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Healthy eating and physical activity environments in out of school hours care: an observational study protocol

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Contribution Statement

Ruth Crowe is a PhD candidate of this study, she has worked with the research team developing the study design and methodology, she will be the lead on data collection and analysis, interpretation and write up of future manuscript. Yasmine Probst and Rebecca Stanley are PhD supervisors on this project. They have contributed to the study design and provided support through the development of this study. They have both revised and edited the manuscript. Jenny Norman, Susan Fusber and Lisa Franco are a part of the Prevention Research Support Program working committee, offering valuable insight and context of local health districts. They have also revised and made significant editorial contributions to this manuscript. Anthony Okely is the chief investigator of this study, contributing to the study design and methodologies. Professor Okely is a PhD supervisor on this project and has revised and edited this manuscript. All authors have read and approved the final manuscript. This manuscript has not been submitted or published in any other journal.

Conflicts of Interest statement

The authors have declared there is no competing interests

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ABSTRACT

Introduction: Healthy eating and regular physical activity are among the most modifiable risk factors for preventing overweight and obesity. Childcare settings have been widely identified as important venues for promoting healthy lifestyles to children. Out of school hours care (OSHC) care is a rapidly growing childcare service, yet there has been limited research reported on healthy eating and physical activity (HEPA) environments within the Australian OSHC setting. This research aims to describe the HEPA environments related to foods and beverages served, staff behaviours and child physical activity levels across two Local Health Districts within [Location removed]. This study will provide evidence to support future interventions and policies in Australian OSHC settings.

Methods and analysis: A cross-sectional study design will be used to describe the food and beverages provided, child activity levels and report on environmental correlates. OSHC programs will be visited on non-consecutive weekdays between 2018 and 2020. The frequency of foods and beverages offered will be observed and categorised into food groups aligned to the Australian guide to healthy eating. Children's physical activity will be measured using Actigraph GT3X accelerometers. Staff behaviour will be captured via direct observation and the Systems for Observing Staff Promotion of Physical Activity and Nutrition (SOSPAN). Short interviews with program directors will gather contextual information about OSHC practices and policies.

Ethics and dissemination: Findings will be disseminated through peer-reviewed scientific journals and conference presentations. Ethical approval was granted by the [removed for blinding].

Strengths and limitations of this study:

- This will be one of the first known Australian studies to systematically describe the healthy eating and physical activity environments within before and afterschool programs to support the development of future interventions, better policies and healthier environments for children attending OSHC programs.

- Foods observed can only provide an estimation of food groups offered, rather than actual foods consumed by the children.
- OSHC programs from the two Local Health Districts in [Location removed] may not be representative of all OSHC programs across [Location removed].

INTRODUCTION

One in four Australian primary school-aged children are classified as overweight or obese.[1] Healthy body weight in childhood supports optimal bone development, cognition and concentration at school, improved sleep patterns and reduced anxiety and depression in later life.[2] Healthy eating and physical activity (HEPA) are important in maintaining healthy body weights[1 3] and are key modifiable risk factors for preventing overweight and obesity.[4] National data indicate that no Australian children (aged 4-8 years) currently meet the vegetable intake recommendations, while most exceed discretionary food intake guidelines.[5] Nearly half of Australian children are not meeting physical activity guidelines and nearly three quarters exceed the recommendations for recreational screen-time.[6] The out-of-school hours' time period may be a critical window in a child's day to intervene as studies have shown children consume large amounts of snack foods[7] and participate in long periods of screen-based sedentary activities[8, 9] during out-of-school hours.

In Australia, out-of-school hours care (OSHC) programs operate before school (6:00-9:00), after school (15:00-18:00) and during school holidays (vacation care) (9:00–18:00). OSHC programs are of growing importance for many Australian parents whose employment requires them to work outside school hours.[10, 11] In 2018, 36% of Australian children in care attended OSHC programs (458,750 children), spending an average of 12 hours per week in these

programs.[10] OSHC programs have the opportunity to provide positive physical and social environments that can promote healthy eating and active play to children who attend.

Within an OSHC setting, staff can create supportive physical environments through; 1) the foods and beverages available to children (provided meals, vending machines, food rewards), 2) health promoting messages[12, 13] (via posters, nutrition education and cooking), and 3) opportunities and equipment for active play. The social environment can influence behaviour via staff role-modelling[12] (e.g. consumption of healthy foods and beverages and engagement in physical activity opportunities) and establishing HEPA practices as a social norm within these settings through the presence of strong and supportive policies.

While limited studies have reported on HEPA within before school care[14, 15] and Australian OSHC programs, international research has found that foods and beverages served and children's physical activity levels within after school programs fell well below national recommendations.[16, 17] This research aims to describe the HEPA environments related to the foods and beverages served, staff behaviours and child physical activity levels across two Local Health Districts within [location removed].

METHODS

A cross-sectional, observation study will be conducted to 1) observe the foods and beverages offered to children; 2) assess the level of physical activity of children; and 3) observe staff behaviours on promotion and role-modelling of HEPA within OSHC programs. Data will be collected during unannounced (non-specified) visits on non-consecutive weekdays to ensure usual behaviour is captured. In the occurrence of unfavourable weather patterns (e.g. heavy rainfall), which may lead to irregular practices or changes to the usual program, observations will be rescheduled. Data collection methods are outlined in Figure 1. Data is scheduled to be

completed within the afterschool programs between March 2018 and April 2019 and within before school care from February 2020 to December 2020.

Study Sample

In 2018, there were 243 OSHC providers in operation across the South Western Sydney and Illawarra Shoalhaven Local Health Districts[18], which will act as the sampling frame. Eligibility criteria for the study are: five or more primary school-aged children (5-12 years) enrolled; the program runs from 06:00 – 09:00 and/ or 15:00 - 18:00 during school terms; provide at least one breakfast or afternoon meal; and the program is not exclusively advertised as a homework or physical activity-related club (e.g. dance academy, swimming or football clubs).[19] Once the inclusion criteria were applied 204 OSHC programs were eligible to participate. A power calculation and sample size estimation were generated with 5% precision requiring 128 OSHC programs to be recruited. Given the large sample size required, all eligible services in the two Local Health Districts will be invited to participate via email and telephone.

Recruitment

Written informed consent will be obtained from OSHC directors. The research methods have been determined to be low risk,[20] therefore a passive consent approach will be applied for staff and children. Staff and parents will be notified of the study via several channels, including: 1) recruitment video, digital research posters and information sheets via OSHC internal communication avenues; 2) research notification posters at each entrance way, notice boards and sign in/out desk within each OSHC; and 3) participant information sheets and opt-out forms (that provide detailed explanation of the research study, investigator contact details, and the opportunity for participants to be excluded from the study) located at sign in/out desks. Information relating to this study will be displayed for a minimum of two weeks prior to data collection commencing and for the duration of the data collection period. Data collectors will

be on site during data collection and available to discuss the study with staff and parents as required. Children will be invited to wear an accelerometer for the duration of their time at the program, unless they have opted-out of the study. A child can refuse assent at any stage of the research process.

Context

In 2010, the National Quality Framework was implemented in Australia as the overarching regulatory framework for early childhood education and care, under which sit OSHC services.[21] Within this framework are seven National Quality Standards that are underpinned by National Legislation and Regulations.[21] Healthy eating and physical activity fall under the National Quality Standards 2, Element 2.1.3, "*healthy eating and physical activity are promoted and appropriate for each child*". The Australian Children's Education and Care Quality Authority disseminated the *Guide to the National Quality Standard*[21] to support service providers in meeting the requirements of the National Quality Standards. These guidelines within the National Quality Framework are not authoritative, but provide flexibility on how service providers might meet the Standards.[22] As demonstrated in Table 1, this guide describes best practice guidelines for education and care services, recommending staff use positive role modelling behaviours, engage children in healthy eating conversations, use cooking experience to build knowledge, provide meals consistent with the Australian Guide to Healthy Eating (AGHE), implement frequent opportunities for physical activity and role model enjoyment by engaging in activities.[21] A combination of resources designed to support OSHC programs in meeting Quality Area 2, will be used to guide the criteria within this study including; 1) Heart Foundations *'Eat Smart, Play Smart'* manual,[23] 2) Nutrition Australia's '*Healthy eating in the National Quality Standards'*[24], and 3) the '*Food and drink checklist for outside school hours*

care'[25]. For the purpose of this study we will report on whether staff behaviour relating to the best practice guidelines was observed or not observed.

Table 1: Best-practice guidelines, selected from the *Guide to the National Quality Standards* for the reporting of HEPA promotion behaviours in OSHC.

National Quality Standards	Direct observation	SOSPAN[b]	Accel[c]	HAAND[d]
Healthy Eating Environment				
Engage children in experiences and conversations that promote mealtimes to be enjoyable and promote healthy, balanced lifestyles	✓			
Use cooking experiences to further children's understanding of food and nutrition	✓			
Never use food to reward children	✓	✓		
Sit and eat with children and model, healthy eating and nutrition practices during mealtimes	✓			
Provide food and beverages consistent with the Australia dietary guidelines	✓			✓
Provide foods and drinks consistent with the menu	✓	✓		✓
Access to water throughout the day	✓	✓		
Physical Activity Environment				
Implement physical games and activities as part of the program and encourage children to participate		✓		
Become involved and demonstrate enjoyment in children's physical activity		✓		
Children should have frequent opportunities to engage in active play		✓		✓
Children should lead physical play activities with peers		✓		
Opportunity for dance, creative movement and drama and respond to music		✓		✓
Provide resources and equipment to support children participate in physical activity		✓		
Additional Measures[a]				
Nutrition and physical activity policies				✓

Children accumulate 30 minutes MVPA in the hours before and afterschool			✓	
Annual nutrition and physical activity staff training				✓

Note: This is not an exhaustive list of best-practice behaviours, only those that could be reported on by the selected tools used within this study. Some of the descriptions have been summarised within this table.

[a]Additional measures are not found within the *Guide to the National Quality Standards*

[b]SOSPAN: System for observing staff promotion of activity and nutrition

[c]Accel: Accelerometer

[d]HAAND: Healthy Afterschool Activity and Nutrition Document

Healthy eating and physical activity measures were selected from the AGHE[26] and the Australian Physical Activity and Sedentary Behaviour Guidelines for Children and Young People, respectively.[27] The AGHE provides the recommended 'serves' individuals should consume, adjusted by age and gender, however, due to the observational nature of this study, the frequency of food groups offered/ served to children will be reported. National physical activity guidelines state that children should accumulate a minimum of 60-minutes of moderate-to-vigorous physical activity (MVPA) across an entire day.[27] For the current study, a measure of 30 minutes of MVPA has been selected as half of the time recommended in the current physical activity guidelines for children.[27] This measure has been used in studies conducted in similar settings in the United States.[19, 28, 29]

Healthy Eating Environment

Food and beverages offered to children will be captured via direct observation and digital images. Food labels, branding, packaging and serving methods (individual portion sizes or "family style", characterised by a shared platter) will be systematically observed and recorded.[30] Digital photography will be used to capture descriptive data on the provided foods, including the types of foods offered as well as waste and leftovers. Digital images will be taken

pre- and post-meals being served, including multiple camera angles and using common objects (e.g. fork, spoon, hand) to assist as a point of reference for size estimation.[26] Water will be recorded as available if cups of water or designated water stations are available to children during the snack time or throughout the program.[30]

Observations of the healthy eating environment will be made during the scheduled mealtime including: staff healthy eating promotion behaviours; staff sitting and eating with children; staff promotion / discouragement of healthy foods and beverages; staff engaging children in healthy eating discussions or nutrition education during the meal time; provision of food knowledge and skill development (including children's involvement in the food preparation activities, and food clean-up); rewarding of good behaviour with discretionary food items[23] (e.g. sweets and confectionary); and food waste management (e.g. use of a compost or worm farm). Weekly food menus will be observed and recorded including if they are displayed for parents, whether menus were consistent with foods served and if they met the requirements of the 'Food and drink checklist for outside school hours care'[25]. Types of food preparation (kitchen) facilities will be observed and documented including food storage, cooking equipment, preparation areas and washing up facilities.

Physical Activity Environments

Prior to data collection, all OSHC programs will be visited to record the physical characteristics of the program environment, including indoor (non-physical activity enrichment or snack areas) and outdoor spaces (physical activity spaces). These spaces will be divided and identified as zones during the data collection period. Available space accessible to children during the OSHC program will be mapped and measured in metres using a CRAFT.RIGHT

measuring wheel (Figure 2). Permanent facilities (e.g. basketball courts, fixed equipment and sandpits) will be measured and identified as zones.

Child physical activity will be measured via ActiGraph accelerometers (wGT3X-BT models). Accelerometers are widely used to provide an objective estimate of physical activity in free-living research.[28, 31, 32] Accelerometers are small, unobtrusive devices that sit around a child's waist, attached using adjustable elastic belts. As children arrive at a program, the accelerometers will be fitted around their waist by trained data collectors, ensuring the unit is sitting on the right hip. The time-on and demographic data of each child (school grade and sex) will be recorded. As children depart from the program accelerometers will be removed and time-off recorded.[33]

System for Observing Staff Promotion of Activity and Nutrition

Staff promotion of HEPA behaviours will be measured by direct observation and momentary time sampling using the System for Observing Staff Promotion of Activity and Nutrition (SOSPAN) instrument.[34] SOSPAN is a validated observation tool created and used within afterschool programs in the United States.[33] The tool is designed to capture 13 physical activity and six healthy eating behaviours of staff as described in detail elsewhere.[33] Staff behaviours captured by SOSPAN include staff encouragement of physical activity (e.g. leading physical activity, verbally promoting physical activity, staff engagement in physical activity with children and providing children with multiple physical activity options) or discouragement of physical activity (e.g. idle time, providing elimination games, children standing or waiting for a turn and withholding physical activity). SOSPAN captures the context of the program, documenting the duration of scheduled activities (physical activity, indoor enrichment activities, homework/ academics and mealtime). Other contextual activities recorded by

SOSPAN include the identification of organised activity (structured activity set up by OSHC staff) versus physical activity free-play (unstructured activity time that was child-led and not organised by staff in the afterschool programs).

Staff promotion and modelling of healthy eating behaviours are captured in SOSPAN via staff verbally promoting healthy eating, educating children on healthy eating and consuming healthy food and beverage options or discouraging healthy eating by staff consuming inappropriate foods or drinks.

Systematic SOSPAN scans will be continually completed throughout the duration of the program or until there are less than five children remaining at the program.[34] Data collectors will move systematically between zones (Figure 2) where both staff and children are present, completing five scans before moving to the next area.[33, 34] Data collectors will be required to meet greater than 80% interrater-reliability agreement via an interval-by-interval agreement on two consecutive data collection days.[26] Interrater reliability will be continuously monitored throughout the data collection process, completing a minimum of five reliability scans per day.

HEPA Policy Environment: Healthy After school Activity and Nutrition Documentation

Written HEPA policies, that use clear-language to guide staff practices have been shown to improve the HEPA environments within child care services.[35, 36] The Healthy After school Activity and Nutrition Documentation (HAAND) instrument is a validated tool that will be used to guide and collect information on HEPA policies within each OSHC program. Detailed information on this tool has been published elsewhere.[37] HAAND explores 11 healthy eating and ten physical activity policy characteristics captured through a short, structured interview conducted on-site with the OSHC Directors by trained data collectors. In short, HAAND evaluates the level at which program policies support HEPA characteristics through written policies, staff training, use of HEPA resources, time allocations and types of physical activity,

healthy eating practices and screen-time availability. In addition, a copy of the nutrition and physical activity policies, as well as weekly food receipts, will be requested from each OSHC program. For the purpose of collecting healthy eating and physical activity policy information, the HANND will be applied to both before and afterschool OSHC programs.

Data Analysis

Foods and beverages will be categorised by a dietitian or nutritionist into the five core food groups according to the AGHE: fruit, vegetables, lean meats, dairy and grains (whole grains). Additional categories of discretionary items, refined grains, water and 'extra' drinks (fruit juice, cordial, soft drinks and flavoured milk) will also be recorded. Food categorisation will be guided by the AUSNUT 2011-13 database developed by Food Standards Australian New Zealand, for the Australian Health Survey food classification system[38] and the Discretionary food listing[39] developed by the Australian Bureau of Statistics. Food categories will be checked by a researcher independent of the OSHC observations. The frequency of food groups and beverages offered across observation days will be calculated and expressed as a percentage, mean and standard deviation, for normally distributed data and median and interquartile ranges for skewed data. Data transformation is not deemed relevant to this study.

Accelerometer-derived physical activity data will be calculated for minutes per day spent in sedentary, total physical activity and MVPA. For this study the Evenson cut points will be used: sedentary behaviour <26 counts/ 15 seconds, light-to-moderate activity 26-573 counts/ 15 seconds, moderate activity 574-1002 counts/ 15 seconds, and vigorous activity >1002 counts/ 15 seconds.[32] The Evenson cut points have been recognised as accurate cut points for measuring the time spent in different physical activity intensities for children aged five to eight years.[31] Within afterschool programs, physical activity data will be considered valid if a total

wear time of accelerometers is equal to or greater than 60 minutes[17] and 30 minutes within before school care. Total time active will be reported on for the before school care programs. All accelerometery data will be analysed using ActiLife software [40] and STATA.[41]

Staff behaviours captured through direct observation, SOSPAN and responses from the structured interview (i.e. HAAND) will be quantified and reported as a percentage of observations and responses completed using SPSS software 'IBM SPSS Statistics for windows, version 25.0. (IBM Corp., Armonk, N.Y., USA)'.

The relationship between serving healthy snack foods and variables such as: socio-economic index for areas (SEIFA), availability of kitchen facilities and healthy eating training of staff will be explored.

To explore the relationships between the physical activity environment and child activity levels, correlations between time spent in MVPA, total physical activity and sedentary behaviour will be assessed against: physical activity policy, staff engagement in physical activity, available space for physical activity (m^2), ratio of number of children to staff, physical activity equipment and sex of child.

ETHICS AND DISSEMINATION

Ethical approval has been provided by the [removed for blinding]. Results from this study will be disseminated through peer-reviewed scientific journals, conference presentations, scientific reports, service reports (providing findings to participating OSHC care providers) and will form part of student dissertations.

PATIENT AND PUBLIC INVOLVEMENT

Although this research was completed without public involvement, it did incorporate key public health stakeholders in the governance and management of the study. These stakeholders did contribute to the research priorities, defining research question and outcome measures and providing input into the study design. Members of the public were not invited to comment on the study design and were not consulted to ensure a true benchmark was achieved. Members of the public were not invited to contribute to the writing or editing of this document for readability or accuracy.

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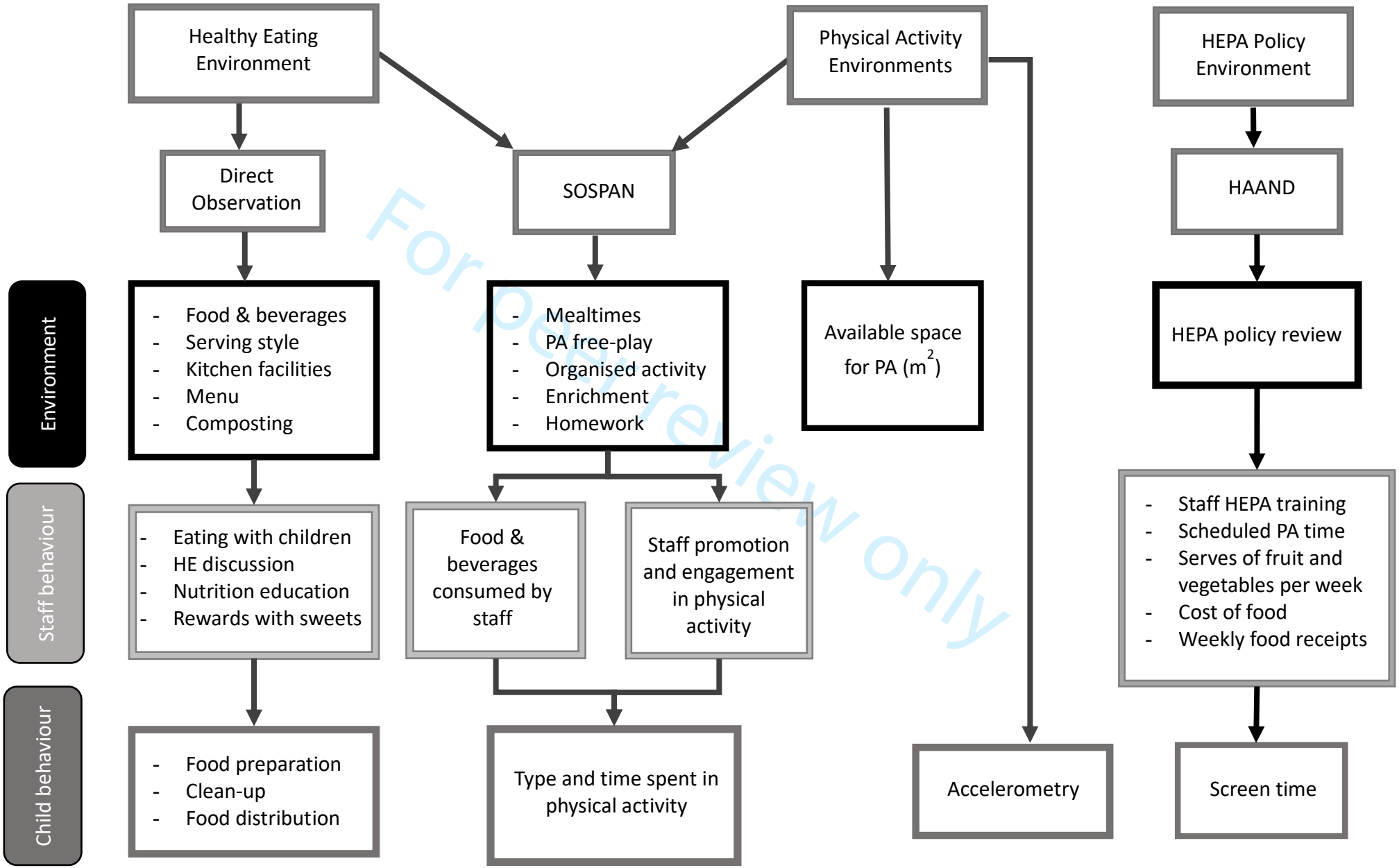
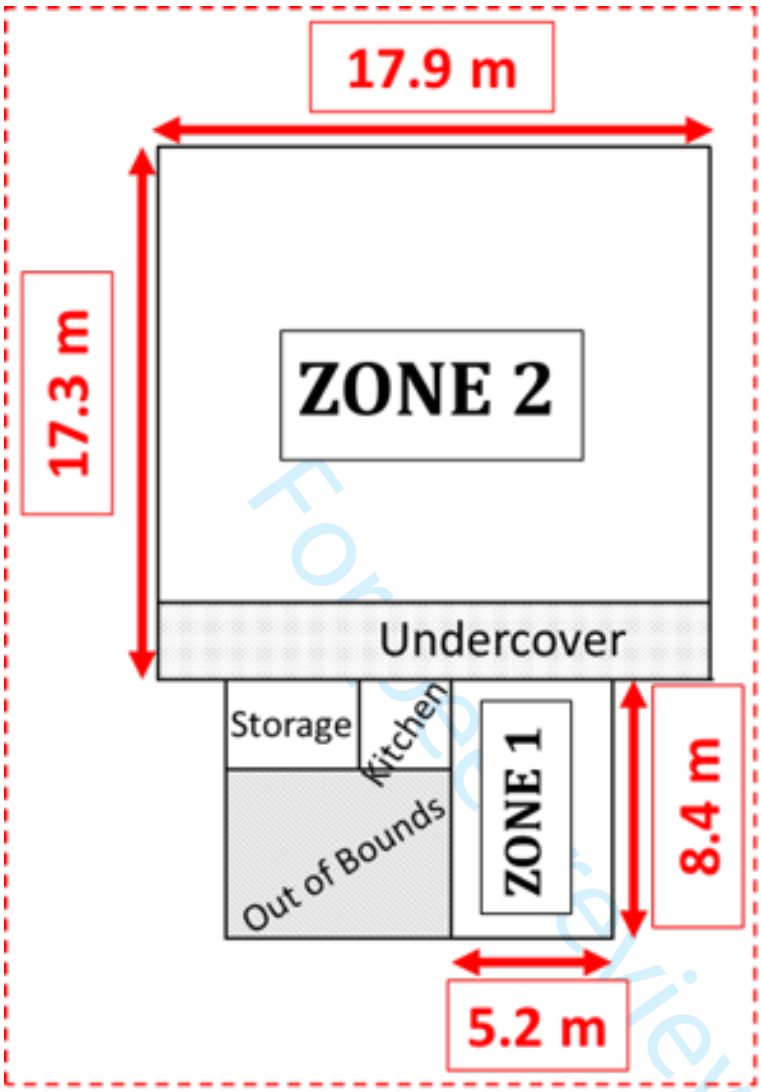
Tables and Figures:

Figure 1: Data collection methods for observing the HEPA environments within out of school hours care (OSHC).

HEPA -Healthy eating and physical active
SOSPAN – Systems for Observing Staff Promotion of Activity and Nutrition
HAAND – Healthy After school Activity and Nutrition Document instrument
PA – Physical activity
HE – Healthy eating

Figure 2: An example of the zones and the size of zones measured in metres (m) in OSHC program





STROBE (Strengthening The Reporting of OBservational Studies in Epidemiology) Checklist

A checklist of items that should be included in reports of observational studies. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Section and Item	Item No.	Recommendation	Reported on Page No.
Title and Abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/Rationale	2	Explain the scientific background and rationale for the investigation being reported	2-3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study Design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	N/A
		Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	N/A
		Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants	4
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed	N/A
		Case-control study—For matched studies, give matching criteria and the number of controls per case	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5 - 7

Section and Item	Item No.	Recommendation	Reported on Page No.
Data Sources/ Measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5 - 10
Bias	9	Describe any efforts to address potential sources of bias	N/A
Study Size	10	Explain how the study size was arrived at	N/A
Quantitative Variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11 - 12
Statistical Methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	11 - 12
		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	N/A
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed	N/A
		Case-control study—If applicable, explain how matching of cases and controls was addressed	N/A
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	N/A
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive Data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	N/A
		(b) Indicate number of participants with missing data for each variable of interest	N/A
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A
Outcome Data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	N/A
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	N/A
		Cross-sectional study—Report numbers of outcome events or summary measures	N/A

Section and Item	Item No.	Recommendation	Reported on Page No.
Main Results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other Analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key Results	18	Summarise key results with reference to study objectives	N/A
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	N/A
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	N/A
Generalisability	21	Discuss the generalisability (external validity) of the study results	N/A
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	12 - 13

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.

BMJ Open

Healthy eating and physical activity environments in out of school hours care: an observational study protocol

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Healthy eating and physical activity environments in out of school hours care: an observational study protocol

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Contribution Statement

Ruth Crowe is a PhD candidate of this study, she has worked with the research team developing the study design and methodology, she will be the lead on the data collection and analysis, interpretation and drafting of future manuscripts. Yasmine Probst and Rebecca Stanley are PhD supervisors on this project. They have contributed to the study design and provided support through the development of this study and both revised and edited the manuscript. Jenny Norman, Susan Furber and Lisa Franco are a part of the Prevention Research Support Program working committee, offering insight and context of local health districts. They have also revised and made significant editorial contributions to this manuscript. Anthony Okely is the chief investigator of this study, contributing to the study design and methodologies. He is a PhD supervisor on this project and has revised and edited this manuscript. All authors have read and approved the final manuscript. This manuscript has not been submitted or published in any other journal.

Conflicts of Interest statement

The authors have declared there is no competing interests

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ABSTRACT

Introduction: Childcare settings have been widely identified as important venues for promoting healthy lifestyles to children. Out of school hours care (OSHC) is a rapidly growing childcare service, yet there has been limited research reported on healthy eating and physical activity (HEPA) environments within the Australian OSHC setting. This research aims to describe the HEPA environments related to foods and beverages served, staff behaviours and child physical activity levels across two Local Health Districts within New South Wales (NSW), Australia. This study will provide evidence to support future interventions and policies in Australian OSHC settings.

Methods and analysis: A cross-sectional study design will be used to describe the food and beverages provided, child activity levels and report on environmental correlates. OSHC programs will be visited on non-consecutive weekdays between 2018 and 2020. The frequency of foods and beverages offered will be observed and categorised into food groups aligned to the Australian Dietary Guidelines. Children's physical activity will be measured using Actigraph GT3X accelerometers. Staff behaviour will be captured via direct observation and the Systems for Observing Staff Promotion of Physical Activity and Nutrition (SOSPAN). Short interviews with program directors will gather contextual information about OSHC practices and policies.

Ethics and dissemination: Findings will be disseminated through peer-reviewed scientific journals, conference presentations and individualised feedback to each participating service. Ethical approval was granted by the University of Wollongong Human Research Ethics Committee (HE17/490).

Strengths and limitations of this study:

- This will be one of the first known Australian studies to systematically describe the healthy eating and physical activity environments within before and afterschool programs to support the development of future interventions, better policies and healthier environments for children attending OSHC programs.

- Foods observed can only provide an estimation of food groups offered, rather than actual foods consumed by the children.
- OSHC programs from the two Local Health Districts in NSW may not be representative of all OSHC programs across NSW or Australia.

INTRODUCTION

Healthy body weight in childhood supports optimal bone development, cognition and concentration at school, improved sleep patterns and reduced anxiety and depression in later life.[1] Healthy eating and physical activity (HEPA) are important in maintaining a healthy weight status.[2, 3] National data indicate that no Australian children (aged 4-8 years) currently meet the vegetable intake recommendations, while most exceed discretionary food intake guidelines.[4] Nearly half of Australian children are not meeting physical activity guidelines and nearly three quarters exceed the recommendations for recreational screen-time.[5] The out-of-school hours' time period may be a critical window in a child's day to intervene as studies have shown children consume large amounts of snack foods[6] and participate in long periods of screen-based sedentary activities[7, 8] during out-of-school hours.

In Australia, out-of-school hours care (OSHC) programs operate before school (6:00-9:00), after school (15:00-18:00) and during school holidays (vacation care) (9:00–18:00). OSHC programs are of growing importance for many Australian parents whose employment requires them to work outside school hours.[9, 10] In 2018, 36% of Australian children in care attended OSHC programs (458,750 children), spending an average of 12 hours per week in these programs.[9] OSHC programs have the opportunity to provide positive physical and social environments that can promote healthy eating and active play to children who attend.

Within an OSHC setting, staff can create supportive physical environments through; 1) the foods and beverages available to children (provided meals, vending machines, food rewards), 2) health promoting messages[11, 12] (via posters, nutrition education and cooking), and 3) opportunities and equipment for active play. The social environment can influence behaviour via staff role-modelling[11] (e.g. consumption of healthy foods and beverages and engagement in physical activity opportunities) and establishing HEPA practices as a social norm within these settings through the presence of strong and supportive policies.

While limited studies have reported on HEPA within before school care[13, 14] and Australian OSHC programs, international research has found that foods and beverages served and children's physical activity levels within after school programs fell well below national recommendations.[15, 16] This research aims to describe the HEPA environments related to the foods and beverages served, staff behaviours and child physical activity levels across two Local Health Districts within New South Wales (NSW), Australia.

METHODS

A cross-sectional, observation study will be conducted to 1) observe the foods and beverages offered to children; 2) assess the level of physical activity of children; and 3) observe staff behaviours on promotion and role-modelling of HEPA within OSHC programs. Data will be collected during unannounced (non-specified) visits on non-consecutive weekdays to ensure usual behaviour of staff is captured. In the occurrence of unfavourable weather patterns (e.g. heavy rainfall), which may lead to irregular practices or changes to the usual program, observations will be rescheduled. Data collection methods are outlined in Figure 1. Data are scheduled to be completed within the afterschool programs between March 2018 and April 2019 and within before school care from February 2020 to December 2020.

Study Sample

In 2018, there were 243 OSHC providers in operation across the South Western Sydney and Illawarra Shoalhaven Local Health Districts,[17] which will act as the sampling frame. Of these, 204 OSHC programs are eligible to participate based on the following criteria: five or more primary school-aged children (5-12 years) enrolled; the program runs from 06:00 – 09:00 and/ or 15:00 - 18:00 during school terms; provide at least one breakfast or afternoon meal; and the program is not exclusively advertised as a homework or physical activity-related club (e.g. dance academy, swimming or football clubs).[18] A power calculation and sample size estimation were generated with 5% precision requiring 128 OSHC programs to be recruited. Given the large sample size required, all eligible services in the two Local Health Districts will be invited to participate via email and telephone.

Recruitment

Written informed consent will be obtained from OSHC directors. Data collected from a service will primarily consist of observing a) staff behaviour, interactions and involvement during OSHC programs, b) food and beverages provided and c) physical activity opportunities. Due to the observational nature of this research, methods have been determined as low risk.[19]A passive consent approach, however, will be applied for collecting accelerometery data. Children will be invited to wear an accelerometer for the duration of their time at the program, unless parents/ guardians have opted their child out of wearing an accelerometer. A child can refuse assent at any stage of the research process. Staff and parents will be notified of the study via several channels, including: 1) recruitment video, digital research posters and information sheets shared via OSHC internal communication avenues; 2) research notification posters at each entrance way, notice boards and sign in/out desk within each OSHC; and 3) participant information sheets and opt-out forms (that provide detailed explanation of the research study,

investigator contact details, and the opportunity for participants to be excluded from the study) located at sign in/out desks. Information relating to this study will be displayed for a minimum of two weeks prior to data collection commencing and for the duration of the data collection period. Data collectors will be on site during data collection and available to discuss the study with staff and parents as required.

Context

In 2010, the National Quality Framework was implemented in Australia as the overarching regulatory framework for early childhood education and care, under which sit OSHC services.[20] Within this framework are seven National Quality Standards that are underpinned by National Legislation and Regulations.[20] Healthy eating and physical activity fall under the National Quality Standards 2, Element 2.1.3, "*healthy eating and physical activity are promoted and appropriate for each child*". The Australian Children's Education and Care Quality Authority disseminated the *Guide to the National Quality Standard*[20] to support service providers in meeting the requirements of the National Quality Standards. These guidelines within the National Quality Framework are not authoritative, but provide flexibility on how service providers might meet the Standards.[21] As demonstrated in Table 1, this guide describes best practice guidelines for education and care services, recommending staff use positive role modelling behaviours, engage children in healthy eating conversations, use cooking experience to build knowledge, provide meals consistent with the Australian Guide to Healthy Eating (AGHE), implement frequent opportunities for physical activity and role model enjoyment by engaging in activities.[20] A combination of resources designed to support OSHC programs in meeting Quality Area 2, will be used to guide the criteria within this study including; 1) Heart Foundations *'Eat Smart, Play Smart'* manual,[22] 2) Nutrition Australia's '*Healthy eating in the National Quality Standards,*[23] and 3) the '*Food and drink checklist for outside school hours*

care'.[24] For the purpose of this study we will report on whether staff behaviour relating to the best practice guidelines was observed or not observed.

Table 1: Best-practice guidelines, selected from the *Guide to the National Quality Standards* for the reporting of HEPA promotion behaviours in OSHC.

National Quality Standards	Direct observation	SOSPAN[b]	Accel[c]	HAAND[d]
Healthy Eating Environment				
Engage children in experiences and conversations that promote mealtimes to be enjoyable and promote healthy, balanced lifestyles	✓			
Use cooking experiences to further children's understanding of food and nutrition	✓			
Never use food to reward children	✓	✓		
Sit and eat with children and model, healthy eating and nutrition practices during mealtimes	✓			
Provide food and beverages consistent with the Australia dietary guidelines	✓			✓
Provide foods and drinks consistent with the menu	✓	✓		✓
Access to water throughout the day	✓	✓		
Physical Activity Environment				
Implement physical games and activities as part of the program and encourage children to participate		✓		
Become involved and demonstrate enjoyment in children's physical activity		✓		
Children should have frequent opportunities to engage in active play		✓		✓
Children should lead physical play activities with peers		✓		
Opportunity for dance, creative movement and drama and respond to music		✓		✓
Provide resources and equipment to support children participate in physical activity		✓		
Additional Measures[a]				
Nutrition and physical activity policies				✓
Children accumulate 30 minutes MVPA in the hours before and afterschool			✓	

Annual nutrition and physical activity staff training				✓

Note: This is not an exhaustive list of best-practice behaviours, only those that could be reported on by the selected tools used within this study. Some of the descriptions have been summarised within this table.

[a]Additional measures are not found within the *Guide to the National Quality Standards*

[b]SOSPAN: System for observing staff promotion of activity and nutrition

[c]Accel: Accelerometer

[d]HAAND: Healthy Afterschool Activity and Nutrition Document

Healthy eating and physical activity measures were selected from the Australian Dietary Guidelines[25] and the Australian Physical Activity and Sedentary Behaviour Guidelines for Children and Young People, respectively.[26] Due to the observational nature of this study, the frequency of food groups offered/ served to children will be reported. National physical activity guidelines state that children should accumulate a minimum of 60-minutes of moderate-to-vigorous physical activity (MVPA) across an entire day.[26] For the current study, a minimum measure of 30 minutes of MVPA has been selected as the criterion.[26] This amount of time is half of the daily recommendation. It is also recognised internationally as an achievable goal specifically within the afterschool period[27] and has been used in studies conducted in similar settings in the United States.[18, 28, 29]"

Healthy Eating Environment

Food and beverages offered to children will be captured via direct observation and digital images. Digital images will capture descriptive data for the provided foods, including food labels, branding, packaging and serving methods (individual portion sizes or "family style", characterised by a shared platter).[30 31] Trained nutritionists or final year nutrition and dietetics graduate students will collect all food and nutrition behavioural observation data. Water will

be recorded as available if cups of water or designated water stations are available to children during the snack time or throughout the program.[31]

Observations of the healthy eating environment will be made during the scheduled mealtime including: staff healthy eating promotion behaviours; staff sitting and eating with children; staff promotion / discouragement of healthy foods and beverages; staff engaging children in healthy eating discussions or nutrition education during the meal time; provision of food knowledge and skill development (including children's involvement in the food preparation activities, and food clean-up); rewarding of good behaviour with discretionary food items[22] (e.g. sweets and confectionary); and food waste management (e.g. use of a compost or worm farm). Weekly food menus will be observed and recorded including if they are displayed for parents, whether menus were consistent with foods served and if they met the requirements of the 'Food and drink checklist for outside school hours care'.[24] Types of food preparation (kitchen) facilities will be observed and documented including food storage, cooking equipment, preparation areas and washing up facilities.

Physical Activity Environments

Prior to data collection, all OSHC programs will be visited to record the physical characteristics of the program environment, including indoor (non-physical activity enrichment or snack areas) and outdoor spaces (physical activity spaces). These spaces will be divided and identified as zones during the data collection period. Available space accessible to children during the OSHC program will be mapped and measured in metres using a CRAFT.RIGHT measuring wheel (Figure 2). Permanent facilities (e.g. basketball courts, fixed equipment and sandpits) will be measured and identified as zones.

Child physical activity will be measured via ActiGraph accelerometers (wGT3X-BT models). Accelerometers are widely used to provide an objective estimate of physical activity in free-living research.[28, 32, 33] Accelerometers are small, unobtrusive devices that sit around a child's waist, attached using adjustable elastic belts. As children arrive at a program, the accelerometers will be fitted around their waist by trained data collectors, ensuring the unit is sitting on the right hip. The time-on and demographic data of each child (school grade and sex) will be recorded. As children depart from the program accelerometers will be removed and time-off recorded.[34]

System for Observing Staff Promotion of Activity and Nutrition

Staff promotion of HEPA behaviours will be measured by direct observation and momentary time sampling using the System for Observing Staff Promotion of Activity and Nutrition (SOSPAN) instrument.[35] SOSPAN is a validated observation tool created and used within afterschool programs in the United States.[34] The tool is designed to capture 13 physical activity and six healthy eating behaviours of staff as described in detail elsewhere.[34] Staff behaviours captured by SOSPAN include staff encouragement of physical activity (e.g. leading physical activity, verbally promoting physical activity, staff engagement in physical activity with children and providing children with multiple physical activity options) or discouragement of physical activity (e.g. idle time, providing elimination games, children standing or waiting for a turn and withholding physical activity). SOSPAN captures the context of the program, documenting the duration of scheduled activities (physical activity, indoor enrichment activities, homework/ academics and mealtime). Other contextual activities recorded by SOSPAN include the identification of organised activity (structured activity set up by OSHC staff) versus physical activity free-play (unstructured activity time that was child-led and not organised by staff in the afterschool programs).

Staff promotion and modelling of healthy eating behaviours are captured in SOSPAN via staff verbally promoting healthy eating, educating children on healthy eating and consuming healthy food and beverage options or discouraging healthy eating by staff consuming inappropriate foods or drinks.

Systematic SOSPAN scans will be continually completed throughout the duration of the program or until there are less than five children remaining at the program.[35] Data collectors will move systematically between zones (Figure 2) where both staff and children are present, completing five scans before moving to the next area.[34, 35] Data collectors will be required to meet greater than 80% interrater reliability agreement via an interval-by-interval agreement on two consecutive data collection days.[35] Interrater reliability will be continuously monitored throughout the data collection process, completing a minimum of five reliability scans per day.

HEPA Policy Environment: Healthy After school Activity and Nutrition Documentation

Written HEPA policies, that use clear-language to guide staff practices have been shown to improve the HEPA environments within child care services.[36, 37] The Healthy After school Activity and Nutrition Documentation (HAAND) instrument is a validated tool that will be used to guide and collect information on HEPA policies and practices through a short interview with Directors from each OSHC program. Detailed information on this tool has been published elsewhere.[38] HAAND explores 11 healthy eating and ten physical activity policy characteristics captured through a short, structured interview that is conducted on-site with the OSHC Directors by trained data collectors. In short, HAAND evaluates the level at which program policies support HEPA characteristics through written policies, staff training, use of HEPA resources, time allocations and types of physical activity, healthy eating practices and screen-time availability. In addition, a copy of the nutrition and physical activity policies, as well as weekly food receipts and menus, will be requested from each OSHC program. For the purpose

of collecting healthy eating and physical activity policy information, the HAAND will be applied to both before and afterschool OSHC programs. To minimise potential response bias, all staff will be reminded at the commencement of the interview that all data collected will be deidentified and the importance of not modifying any of their behaviours.

Training

Data collectors will be extensively trained in all data collection methods prior to data collection commencing. This will occur via a combination of classroom simulation and practical on-site training at local, non-participating OSHC programs. Theoretical classroom training will include the review of study protocols, memorising observational codes and watching video clips depicting the out of school hours environment and coding scenarios using observational tools, developed by Weaver et al (2015). Data collection will be primarily conducted by PhD candidates, nutrition and dietetics final year graduate students and research assistants.

Data Analysis

Foods and beverages will be categorised by a dietitian or nutritionist into the five core food groups according to the AGHE: fruit, vegetables, lean meats, dairy and grains (whole grains). Additional categories of discretionary items, refined grains, water and 'extra' drinks (fruit juice, cordial, soft drinks and flavoured milk) will also be recorded. Food categorisation will be guided by the AUSNUT 2011-13 database developed by Food Standards Australian New Zealand, for the Australian Health Survey food classification system[39] and the Discretionary food listing[40] developed by the Australian Bureau of Statistics. Food categories will be checked by a researcher independent of the OSHC observations. The frequency of food groups and beverages offered across observation days will be calculated and expressed as a percentage, mean and standard deviation, for normally distributed data and median and interquartile ranges for skewed data. Data transformation is not deemed relevant to this study.

Accelerometer-derived physical activity data will be calculated for minutes per day spent in sedentary, total physical activity and MVPA. For this study the Evenson cut points will be used: sedentary behaviour <26 counts/ 15 seconds, light-to-moderate activity 26-573 counts/ 15 seconds, moderate activity 574-1002 counts/ 15 seconds, and vigorous activity >1002 counts/ 15 seconds.[33] The Evenson cut points have been recognised as accurate cut points for measuring the time spent in different physical activity intensities for children aged five to eight years.[32] Within afterschool programs, physical activity data will be considered valid if a total wear time of accelerometers is equal to or greater than 60 minutes[16] and 30 minutes within before school care. Total time active will be reported on for the before school care programs. All accelerometery data will be analysed using ActiLife software [41] and STATA.[42]

Staff behaviours captured through direct observation, SOSPAN and responses from the structured interview (i.e. HAAND) will be quantified and reported as a percentage of observations and responses completed using SPSS software 'IBM SPSS Statistics for windows, version 25.0. (IBM Corp., Armonk, N.Y., USA)'.

The relationship between serving healthy snack foods and variables such as: socio-economic index for areas (SEIFA), availability of kitchen facilities and healthy eating training of staff will be explored.

To explore the relationships between the physical activity environment and child activity levels, correlations between time spent in MVPA, total physical activity and sedentary behaviour will be assessed against: physical activity policy, staff engagement in physical

activity, available space for physical activity (m^2), ratio of number of children to staff, physical activity equipment and sex of child.

ETHICS AND DISSEMINATION

Ethical approval has been provided by the University of Wollongong, Australia Human Research Ethics Committee (approval HE17/490). Results from this study will be disseminated through peer-reviewed scientific journals, conference presentations, scientific reports, service reports (providing findings to participating OSHC care providers) and will form part of student dissertations.

PATIENT AND PUBLIC INVOLVEMENT

Although this research was completed without public involvement, it did incorporate key public health stakeholders in the governance and management of the study. These stakeholders did contribute to the research priorities, defining research question and outcome measures and providing input into the study design. Members of the public were not invited to comment on the study design and were not consulted to ensure a true benchmark was achieved. Members of the public were not invited to contribute to the writing or editing of this document for readability or accuracy.

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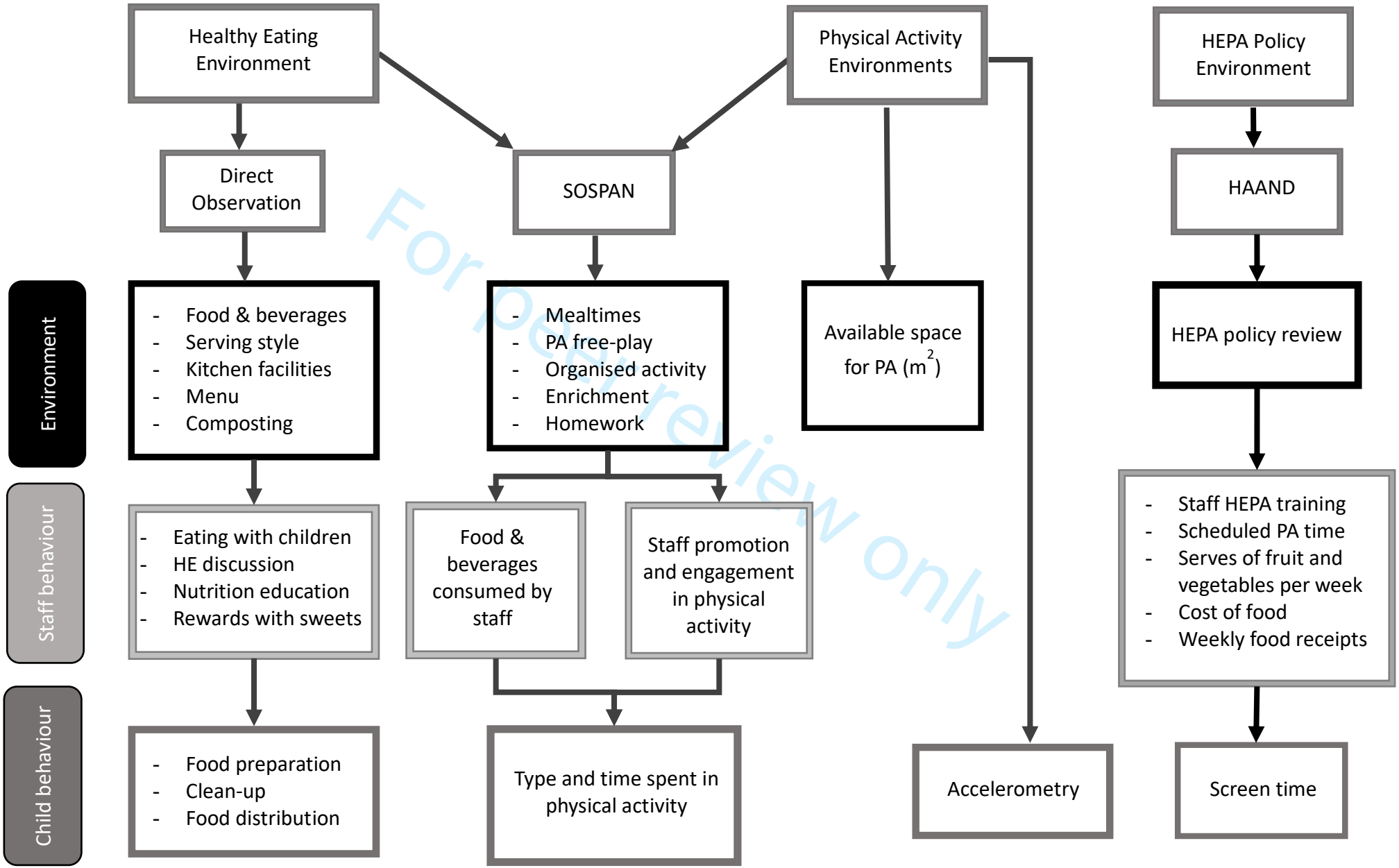
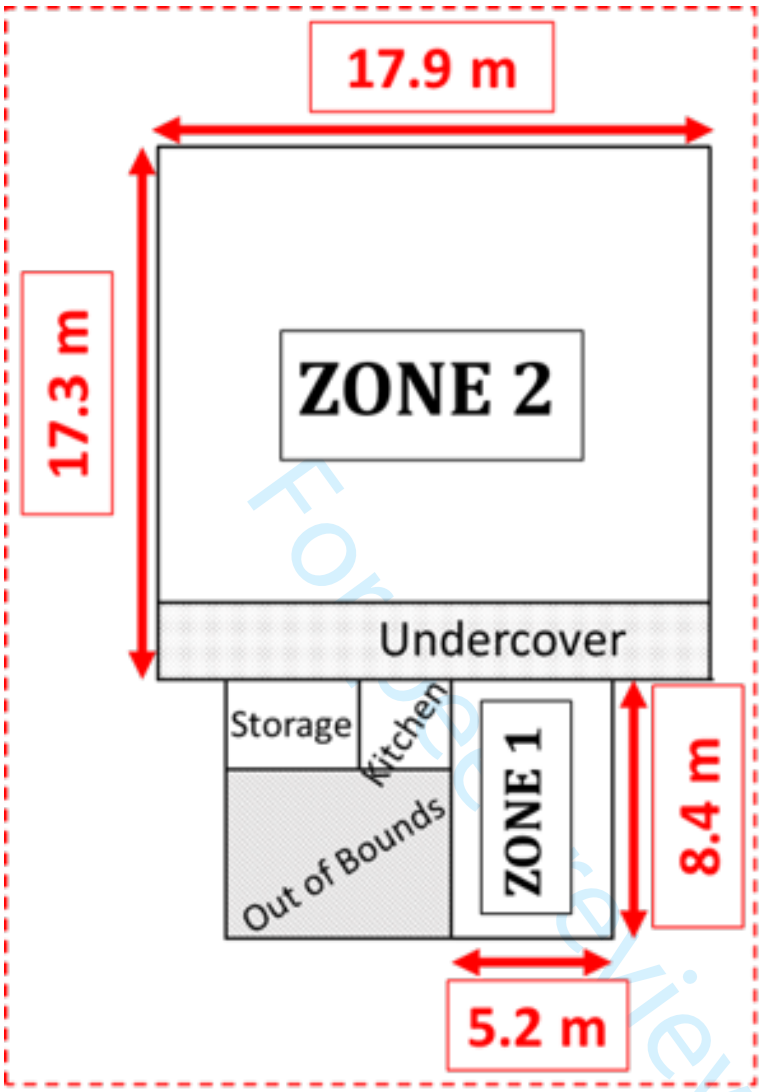
Tables and Figures:

Figure 1: Data collection methods for observing the HEPA environments within out of school hours care (OSHC).

HEPA -Healthy eating and physical active
SOSPAN – Systems for Observing Staff Promotion of Activity and Nutrition
HAAND – Healthy After school Activity and Nutrition Document instrument
PA – Physical activity
HE – Healthy eating

Figure 2: An example of the zones and the size of zones measured in metres (m) in OSHC program





STROBE (Strengthening The Reporting of OBservational Studies in Epidemiology) Checklist

A checklist of items that should be included in reports of observational studies. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Section and Item	Item No.	Recommendation	Reported on Page No.
Title and Abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/Rationale	2	Explain the scientific background and rationale for the investigation being reported	2-3
Objectives	3	State specific objectives, including any prespecified hypotheses	3
Methods			
Study Design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	N/A
		Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	N/A
		Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants	4
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed	N/A
		Case-control study—For matched studies, give matching criteria and the number of controls per case	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5 - 7

Section and Item	Item No.	Recommendation	Reported on Page No.
Data Sources/ Measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5 - 10
Bias	9	Describe any efforts to address potential sources of bias	4, 11,
Study Size	10	Explain how the study size was arrived at	N/A
Quantitative Variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11 - 12
Statistical Methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	11 - 12
		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	N/A
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed	N/A
		Case-control study—If applicable, explain how matching of cases and controls was addressed	N/A
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	N/A
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive Data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	N/A
		(b) Indicate number of participants with missing data for each variable of interest	N/A
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A
Outcome Data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	N/A
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	N/A
		Cross-sectional study—Report numbers of outcome events or summary measures	N/A

Section and Item	Item No.	Recommendation	Reported on Page No.
Main Results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other Analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key Results	18	Summarise key results with reference to study objectives	N/A
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	N/A
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	N/A
Generalisability	21	Discuss the generalisability (external validity) of the study results	N/A
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	12 - 13

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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