



Use of the letter-based grading information disclosure system and its influence on dining establishment choice in Singapore: A cross-sectional study

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ARTICLE INFO

Article history:

Received 3 November 2017

Received in revised form

25 January 2018

Accepted 23 February 2018

Available online 24 February 2018

Keywords:

Food safety

Food hygiene

Information disclosure system

Consumer

ABSTRACT

The aim of this study was to examine the consumer use of Singapore's letter based grading information disclosure system and its influence on dining establishment choice. We used data from a national survey of 1533 households collected from 2012 to 2013 in Singapore to assess (i) the proportion of adults who refer to the letter grade before dining and (ii) the impact of the letter grade on their willingness to dine at an establishment. We used multivariable logistic regression to account for the independent effects of socio-demographic factors. The proportion of respondents who referred to a letter grade before dining was 64.5% (95% confidence interval [CI] = 62.1%, 66.9%). Propensity for referral differed by dining frequency, ethnicity and employment. Fewer respondents were willing to dine at a 'C' (lower) graded establishment [10.3% (95% CI = 8.8%, 11.8%)] compared to a 'B' graded establishment [85.3% (95% CI = 83.5%, 87.0%)]. Willingness to dine at a 'C' graded establishment differed by dining frequency, housing type and citizenship. The letter based grading information disclosure system in Singapore is commonly used among Singaporeans and influences establishment choice. Our findings suggest that information disclosure systems can be an effective tool in influencing consumer establishment choice and may be useful to help improve food safety in retail food establishments. The implementation of such information disclosure systems should be considered in other countries where it has yet to be introduced and be periodically assessed for its effectiveness and to identify areas requiring improvements.

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1. Introduction

Food safety is becoming increasingly important. The World Health Organization estimates that contaminated food causes 600 million individuals to fall ill (approximately 1 in 10 individuals globally), resulting in more than 420,000 deaths annually (World Health Organization, 2015). The economic costs of food-borne illness are substantial. For example, as one of the leading causes of food-borne illness, *Salmonella* is estimated to cost the United States (US) and the European Union (EU) billions of dollars annually (Economic Research Service (ERS) (2015); European Food Safety Authority, 2014). The consumption of food produced outside

homes has increased due to time scarcity (Jabs & Devine, 2006) and as a result, the number of individuals who are more susceptible to food-borne illness is expected to grow (Lund, 2015).

Several food safety strategies have been used to minimise the transmission of food-borne pathogens. Food safety management systems (FSMS) aim to systematically identify and eliminate physical, chemical and microbiological contamination in the production process to ensure that food is safe for consumption (ISO., 2005). Legally mandating FSMS in food establishments has been shown to improve food hygiene standards (Djekic et al., 2016). The implementation of a food safety system can reduce microbiological contamination during the food production process (Cusato et al., 2012). Dining establishment operators can achieve higher hygiene standards with better food hygiene knowledge and more positive attitudes towards food hygiene (Läikkö-Roto & Nevas, 2014). For example, in a hotel setting, food handler training has been

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demonstrated to improve the safety of the food production process (Gomes, Lemos, Silva, Hora, & Cruz, 2014).

One food safety strategy that has been introduced in several high-income countries is the use of public information disclosure systems aimed at influencing where people eat. Such systems aim to reduce the incidence of food-borne diseases by increasing consumer demand for better hygiene standards in dining establishments. While not necessarily mandatory, these information systems usually require dining establishments to publicly display their assessed hygiene standards for consumers and are complementary to the existing regulatory inspection regimes used by public health agencies. Studies have found that posted hygiene grade cards or inspections scores can lead to improvements in the hygiene standards of food establishments (Jin & Leslie, 2009; Vergeris, 2015; Waters et al., 2013; Wong et al., 2015), and that there is a positive consumer attitude towards food safety certification in restaurants (Uggioni & Salay, 2014). Examples of such systems introduced include the “Smiley Scheme” in Denmark in 2001 (The Danish Veterinary and Food Administration, 2017), the Food Hygiene Rating Scheme in the United Kingdom (UK) in 2010 (Food Standards Agency (UK) (2015b)), the restaurant letter grading program in New York City, US in 2010 (McKelvey, Wong, & Matis, 2015) and “Scores on Doors” in New South Wales, Australia in 2011 (New South Wales Food Authority, 2017).

The incidence of reported non-travel related food-borne illnesses in Singapore rose by almost 200% from 15.9 to 47.0 per 100,000 population over a 13-year period (Ministry of Health (Singapore) (2015)). Singaporeans are consuming meals prepared away from homes more than before; almost 2 in 3 dine out at least 4 times a week compared to 1 in 2 more than a decade ago (Health Promotion Board Singapore, 2010). The exact disease incidence attributable to dining establishments is unknown. However, dining establishments are known to be an important source of foodborne diseases (Gormley et al., 2011; Gould et al., 2013; Jones & Angulo, 2006; Park, Kwak, & Chang, 2010) and consumers have to rely on establishments to ensure that the meals that they prepare and sell are safe for consumption.

Singapore introduced its food hygiene grading system in 1997. Public health inspectors from its National Environment Agency (NEA) periodically assess the hygiene standards of each licensed dining establishment. Establishment operators are usually not informed of their visits. The outcome of one of these regulatory inspections is then displayed in the form of a colour coded certificate containing the grade ‘A’, ‘B’, ‘C’ or ‘D’. The prominent display of the assessed grade is legally mandated. An ‘A’ grading is the highest that can be awarded, while ‘D’ is the lowest and signifies the minimum standard of food hygiene for business continuity. Since 2012, no establishments have been graded ‘D’.

Despite being one of the primary measures implemented to ensure food safety, the consumer use of Singapore’s food hygiene grading system has not been examined. In this analysis of survey data collected from 2012 to 2013, we examined consumers’ use of the information disclosure system in Singapore and its influence on their choice of dining establishments. We also assessed consumer attitudes, perceptions and practices of dining out and food safety.

2. Materials and methods

2.1. Study population

Singapore is a city-state with an estimated multi-ethnic population of 5.6 million, of which approximately 3.4 million are Singaporean citizens and 0.5 million are permanent residents (Department of Statistics Singapore, 2017). There are more than

37,000 licenced food establishments (Ministry of Environment and Water Resources Singapore, 2017), an average of more than 48 per square kilometre. Licensed establishments include individual food stalls in hawker centres, food courts and coffeeshops, restaurants, takeaway food kiosks and caterers.

2.2. Study design

We obtained data from a household survey that the NEA conducted on the knowledge, attitudes, beliefs and practices of food safety and hygiene of Singaporeans from 2012 to 2013. The aim of the survey was to collect household information to identify opportunities for improvement in food hygiene and safety programmes. The NEA obtained a random sample of 1700 household addresses from the Government Department of Statistics Singapore and sent a letter of notification to each of them in the four main languages used in Singapore (English, Chinese, Malay and Tamil) to inform them of the purpose of the survey and to provide assurance on data confidentiality. The NEA outsourced the data collection to a market research company and both were responsible for training bilingual (English and one other main language) interviewers to conduct the face-to-face surveys using structured questionnaires that had been pretested in a pilot face-to-face survey on 50 individuals. Survey respondents were randomly selected from each household by choosing the adult with the nearest upcoming birthday. Respondents were given a S\$5 voucher for their time. The questionnaire comprised 14 close-ended questions on attitudes, perceptions and practices of dining out and food safety, including factors related to dining establishment choice and dining frequencies; and 10 socio-demographic questions: age, citizenship, gender, ethnicity (according to the ethnic groups defined by the government), education, marital status, number of children, employment status, income level and housing type (categorised as public or private housing). Respondents were asked to rank 7 choice factors: (i) cleanliness, (ii) taste, (iii) food hygiene practices of staff, (iv) price, (v) service quality, (vi) recommendations and (vii) hygiene grading, in order of importance for each of the categories of dining establishments. Categories of dining establishment included: (i) hawker centres, (ii) coffeeshops and canteens, (iii) food courts, (iv) restaurants and cafes, (v) food kiosks, (vi) bakeries and cake shops, and (vii) caterers. A rank score of ‘1’ signified the most important factor while ‘7’ signified the least important factor, except for caterers in which the cleanliness and food hygiene practices of staff could not be observed and only 5 factors were ranked.

2.3. Study measures

We analysed two main outcome measures: (1) referencing the food hygiene grade before patronising a dining establishment; and (2) willingness to patronise a ‘C’ graded dining establishment (‘C’ being the lowest grade currently given). For the first outcome measure, respondents who either “agreed” or “strongly agreed” with the statement “I always look at the grading of the food establishment before patronising it” were considered as those who referenced the assessed grade. For the second outcome measure, it was assumed that all respondents would dine at the highest ‘A’ graded establishments. For each of the 7 categories of food establishments, respondents were first asked if they would dine at a ‘B’ graded establishment. Those who would were then asked if they would also dine at a ‘C’ graded establishment. Binary variables were created to reflect the proportion of respondents who were willing to dine at (i) any ‘B’ and (ii) any ‘B’ or ‘C’ and a test for difference in proportions carried out if applicable.

2.4. Statistical analysis

We present descriptive statistics for each independent demographic variable and the responses to questions about food safety perceptions. We also present mean rank scores for factors associated with establishment choice. We used housing type and employment status as proxies for socioeconomic status as there was inadequate data on income (38% of respondents did not provide this). Where appropriate, categorical variables were collapsed for reporting and inclusion in the models (see Supplemental File). We used multivariable logistic regression, which is appropriate for assessing the relationship between a dependent categorical variable and multiple independent categorical or continuous variables (Wiest, Lee, & Carlin, 2015). The outcome measures in our study were dichotomous dependent variables while all the sociodemographic and establishment specific dining frequency variables that were assessed were categorical. We coded the first dependent variable that represented referencing the food hygiene grade before patronising an establishment as ‘1’ if a respondent referenced the grade and ‘0’ otherwise. We coded the second dependent variable that represented willingness to dine at a ‘C’ graded establishment as ‘1’ if a respondent was willing to dine and ‘0’ otherwise. We used the Likelihood Ratio Test (LRT) to determine the associations between each outcome measure (dependent variable) and the independent variables representing the socio-demographic factors and establishment specific dining frequencies. The measure of effect for each independent variable on the dependent variable in the multivariable model was expressed as an adjusted odds ratio (AOR). Statistical significance was evaluated at the 5% level. We retained independent variables in the final model for each outcome measure only if they were significantly associated. LRT p-values, stratum specific AORs and 95% CIs for the effects of independent variables were presented. All analyses were performed using STATA 12.1 software (StataCorp, USA).

3. Results

3.1. Participant characteristics

A total of 1533 respondents participated in the study (90.2% response rate). The majority of participants were Singaporean (89.9%), of Chinese ethnicity (77.4%), lived in public housing (83.0%) and had secondary education or higher (92.6%). Slightly less than half of them were male while about a third of them were not employed. The characteristics of the study population are summarised in Table 1.

Hawker centres and coffeeshops/canteens were frequented most, with more than 85% of respondents dining there at least 1–3 times a week (see Fig. 1). Bakeries/cake shops were the least frequented, with more than 99% of respondents reporting a dining frequency of 2–3 times a month or less.

3.2. Food hygiene perceptions and establishment choice factors

Few respondents (0.9%; n = 14) perceived the food hygiene standards in Singapore to be “poor” or “very poor”. Approximately 42% (n = 639) perceived the standards to be “good” or “very good”, while the remaining 57.4% (n = 880) perceived them to be “average”. The majority of respondents (96.4%; n = 1479) either agreed or strongly agreed with the statement “I am confident that eating out is safe as the Government licences all the food establishments”, while the remaining 3.5% (n = 54) disagreed or strongly disagreed with it. When asked about reporting unhygienic practices to the NEA, 83.7% (n = 1283) disagreed or strongly disagreed that they would do so, while the remaining 16.4% (n = 250) agreed

Table 1
Socio-demographic characteristics of study population in Singapore, 2012–2013.

| Description of Variables and Categories | Number (%) |
|---|--------------|
| <i>Socio-demographic characteristics</i> | |
| Citizenship | |
| Singaporean | 1378 (89.9%) |
| Permanent Resident | 155 (10.2%) |
| Age in Years | |
| 18–29 | 271 (17.7%) |
| 30–39 | 307 (20.0%) |
| 40–49 | 358 (23.5%) |
| 50–59 | 328 (21.4%) |
| 60–65 | 269 (17.6%) |
| Gender | |
| Female | 823 (53.7%) |
| Male | 710 (46.3%) |
| Ethnicity | |
| Chinese | 1187 (77.4%) |
| Malay | 133 (8.7%) |
| Indian | 155 (10.1%) |
| Others | 58 (3.8%) |
| Housing Type | |
| Public Executive/Non-Public | 260 (17.0%) |
| Public (1–2, 3, 4 or 5 Room Flat) | 1273 (83.0%) |
| Marital Status | |
| Single | 428 (27.9%) |
| Married | 1056 (68.9%) |
| Separated, divorced or widowed | 49 (3.2%) |
| Number of Children | |
| None | 557 (36.3%) |
| 1 | 221 (14.4%) |
| 2 | 529 (34.5%) |
| ≥3 | 226 (14.7%) |
| Highest Educational Qualification | |
| Primary or Lower | 114 (7.4%) |
| Secondary | 624 (41.4%) |
| Post-Secondary, Diploma or Professional Qualification | 494 (32.2%) |
| Degree or Higher | 291 (19.0%) |
| Employment Status | |
| Not Employed | 534 (34.8%) |
| Employed | 999 (65.2%) |

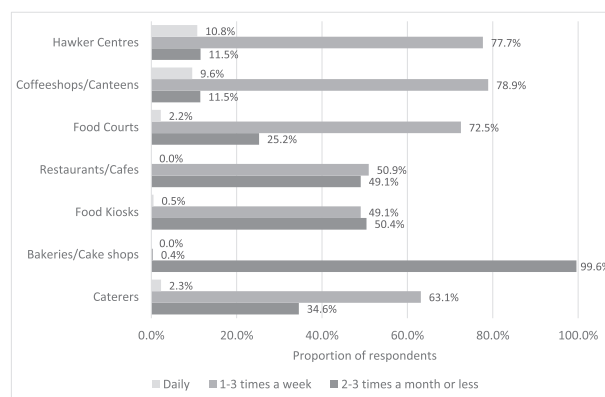


Fig. 1. Establishment dining frequencies of study population in Singapore, 2012–2013.

or strongly agreed that they would do so. Approximately two-thirds (66.0%; n = 1012) reported that they were willing to visit a food

establishment even if they received negative comments about the cleanliness and hygiene standards from people they knew. A summary table of the results is available in the Supplemental File.

Dining establishment cleanliness (mean rank score: 2.31, SD: 0.69), food taste (mean rank score: 2.72, SD: 1.04) and food hygiene practices of staff (mean rank score: 2.83, SD: 0.86) were the top three establishment choice factors for respondents across all categories of establishments. Comparatively, food price (mean rank score: 3.78, SD: 1.27), establishment service quality (mean rank score: 4.82, SD: 0.89) and recommendations (mean rank score: 5.62, SD 0.79) were ranked lower. The assessed hygiene grading of a dining establishment was the lowest ranked factor (mean rank score: 5.90, SD: 1.00).

3.3. Referencing food hygiene grades

Sixty-five percent [64.5% (95% CI = 62.1%, 66.9%); n = 989] of respondents indicated that they would always refer to the assessed hygiene grade before patronising an eating establishment. After multivariable adjustment, the strongest associations that remained were related to ethnicity and dining frequency (see Fig. 2). Malay ethnicity was strongly associated with higher odds of referencing grades compared to Chinese ethnicity [AOR: 2.59, (95% CI = 1.65, 4.06)]. We also found that respondents had lower odds of

referencing grades if they reported dining daily at hawker centres [AOR: 0.50, (95% CI 0.35, 0.72)] and food courts [AOR: 0.42, (95% CI = 0.20, 0.89)] compared to those that dined there 1–3 times a week (summary of results in Supplemental File).

3.4. Willingness to dine at establishments of different assessed grades

Approximately 85% (95% CI 83.5%, 87.0%; n = 1303) of respondents reported willingness to dine at any 'B' graded establishment. When 'C' graded establishments were considered, only 10.3% (95% CI = 8.8%, 11.8%, n = 158) reported willingness to do so. The difference in proportions was statistically significant ($p < 0.01$). After multivariable analysis, the strongest associations that remained were related to dining frequency (see Fig. 3). Compared to those who reported dining 1–3 times a week, the odds of reporting willingness to dine at any 'C' graded establishment were higher in those who reported dining daily at hawker centres [aOR: 2.75 (95% CI = 1.68, 4.48)] and coffeeshops/canteens [AOR: 2.44, (95% CI = 1.44, 17.20)]. Those who reported dining 2–3 times a month or less frequently at food kiosks were also more likely to report willingness to dine at a 'C' graded establishment [AOR: 5.04 (95% CI = 3.21, 7.90)]. Besides establishment dining frequencies, we found that the odds of reporting willingness to dine at any 'C'

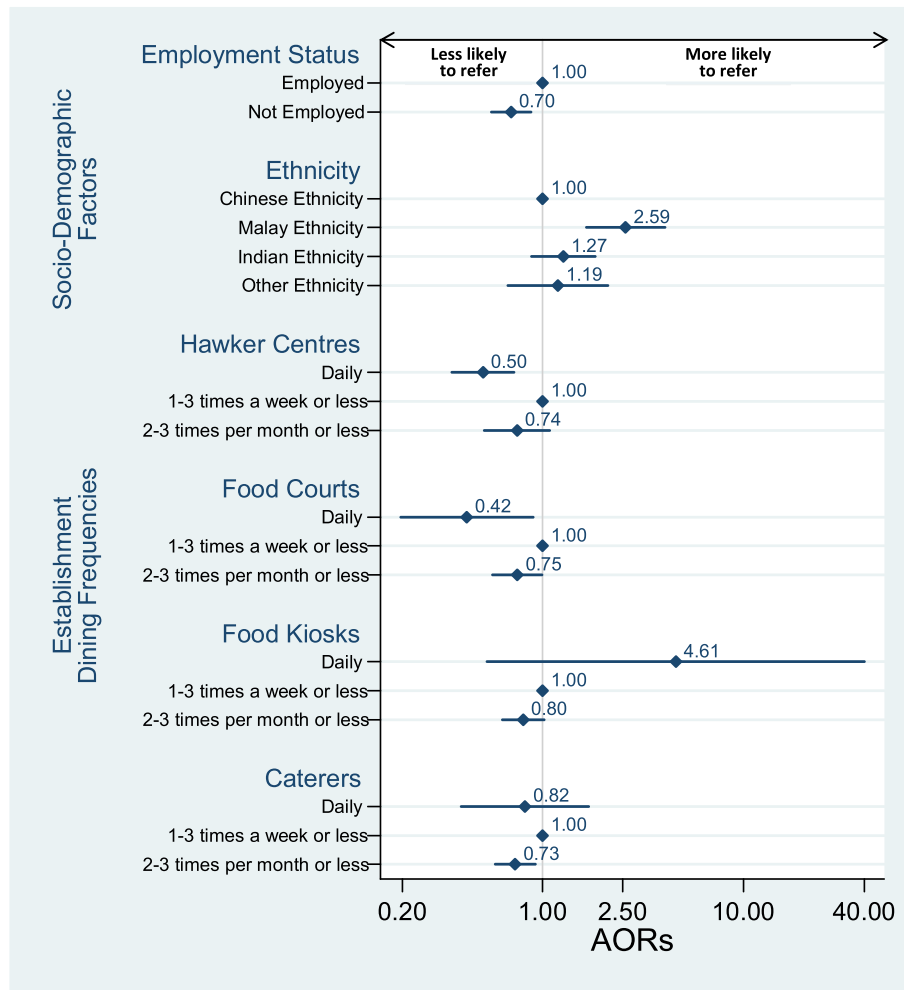


Fig. 2. Adjusted ORs for factors associated with referencing assessed hygiene grades before patronising a food establishment in Singapore, 2012 to 2013. The diamonds indicate the point estimates and the horizontal navy blue lines indicate the 95% confidence intervals for those estimates. The vertical grey line indicates the null value of 1.00. Reference categories are indicated with a value of 1.00. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

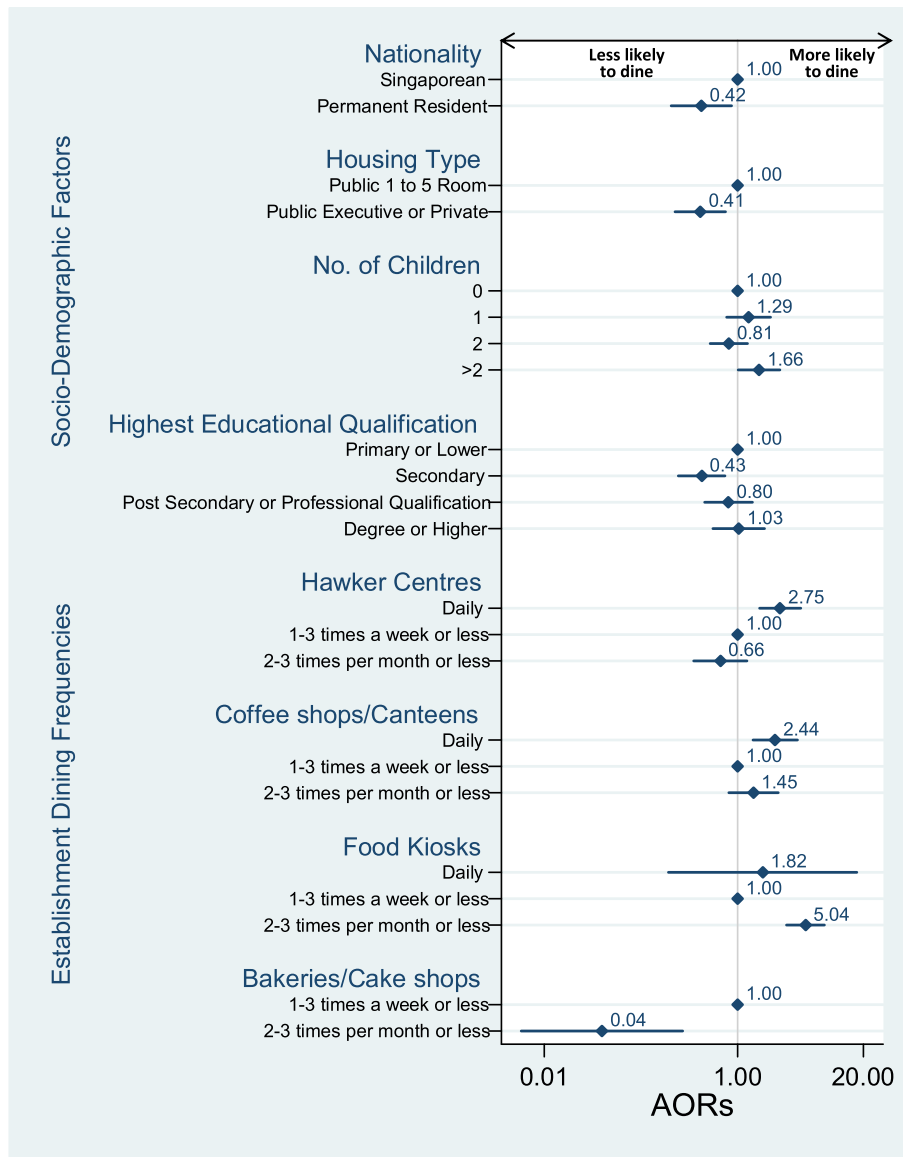


Fig. 3. Adjusted ORs for factors associated with willingness to dine at a 'C' graded food establishment in Singapore, 2012 to 2013. The diamonds indicate the point estimates and the horizontal navy blue lines indicate the 95% confidence intervals for those estimates. The vertical grey line indicates the null value of 1.00. Reference categories are indicated with a value of 1.00. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

graded establishment were higher in those that reported living in Public (1–2, 3, 4 or 5 Room Flat) housing [AOR: 2.33 (95% CI = 1.27, 4.27)] compared to those that did not, and also higher in those that had 3 or more children [AOR: 1.66 (95% CI = 1.01, 2.72)] compared to those who had none. Respondents who had lower odds of reporting the willingness to dine at a 'C' graded establishment reported secondary education as the highest qualification [AOR: 0.43 (95% CI = 0.24, 0.74)], being a permanent resident in Singapore [AOR: 0.42 (95% CI = 0.21, 0.87)] and dining 2–3 times a month or less frequently at bakeries/cake shops [AOR: 0.04 (95% CI = 0.01, 0.27)] (summary of results in Supplemental File).

4. Discussion

In this cross-sectional study, we examined the consumer use of the letter based grading information disclosure system and its influence on dining establishment choice in Singapore. Our study suggests that the majority of Singaporeans use the letter based

grading information disclosure system in Singapore and discriminate their patronage of dining establishments according to the assessed letter grading. We also found that population socio-demographic factors accounted for differences in its use and influence. Public information disclosure systems have been used by health authorities with the aim of influencing consumer dining establishment choice and consequently induce consumer demand for better food hygiene standards. Our study findings add to the growing body of evidence which supports the complementary use of non-regulatory measures in reassuring diners of food safety in dining establishments (Uggioni & Salay, 2014; Wong et al., 2015) and improving food hygiene standards (Jin & Leslie, 2009; Vergeris, 2015; Waters et al., 2013; Wong et al., 2015).

To date, few studies have assessed the consumer use of information disclosure systems aimed at influencing establishment choice. Evidence from such studies can inform the development and evaluation of interventions designed to improve food hygiene standards in dining establishments. In a cross-sectional survey of

adults in the UK in 2012, 10% of respondents used an information disclosure scheme in deciding whether to patronise an establishment (Taylor Nelson Sofres-British Market Research Bureau Limited, Policy Institute Studies (UK), University of Westminster, & Food Standards Agency (UK), 2015a,b). Another study in the US found that only 6.6% of respondents reported using a restaurant inspection report every time or almost every time in establishment choice (Jooho, Jing, & Almanza, 2017). In our study, we estimated that the proportion of respondents who would always check the letter grade before patronising a dining establishment was 64.5%, consistent with a previous Singaporean study (60.7%) (Choi, MacLaurin, Cho, & Hahm, 2010). The larger estimate in referrals in our study compared to those in other countries may be attributed to the level of awareness of such information schemes, or cultural differences in establishment choice considerations, or differences in the level of any bias in self-reporting between studies. Compared to respondents of Chinese ethnicity, those of Malay ethnicity were more likely to reference the assessed grade before dining at an eating establishment. Greater focus on messaging in both English and Chinese languages could be considered for the non-Malay ethnic population of consumers. Respondents who were not employed were less likely to report that they would reference the assessed grade. This may be because the importance of dining at a more affordable establishment exceeds that of its assessed hygiene standards.

Similar to other studies in the UK, the US and Turkey (Aksoydan, 2007; Harrington, Ottenbacher, & Way, 2013; Lee, Niode, Simonne, & Bruhn, 2012; Taylor Nelson Sofres-British Market Research Bureau Limited et al., 2013), we found that cleanliness was one of the most important factors in consumers' choice of the majority of establishments. The importance of cleanliness to participants suggests that their perceived risk of food poisoning acquisition from unsanitary premises was an important factor affecting their choice. Surprisingly, the assessed hygiene grading was ranked as the least important factor in the present study but was consistent with the finding from another study where the assessed hygiene grade/score is among the lower ranked factors (Taylor Nelson Sofres-British Market Research Bureau Limited et al., 2013). A study found that consumers in Canada use a range of observable indicators as proxies for the experience and/or credence characteristics associated with food safety hazards (Henson et al., 2006). These indicators include the consumer's own observation on standards of hygiene, broader concepts of restaurant quality, levels of patronage and external sources of information, of which official inspection certificates form one part. It is plausible that Singaporean consumers use visual cues to assess the standard of hygiene in an establishment as opposed to using the assessed grade which may not be entirely reflective of the standard at the time of patronage.

A public information disclosure system can be considered an effective one if it discriminates consumer patronage at establishments with relatively lower food hygiene standards. Our study results are reassuring and reflect the ability of the letter based grading system in Singapore to influence dining establishment choice - we found that most respondents favoured well graded establishments over the more poorly graded ones. Only a small proportion of respondents were willing to dine at poorly graded establishments. Our results are consistent with an earlier study carried out in California which showed that respondents were least likely to dine at a 'C' graded restaurant compared to better graded ones (Seiver & Hatfield, 2002). These findings were also in agreement with those from a population-based cross-sectional survey on the use of the food hygiene rating scheme carried out in the United Kingdom in 2015 (Food Standards Agency (UK) (2015a).

Respondents who lived in public housing were more likely to report that they were willing to dine at a 'C' graded establishment.

This may suggest that respondents with relatively lower disposable income levels value other factors such as affordability more highly. Respondents who reported having three or more children were also more likely to report that they were willing to dine at a 'C' graded establishment. It is possible that larger families may accord convenience as a more important factor in establishment choice. Educational initiatives aimed at reinforcing the use of the system could be prioritized in housing estates associated with relatively lower income levels and at larger families. Respondents with secondary education were less likely to dine at a 'C' graded establishment compared to those with primary education. Individuals with higher levels of education have been associated with better food hygiene knowledge (Mullan, Wong, Todd, Davis, & Kothe, 2015). However, this association was not straightforward as it was not found for higher levels of education in the present study. Indeed, people with higher education have also sometimes reported poorer food safety practices than those with lower or no education (RØSsvoll et al., 2013).

In several categories of food establishments, daily consumer dining was associated with a lower propensity to reference the assessed grade and a greater willingness to patronise any poorly graded establishment. These findings were not surprising, given that frequent diners of restaurants have been found to be less concerned about food safety compared to those who dined infrequently (Knight, Worosz, & Todd, 2009). However, the present study also found that infrequent diners (2–3 times a month or less frequent) of food courts and catering establishments were less likely to refer to the assessed hygiene grade, and infrequent diners of food kiosks were also more likely to dine at 'C' graded ones, indicating that some infrequent diners may also either be less concerned or knowledgeable about food safety. Initiatives to reinforce the awareness and use of the information system could be prioritized at hawker centres and coffeshops/canteens which are more frequent choice venues for daily diners.

Despite the demonstrated utility of such information disclosure systems, they may be limited in their influence over the hygiene standards of food establishments that have strong patronage linked to other important consumer choice factors such as price and taste. The internet has also been used effectively as a tool to spread consumer dissatisfaction (Aguar et al., 2018), demonstrating its potential to improve food safety and quality. Where appropriate, other tools such as social media can play an important role in communicating and influencing food safety (Peng, Li, Xia, Qi, & Li, 2015). Negative social media comments have been found to significantly increase food safety risk perceptions and reduce behavioral intentions of consumers compared with mixed or positive comments (Frewer et al., 2015). Given that almost 80% of the Singaporean population use smart devices to access the internet (Infocomm Development Authority of Singapore, 2017), we suggest developing an app which features information on recent critical hygiene violations committed by food establishments and allows consumers to enter their establishment specific views on the observed cleanliness and hygiene for other app users to view.

Our study has several strengths. The sample was large and nationally-representative ($n = 1700$). The response rate was in excess of 90%, indicating very low potential for selection bias. The use of standardized questionnaires and training of all interviewers would have minimised observer bias. However, common to all cross-sectional studies, participants may have provided socially desirable answers when answering questions (i.e. they may be more willing to dine at a relatively poorer graded restaurant and may look less often at the food hygiene grading that indicated). For future studies, one way to attempt to address this could be through the use of a smartphone based food diary app that facilitates the capture of the assessed grades of eating establishments and helps

keep records of establishments at which respondents dined.

5. Conclusions

Public information disclosure systems can play an important role in ensuring food safety in dining establishments. While it could be expected that consumers prefer to eat in establishments with better hygiene all else being equal, the use and role of the grading system as a way of consumers making this decision had not previously been assessed in Singapore. Ours is the first nationally representative study to provide evidence that consumers refer to the information system in Singapore and that the letter-grading information disclosure system positively influences their self-reported choice in eating establishments. Our findings suggest that such national public information disclosure systems can be an effective means of improving food safety in dining establishments and complement the regulatory measures of public health authorities. Several socio-demographic factors were important influencers in the use of the information disclosure system and should be taken into account in the design and implementation of such systems. The implementation of such information disclosure systems should be considered in other countries where it has yet to be introduced. However, such systems should also be periodically assessed for its effectiveness and to identify areas requiring improvements. Incorporating recent information on establishment cleanliness and its recent critical hygiene violations may increase its relevance and thus improve its use. Further research is needed to assess which strategies are most likely to improve the use of such information disclosure systems in consumer dining choices.

Contributors

JA conceptualized the study, led the writing of the article, developed the analytic plan, analysed the data and interpreted it.

AEH, ATN & MDK provided feedback on data analysis, contributed significantly to the interpretation of results and revising drafts of the article.

LCN contributed significantly to the analysis, interpretation of results and to revising drafts of the article.

All authors critically revised the article for important intellectual content and approved all components of the final draft.

Ethics approval

This secondary analysis was granted ethical approval by the Human Research Ethics Advisory Panel of the University of New South Wales, Australia (HC15800).

Conflicts of interest

None.

Funding source

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Acknowledgements

Note. The data utilized in this project were made available by the National Environment Agency, Singapore. The information and opinions expressed reflect solely those of the authors.

Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.foodcont.2018.02.038>.

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