




Evaluation of the food environment of public hospitals in a Brazilian metropolis

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Abstract

Objective: To characterise the food environment of public hospitals in a Brazilian metropolis.

Design: A cross-sectional study involving the audit of mini-kitchens, non-commercial food services, commercial food services and vending machines within hospitals and interviews with workers and managers. Environmental dimensions assessed included: availability, accessibility, affordability, convenience, nutrition information, promotion and advertising, infrastructure for food and ambience, in addition to decisions-level aspects.

Setting: Rio de Janeiro, Brazil.

Participants: 24 public hospitals in the municipal health network.

Results: Of the hospitals assessed, 92.0% had a non-commercial food service, 87.5% had mini-kitchens (facilities to consume food taken from home), 37.5% had commercial food services and 25.0% had vending machines. Mini-kitchens were available in most but not all hospitals, a key facility given that few commercial or non-commercial food services were open 24 h a day. The food availability in the hospitals surveyed did not promote healthy eating. A wide variety of ultra-processed foods and drinks was found and advertising promoting their consumption, even in non-commercial food services with menus planned by nutritionists. Water filters/fountains were present in around 50% of mini-kitchens and non-commercial food services but were unavailable in commercial food services. According to workers interviewed, the temperature of the environment was the worst-rated aspect of mini-kitchens, non-commercial food services and commercial food services. Nutrition service managers reported little involvement in producing biddings and proposals for hiring outside companies to run non-commercial food services or commercial food services.

Conclusion: The food environment of the hospitals studied did not promote healthy eating habits.

Keywords
Food environment
Hospital
Workers
Epidemiology

Hospital personnel are exposed to long working hours, shift work, deal with suffering and death daily and need to work swiftly and accurately in executing their professional duties⁽¹⁾. Studies show that this work routine can have deleterious effects on the health of these professionals, such as high levels of stress^(2–4), sleep deprivation⁽⁵⁾, uncontrolled food consumption⁽⁵⁾ and high prevalence of excess weight^(6,7). These effects can lead to a lack of job satisfaction and poor work performance, negatively impacting service users and hospital workers' health and

quality of life. Thus, strategies are needed to improve the working and health conditions of hospital workers, such as activities to provide support, control stress, reduce workloads and promote improvements in hospital facilities.

Regarding the structure and organisation of hospitals, a key strategic element is the food environment, given that healthcare workers spend a large proportion of their day and consume most of their meals in their workplace^(5,7). This situation requires infrastructure and facilities to provide a pleasant and healthy environment for workers'

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meals and wellness⁽⁸⁾. The organisational food environment, of which the hospital food environment is part, is defined as the place where meals are sold or supplied to workers, students or users of institutions and organisations⁽⁹⁾.

Despite its importance, the literature on hospital food environments consists predominantly of studies conducted in high-income countries such as the USA, Canada and the UK focussing mainly on the analysis of availability of commercial food services and consumer food environment, particularly on the evaluation of the availability of specific food items^(10–16).

The importance of the topic, coupled with the current gap in the literature regarding studies analysing these environments, prompted this study whose objective was to assess the food environment of public hospitals in a Brazilian metropolis. This study is novel in the context of low- and middle-income countries and in its evaluation of different dimensions of the food environment, besides food availability.

Methods

A descriptive cross-sectional observational study was conducted in the municipality of Rio de Janeiro, Brazil. Rio de Janeiro is the country's second-largest city and has a population of over 6 million spread across 163 districts and about 50 public hospitals (run by the federal, state or municipal spheres or by universities)^(17–19). The study population was the municipal public hospitals managed by Rio City Hall authorities (n 26)⁽²⁰⁾.

Data collection was carried out from January to April 2019 by a team of 7 trained researchers during daytime hours with the aid of tablets. For the present survey study, baseline data were drawn from a reliability study of an auditing instrument developed specifically for this type of food environment. Inter and intra-rater reliability assessments confirmed that a high proportion of the instrument items exhibited good, very good or excellent agreement⁽²¹⁾.

The instrument (Assessment Instrument of the Hospital Food Environment)⁽²²⁾ applied measured 8 dimensions of the food environment cited in the related literature as most suited for assessing the hospital food environment, namely: availability, accessibility, affordability, convenience, nutritional information (energy, macronutrients, salt, sugar and/or trans-fat), promotion and advertising, infrastructure for food and ambience. In addition, decisional-level aspects were also measured. The instrument comprises 8 sections auditing different eating spaces (which include: mini-kitchen, non-commercial food services, commercial food services and vending machines), and sections for interviewing hospital workers (educated to at least high-school level) and nutrition service managers^(21–23). In our study, we adopted the following definitions: (1) mini-kitchens are facilities restricted to employees to consume food taken

from home, with a microwave and/or refrigerator, tables and chairs; (2) commercial food services are food services whose main purpose is creating and selling food and beverage; and (3) non-commercial food services are food services where food and beverage are not the primary focus of a business, but rather where food and beverage are present to support or supplement a specific group, which are workers and patients in our study⁽²⁴⁾.

The first 2 sections collect information on the general characteristics of each hospital, as reported by the head of nutrition. The third to sixth sections of the instrument are filled out by the researcher based on direct observation of its items. The third section features an evaluation of the worker mini-kitchens, if available, with a focus on the infrastructure for food dimension. The fourth section serves to audit the commercial food services and/or non-commercial food services, assessing the following dimensions: availability, affordability, convenience, nutritional information (energy, macronutrients, salt, sugar and/or trans fat) and promotion and advertising. The fifth section applies to vending machines, measuring the dimensions: availability, affordability and promotion and advertising. For assessing foods, preparations and beverages in all sections, the NOVA food classification was used as adopted in the Brazilian Dietary Guidelines for identifying fresh/minimally processed, culinary preparations based on these ingredients and ultra-processed foods^(25–27). The 'convenience items' are those with ready access not requiring service except for payment (including confectionery) and were basically ultra-processed items, defined using the same criteria cited for assessing foods, preparations and beverages⁽²⁵⁾.

In the case of availability of foods, preparations and beverages, the variables from sections 4 (commercial food services and non-commercial food services) and 5 (vending machines) were used to yield an availability score. To achieve this, the response options of each variable were dichotomised into 0 or 1, where 1 was attributed for availability of each fresh or minimally processed food or beverage or culinary preparation based on these ingredients included in the checklist and 0 for the absence of each of them. A value of 0 was also assigned for the presence of each ultra-processed food and beverage offerings included in the checklist, while 1 was assigned for non-availability of each of these foods. The category of each food item investigated, according to NOVA classification, was pre-defined in the development of the instrument. All of the items collected and that make up the scores can be found in the Supplemental material. Considering the number of items available for each type of eating spaces, scores ranged from 0 to 33 for commercial food services, 0 to 33 for non-commercial food services, 0 to 10 for vending machines and total food availability score for the hospital (sum of the 3 scores) was 0 to 76 points. Scores were subsequently standardised on scale of 0–100 points to aid interpretation. In hospitals with more than one type



of the same space (e.g. 3 vending machines), the mean score was calculated for the respective item. Hence, scores reflected the range of different types of eating spaces present in the hospital as opposed to each individual space. The internal consistency of each score was measured using Cronbach's α coefficient. According to the literature, α values greater than 0.70 are deemed acceptable^(28,29).

The seventh section corresponds to the interview with hospital workers assessing their perceptions regarding the food environment. Statements were scored on a Likert scale⁽³⁰⁾ with 5 response options (totally agree, agree more than disagree, neither agree nor disagree, disagree more than agree and totally disagree). For these analyses, the responses 'totally agree' and 'agree more than disagree' were considered positive. A total of 10 workers were interviewed at each hospital (except for 4 hospitals, in which 2, 4, 8 and 9 workers were interviewed, since the others refused to respond because they were busy or afraid of being punished for their answers, or because superiors restricted the workers to participate, fearing that the answers could tarnish the hospital's image), using questions collecting data on the dimensions availability (referring to delivery services and informal retail within the hospital premises), accessibility and ambience covering the non-commercial food services, mini-kitchens and commercial food services. We considered informal vending as those that are often not regulated through formal governance structures⁽³¹⁾, carried out by street vendors or hospital employees. In view of the importance of drinking water, besides foods and beverages in general, workers were probed on perceived access to water in the hospital. The eighth section is used for interviewing managers, the head of nutrition services for assessing aspects of decision-making involving the food environment (decisional level) and availability of foods, preparations and beverages within the hospital.

In addition, hospitals were characterised according to the Social Development Index (SDI) of the districts in which they are situated to ascertain whether site location affected the respective food environment of the hospital. This stratification was performed by establishing the cut-off index value as the mean SDI of all districts in the city of Rio de Janeiro and then classifying hospitals as 'low SDI' or 'high SDI'. The SDI is calculated by the Rio de Janeiro City Hall, where the index is composed of 8 indicators including clean water supply, sewage sanitation system, refuse collection, characterisation of households and of residents⁽³²⁾.

After each day's collection, the resultant data were synchronised online to build a database, later exported into an Excel spreadsheet. All statistical analyses were performed using Stata SE version 14.2 software (Stata Corp.).

Data for categorical variables were analysed descriptively and expressed as mean absolute and relative frequencies, while continuous variables were expressed using measures of central tendency (means and medians)

and spread (minimum and maximum values). 95 % CI were calculated. On comparisons, the absence of overlap within the 95 % CI was taken as a statistically significant difference, based on a 5 % significance level. The report on managers was presented in descriptive form.

Results

Of the 24 hospitals assessed, 66.7 % were specialised hospitals (5 maternity, 2 paediatric, 3 psychiatric units, 5 specialised and 1 geriatric), with 3–450 beds and 39–2000 workers. The hospitals were distributed across 20 districts of the city, 50 % of which were situated in areas with a high SDI. Of the hospitals evaluated, 92.0 % had a non-commercial food service for workers meals, 87.5 % had mini-kitchens, 37.5 % had commercial food services and 25.0 % had vending machines available. There was a major disparity in the number of mini-kitchens available, ranging from 0 to 36 (median = 3.0). Full meals were the most commonly found offering at the hospitals (88.2 %), due to the fact that they were served by all non-commercial food services and by several commercial food services (Table 1).

The evaluation of mini-kitchen infrastructure revealed that not all were equipped with tables and chairs; most had appliances for cooling foods (fridge/freezers) and for heating foods, although less than 50 % had a water filter/fountain, a rate which was significantly lower among low SDI areas (35.0 % \times 61.4 %) (Table 2).

With regard to non-commercial food services, water filters/fountains were found in just over half (54.2 %) (Table 2). In 70 % of non-commercial food services, the only method of payment was via functional identification of the worker (informing or presenting registration number, ID tag etc.), and was limited to use by hospital worker. Only 4.2 % of non-commercial food services were open 24 h a day, where the remainder opened only at meal times. All non-commercial food services were open on weekends and public holidays (data not shown in table).

Canteens/cafeterias/snack bars were the most common types of commercial food services. No water filters/fountains were found in these establishments (Table 2). In terms of convenience, 90.0 % of commercial food services accepted cash payments, 40.0 % debit or credit card, 30.0 % luncheon vouchers and 10.0 % received payment via functional identification. Regarding opening hours, only 33.3 % of the commercial food services operated 24 h a day, and 50 % were open at weekends and public holidays (data not shown).

On the assessment of the availability of foods, preparations and beverages at the hospitals, the mean overall score of hospitals located in high SDI areas was 42.4 *v.* 30.5 in low SDI areas, a significant difference. The non-commercial food services were the only kind of eating space scoring over 60 points (Table 3). According to the Cronbach's α coefficient, there was good internal consistency among

Table 1 Characteristics of municipal hospitals assessed, according to SDI of district where they are located. Rio de Janeiro, 2019

General characteristics of the hospitals	High SDI area			Low SDI area			Total		
	<i>n</i>	%	95 % CI	<i>n</i>	%	95 % CI	<i>n</i>	%	95 % CI
Type of hospital									
Specialised hospital	6	50.0	21.9, 78.1	10	83.3	47.6, 96.5	16	66.7	45.0, 83.0
General hospital	6	50.0	21.9, 78.1	2	16.7	3.5, 52.4	8	33.3	17.0, 55.0
Plane									
Horizontal	0	0	–	5	41.7	16.4, 72.2	5	20.8	8.5, 42.7
Vertical	12	100.0	–	7	58.3	27.8, 83.6	19	79.2	57.3, 91.5
Presence of elevator									
Yes	12	100.0	–	8	66.7	34.2, 88.5	20	83.3	61.7, 93.9
Working elevator									
Yes	12	100.0	–	7	58.3	27.8, 83.6	19	79.2	53.1, 88.8
Presence of ramps									
Yes	12	100.0	–	8	66.7	34.2, 88.5	20	83.3	61.7, 93.9
Presence of eating spaces within hospitals									
Non-commercial food services	12	100.0	–	10	83.3	47.6, 96.5	22	92.0	70.5, 98.1
Mini-kitchens	11	91.7	52.5, 99.1	10	83.3	47.6, 96.5	21	87.5	66.1, 96.2
Commercial food services	7	58.3	27.8, 83.6	2	16.7	3.5, 52.4	9	37.5	20.1, 58.9
Vending machines	3	25.0	7.1, 59.1	3	25.0	7.1, 59.1	6	25.0	11.2, 46.9
Type of food served in eating spaces									
Snacks	11	52.4	30.7, 73.2	7	53.9	25.8, 79.7	18	52.9	35.9, 69.4
Full meals	19	90.5	66.8, 97.8	11	84.6	50.8, 96.7	30	88.2	71.7, 95.7
Confectionery	7	33.3	16.0, 56.8	2	15.4	3.3, 49.3	9	26.5	14.0, 44.3
	Mean	Median	Min–Max	Mean	Median	Min–Max	Mean	Median	Min–Max
Number of eating spaces within hospitals									
Non-commercial food services	1.2	1.0	1.0–2.0	0.8	1.0	0–1.0	1.0	1.0	0–2.0
Mini-kitchens	4.8	4.0	0–20.0	6.7	2.0	0–36.0	5.7	3.0	0–36.0
Commercial food services	0.6	1	0–1.0	0.3	0	0–2.0	0.4	0	0–2.0
Vending machines	0.8	0	0–4.0	0.5	0	0–3.0	0.7	0	0–4.0
	Median	95 % CI		Median	95 % CI		Median	95 % CI	
Number of beds	135	105.1, 287.4		56	30.8, 84.5		70	74.0, 180.0	
Number of employees in hospitals	750	374.2, 1522.5		257.5	191.7, 492.4		400	333.2, 870.6	

SDI, social development index.

**Table 2** Characteristics of infrastructure of eating spaces of municipal hospitals assessed, according to SDI of district where they are located. Rio de Janeiro, 2019

Infrastructure of eating spaces	High SDI area			Low SDI area			Total		
	<i>n</i>	%	95% CI	<i>n</i>	%	95% CI	<i>n</i>	%	95% CI
Mini-kitchens									
Presence of tables	50	87.7	76.1, 94.1	68	85.0	75.2, 91.4	118	86.1	79.2, 91.0
Presence of seating	51	89.5	78.2, 95.3	63	78.8	68.3, 86.5	114	83.2	75.9, 88.6
Presence of water filter/fountain	35	61.4	48.0, 73.3	28	35.0	25.2, 46.2	63	46.0	37.8, 54.4
Presence of appliances for cooling foods	52	91.2	80.3, 96.4	75	93.8	85.7, 97.4	127	92.7	86.9, 96.0
Presence of appliances for heating foods	48	84.2	72.0, 91.6	66	82.5	72.4, 89.4	114	83.2	75.9, 88.6
Presence of devices for ambient temperature control (air conditioning or fan)	32	56.1	42.9, 68.6	60	75.0	64.2, 83.4	92	67.2	58.8, 74.6
Commercial food services									
Type of venue									
Restaurant buffet service	1	14.3	1.2, 70.1	0	0	–	1	2.9	1.0, 54.7
Snack bar/canteen/cafeteria	4	57.1	17.1, 89.6	3	100.0	–	7	20.6	32.9, 91.7
Mixed (meals + snacks or meals + confectionery or snacks + confectionery or meals + snacks + confectionery)	2	28.6	4.9, 75.6	0	0	–	2	5.9	4.0, 59.9
Presence of tables and seating	7	100.0	–	1	33.3	0.3, 99.0	8	80.0	40.1, 96.0
Presence of water filter/fountain	0	0	–	0	0	–	0	0	–
Presence of chilled display cabinet	4	57.1	17.1, 89.6	3	100.0	–	7	70.0	32.9, 91.7
Presence of microwave oven	2	28.6	4.9, 75.6	0	0	–	2	20.0	4.0, 59.9
Presence of devices for ambient temperature control (air conditioning or fan)	6	85.7	29.9, 98.8	3	100.0	–	9	90.0	45.3, 99.0
Non-commercial food services									
Presence of tables and seating	14	100.0	–	10	100.0	–	24	100.0	–
Presence of water filter/fountain	6	42.9	18.9, 70.7	7	70.0	32.9, 91.7	13	54.2	33.6, 73.4
Presence of chilled display cabinet	1	7.14	0.8, 41.9	2	20.0	4.0, 59.9	3	12.5	3.8, 33.8
Presence of microwave oven	4	28.6	10.0, 58.9	3	30.0	8.3, 67.1	7	29.2	14.0, 51.0
Presence of devices for ambient temperature control (air conditioning or fan)	13	92.9	58.0, 99.2	10	100.0	–	23	95.8	73.5, 99.5

SDI, social development index.

scores: non-commercial food services = 0.97, commercial food services = 0.94, vending machines = 0.95 and total = 0.95. The description of the items available can be found in the Supplemental material.

Of the non-commercial food services assessed, only one of them sold other items for consumption in addition to full meals, offering a range of products (different brands and flavours): (1) ice-cream/popsicles (9 types); (2) soft drinks (8 types); (3) nectar (8 types); (4) electrolyte/sport drinks (7 types); (5) savoury snacks (6 types) and (6) sweet cream-filled biscuits (6 types). The following condiments were also made available for users: table salt in 83% of the hospitals, sweetener in 75% and sugar in 54%. Only 50% of non-commercial food services provided consumer information, of which 83% was printed on menus and less than 10% provided nutritional information. Concerning promotion and advertising material, 30% of non-commercial food services advertised fruit, 25% vegetables and under 5% ultra-processed foods and beverages (data not shown).

Among the commercial food services, items which had the highest average number of types were candies (18 types), ice cream/popsicles (13 types), bagged savoury snacks (10 types) and chocolate (8 types). Of the commercial food services assessed, 90% provided table salt, sugar and sweetener. Information for consumers (nutritional information, price, menu, others) was available in 60% of commercial food services, 67% provided in the form

of menus, while only 17% made nutritional information available to users. However, 70% of commercial food services displayed advertising material promoting the consumption of ultra-processed drinks, 50% on ultra-processed foods and only 20% encouraging purchase of fruit (data not shown).

With regard to vending machines, all accepted cash money and 18.8% accepted cards as means of payment, and one-third displayed material advertising ultra-processed products (data not shown).

Concerning promotions, the possibility of switching items of the meal for others was rare, limited to replacing an item (e.g. French fries) with vegetables for the same price, an option found only in commercial food services of hospitals located in high SDI areas. The option of changing serving size was found in up to a third of commercial food services and combination/promotional meals were observed in only one, located in a high SDI area. Pricing of items in commercial food services varied significantly (e.g. sandwich prices ranged from R\$ 3.50 to R\$ 7.00), whereas prices for products in vending machines was more consistent (Table 4).

In order to complement the information gathered by the audit of the hospitals and eating spaces, workers' views on aspects related to the food environment were probed. A total of 223 workers were interviewed. Among interviewees, 75% were women, mean age was 47 years and job

Table 3 Description of availability scores for foods, preparations and beverages in non-commercial food services, commercial food services and vending machines in the municipal hospitals assessed, according to SDI of district in which they are located. Rio de Janeiro. 2019

Availability scores for foods, preparations and beverages in hospitals	High SDI area					Low SDI area					Total			
	Mean	Median	Min–Max	95 % CI	95 % CI	Mean	Median	Min–Max	95 % CI	95 % CI	Mean	Median	Min–Max	95 % CI
Non-commercial food services	73.9	75.8	60.6–78.8	70.1, 77.7	70.1, 77.7	60.6	71.2	0–78.8	42.5, 78.7	42.5, 78.7	67.2	72.7	0–78.8	58.3, 76.2
Commercial food services	19.4	22.7	0–60.6	6.7, 32.1	6.7, 32.1	6.3	0	0–42.4	–3.1, 15.8	–3.1, 15.8	12.9	0	0–60.6	5.1, 20.7
Vending machines	14.4	0	0–70.0	–2.6, 31.3	–2.6, 31.3	10.7	0	0–55.0	–2.7, 24.1	–2.7, 24.1	12.5	0	0–70.0	2.6, 22.5
Total	42.4	44.1	26.3–58.6	35.7, 49.1	35.7, 49.1	30.5	31.6	14.5–40.1	25.9, 35.0	25.9, 35.0	36.4	33.6	14.5–58.6	31.9, 40.9

SDI, social development index.

roles varied, including technicians, general service assistants, nutritionists, physicians, psychologists, receptionists, kitchen helpers, 60 % were celetist employees/civil servants and shift workers and 91 % worked days (data not shown). Of those workers who used each of the eating spaces, most agreed on positive aspects regarding the accessibility and ambience of the non-commercial food services, commercial food services and mini-kitchens. In general, the most negatively rated aspect was the temperature of eating spaces, where only 48.5 % agreed this was comfortable in the commercial food services (Table 5). Concerning access to drinking water, 91 % of respondents reported enjoying access free of charge, 90 % provided by water filter/fountain and 95 % of interviewees confirmed these devices worked. When asked about permission to use delivery services, 70 % of respondents stated this was allowed, and 67 % said it was used on the site. Use of delivery services was reported by 75 % of workers interviewed in low SDI areas *v.* 60 % in high SDI areas. Informal vending within the hospital environments was reported by 33 % of workers, with this rate proving similar for hospitals located in low and high SDI areas (35 % and 31 %, respectively) (data not shown).

A total of 23 nutrition service managers were interviewed, all of whom were female with mean age of 49 years. In 52 % of hospitals, managers stated they produced the proposal conditions for hiring companies to run the non-commercial food services, 66.7 % of whom claimed to avoid fried and ultra-processed foods and stipulated that fruit and pulp juices be provided. The remaining managers (48 %) reported that the proposal for outsourcing was produced by a government organisation. With respect to the developing of the food procurement contract, 30.4 % of the managers were unaware of who was responsible and only 26 % reported being involved in the process, where some of the criteria used for defining the service were: cost of the food products, demand by staff/patients, nutritional and health quality of foods, including aspects related to the industrial processing of the foods. With regard to the bidding process for contractually engaging commercial food services, 100 % of managers reported having no involvement in the process and 44 % reported that the bidding specified which foods were to be offered at commercial food services (data not shown).

Discussion

This is the first study conducted in a middle-income country assessing the hospital food environment. Moreover, this is the first investigation to perform a more comprehensive evaluation of this environment, addressing not only food availability but also accessibility, promotion and advertising, ambience of the different eating spaces, food-related infrastructure and decisional-level aspects. The results characterizing the public hospitals of a Brazilian metropolis



Table 4 Pricing and promotion in commercial food services and vending machines in municipal hospitals assessed, according to SDI of district in which they are located. Rio de Janeiro. 2019

Pricing and promotion	High SDI area			Low SDI area			Total		
	<i>n</i>	%	95 % CI	<i>n</i>	%	95 % CI	<i>n</i>	%	95 % CI
Switching									
Some items for vegetables	3	42.9	10.4, 82.9	0	0	–	3	30.0	1.0, 54.0
Same price	3	57.1	10.4, 82.9	0	0	–	3	30.0	8.3, 67.1
Soft drink/sugary drink for natural fresh juice/with pulp	0	0	–	0	0	–	0	0	–
Change in serving size									
Larger portion of foods	2	28.6	4.9, 75.6	1	33.3	0.3, 99.0	3	30.0	8.3, 67.1
Larger portion of drinks	1	14.3	1.2, 70.1	1	33.3	0.3, 98.0	2	20.0	4.0, 59.0
Smaller portion of an item	2	28.6	4.9, 75.6	1	33.3	0.3, 99.0	3	30.0	8.3, 67.1
Presence of combination/promotional meals	1	14.3	1.2, 70.1	0	0	–	1	10.0	1.0, 54.7

	Mean price (R\$)	Min–Max	Mean price (R\$)	Min–Max	Mean price (R\$)	Min–Max
Prices at commercial food services*						
Bagged crisps	4.0	2.5–6.0	3.3	3.0–3.5	3.8	2.5–6.0
Sweet biscuits	4.6	2.5–6.0	2.8	2.0–3.5	4.1	2.0–6.0
Sandwich	4.8	3.5–7.0	0	0	4.8	3.5–7.0
Fried savoury	5.0	4.5–6.0	0	0	5.0	4.5–6.0
Baked savoury	4.7	4.0–5.0	5.0	5.0–5.0	4.8	4.0–5.0
Soft drink (regular cola type)	4.6	3.0–6.0	3.0	3.0–3.0	4.3	3.0–6.0
Prices at vending machines*						
Soft drink (regular cola type (350 ml))	4.0	4.0–4.0	4.5	4.0–5.0	4.3	4.0–5.0
Nectars (200 ml)	0	0	2.0	2.0–2.0	2.0	2.0–2.0
Still water (500 ml)	2.0	2.0–2.0	2.5	2.5–2.5	2.1	2.0–2.5
Cereal bar	1.0	1.0–1.0	2.0	2.0–2.0	1.5	1.0–2.0
Chocolate bar (130–150 g)	0	0	0	0	0	0
Savoury snacks (45–60 g packet)	2.3	2.0–2.5	2.0	2.0–2.0	2.2	2.0–2.5

SDI, social development index.

*Items with smallest portion or lowest price were selected.

Table 5 Workers perceptions* regarding the food environment of the municipal hospitals assessed, according to SDI of district where they are located. Rio de Janeiro, 2019

Opinion about food environment†	High SDI area			Low SDI area			Total		
	<i>n</i>	%	95 % CI	<i>n</i>	%	95 % CI	<i>n</i>	%	95 % CI
Non-commercial food services									
Short distance away	86	91.5	83.8, 95.7	66	85.7	75.8, 92.0	152	88.9	83.2, 92.8
Layout helpful	91	96.8	90.4, 99.0	75	97.4	90.0, 99.4	166	97.1	93.1, 98.8
Lighting satisfactory	89	94.7	87.7, 97.8	73	94.8	86.8, 98.1	162	94.7	90.2, 97.3
Noise level satisfactory	61	65.6	55.3, 74.6	57	74.0	62.9, 82.7	118	69.4	62.0, 75.9
Cleanliness satisfactory	79	84.9	76.0, 90.9	65	84.4	74.3, 91.0	144	84.7	78.4, 89.4
Temperature satisfactory	50	53.8	43.5, 63.7	41	53.3	41.9, 64.2	91	53.5	46.0, 60.9
Queuing time short	84	89.4	81.2, 94.2	72	93.5	85.1, 97.3	156	91.2	85.9, 94.7
Mini-kitchens									
Short distance away	53	96.4	86.2, 99.1	53	96.4	86.2, 99.1	106	96.4	90.6, 98.6
Layout helpful	53	96.4	86.2, 99.1	55	100.0	–	108	98.2	92.9, 99.6
Lighting satisfactory	46	85.2	72.7, 92.5	50	90.9	79.6, 96.2	96	88.1	80.4, 93.0
Noise level satisfactory	46	85.2	72.7, 92.5	50	90.9	79.6, 96.2	96	88.1	80.4, 93.0
Cleanliness satisfactory	40	74.1	60.5, 84.2	46	83.6	71.1, 91.4	86	78.9	70.1, 85.6
Temperature comfortable	26	48.2	35.0, 61.6	36	65.5	51.8, 77.0	62	56.9	47.3, 65.9
Commercial food services									
Short distance away	21	77.8	57.5, 90.1	5	83.3	23.0, 98.8	26	78.8	60.9, 89.8
Layout helpful	25	92.6	73.4, 98.3	5	83.3	23.0, 98.8	30	90.9	74.4, 97.2
Lighting satisfactory	25	92.6	73.4, 98.3	6	100.0	–	31	93.9	77.8, 98.6
Noise level satisfactory	22	81.5	61.4, 92.4	5	83.3	23.0, 98.8	27	81.8	64.2, 91.9
Cleanliness satisfactory	21	77.8	57.5, 90.1	5	83.3	23.0, 98.8	26	78.8	60.9, 89.8
Temperature comfortable	13	48.2	29.6, 67.2	3	50.0	10.9, 89.1	16	48.5	31.6, 65.7
Access to drinking water									
Ready access	102	82.9	75.1, 88.6	86	86.0	77.6, 91.6	188	84.3	78.9, 88.5
Quality satisfactory	92	81.4	73.1, 87.6	68	74.7	64.7, 82.7	160	78.4	72.2, 83.6

SDI, social development index.

*n 223 workers.

†Results shown are sum of 'totally agree' plus 'agree more than disagree'.

revealed food environments that do not favour healthy eating. This result is owing to the availability of foods, preparations and beverages in different eating spaces, besides the wide variety and presence of advertising material promoting ultra-processed foods, even in non-commercial food services, where menus offerings are planned by a technical nutrition team. In terms of infrastructure and convenience within the eating spaces, few commercial food services and non-commercial food services stayed open 24 h a day, even though this reflects the working hours of hospitals. Thus, mini-kitchens were the places supporting shift workers, but a major disparity in the number of mini-kitchens available was identified. The number of tables and seats in these places was not assessed, which is a limitation of the study, since where and how people can eat may incentivise people to use facilities or not. Although making available free drinking water in the workplace is a legal requirement under labour laws in Brazil⁽³³⁾, the presence of water filters/fountains in mini-kitchens, commercial food services and non-commercial food services was unsatisfactory. These results highlight the importance and pressing need to assess the hospital food environment, and the wealth of information they can yield towards developing interventions in these spaces.

The availability of unhealthy food and drinks, such as ultra-processed products, in the food environment negatively influences food choices and consumption⁽³⁴⁾. A study carried out in South Africa found that workers felt uncomfortable refusing to eat ultra-processed foods, since most people eat these products when available⁽³⁵⁾. In 2021, the WHO published a document urging governments to develop and implement public policies aimed at promoting the availability of healthy foods and/or curbing or banning unhealthy foods in public facilities, such as hospitals, by establishing nutritional criteria for the supply and sale of foods⁽³⁶⁾.

In this study, the availability of foods, preparations and beverages was assessed using scores for different eating spaces within hospitals. In cases where more than one type of eating space was found, scores for these were averaged, allowing the adoption of number of hospitals as a unit of measure. This methodological approach was elected, as opposed to the presence of a food item in a given commercial food service, for example, so that heterogeneous situations found within the same hospital among its eating spaces (non-commercial food services, commercial food services and vending machines) were not simplified, that is, a hospital which makes soft drinks available in more than one commercial food service translates to greater exposure of its staff to this item.

The fact that commercial food services and non-commercial food services did not operate 24 h a day, predominantly impacts nightshift workers who likely have lesser access to fresh foods (fresh or minimally processed) within the hospital and its vicinity, because formal and informal vendors near the site also do not operate 24 h daily.

Consequently, night workers have to choose from informal vendors, when present, food delivery services or bringing in their own food from home and storing it for later consumption in the mini-kitchen, if it exists. This finding is in line with the results of a review showing that nurses working nights have a greater prevalence of excess weight and consume more snacks compared to day workers⁽³⁷⁾. Nurses interviewed in another study stated that, after 11 pm, the availability of healthy options for meals is much reduced, leading to the use of outside food services⁽³⁸⁾. There are also reports that nurses feel uncomfortable eating in non-commercial food services because, in some hospitals, this facility is also for shared use by patients and their companions, a factor which may affect workers during meal times⁽³⁸⁾.

With regard to the availability of drinking water, a lack of water filters/fountains in hospitals may promote lower fluid intake by workers. This phenomenon was documented in a study of university workers in which the group consumed only 39% of the daily recommended amount of water⁽³⁹⁾. In hospitals, where work breaks tend to be short or non-existent and working hours often longer than those of a university, water consumption should be facilitated to avoid harming health.

Studies carried out in hospital food environments worldwide have failed to take into account hospital infrastructure, access to water during the work shift, use of food delivery services, the ambience for eating spaces, or information on management of the food services. All these issues also influence the workers' dietary habits, which in turn has implications for their health status and work productivity. The exploring of these aspects is the strength of the present investigation, which sought to map the complexity of the hospital food environment. To this end, the use of an instrument with good psychometric performance able to capture this complexity was fundamental. The audit instrument employed is based on a conceptual model and on national and international benchmarks and is grounded in official guidelines for an adequate and healthy diet adopted in Brazilian public policies⁽²¹⁾.

The few studies assessing the hospital food environment were carried out in high-income countries, and so results cannot be generalised to the Brazilian context^(10–16,40,41).

A narrative review on hospital food environments reported that 5 out of the 7 studies included found fast-food chains within USA hospitals⁽¹³⁾. Another study, also in the USA, assessed children's hospitals and found that 30% of these sites had fast-food restaurants⁽¹⁴⁾. Despite the high prevalence of ultra-processed foods and beverages available in the hospitals analysed in this study, no fast-food type restaurants were found within the hospitals surveyed.

A UK study found that hospitals offered 800 different types of snacks (*n* 533) and drinks (*n* 262) for sale. Of the 20 top-selling snacks, only 5 were healthy options according to criteria based on calorie content and number of critical nutrients (fat, sugar and salt)⁽⁴⁰⁾. This scenario is



concerning for the health of hospital workers, given that these foods may be consumed at several meals throughout the long working day of health care professionals.

In a study conducted in California, USA, an instrument was applied probing the availability of healthy and unhealthy foods, the presence of nutritional information and pricing/promotions, assessing serving size and prices, in addition to combination meals. Of the 14 hospitals surveyed, only 13 % offered smaller serving sizes and lower price for smaller portions, and 50 % offered combination meals at a lower price than for each item purchased separately⁽¹¹⁾. Results differed for the Rio de Janeiro municipal hospitals assessed, where 30 % offered smaller portions and 10 % combination meals.

In a study conducted in the USA and Canada, less nutritious foods predominated in hospital non-commercial food services, with chocolate and candies available in 92 %, whereas only 34 % had alternatives which the authors considered healthy, such as low-fat desserts or baked products⁽¹²⁾. Candy and chocolate items had a larger mean variety of types offered by commercial food services within the hospitals surveyed in this study. However, the healthier alternatives are not comparable with those selected because studies adopted different concepts defining 'healthy' foods.

Despite differences in items evaluated, overall, studies in the literature reported a high availability of unhealthy foods and beverages^(11–14,40). This finding was corroborated by the present study results, although the scenario in Brazilian hospitals appears to be better than that observed in other studies. Disparities were evident in the concept used to define healthy and unhealthy foods and beverages. The present study was based on the Brazilian Dietary Guidelines⁽²⁵⁾, which takes into account both the extent and purpose of industrial processing of the foods, as opposed to being based on nutrients alone⁽²⁷⁾. In countries such as the UK and USA, foods low in sugar and fat are deemed healthy, even when ultra processed, as exemplified by diet soft drinks^(10–12,40).

In a UK study, doctors were interviewed about barriers to healthy eating in the hospitals where they worked. The lack of food options and opening hours of commercial food services were the most frequently cited aspects⁽¹⁶⁾. Restricted opening times of the commercial food services and non-commercial food services was also an issue identified in this study.

The studies available have used a variety of instruments and measured different dimensions of the food environment. Most of the North American and British studies assessing the hospital food environment focussed on the consumer food environment, that is, on aspects such as access to healthy options, pricing, promotion, shelf placement/positioning of item at the venue, nutritional information and variety, centring on a maximum of 3 of these dimensions⁽⁴²⁾. Thus, the main dimensions explored in these studies were availability^(10–12,14,40), pricing/promotion^(10,11,15), nutritional

information^(10–12,40) and convenience^(15,16), while some, for example, explored non-commercial food services only^(10,11) or non-commercial food services together with commercial food services and vending machines^(15,40). The present study is pioneering in that it audited a broad variety of dimensions, including non-commercial food services, staff mini-kitchens, commercial food services, vending machines, used scores with good internal consistency to reflect the availability of foods, preparations and beverages in the hospitals, and also conducted interviews with managers and workers. The novel tool used in this study was developed as an attempt to cover the complexity of hospitals' food environment and adopted a healthy eating paradigm based on the recommendations of the Brazilian Dietary Guidelines^(43–45).

The instrument used in this study, despite having been applied in public hospitals, can easily be used in private hospitals. One of the places where its pre-test was carried out was a private hospital and the instrument performed well. However, for its use in other countries, a thorough and standardised assessment is recommended, since the food environment is complex, with an expressive diversity of establishments, foods, beverages and information, which even with a complete and complex instrument can let information pass through country-specific cultural events⁽⁴⁶⁾.

The present study has limitations. The focus was public municipal hospitals of a single city in Brazil, limiting the generalisability of findings to other settings. This investigation did not include public hospitals run by other levels of government or by social organisations for health (NGO management partners), private hospitals and/or those located in other cities, whose situations may differ from that encountered in this study. In addition, the management boards of 2 of the hospitals refused to grant permission to conduct the audits. However, the diverse profile of the hospitals studied can partially compensate for this limitation. It is noteworthy that some level of difficulty understanding the Likert scale was observed among some of the workers interviewed. Moreover, respondents were selected based on convenience and not randomly selected and interviews were conducted only during daytime hours. This timing may have led to a sample comprising mostly day-shift workers, who may have different perceptions compared to night-shift workers.

The present study results can help to define actions for improving the quality of the hospital food environment, such as developing rules governing the availability and sale of ultra-processed foods, akin to Ruling *n*° 1 274 of July 2016, which provides for actions Promoting Adequate and Healthy Foods based on the Brazilian Dietary Guidelines within public workplaces under the auspices of the Ministry of Health and other affiliated entities⁽⁴⁷⁾. Similarly, Regulation *n*° 7 of 26 October 2016 enacts the guidelines for Promotion of Adequate and Healthy Food based on the Organic Law on Food and Nutritional Security and in health and safety legislation in the

workplace of organisations and entities belonging to the Federal Government Civil Servant System – SIPEC⁽⁴⁸⁾, encompassing public buildings in the ambit of the Federal government. Such rulings are important to support decision-making by administrators and serve as a tool for workers to lobby for improved conditions in the workplace. At a local level, the results of this study can serve to alert managers to the dietary needs of hospital staff, including the availability of healthy foods, presence of water filters/fountains, convenience, accessibility, affordability, as well as pleasant food environments in which to eat.

Conclusion

Taken together, the results of this study showed that the food environment of municipal hospitals in a Brazilian metropolis did not promote healthy eating. Overall, this scenario did not differ according to SDI of the area where the hospitals were located, except for food availability. This finding is due to the high availability of ultra-processed food and beverages within the hospitals, the use of advertising to promote the consumption of these food products, the limited opening times of the food services, the fact that facilities such as mini-kitchens were not always present, the lack of availability of water filters/fountains for ready access to drinking water for workers and to the thermal discomfort of areas for food consumption.

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Committee of the HUPE/UERJ (CAAE: 91960718.3.0000.5259) and of the Secretaria Municipal de Saúde do Rio de Janeiro (CAAE: 91960718.3.3001.5279). Written informed consent was obtained from all subjects/patients.

Supplementary material

For supplementary material accompanying this paper visit <https://doi.org/10.1017/S1368980021003992>

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