years to account for changes in prices.

8 NSW Treasury, 2017, *NSW Government Guide to Cost-Benefit Analysis TPP17-03*, available at: https://arp.nsw.gov.au/assets/ars/393b65f5e9/TPP17-03_NSW_Government_Guide_to_Cost-Benefit_Analysis_0.pdf

3 *Impact of the Program on physical activity levels*

Engagement with the Program has led to increases in physical activity for 92 per cent of the over 6 000 population cohorts, representing 98 per cent of participants.

The biggest change was among children that undertook physical activity 7 days a week, which increased by 2.1 percentage points for boys and 1.7 percentage points for girls. Physical activity increases where higher for those using a voucher for a new activity rather than an existing one, for children with a disability, and the most socioeconomically disadvantaged children.

Participants that used more vouchers experienced higher uplifts in physical activity, indicating that ongoing participation in the Program leads to increased benefits.

Increases in physical activity

Since 2018, increases in physical activity are observed for girls and boys:

- the share of boys meeting the physical activity guidelines increased by over 2.1 percentage points between 2018-2021, and the share of those not meeting the guidelines to varying degrees all fell. In 2018, 0.41 per cent of boys were not active at all, which has fallen to 0.38 per cent, and
- the share of girls meeting the physical activity guidelines increased by over 1.7 percentage points. In 2018, 0.60 per cent of girls were not active at all, which has fallen to 0.55.[9]

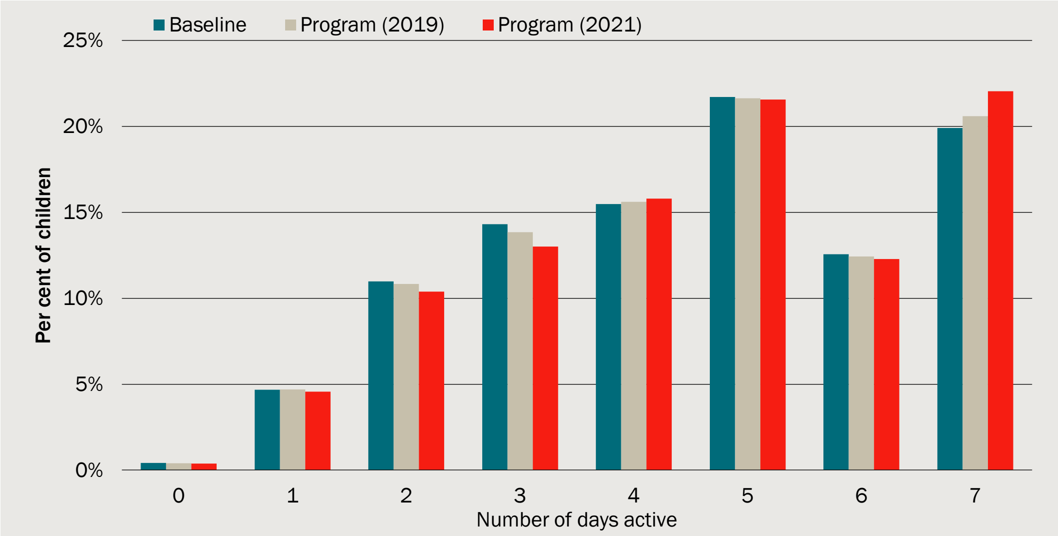
Only 2 per cent of cohorts experienced a decline in physical activity over the evaluation period.[10]

Chart 3.1 shows the reduction in the number of boys who were physically active 1 to 3 days per week over 2018 and 2021, and an increase in those physically active 7 days a week. Similarly for girls, there were steep reductions in children who were physically active 2 and 3 days per week, and a large increase in the number of girls active 7 days per week (chart 3.2).

9 CIE Analysis based on linked dataset, registration, and redemption data from the Office of Sport and SPRITNER.

10 A very limited number of cohorts experience a decline in physical activity based on a highly specific combination of demographic factors with small populations.

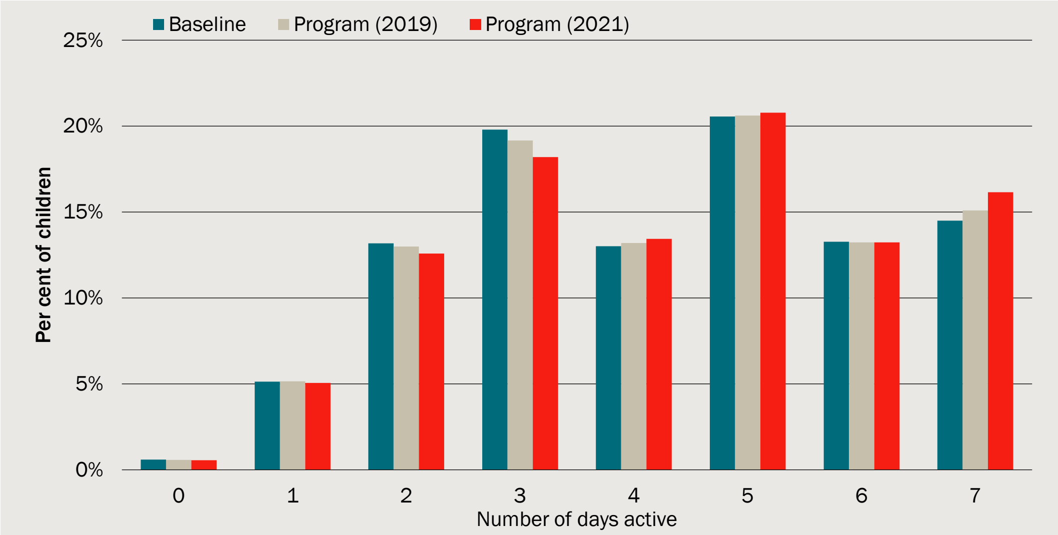
3.1 Number of days physically active for boys in the Program



Note: Physical activity level categories have been transformed into number of days active by estimating the average distribution within each category based on the registration data.

Data source: CIE Analysis based on linked dataset, registration, and redemption data from the Office of Sport and SPRITNER.

3.2 Number of days physically active for girls in the program



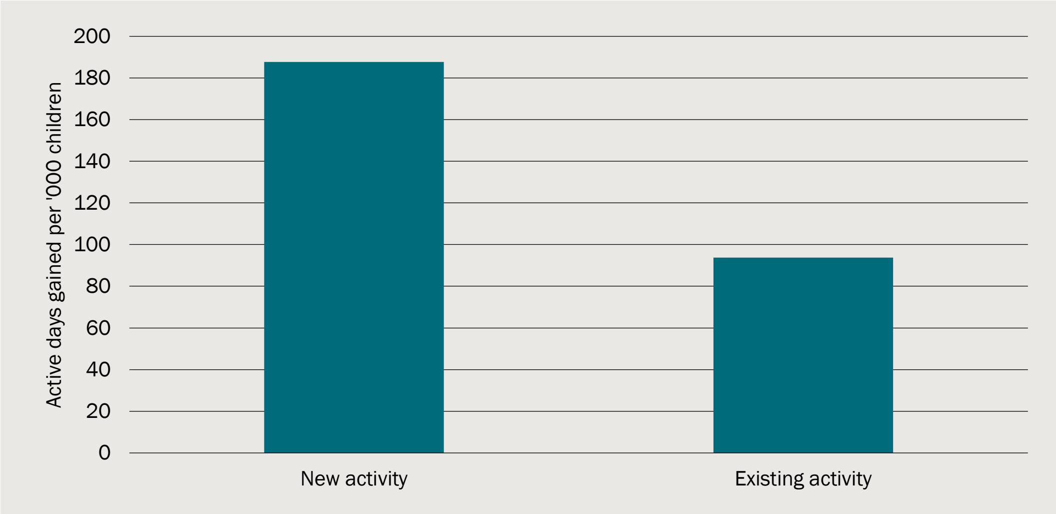
Note: Physical activity level categories have been transformed into number of days active by estimating the average distribution within each category based on the registration data.

Data source: CIE Analysis based on linked dataset, registration, and redemption data from the Office of Sport and SPRITNER.

Differences when commencing a new activity

Children who used a voucher for a new activity have an increased impact on the number of days physically active than the population who used the voucher for an existing activity. In 2021, 185 days of activity were gained per 1 000 children when using a voucher for a new activity, compared with 90 days when used for an existing activity. This is partly due to the higher levels of baseline activity for those already engaged in a community sport.

3.3 Active days gained when using voucher for a new or existing activity, 2021



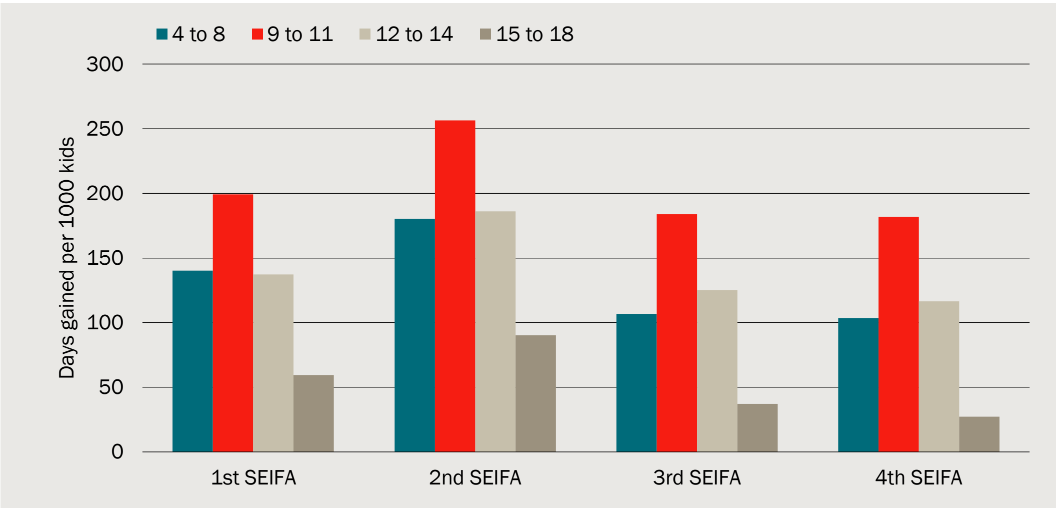
Data source: CIE.

Impacts for priority populations

The priority populations that experienced statistically significantly differences in their activity outcomes include children from lower socioeconomic backgrounds, and those with a disability.

Across the SEIFA quartiles, the second quartile experienced the largest increase in days physically active as a result of the Program, followed by the first quartile (chart 3.4). The more advantaged quartiles did not experience the same magnitude of days gained, although this partly reflects their higher level of baseline activity. Across the age cohorts, children aged between 9 and 11 experienced the largest increase in days gained, followed by ages 12 to 14, with a significant decrease for children aged between 15 to 18. The age pattern of days gained was consistent across all SEIFA quartiles.

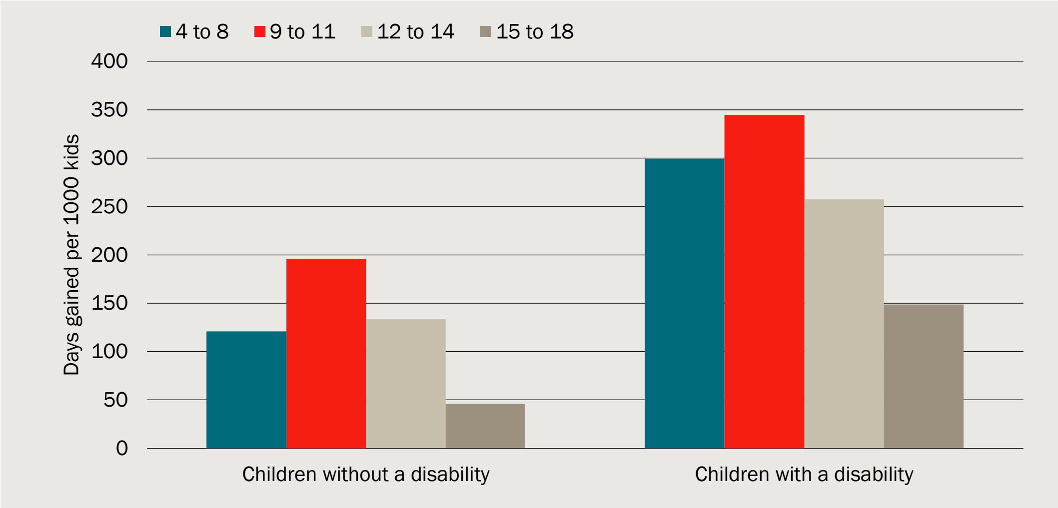
3.4 Active days gained by age and socioeconomic status, 2021



Data source: CIE.

Children who identified as having a disability at registration experienced a substantially larger increase in days gained. Children with a disability aged 9 to 11 experienced the largest gain (up 75 per cent) compared to children without a disability. Children with a disability aged 4 to 8 had a larger increase in days gained than children aged 12 to 14, which breaks the trend visible in other populations (no disability, SEIFA, First Nations).

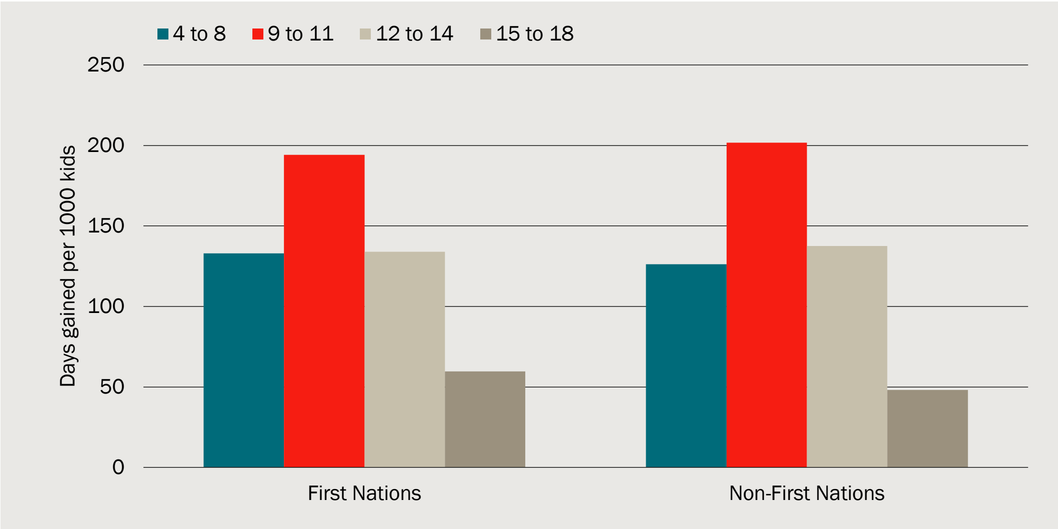
3.5 Active days gained by age and disability status, 2021



Data source: CIE.

There was no statistically significant difference in activity level changes for First Nations children vis-a-vis non-First Nations children (chart 3.6).

3.6 Active days gained by age and First Nations status, 2021



Data source: CIE.

4 Value of health benefits

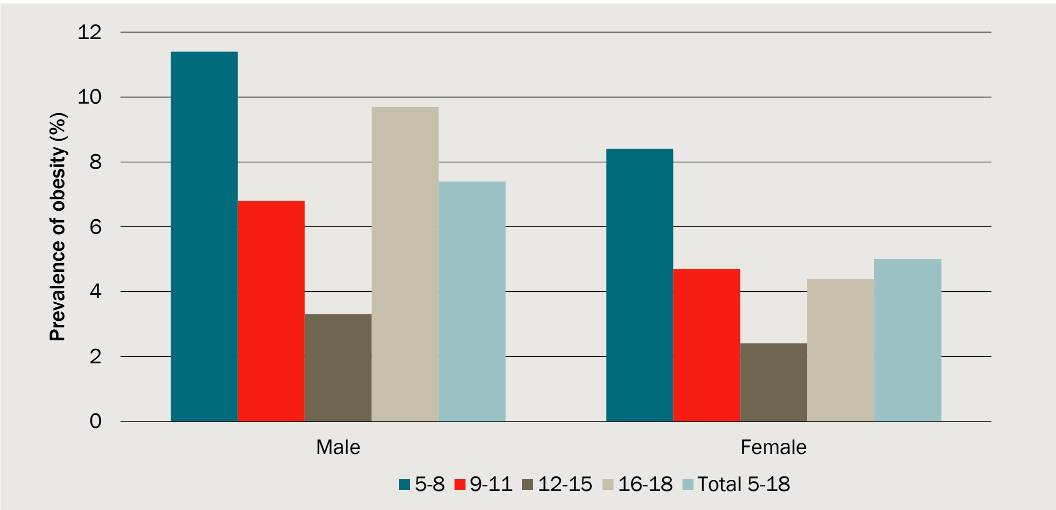
Childhood and adolescence are critical periods for developing a firm foundation for lifelong health and wellbeing. Physical activity is important during this period, as it supports healthy physical development and growth, and improves and prevents mental health disorders.

The increase in physical activity attributed to the Program is estimated to have had a measurable impact on wellbeing, and reduced risk of obesity and other poor physical health outcomes later in life. Physical health benefits are valued at $43 million over the evaluation period and are experienced by the 98 per cent of participants. The impact of the Program on preventing mental health disorders is valued at $26 million over the evaluation period, with benefits accruing to 60 per cent of participants.

Reduction in obesity risk and physical health improvement

Childhood obesity is directly linked to physical and psychological poor health.[11] In NSW, approximately 27.5 per cent of males, and 22.5 per cent of females aged between 5 and 18 are overweight or obese. Males are more likely to be more obese than females across all age groups, but particularly those aged 16 to 18 years, where male obesity is double that of females (chart 4).

4.1 Prevalence of obesity by age and gender (2019-2021)



Data source: NSW Population Health Survey, SAPHaRI. Centre for Epidemiology and Evidence, NSW Ministry of Health.

11 Obesity Evidence Hub, Impact of obesity on children, see https://www.obesityevidencehub.org.au/collections/impacts/impact-on-children

Obesity and a lack of activity are risk factors for cardiovascular diseases, type 2 diabetes, osteoarthritis, and some types of cancer in adults. In NSW:

- 46 644 people were hospitalised because of coronary heart disease in 2019-20 (468.2 people per 100 000 population)
- 13 476 people were hospitalised because of a stroke in 2019-20 (131.3 people per 100 000 population), and
- 11.3 per cent of adult had diabetes. This percentage increases with each age group, from 3.0 per cent for those aged 16 to 24 years old to 21.8 per cent for those above 75.[12]

The link between physical activity and physical health outcomes have long been established in the literature. For instance:

- Reiner M et al (2013) reviewed 15 longitudinal studies to investigate the relationship between physical activity and weight gain, obesity, coronary heart disease, type 2 diabetes mellitus, Alzheimer's disease and dementia and found physical activity has a positive long-term influence on all these disease types[13]
- Tan et al. (2014) reviewed 14 intervention and 23 observational studies and concluded prepuberty and peri-puberty are the most opportune time for boys and girls to enhance bone strength through physical activity,[14]
- Janssen and LeBlanc (2010) reviewed 11 088 papers and found that physical activity was associated with numerous health benefits, with even modest amounts of physical activity having health benefits in high-risk youngsters at risk of obesity,[15] and
- Hong et al. (2016) found time spent in moderate-to-vigorous physical activity was negatively associated with change in BMI from age 9 to 15.[16] Multivariate logistic regression models were used to estimate the adjusted odds ratios (AORs) for overweight and obese participants. It found that the risk of overweight and obesity decreased by 7 per cent as the number of days on which participants were physically active increased.

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12 NSW Health, HealthStats NSW, NSW Government

13 Reiner M. et al. (2013), Long-term health benefits of physical activity – a systematic review of longitudinal studies, BMC Public Health, http://www.biomedcentral.com/1471-2458/13/813

14 Tan et al. (2014), Influence of Physical Activity on Bone Strength in Children and Adolescents: A Systematic Review and Narrative Synthesis, Journal of Bone and Mineral Research, Vol. 29, No. 10, October 2014, pp 2161–2181 DOI: 10.1002/jbmr.2254

15 Janssen and LeBlanc (2010), Review Systematic review of the health benefits of physical activity and fitness in school-aged children and youth, International Journal of Behavioral Nutrition and Physical Activity https://ijbnpa.biomedcentral.com/articles/10.1186/1479-5868-7-40

16 Hong, I. et al. (2016), Relationship between physical activity and overweight and obesity in children: Findings from the 2012 National Health and Nutrition Examination Survey National Youth Fitness Survey. American Journal of Occupational Therapy, 70, 7005180060. http://dx.doi.org/10.5014/ajot.2016.021212.

A cohort longitudinal study by Venn et al.[17] of 8 498 children aged 7–15 years who participated in the 1985 Australian Schools Health and Fitness Survey; of these, 2 208 men and 2 363 women completed a follow-up questionnaire at age 24–34 years in 2001–2005. This study provides strong evidence to support the association between youth and adult overweight and obesity and is relevant to the NSW population because it is based on an Australian sample. The results from the study were in line with other reported studies in systematic reviews, see Singh A. et al (2008). No studies in the literature review undertaken for this economic evaluation identified a causal relationship between youth and adult overweight and obesity.

From this study, table 4.2 shows the relative risks of becoming an obese adult by sex, childhood weight category and age.

4.2 Relative risk of becoming an obese adult by gender and age

Age	Males – Overweight	Males – Obese	Females – Overweight	Females – Obese
7-9	4.30	4.90	5.30	10.30
10-12	5.00	3.40	6.00	9.20
13-15	3.60	5.10	5.50	8.10

Note: Relative risk with healthy weight in childhood as the referent category

Source: Venn et al.

The risk of becoming obese as an adult was significantly increased for boys and girls who were overweight or obese, irrespective of their age at baseline. The estimates were not significantly different across categories of marital status, highest level of education achieved or childhood socioeconomic status. Already, adult obesity in NSW has been on an upward trajectory for the past 10 years, with the rate of obesity increasing from 19.1 per cent to 22.5 per cent during this time.

Reducing the prevalence of overweight and obesity in children will decrease the likelihood of these disorders persisting to adults, providing an opportunity to mitigate costs incurred for adults with overweight and obesity. This is important, given substantial body of evidence in Australia and overseas showing childhood obesity persists into adulthood[18],[19],[20].

For instance, Singh A. et al. (2008) reviewed 25 studies and found consistent reporting of an increased risk of overweight and obese youth becoming overweight adults.[21]

17 Venn A. et al. (2007), Overweight and obesity from childhood to adulthood: a follow-up of participants in the 1985 Australian Schools Health and Fitness Survey, Med J Australia Volume 186 Number 9, DOI: 10.5694/j.1326-5377.2007.tb00997.x

18 Braddon FE, Rodgers B, Wadsworth ME, Davies JM. Onset of obesity in a 36 year birth cohort study. BMJ 1986; 293: 299-303.

19 Clarke WR, Lauer RM. Does childhood obesity track into adulthood? Crit Rev Food Sci Nutr 1993; 33: 423-430

20 Serdula MK, Ivery D, Coates RJ, et al. Do obese children become obese adults? A review of the literature. Prev Med 1993; 22: 167-177.

21 Singh A. et al. (2008), Tracking childhood overweight into adulthood: a systematic review of the literature, Obesity reviews Volume 9 issue 5, doi: 10.1111/j.1467-789X.2008.00475.x

Similarly, Kohl H.W. 2013 links physical activity risk factors in childhood, and especially adolescence, into adulthood, finding that as many as 80 per cent of obese adolescents become obese adults.[22]

Estimating the impact of the Program on risk of obesity

To estimate the impact of physical activity attributed to the Program on the risk of obesity, we assume that increases in physical activity reduces the risk of obesity in line with the findings from Hong, I. et al. (2016). Hong (2016) uses a cross-sectional design to estimate the impact of days physically active on the likelihood of experiencing overweight and obesity. It finds a positive linear association, where each additional day active per week decreases the likelihood of overweight and obesity by 7 per cent. While the study is based in the United States, we believe the association between overweight and obesity and physical activity is transferable. Neither this, nor other identifiable sources, established a *causal* link.

The model estimates the change in likelihood of physical activity based on years in the Program, the number of vouchers redeemed, and the length of engagement with the Program. An increase in days active due to the Program decreases the likelihood of being overweight or obese as a child and therefore the likelihood of experiencing health wellbeing and hospital costs related to overweight and obesity. The reduction in likelihood increases as the number of days active gained increases, in line with the findings of Hong (2016). This applies to children who have already engaged with the Program as well as children who are expected to engage by June 2023.

Our estimates only include the cohorts who are overweight and obese, using the International Obesity Task Force (IOTF) definitions.[23] The IOTF definitions provide age and sex specific BMI cut-offs for overweight, and obesity based on representative data from six countries, providing a standard international definition for categorising childhood overweight and obesity. The prevalence for overweight and obesity in the Active Kids cohort for 2018 is shown in table 4.3.

4.3 Overweight and obese prevalence in the Active Kids cohort 2018

Gender	Age cohort	Overweight	Obese
		%	%
Female	4 to 8	16.3	11.6
Female	9 to 11	18.8	6.3
Female	12 to 14	15.6	2.5
Female	15 to 18	11.5	1.6
Male	4 to 8	14.2	12.0

22 Kohl H.W. and Cook H.D. 2013. Educating the student body: Taking physical activity and physical education to school, IOM (Institute of Medicine), Washington, DC: The National Academies Press.

23 Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ. 2000;320:1240-3.

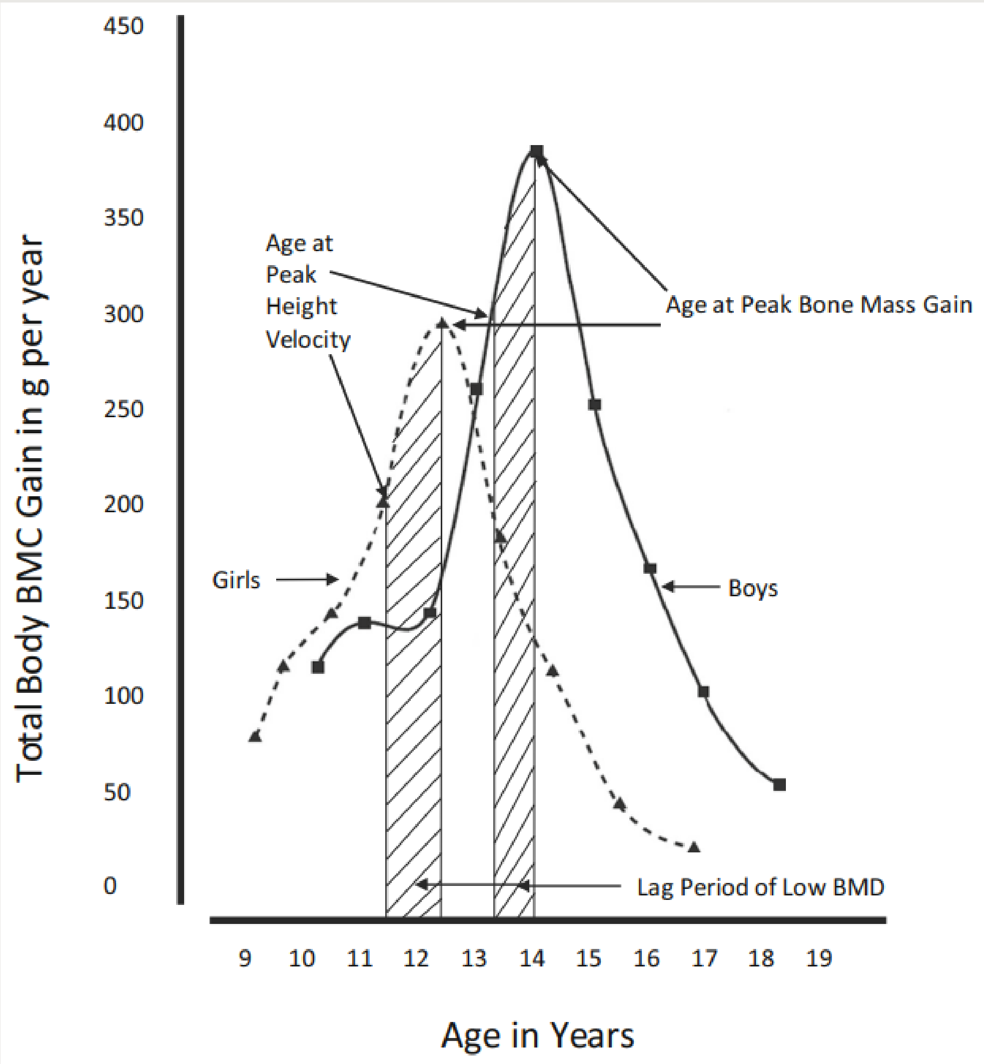
Gender	Age cohort	Overweight	Obese
		%	%
Male	9 to 11	20.6	8.1
Male	12 to 14	19.8	4.1
Male	15 to 18	18.4	3.2

Source: Active Kids population, CIE.

Improvements in lifelong bone health

Bone mass is acquired relatively slowly throughout childhood. With the onset of puberty and the adolescent growth spurt in height, bone mineral accretion is rapid, reaching a peak shortly after peak height gain (chart 4.4).

4.4 Peak bone mineral content gain and peak height velocity in boys and girls



Data source: Bailey DA, McKay HA, Mirwald RL, Crocker PR, Faulkner RA (1999) A six-year longitudinal study of the relationship of physical activity to bone mineral accrual in growing children

For total body bone mineral, the peak bone mineral accretion rate occurs at 12.5 ± 0.90 years in girls and 14.1 ± 0.95 years in boys of European ancestry.[24] During the 4 years surrounding the peak in bone accretion, 39 per cent of total body bone mineral is acquired. By 4 years following the peak, 95 per cent of adult bone mass has been achieved.[25] This period of rapid accretion is a time of opportunity and vulnerability for optimising peak bone mass.

Optimising bone accrual during growth can significantly prevent current or future bone fractures.[26] [27] [28] After peak bone mass is achieved, there is a slow but progressive decline in bone mass until a theoretical fracture threshold is reached, meaning that an optimisation of bone mass accrual can decrease fracture risk later in life.[29]

The National Osteoporosis Foundation performed an evidence-based review of the literature since 2000 on factors that influence achieving the full genetic potential for skeletal mass.[30] The review found that the best evidence existed for the positive effects of calcium intake and physical activity, especially during the late childhood and peripubertal years, as modifiable factors for peak bone mass accrual. The search for the effects of physical activity on bone mineral content identified 36 randomised control trials (RTCs) and 20 observational studies published since 2000, encompassing 9 942 individuals. Eighty-three percent (n = 30) of the RCTs reported statistically significant (P< 0.05) differences between exercise and control groups at the completion of the intervention.

For our modelling of the impacts of bone health, we refer to two RTCs (table 4.5).

The first follows an intervention for a cohort of 7–9-year-old boys in Sweden, where they participated in a curriculum based exercise program comprising 40 minutes of exercise

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24 Bailey DA, McKay HA, Mirwald RL, Crocker PR, Faulkner RA (1999) A six-year longitudinal study of the relationship of physical activity to bone mineral accrual in growing children: the University of Saskatchewan Bone Mineral Accrual Study. J Bone Miner Res 14:1672–1679

25 Baxter-Jones AD, Faulkner RA, Forwood MR, Mirwald RL, Bailey DA (2011) Bone mineral accrual from 8 to 30 years of age: an estimation of peak bone mass. J Bone Miner Res 26: 1729–1739

26 Kalkwarf HJ, Laor T, Bean JA (2011) Fracture risk in children with a forearm injury is associated with volumetric bone density and cortical area (by peripheral QCT) and areal bone density (by DXA). Osteoporos Int 22:607–616

27 World Health Organization (1994) Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. Report Series 843. World Health Organization, Geneva

28 Holloway KL, Brennan SL, Kotowicz MA, Bucki-Smith G, Timney EN, Dobbins AG, Williams LJ, Pasco JA (2015) Prior fracture as a risk factor for future fracture in an Australian cohort. Osteoporos Int 26:629–635

29 Golden NH, Abrams SA. Optimizing bone health in children and adolescents. Pediatrics. 2014;134(4):e1229-43

30 Weaver C.M. et al. (2016), The National Osteoporosis Foundation’s position statement on peak bone mass development and lifestyle factors: a systematic review and implementation recommendations, Osteoporos Int (2016) 27:1281–1386, DOI 10.1007/s00198-015-3440-3

per day (200 minutes per week).[31] The control group followed the national school exercise program of 60 minutes per week. The mean annual bone mineral content gain for the intervention group was 3.2 percentage points greater than the control group. As this study is a controlled trial, we can place greater reliance on the findings of the causal relationship between physical activity and bone growth. We expect the findings to translate to the NSW population as the driver of bone growth is physical activity and no other geo-specific factors.

The second study follows a cohort of 7–9-year-old girls in Sweden, where the intervention group participated in a school curriculum–based exercise intervention program of general physical activity for 40 minutes per school day (200 minutes/week).[32] A control group followed the national school exercise program of 60 minutes per week. The mean annual bone mineral content gain for the intervention group was 7.6 percentage points greater than the control group.

4.5 Impact of physical exercise on bone mass accrual

Gender	Age	Annual mean increase in bone mineral content
		%
Male	7-9	3.2
Female	7-9	7.6

Note: Both results statistically significant $p<0.05$

Source: Alwis G. et al. 2008, Linden C. et al. 2006.

Estimating the impact of the Program on bone health

To estimate the benefits of physical activity on long term bone health, we assume that all increases in the physical activity will increase bone mass to a certain extent. Peak bone mass accrual is limited to a window of years (chart 4.4), which is approximately around 12.5 years old for girls and 14 years old for boys. To account for this, we apply a full and reduced growth rate for the two cohorts (table 4.6).

4.6 Years applied bone mineral content growth rates for boys and girls

Gender	Reduced growth rate	Full growth rate
	Age	Age
Boys	4-10, 15-18	11-14
Girls	4-10, 15-18	11-14

Source: CIE.

31 Alwis G. et al. (2008), A 2-year school-based exercise programme in pre-pubertal boys induces skeletal benefits in lumbar spine, Acta Pædiatrica 97, pp. 1564–1571. DOI: 10.1111/j.1651-2227.2008.00960.x

32 Linden C. et al. (2006), A School Curriculum–Based Exercise Program Increases Bone Mineral Accrual and Bone Size in Prepubertal Girls: Two-Year Data From the Pediatric Osteoporosis Prevention (POP) Study, Journal of bone and mineral research Volume 21, Number 6, DOI: 10.1359/JBMR.060304

Although literature finds that higher bone mineral content reduces the risks of osteoporosis and osteopenia later in life, no studies have quantified the magnitude of the reduction in Osteoporosis and Osteopenia due to increasing bone mineral content during childhood. Osteoporosis is a disease in which the density and quality of bone are reduced, leading to weakness of the skeleton and increased risk of fracture, particularly at the hip, spine and wrist. Osteopenia represents the state between normal bone health and osteoporosis, where bone mass is decreasing but not enough to trigger the risks of Osteoporosis.

We assume a direct association between bone mineral content gain and a reduction in the risk of osteoporosis and osteopenia. In other words, a 2 per cent gain in bone mineral content results in a 2 per cent reduction in the likelihood of osteoporosis and osteopenia in later life.

Wellbeing benefits

Children and adolescents who are overweight or obese will experience wellbeing costs associated with their health status, hereafter 'wellbeing costs'. For children under the age of 15, the wellbeing costs are related to suffering from asthma, caused by the child's overweight or obesity. For adolescents aged 15-18, wellbeing costs are associated with 28 linked diseases, the most impactful being asthma, back pain, stroke and type 2 diabetes.[33]

Estimating the impact of the Program on wellbeing

To estimate the wellbeing costs of these illness, we use the disability-adjusted life years (DALYs) estimated in the National Health Survey (see box 4.7 for an overview).

4.7 Disability adjusted life years[34]

Rationale: Mortality does not give a complete picture of the burden of disease borne by individuals in different populations. The overall burden of disease is assessed using DALYs, a time-based measure that combines years of life lost due to premature mortality (YLLs) and years of life lost due to time lived in states of less than full health, or years of healthy life lost due to disability (YLDs).

One DALY represents the loss of the equivalent of one year of full health. Using DALYs, the burden of diseases that cause premature death but little disability (such as drowning or measles) can be compared to that of diseases that do not cause death but do cause disability (such as cataract causing blindness).

33 Australian Bureau of Statistics 2018. National Health Survey: first results, 2017–18. ABS cat. no. 4364.0.55.001.

34 For more information, see World Health Organisation methods and data sources for global burden of disease estimates 2000-2019 https://cdn.who.int/media/docs/default-source/gho-documents/global-health-estimates/ghe2019_daly-methods.pdf?sfvrsn=31b25009_7

Method of estimation: DALYs for a specific cause are calculated as the sum of the years of life lost due to premature mortality (YLLs) from that cause and the years of years of healthy life lost due to disability (YLDs) for people living in states of less than good health resulting from the specific cause.

The YLLs for a cause are calculated as the number of cause-specific deaths multiplied by a loss function specifying the years lost for deaths as a function of the age at which death occurs. The loss function is based on the frontier national life expectancy projected for the year 2050 by the World Population Prospects 2012 (UN Population Division, 2013), with a life expectancy at birth of 92 years

By dividing the total attributable DALYs in the national health survey by the population that is overweight and obese, we can estimate the DALYs per overweight and obese person. Multiplying these DALYs by the value of a statistical life gives the wellbeing cost per age group for males and females (table 4.8).

4.8 Wellbeing cost of overweight and obesity for children and adolescents

Age cohort	Males	Females
	$2021	$2021
Under 15	472	321
15 – 24	774	656

Source: ABS.

We apply the findings from the Hong study, which shows that increasing physical activity results in a decreased likelihood of suffering from overweight and obesity. Increasing physically active days by one day, decreases the likelihood of obesity by 7 per cent. We can then infer that likelihood of incurring the wellbeing costs of overweight and obesity will be reduced by 7 per cent.

Reduced healthcare costs for children

Improvements in child (and their later adult) healthy weight status will reduce the healthcare costs faced by government. Recent studies have shown a positive association between obesity and health care costs during childhood.[35] [36] To understand the magnitude of these costs, Black et al.[37] estimated the additional costs incurred by Australian children who are overweight and obese from the ages 6 to 13.

35 Au, N., (2012), The health care cost implications of overweight and obesity during childhood. Health Serv. Res. 47 (2), 655–676.

36 Batscheider, A. et al., (2014), Development of BMI values of German children and their healthcare costs. Econ. Hum. Biol. 12, 56–66.

37 Black N. et al. (2018), The health care costs of childhood obesity in Australia: An instrumental variables approach, Economics & Human Biology, Volume 31, Pages 1-13, https://doi.org/10.1016/j.ehb.2018.07.003

A sample of 4 534 children was drawn from the Longitudinal Survey of Australian Children[38] (LSAC), which linked Medicare records to identify medical expenditure per child. Medicare records include complete data on medical services funded under the Medicare Benefits Schedule (MBS) and pharmaceutical subsidies funded under the Pharmaceutical Benefits Scheme (PBS).

4.9 Difference in healthcare costs for overweight and obese children

Bodyweight	Ages 6-7	Ages 8-9	Ages 10-11	Ages 12-13
	$2021	$2021	$2021	$2021
Normal weight	196	249	266	318
Difference to overweight	90	68	75	34
Difference to obese	160	112	121	54

Source: Black et al.

Table 4.9 shows the estimates for the increased medical expenses for overweight and obese children for each age cohort between 6 and 13. Obese children incur significantly higher expenses than overweight and normal weight children, however this difference reduces in older age cohorts as expenses incurred by children who are a normal weight increase. This study can be relied upon to provide reliable estimates for healthcare costs as it based on a recent cohort of Australian children.

Reduction in absenteeism

Children who are obese are at risk of developing a range of co-morbidities, which impact child physical and mental health that are linked to increased school absenteeism. A recent systematic review and meta-analysis of thirteen studies from the USA, Germany, and the Netherlands finding the odds of being absent from school were 27 per cent higher among children with overweight and 54 per cent higher among children with obesity compared to children of a healthy weight.[39]

Frequent school absenteeism has negative effects on academic achievement,[40] which in turn impact future income[41] and health outcomes.[42] The synergy between childhood obesity and school absenteeism indicates children with obesity may face much larger barriers to achieving good health compared to their classmates of a healthy weight, both in the immediate and long term.

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38 https://growingupinaustralia.gov.au/about-study

39 An R, Yan H, Shi X, Yang Y. (2017), Childhood obesity and school absenteeism: a systematic review and meta-analysis. Obes Rev;18(12):1412–24.

40 Allen CW, Diamond-Myrsten S, Rollins LK. School absenteeism in children and adolescents. Am Fam Physician 2018;98(December (12)):738–44.

41 Black N, Kung CSJ, Peeters A. For richer, for poorer: the relationship between adolescent obesity and future household economic prosperity. Prev Med 2018;111:142–50.

42 Allison MA, Attisha E, Council on School Health. The link between school attendance and good health. Pediatrics 2019;143(February (2)):e20183648

A recent study by Carello J. et al.[43] estimated the association between school absenteeism and weight status among a sample of children aged between 6 and 13 years drawn from the LSAC. These results of this study can be relied upon as it uses a recent sample of Australian children.

The main ways of estimating the costs of school absenteeism include:

- estimating school funding lost due to a child's absence,[44] [45] and
- estimating the daily wage rate of the primary caregiver who must care for the absent child using the national daily wage rate.[46] [47]

As schooling in Australia is provided by a mix of public and private institutions with carriable government funding not based on attendance, Australian Bureau of Statistics data for gross average weekly ordinary time earnings for individuals wage rate has been used to calculate the opportunity cost of missed day's work. Table 4.10 shows the association between obesity and extra days of school absenteeism. The estimated average extra days absent per year increases as the child gets older, reaching an estimate of 1.12 for the 12–13-year-old cohort.

4.10 Association between obesity and extra days of school absenteeism

Age cohort	Estimated average extra days absent per year	Estimated average indirect cost per child
	#	$2021
6-7 years	1.01	355
8-11 years	1.07	373
12-13 years	1.12	392

Source: Carrello.

Long term wellbeing benefits

Adults who experience overweight and obesity face significantly more risks of comorbidities than children and adolescents. In 2018, the national health survey revealed the most DALYs attributable for overweight and obesity in adults aged 25-34 were asthma, back pain, coronary heart disease and type 2 diabetes. Attributing these DALYs

43 Carrello J. et al. (2021), Obesity Research & Clinical Practice 15, pp. 587-592, https://doi.org/10.1016/j.orcp.2021.09.006

44 Noyes K, et al. (2013). Cost effectiveness of the school-based asthma therapy (SBAT) program. Pediatrics; 131(March (3)):e709–17y

45 Willems DC, et al. (2007), Cost-effectiveness of a nurse-led telemonitoring intervention based on peak expiratory flow measurements in asthmatics: results of a randomised controlled trial. Cost Eff Resour Alloc; 5(July (1)):10.

46 Weiss K, et al. (2006), Cost effectiveness of early intervention with once-daily budesonide in children with mild persistent asthma: results from the START study. Pediatr Allergy Immunol; 17(s17):21–7.

47 Sullivan SD, et al. (2003), Cost effectiveness analysis of early intervention with budesonide in mild persistent asthma. J Allergy Clin Immunol; 112(December (6)):1229–36.

to the overweight and obese population, multiplied by the value of a statistical life year reveals the average cost per person of these disorders, see table 4.11.

4.11 Wellbeing costs for adults with overweight or obesity

Age cohort	Males	Females
	$2021	$2021
25-34	$1 401	$1 469

Source: ABS.

As overweight and obesity is shown to track from childhood to adulthood, intervening in the prevalence of these disorders in childhood can reduce the likelihood of these wellbeing costs being incurred in adulthood.

To estimate the value of the avoided long term wellbeing costs, we apply the findings from Venn et al. and assume that increasing physical activity in childhood reduces the chance of being overweight and obese. As overweight and obese children are more likely to be overweight and obese adults, avoiding overweight and obesity as a child decreases the chance of being an overweight or obese adult at age 25.

We assume that this benefit persists until the end of the age bracket in the study (34), after which the chances of being overweight or obese will be likely more influenced by various lifestyle and economic factors than childhood weight status. The annual wellbeing costs for ages 25 to 34 combined and discounted at 7 per cent to be presented as a current avoided cost benefit for each age cohort, based on the time until age 25.

Reduction in long term healthcare costs

The total healthcare costs for obese adults are almost 50 per cent greater than adults with normal weight.

This is based on Colagiuri et al.[48] which compared the healthcare costs incurred by 6 140 normal weight, overweight and obese Australians drawn from the Australian Diabetes, Obesity and Lifestyle study (table 4.12). The results of this study can be relied upon as it uses a recent sample of an Australian population.

4.12 Annual cost and excess cost above normal-weight costs per person, for age and sex-matched participants

Weight status	Direct costs	Indirect costs	Government subsidies	Total
	$2021	$2021	$2021	$2021
Normal weight	1 644	497	3 690	5 831
Difference to overweight	308	193	988	1 488
Difference to obese	894	145	1 508	2 547

48 Colagiuri et al. (2010), The cost of overweight and obesity in Australia, MJA 2010; 192: 260–264, https://doi.org/10.5694/j.1326-5377.2010.tb03503.x

Note: Direct health care costs included ambulatory services, hospitalisation, prescription medication and some medically related consumables (e.g., blood glucose self-monitoring meters and strips). Prescription medications for creams, eye drops and inhalers, and non-prescription medications, except for aspirin, were not included. Direct non-health care costs included transport to hospitals, supported accommodation, home service and day centres, and purchase of special food. Government subsidies included payments for the aged pension, disability pension, veteran pension, mobility allowance, sickness allowance and unemployment benefit

Source: Colagiuri

To estimate the impact of improving weight status at childhood to avoid the healthcare costs of being an overweight or obese adult, we apply the same assumption used in the wellbeing benefit for the lifetime obesity benefit persisting from ages 25 to 34. The sum of the annual avoided costs is discounted at 7 per cent to produce a current benefit for each age cohort, based on the time until age 25.

Bone health

Osteoporosis manifests itself as fractures, occurring at multiple skeletal sites. In older age groups the burden of disease attributable to osteoporosis is significant, not only the consequent health service utilisation but also the burden on individual utility, health related quality of life, family and households. Osteoporosis rapidly increases in prevalence beyond the age cohort of 50 to 69 years (table 4.13).

4.13 Osteoporosis and Osteopenia age and gender standardised prevalence

Age group	Osteoporosis - Women	Osteoporosis - Men	Osteopenia - Women	Osteopenia - Men
	%	%	%	%
50-69	13	3	49	55
70+	43	13	46	59

Source: Osteoporosis Australia.

Osteoporosis Australia[49] estimates the costs of osteoporosis and osteopenia to be $2.9 billion in 2012. Based on this study, we have derived a cost per person for osteoporosis and osteopenia (table 4.14).

4.14 Cost per person of Osteoporosis and Osteopenia

Age cohort	Women	Men
	$2021	$2021
50-69	502	360
70+	1343	795

Note: Includes the direct costs of managing fractures (health and non-health care), as well as the non-fracture costs relating to the management of osteoporosis and osteopenia (bone health medications, predominantly bisphosphonates, DXA scans and routine pathology tests (including Vitamin D tests). Other fracture management direct (non-health care) costs included were for informal care in the community. With informal care costs excluded, the direct costs in 2012 were $2.4 billion. The indirect costs from productivity losses associated with fractures due to hospitalisation (acute and rehabilitation) in 2012 were $165 million, which represented 6 per cent of the total cost.

Source: Bone health burden of disease analysis, CIE

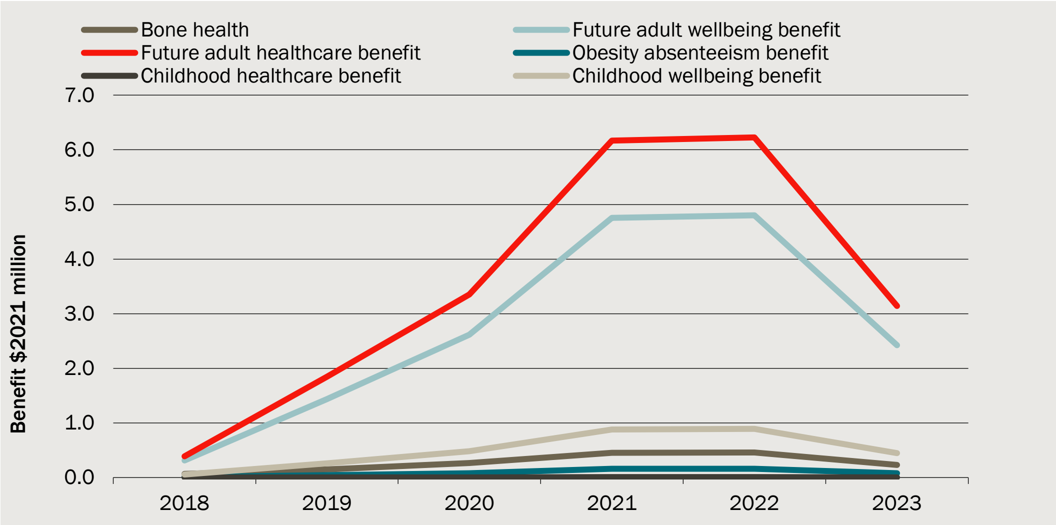
49 Osteoporosis Australia (2013), Osteoporosis costing all Australians A new burden of disease analysis – 2012 to 2022, https://healthybonesaustralia.org.au/wp-content/uploads/2020/11/Burden-of-Disease-Analysis-2012-2022.pdf

We assume the percentage increase in bone mass accrued in childhood as a result of the Program translates to a decreased likelihood of experiencing osteoporosis and osteopenia. The lifetime cost of having osteoporosis and osteopenia has been estimated for ages 50 to 69 and 70 to 99, converted into 2021 dollars. For example, for a 10-year-old male, a 1 per cent increase in bone mass reduces the expected likelihood of osteoporosis and osteopenia by 1 per cent, hence, the total present value cost of $3 068 is avoided.

Value of physical health benefits

Increasing physical activity in childhood improves physical and mental health outcomes in the short and long term. The most highly valued benefit is the avoided wellbeing costs associated with childhood obesity and avoided wellbeing costs later in life. By age group, the largest benefits accrue to the cohort aged 9 to 11 for both males and females, who experience the greatest increase in physical activity.

4.15 Total benefit of physical health outcomes 2018 to 2023



Note: Forecast benefit growth rate increases in line with population.

Data source: CIE.

4.16 Physical health benefit by gender and age cohort from 2018 to 2023

Gender	Age cohort	Wellbeing	Healthcare	Absenteeism - Carer	Absenteeism - Individual	Bone health
Female	4 to 8	1 660.9	1 970.8	85.4	5.0	260.4
	9 to 11	4 515.0	5 377.2	112.1	6.4	467.4
	12 to 14	1 737.2	2 349.8	15.0	0.8	461.3
	15 to 18	502.5	491.5	-	-	64.2
Male	4 to 8	1 934.4	1 758.4	105.0	6.2	76.5
	9 to 11	5 602.7	6 023.4	148.9	8.5	136.5

Gender	Age cohort	Wellbeing	Healthcare	Absenteeism - Carer	Absenteeism - Individual	Bone health
	12 to 14	2 457.5	2 793.9	24.1	1.3	133.3
	15 to 18	758.3	599.6	-	-	19.3
Total		**19 168.6**	**21 364.5**	**490.5**	**28.3**	**1 618.8**

Note: All results are present value $2021, discount rate 7 per cent

Source: CIE.

Mental health outcomes

Prevalence of mental health disorders

Poor mental health can have a major deleterious effect on the potential of young people to live fulfilling and productive lives (WHO 2014a).[50] There is strong evidence that mental disorders in childhood and adolescence predict mental illness in adulthood (WHO 2014b; Lahey 2015; NMHC 2019a).[51] Students with mental health disorders, such as anxiety disorders and depressive disorders, also score lower than students without mental disorders in all NAPLAN test domains and year levels.[52]

The 2017 Young Minds Matter survey found that:

- mental disorders affected 13.9 per cent of school students nationally (1 in 7 children). After attention deficit hyperactive disorder, the most prevalent disorders were anxiety disorders (6.9 per cent of all children), oppositional behavioural problems (5.1 per cent of all children), and major depressive disorders (2.8 per cent of all children)
- anxiety disorders were most common in males aged 4 to 11 (7.8 per cent), lowering to 6.2 per cent for males aged 12 to 17. Female anxiety disorders peak at age 12-17 (7.1 per cent)
- major depressive disorders are uncommon in children aged 4 to 11 (1.2 per cent for males and 1.3 per cent for females). However, prevalence increases with age, with 5.0 per cent of females and 4.1 per cent of males aged 12 to 17 having a major depressive disorder in the previous 12 months. These disorders have the greatest impact on children's lives, with 43 per cent of sufferers experiencing a 'severe impact'

50 Australian Institute of Health and Welfare 2020, Australian Children, Australian Government, see https://www.aihw.gov.au/reports/children-youth/australias-children/contents/health/children-with-mental-illness

51 Australian Institute of Health and Welfare 2020, Australian Children, Australian Government, see https://www.aihw.gov.au/reports/children-youth/australias-children/contents/health/children-with-mental-illness

52 Goodsell B., Lawrence D., Ainley J., Sawyer M., Zubrick S. and Maratos J. 2017 Child and Adolescent Mental Health and Educational Outcomes: An analysis of educational outcomes from Young Minds Matter, The University of Western Australia, Graduate School of Education.

- mental disorders are more common in families already facing other challenges such as unemployment, low incomes, lower level of parental education attainment, or family breakup, and
- just over half (56 per cent) of children with mental disorders have used specialist mental health services in the previous 12 months (such as psychologists and psychiatrists). Other supports such as General Practitioners and school counsellors also play an important role in supporting students and their families and identifying referral pathways.[53]

The cost of child and youth mental health

The financial and social cost of child or adolescent mental health conditions is high:

- according to AIHW's Mental Health Services in Australia report, $10.6 billion was spent on mental health related services in Australia during 2018-19, representing $420 per person[54]
- Le LK-D (2021) estimated that the additional health care and medication cost for children and adolescents with mental disorders is higher than those without a mental disorder. The additional healthcare cost due to mental disorders was found to be $234 million annually,[55] and
- in 2009, Access Economics estimated that mental illness in peopled aged 12 to 25 cost $10.6 billion, mainly due to lower employment outcomes (70.5 per cent), deadweight loss from transfers such as welfare payments (15.5 per cent), and direct health system expenditure (13.4 per cent).[56]

One method of costing mental health issues is to consider an individual episode of health care, such as a single inpatient hospital admission. This approach has been applied by Neil A. (2020).[57] In this study, hospital separations were analysed for age bands, from 0-1 years old to 12-13 years old. AR-DRG codes were then used to determine the cost per admission. A summary of the average cost per admission is provided below.

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53 Goodsell B., Lawrence D., Ainley J., Sawyer M., Zubrick S. and Maratos J. 2017 Child and Adolescent Mental Health and Educational Outcomes: An analysis of educational outcomes from Young Minds Matter, The University of Western Australia, Graduate School of Education.

54 Australian Institute of Health and Welfare 2021, Mental Health Services in Australia, Australian Government, see https://www.aihw.gov.au/reports/mental-health-services/mental-health-services-in-australia/report-contents/expenditure-on-mental-health-related-services

55 Le LK-D., Shih S., Richards-Jones S., lou Chatterton M., Engel L., Stevenson C., Lawrence D., Pepin G., Milhalopoulos C. 2021 The cost of Medicare-funded medical and pharmaceutical services for mental disorders in children and adolescents in Australia, see https://doi.org/10.1371/journal.pone.0249902.

56 Access Economics 2009 The economic impact of youth mental illness and the cost effectiveness of early intervention.

57 Neil A, Islam F., Kariuki M., Laurens K., Katz I., Harris F., Carr V., Green M. 2020, Costs for physical and mental health hospitalizations in the first 13 years of life among children, Child Abse & Neglect, Vol 99, https://doi.org/10.1016/j.chiabu.2019.104280

4.17 Mental health hospital admissions in children

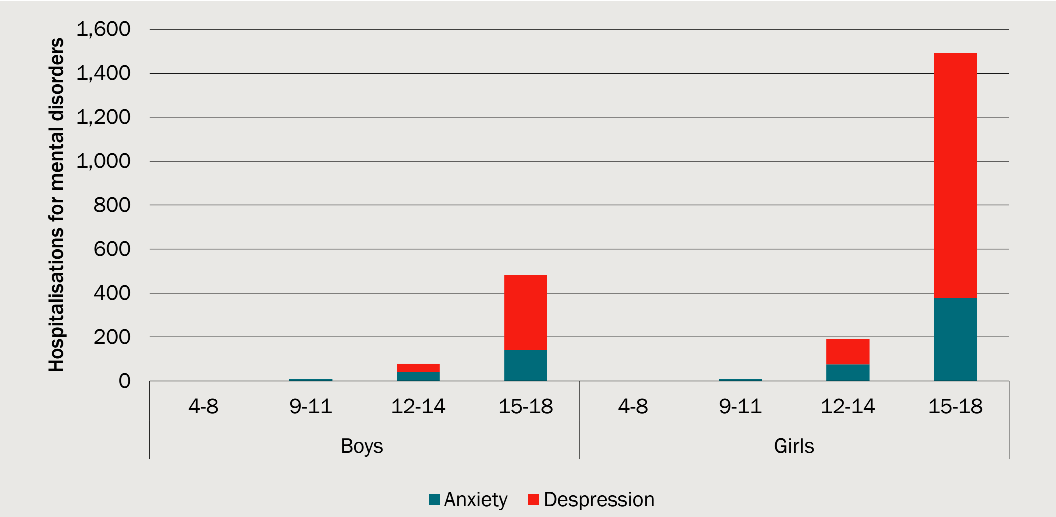
Age band	Cost per admission
	$ 2015-16 dollars
4 to 5	4 745
5 to 6	5 867
6 to 7	15 167
7 to 8	7 050
8 to 9	7 222
9 to 10	7 925
10 to 11	8 617
11 to 12	15 181
12 to 13	23 200

Note: Data for children unknown to child protection services have been provided.

Source: Neil A, Islam F., Kariuki M., Laurens K., Katz I., Harris F., Carr V., Green M. 2020, Costs for physical and mental health hospitalizations in the first 13 years of life among children engaged with Child Protection Service, Supplementary Table 4 and Table 3, https://doi.org/10.1016/j.chiabu.2019.104280

Table 4.17 shows that as children become older, the cost of the hospital admissions trends upwards. As age increases, so too does the rate of hospitalisations (chart 4.18).

4.18 Hospitalisations for anxiety and depressive disorders, NSW 2015-2019



Data source: NSW Combined Admitted Patient Epidemiology Data, SAPHaRI. Centre for Epidemiology and Evidence, NSW Ministry of Health.

Literature on sport participation and mental health outcomes

Physical activity interventions supporting children and adolescents can help to reduce the rates of hospitalisations and the financial and social costs of mental health disorders.

Most of the literature are cross-sectional by design and show associations between physical activity and mental health outcomes. There are limited longitudinal studies, of which show a minor positive effect. A summary of the literature is shown in table 4.19.

4.19 Mental health literature

Modelling assumption	Literature summary	Source
There is a positive relationship between physical activity and mental health outcomes. Including self-efficacy, self-concept, self-worth, social behaviours, motivation and goal orientation, and friendships	Harold W (2013) summarises numerous studies that have established the association between physical activity and mental health. This includes both reducing symptoms and helping to prevent complaints, such as depression and anxiety. The relationship is most likely to be bidirectional. For instance, physical activity improves mental health, and people are more physically active when they are mentally healthy. From the literature reviewed, the impact of physical activity on measures of mental health is moderate, with effect sizes generally ranging from 0.4 to 0.7. Guddal MH (2018) confirmed this, by finding that a high level of physical activity, compared with a low level of physical activity was significantly associated with reduced odds of low self-esteem and low life satisfaction among all students. Higher levels of physical activity were favourably associated with self-esteem and life satisfaction throughout adolescence, as well as with reduced likelihood of psychological distress in senior high school students.	https://www.ncbi.nlm.nih.gov/books/NBK201497/ https://bmjopen.bmj.com/content/bmjopen/9/9/e028555.full.pdf
All increases in physical activity are beneficial	Harold W (2013) found that many different types of physical activity (such as aerobic activity, resistance training, yoga, dance, flexibility training, walking programs, and body building) improve mood and other mental health indicators. The evidence is strongest for aerobic physical activity, particularly for reduction of anxiety symptoms and stress. However, some studies found no difference in benefits between vigorous- and lower-intensity physical activity. This suggests that all levels of physical activity may be helpful.	https://www.ncbi.nlm.nih.gov/books/NBK201497/
8 weeks participation is sufficient to achieve a benefit	Harold W (2013) noted that the ideal length and duration of physical activity for improving mental health remain unclear. Although regular exercise is associated with improved mood, the association between mood and medium- or long-term exercise is not consistent. Studies often do not specify the frequency and duration of physical activity episodes; among those that do, interventions ranged from 6 weeks to 2 years in duration. In one meta-analysis, Ahn and Fedewa (2011) found that, comparing interventions entailing a total of more than 33 hours, 20-33 hours, and less than 20 hours, the longer programs were more effective.	https://www.ncbi.nlm.nih.gov/books/NBK201497/
Adolescents benefit from mental health outcomes more than younger children	Guddal MH (2018) found that high levels of physical activity did not have a statistically significant impact for junior high school students on psychological distress outcomes (odds ratio of 0.88 for girls and 0.70 for boys). However, the findings were statistically significant for senior high school students (odds ratio of 0.63 for girls and 0.46 for boys).	https://bmjopen.bmj.com/content/bmjopen/9/9/e028555.full.pdf

Modelling assumption	Literature summary	Source
	For senior high school girls, the difference between low and moderation physical activity also reduced the odds of psychological distress (odds ratio of 0.73) Guddal MH (2018) noted the importance of continuing with sports in the late teens, especially in team sports.	

Source: as listed within the table.

Association between physical activity and psychological distress

Our analysis of the benefits of physical activity on mental health outcomes draws from the Guddal[58] study, which shows the association between levels of physical activity and the likelihood of suffering from psychological distress.

The study population is a cohort of 10 464 Norwegian junior and senior high school students who completed a population-based health survey between 2006 to 2008. Junior high school students had a mean age of 14.6 years in junior high and 17.6 years in senior high, while boys had a mean age of 14.6 years in junior high and 17.5 years in senior high. Logistic regression models were used to estimate the likelihood of psychological distress according to self-reported physical exercise levels.

The physical activity level was assessed by a validated question on frequency of physical activity from WHO Health Behaviour in Schoolchildren Survey Questionnaire[59]: Outside school hours: 'How often do you usually exercise in your free time so much that you get out of breath or sweat?'. The level of intensity during exercise where you breathe heavily and/or sweat refers to moderate to vigorous activity. Response alternatives were:

- every day,
- 4–6 days/week,
- 2–3 days/week, 1 day/week,
- less than every week,
- less than every month, and
- never.

Responses were categorised into three levels of physical activity:

- 'low physical activity' (≤1day/week) (reference group)
- 'moderate physical activity' (2–3days/week), and
- 'high physical activity' (≥4days/week).

58 Guddal MH, et al. (2019), Physical activity and sport participation among adolescents: associations with mental health in different age groups. Results from the Young-HUNT study: a cross-sectional survey. BMJ Open. doi:10.1136/bmjopen-2018-028555

59 Booth ML, et al. (2001), The reliability and validity of the physical activity questions in the WHO health behaviour in schoolchildren (HBSC) survey: a population study. Br J Sports Med 2001;35:263–7.

Psychological distress was assessed using a validated short version of the Hopkins Symptom Check List Five-item (SCL-5)[60], including the phrases: 'During the last 14 days: I have been constantly afraid and anxious; I have felt tense or uneasy; I have felt hopeless about the future; I have felt dejected or sad; I have worried too much about various things'. Responses were scored according to four response alternatives ranging from 'not at all bothered' (1) to 'extremely bothered' (4). A mean score was calculated, and a cut-off for symptoms of anxiety and depression was set at a mean score above two.

Results showed that a high physical activity level was associated with reduced levels of psychological distress among high school students (table 4.20). For example, for girls in senior high school, of those who report moderate physical activity have odds of 0.73 for having physical distress, compared with 1 for low physical activity. This means that there is a 17 per cent decrease in the odds of having psychological distress for senior high school girls reporting moderate physical activity.

4.20 Link between physical activity and psychological distress among youth

PA level	Junior high school outcome	Senior high school outcome
	Odds ratio (95% CI)	Odds ratio (95% CI)
Girls		
Low PA	1.0 (Reference)	1.0 (Reference)
Moderate PA	0.86 (0.62 to 1.21)	**0.73 (0.54 to 0.99)**
High PA	0.88 (0.63 to 1.24)	**0.63 (0.46 to 0.86)**
Boys		
Low PA	1.0 (Reference)	1.0 (Reference)
Moderate PA	**0.56 (0.31 to 0.99)**	0.89 (0.53 to 1.49)
High PA	0.70 (0.41 to 1.18)	**0.46 (0.27 to 0.79)**

Note: PA (Physical Activity), Bold numbers are statistically significant associations $p<0.05$

Source: Guddal M. et al. (2019), Physical activity and sport participation among adolescents: associations with mental health in different age groups. Results from the Young-HUNT study: a cross-sectional survey, BMJ Open 2019

Males who participate in physical activity have a much lower risk of mental disorders than females. For instance, senior high school boys undertaking a high level of physical activity have a 54 per cent reduction in psychological distress compared to girls that have a 37 per cent decrease.

This study establishes an association between levels of physical activity and psychological distress. While the cohort is drawn from Norway, the psychological distress measurement tool used is globally recognised and can be translated to an Australian context. While patterns of psychological distress may vary between Norway and NSW, we use the results of study as a relative, not absolute, measure for assessing changes in psychological distress due to physical activity. We note that no causal link is established, and that no studies with a causal link were identified in our literature review.

60 Strand BH, et al. (2003), Measuring the mental health status of the Norwegian population: a comparison of the instruments SCL-25, SCL-10, SCL-5 and MHI-5 (SF-36). Nord J Psychiatry 2003;57:113–8.

Physical activity reduces the risk of psychological distress

We assume any increase in physical activity days decreases the likelihood of suffering from mental health disorders. For the mental health analysis, we use the same classifications of physical activity (low, moderate and high) segments as in the Guddal study. To calculate this change in physical activity, we estimate the probability of each cohort in the dataset to be distributed among the physical activity segments. For example, cohort A has a:

- 10 per cent probability to be in the low physical activity segment
- 70 per cent probability to be in the moderate segment, and a
- 20 per cent probability to be in the high segment (total = 100 per cent).

As each cohort interacts with the Program, through increasing participation and voucher use, the probabilities of being in each segment shift, such that the overall days active increases. In the above example, this shift could be cohort A to become:

- 8 per cent for low physical activity (2 per cent decrease),
- 71 per cent in moderate activity (1 per cent increase) and
- 21 per cent in high (1 per cent increase), (total = 100 per cent).

The shift from low activity to the moderate and high activity segments, when multiplied by the number of children in the cohort, would show the increase in overall days gained. This result can be aggregated across each cohort to show the total change in days across the full population due to the Program.

We assume that changing the level of physical activity will impact the risk of suffering from a mental health disorder. We apply the results of the Guddal study to estimate the reduction in odds of psychological distress across each cohort as a result of changing physical activity segments. We note that the study shows an association, as opposed to a causal link, for the relationship between psychological distress.

The survey cohort used in the Guddal study were children and adolescents aged between 13-19 years old. However, given the significant amount of literature substantiating the mental health benefits from physical activity, these findings have been extrapolated to the 9 to 18 years old population.

When estimating the impact of increasing physical activity on the population experiencing psychological distress, the baseline for the prevalence of mental health disorders needs to be identified. The Guddal study shows individuals who engage in low physical activity have a higher likelihood of mental health disorders. To identify the prevalence of mental health disorders in Australian children, we refer to the results of the national survey of the mental health and wellbeing of Australian children and adolescents[61] conducted by the Telethon Kids Institute at the University of Western Australia in 2013-14. Anxiety disorders ranged from 6.1 per cent of children aged 4-11 to

61 Australian Government (2020), The Mental Health of Children and Adolescents - Report on the second Australian child and adolescent survey of mental health and wellbeing, https://www.health.gov.au/sites/default/files/documents/2020/11/the-mental-health-of-children-and-adolescents_0.pdf

7.7 per cent for children aged 12-17. Depression disorders ranged from 1.2 per cent to 5.8 per cent for the same age cohorts. Mental health disorders often occur simultaneously, with children suffering both anxiety and depression. To account for this, an adjustment is included in the analysis, see appendix C for details.

Impact of reducing prevalence risk of poor mental health

Psychological distress in children and adolescents imposes costs on both the individuals themselves, through reduced wellbeing and school attendance, as well as the government through higher healthcare costs. Reducing the risk of children experiencing psychological distress will decrease the prevalence of disorders, and in turn, decrease costs to both stakeholders. Physical activity as an intervention can enable this prevalence reduction.

Improved wellbeing

Psychological distress relates to anxiety and depression. These disorders can be experienced under different levels of severity, with each level corresponding to a different cost on the individual. Table 4.21 shows the DALYs attributable and cost for each severity of anxiety and depression, as reported in the Global Burden of Disease Study 2019.[62] The study is the most comprehensive global analysis, which analyses 286 causes of death, 369 diseases and injuries, and 87 risk factors in 204 countries and territories.

4.21 Attitude DALYs and DALY cost for Anxiety and Depression

Disorder	Severity	DALY's attributable per year	DALY cost per year
		#	$2021
Anxiety	Mild	0.03	6 660
	Moderate	0.133	22 866
Depression	Mild	0.145	32 190
	Moderate	0.396	55 722

Data Source: Institute for Health Metrics and Evaluation, Global Burden of Disease Study 2019.

The DALY cost is calculated by multiplying DALYs by the value of a statistical life year, which in 2021 was $222 000.[63]

Reduced absenteeism

Children suffering from psychological distress will experience a range of symptoms with various severities that may impact their participation in daily life. Symptoms associated with anxiety are feeling anxious and worried, difficulty in concentrating, remembering

62 Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019) Human Resources for Health 1990-2019. Seattle, United States of America: Institute for Health Metrics and Evaluation (IHME), 2022

63 Office of Best Practice Regulation (2021), Best Practice Regulation Guidance Note: Value of statistical life, https://obpr.pmc.gov.au/sites/default/files/2021-09/value-of-statistical-life-guidance-note-2020-08.pdf

things, sleeping, and difficulty in performing daily activities. Symptoms associated with depression are feeling persistent sadness and loss of interest in usual activities, poor sleeping and tiredness, and needing effort to function in daily life.

Children who suffer from mental health disorders have an increased number of days absent from school.[64] Table 4.22 shows the average days absent from the school in the past 12 months due to symptoms of mental disorders among 4–17-year old's with mental disorders. The impact of psychological distress on days absent from school increases with age, which means the intervention has a higher impact for older age groups.

Absenteeism can increase social isolation, including alienation and lack of engagement with the school community and peers, leading to emotional and behavioural difficulties.[65] [66] It is also associated with an increased likelihood of drop-out.[67] [68]

4.22 School absence in the past 12 month due to poor mental health

Disorder	4-11 years	12-17 years
	Average days absent	Average days absent
Any anxiety disorder	6	20
Major depressive disorder	14	23

Source: Australian Government (2020), The Mental Health of Children and Adolescents – Report on the second Australian child and adolescent survey of mental health and wellbeing.

Schooling also provides students with skills that promote labour productivity and increased potential earnings level, with a return on education of 30.8 per cent.[69]

The value of an additional day of schooling can be derived by applying this return to average wage of an individual who completes year 10 and above, which is $35 728 ($2021), resulting in a value per school day of $55.02. See appendix D for further details.

64 Australian Government (2020), The Mental Health of Children and Adolescents - Report on the second Australian child and adolescent survey of mental health and wellbeing, https://www.health.gov.au/sites/default/files/documents/2020/11/the-mental-health-of-children-and-adolescents_0.pdf

65 Carroll, H. (2013). The social, emotional and behavioural difficulties of primary school children with poor attendance records. Educational Studies, 39(2), 223–234. https://doi.org/10.1080/03055698.2012.717508

66 Gottfried, M. A. (2009). Excused versus unexcused: How student absences in elementary school affect academic achievement. Educational Evaluation and Policy Analysis, 31(4), 392–415. https://doi.org/10.3102/0162373709342467

67 Keppens, G., & Spruyt, B. (2017). The development of persistent truant behaviour: an exploratory analysis of adolescents' perspectives. Educational Research, 59(3), 353–370. https://doi.org/10.1080/00131881.2017.1339286

68 London, R. et al. (2016). The dynamics of chronic absence and student achievement. Education Policy Analysis Archives, 24(112). https://doi.org/10.14507/epaa.24.2471

69 Montenegro C.E., Patrinos H.A. (2014), Comparable Estimates of Returns to Schooling Around the World, World Bank Group, Education Global Practice Group. https://openknowledge.worldbank.org/handle/10986/20340

Reduced healthcare costs

Mental disorders in children and adolescents impose high health costs. The average annual cost per child (including the direct health care, direct non-medical, and indirect costs (usually defined as productivity losses)) have been estimated at €1,735 for conduct disorder (CCD), €1,782 for major depressive disorder (MDD), €1,077 for anxiety disorder and €781 for Attention-Deficit/Hyperactivity Disorder (ADHD) in Europe.[70] The annual cost of sub-threshold and clinical mental disorders (including both direct and indirect costs) was 4.7 and 9.2 times greater than the lifetime cost of having no mental disorders[71]. Fatori et al. 2018 found the annual health costs accounted for more than half of the national costs of sub-threshold and clinical mental disorders in 6–14-year old's followed by costs associated with school problems and parental loss of productivity.

A study by Khang-Dao Le et al. (2021)[72] in Australia of children and adolescents using data derived from the Young Minds Matter Survey found costs associated with health care attendances and medications were higher for children and adolescents with mental disorders and subthreshold mental disorders compared to those without a mental disorder. This estimates in this study can be relied upon as they use a recent sample of an Australian population. The additional population health care costs due to mental disorders amounted to $234 million annually in children and adolescents.

Young persons with anxiety and depression use more mental health services than those without (14-15 per cent versus 1.5 per cent for the MBS, and 5-8 per cent versus 0.7 per cent for the PBS). The total costs of mental health disorders are shown in table 4.23.

4.23 Total healthcare cost of mental health

Disorder	Total cost	Difference to no disorder
	$2021	$2021
No disorder	363	-
Anxiety	723	360
Depression	794	430

Source: Khang-Dao Le et al. (2021), The cost of Medicare-funded medical and pharmaceutical services for mental disorders in children and adolescents in Australia, CIE.

70 Olesen J, Gustavsson A, Svensson M, Wittchen HU, Jo¨nsson B, Group CS, et al. The economic cost of brain disorders in Europe. Eur J Neurol. 2012; 19(1):155–62. https://doi.org/10.1111/j.1468-1331.2011. 03590.x PMID: 22175760

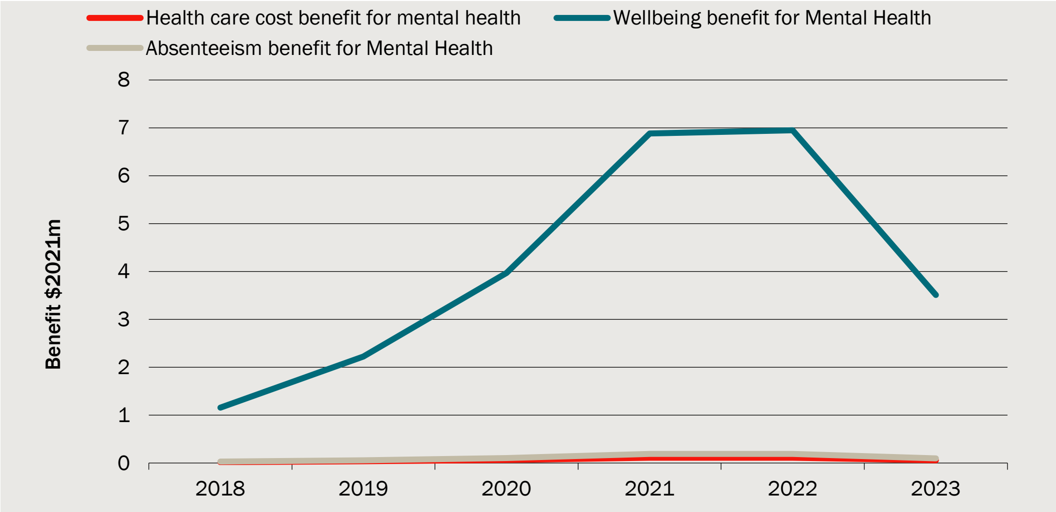
71 Fatori D, Salum G, Itria A, Pan P, Alvarenga P, Rohde LA, et al. The economic impact of subthreshold and clinical childhood mental disorders. J Ment Health. 2018; 27(6):588–94. https://doi.org/10.1080/ 09638237.2018.1466041 PMID: 29708045

72 Khang-Dao Le et al. (2021), The cost of Medicare-funded medical and pharmaceutical services for mental disorders in children and adolescents in Australia, PLOS One, 16(4): e0249902. https://doi.org/10.1371/journal.pone.0249902

Quantified benefits of reduced mental health costs

Reduced mental health costs are valued at $25.8 million. Wellbeing benefits are the greatest ($6.9 million in 2021) followed by reduced absenteeism ($193 000) and reduced healthcare costs ($115 000) (chart 4.24). All benefit categories increasingly ramp up from 2018 to 2021, after which the benefit growth rate forecast reflects population growth.

4.24 Mental health benefits outcomes 2018 to 2023



Data source: CIE

Benefits are the highest for males aged 9 to 11 years, as they have the largest risk reduction from physical activity and experience the largest increase in activity days gained from the Program.

4.25 Mental health benefit by gender and age cohort from 2018 to 2023

Gender	Age cohort	Wellbeing	Healthcare	Absenteeism
		$'000	$'000	$'000
Female	9 to 11	2 974.8	48.9	70.1
	12 to 14	3 039.1	49.9	87.7
	15 to 18	1 825.3	30.0	69.0

Gender	Age cohort	Wellbeing	Healthcare	Absenteeism
		$'000	$'000	$'000
Male	9 to 11	9 221.6	154.6	222.6
	12 to 14	6 013.9	100.8	177.9
	15 to 18	1 578.5	26.5	61.2
Total		**24 653.1**	**410.7**	**688.5**

Note: All results are present value $2021, discount rate 7 per cent

Source: CIE.

5 Value of educational benefits

Physical activity provides a small but meaningful impact on academic performance and improved educational behaviours, including school attendance. Educational benefits of increased physical activity attributed to the Program (and not previously included in other estimates) are valued at $4.5 million, driven by increased school performance and associated higher earnings potential.

Physical activity and educational outcomes

Physical activity and school performance

PANORG analysed 29 systematic reviews which considered the relationship between physical activity and educational achievement, concluding physical activity is positively associated with improved attention, concentration, classroom behaviour, and school engagement.[73] This is particularly the case for adolescents that move from a low level of physical activity to a moderate-to-vigorous level.[74]

The literature shows that physical activity has a positive impact on attention, on-task and in-classroom behaviours and school engagement. The impact from these positive behavioural changes will ultimately be seen through improved school performance.

However, outside the school environment, links between education and physical activity are more moderate. Of the seven systematic reviews that considered physical activity outside of the school environment, 2 studies were mixed or inconclusive, and 5 found small positive impacts on educational outcomes.

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73 Physical Activity Nutrition Obesity Research Group (PANORG) 2020 Healthy eating and active living and education-related outcomes in children and adolescents: A rapid evidence review, the University of Sydney, see https://ses.library.usyd.edu.au/bitstream/handle/2123/24104/HEAL%20Rapid%20Review_Full%20Technical%20Report%20FINAL.pdf?sequence=1&isAllowed=y

74 Physical Activity Nutrition Obesity Research Group (PANORG) 2020 Healthy eating and active living and education-related outcomes in children and adolescents: A rapid evidence review, the University of Sydney, see https://ses.library.usyd.edu.au/bitstream/handle/2123/24104/HEAL%20Rapid%20Review_Full%20Technical%20Report%20FINAL.pdf?sequence=1&isAllowed=y

5.1 Summary of literature — Physical activity and educational outcomes

Study	Population	Association	Impact from physical activity
Singh et al 2019	children and adolescents	Mixed	▪ Beneficial effects on maths ▪ Inconclusive evidence on cognitive performance and overall academic performance
Li et al., 2017		Inconclusive	▪ Although there was some indication of positive impacts on cognitive function and academic performance, the evidence was inconclusive and limited in quantity and quality.
Singh, 2012	Children and adolescents	Positive	▪ limited evidence of a significant positive relationship between physical activity and academic performance
de Greef et al., 2018	Children	Positive	▪ positive effect on executive functions and academic performance
Donnelly et al., 2016		Positive	▪ positive effects on cognition and academic performance
Haapala 2012	Children and adolescents	Positive	▪ positive effects on working memory, language, and arithmetic skills
Fedewa and Ahn, 2011		Positive	▪ Positive effect on maths and reading achievements

Source: Summarised from Physical Activity Nutrition Obesity Research Group (PANORG) 2020 Healthy eating and active living and education-related outcomes in children and adolescents: A rapid evidence review, the University of Sydney, see https://ses.library.usyd.edu.au/bitstream/handle/2123/24104/HEAL%20Rapid%20Review_Full%20Technical%20Report%20FINAL.pdf?sequence=1&isAllowed=y

Outside the systematic review, other evidence include:

- Nelson & Gordon (2006) using data from a sample of US adolescents in grades 7 through 12 that found students with a high level of participation in school-based physical activities were more likely to earn higher grades
- In Kansas, Donnelly et al. (2009) found children in grades 4 and 5 who had an additional 90 min of physical education per week improved their grades
- Castelli et al. (2007), which carried out fitness tests for students in third and fifth grades in the USA and found physical activity was positively related to scores on the Illinois Standards Achievement Test
- Stevens et al. (2008), which collected data about physical activity of children and families in the USA and found that physical activity was significantly and positively related to both mathematics and reading grades of students in the fifth grade
- Lorenz et al. (2017), which analysed fourth grade students in the USA and found a positive association between physical activity and school grades
- OECD (2017), which found a positive relationship between students' physical activity and academic performance based on PISA data, and
- Pellicer-Chenoll et al. (2015), which examined a sample of students in the first year of secondary education from five schools in Barcelona and concluded that students with better physical fitness exhibit higher school grades.[75]

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75 Gomez-Fernandez N. 2020, Physical activity in and out-of-school and academic performance in Spain, Health Education Journal, DOI: 10.1177/0017896920929743

On balance, the evidence suggests the physical activity boost through the Active Kids program has a small beneficial impact on school achievement.

Physical activity and education-related behaviours

There is strong evidence that children that undertake higher levels of physical activity have improved education-related behaviours, such as attention, behavioural conduct, and school engagement in general.[76] [77] [78]

PANORG analysed 11 systematic reviews that investigated the effect of physical activity in school age children on attention, on-task and in-class behaviour conduct and school engagement. These studies are summarised in the table below.

5.2 Summary of literature — Physical activity and educational behaviours

Study	Population	Association	Impact from physical activity
Attention			
de Greef et al., 2018	children 6-12 years	Positive	▪ small-moderate positive effect of acute physical activity ▪ large positive effect of a longitudinal physical activity program
Haapala, 2012	children and adolescents	Positive	▪ positive effects of single bouts of physical activity on attention
Sullivan et al., 2017	children 5-6 years	Positive	▪ short bouts of physical activity (5-30 minutes) improved attention
Cornelius et al., 2017	children and adolescents with attention deficit hyperactivity disorder	Not significant	▪ no significant effect of physical activity on attention
Lees and Hopkins, 2013	children and adolescents	mixed	▪ no consistent effect of aerobic physical activity on inattention or impulsivity ▪ However, fitter children and adolescents performed better on attention and impulsivity outcomes
On-task and in-class behavioural conduct			
Haapala, 2012	children and adolescents	Positive	▪ positive effects of single bouts of physical activity on concentration
Sullivan et al., 2017	children 5-6 years	Positive	▪ short bouts of physical activity (5-30 minutes) improved on-task behaviour

76 Harold W. Kohl III and Heather D. Cook 2013 Educating the student body: taking physical activity and physical education to school, Committee on Physical Activity and Physical Education in the School Environment, Institute of Medicine

77 Myrto Foteini Mavilidi, Margina Ruiter, Mirko Schmidt ,Anthony D. Okely, Sofie Loyens, Paul Chandler, and Fred Paas 2018 A narrative review of school-based physical activity for enhancing cognition and learning: the importance of relevancy and integration, Front. Psychol., https://doi.org/10.3389/fpsyg.2018.02079

78 Active Education: Growing evidence on physical activity and academic performance, Active living research, Research brief.

Study	Population	Association	Impact from physical activity
Cornelius et al., 2017	children and adolescents with attention deficit hyperactivity disorder	Not significant	▪ no significant effect of physical activity on disruptive behaviour
Alvarez-Bueno et al., 2017	children and adolescents	Positive	▪ time spent in on-task classroom behaviour improved with physical activity interventions
Martin and Murtagh et al., 2017		Positive	▪ medium and large effect sizes for on-task behaviour both during and following active lessons
Watson et al., 2017	Primary school children	Positive	▪ classroom-based physical activity had a positive effect on improving on-task behaviour and reducing off-task behaviour.
Keays and Allison, 1995	10-14 years old	Positive	▪ daily physical activity in schools improved attitude, discipline and creativity
School engagement			
Owen et al., 2016		Positive	▪ Interventions such as physical active breaks during academic classroom lessons, integrated into classroom lessons or implemented during recess or lunch had a small positive association with school engagement

Source: Summarised from Physical Activity Nutrition Obesity Research Group (PANORG) 2020 Healthy eating and active living and education-related outcomes in children and adolescents: A rapid evidence review, the University of Sydney, see https://ses.library.usyd.edu.au/bitstream/handle/2123/24104/HEAL%20Rapid%20Review_Full%20Technical%20Report%20FINAL.pdf?sequence=1&isAllowed=y

Active Kids survey data confirms beneficial impacts on attention

The Active Kids survey data shows that children that participate in the Program are more likely to feel 'full of energy' and are less likely to feel 'unable to concentrate'. The following analysis considers the last survey response for program participants (including those that did not redeem a voucher), and their responses to the following survey questions:

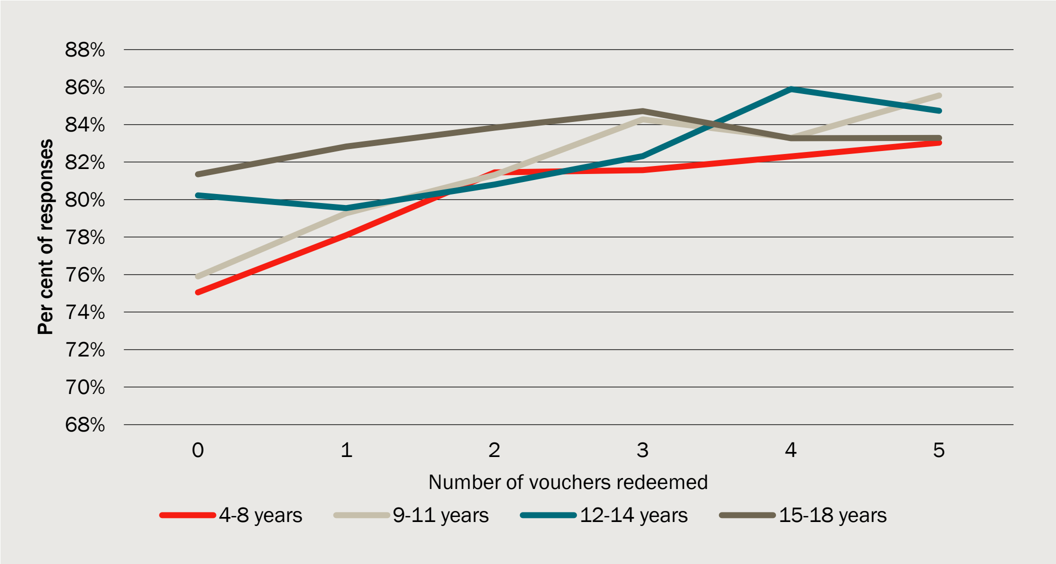
- Thinking about the last week, how often has the child felt full of energy, and
- Thinking about the last week, how often has the child felt unable to concentrate.

Possible responses to both questions were never, rarely, quite often, and always.

Link between voucher use and attention

Chart 5.3 shows that as the number of voucher increases, the proportion of participants feeling 'never' or 'rarely' unable to concentrate increases. This association is particularly strong for 9- to 11-year-olds, with a 10 percentage point difference between those who have not redeemed a voucher to those that redeemed 5.

5.3 Per cent of responses feeling 'never' or 'rarely' unable to concentrate

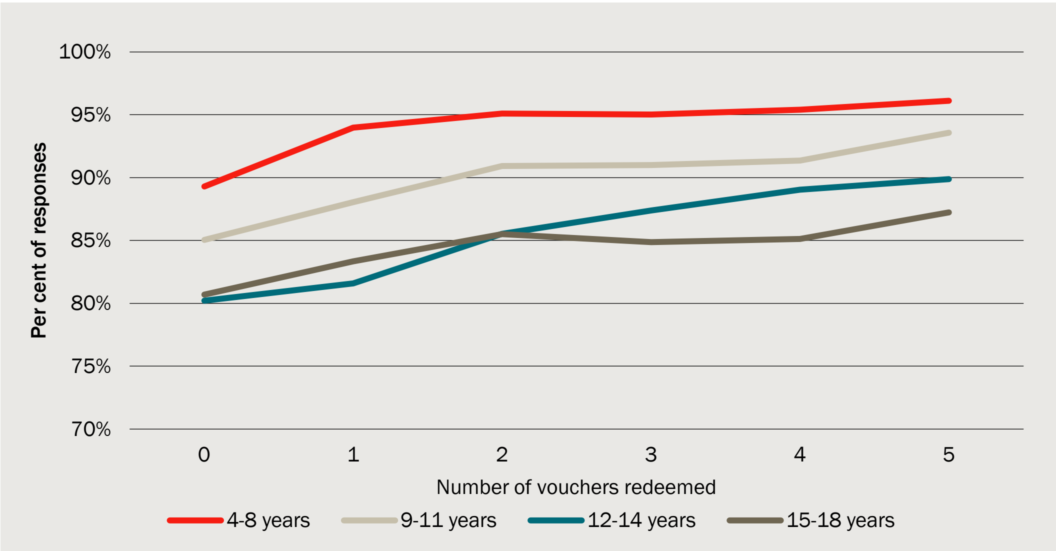


Data source: Active Kids survey response data, SPRINTER.

Link between voucher use and energy

Chart 5.4 shows that as the number of voucher increases, the proportion of program participants feeling 'quite often' or 'always' full of energy increases. The increase in reported energy levels is seen across all age groups, from a 7-percentage point increase for the 4 to 8 and 15 to 18 years old age groups, to a 10 percentage point increase for the 12 to 14 years old group.

5.4 Per cent responses feeling 'quite often' or 'always' full of energy



Data source: Active Kids survey response data, SPRINTER.

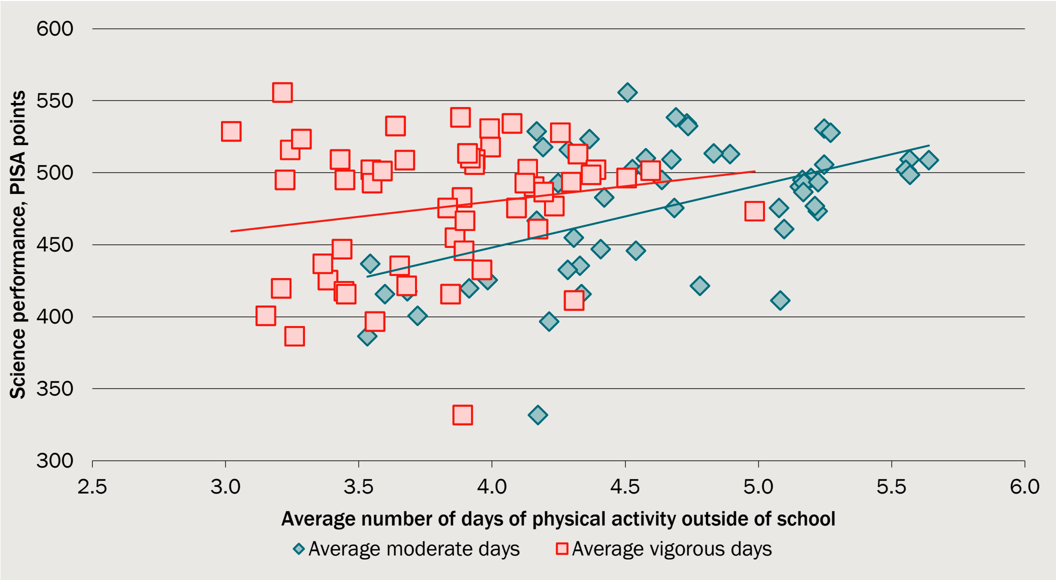
Value of improved educational outcomes

The benefits from improved educational performance are well known and documented.[79] [80] [81] [82] To estimate the value of improved educational performance, we have drawn from OCED's Programme for International Student Assessment (PISA) data.

PISA is an international assessment of 15-year-old students' ability in reading, mathematics and science. The test provides school-level estimates of academic performance, combined with a student questionnaire to gather information about the learning environment and students' attitudes.

A previous analysis used PISA 2015 to evaluate the impact of exercise outside of school on science academic outcomes. The analysis found that there is a positive relationship between the number of days students engage in physical activity outside of school and the average science performance of education systems.[83]

5.5 Association between physical activity and science performance



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[79] Productivity Commission 2019, '*Skills and workforce development agreement: Issues paper*', Australian Government, accessed 15 April 2020 <https://www.pc.gov.au/inquiries/current/skills-workforce-agreement/issues/skills-workforce-agreement-issues.pdf>

[80] Independent Pricing and Regulatory Tribunal (IPART) 2013, '*Pricing VET under Smart and Skilled: Other Industries – Final Report*'.

[81] Deloitte Access Economics 2011, '*The economic and social benefit of increased participation by disadvantaged students in VET*', National VET Equity Advisory Council.

[82] Independent Economics 2013, '*Cost-benefit analysis and returns from additional investment in Vocational Education and Training*', TAFE Directors Australia

[83] https://www.oecd-ilibrary.org/docserver/9789264273856-en.pdf?expires=1649223535&id=id&accname=guest&checksum=F4CDBA2F62762BC942B804FE3AD05707

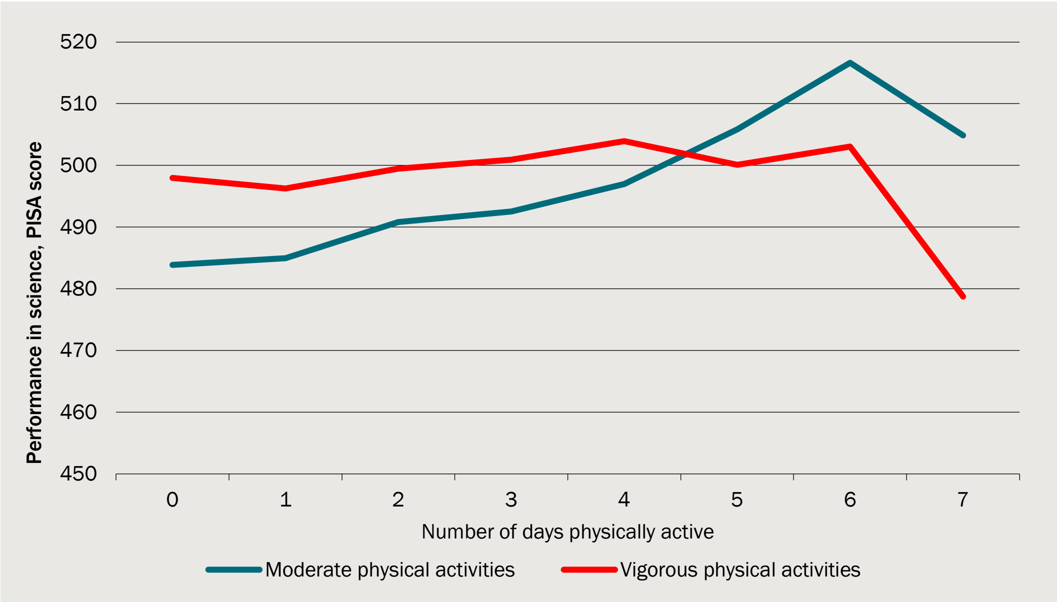
Data source: OECD, PISA 2015 Database, Tables I.2.3 and III.11.13.

The data indicates that an additional day of moderate physical activity is positively associated with students' science performance. Based on the OECD average, an additional day of moderate physical activity results in an increase of 3 points, reducing to 2 points when controlling for gender and socio-economic status.

An additional day of 'vigorous' physical activity resulted in a reduction of 1 point, or a reduction in 3 points when controlling for student characteristics. This negative association appears to be driven by student athletes who assign a higher priority to success in sports than to academic achievement. There is a general but slight upward trend between vigorous physical activity and science performance from 0 days to 6 days, however, PISA performance falls by nearly 25 points for students with 7 days of vigorous physical activity.[84]

The relationship between PISA achievement and the number of days physically activity is shown in chart 5.6 below.

5.6 PISA score by average number of days physically active



Data source: OECD, PISA 2015 Database, Table III.11.15.

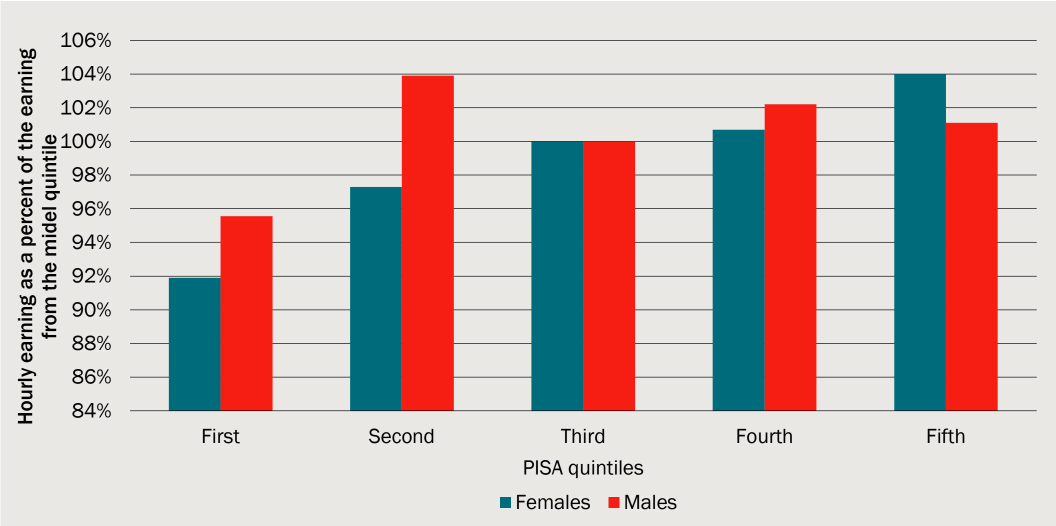
Because there are a mix of moderate and vigorous physical activities within the Active Kids Program, we have used the average to calculate our results. This results in a steady increase in PISA performance for each additional day of physical activity.

84 https://www.oecd-ilibrary.org/docserver/9789264273856-en.pdf?expires=1649223535&id=id&accname=guest&checksum=F4CDBA2F62762BC942B804FE3AD05707

Uplift in earnings

An OECD analysis investigated the relationship between PISA scores and earnings in Canada at the age of 21.[85] The study found that there was a steady increase in earning power alongside increases in achievement. This relationship was strongest for females, with a less consistent but similar pattern for males (chart 5.7).

5.7 Hourly earnings as a percent of earnings of those in middle quintile



Data source: OECD, 2010, Competent Pathways to Work: PISA Scores and Labour Market Returns.

Females at the top quintile were earning 12.0 per cent more than those in the bottom quintile, and males at the top quintile were earning 5.5 per cent more than those in the bottom quintile. Assuming a 50/50 spilt between females and males, there is an average of 8.8 per cent difference between the top and bottom quintiles.

To estimate the impact of an increase in PISA scores in NSW, we overlay these findings to the Australian PISA results. The difference in PISA scores between 75th percentile and the 25th percentile is 151. When the percentage change in earnings is divided by the difference in PISA scores, there is a 0.06 per cent increase in earnings per score.

5.8 Increase in earnings per score

	25th Percentile	75th Percentile	Difference in scores	Percentage change in earnings	Increase in earnings per score
	Score	Score		%	% per score
Australia	429	580	151	8.8	0.06

Source: https://research.acer.edu.au/context/ozpisa/article/1037/type/native/viewcontent, OECD, 2010, Competent Pathways to Work: PISA Scores and Labour Market Returns, and CIE.

85 OECD, 2010, Competent Pathways to Work: PISA Scores and Labour Market Returns

When applying this increase in earnings per PISA score to the average wage[86] and the findings in chart 5.6, the following benefits are estimated.

5.9 Earnings benefit per additional day of physical activity per participant

Population	0 days	1 to 3 days	4 to 6 days	7 days
	$	$	$	$
Average benefit	0	39-214	162-395	-443

Notes: Average wages for individuals ages 21 to 24 applied.

Source: CIE.

The benefit of the Program is estimated by comparing the change in the number of days being active across each population group. Participants that have an increase in the number of days active will receive a positive benefit, until 7 days of activity is reached.

For example, a participant that moves from 0 days physically active to 4 days physically active will receive an earnings benefit of $162 for each year they participate in the program. However, if the same participant moved to 7 days of physical activity, the participant would receive a cost of $443, consistent with OECD.[87]

Increased employment participation

An increase in PISA score reduces the chance of being unemployed at age 21.[88] The results of this study are shown in chart 5.10. There is a clear linear relationship between unemployment rates and PISA scores. Approximately 14 per cent of males in the first PISA quintile were unemployed, compared to nearly 8 per cent in the fifth. The relationship is less clear for females, however, there is a general trend towards lower unemployment from higher PISA scores. Approximately 12 per cent of females in the first PISA quintile were unemployed, compared to approximately 9 per cent in the fifth.

Applying a similar methodology to above, the average change in the unemployment rate from a single PISA point increase is -0.04 for males and -0.02 for females. When applying this change in unemployment outcomes per PISA score to the average wage,[89] benefits can be estimated, as shown in table 5.10.

86 ABS, May 2021, Employee Earnings and Hours, Australia, Table 2 ALL EMPLOYEES, Number of employees, Average weekly total cash earnings–Age category, Employment status by Sex (21 to 34 years old)

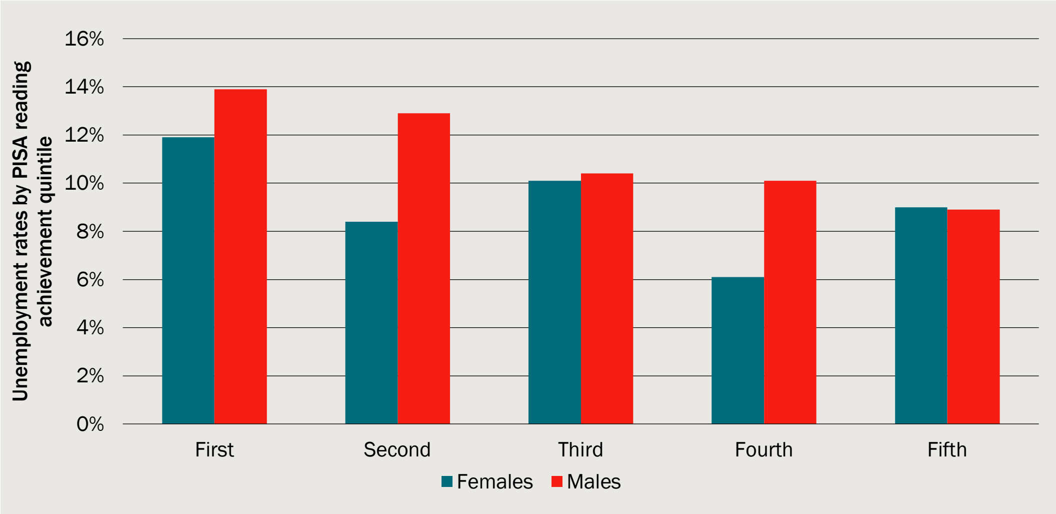
87 https://www.oecd-ilibrary.org/docserver/9789264273856-en.pdf?expires=1649223535&id=id&accname=guest&checksum=F4CDBA2F62762BC942B804FE3AD05707

88 OECD, 2010, Competent Pathways to Work: PISA Scores and Labour Market Returns

89 ABS, May 2021, Employee Earnings and Hours, Australia, Table 2 ALL EMPLOYEES, Number of employees, Average weekly total cash earnings–Age category, Employment status by Sex (21 to 34 years old)

The benefit for males up to 7 days of physical activity are approximately 1.5 times higher than females because of the larger reduction in unemployment rates at higher PISA scores, as well as higher average incomes.

5.10 Relationship between PISA score and unemployment rates



Data source: OECD, 2010, Competent Pathways to Work: PISA Scores and Labour Market Returns, Figure 7.1

5.11 Employment benefit per additional day of physical activity per participant

Population	0 days	1 to 3 days	4 to 6 days	7 days
	$	$	$	$
Males	0	15-80	61-148	-162
Females	0	6-31	24-58	-64

Notes: Average wages for individuals ages 21 to 24 applied. Unemployment duration assumed to be 6 months – in alignment with the survey question asked in the study.

Source: CIE.

Benefit estimate

The Active Kids Program is expected to increase the number of days in attendance at school by combining the positive effects of increased physical activity and improvements in mental health and obesity (chart 5.12). The value of additional attendance is measured in the physical and mental health chapters the return from earnings after completing schooling.

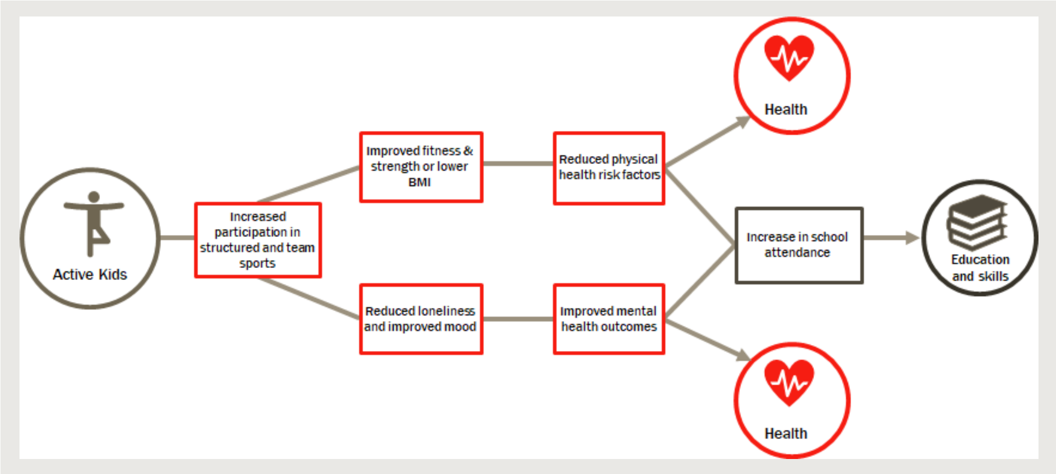
In addition, children's educational performance while at school will increase, as measured by improvements in PISA scores. The value of this increased performance while at school is measured using improved earnings and employability. The total value of educational benefits is $4.5m[90], accounting for the increased earning and employment

90 2021 dollars, present value from 2018 to 2031

potential. The benefit value from an increase in earnings is the largest educational benefit category, which reaches approximately $1m per year by 2021, see chart 5.13.

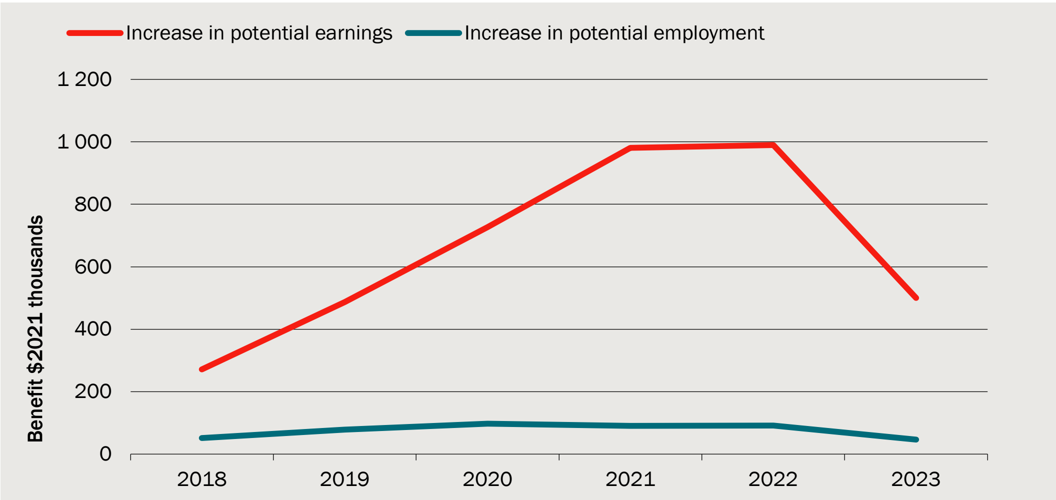
For females, the largest benefits accrue to the age cohort 9 to 11, whereas for males it is the age cohort 12 to 14 (table 5.14).

5.12 Link between health and education benefit pathways



Data source: CIE.

5.13 Educational benefits of active kids 2018 to 2023



Data source: CIE.

5.14 Educational benefit by gender and age cohort from 2018 to 2031

Gender	Age cohort	Earnings	Employment
		$'000	$'000
Female	4 to 8	1 060.7	169.8
	9 to 11	1 897.8	303.9
	12 to 14	1 443.1	231.1
	15 to 18	338.5	54.2
Male	4 to 8	-1 285.0	-504.1

	9 to 11	-161.8	-63.5
	12 to 14	539.6	211.7
	15 to 18	178.4	70.0
Total		**4 011.3**	**473.1**

Source: CIE.

6 Economic benefits

During COVID-19 lockdowns, community sport providers had a substantial reduction in income. Small clubs had an average reduction in revenue of $11 262 (including $3 536 in membership fees) and large clubs had a reduction of $77 549 (including $30 211 in membership fees).

While some services were cancelled, Active Kids vouchers were not required to be paid back, with $8.7 million in vouchers redeemed during 2020 and 2021 lockdowns in NSW. This provided a much-needed financial stimulus to help mitigate the reduction in membership fee revenue.

This is expected to have avoided provider closures, although the number of avoided closures cannot be estimated.

Economic stimulus to community sport providers

The Australian Sports Foundation[91] (ASF) undertook two surveys of community sporting organisations: the first in May 2020, and the second in July 2021 to assess the impact of the COVID-19 pandemic. While findings are not limited to children and adolescent providers, findings are deemed to be equally relevant to Active Kids Providers.

The survey found that COVID-19 reduced community sport provider revenue, the number of volunteers, and participation:

- **Reduced revenue** – Small local clubs[92] had an average reduction in revenue of $11 262, compared to a reduction of $77 549 for large local clubs[93]. Across all clubs, the average reduction in revenue was $18 571. For small local clubs, reduced membership fees amounted to $3 536 on average, and $30 211 on average for large local clubs. 10 per cent of providers are in fear of insolvency.
- **Increased operational costs** – 47 per cent of providers stated that their running costs had increased, and 50 per cent saw a reduction in their financial reserves.
- **Decreased participation in ages 11 to 18** – 43 per cent of providers within the 11- to 18-year-old group reported a decrease in participation, compared to 18 per cent that reported an increase (a net change 25 per cent negative).

91 The Australian Sports Foundation is Australia's national non-profit sports fundraising organisation and charity.

92 Defined as having fewer than 1 000 members and less than $250 000 in annual revenue.

93 Defined as having more than 1 000 members and more than $250 000 in annual revenue.

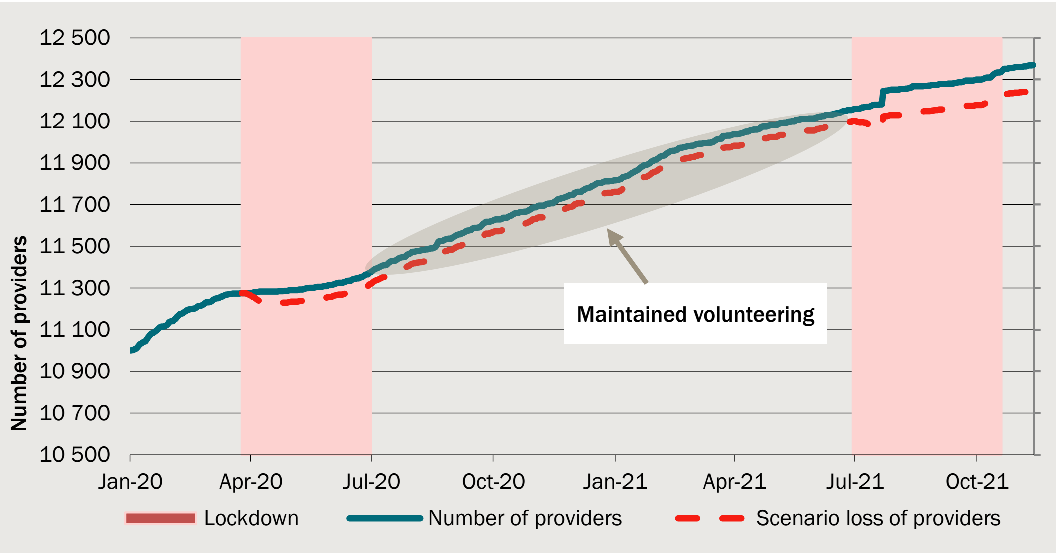
- **Decrease in volunteers** – Nearly 42 per cent of providers reported a decline in volunteers, compared to 9 per cent that reported an increase.[94]

Active Kids counteracted some of the revenue loss

During COVID-19 lockdown periods, community sport providers were not able to run programs, however, Active Kids Providers did not need to return the revenue gained from redeemed Active Kids vouchers. The estimated amount of revenue from Active Kids vouchers provided to activities that were during this lockdown period is $8.7 million. This includes two NSW lockdown periods between 24 March 2020 to 1 July 2020 and 28 June 2021 to 20 Oct 2021.[95] This revenue supported community providers during a time of significant lost income, and likely reduced the number of providers that would have closed temporarily or permanently.

The minimum expected stimulus provided by the Active Kids Program during this time is shown in chart 6.1, assuming 0.5 per cent of providers avoided closing in each 2020 and 2021 lockdowns, compared to the ASF's estimate that one in ten community sport providers were in fear of insolvency.[96] Since many staff are volunteers, the benefit of the Program could be measured by the number of volunteers that were retained but otherwise would not have been, assuming the value of an hour of volunteer time of $38.93.[97]

6.1 Visual representation of Active Kids economic stimulus impact



Note: This scenario does not include lockdowns in specific LGAs.
Data source: Active Kids Provider data, CIE.

94 Australian Sports Foundation 2021 Impact of COVID-19 on Community Sport, Survey report September 2021 update.

95 Based on the number of vouchers redeemed by providers during NSW lockdowns.

96 Australian Sports Foundation 2021 op. cit.

97 Volunteering Australia 2017, The Value of Volunteering Support Services, see https://www.volunteeringaustralia.org/wp-content/uploads/The-Value-of-Volunteering-Support-Services.pdf

The actual value of the economic stimulus cannot be quantified due to lack of data on the number of providers would have closed without the support of the Program, as Program data does not include ongoing provider status.

Data on new provider registrations with the Program shows that:

- within the lockdown that spanned from 25th March 2020 to 30th June 2020, 100 additional providers registered for the Program, much reduced from previous registrations of an average 23 provider registrations per week, and
- within the 29th of June 2021 to 19th October 2021 lockdown, 181 additional providers registered for the Program, which included a spike in the number of providers from the announcement of the First Lap Program. Like the first lockdown, the number of providers registering per week decreased during the lockdown, from nearly 15 per week before to approximately 11 per week during the lockdown.

Although there is insufficient evidence to quantify the extent to which provider solvency was supported by the Program, the Program is expected to have enabled some providers to maintain operations and support fixed costs such as leases or utilities prior to recommencing activities post lockdowns.

7 Community benefits

Community sport builds resilience in communities and contributes to the development of social capital. Since the beginning of the Active Kids Program, there have been a number of major challenges facing the NSW community, including the Black Summer bushfires in 2019, and COVID-19 related lockdowns and risks in 2020 and 2021. People have had to depend on one another to overcome these challenges and rebuild.

Sport provides protective factors for youth during their years of development and is aided by the network of family and community. In this way, the Active Kids Program has been an important contributor to the development of skills and social networks for children during a difficult period in NSW history.

Community sport also facilitates intersections between communities, networking children and communities across ages, ethnicities, and socio-economic backgrounds.

Improved community resilience

Community sport is a vehicle to develop and strengthen resilience among communities and has been widely adopted throughout Australia. In recent years, youth sport programs have been established to improve participation and retention among girls,[98] ethnically diverse groups,[99] First Nations Australians,[100] and children with a disability.[101]

Sporting clubs and organisations also proactively improve mental health literacy,[102] increasingly incorporating methods to advocate educational messages about depression, drugs and alcohol, and domestic violence as part of the development pathway for youth athletes. Sporting clubs and organisations can also engage with schools and communities to deliver health-related messages about nutrition, sleep, and physical activity.[103]

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98 Elliott S. et al. (2019), Parents, girls' and Australian football: a constructivist grounded theory for attracting and retaining participation, Qualitative Research in Sport, Exercise and Health

99 Jeanes R. et al. (2019), Managing informal sport participation: tensions and opportunities, International Journal of Sport Policy and Politics

100 Ferrer J., Turner P. (2017), Indigenous player inclusion in the Australian Football League, Equality, Diversity and Inclusion: An International Journal

101 Jeanes R., et al. (2019), Developing participation opportunities for young people with disabilities? Policy enactment and social inclusion in Australian junior sport, Sport in Society

102 Dowell TL. et al (2020), Tackling Mental Health in Youth Sporting Programs: A Pilot Study of a Holistic Program, Child Psychiatry Hum Dev

103 Drummond M. et al. (2016), Promoting healthy physical activity and nutrition in low SES communities: Reflections on a University-Australian football collaborative model. In: Sports-Based Health Interventions: Case Studies from Around the World

Sport can play a vital role in developing resilience during childhood, particularly in adolescent years, where apart from struggling with the physical and hormonal changes associated with puberty, young people experience difficulties in defining their identities as they strive to achieve independence, providing protective factors[104] that can make this transitional period easier for children and adolescents to navigate.

For instance, participation in community sport:

- promotes individual characteristics such as high self-esteem, self-confidence, communication skills, conflict resolution skills, cultural pride, easy temperament, and a sense of belonging
- provides access to family group support systems, and
- provides access to networks such as supportive persons or agencies outside the family such as sporting clubs and schools.

Resilience can be further developed through fostering a sense of belonging through community recognition of sporting achievements[105], resulting in an increased sense of health and wellbeing for the participants. This building of social networks is key to developing a sense of belonging and a means of contributing to community.

The Active Kids Program has given a positive fillip to social capital across NSW communities. This included during 2020 and 2021 when COVID-19 induced isolation rules reduced contact between children and social and sporting events were cancelled or postponed. The Program enabled memberships to be retained throughout this period, ensuring children maintained connections to their sporting community, and could rapidly reconnect in 2022.

Participation in community sport is also well recognised as a means to strengthening individual resilience. A study of young Australian males showed that sport participation had given them confidence to:

- speak in front of other people
- to express their opinions
- confront others with whom they disagreed
- problem-solve by talking through issues
- motivate others, and
- speak easily about themselves in job interviews.[106]

Participants also reported having less fear because of their involvement in sport, which provided confidence to not fear the opinions of others or being in the limelight. The lessening of fear increased interpersonal confidence, provided greater self-assuredness to meet new people, and made participants feel more able to handle adversity.

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104 Atwool, N. (2002), Adolescents and attachment: Implications for adults working with young people, Journal of the Children's Issues Centre

105 Woodman, D. (2004), Responsibility and time for escape: The meaning of wellbeing to young people, Melbourne Journal of Politics

106 Hall et al (2011), "Give It Everything You Got" Resilience for Young Males Through Sport, International Journal of Men's Health

Developing social capital

Sport as a form of 'social builder' and 'cultural bridge' is widely recognised.

Sport provides an opportunity for diverse community groups and individuals to come together and interact on a social level and has been shown to perform an important bridging role between people across different socio-economic status, age and ethnicity.[107], [108], [109].

Community sport is also an important setting where people are socialised into societal norms around race, gender, and ability, which has significant consequences for how people engage with people from diverse backgrounds.[110] The social interactions that occur through participation in sporting teams and community clubs play an important part in defining and reinforcing patterns of community identification and community belonging.

For instance:

- Delaney, L., Keaney, E. (2005) identified sport as a useful tool for building community networks and relationships, demonstrating strong correlations between the level of sports membership, and levels of social trust and well-being,[111] and
- DeGraaf, D., Jordan, D. (2003) identified the important role of sport and recreation in promoting a sense of well-being and happiness, and promoting close relationships, social support, purpose and hope.[112] Individuals, communities and organisations were found to have the capacity to develop their own social capital, through participation in networks, in the opportunities to develop trust and form new relationships across age, ethnic, religious and economic lines, and by embedding the notion of pooled resources as a benefit to all.

The Active Kids Program has contributed to the development of social capital through attracting children from all ages, backgrounds, and socio-economic status to participate in new activities. The social capital benefits have been reinforced through retaining these cohorts throughout each year of the Program and encouraging cohorts to remain connected on a year-on-year basis.

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107 Tonts, M. (2005), Competitive sport and social capital in rural Australia, Journal of Rural Studies

108 Atherley, K. M. (2006), Sport and Community Cohesion in the 21st Century: Understanding linkages between sport, social capital and the community, University of Western Australia

109 Oliver, P. (2014), The Power of Sport Building social bridges and breaking down cultural barriers

110 Spaaij, R. et al. (2013), A Fair Game for All? How Community Sports Clubs in Australia Deal With Diversity, Journal of Sport & Social Issues

111 Delaney, L., Keaney, E. (2005), Sport and social capital in the United Kingdom: statistical evidence from national and international survey data, Dublin: Economic and Social Research Institute and Institute for Public Policy Research

112 DeGraaf, D., Jordan, D. (2003), Social capital: How parks and recreation help to build community, Parks and Recreation

8 Program costs

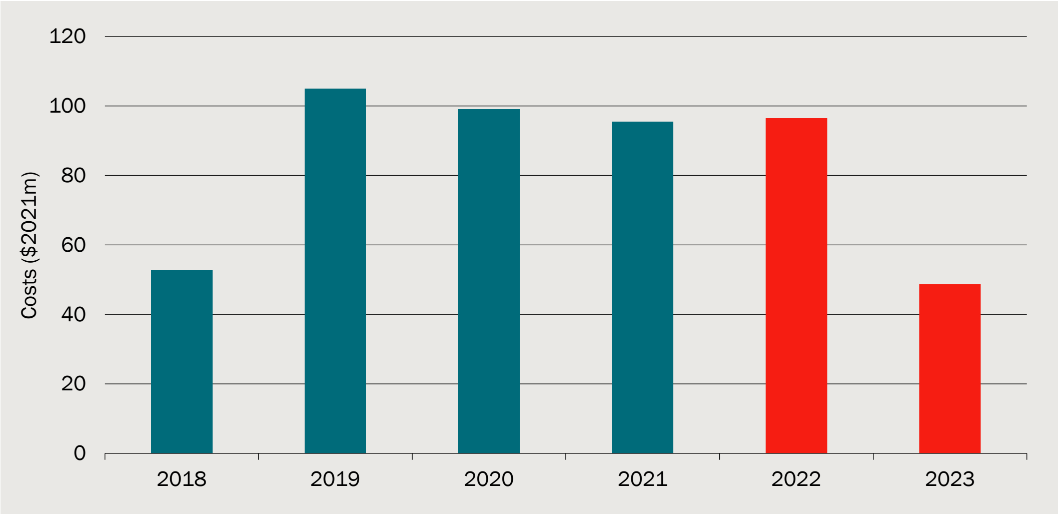
The costs of the Active Kids Program includes the payment of vouchers to families, and staff and administration costs, valued at $0.57 billion over the 2018-2023 economic evaluation period in present value terms.

Costs to NSW Government

Payments to families

With a cost of $100 per voucher, the largest expense of the Program is the vouchers themselves. Across the evaluation period (2018 to 2023), the total cost of the payments to families is $519 million (91 per cent of total costs).

8.1 Previous and forecast Payments to families, real $2021



Data source: The Office of Sport, CIE.

The costs in 2018 were approximately half the cost for other years as only one voucher was available per eligible child, with the number of available vouchers extended to two in 2019.

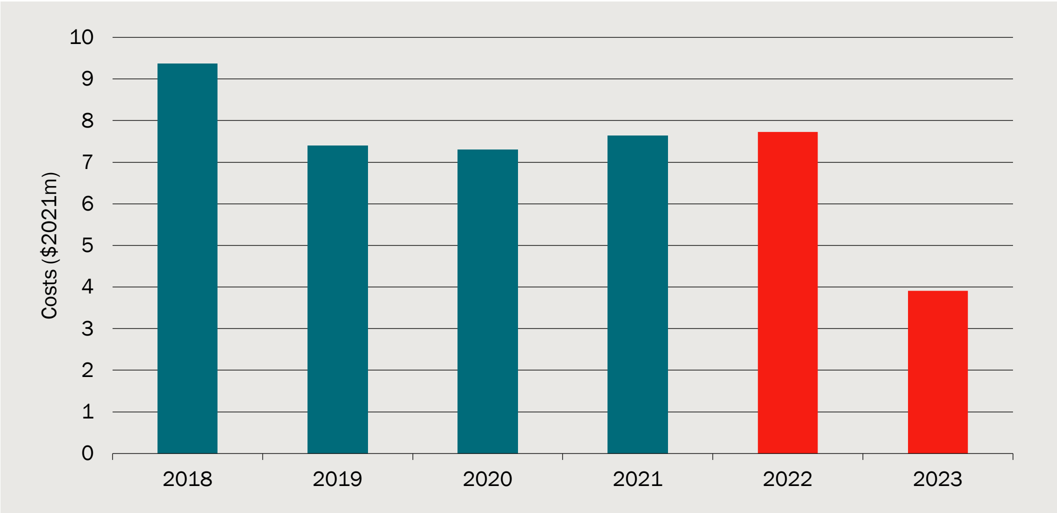
To estimate the cost of the payments to families in the future, we assume registration and redemption rates remain consistent with those in 2020-21, as we have done to calculate future benefits.

Voucher system administration costs

Expenses to support the Program are valued at $46 million in present value terms over the analysis period (2018 to 2023), including:

- initial IT infrastructure investment to build the platform supporting the vouchers (accounting for the high cost in 2018), and
- an ongoing charge for every voucher that is created, with Service NSW charging the Office of Sport $6 per voucher (chart 8.2).

8.2 Voucher system expenses



Note: 2021-20 is up to 30 November 2021

Data source: The Office of Sport, CIE.

Ongoing voucher creation costs are forecast in line with population growth for 4-to-18-year-olds in NSW. This assumes that the adoption of the Program remains consistent with the 2020-21 adoption rate, consistent with the benefit calculations.

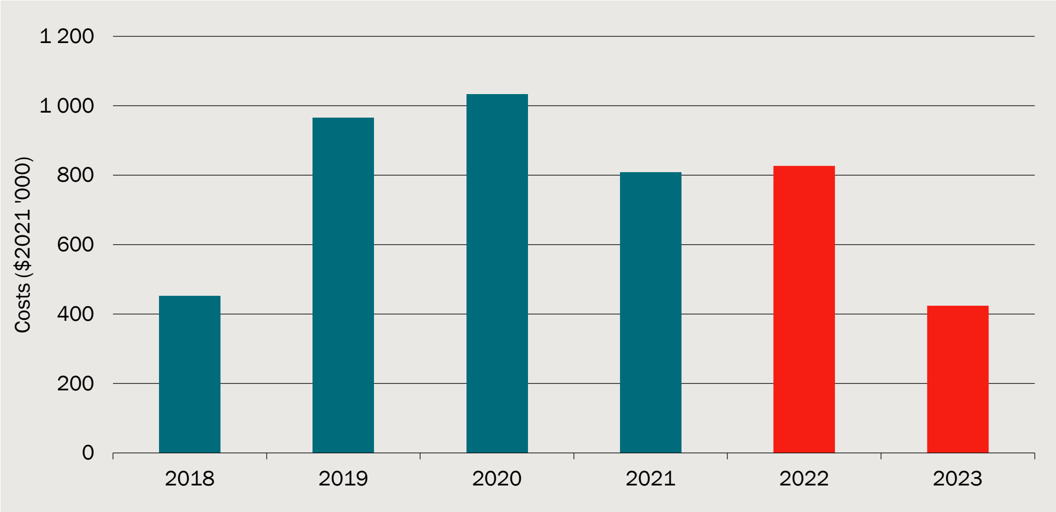
Administration and staffing costs

The Office of Sport employs staff to manage the Program and provide ongoing policy advice and guidance to NSW Government.

Staffing costs were approximately $0.5 million in 2017-18, $1.0 million in 2019-20, and $0.8 million in 2020-21.

We have assumed that the ongoing staffing cost will remain consistent with the 2020-21 costs, increasing by 2.5 per cent per annum to reflect real wage growth.

8.3 Staffing costs



Data source: Financial information provided by the Office of Sport.

Potential additional costs

Potential costs that have not been included in this economic evaluation include:

- additional injuries: additional participation in sport may drive additional sporting injuries, however, there is insufficient evidence to identify a potential injury rate or average cost
- fraud: there is the potential for fraudulent vouchers to be created by individuals or providers, although there is insufficient evidence that this occurs, with minimal detection of fraudulent activities that are typically unintended, and
- costs to providers, who bear the administrative cost of processing each voucher. For larger providers, this is relative automatic with minimal costs. There is a potential for this to be more burdensome for smaller providers, however, there is no evidence available to assess this.

9 Economic evaluation results

This economic evaluation finds that the Program has delivered an excellent return to the people of NSW.

- **$1.04 is returned for every dollar spent assuming that the Program runs to the end of the current funded period (2023), and**
- **$1.08 is returned for every dollar spent if we extend the evaluation period to 2031**
- **children in lower socio-economic areas benefit more than those in higher income locations, but are underrepresented relative to their population size, and children in higher socio-economic areas benefit less, but are over-represented in the participant pool relative to their population size**
- **for children with a disability, the Program infers substantially higher benefits than for children without a disability, and**
- **overweight children benefit substantially more than those that are obese, thin, or of normal weight, as they have a larger increase in days active per week.**

This economic evaluation has selected conservative parameters to measure benefits, and derived changes in physical activity from detailed statistical modelling on approximately 6 000 different cohorts of children using linked datasets.

Sensitivity analysis has been undertaken to take an even more conservative view of benefits that are attributable to the Program. It finds that benefits continue to outweigh costs in most cases.

Results summary

The Active Kids Program is estimated to generate $0.59 billion of benefits in present value terms over the evaluation period, compared to $0.57 in costs. This results in a benefit cost ratio of 1.04 (table 9.1).

The largest benefit is the financial relief provided to families to cover membership costs, followed by the benefits of improved physical health, mental health, student absenteeism and school performance (chart 9.2). For males and females, benefits per participant are highest for those aged 9 to 11, which is driven by large benefits from avoided future wellbeing and healthcare costs of adult obesity.

Benefits are higher for females than males aged 4 to 8 years old, but for other age groups are higher for males reflecting a higher increase in total days active gained (chart 9.3).

Benefit types by age are summarised in table 9.4.

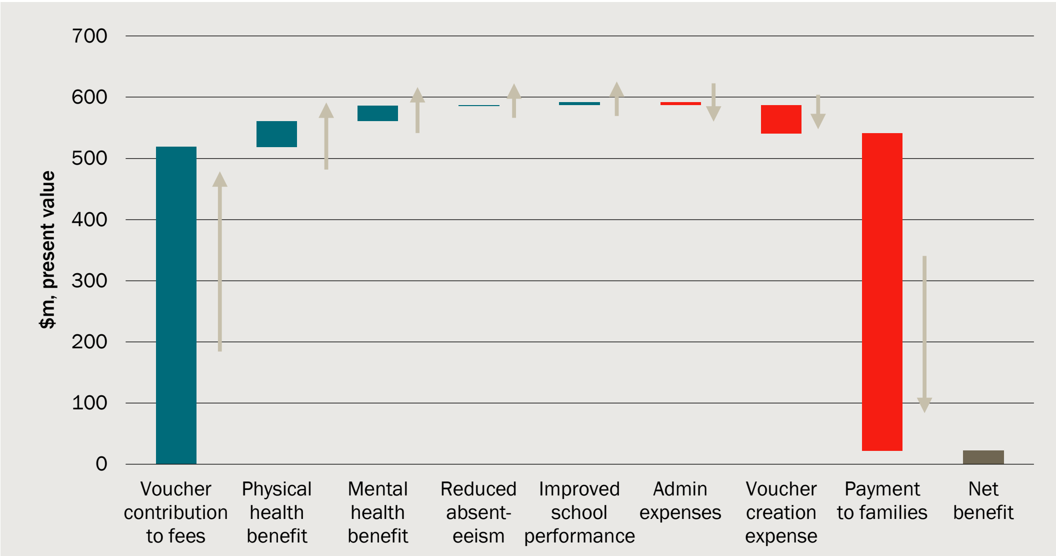
9.1 Cost benefit analysis results 2018 to 2023

Cost/benefit item	Total undiscounted	Total discounted
	$m	$m, PV
Benefits		
Physical health - Reduced childhood obesity	3.5	3.5
Physical health - Avoided adult obesity	37.5	37.1
Physical health - Bone health	1.6	1.6
Mental health	25.1	25.1
Reduced absenteeism	1.2	1.2
Improved educational outcomes	4.4	4.5
Voucher contribution to fees	497.4	518.9
Total benefits	**570.7**	**591.8**
Costs		
Employee related expenses	-4.5	-4.7
Voucher system expenses	-43.3	-46.0
Payment to families	-497.4	-518.9
Total costs	**-545.2**	**-569.6**
Net results		
Net benefit		**22.2**
Benefit cost ratio		**1.04**

Note: Based on a discount rate 7 per cent and reporting present value $2021.

Source: CIE.

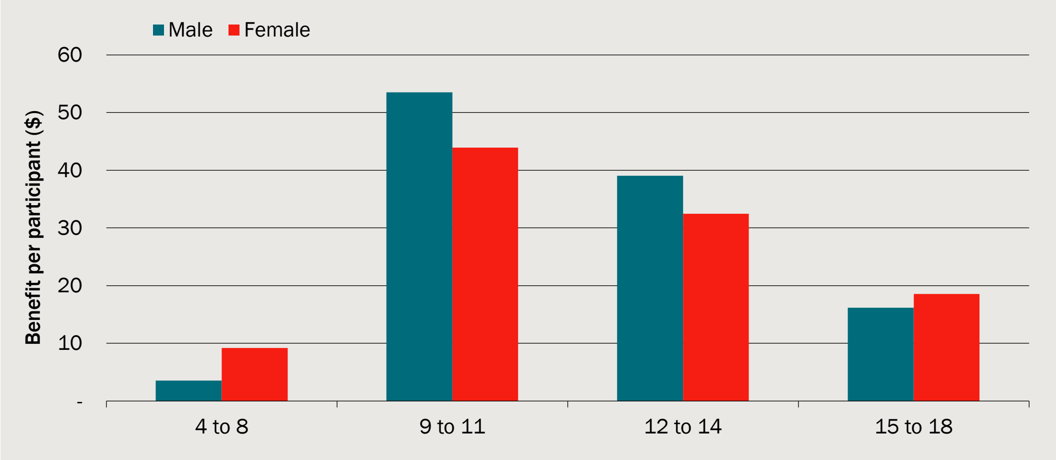
9.2 Breakdown of net benefit (present value 2018 to 2023)



Note: Discount rate 7 per cent, $2021

Data source: CIE.

9.3 Benefit per participant (excl. transfer from the voucher)



Note: Discount rate 7 per cent, $2021

Data source: CIE.

9.4 Total benefit per age cohort (present value 2018 to 2023)

Benefit item	4 to 8	9 to 11	12 to 14	15 to 18
	$m	$m	$m	$m
Improved bone health	0.3	0.6	0.6	0.1
Avoided current healthcare costs from childhood obesity	0.2	0.3	0.0	-
Avoided current wellbeing costs from childhood obesity	1.0	1.2	0.5	0.2
Avoided carer costs from absenteeism due to childhood obesity	0.2	0.3	0.0	-
Avoided future healthcare costs from adult obesity	3.6	11.1	5.1	1.1
Avoided future wellbeing costs from adult obesity	2.6	8.9	3.7	1.1
Avoided absenteeism due to mental health disorders	-	0.3	0.3	0.1
Avoided absenteeism due to childhood obesity	0.0	0.0	0.0	-
Avoided wellbeing costs due to mental health disorders	-	12.2	9.1	3.4
Avoided healthcare costs due to mental health disorders	-	0.2	0.2	0.1
Improved educational outcomes leading to increased wages	-0.2	1.7	2.0	0.5
Improved educational outcomes leading to increased employment	-0.3	0.2	0.4	0.1
Total	**7.3**	**37.1**	**21.9**	**6.7**

Note: Results reported in present value terms in $2021. Due to limitations in the evidence, mental health benefits for the age cohort 4 to 8 years old, as well as the current obesity costs for the age cohort 15 to 18 years old, cannot be quantified. The educational benefit for the age cohort 4 to 8 years old registers as negative due to a high number of children increasing physical activity to 7 days per week, which has a lower educational benefit than the 4 to 6 days.

Source: CIE.

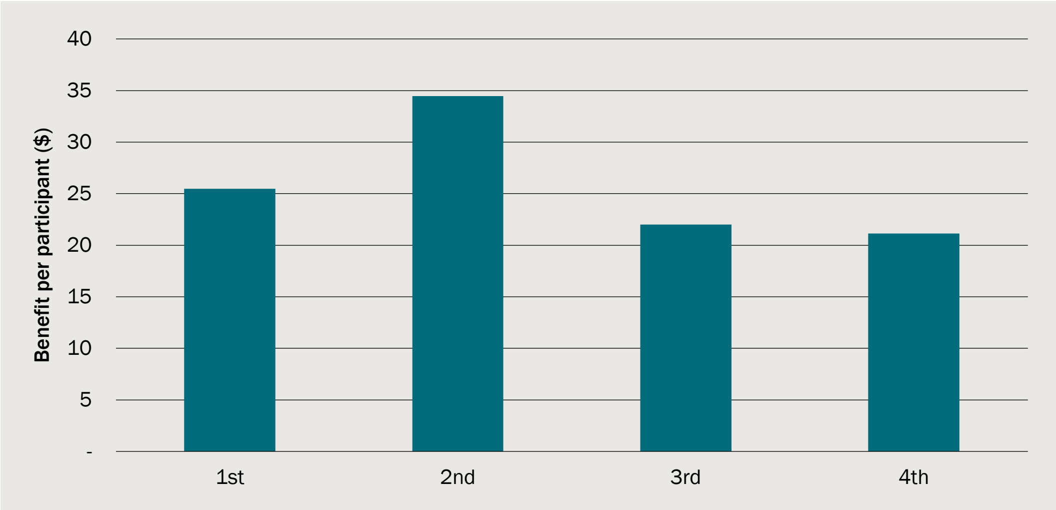
Findings by cohort of children

Children in lower socio-economic areas are found to benefit more from the Program compared to those in higher socio-economic locations, with the Program having a greater impact on attraction to community sport and leading to a greater increase in duration of physical activity.

The second SEIFA quartile[113] experiences the highest benefit per participant, followed by the first SEIFA quartile (chart 9.5), who experience the largest increases in physically active days.

The more advantaged populations designated as SEIFA 3 and SEIFA 4 make up the majority of program registrations (64 per cent), and are 'overweighted' in the participant population given they comprise only 56 per cent of the NSW population. On the other hand, SEIFA 1 is underrepresented in the population with only 16 per cent of registrations, compared to a NSW population share of 21 per cent.

9.5 Annual benefit per participant by SEIFA quartile



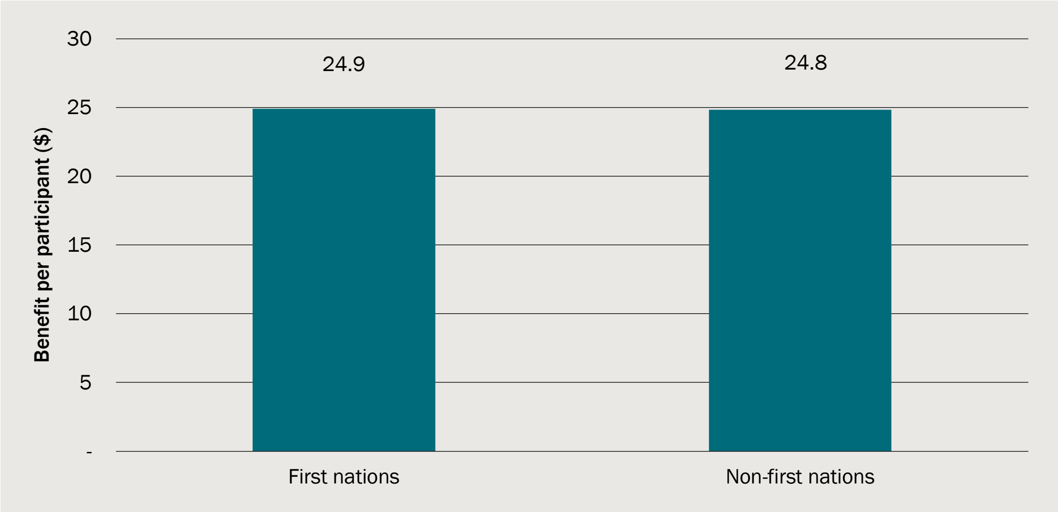
Note: $2021

Data source: CIE.

First Nations children receive a marginally higher benefit per person than non-First Nations children (chart 9.6), who are also slightly more likely to use the voucher for financial reasons, and for whom the voucher covers slightly more of their membership fees. The increase in physical activity is marginally higher for First Nations people compared to non-First Nations people.

113 The SEIFA index is a general socio-economic index that summarises a wide range of information about the economic and social resources of people and households within an area, see for more detail: ABS An Introduction to Socio-Economic Indexes for Areas (SEIFA)

9.6 Annual benefit per participant by First National status

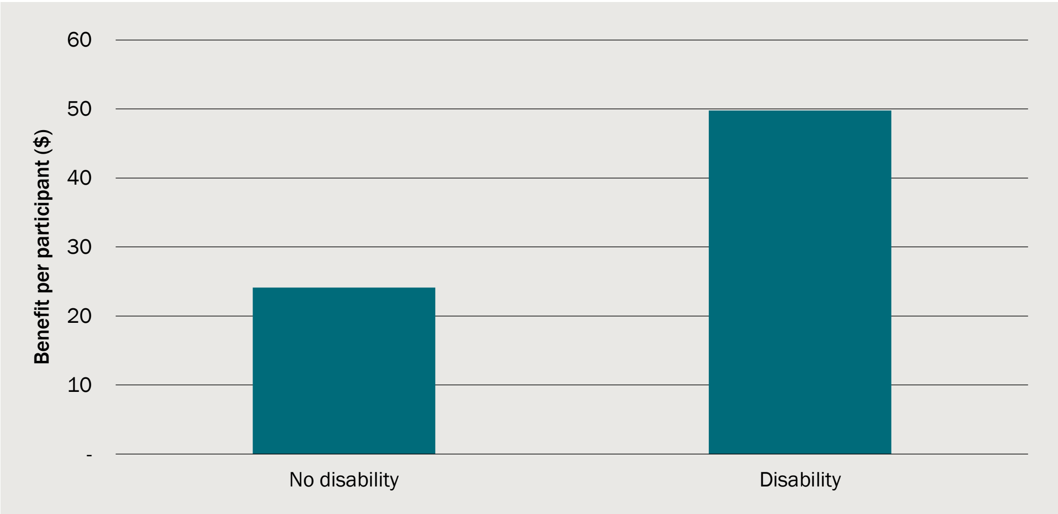


Note: $2021

Data source: CIE.

Benefits for children with a disability are substantially higher benefits for children without a disability (chart 9.7), who are estimated to have increased their physical activity 117 per cent more than children without. Children with a disability are also more likely to have ongoing Program engagement (redeem more vouchers).[114]

9.7 Annual benefit per participant by disability status



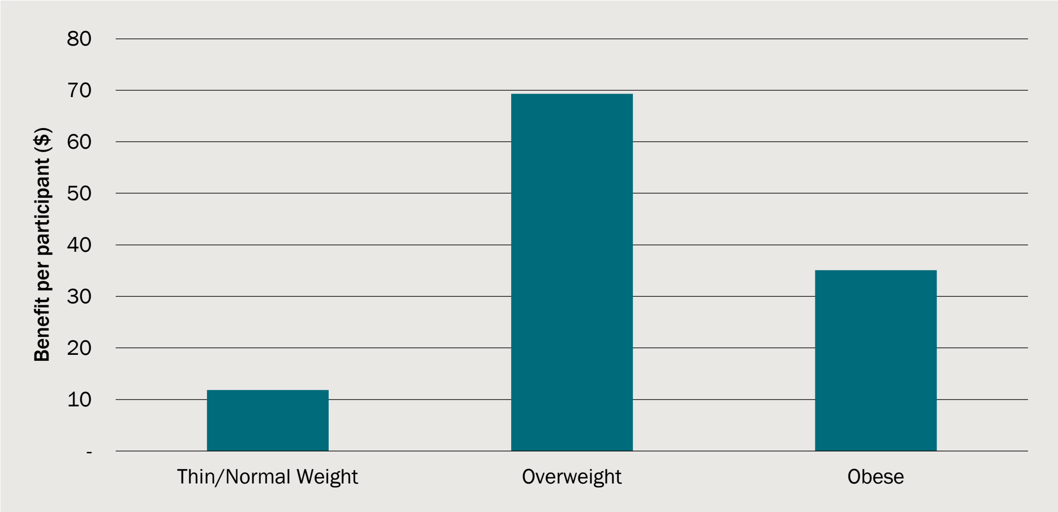
Note: $2021

Data source: CIE.

114 It is acknowledged that the identifier for children with a disability is likely to be less robust than other data collections, relying on self-reported answers to "does the student have a disability?" (yes, no, prefer not to say). This is different to methods used by the Australian Bureau of Statistics (ABS) Australian Bureau of Statistics, Disability ageing and carers Australia summary findings 2018, https://www.abs.gov.au/methodologies/disability-ageing-and-carers-australia-summary-findings/2018

Children who have a weight status classified as overweight benefit substantially more than those of obese and thin/normal weight status, having a larger increase in days active per week, and accessing the health benefits that those additional days generate.

9.8 Annual benefit per participant by weight status



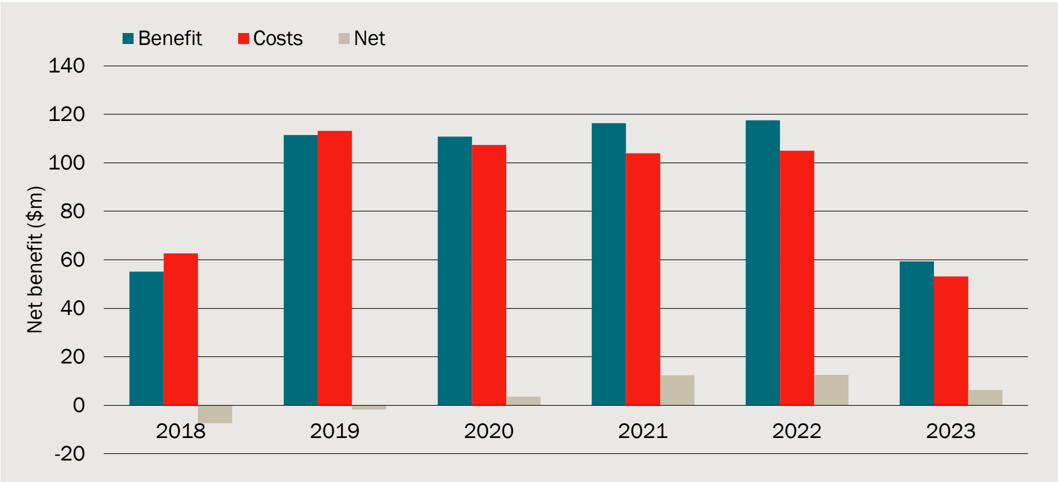
Note: $2021

Data source: CIE.

Benefits and costs over time

The Program is associated with a net cost in 2018 (high implementation costs and only one voucher redeemable per child), which converts to a net benefit from 2019 onwards.

9.9 Cost and benefits over the evaluation period



Note: Undiscounted, $2021

Data source: CIE.

9.10 Cost benefit analysis results for each year

Cost/benefit item	2018	2019	2020	2021	2022	2023
	$m	$m	$m	$m	$m	$m
Benefits	55.2	111.5	110.8	116.3	117.5	59.4
Costs	-62.6	-113.2	-107.3	-103.9	-105.0	-53.1
Net benefit (undiscounted)	-7.5	-1.7	3.5	12.4	12.5	6.3
Benefits	67.6	127.7	118.6	116.3	109.8	51.8
Costs	-76.7	-129.6	-114.8	-103.9	-98.2	-46.4
Net benefit (discounted)	-9.1	-2.0	3.8	12.4	11.6	5.5

Note: $2021

Source: CIE.

Sensitivity analysis

Attributing impacts to the Program

The Active Kids Program provides a financial incentive to participate in community sport. For many participants, receiving the financial incentive was a key factor in enabling children to participate in sport, and increase their days physically active. However, in some cases, students would have enrolled in sport irrespective of vouchers, meaning that the benefits of participating may not be attributed to the Program.

This economic evaluation has taken several steps to account for an appropriate attribution of benefits to the Program.

For the Headline results presented in this report, findings are based on detailed statistical analysis of changes in physical activity (from baseline) of linked data on participant surveys over multiple years, registrations, and voucher redemptions. The statistical analysis has controlled for a wide range of drivers of variation, meaning results are statistically significant for all cohorts of children.

However, it does rely only on the data that is available.

Further consideration has been given to limiting the number of children that benefit in various ways to account for other factors that may be relevant in accounting for the behaviour of participating children and their families while engaging with the Program.

This is illustrated in chart 9.11, which shows different approaches that have been taken to defining children who benefit, namely:

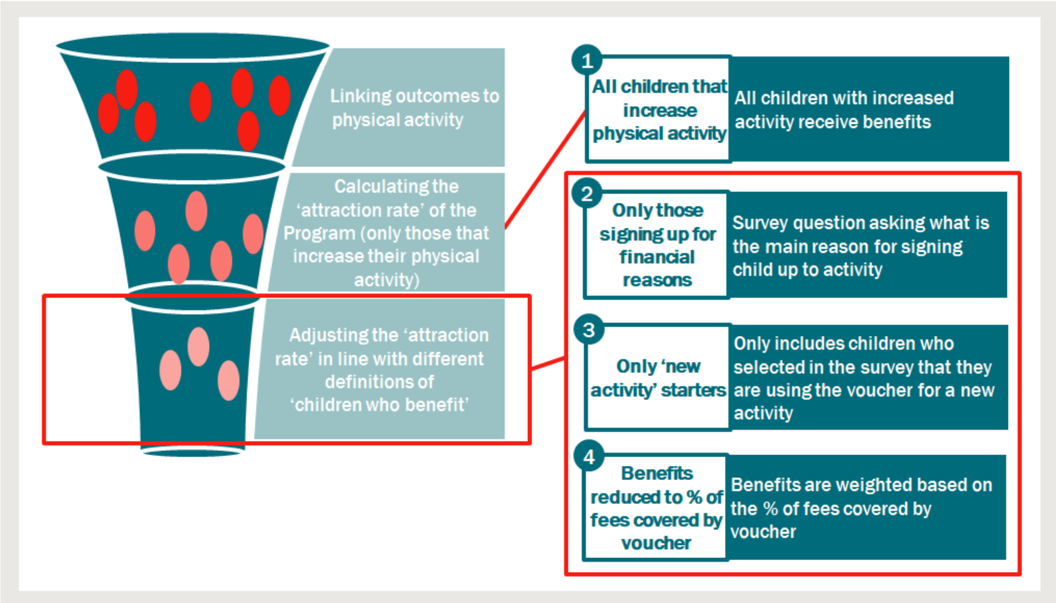
- limiting children who benefit to only those who report that a ‘financial reason’ was the main reason for signing up to the Program[115]
- limiting children who benefit to only those that use a voucher for new, rather than an existing, activity[116], and

115 Based on the survey of participants that could select multiple reasons, which also included ‘trying new activities’, ‘joining a friend’, and ‘managing the child’s weight’.

116 Based on registration response data.

- aligning the degree of benefit to the proportion of membership fees that are covered by the voucher. For instance, allowing children to benefit in full if the voucher covers all membership fees, or reducing benefits by 50 per cent where the voucher only covers 50 per cent of membership fees.[117]

9.11 Altering the definition of 'children who benefit'



Data source: CIE.

These three scenarios reduce the net benefit of the Program by comparing costs to a smaller number of beneficiaries. The impact on net benefit results is shown in table 9.12. The benefits of the Program outweigh costs when attributing benefits to those that report a financial barrier to participation, but not for those participating in a new activity or when equivalating benefits to the contribution of the voucher.

9.12 Impact of restricted definitions of 'children that benefit'

Benefit/cost item	Main results	Only those that report financial barrier to participation	New activity only	Benefits equivalent to % of fees covered
	$m	$m	$m	$m
Voucher contribution to fees	519	519	519	519
Physical health benefit	42	33	28	24
Mental health benefit	25	20	16	14
Reduced absenteeism	1	1	1	1
Improved school performance	4	3	2	2
Admin expenses	-5	-5	-5	-5

117 Based on survey responses on how much additional money was spend when redeeming the voucher. Respondents had the option of 'no additional money', increments of 25 dollars, and greater than 100 dollars.

Benefit/cost item	Main results	Only those that report financial barrier to participation	New activity only	Benefits equivalent to % of fees covered
	$m	$m	$m	$m
Voucher creation expense	-46	-46	-46	-46
Payment to families	-519	-519	-519	-519
Net benefit	22	7	-4	-10
Benefit cost ratio	1.04	1.01	0.99	0.98

Note: Discount rate 7 per cent, $2021
Source: CIE.

Sensitivity to changes in modelling parameters

Additional sensitivity analysis has been undertaken on key underlying assumptions to test the robustness of the results, including using alternative discount rates, the inclusion of deadweight loss, alternative approaches to measuring wellbeing, and extending out Program duration.

The results show that the overall net benefits are *not* highly sensitive to alterative parameter values:

- A lower or higher discount rate has a negligible impact on the net benefit or benefit cost ratio. This is due to the magnitude of benefits and costs relating to the voucher contribution and payment to families substantially outweighing the activity benefits and program costs and overheads.
- The inclusion of the deadweight loss of taxation as a cost associated with the Program reduces the BCR to 0.87. To estimate the deadweight loss of taxation, we refer to Robson's 2005 review of the costs of taxation.[118] It is estimated that the cost of raising $1 in additional tax revenue is between $1.19 and $1.65. We use the lower estimate of 19 per cent for the sensitivity analysis. As per NSW Treasury guidelines, we have included this as a downside sensitivity test.[119] See appendix E for further analysis on the deadweight loss.
- Valuing the avoided disability adjusted life years (DALYs) using guidance by the Family and Community Services Insights Analysis and Research (FACSIAR) to use a DALY cost figure of $60,500 ($2019), based on willingness to pay estimates of avoiding deterioration in quality of life.[120] This reduces wellbeing benefits, and results in a benefit cost ratio of 0.98.
- Extending the program to 2031 to understand the impact on costs and benefits as they program continues into the longer term lifts the BCR to 1.08.

118 Robson A. (2005), The Costs of Taxation, Centre for Independent Studies, https://library.bsl.org.au/jspui/bitstream/1/611/1/Costs_of_taxation.pdf

119 NSW Treasury (2017), NSW Government Guide to Cost-Benefit Analysis (TPP17-03), pp.61

120 FACSIAR (2020). Non-market valuation (NMV) approaches for cost-benefit Analysis, Determining benefit values for the improved quality of life as a result of Department of Communities and Justice (DCJ) interventions

9.13 Results of sensitivity analysis of underlying parameters

Sensitivity analysis case	Physical health	Mental health	Absent-eeism	Educ-ation	Contribut-ion to voucher	Total benefit	Total costs	Net benefit	Benefit cost ratio
	$m	$m	$m	$m	$m	$m	$m	$m	
Central case	42	25	1	4	519	**592**	**-570**	**22**	**1.04**
Low discount rate (3%)	42	25	1	4	506	**579**	**-555**	**24**	**1.04**
High discount rate (10%)	42	25	1	5	530	**602**	**-582**	**21**	**1.04**
Including the deadweight loss of taxation	42	25	1	4	519	**592**	**-678**	**-86**	**0.87**
Reduced WTP DALY value	29	8	1	4	519	**561**	**-570**	**-9**	**0.98**
Extension of Program to 2031	116	67	3	11	1 093	**1 291**	**-1 195**	**95**	**1.08**

Note: $2021

Source: CIE.

A Linked dataset used for this review

All children that registered for an Active Kids voucher were invited to participate in the Active Kids evaluation survey each year.

At point of voucher registration, parents and carers were asked for consent to participate in Active Kids research. Throughout 2018 to 2020, 958 518 (90 per cent) of registrants agreed to this research.[121]

Multiple surveys were sent to all children who provided consent, irrespective of voucher use. Surveys were developed based on the outcomes in the program logic model and additional research outcomes identified by SPRINTER.

The online surveys captured the following outcomes:

- physical activity levels in accordance with Australian physical activity guidelines
- frequency and duration of sport participation
- voucher use including voucher activity, frequency, and duration of participation in voucher activity
- child height and weight (enabling Body Mass Index to be calculated)
- global subjective well-being, and
- adults' awareness of the Australian physical activity guidelines for children.

Additional SPRINTER research outcomes included:

- expenditure on sport and physical activity per calendar year
- contribution of the voucher to overall expenditure
- voucher activity participation: choice of activity, frequency, and duration
- voucher contribution to overall activity
- annual sport participation
- perceived impact of the Active Kids vouchers on children's physical activity
- reasons for registering but not redeeming an Active Kids Voucher
- adult sport participation, and
- adult's achievement of physical activity level.

To maintain appropriate confidentiality requirements, the SPRINTER group merged raw evaluation survey data and Office of Sport Program administration data for all survey

121 Reece, L., Owen, K., Foley, B.C., Bellew, W., Bauman, A. *Active Kids Evaluation Report (2018-2020) – Full Report*. SPRINTER Group, Prevention Research Collaboration, Sydney School of Public Health, Faculty of Medicine and Health, Charles Perkins Centre, The University of Sydney, 2022, p. 10

respondents,[122] which was then made available to this economic evaluation in a de-identified format. To further maintain respondent's data privacy, i.e., no identification through identifiable combinations of demographic variables is possible, an observation threshold of more than 5 was agreed for each unique combination of demographic characteristics, and some potentially identifiable demographic variables were aggregated:

- age, BMI and physical activity were aggregated from continuous to categorical variables
- heritage, identified disability, primary language spoken at home, and intention of voucher use were reduced to binary variables, and
- residential postcode was aggregated to government regions, while maintaining the SEIFA index of disadvantage and Accessibility/Remoteness Index of Australia (ARIA).

This approach resulted in minimal loss of survey data, with responses of more than **96 per cent** of all children who took part in the survey including their registration and redemption data in all years, being made available for this economic evaluation.

The linked dataset contains 956 957 observations of 168 321 unique children (chart A.1):

- who registered 510 508 times
- redeemed 712 121 vouchers, and
- completed 244 836 surveys from 2018 to 2021.

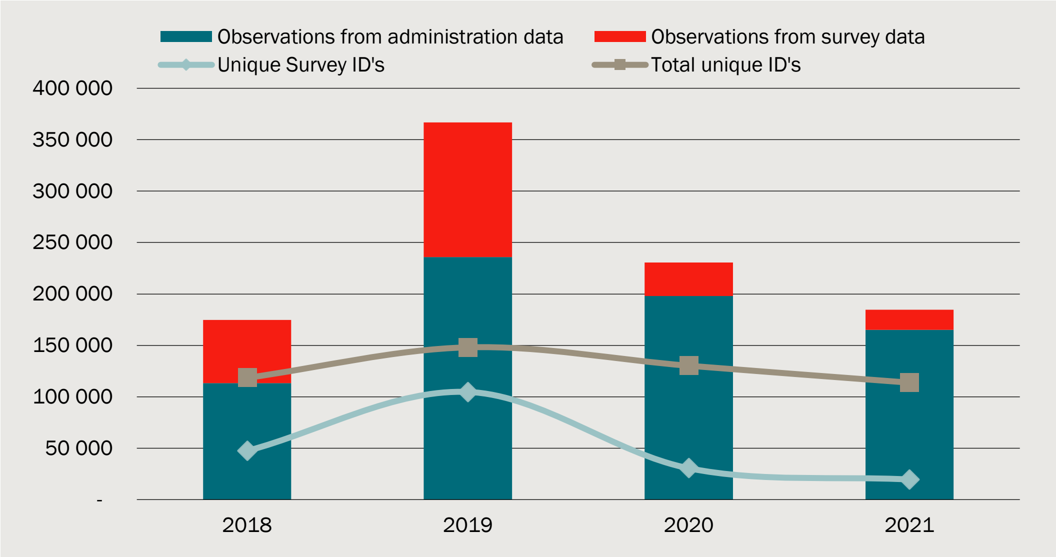
Since the introduction of the Program, SPRINTER conducted eight survey rounds, however, response rates were significantly lower in 2020 and 2021 compared to the previous years.[123]

This means that on average the linked dataset contains information of over 100 000 children per year, ensuring a consistent and comprehensive longitudinal dataset to track individual children over multiple years.

122 This means we have administrative information across all years even if a child only took part in a survey in 2019.

123 Technical issues as well as from 2020 only one survey was sent to each family rather than a survey for each child to each family.

A.1 Linked dataset summary



Data source: CIE.

The linked dataset was reshaped from wide to long, i.e., the dataset has observations across individuals and through time.

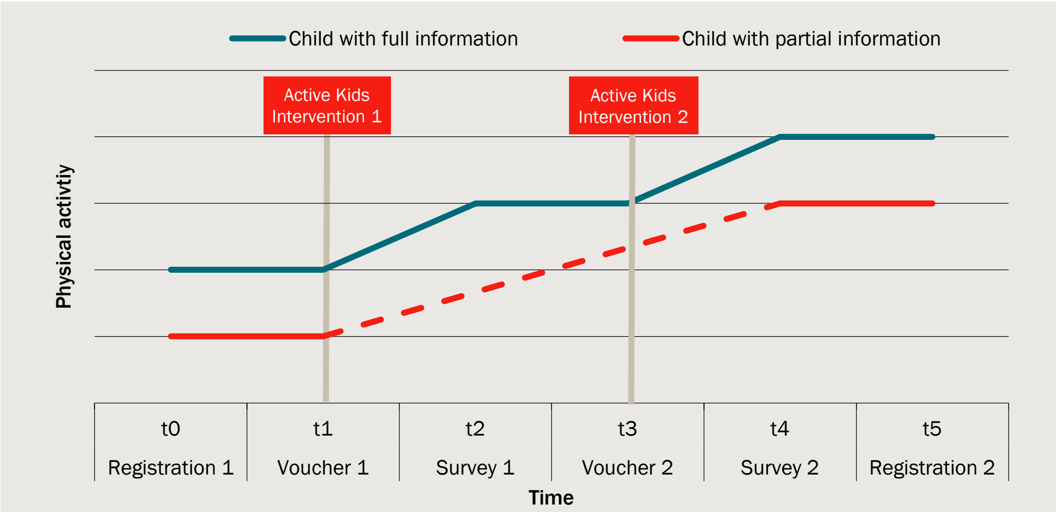
This means we that we were able to construct a timeline for each child over the course of the Program to date and observe the change in the outcome variable of interest. In doing so, we define points in time of interest which help understand the impact of the Program.

Chart A.2 illustrates the dataset design:

- **T0, first registration:** This represents the child's first registration and serves as the baseline, i.e., what is the state of the outcome variable of interest at time 0 before engaging with the program.
- **T1, first redemption:** Date of the first voucher redemption and program intervention. This serves as the starting point of counting the number of vouchers over time as well as the measure of time of engagement with the program.
- **T2 onwards, Survey response, voucher redemption or registration:** Any further observation can be either a survey taken, another voucher redeemed or the next years registration. Survey response and registration will help understand how the outcome variable of interest is changing over time since the program intervention, while another voucher redemption adds to the measure of program engagement.

This approach allows us to use all available information even if a child does not take a survey every year or registers and redeems every year.

A.2 Illustrative dataset design



Data source: CIE.

Sample selection bias and sample size

Two key features of a survey are the sample size and randomness of the sample. These features are important because they indicate the degree to which sample statistics will be accurate and unbiased estimates of population parameters.

To illustrate how sample size and randomness can vary, consider the following options for a survey of children about physical activity levels:

- **survey the entire population**: Measure the physical activity levels for all children, through, for example, a compulsory survey instrument capturing multiple points in time
- **survey a random sample**: Measure the physical activity levels by a random sample of children for random selections of points in time, or
- **survey a non-random sample**: Measure the physical activity levels by a non-random sample of children for a non-random point in time.

Having a large sample size will improve the accuracy of sample statistics as an estimate of population parameters. At an extreme, where the survey covers the entire population, sample statistics and population parameters are the same.

The first two options will not suffer from sample selection bias, which is where the sample is collected in such a way that some members of the population have a lower chance of being sampled than others.

However, the third option will suffer from such bias. In the present case, the survey link was provided to all adult caregivers who provided consent for additional research at the point of voucher registration, but only some completed the survey. The subset that completed the survey was not random, but rather is affected by a range of factors such as:

- how much time adult caregivers are willing to spend on surveys
- how much children engage with the program, and

- how keen and able adult caregivers are in participating in surveys.

Of these sources of selection bias, the second and third are clearly the most relevant. If survey respondents are a subset of the population with high engagement with the program relative to the population in general, this will mean our sample statistics will be biased estimates of the population parameters. The same is true for the latter, which significantly correlates with demographic characteristics.

Comparing the relative size of subgroups in the administration data (full population dataset) with the linked dataset (survey population) shows that the sample statistics will be biased estimates of the population parameters:

- lower socioeconomic groups, people whose primary language is other than English, outer regional and remote regions, people with identified disability and First Nations are **under-represented**, while
- high socioeconomic groups and some regions are **over-represented**.

The overall direction of the bias is unclear, as physical activity levels are driven by multiple factors and demographic characteristics.

To summarise, having a larger sample improves the accuracy of the sample statistics as estimates of population parameters. On the other hand, having a random sample, rather than a non-random sample suffering from sample selection bias, will result in sample statistics being unbiased estimates of population parameters.

There are multiple approaches to overcome potential bias:

- change the survey selection process to ensure randomness of the sample, or
- apply statistical correction in the model to account for misrepresented groups by assigning sampling weights based on the full population/registered population.

Since the evaluation survey design is voluntary in nature, we have included sampling weights to correct for any misrepresentation of subgroups based on the administration dataset (the following section has a full description on how to quantify the degree of sample selection bias).

Comparing relative size of subgroups in sample and population

For each demographic variable, the relative size within the survey sample and the registration population is calculated. To quantify how significant the differences are the following formula is used:

$$Diff_{i,j} = \frac{(S_{i,j} - P_{i,j})}{P_{i,j}}$$

Where

i is the demographic category

j is the group within the demographic category

S is the relative size of the chosen demographic category-group in the **survey data**

P is the relative size of the chosen demographic category-group in the **registration dataset.**

The table below shows the descriptive comparison of the survey to the registration dataset. The difference within SEIFA, identified disability and First Nation are the most significant ones.

A.3 Comparison registered population and survey population

Category	Group	Registration (all years)	Survey (all years)	Difference
		per cent	per cent	per cent
Age group	4 to 8	40.6	41.5	2.2
	9 to 11	26.5	25.4	-4.2
	12 to 14	20.7	20.5	-1.0
	15 to 18	12.3	12.6	2.4
Sex	Male	52.8	52.2	-1.1
	Female	47.2	47.8	1.3
SEIFA (Most to least disadvantaged)	1st	16.1	12.6	**-21.7**
	2nd	22.2	22.2	0.0
	3rd	26.4	27.6	4.5
	4th	35.2	37.6	**6.8**
Primary language spoken	English	91.3	91.9	0.7
	Other	8.7	8.1	**-6.9**
Government Regions	Central Coast	4.9	4.9	0.0
	Central West and Orana	4.0	3.6	**-10.0**
	Far West	0.4	0.2	**-50.0**
	Hunter	10.0	9.5	-5.0
	Illawarra Shoalhaven	5.0	5.4	8.0
	Metropolitan Sydney	60.1	61.3	2.0
	New England North West	2.4	2.1	**-12.5**
	North Coast	6.8	6.5	-4.4
	Riverina Murray	3.6	3.6	0.0
	South East and Tablelands	2.8	2.9	3.6
	Central Coast	4.9	4.9	0.0
BMI Categories	Thin/Healthy	68.5	75.7	**10.5**
	Overweight	18.8	16.5	**-12.2**
	Obese	12.6	7.7	**-38.9**
ARIA	Major Cities	76.2	76.7	0.7
	Inner regional	18.9	19.2	1.6
	Outer regional and remote	4.9	4.0	**-18.4**

Category	Group	Registration (all years)	Survey (all years)	Difference
		per cent	per cent	per cent
Identified disability	Yes	3.3	2.1	**-36.4**
	No	96.7	97.9	1.2
First Nation	First Nation	5.6	3.2	**-42.9**
	Non- First Nation	94.4	96.8	2.5

Source: CIE, Office of Sport, SPRINTER.

B Measuring changes in physical activity

Statistical modelling was used to estimate the relationship between an outcome variable of interest and the program intervention. Analysis of key areas of change one by one cannot give a good characterisation of all the changes that have occurred together. For example, we can compare how physical activity levels of girls and boys changed over time when using vouchers, however, more individual characteristics such as age, BMI, identified disability, socio-economic status etc. play a role.

This can only be done by formal statistical analysis.

The choice of the appropriate statistical model depends on a number of factors, and has been carefully balanced against the limitations of any potential model. Main factors include:

- the choice, format, and distribution of the outcome variable of interest, i.e.:
  - what variable changes are we trying to explain
  - is the variable in the dataset binary, categorical or continuous, and
  - is it normally distributed across the population or skewed? and
- the type of data, i.e., time series data, cross-sectional data, or longitudinal data.

There are three sorts of models that could be estimated for the Active Kids Program making use of the (longitudinal) linked dataset described in the previous section:

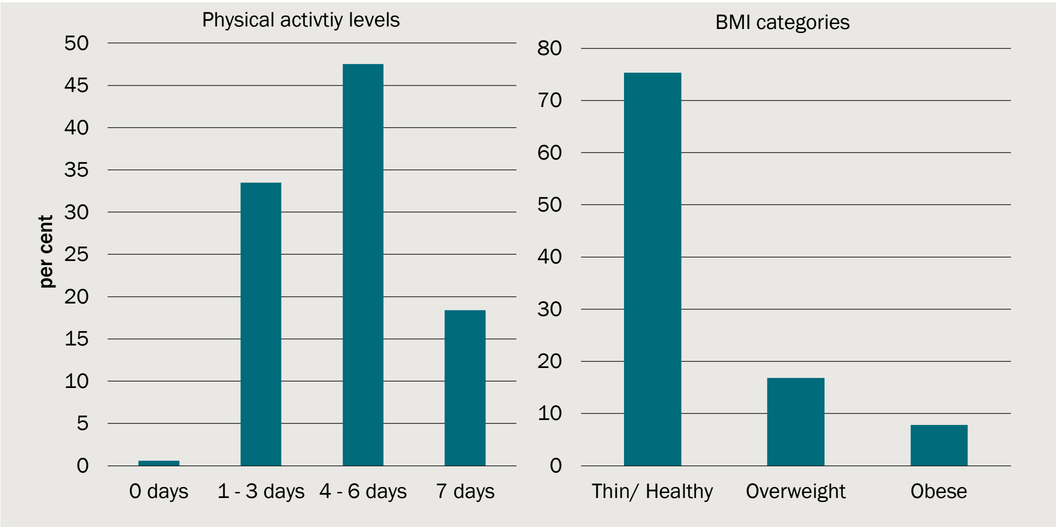
- A fixed effects model — this model allows each child to have a different base outcome (such as physical activity or BMI) and then uses changes in this through time to assess the impact of variables that also change through time. This method is best for identifying impacts of variables that change through time, such as voucher use, age or time itself. It cannot be used for variables that remain the same for a child such as gender or First Nation status.
- A random effects model — this model uses differences across children as well as differences through time to assess the impact of particular individual characteristics and variables that change through time. It allows for children to be systematically different through the error term rather than through a constant. It can be used to identify impacts of gender and First Nation status for example.
- A mixed effects model — uses both fixed and random effects. It allows for children to be systematically different through a random effects term, while estimating a fixed effect model on the unit-level maintaining the advantages of a fixed effect model to estimate changes over time. The significant advantage of this type of model is the flexibility as it allows to use correlated (non- independent) data, i.e., repeated measurements on each subject over time. For example, a child who registered in February and responds to a survey in April will have very similar responses to physical activity or BMI.

A further consideration is whether the model should be linear, nonlinear or generalised linear:

- linear models require that observations are independent and identically distributed (iid), this means that every survey response or observation from the registration is independent from the previous one[124] and that data is normal distributed (bell-shaped), and
- non-linear and generalised linear models can deal with non-normal distributed data.

The linked dataset has a variety of non-normal (e.g., chart B.1) and non-independent observations as mentioned above.

B.1 Distribution of potential outcome variables



Data source: Linked dataset SPRINTER, CIE.

We have chosen a Generalised Linear Mixed Model (GLMM), which offers a flexible approach to handle fixed and random effects in the data as well as accounting for non-normal distributed and non-independent variables.

The GLMM is, depending on the format and type of outcome variable, fitted by:

- Ordinal Logistic Mixed,
- Logistic Mixed, or
- Poisson Mixed Regression

$$\Pr\left(y_{ij} = k \,\middle|\, \boldsymbol{T}_{ij}, x_{ij}, u_j\right) = H(\gamma \boldsymbol{T}_{ij} + \beta \boldsymbol{x}_{ij} + \delta \boldsymbol{T}_{ij} * \boldsymbol{x}_{ij} + \boldsymbol{z}_{ij}\boldsymbol{u}_j)$$

where,

j is a unique child

124 For example, independent would mean that the physical activity level or BMI of a child in April 2019 has no influence on the level or BMI in October 2019. However, in reality we often observe that variables like BMI or physical activity level do not change significantly, such as from 1 day to 7 days active or from obese to healthy.

i identifies the point in time

y_{ij} the outcome variable of interest

T_{ij} the treatment variable(s) which measure(s) the intervention of the Active Kids program and in turn the participation of a child in the program

x_{ij} set of control variables containing demographic characterises such as age group, sex, socioeconomic status, First Nation Status etc., which are estimated as fixed effects.

u_j represents the differences between each child *j,* which can be modelled as random effect

γ, β, δ are the estimated regression coefficients from the corresponding model.

Choice of outcome, treatment, and control variables

Based on availability in the dataset and literature research, we have considered three potential outcome variables of interest:

- meeting physical activity guidelines (Yes, No),
- level of physical activity (0, 1 to 3, 4 to 6, and 7 days), and
- body mass index categories (Thin/Healthy, Overweight, Obese).

For this analysis we use 'level of physical activity' as the main outcome variable of interest as this represents best the primary goal of the Active Kids Program as well as the link to the physical inactivity literature.

The treatment or explanatory variable represents the Active Kids Program and aims to explain how physical activity has changed due to the engagement with the program. Engagement with the program can be measured with different available variables:

- number of vouchers used over time (0 to 7)
- time spent within the program (e.g., time since first voucher used), and
- intended use of first voucher (new or existing activity).

Each one answers a different research question, which has to be taken into consideration. For example, the first one reflects the degree of engagement, and to some extent the duration of engagement (i.e., the more vouchers used the longer the child engaged with the Program). However, redemption data shows that most children redeem significantly less than the potential seven vouchers to date, which means that redemptions can be spread out over the full time undermining the time factor.[125]

To measure the full extent of the Program we use a combination of all three treatment variables. This allows us to estimate the degree of engagement, while accounting for the time the child engages with the program and distinguish between children starting a new activity compared to existing activity.

125 For example, a child could redeem 2 vouchers in 2019 and 2 vouchers in 2021, while another child redeems 2 vouchers in 2020 and 2 vouchers in 2021. The total number of vouchers is the same, however, the time spent within the program is different (3 vs 2 years).

The control or exogenous variables are a set of demographic variables to define 'child types' and will help us to understand two key questions:

- what is the baseline level of physical activity independent of program engagement by child type, and
- how much does each child type gain from the program intervention.

The full set of control variables includes age groups, sex, socioeconomic status, First Nation status, identified disability, primary language spoken at home, BMI category, government regions, and remoteness index (ARIA).

The final model takes the following form:

$$\left.\begin{aligned} &Probabiity(y_{ij} = k) = \gamma_1 \#Vouchers_{it} + \gamma_4 \#TimeProgram_t + \gamma_3 \#Activtiy_{intention_{it}} \\ &+\gamma_4 \#Vouchers_{it} * \gamma_4 \#TimeProgram_{it} + \gamma_5 \#Vouchers_{it} * \#Activtiy_{intention_{it}} \end{aligned}\right\} \boldsymbol{T}_{ij}$$

$$\left.\begin{aligned} &+\beta_1 Agegroup_{it} + \beta_2 Sex_{it} + \beta_3 SEIFA_{it} + \beta_4 Language_{it} + \beta_4 Region_{it} + \beta_4 BMI_{it} + \beta_4 ARIA_{it} \\ &\qquad + \beta_4 Disability_{it} + \beta_4 FirstNation_{it} \end{aligned}\right\} x_{ij}$$

$$\left.\begin{aligned} &+\#Vouchers_{it} * (\delta_1 Agegroup_{it} + \delta_2 Sex_{it} + \delta_3 SEIFA_{it} + \delta_4 Language_{it} + \delta_4 Region_{it} + \delta_5 BMI_{it} \\ &\qquad + \delta_6 ARIA_{it} + \delta_7 Disability_{it} + \delta_8 FirstNation_{it}) \end{aligned}\right\} x * \boldsymbol{T}_{ij}$$

$$+ z_{ij} u_j$$

The first part of the equation ($\boldsymbol{T}_{ij}$) represents the different treatment measures we included. The estimated parameter helps us explain the overall on average effect of the program independent of any demographics:

- how do physical activity levels change over time, with more voucher use, and differ by intention of vouchers use, and
- how does increased program engagement intensity (many vouchers and multiple year participation) effect physical activity levels.

The second part of the equation ($\boldsymbol{x}_{ij}$) represents the child type measures. The estimated parameters help us understand what the baseline physical activity levels for each child is. We are able to estimate the baseline level on a very granular level for more than 6 000 different child types (total number of existing combinations of all demographic variables).

The third part of the equation ($\boldsymbol{x} * T_{ij}$) represents the program intervention measure for each child type. Each child type has a different baseline level of physical activity and will also engage differently with the program. The estimated parameters measure for each child type the change in physical activity level conditional on the number of vouchers used. This refines the estimated overall program effect and adjust for differences between child types.

Some examples of questions which we will be able to answer is:

- Do socioeconomic disadvantaged children benefit more or less compared to socioeconomic advantaged children or is there no measurable difference?
- Are there significant regional differences, such as urban versus remote or New England versus Illawarra?

- How does physical activity levels of the female 9- to 12-year-old with identified disability and First Nation status living in Sydney cohort change with more Program engagement?

Missing values

Survey data is prone to have missing data for mainly two reasons:

- Unit nonresponse – Refers to the complete absence of a survey from a sampled child
- Item nonresponse – Refers to the absence of answers to specific questions in the survey.

There are missing values in the linked data, however, the extent is minimal for the relevant variables we have chosen (~2 per cent of the main outcome variable data is missing).

Interpretation of estimated coefficients

Due to data privacy concerns mentioned, the chosen outcome variable had been aggregated from a continuous to a categorical variable. This in turn means that we have to estimate an ordinal mixed model that provides a discrete output *(log odds)* rather than a continuous output. Therefore, the interpretation of estimated coefficient is inherently different compared to linear (continuous) models.

For example, instead of being able to say males are on average one day more active than females (continuous output), the model estimates log odds which can be transformed into predicted probabilities, such as males have a 30 per cent probability of being 4 to 6 days active while females have a 25 per cent probability.

This, however, means that we have to make adjustments in the cost benefit analysis model in order to accommodate the predicted probabilities. For example, the health literature might report health improvements for a one-day change in physical activity and not a change in the physical activity level. We have applied a workaround without compromising our estimates.

Therefore, after we have estimated the predicted probability of a cohort being in a physical activity level, we have applied estimated shares[126] to transform the level probabilities to a per day probability. Table B.2 shows an illustrative example:

- The model estimates for a specific child type *x* the probability to be 1 to 3 days active after program engagement. In this example the probability is 50 per cent.
- From the registration data set we estimate the probability for 1,2 or 3 days within the 1 to 3 days category. In this example a child type *x* that is 1 to 3 days active is on average 25 per cent 1-day active, 50 per cent 2-days and 25 per cent 3-days.
- Based on those estimated shares within each level we can adjust the predict probabilities from the model and use a continuous physical activity variable.

126 For the physical activity levels 1 to 3 days and 4 to 6 days we have separately estimated the distribution within those levels for each child type.

B.2 Illustrative example outcome variable transformation

Original outcome variable	Predicted probability after program engagement	Transformed outcome variable	Average distribution in registration dataset	Adjusted predicted probability after program engagement
per week	per cent	per week	per cent	per cent
0 days	5	0 days	100	5
1 to 3 days	50	1 days	25	12.5
		2 days	50	25
		3 days	25	12.5
4 to 6 days	25	4 days	40	10
		5 days	40	10
		6 days	20	5
7 days	20	7 days	100	20
Total	**100**	**Total**	**NA**	**100**

Source: CIE.

Statistical analysis limitations

Potential biases

We have used sampling weights to correct for misrepresentation of subgroups in the statistical analysis. This is a common method to adjust for sample selection bias, however weighting methods can only compensate for proportionality, not always representativeness.[127] There are additional caveats, which cannot be corrected in the statistical analysis, and which could bias the overall results:

- Self-selection bias – This bias is very similar to sample selection bias. However, self-selection bias incurs as a purposeful intent on the part of respondents. The underlying assumption for using sampling weights is that responses within demographic cohorts are the same or very similar and weighting misrepresented groups corrects for misrepresentation of cohorts. However, participants choose whether or not to participate in the survey, which could mean that participants of a specific cohort self-select themselves and are not representative for their cohort. This could arise from inherent differences within cohort which we are not able to observe with the variables we have, e.g., lifestyle differences coastal versus urban Sydney. The direction of this bias is unknown and sampling weights cannot correct for this bias.
- Social desirability bias – A very common bias in self-reporting questionnaires. This often leads to survey responses in a way that will be viewed favourably by others. This will most likely have an upward bias on the results.
- Recall bias – A systematic error that occurs when survey respondents cannot recall previous experiences and events accurately or omit details. Research has shown that

127 Loosveldt G, Sonck N, editors. An evaluation of the weighting procedures for an online access panel survey. Surv Res Methods. 2008;2(2):93–105

this bias is influenced by age, education, socioeconomic status and how important the matter is to the participant.[128] The direction of this bias is unclear.

- Comparison group – There is no control group to verify how children and their physical activity levels would have developed in the past years without the Active Kids Program. However, we think due to the combination of the survey and registration dataset we are able to track children with minimal or no voucher use, which means we can make inferences for children with no or low Active Kids engagement.

Data caveats

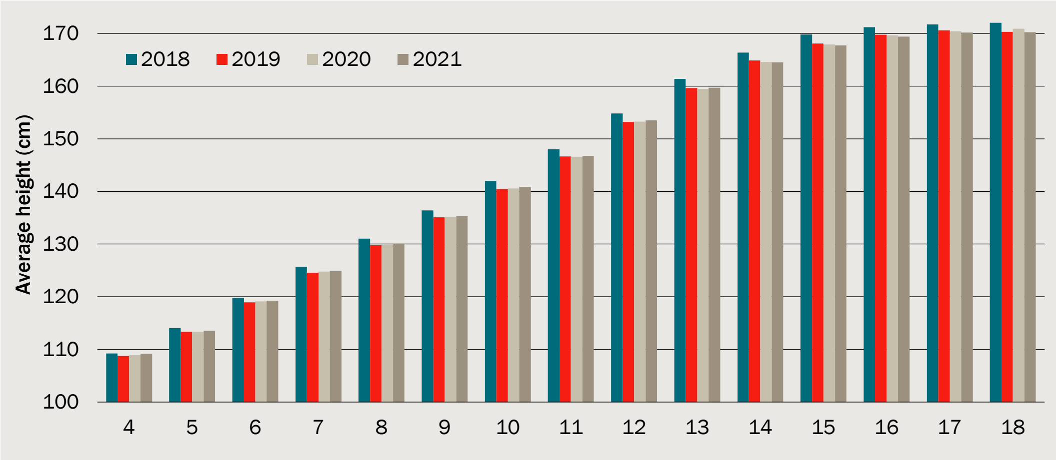
Some of the demographic characteristics used to define child types differ considerably from the NSW reference group or it is unclear what exactly falls under the characteristic.

Identified disability, primary language spoken at home and BMI are the main areas of potential concern:

- Identified disability – There is a great variability in degree and type of disability. Therefore, we note that any results for this specific cohort could be distorted or biased and is based on what care givers define as disability. Furthermore, we cannot make any inferences around what type of disability is more or less active or benefits more or less from the Program.
- Primary language spoken at home – The registration form asks for the 'main language spoken at home' while the Census asks whether 'the person uses a language other than English at home'. It is likely that a great difference in the shares of children speaking a primary language other than English at home compared to the NSW reference group arises from the different phrasing of the question. We note that any interpretation of the result should consider this difference to the Census data.
- BMI Categories – There is a considerable difference in the composition of thin/healthy and obese children compared to the NSW Health Survey data. While some of the difference can be explained by an overrepresentation of younger cohorts, a data issue in the recorded height explains a majority of the difference (chart B.3). This means the results could be upward biased to some degree as obese children benefit relativity more from program engagement.

128 Catalogue of Bias Collaboration, Spencer EA, Brassey J, Mahtani K. **Recall bias.** In: Catalogue Of Bias 2017.

B.3 Average recorded height in the registration data



Note: Large outliers, namely 1st and 99th percentile, have already been removed to not distort the average values.
Data source: Office of Sport, CIE.

Physical activity levels

The key outcome variable in the statistical model is the 'level of physical activity'. As noted, we have only been able to use the categorical rather than the continuous version of this variable. This has a number of consequences that could influence the overall results:

- Restricted variability within the variable – Children are less likely to move between 'levels of activity' compared to 'number of days.' For example, a child is 2 days per week active and after engaging with the program 3 days per week. A model using a continuous outcome variable picks up this change while a model using a categorical variable identifies no change as the activity level is still '1 to 3 days.'
- Discrete rather than continuous output – The choice of the statistical model (generalised *ordinal* linear mixed model) was predetermined due to the format of the outcome variable. This means that the estimated coefficients are 'log odds' (logarithmic likelihoods), which impedes the interpretation of results.

COVID-19 pandemic

In the course of the pandemic, State and Local Governments imposed temporary restrictions due to public health concerns, some included school closures, physical distancing, and disruptions of community sport. In 2020 and 2021, Program registration increased further while total voucher redemption slightly decreased compared to pre-Covid years. In general, we observe on average an increase in physical activity levels based on the linked dataset as well as relatively stable voucher redemptions, however, it is unclear whether activities took actually place for which vouchers were redeemed for.

Significance testing

We have applied statistical procedures to the available data to identify patterns and to draw conclusions from the data. However, it is important to understand what the results mean and to validate the estimate against the observed data. In empirical research, the 'null-hypothesis significance testing' is preferred method to formally test whether there is evidence of a relationship between the explanatory variables and outcome variable. This is often referred to as testing for statistical significance of the coefficient estimates. We postulate a set of null hypotheses that each of the variables in the model doesn't have a relationship with physical activity and test the extent to which the data is incompatible with those hypotheses. We can find evidence about there being a relationship between the variables, which suggests the variables are drivers of physical activity that should be included in the model.

For each of the estimates, we test whether we can reject the null hypothesis that it has a value of zero. We do so based on the p-value of the coefficient estimate, while a p-value smaller than 5 per cent infers statistical significance.[129] For example, if the p-value is P=0.04 (i.e., 4 per cent) it means that if the null hypothesis is true and we perform the study multiple times, in 4 per cent of the time the estimated value will be zero.[130] It is empirical convention to define an 'arbitrary' cut-off point of 5 per cent for statistical significance. It is important to note that a p-value of >5 per cent does not mean 'not different' from zero but only that the probability is higher.

We caution against 'black and white' interpretation of tests of statistical significance. While it is tempting to choose to rely only on the statistical significance of estimated coefficients, there are a range of limitations of statistical significance testing. For example, the threshold for confidence intervals that are sufficiently tight (95 per cent) is chosen only by convention. We have considered the results of the statistical significance testing as our central model result but conduct sensitivity testing by including results with p-values higher than 5 per cent.

129 There has been significant discourse in the statistics community about the use (and misuse) of p-values. P-values are a useful statistical measure to indicate how incompatible data are with a specified statistical model. See: Wasserstein, R.L. and Lazar, N.A., 2016, 'The ASA Statement on p-Values: Context, Process and Purpose', *The American Statistician*, 70(2), pp.129-133, available at: https://amstat.tandfonline.com/doi/pdf/10.1080/00031305.2016.1154108?needAccess=true

130 Andrade C. (2019). The P Value and Statistical Significance: Misunderstandings, Explanations, Challenges, and Alternatives. Indian journal of psychological medicine, 41(3), 210–215. https://doi.org/10.4103/IJPSYM.IJPSYM_193_19

Result tables

Results of the core statistical model

B.4 Main result table for physical activity level

Variables	coef.	Std. Err.	z	p-value	[95% Conf. Interval]	
Treatment variables (program intervention)						
No. of vouchers (V)	0.0963	0.018	5.35	0	0.0611	0.1316
Time since first voucher use (T)	-0.0956	0.0063	-15.27	0	-0.1079	-0.0834
Voucher used for new activity (NA)	-0.2446	0.0099	-24.6	0	-0.2641	-0.2251
V*T	0.0173	0.001	11.67	0	0.0144	0.0202
V*NA	0.0232	0.004	6.34	0	0.0160	0.0304
Control variables (baseline level of activity)						
age, 4 to 8	Reference					
age, 9 to 11	-0.2456	0.0107	-22.89	0	-0.2666	-0.2246
age, 12 to 14	-0.4370	0.0113	-38.63	0	-0.4591	-0.4148
age, 15 to 18	-0.5492	0.0141	-39.02	0	-0.5767	-0.5216
sex, Male	Reference					
sex, Female	-0.4078	0.0083	-48.99	0	-0.4241	-0.3915
seifa, 1st	Reference					
seifa, 2nd	0.1275	0.0164	7.76	0	0.0953	0.1597
seifa, 3rd	0.2226	0.0158	14.1	0	0.1917	0.2536
seifa, 4th	0.4266	0.0156	27.27	0	0.3959	0.4572
primary language, English	Reference					
primary language, Other	-0.6937	0.0178	-38.93	0	-0.7286	-0.6588
region, Central Coast	Reference					
region, Central West and Orana	0.0449	0.0366	1.23	0.220	-0.0268	0.1166
region, Far West	0.0953	0.0972	0.98	0.327	-0.0952	0.2858
region, Hunter	0.065	0.0233	2.79	0.005	0.0194	0.1107
region, Illawarra Shoalhaven	0.0332	0.0261	1.27	0.204	-0.018	0.0844
region, Metropolitan Sydney	-0.2402	0.0199	-12.09	0	-0.2792	-0.2013
region, New England North West	0.1658	0.0427	3.89	0	0.0822	0.2494
region, North Coast	0.1321	0.0315	4.19	0	0.0703	0.1938
region, Riverina Murray	0.0125	0.0358	0.35	0.727	-0.0577	0.0827
region, South East and Tablelands	0.0836	0.0406	2.06	0.039	0.0041	0.1631
bmi, thin/healthy	Reference					
bmi, overweight	-0.2971	0.0113	-26.34	0	-0.3192	-0.275
bmi, obese	-0.5017	0.017	-29.5	0	-0.535	-0.4683
ARIA, Major Cities	Reference					

Variables	coef.	Std. Err.	z	p-value	[95% Conf.	Interval]
ARIA, Inner regional	0.1188	0.0205	5.81	0	0.0787	0.1589
ARIA, Outer regional and remote	0.2348	0.0343	6.84	0	0.1675	0.3021
disability, Yes	Reference					
disability, No	0.5518	0.0338	16.33	0	0.4856	0.6181
heritage, First Nations	Reference					
heritage, Non-First Nations	-0.1211	0.0275	-4.41	0	-0.1749	-0.0672
Control variables * No. of Vouchers used (V) (i.e., change in activity level by voucher use for each characteristic)						
age, 4 to 8	Reference					
age, 9 to 11	0.0200	0.0040	5.06	0	0.0123	0.0278
age, 12 to 14	0.0117	0.0042	2.77	0.006	0.0034	0.0199
age, 15 to 18	0.0051	0.0052	0.98	0.326	-0.0051	0.0153
sex, Male	Reference					
sex, Female	0.0019	0.0030	0.64	0.519	-0.0040	0.0079
seifa, 1st	Reference					
seifa, 2nd	-0.0106	0.0061	-1.73	0.084	-0.0226	0.0014
seifa, 3rd	-0.0129	0.0059	-2.18	0.029	-0.0244	-0.0013
seifa, 4th	-0.0120	0.0058	-2.06	0.039	-0.0235	-0.0006
primary language, English	Reference					
primary language, Other	-0.0053	0.0066	-0.80	0.422	-0.0183	0.0076
region, Central Coast	Reference					
region, Central West and Orana	-0.0204	0.0136	-1.49	0.136	-0.0471	0.0064
region, Far West	-0.0011	0.0372	-0.03	0.977	-0.0741	0.0719
region, Hunter	-0.0182	0.0083	-2.20	0.028	-0.0345	-0.0020
region, Illawarra Shoalhaven	-0.0127	0.0093	-1.37	0.172	-0.0309	0.0055
region, Metropolitan Sydney	-0.0172	0.0070	-2.45	0.014	-0.0309	-0.0034
region, New England North West	-0.0092	0.0155	-0.59	0.553	-0.0396	0.0212
region, North Coast	-0.0221	0.0115	-1.93	0.054	-0.0446	0.0004
region, Riverina Murray	-0.0147	0.0132	-1.12	0.263	-0.0405	0.0111
region, South East and Tablelands	-0.0346	0.0151	-2.30	0.022	-0.0641	-0.0051
bmi, thin/healthy	Reference					
bmi, overweight	-0.0014	0.0041	-0.35	0.728	-0.0094	0.0066
bmi, obese	-0.0197	0.0065	-3.05	0.002	-0.0323	-0.0070
ARIA, Major Cities	Reference					
ARIA, Inner regional	-0.0065	0.0076	-0.85	0.395	-0.0214	0.0084
ARIA, Outer regional and remote	-0.0203	0.0128	-1.59	0.112	-0.0453	0.0047
disability, yes	Reference					
disability, no	-0.0512	0.0118	-4.33	0	-0.0744	-0.0281
heritage, First Nations	Reference					
heritage, Non-First Nations	0.0155	0.0102	1.52	0.1280	-0.0045	0.0355

Variables	coef.	Std. Err.	z	p-value	[95% Conf. Interval]	
Cut point predictors						
Cut1 (“0 days” to “1 to 3 days”)	-5.446	0.053	-102.85	0	-5.550	-5.342
Cut2 (“1 to 3 days” to “4 to 6 days”)	-0.732	0.049	-15.03	0	-0.827	-0.636
Cut3 (“4 to 6 days” to “7 days”)	1.555	0.049	31.88	0	1.460	1.651

Note: No. of observations 767,734; F(51, 797,683)=493.62, P-value (F-test) = 0.000
Source: CIE.

Estimates of days distribution within activity levels

B.5 Predicted distribution within ‘1 to 3 days’ activity level

Variables	coef.	Std. Err.	z	p-value	[95% Conf. Interval]	
Predictor variables						
age, 4 to 8	Reference					
age, 9 to 11	0.1614	0.0054	30.01	0	0.1508	0.1719
age, 12 to 14	0.1832	0.0058	31.44	0	0.1718	0.1946
age, 15 to 18	0.0943	0.0068	13.84	0	0.0810	0.1077
sex, Male	Reference					
sex, Female	0.1401	0.0045	31.44	0	0.1314	0.1489
seifa, 1st	Reference					
seifa, 2nd	0.1120	0.0077	14.52	0	0.0969	0.1271
seifa, 3rd	0.1888	0.0071	26.76	0	0.1749	0.2026
seifa, 4th	0.3496	0.0070	50.16	0	0.3359	0.3633
primary language, English	Reference					
primary language, Other	-0.4399	0.0068	-64.32	0	-0.4533	-0.4265
region, Central Coast	Reference					
region, Central West and Orana	0.0033	0.0196	0.17	0.866	-0.0351	0.0417
region, Far West	-0.0551	0.0447	-1.23	0.217	-0.1427	0.0325
region, Hunter	-0.0188	0.0131	-1.43	0.153	-0.0445	0.0070
region, Illawarra Shoalhaven	-0.0214	0.0149	-1.43	0.152	-0.0506	0.0079
region, Metropolitan Sydney	-0.2333	0.0112	-20.82	0	-0.2552	-0.2113
region, New England North West	-0.0233	0.0229	-1.02	0.307	-0.0681	0.0215
region, North Coast	-0.0254	0.0167	-1.52	0.128	-0.0581	0.0073
region, Riverina Murray	-0.0467	0.0198	-2.36	0.018	-0.0855	-0.0079
region, South East and Tablelands	-0.0421	0.0210	-2	0.045	-0.0833	-0.0009
bmi, thin/healthy	Reference					
bmi, overweight	-0.0835	0.0053	-15.79	0	-0.0938	-0.0731
bmi, obese	-0.2339	0.0062	-37.87	0	-0.2460	-0.2218
ARIA, Major Cities	0.0000					
ARIA, Inner regional	0.0439	0.0109	4.03	0	0.0225	0.0652

Variables	coef.	Std. Err.	z	p-value	[95% Conf. Interval]	
ARIA, Outer regional and remote	0.1293	0.0175	7.4	0	0.0950	0.1635
disability, yes	Reference					
disability, no	-0.5447	0.0115	-47.2	0	-0.5674	-0.5221
heritage, First Nations	Reference					
heritage, Non-First Nations	0.0187	0.0105	1.79	0.074	-0.0018	0.0392
Cut point predictors						
Cut1 (“1 day” to “2 days”)	-1.6668	0.0160		0	-1.6981	-1.6355
Cut2 (“2 days” to “3 days”)	0.1394	0.0158		0	0.1084	0.1703

Note: No. of observations 913,799; Wald Chi2(23) = 15813.29, P-value (Chi2-test) = 0.000

Source: CIE.

B.6 Predicted distribution within ‘4 to 6 days’ activity level

Variables	coef.	Std. Err.	z	p-value	[95% Conf. Interval]	
Predictor variables						
age, 4 to 8	Reference					
age, 9 to 11	-0.1071	0.0047	-22.74	0	-0.1163	-0.0979
age, 12 to 14	-0.2638	0.0052	-51.08	0	-0.2739	-0.2537
age, 15 to 18	-0.3018	0.0062	-48.66	0	-0.3139	-0.2896
sex, Male	Reference					
sex, Female	0.1628	0.0039	41.38	0	0.1551	0.1705
seifa, 1st	Reference					
seifa, 2nd	0.0149	0.0069	2.18	0.03	0.0015	0.0284
seifa, 3rd	0.0214	0.0066	3.26	0.001	0.0085	0.0342
seifa, 4th	0.0515	0.0066	7.84	0	0.0386	0.0644
primary language, English	Reference					
primary language, Other	-0.0230	0.0072	-3.18	0.001	-0.0372	-0.0088
region, Central Coast	Reference					
region, Central West and Orana	0.0776	0.0161	4.82	0	0.0461	0.1092
region, Far West	0.0205	0.0358	0.57	0.566	-0.0496	0.0907
region, Hunter	0.0231	0.0109	2.11	0.035	0.0017	0.0445
region, Illawarra Shoalhaven	-0.0140	0.0125	-1.12	0.262	-0.0384	0.0104
region, Metropolitan Sydney	-0.0392	0.0095	-4.12	0	-0.0579	-0.0205
region, New England North West	0.0778	0.0185	4.21	0	0.0416	0.1140
region, North Coast	0.0568	0.0138	4.11	0	0.0297	0.0838
region, Riverina Murray	0.0250	0.0163	1.53	0.125	-0.0070	0.0570
region, South East and Tablelands	0.0942	0.0168	5.6	0	0.0612	0.1271
bmi, thin/healthy	Reference					
bmi, overweight	-0.1121	0.0049	-23.12	0	-0.1216	-0.1026
bmi, obese	-0.1741	0.0060	-29.1	0	-0.1858	-0.1623

Variables	coef.	Std. Err.	z	p-value	[95% Conf. Interval]	
ARIA, Major Cities	Reference					
ARIA, Inner regional	-0.0019	0.0090	-0.21	0.832	-0.0195	0.0157
ARIA, Outer regional and remote	0.0180	0.0141	1.28	0.202	-0.0097	0.0457
disability, yes	Reference					
disability, no	-0.0469	0.0113	-4.15	0	-0.0691	-0.0248
heritage, First Nations	Reference					
heritage, Non-First Nations	-0.0141	0.0088	-1.61	0.107	-0.0313	0.0030
Cut point predictors						
Cut1 (“4 day” to “5 days”)	-0.7043	0.0135		0	-0.7307	-0.6779
Cut2 (“5 days” to “6 days”)	1.1988	0.0135		0	1.1723	1.2252

Note: No. of observations 1,070,864; Wald Chi2(23) = 6326.87, P-value (Chi2-test) = 0.000

Source: CIE.

Transforming estimated coefficients to predicted probabilities

Due to the format of the outcome variable (discrete rather than continuous) and the choice of the statistical model, estimated coefficients take the form of *log odds.* Log-odds itself are difficult to interpret and inherently different compared to estimated coefficients from linear (continuous) models. Those estimated parameters can be used to calculate *predicted probabilities,* i.e. the model predicts that a specific child type (represented by the corresponding combination of coefficients) has *x*% probability to be 0 days active, *y*% probability to be 1 to 3 days active and so on.

For that we can use the formula:[131]

$$P\ (y \leq k) = \pi_1 + \pi_2 + \cdots + \pi_k = \frac{e^{(Cut_k - S)}}{1+e^{(Cut_k - S)}}$$

where,

y is the outcome variable

k is the manifestation of the outcome variable, i.e., k = 4 as we have for four physical activity levels

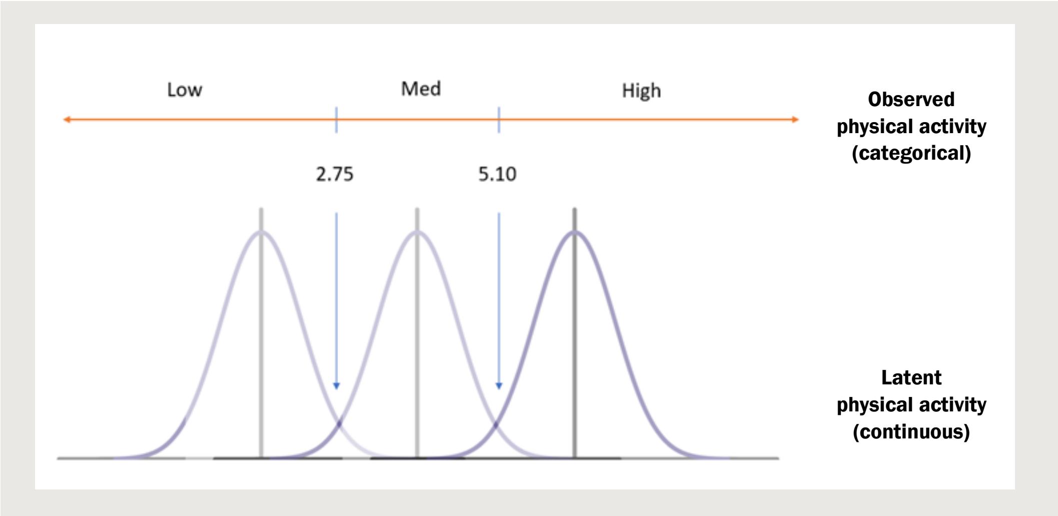
π_k are the event probability for each manifestation of k

Cut_k are the cut points for the adjacent levels of the latent response variable (see chart B.7). Those are comparable to the constant in a normal regression model, however, as the outcome variable has multiple levels there a also *(k-1)* constants. Those can also be used to predict the overall average activity level distribution in the population.

S is the sum of the corresponding parameter estimates

131 https://www.stata.com/manuals/rologit.pdf

B.7 Mapping categorical observed levels to latent continuous levels



Data source: https://stats.oarc.ucla.edu/wp-content/uploads/2020/09/ologit-ses-latent.png.

The following example serves as an illustration based on the estimated result (table B.1):

We are interested in the predicted probabilities for a specific child type that has used in total **5** vouchers within **4** years of program engagement for an **existing activity**. The child is **9 to 11** years old, **male** with a **healthy weight**, lives in an **inner regional** postcode with **2nd** SEIFA index at the **Central Coast**, speaks **English** at home, has **no disability** and is **not a First Nation** people.

- The formulas to predict the *baseline level of physical activity prior* to program engagement is:

$S_{Baseline}$ = - 0.2455 + 0 + 0 + 0.1188 + 0.1275 + 0 + 0 + 0.5518 - 0.1211 = 0.4314

$$P\ (y = 0\ days) = \frac{e^{(Cut_1 - S_{Baseline})}}{1+e^{(Cut_1 - S_{Baseline})}} = \frac{e^{(-5.4461-0.4314)}}{1+e^{(-5.4461-0.4314)}} = 0.28\%$$

$$P\ (y = 1\ to\ 3\ days) = \frac{e^{(Cut_2 - S_{Baseline})}}{1+e^{(Cut_2 - S_{Baseline})}} - \pi_1 = \frac{e^{(-0.7318-0.4314)}}{1+e^{(-0.7318-0.4314)}} - 0.28\% = 23.53\%$$

$$P\ (y = 4\ to\ 6\ days) = \frac{e^{(Cut_3 - S_{Baseline})}}{1+e^{(Cut_3 - S_{Baseline})}} - \pi_2 - \pi_1 = \frac{e^{(-0.7318-0.4314)}}{1+e^{(-0.7318-0.4314)}} - 23.53 - 0.28\% = 51.66\%$$

$$P\ (y = 1\ to\ 3\ days) = 1 - \pi_3 - \pi_2 - \pi_1 = 1 - 51.66\% - 23.53\% - 0.66\% = 24.53\%$$

- The formulas to predict the *level of physical activity after* program engagement is:

$S_{Program}$ = 5*0.0963 + 0 + 4*-0.0956 + 5*4*0.0.173 + 5*0

+ 5*(0.0200 + 0 + 0 + 0 + 0 + 0 + 0 – 0.0512 + 0) = 0.3076

$$P\ (y \leq 0\ days) = \frac{e^{(Cut_1 - S_{Baseline} - S_{Program})}}{1+e^{(Cut_1 - S_{Baseline} - S_{Program})}} = 0.21\%$$

$$P\ (y \leq 1\ to\ 3\ days) = \frac{e^{(Cut_2 - S_{Baseline} - S_{Program})}}{1+e^{(Cut_2 - S_{Baseline} - S_{Program})}} - \pi_1 = 18.75\%$$

$$P\ (y \leq 4\ to\ 6\ days) = \frac{e^{\left(Cut_3 - S_{Baseline} - S_{Program}\right)}}{1+e^{\left(Cut_3 - S_{Baseline} - S_{Program}\right)}} - \pi_2 - \pi_1 = 50.77\%$$

$$P\ (y \leq 1\ to\ 3\ days) = 1 - \pi_3 - \pi_2 - \pi_1 = 30.27\%$$

In this example, a child with the described characteristics has an increased probability of being more active after program engagement.

C Health assumptions and inputs

Psychological distress prevalence

In order to identify the prevalence of mental health disorders in Australian children, we refer to the results of the national survey of the mental health and wellbeing of Australian children and adolescents[132] conducted by the Telethon Kids Institute at the University of Western Australia in 2013-14. In total 76 606 households were approached, where the survey was distributed to parents and carers of 4–17-year-olds in the general population and 11-17 year old's to complete themselves. The prevalence of mental health disorders by gender and age cohort are shown in table C.1. An adjusted prevalence is calculated to account for children who experience both anxiety and major depressive disorder, based on the share of each disorder relative to the total share for any mental disorder.

C.1 Prevalence of mental health disorders in Australian children

Disorder	Females 4-11	Females 12-17	Males 4-11	Males 12-17
	%	%	%	%
Anxiety	6.1	7.7	7.6	6.3
Major depressive	1.2	5.8	1.1	4.3
ADHD	5.4	2.7	10.9	9.8
Conduct disorder	1.6	1.6	2.5	2.6
Any mental disorder	10.6	12.8	16.5	15.9
Adjusted prevalence				
Anxiety adjusted	4.5	5.5	5.7	4.4
Major depressive adjusted	0.9	4.2	0.8	3.0

Note: Adjusted prevalence is used for the modelling results

Source: Australian Government (2020), The Mental Health of Children and Adolescents - Report on the second Australian child and adolescent survey of mental health and wellbeing.

The prevalence of major depressive disorder was higher in adolescents compared to those aged 4-11 years for both sexes. Among those aged 4-11 years prevalence was almost the same at 1.2 per cent for females and 1.1 per cent for males. However, among adolescents the prevalence of major depressive disorder was 5.8 per cent for females and 4.3 per cent for males.

132 Australian Government (2020), The Mental Health of Children and Adolescents - Report on the second Australian child and adolescent survey of mental health and wellbeing, https://www.health.gov.au/sites/default/files/documents/2020/11/the-mental-health-of-children-and-adolescents_0.pdf

We do not expect the prevalence of mental health disorders to be equally distributed among the categories of physical activity, as studies show mental health prevalence to decrease with higher levels of physical activity. We estimate the mental health prevalence across the Active Kids cohort using the prevalence rates from the Guddal study. The odds risk reduction for psychological distress as a result of increases in physical activity and mental health prevalence can be combined with observed changes in activity in the Active Kids program to estimate the reduction in psychological distress.

Change in psychological distress likelihood due to active kids

The observed increase in physical activity due to the Program will decrease the likelihood of children experiencing psychological distress. Each cohort will experience a shift in likelihood of experiencing psychological distress, which can be aggregated to the effect in terms of children, shown in table C.2.

C.2 Reduction in prevalence of mental health in the population due to the program

Gender	Age Cohort	2018	2019	2020	2021
		# children	# children	# children	# children
Female	9 to 11	5	11	19	32
Female	12 to 14	6	10	17	31
Female	15 to 18	5	5	8	15
Male	9 to 11	17	34	59	100
Male	12 to 14	12	19	34	63
Male	15 to 18	5	4	6	14
Total		**51**	**83**	**143**	**255**

Source: CIE.

Healthcare costs of mental disorders

The total aggregate of children who are no longer expected to experience psychological distress is 51 in 2018 and increases to 255 in 2021 as participation and redemptions increase in the program. The value of these children avoiding experiencing psychological distress is estimated in the following sections.

Table C.3 show the costs of anxiety and depression relative to children and adolescents with no mental health disorder for using mental health and general health services under the Medicare Benefits Scheme (MBS). Table C.4 shows the same results except for the Pharmaceutical Benefits Scheme (PBS).

C.3 MBS costs from mental health disorders

Disorder	Using mental health service	Mental health service cost	Using general health services	General health services cost
	%	$2021	%	$2021
No disorder	1.5	472	84.2	369
Anxiety	**14.9**	**764**	88.2	**613**
Depression	**14.3**	1 530	**94.6**	**513**

Note: Bold numbers are statistically significant at p<0.05

Source: Khang-Dao Le et al. (2021), The cost of Medicare-funded medical and pharmaceutical services for mental disorders in children and adolescents in Australia.

C.4 PBS costs from mental health disorders

Disorder	Using mental health service	Mental health service cost	Using general health services	General health services cost
	%	$2021	%	$2021
No disorder	0.7	226	25.1	176
Anxiety	**5.1**	271	**42.7**	129
Depression	**8.3**	474	29.6	170

Note: Bold numbers are statistically significant at p<0.05

Source: Khang-Dao Le et al. (2021), The cost of Medicare-funded medical and pharmaceutical services for mental disorders in children and adolescents in Australia.

Bone health

The burden of disease study by Osteoporosis Australia[133] estimates the annual costs associated with osteoporosis and osteopenia for male and female cohorts aged 50 to 69 years and 70 years and over. Total costs range from $435m to $1.2bn for these cohorts, see table C.5 for a breakdown of cost items. The highest costs result from the female cohort aged 70 and over, who have the highest rates of Osteoporosis.

C.5 Cost of osteoporosis and osteopenia

	Women	Women	Men	Men
	50-69 years ($2012)	70+ years ($2012)	50-69 years ($2012)	70+ years ($2012)
All hospital	240 320 269	610 741 469	114 409 043	215 407 040
Ambulance	10 603 507	23 469 688	6 275 348	9 777 031
Subacute care	54 347 995	112 773 917	25 406 393	30 233 211
Community care	8 278 743	8 252 088	3 959 762	2 588 252
Nursing home	-	59 514 931	-	17 767 909
Home help	7 696 338	22 028 600	173 589	3 478 325
Meals on wheels	-	9 359 035	-	4 619 957

133 Osteoporosis Australia (2013), Osteoporosis costing all Australians A new burden of disease analysis – 2012 to 2022

	Women	Women	Men	Men
	50-69 years ($2012)	70+ years ($2012)	50-69 years ($2012)	70+ years ($2012)
Community health care	206 532 281	140 034 153	190 241 433	89 896 045
DXA scan	7 785 948	5 279 071	7 171 808	3 388 942
Pharmaceutical-Osteoporosis treatment	59 093 970	40 067 218	54 432 757	25 721 471
Community health care	273 412 199	185 380 443	251 845 998	119 006 458
Calcium and vitamin D costs	3 187 825	4 089 705	1 596 311	1 394 991
Informal community care	31 603 792	74 392 420	17 253 390	18 502 080
Production loss	29 440 969	89 578 483	14 272 389	31 881 263
Total cost of fractures in 2012	**658 891 637**	**1 199 580 779**	**435 192 223**	**454 656 517**

Source: Osteoporosis Australia (2013), Osteoporosis costing all Australians A new burden of disease analysis – 2012 to 2022.

D Education inputs

Value of increased attendance

Educational benefits from the Active Kids Program relate to improved attendance rates. We have estimated the average return for an individual from each day of attendance, drawing from the literature on the rate of return from educational attainment.

The world bank found that an individual's return on investment from secondary school in Australia was 30.8 per cent.[134] If this rate of return was applied to the personal income for those who completed school,[135] there is an estimated $55.02 benefit to the individual from each school day attended.[136]

However, since they benefit has been calculated based on future earnings, the benefit value has been discounted for each age group. The final benefit value for each day of school attendance is:

- $21.34 for ages 4 to 8
- $27.97 for ages 9 to 11
- $34.26 for ages 12 to 14, and
- $44.91 for ages 15 to 18.

These values are based on a wage uplift for only one year once an individual enters the workforce (assumed to be around the age of 20). This ensures that benefits are not double counted for individuals that participate in the program in multiple years. For example, if a participant redeems one or more vouchers in one year only, they are expected to experience outcomes from the program only within that year, with the value estimated based on one year of wage uplift. However, an individual that redeems one or more vouchers over 2 years, may experience positive outcomes across both years, estimated as two years of wage uplift.

134 Montenegro C.E., Patrinos H.A. 2014 Comparable Estimates of Returns to Schooling Around the World, World Bank Group, Education Global Practice Group.

135 Extracted from the Census 2016 where educational attainment is "Secondary Education - Years 10 and above" for NSW residents, Census of Population and Housing, 2016, TableBuilder, Australian Bureau of Statistics

136 Calculated as (average wage per annum* personal education return) / number of school days per annum

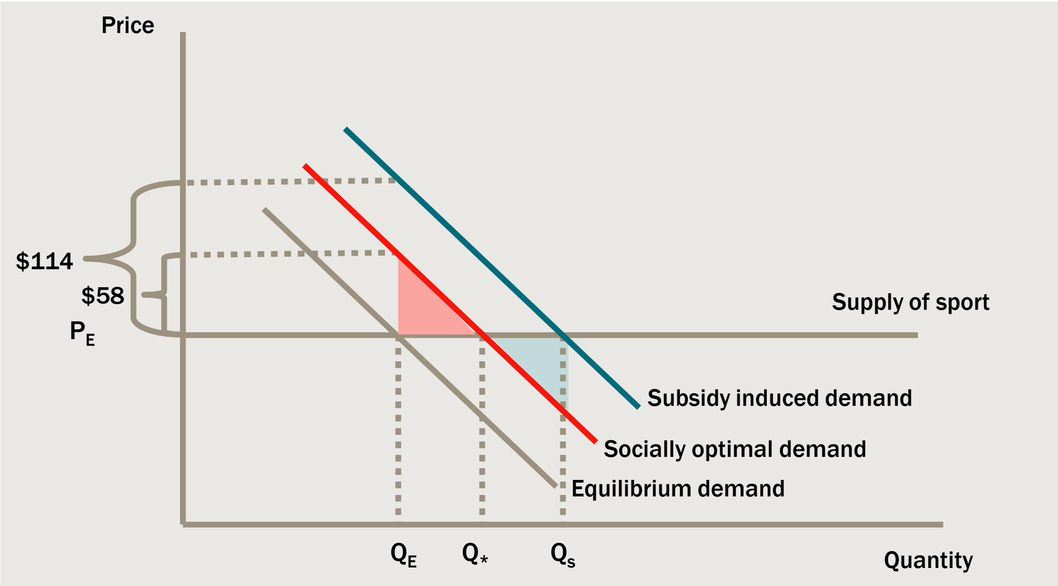
E Deadweight loss

Deadweight loss associated with the positive externality of physical activity

The Active Kids Program has been shown to induce physical activity across a broad population of children and adolescents. As each participant increases their physical activity, they experience benefits which relate to avoided costs of physical, mental and educational outcomes. These benefits can be interpreted as *positive externalities*, based on the assumption that the parents decision to enrol the child in sport has not factored in these outcomes[137]. As the decision to enrol in sport is assumed to not factor in these outcomes, which will impact third parties (the child, government, carers), a market failure exists in provision of sport.

To illustrate, chart E.1shows the market for child's sport participation. The equilibrium level of sport participation is shown by the intersection of the equilibrium demand curve and the supply curve. This shows the baseline level of participation before the program was initiated, with price (P_E) and quantity (Q_E) at equilibrium. The supply curve is inelastic based on the assumption that there is excess capacity for new participants in the community sporting sector.

E.1 Deadweight loss associated with positive externality of physical activity



Data source: CIE.

137 The size of the externality will be dependent on the composition of utility function of the parent who makes the decision to enrol in sport, we present a maximum, meaning that all benefit categories are not considered by the parent.

For each child who engaged in a new activity, the marginal weighted benefit was $58, which represents the positive externality associated with increasing physical activity. Thus, the red curve shows what the level of demand should be to optimise the benefit for society (Q_*), the *socially optimal level of demand*. The red shaded region represents the deadweight loss of demand being lower than the socially optimal level. Considering this forgone benefit at Q_*, the market has an under provision of sport at Q_E.

Introducing a subsidy will increase demand and shift the demand curve out towards the socially optimal level, see the blue curve *subsidy induced demand*. Each increment demand increases it will decrease the deadweight loss, until the point that the subsidy induced demand curve exceeds the optimal quantity of participation. The subsidy in the case of the program is on average $114 per participant per year. As shown in the chart, the subsidy induces more demand than the socially optimal quantity and results in excess demand, Q_S minus Q_*. This creates a deadweight loss between Q* and Qs, denoted by the blue shaded region. The net welfare gain is then the size of the socially optimal deadweight loss (red shaded area) minus the size of the deadweight loss associated with excess demand (blue shaded area). We cannot exactly measure the magnitude of the net welfare gain without knowing the shape the demand curve, which has not been estimated in this analysis.

To achieve a maximum welfare gain, the subsidy should equal the marginal external benefit at the efficient output level. Based on the program data, the subsidy exceeds the optimal level to achieve the socially optimal level of demand.

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