

Food Safety Communication in YouTube Video-Recipes.

Naomi J. Melville¹, Ruth M. Fairchild² and Ellen W. Evans^{3*}

Abstract.

Purpose: Given the popularity of online video-recipes, the purpose of this study was to explore the potential communication of food safety malpractices in YouTube video-recipes.

Design/methodology/approach: Content-analysis of purposively sampled, high-risk chicken salad video-recipes ($n=38$) using an observational checklist was undertaken. The checklist was based upon the requirements of the Partnership for Food Safety Education 'Safe Recipe Style Guide', which was annotated with visual and verbal communication of food safety practices being 'best practice', 'inadequate' or 'absent'.

Findings: None of the observed video-recipes showed visual handwashing at the start of the recipe. Furthermore, there was a distinct lack of visual communication of handwashing during the video-recipes.

Research Implications: The lack of visual and verbal food safety communications within video-recipes indicates a failure to adequately inform consumers of risks and safeguarding practices.

Originality: Previous research has focused on communication of food safety practices in broadcasted television cookery programmes and published recipe books; this research extends consumer foods safety research to include resources commonly used by consumers to obtain meal inspiration. To date, this is the first study that has utilised the 'Safe recipe style guide' as a tool to assess inclusion of food safety messages.

Keywords: Food safety behaviours; Video-recipes; Celebrity-chef; Amateur-cook; observed behaviour; food safety communication.

Article classification: Research Paper.

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¹ Corresponding author
nmelville@cardiffmet.ac.uk; ZERO2FIVE Food and Drink Research Unit, Food Industry Centre, Cardiff Metropolitan University, 200 Western Avenue, Cardiff CF5 2YB.

² rfairchild@cardiffmet.ac.uk; Cardiff School of Sport and Health Sciences, Cardiff Metropolitan University, 200 Western Avenue, Cardiff CF5 2YB.

³ eevans@cardiffmet.ac.uk; ZERO2FIVE Food and Drink Research Unit, Food Industry Centre, Cardiff Metropolitan University, 200 Western Avenue, Cardiff CF5 2YB.

Introduction.

The importance of domestic food safety practices.

The domestic kitchen is reported to be a multi-factorial contributor to foodborne illness (Scott, 2003), as considerable incidences are related to microbial contamination transmitted by domestic activities (Meredith et al., 2001) and domestic food handling malpractices significantly contribute to foodborne illness (Simpson, 1993). Most common contributory factors to foodborne diseases are cross-contamination, inadequate heat treatment and inappropriate storage (Panisello et al., 2000, WHO, 2000).

Food safety practices to reduce the risk of foodborne illness in the domestic setting include: the use of a food thermometer to measure the temperature of cooked meat and poultry; washing hands to remove microbial load, cleaning surfaces and kitchen equipment; avoiding cross-contamination through separation of raw and ready-to-eat (RTE) foods; rinsing fresh produce under running water and storing perishables at correct temperatures (PFSE, 2021, FSA, 2018, FSA, 2020b). It is essential that consumers are aware of such domestic food safety recommendations.

A number of review papers detailing consumer food safety research studies indicate that consumers fail to adhere to domestic food safety recommendations (Redmond and Griffith, 2003, Evans and Redmond, 2014, Milton and Mullan, 2010), indeed Milton and Mullan (2010) state that despite the recognised importance of food safety, a large number of consumers do not practice adequate food safety in the home.

Sources of food safety information for consumers.

Consumers obtain food safety related information from a number of sources, as a learnt behaviour in the home, in an educational setting, from government agency initiatives or through the media (Maughan et al., 2016a). The use of mass-media in improving domestic food-hygiene has previously been investigated; results indicate that magazines and cook books are used for food-hygiene information by consumers (Griffith et al., 1994), and some consumers are said to rely upon cook books more than government sources for food safety information (Buzby and Ready, 1996). Although television is considered to be an entertainment source, food safety information could be incorporated into television food-programs to promote domestic food safety practices (Redmond and Griffith, 2006).

Written food safety information requires the intended audience to have the ability to access and read the information, therefore delivery of food safety related information, in ways that do not

rely on the ability to read instructions (e.g. television and online video-recipes) may reach a wider audience (FAO and WHO, 2016).

Inclusion of food safety in television cookery programmes.

Woods and Bruhn (2016), suggest that television celebrity-chefs are seen as role models, as consumers utilize the information and practice the behaviours transmitted during television cookery shows. Maughan et al. (2016a) recognise celebrity-chefs as potential educators of appropriate food safety behaviours. Although consumers view such programs for entertainment celebrity-chefs' poor food-handling practices could wrongly educate consumers and increase the risk of domestic foodborne illness (Woods and Bruhn, 2016).

In recent years, a number of research studies have assessed the inclusion of food safety practices in television cookery programmes, such research indicate that appropriate food handling practices are rarely conveyed to viewers as they do not follow recommended food safety behaviours and may be promote potential malpractices (Borda et al., 2014, Cohen and Olson, 2016, Geppert et al., 2019, Maughan et al., 2016a, Mathiasen et al., 2004, Woods and Bruhn, 2016).

It is suggested that broadcasting requirements do not allow sufficient time to demonstrate food safety practices, Irlbeck et al. (2009) discuss the difficult of demonstrating every food safety measure in a short television show. Maughan et al. (2016a) consider whether chef's food safety behaviours are different in television programmes to what they may do in a restaurant setting, as a result of 'good food safety behaviours' being edited out of the programme due to the 'tedious' nature of such practices, likewise Mathiasen et al. (2004) discuss that food safety practices may be neglected due to time-constraints or are perceived to make a program less interesting for viewers.

Interestingly, Koch et al. (2021) assert that TV cooking shows are well placed to convey information regarding essential food safety practices to a broad audience as the level of food safety practices displayed in cooking videos significantly affects the hygiene practices implemented by individuals following such recipes.

Increase popularity of video-on-demand services.

The way consumers access television programmes have dramatically changed in recent years. Due to internet based technologies, people no longer only view live broadcast media on television sets, video-on-demand systems allow users to access videos without the constraints

of static broadcasting schedules (Deign, 2013). Video-on-demand systems can be streamed to devices with internet access such as computers, tablets and smartphones (Lakshmi, 2020).

YouTube is a free online video sharing and social media platform, which challenges traditional relations between consumer and creator as anyone with a smartphone or tablet computer, can upload a video on YouTube, which can be viewed by anyone with access to the platform (Kavoori, 2015). YouTube is the second most popular social network site worldwide (Statista Research Department, 2021) and is ranked second in all global internet traffic and engagement (Alexa Internet, 2021).

The world of food has been quietly colonised by an array of electronic devices, online content, and information and communication technologies (Lewis and Phillipov, 2018). Indeed, Millennials are said to utilise mobile technology at every phase of the cooking journey – from deciding what to make, learning how to prepare it, and actually cooking or baking (Cooper, 2015). People are increasingly turning to YouTube for ideas, inspiration and tips on cooking techniques, with views of food and recipe content continuously increasing (Delgado et al., 2014). Advice and ‘how-to’ videos related to cooking are among the top ten most searched for videos on YouTube (Cooper, 2015), such video-recipes from home kitchens have increased extensively over the last decade, thus blurring the lines between amateur-cooks and celebrity-chefs, with ordinary expertise in the domestic kitchen becoming noticeable (Lewis, 2018). However, it is unlikely that amateur-cooks will have received food safety training to make them suitable ambassadors for safe cookery instruction content.

Inclusion of food safety information in YouTube videos.

Given the widespread use of YouTube among consumer to access food-related information and recipe ideas, it may be suggested that YouTube video-recipes have an ideal opportunity to include recommended food safety practices, which may not be included in regular televised recipes due to time and production limits.

Raymond and Yang (2014) conducted a content analysis of food safety practices in YouTube beef burger ‘how-to videos’ and reported that negative food safety behaviours were modelled in all of the reviewed videos. The study concluded that YouTube videos encompass verbal instruction and symbolic behaviour that may influence food safety behaviours and suggest that the absence of positive behaviours or inclusion of negative food safety behaviour may unintentionally promote malpractices to viewers. Barrett and Feng (2021) conclude that

exposing consumers to YouTube video-recipes that promote malpractices may lead to a higher risk for foodborne illness among consumers.

Safe recipe style guide.

Given that inclusion of food safety information in recipes are reported to improve domestic food handling behaviours (Maughan et al., 2016b), in 2019, the Partnership for Food safety Education (PFSE), launched the ‘Safe Recipe Style Guide’ (PFSE, 2020b) to enable individuals that produces recipes for the general public to include specific and concise information relating to four critical areas of food safety, namely: temperature, handwashing, cross-contamination and produce handling (PFSE, 2020d). Although the Safe Recipe Style Guide, was created for written content, including; cookbooks, social media, web sites, newspapers, and magazines (PFSE, 2020a), the authors of this study believe the principles can be applied to audio visual media such as YouTube video-recipes.

Identified need for research.

Although previous research has assessed the inclusion of food safety messages by celebrity-chefs in televised programs, and the observed food safety practices in YouTube videos, the aim of this study was to assess food safety communication in YouTube video-recipes, using the Safe Recipe Style Guide (PFSE, 2020c) to develop a tool to assess inclusion of food safety messages. This is the first study to utilise the Safe Recipe Style Guide in this way.

Materials and Methods.

Ethical approval.

Ethical approval for the research project and all associated documentation was sought and obtained from the Ethics Committee [information removed to anonymise manuscript] (Ethics reference number: UG-2886).

Design of an observational checklist.

To enable the creation of an observational checklist, the researchers developed an electronic quantitative database (Qualtrics XM Platform™, Provo, Utah, USA) to enable capture of observed practices. The practices for observation included in the database were based upon the four key food safety practices included in the Safe Recipe Style Guide (PFSE, 2020c), specifically: (i) cook until internal temperature reaches safe temperature on food thermometer, (ii) wash hands with soap and water at beginning of recipe, (iii) wash hands with soap and water after each touch of raw meats, poultry, seafood or raw eggs, (iv) wash equipment after touching raw meats, poultry, seafood or eggs, (v) not reusing marinades used on raw foods,

(vi) Not rinsing raw poultry or meat, (vii) gently rubbing produce under cold running water, and (viii) Scrubbing firm produce with a clean vegetable brush under running water. The database recorded if the practices were (a) demonstrated visually and/or (b) referred to verbally (c) not communicated visually and/or verbally, or (d) demonstrated/communicated a malpractice. Notations were made regarding visual and verbal forms of communication.

Selection of video-recipes.

Discussions held by the researcher and research supervisor established that selection of a chicken salad video-recipe would be suitable for the purpose of this study as it would include raw poultry and RTE elements and the preparation method would require inclusion of the food safety practices included in the Safe Recipe Style Guide to ensure food safety, furthermore, chicken salad have been selected and utilised in observational studies of consumer food safety practices (Dharod et al., 2007, Evans and Redmond, 2018, Redmond et al., 2004). YouTube video-recipes were identified by entering the keywords ‘chicken salad’ into the search bar on the homepage of the YouTube webpage. No filters regarding upload date were applied. A filter to select videos with durations labelled as ‘under 4 minutes’ and ‘4 – 20 minutes’ were selected, videos with longer durations labelled as ‘over 20 minutes’ were excluded for the purpose of this study. No filters relating to video quality or location were applied, the videos returned were sorted by relevance to the search term. Identified video-recipes were watched in sequential order as displayed by the video-sharing platform to determine suitability. The videos had to be instructive in nature, intending to inform and enable others to replicate the recipe demonstrated in the video, the video-recipes had to include raw and RTE elements to fit the parameters of potentially promoting cross-contamination through risky food safety behaviours. Video-recipes that involved pre-cooked chicken were omitted as a raw element was required. Video-recipes that included non-English language verbal or written communication were excluded.

Videos by amateur-cooks and celebrity-chefs were both included. Amateur-cooks were considered as those who were not generally known to the public, who may have become popular from YouTube and were not professionally trained chefs and were cooking recipes in a domestic kitchen. Celebrity-chefs were regarded as individuals who are known to the public due to prior recognition on television programmes, a restaurant, through published cookery books or had been professionally trained. The chosen videos were representative of the types of video-recipes accessible to consumers detailing how to prepare a chicken salad.

Pilot study.

As described by Mathiasen et al. (2004), prior to conducting the research, the researcher became familiar with positive and negative examples of food handling practices and had undergone food safety training. As part of the pilot study video-recipes ($n=5$) were selected and reviewed. The data captured during the pilot study were not included in the final dataset or statistical analysis results as the data collection tool was amended because of the pilot study – the researcher wanted to avoid having missing values in the dataset.

The observational checklist was piloted, amended, and finalised by the researchers prior to commencing data collection. Post-pilot amendments included the addition of two practices relating to recommended refrigeration practices (FSA, 2020a) – which were not included in the Safe Recipe Style Guide (PFSE, 2020c) – namely (ix) refrigerate perishable foods below 5°C within 2 hours of cooking, and (x) thaw or marinate foods in refrigerator below 5°C. A mechanism to capture non-verbal communication through subtitled on-screen text was added along with a method to distinguish if the practice was not applicable or relevant to the recipe video. The database was amended to enable the research to capture if visual or verbal inclusion of a food safety practice was present as ‘best practice’ or ‘inadequate’. The pilot confirmed the need to distinguish between a practice being ‘present – best practice’, ‘present – inadequate’, ‘not present’ and ‘malpractice’. A text entry box was added to enable the researcher to describe the content of the video and specify details regarding the visual demonstrations or verbal communications. The researcher took screenshots of footage that promoted food safety behaviours or food safety malpractices.

Data collection

Following piloting and validation with the research project supervisory team, data collection commenced utilising the amended observational checklist. One researcher was responsible for the selection, viewing and coding of every video in this study. Although inter-reliability and intra-reliability testing were not calculated, the research project supervisory undertook a spot check of 50% of the coded videos to ensure agreement and consistency of the researcher responsible for coding the videos.

Statistical Analysis.

Following data entry, the dataset was downloaded in appropriate formats for analysis. Descriptive statistics were conducted using a Microsoft Excel 2016 spreadsheet (Microsoft Corporation, Redmond, WA, USA) to obtain information regarding the sample, giving an illustrative summary of the data. The results give a qualitative interpretation of the findings with descriptive statistics.

Results and discussion.

Sample characteristics.

A total of 38 video-recipes demonstrating the preparation of a chicken salad were reviewed in this study. The sample consisted amateur-cooks ($n=25$) and celebrity-chefs ($n=13$), of which 24 were female and 14 were male. Video durations ranged from 03:19 – 16:37 minutes, the date of when videos were uploaded ranged from 2013 to 2020. The number of views for the videos ranged from 1,305 to 9,613,146 and channel subscribers ranged from 1,070 to 16,800,000. The reviewed video-recipes included celebrity-chefs from the UK and USA, and international amateur-cooks.

Cooking temperature.

Ensuring thorough cooking is critical for protecting food safety, as inadequate heat treatment is often implicated with incidence of foodborne illness (Gormley et al., 2010). Although consumers in the UK are advised to ensure cooking adequacy by cutting the thickest part to ensure the juices are clear, is steaming hot, and has no pink meat (FSA, 2014). Such visual inspection do not guarantee that recommended cooking temperatures are achieved, therefore consumers should use a thermometer to ensure thorough cooking (Byrd-Bredbenner et al., 2013). For consumers in the US, when cooking raw poultry, it is recommended that a thermometer is used to ensure an internal temperature exceeding 165°F is achieved to ensure the safety of food (USDA, 2019), recipes should advise consumers that a thermometer should be used and of the appropriate temperature (PFSE, 2020c).

In this study, as indicated in Table 1, three video-recipes (only 8% of reviewed video-recipes) demonstrated best practice in relation to ensuring thorough cooking, these were all by amateur-cooks. In two of these video-recipes, the cooks demonstrate the use of a temperature probe and communicated the appropriate temperature verbally, the third video did not include audio communication nor visual presentation of using a cooking thermometer, however, an on-screen prompt communicated the best practice of ensuring the chicken is cooked to 165°F (Figure 1). Although additional information specifying the most appropriate location to probe the chicken would be beneficial, this demonstrates that food safety information can be provided as on-screen prompts to overcome potential time constraints faced in producing video-recipes. Indeed Irlbeck et al. (2009) discussed that time-constraints may make the inclusion of all recommended food safety practices unrealistic and suggested that pop-up brief comments could provide food safety advice on screen. However, the use of such on-screen prompts may promote potential malpractices, for example a video demonstrating a chicken Caesar salad, did not demonstrate or communicate the need to use a thermometer to ensure thorough cooking, a

visual prompt on screen directed people to *“cook till golden brown from both sides”*, after the chicken had been cooked and rested. Whilst the video showed the chicken being cut into cubes, the researcher was of the opinion that the visual appearance did not suggested that the chicken had been thoroughly cooked as the thickest part remained pink in appearance (Figure 2), such information and visual communication may endorse malpractices among consumers.

In another video, an amateur-cook describes *“to cook chicken properly it’s supposed to come up to temperature – its 165 degrees, but we don’t have an internal thermometer”*. The cook then goes on to describe how a one-inch-thick chicken breast will require *“5 – 7 minutes cooking on each side”*. Although the cook acknowledges internal cooking temperature, the importance of the practice is not reinforced as the cook does not explain why the practice is required and does not demonstrate how to implement the practice. For food safety instruction to be credible and believable, those presenting the recipe must explain why it is important and demonstrate how it should be done. One video communicated an incorrect internal temperature, stating it should be 160°F. A UK amateur-cook demonstrated sous-vide technique of cooking chicken, although they referred to the temperature of the water bath and the duration of cooking, they failed to demonstrate or refer to the internal temperature.

In comparison with previous research, Irlbeck et al. (2009) reported that use of a temperature thermometer was not demonstrated in 49 cookery show videos from the US. Maughan et al. (2016a) described that temperature information was only provided in 25% videos, with 96% of chefs indicating that colour was a good indicator to determine doneness. In research regarding online written recipe blogs, Morrison and Young (2019) reported that the use of a thermometer was suggested in 17% of written recipes, and where endpoint temperatures were provided only 61% were correct. Endpoint temperatures were often paired with subjective indicators of cooking doneness which are not adequate indicators of cooking adequacy. Raymond and Yang (2014) determined that only 1% of YouTube beef burger video-recipes demonstrated appropriate use of a food thermometer, with widespread inclusion of inappropriate methods to determine cooking adequacy. Feng and Bruhn (2019) discussed that mainstream media and food professionals seldom serve as role models for thermometer use and often negate to communicate the need for food thermometers. This study established widespread failure to communicate the importance of checking cooking temperatures and to demonstrate appropriate use of a thermometer to ensure adequate cooking in reviewed YouTube video-recipes by amateur-cooks and celebrity-chefs.

Hand washing.

Handwashing is one of the most important practices maximizing food safety (Health Protection Agency, 2013). Consumers handwashing recommendations include the use of hot water and soap, palms, fingers and the back of hands should be rubbed, hands should be rinsed and dried well with paper towels (HPA, 2011).

The present study found that no video-recipes visually demonstrated or verbally communicated the need to wash hands before commencing food preparation (Table 1). Likewise, there was a lack of appropriate communication regarding the need to wash hands after handling raw poultry. Only 3% of reviewed video-recipes verbally communicated the need for handwashing after touching raw poultry, likewise only 8% of video-recipes demonstrated handwashing after handling raw chicken, however none demonstrated best practices (Table 1). For example, a UK celebrity-chef that demonstrated the preparation of jerk chicken with salad in an outside broadcast, after handling the raw chicken he stated “*Any time you’re dealing with raw meat, you know the rules, wash your hands, wipe down*” although he had a bucket of soapy water to wipe the chopping board that had been used for raw chicken, he did not demonstrate handwashing.

Of the reviewed video-recipes, 26% included a verbal or visual malpractice relating to handwashing (Table 1); for example, three video-recipes showed amateur-cooks tasting the food with their fingers and failing to wash hands after doing so. Other malpractices included contaminating salt container with potentially contaminated hands whilst preparing raw poultry and seasoning. Although one video-recipe showed that gloves were worn when chicken was being prepared, however it was not communicated or demonstrated if the gloves were removed and changed between preparing the raw chicken and cutting the lettuce.

Although several video-recipes failed to demonstrate handwashing, it should be noted that some videos did display signs of editing, which may suggest that handwashing may have occurred but not demonstrated to the viewer. Nevertheless, some video-recipes demonstrated concerning malpractices such as chefs handling raw poultry and then moving on to the next preparation step while not washing hands.

Previous research by Borda et al. (2014) found that handwashing before handling food was occasionally performed although not common practice, they also reported that when handwashing was emphasised as necessary no further instruction on how handwashing should be implemented correctly. Irlbeck et al. (2009) also reported that handwashing was seldom demonstrated in television programmes.

Cross-contamination.

Cross-contamination is one of the most common contributing factors associated with foodborne illness (Gormley et al., 2010), cross-contamination is particularly common during the preparation of raw poultry in the domestic setting (Mazengia et al., 2015). For example, rinsing raw poultry is considered a food safety malpractice that consumers are discouraged from implementing as it has been linked to increased risk of cross-contamination (FSA, 2018). Despite this, a number of consumers frequently report washing or rinsing raw poultry before cooking (Kosa et al., 2015) and have been observed implementing the malpractice (Evans and Redmond, 2018). Laboratory based research has established droplet splashes created when washing raw meat can result in the cross-contamination of the domestic kitchen environment (Everis and Betts, 2003).

Although the vast majority (95%) of reviewed video-recipes did not demonstrate the practice of washing raw poultry (Table 1), they did not emphasise that there is no need to implement the practice that is mistakenly implemented by consumers. Two video-recipes (5%) promoted the malpractice. In an amateur recipe video, although it doesn't show the chicken being washed by the presenting cook in the video, they verbalise to the viewer that the chicken has been washed before commencing with the recipe. In a Vietnamese shredded chicken salad recipe video, an amateur-cook demonstrates how to clean a chicken by rubbing it in salt and rinsing it under a running tap, this is supported by an on-screen written prompt describing how to implement the practice (Figure 3).

In previous research, Irlbeck et al. (2009) and Borda et al. (2014) regarding television cookery shows, and Morrison and Young (2019) regarding recipe blogs, did not capture information detailing the malpractice of washing raw poultry. Although Maughan et al. (2016a) reported that 3% of celebrity-chef cooking shows demonstrate raw meat being washed before cooking, the finding was not discussed. It may be argued that absence of the malpractice could be sufficient to promote food safety practices, however given this particular malpractice is widely implemented by consumers (Evans and Redmond, 2018, Henley et al., 2015, Knight et al., 2003, Kosa et al., 2015), video-recipes could help to dismiss the perceived need to wash raw meat and poultry prior to cooking, and communicate that the practice simply increases the risk of cross-contamination.

Another practice to prevent cross-contamination included in the Safe Recipe Style Guide is washing equipment and surfaces (e.g. cutting board, work top counter, utensils, serving dishes) after touching raw meats, poultry, seafood or eggs (PFSE, 2020c). Simple practices such as

using different utensils, and equipment for raw and cooked food or washing them thoroughly between tasks can help to avoid cross-contamination in the domestic kitchen (FSA, 2017). The amateur-cook and celebrity-chef video-recipes lacked visual presentation and verbal communication detailing that equipment and surfaces should be washed or swapped for clean equipment after use for raw meat and before RTE salad produce. As indicated in Table, 16% of video-recipes included malpractices such as using the same equipment for raw and cooked chicken. The editing of video-recipes would cut from an untidy workspace or a used chopping board to a clean one in the next scene. However, one video-recipe did include some visual presentation along with verbal communication to promote the use of separate equipment between raw and cooked chicken. For example, an amateur-cook stated in one video-recipe once they had cooked the chicken *“I’m just going to put it on a clean plate, make sure you grab a pair of clean tongs as well, because you don’t want to use the same tongs that you used on the raw chicken”*.

However other videos attempted to incorporate the practice, nevertheless it resulted in potential malpractices, for example a celebrity-chef was shown removing the chopping board that had been used for raw chicken whilst saying *“Whenever you’re using birds, you immediately change”*, although this was a positive behaviour, it did not state why, furthermore, the chef did not wash their hands after removing the chopping board used for raw chicken, before commencing with salad preparation. In another video-recipe, as referred to in relation to handwashing, a celebrity-chef stated *“Any time you’re dealing with raw meat, you know the rules, wash your hands, wipe down”* at which point the celebrity-chef wipes the surface of the chopping board used for raw meat with a damp cloth, turns the chopping board over and wipes the unused ‘clean’ side of the chopping board with the potentially contaminated damp cloth.

Borda and colleagues discussed that in the television cookery programmes they reviewed from the UK, colour-coded chopping boards were used, with red and blue plastic chopping boards reportedly being used regularly for meat and fish, while wooden chopping boards were used for vegetables, fruit and bread (Borda et al., 2014). The use of colour-coded chopping boards was only observed in one video-recipe in the present study, however the reason for using separate chopping boards and equipment was not verbally referred to in the video-recipe.

Produce.

The Safe Recipe Style Guide, suggests that recipes should inform consumers to gently rub produce under cold running water or to scrub firm produce with a clean vegetable brush under running water (PFSE, 2020c). Washing produce is an important food safety practice intended

to potentially reduce the number of pathogenic microorganisms when produce is not subjected to further processing steps to ensure effective removal or inactivation of pathogenic microorganisms before consumption (Machado-Moreira et al., 2019). Produce such as leafy greens are the second most common source of foodborne shiga toxin-producing *Escherichia coli* outbreaks (Marshall et al., 2020).

Although the practice was included in four of the reviewed videos (11%) (Table 1) only one video appropriately demonstrated how salad produce should be washed, however this was not accompanied by the practice being appropriately communicated. Three of the videos partly demonstrated the practice, for example chefs and cooks were observed briefly washing some, but not all salad ingredients. It was also observed that in the description box below a video for a buttermilk fried chicken salad, the recipe and method was included. The text advised viewers to “*wash and pat dry salad ingredients*”, however this was not demonstrated or referred to in the video. On occasions, it was seen that salad ingredients had been pre-prepared ahead of the video, however information detailing how were not included.

In agreement with previous research, video-recipes fail to highlight the importance of washing salad produce before preparation and consumption, indeed Morrison and Young (2019) described that lettuce was only occasionally shown to be washed before use.

Refrigeration.

Although the Safe Recipe Style Guide does not include recommended practices relating to refrigeration (PFSE, 2020c), food safety requirements for domestic storage of refrigerated foods are $\leq 5.0^{\circ}\text{C}$ (41°F) in the UK (FSA and DoH, 2008) or $\leq 4.0^{\circ}\text{C}$ (40°F) in the USA (USDA FSIS, 2015). Verbal or visual communication regarding refrigeration in YouTube video-recipes were explored in the current study.

Borda et al. (2014) reported that television programmes did not provided advice on appropriate storage and cooling conditions. Likewise, in this study reference to safe refrigeration practices were seldom. Although two video-recipes referred to keeping leftover food in a refrigerator, they did not refer to the recommended temperature. Three video-recipes that included marinating chicken before cooking in which they stated that it should be kept in the refrigerator during this time. An amateur-cook video-recipe for a Vietnamese shredded chicken salad demonstrated the chicken being transferred to an ice bath to cool down rapidly as opposed to leaving it at room temp, however the video-recipe did not communicate why this was done. No

video-recipes discussed the importance of refrigeration or referred to the recommended temperature.

Recommendations.

This study has successfully created a data collection tool based on the Safe Recipe Style Guide to evaluate the inclusion of food safety information in video-recipes. The number of video-recipes reviewed is a potential limitation, therefore, future research should utilise the tool to evaluate the inclusion of food safety information from a larger sample of video-recipes available on YouTube. Given that only one researcher was responsible for selecting, viewing and coding the videos in this study, and that inter-reliability and intra-reliability testing were not calculated, there is a need to acknowledge the potential for researcher bias and associated limitations. Future research involving a larger sample size would be beneficial to explore potential difference between amateur-cooks and celebrity-chefs.

The data collection tool can also be utilised to evaluate food safety information provision on other social media video sharing platforms – such as TikTok. Indeed, concerns regarding potential food safety misinformation on TikTok and the need to distinguish food safety fact from social media fiction have been discussed (Samuel, 2022).

Borda et al. (2014) discussed the importance of not antagonising the viewer with repetition of food safety advice and Mathiasen et al. (2004) discussed that time-constraints may result in food safety practices being neglected. Likewise, in relation to time-constraints Irlbeck et al. (2009) suggested that brief pop-up comments could provide on screen food safety advice. This present study determined that information pop-ups are utilised in YouTube video-recipes, nevertheless, these on-screen prompts can also promote food safety malpractices. The authors believe that on-screen prompts are an opportunity to promote food safety practices, without overwhelming the viewer. It is suggested that pop-up messages can be utilised to indicate ‘*why*’ certain food safety practices are implemented during video-recipes. This additional information would clarify the reason for food safety measures to enable consumers to evaluate the benefit of engaging with the recommended practice. Combining ‘*how*’ to implement the food safety practice with ‘*why*’ the practice is needed would reinforced the importance of the practice (Evans and Redmond, 2022). Currently, the Safe Recipe Style Guide, is intended to support recipe writers to incorporate food safety messaging into all written materials, (PFSE, 2020a), nevertheless, this study suggest that the guide should be utilised by YouTubers that create video-recipes to incorporate food safety recommendations into pop-up messaging content and scripting.

Given the positive impact of food safety instructions in written-recipes upon food safety preparation behaviours (Maughan et al., 2016b), there is a need to explore if a similar trend in food safety practices is observed when consumers are following video-recipes that include food safety communication.

Although many consumers may utilise YouTube video-recipes for meal inspiration, there is a need to consider other routes that consumers may obtain and access recipes and cooking guidance. For example, meal kit delivery services have grown in popularity as they provide meal variation for time-poor consumers through recipe cards and delivery of ingredients (Khan and Sowards, 2018). However, the impact of such food provision and guidance on domestic food safety practices is unknown.

There is also a need to consider if Artificial Intelligence (AI technology) could automatically analyse video-recipes for key features such as preparing/cooking raw poultry and add specific food safety prompts. Increasingly, when users view YouTube videos related to topics that are prone to misinformation, an information panel will be displayed with basic background information obtained from independent, third-party partners, to give more context. These information panels are shown regardless of the opinions expressed in the video (YouTube, 2021). Such technology is intended to remove or label misinformation to reduce the spread of false information and enable individuals to be appropriately informed (Instagram Help Centre, 2021). The authors of this study suggest that food safety recommendations from appropriate Government sources from the region in which the viewer is located could facilitate the dissemination of food safety advice to inform and enable consumers to implement appropriate food safety practices in the domestic kitchen.

Conclusion.

This is the first study to utilise the Safe Recipe Style Guide as a tool to assess inclusion of food safety messages. Completion of this study has determined a lack of food safety communication in YouTube video-recipes. The most common concern was the absence of communicating the need to implement handwashing after handling raw poultry. The most positive behaviour observed was the absence of washing poultry. However, it should be noted that this positive behaviour wasn't supported by verbal communication to the viewer reinforcing why it is necessary to aid understanding and thus help reduce the malpractice. Although inclusion of food safety information in video-recipes does not guarantee that consumers will adhere to recommendation, it would reinforce the importance of food safety to safeguard health. There is also a need to consider who is liable for communicating food safety information or

480 misinformation. Overall, the results indicate that the food safety recommendations included in
481 the Safe Recipe Style Guide (PFSE, 2020c) were not sufficiently communicated verbally or
482 visually in YouTube video-recipes depicting chicken salad preparation. Completion of this
483 study has identified that the Safe Recipe Style Guide is a useful tool that could be utilised to
484 aid the inclusion of food safety recommendations into video-recipes to inform consumers of
485 appropriate domestic food safety practices. There is a lack of appropriate food safety messaging
486 in video-recipes, furthermore some videos promote potential food safety malpractices.

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Table 1. Visual and verbal inclusion of recommended food safety practices in reviewed video-recipes (n=38).

Food Safety Practices	Visual presentation			Verbal communication			Inclusion of visual or verbal malpractice (%)	N/A (%)
	Present		Not present (%)	Communicated		Not communicated (%)		
	Best practice (%)	Inadequate (%)		Best practice (%)	Inadequate (%)			
Cooking temperature								
Cook until internal temperature reaches 75°C (167°F) on food thermometer	8	0	82	11	0	79	11	0
Hand washing								
Wash hands with soap and water (at beginning of recipe)	0	0	100	0	0	100	0	0
Wash hands with soap and water (after each touch of raw poultry or eggs)	0	8	66	0	3	71	26	0
Cross-contamination								
Wash equipment and utensils after touching raw poultry or eggs	0	5	79	3	5	76	16	0
Do not reuse marinades used on raw foods	5	0	3	0	0	8	0	92
Do not rinse raw poultry or meat	95	0	0	0	3	92	5	0
Produce								
Gently rub produce under cold running water/ Scrub firm produce with a clean vegetable brush under running water	3	8	89	0	13	87	0	0
Refrigeration								
Do not leave cooked perishable foods at room temperature. Store in refrigerator below 5°C within 2 hours of cooking	0	3	18	0	11	11	5	74
Thawing or marinating in the refrigerator below 4°C.	8	0	50	5	8	45	3	39



Figure 1 Example of on-screen food safety prompt

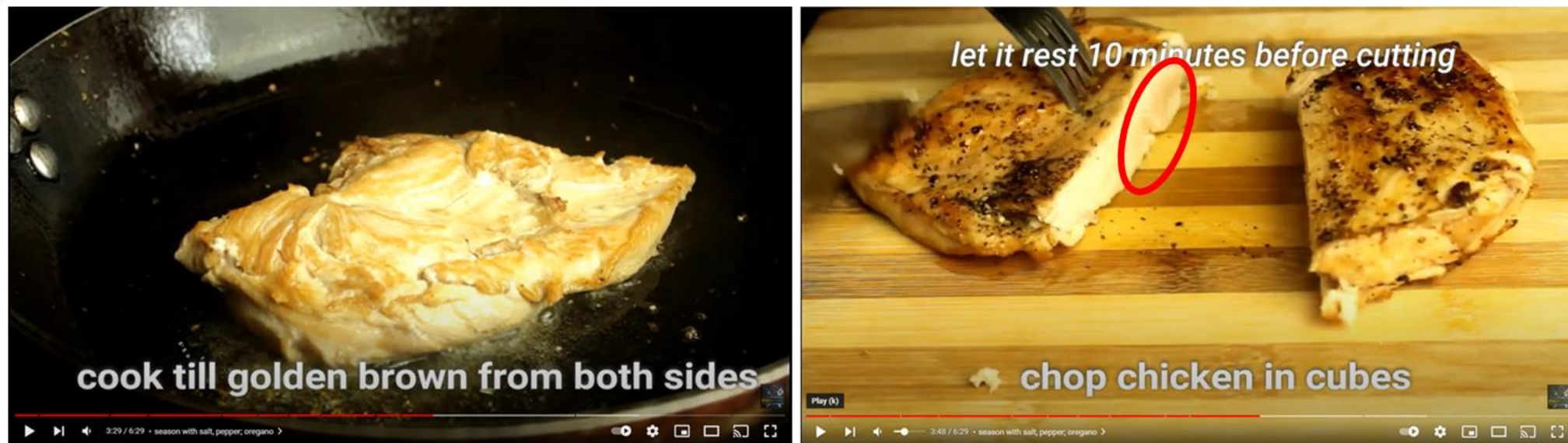


Figure 2 Examples of prompts that may promote unsafe cooking practices, red circle denotes visibly undercooked chicken



Figure 3 Examples of food safety malpractices communicated in YouTube video-recipes

