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# Identifying healthy food and beverages in food retail store point-of-sale systems: a feasibility and validity study

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## Abstract

**Background** Health-promoting strategies targeting the food retail environment can influence consumer purchasing behaviour. Most strategies require the healthiness of available food and beverages to be determined. Healthiness classification systems exist; however, no system is linked to remote food retail point-of-sale systems. The objective of this study was to explore the feasibility and validity of a process to identify healthy food and beverages in food retail store point-of-sale systems, as applied in a discount card study in remote Aboriginal and Torres Strait Islander communities, Australia.

**Methods** A convergent mixed methods study design was used. Feasibility was explored through semi-structured interviews with project and store team members involved in a process to identify healthy food and beverages in point-of-sale systems across five remote stores. Convergent validity was assessed by comparing alignment of classification of food and beverages via the expert-informed process used, with a technology-driven system underpinned by Australia's Health Star Rating and discretionary classification, the Thumbs Rating system.

**Results** All eight eligible project and store team members involved in the process were interviewed. The expert-informed process, while implemented successfully overall, was not entirely acceptable to participants. Challenges related to the manual classification of products, with participants recommending exploring automated processes to classify products. There was substantial alignment with technology-driven classification (86% of 6281 unique products). Misalignment was largely related to differences in criteria; the expert-informed process was underpinned by a food-based classification system, including selection of the healthier alternatives within food groups, and the Thumbs Rating system is underpinned by food-based classification with nutrient-profiling.

**Conclusion** Alternative methods to the expert-informed process examined in this study should be considered to classify food and beverages in remote food retail point-of-sale systems. The Thumbs Rating provides a valid classification system and would provide an automated means of classification that could be linked to point-of-sale systems. A shift in classification for a small proportion of products, would need to be considered in applying the Thumbs Rating system to remote food retail interventions, or additional criteria overlaying the system could be implemented to meet specific criteria for targeted strategies.

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**Keywords** Food retail intervention, Healthiness classification, Remote food retail stores, Aboriginal and Torres Strait Islander

## Background

In food retail settings, the availability, price, promotion, placement of products and availability of nutrition information form a consumer nutrition environment [1]. Interventions that focus on product, promotion and placement strategies have demonstrated positive effects on the healthiness of consumer purchases, with strategies including shelf-labels and technology delivered nutrition information showing promise [2–4]. Pricing intervention trials and modelling studies have also shown a positive effect of price subsidies, sometimes in combination with nutrition education interventions, on the purchase of targeted healthy products, including fruit and vegetables [5–9].

In remote Aboriginal and Torres Strait Islander communities the community food retail store is often the sole, or one of few, food retail providers. It is estimated that over 90% of food consumed in remote communities is purchased from the store [10, 11]. Often remote community stores are community owned, enabling local capacity to initiate and sustain in-store health promoting strategies [12]. In remote communities a range of nutrition strategies aimed at improving dietary intake and health outcomes have been trialled including store-based interventions [13]. Evidence has shown that food retail-based strategies in remote Aboriginal and Torres Strait Islander communities can promote the purchase of healthy food and beverages and reduce the sale of less healthy food and beverages [13–17].

Effective implementation of food retail strategies requires a mechanism to classify the healthiness of food and beverages available, in order to appropriately target strategies. Most previous food retail-based strategies in remote Aboriginal and Torres Strait Islander communities aimed at incentivising healthy food and beverages, and/or disincentivising less healthy products have targeted product categories such as fruit and vegetables, water, sugar-sweetened beverages, or selected types of discretionary foods [14, 17]. The application of strategies to whole product categories such as these is relatively straightforward and may not require a classification system to support implementation. However, strategies that aim to target a wide range of products, for example all healthy food and beverages available in stores, require a system to distinguish between healthy and less-healthy products, that enables consistent classification, and minimises error.

A number of systems exist for the healthiness classification of food and beverages, including systems underpinned by nutrient profiling, food processing levels,

and food-based classification [18–21]. The Australian Dietary Guidelines are a food-based classification system, underpinned by nutrient value data, that provide population-level recommendations on food groups, types and amounts, and dietary patterns to support health and reduce the risk of diet-related disease [20]. The Thumbs Rating system is a healthiness classification system that was developed to underpin the Good Tucker App (GTA); a smartphone app developed for use in Aboriginal and Torres Strait Islander communities in response to community identified need for a simple means of identifying healthy food and beverages at the point-of-sale (POS) [21]. The app is linked to The George Institute of Global Health's FoodSwitch database and allows users to scan product barcodes and receive interpretive information on the healthiness of the product. The Thumbs Rating also uses a food-based logic and the rating is derived from the product's Health Star Rating (HSR), which is underpinned by nutrient-profiling logic that considers energy, saturated fat, total sugars and sodium, as well as protein, fibre and FVNL (fruit, vegetable, nut and legume) content of some products [18, 22, 23]. The Thumbs Rating system applies an additional discretionary food filter, based on the Australian Bureau of Statistics definition [22]. The Thumbs Rating system assigns a 'double thumbs up' to core foods with a HSR of  $\geq 4.5$  and a 'thumbs up' to core foods with a HSR of 3.5 or 4.0. A 'thumbs sideways' is assigned to core foods with a HSR of  $\leq 3.0$  and discretionary foods with a HSR of  $\geq 3.5$ , and a 'thumbs down' to discretionary foods with a HSR of  $\leq 3.0$  [21]. Recent literature has shown the Thumbs Rating system to be superior to the HSR in accurately identifying healthy and unhealthy food and beverages, due to the application of its discretionary filter [24].

In Australia, healthiness classification systems are used by manufacturers in food labelling, such as the voluntary HSR program however, to the authors' knowledge, such classification systems have not been integrated into food retail POS systems. Systems to identify healthy and/or less healthy products within POS systems would enable automated classification of a broad range of products, which could provide a tool to support food retail research, practice and policy. In the absence of automated classification mechanisms within POS systems, manual processes to classify the healthiness of products are required. This study aims to assess (i) the feasibility of an expert-informed process to identify healthy food and beverages in remote food retail POS systems applied in a discount card study by exploring implementation, practicality and acceptability to stakeholders, and (ii) the

validity of the expert-informed process, by comparing the healthiness classification of products via the expert-informed process with the Thumbs Rating system. As there is no established gold standard classification system for identifying healthy food and beverages in remote food retail POS systems, the Thumbs Rating system was used as the comparator due to its validity and superiority compared with the HSR system, its relevance to remote food retail stores, and the fact that the tool is linked to price look up (PLU) codes [24].

## Methods

### Study design

This study used a convergent mixed methods design to assess the feasibility and validity of the expert-informed process to identify healthy food and beverages in remote food retail POS systems [25]. Feasibility and validity data were collected and analysed separately and were brought together at the data interpretation stage to understand whether the process should be recommended for future use.

### Ethics

This research was conducted with the approval of the Central Australian Human Research Ethics Committee (CA-20-3701) and The University of Queensland Human Research Ethics Committee (2020/HE000636).

### Research context

#### The discount card study

The expert-informed process was developed in 2021 as part of a broader food security study, aimed to evaluate the impact of a price discount on healthy food and beverages on the diet quality of women and children, and affordability of a healthy diet, in remote Aboriginal and Torres Strait Islander communities [26]. The discount card study design has been reported elsewhere [26], and its outcomes are yet to be reported. To apply the discount to eligible products in remote food retail stores, the ‘expert-informed process’ was developed to identify healthy food and beverages in remote food retail POS systems (see Fig. 1).

#### Stakeholders involved in the ‘expert-informed process’

The ‘experts’ who developed the expert-informed process (described below) refers to a working group of researchers and public health nutrition professionals, who oversaw the design of the discount card study. ‘Project team

members’ were the research and Aboriginal Community Controlled Health Organisation staff responsible for the implementation of the discount card study in remote communities. ‘Store team members’ were employees of participating stores organisations who had a role in implementing the expert-informed process in their community store.

### Expert-informed process

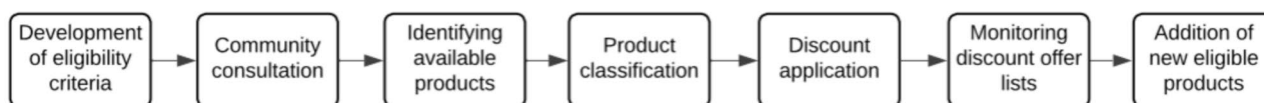
#### Development of discount eligibility criteria

Criteria for discount eligibility were developed by a project working group comprised of researchers and public health nutrition experts. The criteria was informed by two key Australian Dietary Guideline resources; the Aboriginal and Torres Strait Islander Guide to Healthy Eating and the Infant Feeding Guidelines [27, 28]. Fresh, frozen, and non-perishable healthy products were included. Eligible food and beverages included the following seven categories: fruit, vegetables and legumes; lean meat and alternatives; dairy; wholegrain breads and cereals; healthy fats and oils; healthy infant foods; and ‘other’ (products that were not categorised in one of the other six categories).

Additional context-specific criteria were developed by the working group and overlaid on the Australian Dietary Guideline criteria. Healthier alternatives of products, where they existed, were selected for discounting to support a change in the primary outcome of the study; diet quality, as measured by a validated diet quality assessment tool [29]. For example, white bread was classified as ineligible for discount while wholegrain varieties were eligible. Additional inclusion of products that were not necessarily the healthier alternative within a product range, but were still considered healthy, were included where the healthier alternative was not readily available in remote stores. For example, wholemeal pasta was considered the healthier alternative, however was not readily available in remote stores, therefore white pasta was included.

#### Community consultation

At the outset of the discount card study the project team engaged with local Community Advisory Groups to inform the selection of food and beverages for discounting in their community store, based on project criteria. Community Advisory Groups comprised Aboriginal and Torres Strait Islander community members who were



**Fig. 1** Overview of the expert-informed process to identify healthy food and beverages in remote POS systems

part of existing community governance or reference groups, such as health boards and staff, and provided oversight of the broader food security study in participating communities. After feedback was received from one community to include all healthy food and beverages available in the store, a process was implemented to identify eligible products from all available products in stores to allow for the greatest range of products to be offered for discounting, in all participating communities.

#### **Identifying available products**

Product files from five stores were provided for the project team to identify eligible products for discounting from. The product files included product descriptions, Price Look Up (PLU) codes (barcodes), and category/commodity information. Two of the product files had been filtered by store team members, based on project criteria, prior to being provided to the project team for further assessment.

#### **Product classification**

The Thumbs Rating system was considered for use for identifying eligible products, however there were concerns regarding application of the specific project criteria using this system [24]. Hence, manual classification of products was conducted. Products were manually classified by two project team members with nutrition expertise and experience with store files, from product descriptions. Products were classified as either eligible (healthier products) or ineligible (less healthy products) for discounting, according to project criteria. Internet searches for product information were required when product descriptions alone were insufficient to inform classification. At the time of classification, two project team members were visiting participating communities and able to sight products which were difficult to classify from their description (for example cuts of meat) to inform classification.

#### **Discount application**

The lists of eligible products (hereafter referred to as 'discount offer lists') were provided by the project team to stores and were loaded by stores or their POS vendor into their POS system for discount application. The PLUs of eligible products were flagged in POS systems to receive the discount, activated by scanning the discount card.

#### **Monitoring of discount offer lists**

Fortnightly discount card purchase reports were reviewed by the project team to monitor discount application and use. Access to the reporting software utilised by all except one participating store was provided to the project team, enabling direct access to project reports. The reports were manually scanned to identify any new

eligible products i.e., products that had been missed in the initial identification process or new products added to the store range.

#### **Addition of new eligible products**

New eligible products that were identified by the project team through monitoring of sales reports were requested to be added to the discount offer by stores. Additionally, stores were able to request new products to be added by seeking approval from the project team, and then adding to the discount offer.

#### **Feasibility assessment**

##### ***Participants***

Purposive sampling was used to recruit participants who were involved in the expert-informed process. This included project and store team members who were involved in at least one of the three main steps in the process; the identification of eligible food and beverages for discounting according to project criteria, loading the discount offer lists for application of the discount in POS systems, and maintenance of the discount offer lists during the study period. Snowball sampling was used to identify additional eligible participants.

##### ***Data collection***

An interview guide to facilitate semi-structured interviews was developed for this study (see Supplementary File 1), informed by Bowen et al.'s feasibility framework, including the areas of focus deemed relevant to the research question and the scope of this study; implementation, practicality and acceptability [30]. Interview questions were mapped against these areas of focus, and background questions relating to the participant's position and role in the expert-informed process. Due to the small and niche target sample, the interview tool was not able to be piloted, however interview questions were reviewed during the interview process, with minor amendments made. Semi-structured interviews were conducted by the first author via videoconference or in-person. Participants provided informed verbal consent to participate at the start of the interview, and the interviews were audio-recorded. The audio files were professionally transcribed.

##### ***Data analysis***

A six-stage approach to data analysis was conducted, informed by Braun et al.'s thematic analysis framework which was designed for flexibility of thematic analysis within a deliberate and rigorous approach. The six-stages are; (1) data familiarisation, (2) coding, (3) searching for themes, (4) reviewing themes, (5) defining themes, (6) writing up [31]. Interview transcripts were checked for accuracy against audio files, with minor amendments

made, and then imported into NVivo (version 12.7.0, QSR International) for coding. A deductive approach to coding was used, with allowance for codes to be inductively developed from the data as required. A codebook of initial codes was developed, mapped against the areas of focus defined in Bowen et. al's feasibility framework. Two interviews were blind cross-coded by two of the members of the research team (EC, EMc, JB), with codes reviewed and consensus reached. The remaining six interviews were coded by one member of the team (EC). Thematic analysis was conducted, with data mapped against three areas of focus; implementation, practicality and acceptability. The main findings were then synthesised and are reported here across the three main steps of the process and in overall feedback and recommendations.

### Validity assessment

#### Data collection

**Thumbs rating classification** Product lists provided by stores were consolidated to form a master list of all products that were assessed via the expert-informed process for discount eligibility. Duplicates, non-food products, and non-packaged products were removed. The refined list of PLUs was then matched by The George Institute to the FoodSwitch database to obtain the corresponding Thumbs Rating.

**Data analysis** For the purpose of assessing alignment between the two systems, a Thumbs Rating of 'thumbs down' or 'thumbs sideways' equated to ineligible, and a 'thumbs up' or 'double thumbs up' equated to eligible. Additionally, the number of products that did not have a Thumbs Rating was assessed to indicate the products that would require manual classification if the Thumbs Rating system was applied as a classification system.

Statistical analysis was performed in Stata (version Stata/BE 17.0, StataCorp). Cohen's kappa efficient ( $k$ ), a measure of inter-rater reliability, was performed to measure the pairwise agreement between the expert-informed process classification and the Thumbs Rating classification. Agreement between the two systems was assessed using the following  $k$  statistic cut-offs;  $\leq 0$  = no, 0.01–0.20 = slight, 0.21–0.40 = fair, 0.41–0.60 = moderate, 0.61–0.80 = substantial, 0.81–0.9 = near perfect [32]. To explore misalignment by product types, misaligned products were coded to the seven product categories used to categorise eligible products in the discount card study: 'fruit'; 'vegetables and legumes'; 'meat and alternatives'; 'dairy'; 'breads and cereals'; 'fats and oils'; 'infant foods'; and 'other'.

**Positionality of researchers** All authors of this study are non-Indigenous health professionals, who have an inter-

est in supporting nutrition outcomes in Aboriginal and Torres Strait Islander communities, through social justice approaches. EC, JB and MF were members of the working group overseeing the discount card study. EC had a minor role (the identification of some eligible food and beverages for discounting according to project criteria) in the expert-informed process, while MF had a greater role in the process (the identification of eligible food and beverages for discounting according to project criteria, and oversight of loading the discount offer lists for application of the discount in POS systems, and maintenance of the discount offer lists during the study period). To reduce any bias related to positionality, MF did not contribute to the initial coding and thematic analysis of interviews. The positioning of the lead author, and data collector, in this study has allowed for a deeper understanding of the feedback provided by stakeholders due to contextual understanding of the novel process being reviewed. JB co-conceptualised and co-developed the Thumbs Rating system and GTA and continues to co-lead research and practice relating to its use.

### Results

#### Feasibility assessment

Eight interviews were conducted with project team members ( $n=3$ ) and store team members ( $n=5$ ). Project team members were primarily involved in the classification of products to determine eligibility for the discount and monitoring and maintenance of the discount offer lists during the study period. Store team members were predominantly involved in loading the discount offer lists into their store POS systems, usually with support from their POS vendor.

#### Product classification

The process to classify products according to project criteria for discount eligibility was reported to be largely inefficient, labour-intensive and potentially error prone due to the need to manually classify a large number of products from product descriptions in store files. The absence of specifying parameters for product files being provided by stores resulted in working across different product file formats, adding to inefficiency of the process. Challenges in classifying products, such as meat, from descriptions were identified, though this was alleviated to some extent by project team members who could sight products in stores. While such challenges were experienced by project team members involved in this step of the process, store team members appreciated that product classification was managed by the project team as it resulted in minimised burden on stores and increased perceived consistency in classification by having the same people classifying the products across all stores.

Feedback on the criteria applied to product classification included that the criteria for particular products were not in line with products available to the retailer and customer preference. For example, only yoghurt products with no added sugar were eligible for discount, however it was reported that it is difficult to obtain from suppliers and not often chosen by customers. It was also reported that the criteria were too strict in some areas and did not include particular products that should be promoted as healthier options to customers, for example snack items such as tuna and crackers and cheese and crackers, when compared with alternative products.

#### ***Discount application***

The process for stores to load the eligible product list into their POS system was reported to be relatively straightforward and efficient for store team members, and able to be implemented using resources already available to them for their core business. However, having external POS vendors support this step of the process received mixed feedback. While having this support reduced burden on store team members, concerns were raised about this resulting in less ability for store team members to provide support to store staff if any issues were to arise with the offer. A disruption to one store's POS system during the process to load the discount caused a delay in customers being served.

#### ***Monitoring and updating the discount offer list***

The process of monitoring and updating the discount offer lists was noted to be inefficient for project team members involved in this step, due to the manual nature of the process and the number of people required in this step of the process. Challenges were identified when the project team were not able to directly access store sales reports due to the store not utilising the software being used by others. It was also reported that sometimes store team members were not aware of the process for new products to be added to the offer. It was reported that there were also sometimes delayed responses by stores to requests from project team members to have new eligible products added to the discount offer.

#### ***Overall feedback and recommendations***

Overall, the process was reported to be implemented successfully to meet its intended outcome. Time was identified as the main resource required for participants to implement the process, as well as access to POS vendors, internal IT and/or data analyst departments, and reporting software for store team members. While project and store team members felt they had the capacity and access to the resources required to implement the process, challenges relating to competing priorities and working to project timelines were noted. Mixed responses were

received regarding perceived appropriateness of the process in its current form. Aspects of the process perceived to be appropriate included: community consultation to inform product selection, communication processes between project and store team members, robust processes to classify products, capacity to apply the discount and monitor the offer via sales reports, and the simplicity of the process for store team members.

Less than half of participants supported the process to be used in future in its current form, while others felt it would likely be unsustainable and unmanageable at a larger scale than the discount card study and would therefore only support it for future use with changes or in similarly sized studies. The primary reasons that the process was not supported for future use included time intensiveness, particularly for project team members involved in manually classifying products and monitoring the discount offer list, and the potential for human error posed by manual product classification. A number of suggestions to improve the current process were made including pre-establishing parts of the process such as parameters and formatting of store product files, targeting whole product categories instead of individual products, and reviewing classification criteria to better align with product availability and products promoted by stores as healthy choices. Suggestions were made to investigate ways to automate the process, both to classify products and to monitor and update the eligible product lists, with one participant suggesting to investigate use of the Good Tucker App Thumbs Rating database to automate classification.

#### ***Validity assessment***

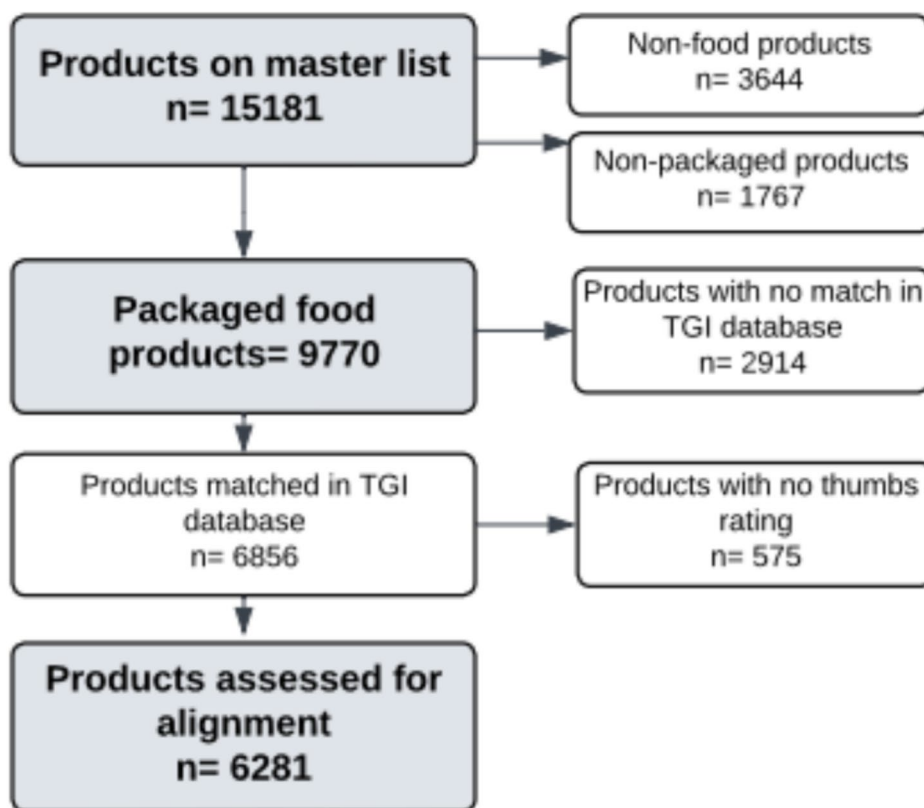
##### ***Products***

Convergent validity was assessed by determining the alignment of product classification via the expert-informed process, with the Thumbs Rating system. The master list of merged product files provided by stores in the food security study contained 15,181 products. Of these, 9770 were unique packaged food products, and of these 6856 were in the FoodSwitch database. Of the products that matched, 6281 returned a Thumbs Rating and were assessed for alignment with the expert-informed process classification (see Fig. 2).

##### ***Alignment***

Of the 6281 products that were assessed 86.2% were aligned and 13.8% were misaligned, between the two classification systems. The kappa co-efficient of 0.64 indicates substantial agreement.

Of the products assessed 19% were classified as eligible by both systems, and 67% were classified as ineligible by both systems. 3% were classified as eligible by the expert-informed process however ineligible by Thumbs Rating



**Fig. 2** Flow chart of products assessed for alignment

**Table 1** Alignment by expert-informed classification and thumbs rating eligibility classification, and expert-informed classification and thumbs rating

Expert-informed process classification	Thumbs Rating eligibility classification, n (%)		Thumbs Rating, n (%)			
	Ineligible	Eligible	Thumbs down	Thumbs sideways	Thumbs up	Double thumbs up
Ineligible	4224 (67%)	<b>636</b> <b>(10%)*</b>	3142 (50%)	1082 (17%)	<b>494</b> <b>(8%)*</b>	<b>142</b> <b>(2%)*</b>
Eligible	<b>231</b> <b>(4%)*</b>	1190 (19%)	<b>10</b> <b>(0.2%)*</b>	<b>221</b> <b>(4%)*</b>	664 (11%)	526 (8%)

Cells with bolded text and a \* indicate misalignment

classification, and 10.1% were deemed ineligible by the expert-informed process however eligible by Thumbs Rating classification (Table 1).

**Misalignment by product category**

Of the 867 misaligned products the highest proportion (42%) were categorised in the ‘other’ category, 21% were ‘dairy’, 15% were ‘breads and cereals’, 7% were ‘meat and alternatives’, 7% were ‘fruit’, 5% ‘vegetables and legumes’, and 3% were ‘fats and oils’ (Table 2).

Misaligned products within the ‘other’ group were predominantly ineligible by the expert-informed process however eligible by Thumbs Rating classification. The

most common products in this group were ready-to-eat meals, including frozen and tinned mixed-meals and tinned and dried soups, as well as beverages including fruit juices and milk-based breakfast beverages. The misaligned products in the dairy category were more evenly split between misalignment type. The most common dairy products that were classified as ineligible by expert-informed classification however eligible by Thumbs Rating classification were flavoured milk beverages and yoghurts containing added sugar, and the most common product classified as eligible by expert-informed classification however ineligible by Thumbs Rating classification were varieties of cheese. The misaligned products in the

**Table 2** Breakdown of misaligned products by product type according to the expert-informed process categories

Category	Total misaligned products, <i>n</i> (%)	No. of products ineligible by the expert-informed process and eligible by Thumbs Rating, <i>n</i> (%)	No. of products eligible by the expert-informed process and ineligible by Thumbs Rating, <i>n</i> (%)
Other	360 (42)	346 (96)	14 (4)
Dairy	181 (21)	74 (41)	107 (59)
Breads and cereals	127 (15)	102 (80)	25 (20)
Meat	64 (7)	44 (64)	20 (31)
Fruit	62 (7)	29 (47)	33 (53)
Vegetables and legumes	47 (5)	37 (79)	10 (21)
Fats	26 (3)	4 (15)	22 (85)
<b>Total</b>	<b>867</b>	<b>636</b>	<b>231</b>

bread and cereals category were largely classified as ineligible by the expert-informed process however eligible by Thumbs Rating, with the common products including some types of white bread and breakfast cereals. A smaller proportion of misaligned products in this category were classified as eligible by the expert-informed process however ineligible by Thumbs Rating classification, with the most common product being white self-raising flour.

## Discussion

Feasibility and validity of an expert-informed process to identify healthy food and beverages in remote store POS systems, as applied in the discount card study [26], were explored via consultation with stakeholders, and by comparing product classification with the Thumbs Rating system. This mixed method approach demonstrated that whilst the expert-informed process was successfully implemented to identify healthier food and beverages in remote store POS systems, it was not an entirely feasible process. Enablers, barriers and general feedback on the process largely corresponded to individual roles and tasks in the process, with product classification, monitoring of the discount offer list and addition of new eligible products posing challenges, while the discount application process was relatively straightforward. The main issues identified were the time and human resourcing required, and the potential for error in manual product classification.

Substantial alignment between classification of products via the expert-informed process applied in the discount card study and the Thumbs Rating system indicates good convergent validity, with the small proportion of misalignment largely explained by the differences in criteria underpinning the two systems, rather than error in classification. That is, the expert-informed process was a food-based system which selected the healthier versions of core foods as eligible, while the Thumbs Rating system is a food-based system that classifies products based on their individual nutrient profile. The majority of misaligned products were in the 'other' food and

beverages category, such as ready-to-eat meals and some fruit juices. This finding is unsurprising as the expert-informed process included only frozen and tinned meals containing vegetables for discounting and selected only water and plain milk as eligible beverages. Similar outcomes were identified for the 'dairy' and 'bread and cereals' category. While trade-offs such as this are important to consider in determining acceptability of any alternative classification process, it should be interpreted in context of this group of misaligned products constituting a very small percentage of the total products assessed for eligibility.

Also, important to consider is the level of manual classification that would be required in addition to use of the Thumbs Rating system if this system was employed for classification. Of the 11,537 food products on the master list, 15% ( $n=1767$ ) were not packaged products and therefore not in the FoodSwitch database (which includes packaged products only), and 25% ( $n=2914$ ) were packaged products that were either not in the FoodSwitch database or did not have a Thumbs Rating. The latter is explained by some product types being excluded from the HSR system, or insufficient product information in the FoodSwitch database for a HSR to be calculated [18]. This means around one-third of food products would need to be classified manually, or by alternative means. However, it should be considered that many non-packaged products, such as fresh fruit and vegetables, are easy to classify manually by whole category and would not need to be classified at an individual product level. The time involved in manually classifying products should also be considered in this trade-off. Regular updating of the GTA product database, ensuring products available in remote stores are included, would help to increase the percentage of products that return a Thumbs Rating.

Effective and feasible classification systems are needed to support the implementation of health-related food retail interventions to achieve public health outcomes. In public health research, practice and policy, where resourcing is limited, time and labour efficiency is important in the design of any food retail intervention.

So, while utilising the expert-informed process or the Thumbs Rating system would achieve a similar outcome in terms of product classification, the application of a manual process such as the expert-informed process in a real-world setting or large-scale public health intervention is not feasible.

### Strengths and limitations

A strength of the feasibility assessment was having stakeholders involved in all stages of the expert-informed process participate in interviews, including both project and store team members. This allowed for an understanding of the implementation, practicality and acceptability of each stage of the process, from varying perspectives, to inform feasibility of the process as a whole. Having a large data set of products included in the validity assessment, generated from remote stores across different regions, suggests that it is likely that the products assessed are representative of products available in remote community stores more broadly, making the findings from this study applicable to other remote stores. While the qualitative and quantitative methods were designed to address separate components of the research question, the findings were integrated and ultimately the validity assessment results were able to inform and lend insight into some of the findings of the feasibility assessment.

A limitation of this work is that there is no established gold standard classification system for identifying healthy food and beverages in remote food retail POS systems, and hence the Thumbs Rating system was used as a proxy gold standard. Additionally, the two systems being compared are underpinned by different logic. While both systems are ultimately food-based systems that are underpinned by nutrient-based profiling or modelling, the expert-informed process applied these criteria to whole food and beverage products, rather than the food-based with nutrient profiling of products as the Thumbs Rating system does.

### Conclusion

The expert-informed process used to identify healthy food and beverages in remote food retail POS systems, applied in the discount card study, was overall successfully implemented, many aspects were considered practical, and it was largely perceived to be appropriate. However, the process in its entirety was not entirely acceptable to all stakeholders. In particular the process to classify food and beverages available in remote food retail stores, via a manual process, was labour-intensive and considered unsustainable. The classification process was thought to be potentially error prone, and though this was not observed in the validity assessment, utilising such a manual system presents risk of human error. Recommendations made by stakeholders included

investigating an automated way to classify products and to monitor eligible product lists in POS systems.

A high level of alignment between the expert-informed process and Thumbs Rating classification of products indicates that (1) the expert-informed process is a valid process to classify the healthiness of products when compared with the existing Thumbs Rating system and (2) using the Thumbs Rating system to classify healthy food and beverages in remote food retail stores would achieve similar outcomes to the expert-informed process in regard to product classification. Based on the findings of both the feasibility assessment, conducted with stakeholders, and the validity assessment, the Thumbs Rating system should be considered for future research strategies in remote food retail settings, where a means of classifying the healthiness of products in POS systems is required. In practice, a classification system embedded within POS systems could support store policy, where requirements target healthy or unhealthy foods, and store practice such as promotional or merchandising strategies, and monitoring. Where outcomes are being sought which rely on specific criteria, like that in the discount card study, the Thumbs Rating system could be applied as the primary means of classification with additional filters or criteria overlaid to meet these specific aims.

### Abbreviations

GTA	Good Tucker App
HSR	Health Star Rating
POS	Point-of-sale

### Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-025-22116-5>.

Supplementary Material 1

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### Author contributions

EC, MF, EMc and JB conceptualised the study, formulated the research question, and designed the study and methodology. EC conducted the data collection, analysed the data, interpreted the findings, and wrote and revised the original manuscript. EMc and JB assisted with data analysis. EMc, JB and MF assisted with data interpretation, and provided critical input into writing of the manuscript. All authors approved the final manuscript.

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**Data availability**

The datasets generated and/or analysed during the current study are not publicly available in line with ethics approval for this context specific data but are available from the corresponding author on reasonable request.

**Declarations****Ethics approval and consent to participate**

This research was conducted with the approval of the Central Australian Human Research Ethics Committee (CA-20-3701) and The University of Queensland Human Research Ethics Committee (2020/HE000636). All participants were provided with a Participant Information Sheet and provided informed verbal consent to participate in the research project. This study was conducted according to the guidelines of the Declaration of Helsinki.

**Consent for publication**

Not applicable.

**Competing interests**

The authors declare no competing interests.

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