Geographic remoteness and socioeconomic disadvantage reduce the supportiveness of food and physical activity environments in Australia

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Abstract

Objective: An analysis of food and physical activity environments in relation to socioeconomic disadvantage was conducted in 25 communities across Queensland, Australia.

Methods: Physical activity and food environments were assessed in 25 Queensland communities using The Systematic Pedestrian and Cycling Environmental Scan (SPACES) and the Nutrition Environment Measurement Survey (NEMS). Spearman's correlation tested the association between physical activity and food environments and degree of remoteness and socioeconomic disadvantage of each region.

Results: A significant negative association was observed between the supermarket food environment and degree of remoteness and socioeconomic disadvantage. All regions have a moderately supportive environment for physical activity. Food availability and price varied in supermarkets with more remote communities having less supportive food environments.

Conclusions: Areas with a high degree of remoteness and socioeconomic disadvantage were more likely to experience disadvantages in the physical activity, supermarket, and restaurant food environments than metropolitan areas and socioeconomically disadvantaged areas.

Implications for public health: Socioeconomic disadvantage and remoteness were associated with reduced supportiveness of the built environment hindering the ability of consumers to make healthy food and physical activity choices. Improving the food and physical activity environments in these areas may assist in reducing the health inequalities experienced by these communities.

Key words: systems approach, food environment, built environment, physical activity, research agenda, socioeconomic, regional, remote

The implication of the burden of disease to individuals, their families, and the wider community is significant, costing the Australian economy between $840 million and $185 billion annually.[1-3] In the Australian state of Queensland, the prevalence of non-communicable disease such as diabetes[4] and cardiovascular disease[5] is highest in remote locations and areas of socioeconomic disadvantage.[6] Poor diet and insufficient physical activity are two preventable risk factors contributing to the burden of non-communicable disease, globally and in Australia.[7] Poor diet is driven by unsupportive food environments where healthy foods are less affordable and accessible, encouraging the consumption of unhealthy options.[8] Changes in the physical activity environment and the increased use of motor vehicles have led to insufficient physical activity levels.[2,9] Access to healthy food and physical activity environments in Queensland are inequitably distributed across remote locations and areas of socioeconomic disadvantage.[10,11] Thus, there is a growing need to understand drivers of food choices and enablers of physical activity to support action that will improve food and physical activity environments to reduce the prevalence of non-communicable disease, particularly in remote locations and areas of socioeconomic disadvantage.

The food environment is defined as the collective economic, policy and social surroundings, opportunities and conditions that influence people's food and beverage choices and nutritional status.[8,12] The structure of food environments, including price, variety, quality, and availability of foods, as well as the accessibility of stores, have the potential to create a supply push effect on unhealthy diets and energy overconsumption,[13] the predominant driver of population unhealthy weight gain.[9] The physical activity environment is the physical and social context in which behaviour occurs and some are designed for physical activity, for example, hiking and bicycle trails, sports fields, gymnasiums and health clubs.[14] Physical activities thus take place in particular physical environments which can influence the form and frequency of activity.[14] To reduce obesity and related non-communicable disease, a focus on creating healthy food and physical activity environments is needed to shift behaviours that meet diet and physical activity guidelines, particularly those of socially disadvantaged populations.[15]

Community retail food environments including the number, type, density and location may be a contributing factor

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to high obesity rates in Australia.[16] Many studies have investigated the relationships between community retail environments and disadvantaged areas and specifically Indigenous remote Indigenous communities.[10,17] Food swamps are geographic areas with unequal access to outlets with an overabundance of energy-dense, nutrient-poor foods.[18] These areas have previously been assessed through income or ethnicity mapping overlayed with spatial data on the distribution of food retailer types.[19] Global studies including North America,[20] the United Kingdom[21] and New Zealand[22] have found increased clustering of unhealthy food retailers in more disadvantaged areas than in more advantaged areas.

A growing body of evidence shows an unsupportive physical activity environment may be another contributing factor.[23,24] Research suggests living in socioeconomically disadvantaged areas is associated with overall lower levels of physical activity, despite adjusting for individual demographic variables including individual socioeconomic status.[25,26] There is a substantial socioeconomic gradient observed in participation in physical activity across all age groups including children.[27] Despite recommendations for action on the social determinants of health dating back to the 1980s, inequalities in many countries continue to grow and are now a widely recognised problem that requires immediate and significant action.[28]

Queensland is a large Australian state with a population of more than 5.2 million[29] spread across 1.730 million square kilometres, and it is Australia's second most decentralised state after Tasmania.[30] The aim of this study was to comprehensively assess the community food and physical activity environments from a range of communities spread across Queensland, particularly those of socially disadvantaged populations.

Methods

An observational, cross-sectional study design using validated instruments assessed the food, physical activity and health support-service environment. Twenty-five communities were observed between 2018 and 2019 (see Figure 1).

Figure 1: Queensland Audit Locations.

Study site selection

To provide a broad sample of Queensland communities, the selection of study sites was determined using the Heart Foundation Australian Heart Maps and diabetes rates from the National Diabetes Services Scheme (NDSS) Australian Diabetes Map.[5,31] Using these two tools, communities with the highest rates of diabetes and the greatest risk of cardiovascular disease were prioritised and included in the study sample. Socio-Economic Indexes for Areas (SEIFA) were then used to identify potential regions as study sites using postcodes to ensure data from a range of social-economic levels was obtained.[32] SEIFA ranks areas according to relative socioeconomic advantage and disadvantage with the lowest scores denoting the highest disadvantage. The Modified Monash Model was used to classify regions as metropolitan, rural, remote or very remote[33] (see Figure 2). The model ranks the degree of remoteness on a scale of Modified Monash (MM) category 1 to 7, where MM1 represents a major city and MM7 is very remote. Areas classified as MM 2 to MM 6 are considered rural and remote, with people living in these areas likely to find it harder to obtain medical help, as accessing health professionals can take more time and involve higher costs.

Research tools: Nutrition Environmental Surveys

To assess the food environment, the Nutrition Environment Measurement Survey for supermarkets and restaurants, NEMS-S and NEMS-R, respectively, were used.[34,35] The NEMS-S collects data on the location of food outlets, the availability of healthy choices, and the pricing of food and beverage products. Eleven food and beverage categories are considered: fruit, vegetables, milk, minced meat, sausages, frozen dinners, baked goods, beverages, bread, chips, and cereal. Each category is scored on availability (range of 0–30), and price (range of -9–18), fruit and vegetable categories are also scored on quality (0–6). The sum of category scores provides a grand total for each outlet (-9–54); therefore, stores were compared against healthy food availability, price, quality and overall total score, with higher scores indicating a healthier environment.

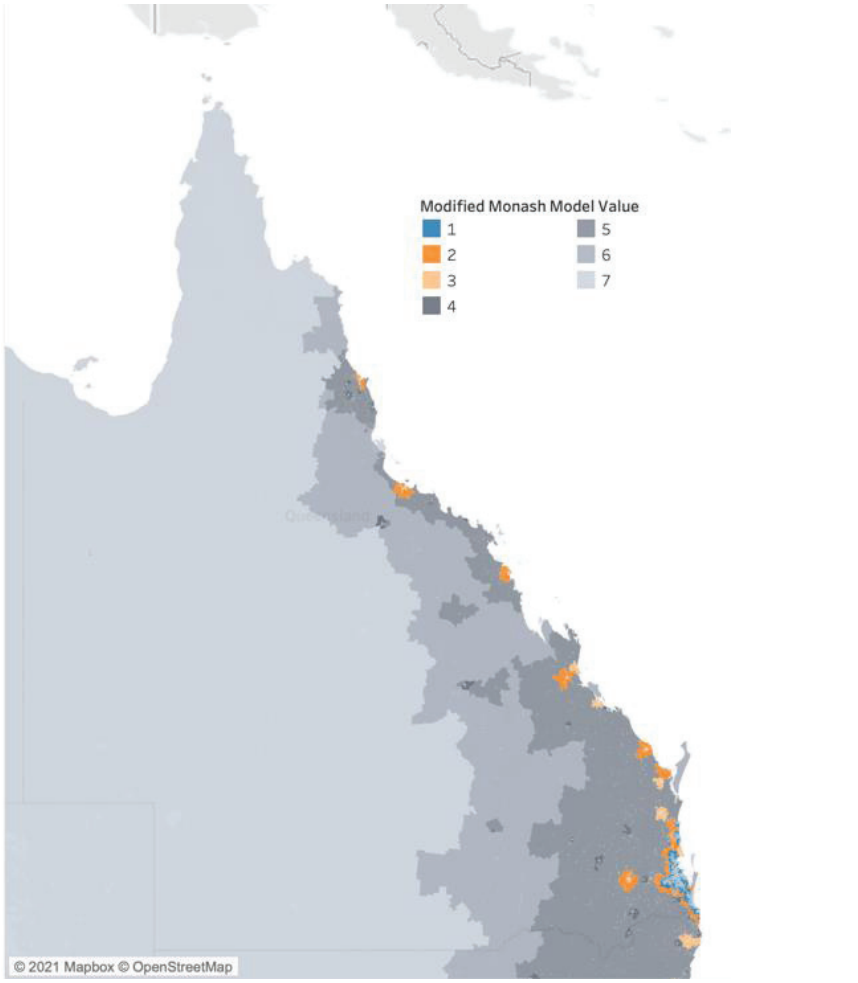
The NEMS-R assesses the healthiness of restaurants by scoring across categories including the availability of healthy options (range of 0–15), facilitators of healthy eating (range of 0–8), and barriers to healthy eating (range of -5–0), with higher scores representing healthier restaurants. A category for assessing the children's menu is also available but was excluded from this study. The NEMS-R collects data from a range of sources including in-person site visits, takeaway menus and online information. The restaurant category (fast food, fast casual, sit down, or speciality), size and seating arrangements, range of refrigerated beverages, visual displays and promotions, the presence of nutritional information, opening hours, drive-through service, and the range of healthy and non-healthy items were measured. An analysis of healthy options included the identification of healthy alternatives on the menu, low-carbohydrate options, reduced portion sizes, and the availability of fresh salads and juices. The promotion of unhealthy options, including two-for-one deals, meal upsizing and discounts for unhealthy options were also analysed.

Research Tools: Systematic Pedestrian and Cycling Environmental Survey (SPACES) instrument

To assess the physical activity environment, the Systematic Pedestrian and Cycling Environmental Scan (SPACES), a validated observational quantitative audit tool, was used.[36] SPACES assesses the neighbourhood level physical activity environment by measuring walkability, such as street connectivity, density and land use. Each region is divided into quartiles and segments.

Observations of the pavement type and quality, road quality, verge maintenance, garden maintenance, presence of streetlights, bicycle lanes, surveillance from houses and overall cleanliness were recorded. Measures fall into one of four categories: safety, function, aesthetics and the presence of destinations.[37] Function reflects the fundamental structural aspects of the local environment and relates to the physical attributes and quality of the street and path. Safety reflects the need to provide safe physical environments for people to engage in outdoor physical activity and incorporates two elements, personal safety and traffic safety.[37] Measures for personal safety include the presence of streetlights, surveillance and cleanliness such as the absence of graffiti. Measures for traffic safety include road markings, pedestrian crossings, speed signs and traffic slowing devices, such as speed humps, curbs and roundabouts. Aesthetics refers to the pleasantness of the physical environment and incorporates two elements: streetscape and views.[37] Measures for streetscape included garden maintenance and the consistency of building designs, while views included the measures such as the presence of green space and natural features. Destinations refers to the availability of community and commercial facilities in the neighbourhood that provide reasons for people to walk or cycle.[37] Destinations include parks, trails, beaches, shops, schools, mailboxes, railway stations and bus stops. Each segment received a category score and the sum of these provided an overall total score between 10 and 155, with higher scores representing better physical activity environments.

Figure 2: Modified Monash Model Queensland Remoteness.



Statistical analyses

Surveys were scored in compliance with the protocols outlined above. For each suburb, the total mean scores for the SPACES, NEMS-S and NEMS-R were calculated as well as the mean scores for each subcomponent. Spearman's correlation tests were performed to measure the strength of association between the food and physical activity environments of each region, and the degree of socioeconomic disadvantage, remoteness, NDSS prevalence registrants and all heart-related hospital admissions.

Results

NDSS and all heart-related hospital admissions

Unsurprisingly, there were negative correlations with SEIFA and NDSS, and positive correlations with MM and NDSS and all heart-related hospital admissions

(See Table 1). This means the more remote and disadvantaged the area, the more likely there is a high prevalence of NDSS registrants and all heart-related hospital admissions. Conversely, the higher the SEIFA index, the lower the NDSS and all heart-related admission scores.

Food environment

Supermarket food environment

As detailed in Table 1, significant negative correlations were observed between the NDSS percentage prevalence of diabetes registrants within a population and the availability and affordability of healthy food. Significant negative correlations were also observed between the number of all heart-related hospital admissions and the overall affordability of healthy foods in supermarkets as well as the availability and affordability of healthy beverages and frozen dinners. This means that there are fewer healthy options available in the areas where there is the highest incidence of diabetes and heart-related hospital admissions.

Food availability and price varied across supermarkets. Significant positive correlations between remoteness (MM) and socioeconomic disadvantage (SEIFA) and access to healthy food options in terms of the availability of supermarket food items were observed as shown in Table 1. This means that the lower the SEIFA score, or the more disadvantaged, the lower the total mean score for NEMS-S (supermarket food quality, price and availability). Thus, regions with a high degree of remoteness and socioeconomic disadvantage experienced the least availability of healthy food and beverages in supermarkets. This indicates the food environments of these areas are less supportive of healthy eating and more disadvantaged in terms of access and affordability of healthy food when compared to areas of less socioeconomic disadvantage and remoteness. Price was negatively correlated with remoteness, meaning that the more remote the region, the higher the price of supermarket food items. Availability of healthy food items including vegetables, healthy beverages, baked goods and healthy frozen dinners, were positively correlated with SEIFA decile and negatively correlated with remoteness, showing that more disadvantaged and/or remote regions have less availability of healthy options and vegetables in supermarkets.

One of the most remote and disadvantaged areas observed, Cherbourg, had no supermarket in the town, resulting in this area receiving the lowest total mean score (0) for supermarket environments (Table 2). Residents in this area are required to travel 6.5 kilometres (4 miles) to a neighbouring town by car or public transport to access a supermarket and there is no footpath or cycle path connecting these towns. Interestingly, this town has a high proportion of Indigenous residents, indicative of the entrenched disadvantage of Indigenous populations as shown in other studies.[38,39] Other regions with a high degree of remoteness (MM scores of 6 or 7), including Thursday Island (MM 7), Charleville (MM 7), Mt Isa (MM 6) and St George (MM 6), also scored poorly for the food supermarket environment. These regions scored among the lowest for the availability of healthy foods and beverages sold in supermarkets, while Mount Isa also scored amongst the lowest for affordability. Remote areas such as Thursday Island, St George and Charleville receive less frequent deliveries of fresh produce each week. St George has a higher representation of Aboriginal and Torres Strait Islander people (17.8%, Qld 4% and Australia 2.8%),[40] as does Thursday Island (68.6%, Qld 4% and Australia 2.8%),[41] highlighting the disadvantage of this important group. Although no significant differences were found in the quality of the fresh fruit and vegetables observed in these remote locations, the availability and range of fresh produce were limited; subsequently, people's access to reliable, fresh and healthier food choices was reduced.

Metropolitan areas with the lowest degree of remoteness achieved the highest total mean scores for the supermarket food environment. These areas also scored the highest for affordability and availability of healthy food and beverages in supermarkets, meaning they have more facilitators to enable access to

Table 1: Correlations between community statistics and survey scores.

	SEIFA Decile	Modified Monash (MM)	NDSS Prevalence Registrants (% of Pop)	All heart related hospital admission (ASR per 10,000)
SEIFA Decile	1.000	-0.314	-0.761**	-0.331
Modified Monash (MM)	-0.314	1.000	0.613**	0.596**
NDSS Prevalence Registrants (% of Pop)	-0.761**	0.613**	1.000	0.719**
All heart related hospital admission (ASR per 10,000)	-0.331	0.596**	0.719**	1.000
NEMS-S Total Mean Score	0.406*	-0.577**	-0.557**	-0.433*
NEMS-S Percentage Score	0.405*	-0.574**	-0.556**	-0.430*
NEMS-S Milk Mean Score	0.120	-0.353	-0.096	-0.062
NEMS-S Fruit Mean Score	0.273	-0.290	-0.247	-0.137
NEMS-S Vegetables Mean Score	0.383*	-0.485*	-0.489*	-0.418*
NEMS-S Mince Meat Mean Score	0.128	-0.372	-0.114	-0.147
NEMS-S Sausages Mean Score	0.042	-0.173	-0.001	0.014
NEMS-S Frozen Dinners Mean Score	0.418*	-0.162	-0.501*	-0.354
NEMS-S Baked Goods Mean Score	0.455*	-0.418*	-0.534**	-0.403*
NEMS-S Beverages Mean Score	0.546**	-0.479*	-0.493*	-0.259
NEMS-S Bread Mean Score	-0.034	0.222	0.280	0.328
NEMS-S Chips Mean Score	-0.399*	0.127	0.174	-0.083
NEMS-S Cereal Mean Score	0.209	0.007	-0.162	0.061
NEMS-S Mean Price	0.052	-0.418*	-0.349	-0.382
NEMS-S Mean Availability	0.415*	-0.467*	-0.478*	-0.405*
NEMS-S Mean Quality	0.387	0.038	-0.187	-0.037
NEMS-R Total Mean Score	0.250	-0.392	-0.620*	-0.376
NEMS-R Availability Mean Score	0.103	-0.509	-0.553*	-0.420
NEMS-R Facilitators Mean Score	-0.063	-0.637*	-0.456	-0.702**
NEMS-R Barriers Mean Score	0.217	0.398	-0.039	0.390
SPACES Total Mean Score	0.324	-0.322	-0.186	-0.011
SPACES Aesthetics Mean Score	0.147	0.270	-0.071	0.225
SPACES Destinations Mean Score	0.272	0.040	-0.074	0.111
SPACES Function Mean Score	0.312	-0.470*	-0.204	-0.147
SPACES Safety Mean Score	0.268	-0.202	-0.195	0.035

Note:

** denotes statistical significance (* p < .05; ** p <.01)*

healthy food than more remote communities. Metropolitan areas have the largest range of food choices, meaning they have fewer barriers and more facilitators to enable access to affordable healthy foods. However, overall, the scores for all supermarkets observed in the study demonstrate there is room to improve access, availability and affordability of healthy food, as even the highest-scoring suburbs still only achieved 30 out of 54 (total score available) using the NEMS-S survey.

Restaurant food environment

As shown in Table 1, there are significant negative correlations between the NDSS percentage prevalence of registrants within a population and the total mean score for healthfulness of the restaurant food environment, as well as the availability of healthy foods in these outlets. Significant negative correlations were also observed between the number of all heart-related hospital admissions and the presence of facilitators to support healthy eating in restaurants.

Remote areas which fall within the lowest SEIFA decile achieved the lowest total mean scores for the restaurant food environment, including the lowest mean scores for the availability of healthy options. These areas achieved the lowest score for the presence of facilitators to healthy eating. More disadvantaged areas also received low total mean scores for the restaurant food environment. This highlights the lack of availability and affordability of healthy out-of-home meal options.

Metropolitan areas scored the highest total mean score for restaurant food environment including availability and facilitators to healthy eating. The remote town of St George had the least barriers to healthy eating, however, it also scored amongst the lowest for facilitators, indicating that while overeating and large portions sizes are not encouraged, the access and availability of healthy options is still limited.

No significant correlations were observed between the restaurant food environment and the degree of remoteness and socioeconomic disadvantage; however, the density of food outlets in each suburb may explain this. The metropolitan suburb of Logan (SEIFA 1) achieved the second-lowest total NEMS-R score after Cherbourg (SEIFA 1), however, it also had the greatest number of food outlets (145) which is considerably more than any regional or remote suburb (range 1–29), consistent with previous findings on food swamps.[22] The number of fast-food outlets offering unhealthy foods in Logan influence the mean scores for the presence of facilitators and barriers to healthy eating and thus affect the total mean score for the restaurant food environment for this area. However, the sheer number of restaurants increase the availability and variety of foods, healthy as well as unhealthy, and subsequently residents in this area may still access healthy food, even though these options are far outweighed by unhealthy options.

Table 2: Overall NEMS scores .

Region	Suburb	SEIFA Decile	Modified Monash (MM)	NDSS Prevalence Registrants (% of Pop)	All heart related hospital admission (ASR per 10,000)	NEMS-S Total Mean Score	NEMS-R Total Mean Score
South Burnett	Kingaroy	3	4	6.1	65.5	26.3	4.41
	Murgon	1	5	8.2	65.5	26	3.55
	Cherbourg	1	5	8.2	65.5	0	1
Mt Isa	Mt Isa	4	6	6.8	63.2	18	2.88
Rockhampton	Rockhampton City	3	2	7.8	69.4	21	4.07
	Mt Morgan	1	5	12	69.4	20	2
	Berserker	3	2	6.4	69.4	25.33	4.29
	Gracemere	4	2	5.9	69.4	21	2.69
Thursday Island	Thursday Island	1	7	8.3	78	19	3.17
Gold Coast	Southport	3	1	4.5	45.9	25	4
	Ashmore	7	1	4.5	45.9	29.66	6.3
	Benowa	6	1	3.5	45.9	29.33	5.77
Mackay	Mackay	5	2	6.1	66.8	23.38	4.12
Townsville	Alligator Creek	1	2	6.1	58.7	0	1
	Townsville City	6	2	4.6	58.7	26	6
	Hermit Park	3	2	5.7	58.7	23	4
	Rasmussen	2	2	6.4	58.7	23	3
	Idalia	6	2	4.5	58.7	27	6
South West Queensland	Roma	6	4	5.5	61.8	20.3	5
	Charleville	3	7	7.3	76.9	21.5	4
	St George	4	6	6.6	81.6	19.3	3.86
Logan	Beenleigh	3	1	6	63.3	25.67	2.31
	Waterford West	3	1	6.3	63.3	23.5	1.7
	Logan Central	1	1	8	63.3	25	2.4
	Loganholme	7	1	5.6	63.3	24.33	4.46

Physical activity environment

Only one significant correlation was identified between the physical activity environment and degree of remoteness and socioeconomic disadvantage, with the function of the physical activity environment and remoteness negatively correlated. This indicates that more remote areas had less functional physical activity environments, that is, they have poorer structural aspects relating to the physical attributes and quality of the streets and pathways. The lack of significant correlations for the physical activity environment may indicate the tool is not sensitive enough to pick up these differences or the regions chosen for this study have had some investment in the physical activity environment, potentially skewing the results. However, regions higher on the MM scale (closer to 1) achieved the highest total mean scores for the physical activity environment, which is consistent with the inequitable distribution of supportive environments.[10,11] Cherbourg, the most socioeconomically disadvantaged region, achieved the lowest total mean score for the physical activity environment (Table 3). This suburb scored among the lowest for all components including aesthetics, destinations, function and safety. The population of Cherbourg is 98.7% Indigenous residents, and consistent with previous research, these results highlight the entrenched disadvantage of Indigenous populations.[38] Interestingly, very remote areas including Thursday Island (MM 7) scored well on physical activity environment, demonstrating investment in physical infrastructure such as the Thursday Island Cycleway through the Queensland

Government's Cycle Network Local Government Grants program[42] can enhance the environment and encourage community members to participate in physical activity. However, there are also disparities in physical activity environments within cities, for example, as seen in Townsville, where the city area has a higher SEIFA decile (6) and higher SPACES score (74.8), whereas Hermit Park is a SEIFA decile 3 and has a much lower SPACES score (48.25). The situation is similar in Rockhampton with the city area SEIFA decile 3 and SPACES score of 82.5, and Mt Morgan, SEIFA decile 1 and SPACES score of 57.62. This shows that more disadvantaged areas, often residential areas, within the same local government area have access to lower quality physical activity environments.

Discussion

The purpose of this study was to comprehensively assess the community food and physical activity environments from a range of communities across Queensland, particularly those of socially disadvantaged populations. The results highlight the differences in the food and physical activity environments, depending on where people live, providing further support that access to healthy food and physical activity environments in Queensland is inequitably distributed.[11] Consistent with previous studies, this study found those living in more disadvantaged areas generally have less opportunity to eat healthily and to undertake physical activity in a safe and accessible environment. Furthermore, people living in these communities are more likely to have high levels of diabetes within their populations and high levels of heart-related hospital admissions. While these people are the most in need of a supportive environment to enable them to access and consume healthy food and participate in physical activity, they have the least supportive environments, limiting their opportunities to participate in healthy behaviours.

Proximity to fast food outlets has been shown to increase the risk of obesity.[43,44] Such is the case in more disadvantaged areas where, despite healthy options being available, the high density of fast-food outlets offering unhealthy food far outweighs the healthy options, therefore creating barriers reducing residents' opportunities to make healthy choices. As demonstrated by the significant correlations between these factors and the restaurant food environment, improving this environment may benefit such populations by supporting them to make healthy food choices when they are outside of the home. Improving facilitators to healthy eating includes implementing nutrition information on menus, such as displaying the kilojoule content of items, as well as supporting restaurants, cafes and takeaway outlets to improve their food and beverage offerings through education and training.

Other food environmental barriers that may influence a consumer's opportunity to make healthy choices could include geographical location, infrastructure, social structures and limited access to healthy food options. As demonstrated by the significant correlations between remoteness and socioeconomic disadvantage, access to healthy food options in terms of availability and affordability of supermarket food items represents an important environmental barrier to consumers' opportunities to make healthy choices. This means residents of more disadvantaged neighbourhoods, which experience 'high' or 'very high' rates of heart-related hospital admissions and prevalence of diabetes, face greater barriers to healthy choices than less remote, more socioeconomically advantaged neighbourhoods. Working with supermarkets to increase the accessibility of items such as fresh and frozen fruit and vegetables, as well as advocating for fresh food delivery subsidies to increase the availability of healthy options in economically disadvantaged and regional or remote suburbs, may benefit residents in these areas.

Limited access to relevant infrastructure in more regional or remote or disadvantaged communities may reduce the opportunity to access services such as healthcare and community groups in the same way that limited access to safe, defined walking paths inhibits children walking to school. Studies have found adults living in less walkable neighbourhoods had a higher predicted 10-year cardiovascular disease risk than those living in highly walkable areas.[45] While many regional and more

Table 3: SPACES Mean Total and Subcategory Scores.

Region		MM	SEIFA Decile	Aesthetics	Destinations	Function	Safety	Total
Logan	Beenleigh	1	3	5.08	8.33	23.08	22.24	58.75
	Logan Central	1	1	5.23	8.35	31.25	26.15	70.98
	Loganholme	1	7	5.61	8.44	24.20	26.52	64.77
	Waterford West	1	3	5.13	7.64	21.88	25.04	59.69
South Burnett	Cherbourg	5	1	4.03	7.42	15.06	19.71	46.23
	Murgon	5	1	5.81	8.63	16.62	26.53	57.59
	Kingaroy	4	3	5.78	9.09	20.09	27.97	62.94
Torres Strait	Thursday Island	7	1	6.63	12.70	23.60	29.87	72.80
Rockhampton	Berserker	2	3	6.16	9.5	17.66	28.63	61.96
	Gracemere	2	4	6.125	9.72	20.53	28.12	64.5
	Mt Morgan	5	1	5.313	9.37	15.93	27	57.62
	Rockhampton City	2	3	5.45	14.32	32.96	29.81	82.54
South West Qld	Roma	4	6	5.97	10.28	16.58	23.97	56.81
	Charleville	7	3	5.61	8.28	12.93	22.09	48.91
	St George	6	4	5.61	8.28	12.93	22.09	48.91
Mt Isa	Mornington	6	4	5.54	9.91	20.12	23.18	58.75
	Mt Isa City	6	4	5.03	12.18	36.11	26.55	79.88
	Sunset	6	4	5.81	9.09	15.37	21.53	51.81
Mackay	Mackay	2	5	5.30	8.19	23.70	25.86	63.05
Gold Coast	Southport	1	3	6.17	13.67	39.00	42.17	101.00
	Ashmore	1	7	5.13	11.40	22.73	31.00	70.27
	Benowa	1	6	5.70	12.32	27.41	33.14	78.57
Townsville	Alligator Creek	2	1	4.14	4.28	8.60	18.28	35.32
	Townsville City	2	6	5.90	10.40	29.07	29.50	74.88
	Hermit Park	2	3	5.35	7.032	13.80	22.06	48.25
	Idalia	2	2	5.21	5.34	16.02	22.86	49.45
	Rasmussen	2	6	5.44	6.26	17.73	22.32	51.77

remote areas have lower traffic levels, there is potential to improve the aesthetics, function of and access to destinations. This means developing connective infrastructure to ensure connectivity of sporting, retail and educational facilities via safe walking and cycling paths. Also, improving the pleasantness and safety of neighbourhoods may assist in increasing physical activity levels. Maintaining path surfaces and verges, planting trees, installing more pedestrian crossings and dedicated cycle paths, increasing the number of streetlights, reducing litter, and improving general maintenance, such as removing graffiti, may also assist in achieving this.

Healthy food should be accessible and affordable to be available in the home, in schools and in workplaces. Accessible and safe physical activity spaces in civic areas should be available to ensure people are safe to participate in physical activity, whether structured or incidental. Furthermore, walking and cycling paths should connect destinations such as schools, sporting venues and retail precincts to provide active transport options on local streets; this has the potential to encourage incidental exercise for those living in these communities.

This study provides evidence to inform policy and practice through understanding the system of local barriers and enablers for supporting a healthy lifestyle. Practitioners and policy makers can draw on the insights to understand where to invest time and resources to provide opportunities for local communities for affordable and available healthy food and safe and accessible physical activity infrastructure. This has the potential to improve health outcomes for people living in communities with healthier food and physical activity environments.

Limitations and future research

This study only evaluates a sample of the Queensland region. Further research is required to examine the intersection between food environments and physical activity environments, particularly in regional and remote areas, to understand the potential leverage points to improve health outcomes for these communities. While there has been research done in some areas of Australia, further research is required to develop a complete understanding of the food and physical activity environments across the country to identify where the modifiable leverage points are for making positive changes to improve the health outcomes of the people living in these communities. Furthermore, research with local stakeholders such as food retailers, healthcare service providers, cultural groups, community leaders and local council representatives should be undertaken to provide further insight into the opportunities and barriers for undertaking physical activity and healthy food consumption. Further research is needed to examine the health outcomes and social impact of policy and environmental change. Research in this area should include qualitative and participatory components such as interviews, focus groups, table talks and stakeholder interviews. Observational work would also provide useful insights into physical activity and food environments beyond self-report data.

There were limitations with the instruments used in this study, which is consistent with the acknowledgement that robust measures of the food and physical activity environment are needed to improve our understanding of the causes of variation in diet, physical activity and non-communicable disease risk and rates to strengthen interventions and to provide evidence to inform policy.[46]

Conclusions

The results from this study provide further evidence to advocate for change in areas of remoteness and disadvantage. The neighbourhood built environment plays an important role in shaping individual dietary and physical activity behaviour, particularly in areas of greater disadvantage where individuals may spend more time locally and may be restricted in their food access through ill health or functional limitations. Significant associations have been identified between the level of socioeconomic disadvantage, degree of remoteness, and the supportiveness of the built environment to enable consumers to make healthy food and physical activity choices. Areas with a high degree of remoteness and socioeconomic disadvantage are more likely to experience disadvantages in the physical activity, supermarket and restaurant food environments than areas with a low degree of remoteness and socioeconomic disadvantage. Barriers and facilitators for healthy eating and physical activity varied among regions, which can provide inequalities between communities. This study attempts to build a picture across regions to understand the environmental mechanisms that support residents to make healthy choices and get the support they need to have good health and wellbeing. When seeking to make change, a place-based approach may have more chance of success. There are strong supports in some regions and room for improvement in more remote regions. By using the information provided in this study, there is potential to reduce the inequalities across regions. Therefore, policy actions are recommended to make improvements in nutrition and physical activity equity, sustainability and health and wellbeing for all.

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