



A practical guide to the design, implementation and evaluation stages of food safety nudges

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November 2021

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ILRI thanks all donors and organizations which globally support its work through their contributions to the [CGIAR Trust Fund](#)



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Editing, design and layout—ILRI Editorial and Publishing Services, Addis Ababa, Ethiopia.

Cover photo—ILRI/Vu Ngoc Dung

ISBN: 92-9146-674-9

Citation: Hennessey, M., Unger, F., Dang Xuan Sinh, Pham Duc Phuc, Ngo Hoang Tuan Hai, Le Thi Thanh Huyen, Pham Van Hung and Häslser, B. 2021. *A practical guide to the design, implementation and evaluation stages of food safety nudges*. ILRI Manual 52. Nairobi, Kenya: ILRI. <https://hdl.handle.net/10568/115844>

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Acknowledgement

This work was undertaken as part of the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH). Funding support for this study was provided by the Australian Centre for International Agricultural Research (ACIAR) and A4NH. We thank peer-reviewers including Fred Unger, Sinh Dang, researchers, the International Livestock Research Institute (ILRI), and Ngo Hoang Tuan Hai, researcher, Hanoi University of Public Health (HUPH). This publication has gone through the standard peer-review procedure of ILRI. The opinions expressed here belong to the authors, and do not necessarily reflect those of ACIAR, A4NH or CGIAR.

Executive summary

The field of nudge theory – influencing the way people make choices through subtle environmental change – has been used to improve healthy food choices, but to date has not been extensively applied to the livestock and food chain sector. In this document we present a practical guide to the design, implementation, and evaluation stages of food safety nudges, using case studies from the SafePORK project in Vietnam to provide context for the discussion of each stage.

We propose that the following five stages should be considered at the start of projects looking to implement food safety nudges; 1) setting out the problem, 2) identifying relevant behaviours, 3) defining assumptions, 4) designing the nudge, and 5) establishing evaluation design.

At the outset, clearly setting out the problem to be addressed allows identification of the expected outputs to be observed. We suggest the application of a theory of change framework such as the one set out by Mayne (2015) allowing examination of the various elements needed to achieve a behavioural change.

To identify and understand relevant behaviours to be changed we look to two psychological frameworks - the theoretical domains framework (Atkins et al. 2017) and the COM-B model of behavioural change (Michie and West 2013). These frameworks provide insights into behavioural change and can be used to identify suitable nudges in food safety interventions.

Defining assumptions allows the different steps and pathways within the theory of change to be connected. Assumptions may be formed using a variety of existing evidence – published literature, expert opinion, surveys, interviews, focal group discussions – i.e. the strength of evidence behind them can vary.

During the design of a food safety nudge we look to the following three frameworks; 1) the Nuffield intervention ladder (Nuffield Council on Bioethics, 2007) to consider the level of intrusiveness exerted by the nudge, 2) the EAST framework (Service et al. 2014) to increase the effectiveness of the nudge, and 3) the MINDSPACE framework (Dolan et al. 2012) to consider which behavioural elements to target with the nudge.

Finally, establishing an evaluation design needs to consider the level of resources available. We discuss the evaluation of food safety nudges in two scenarios, 1) where it is possible to implement a controlled before and after or randomly controlled trial, and 2) when nudge interventions occur as part of a package of broader interventions and alternative strategies of evaluation such as contribution analysis can be considered.

Consideration of the steps outlined in this document from the outset of behavioural nudge design will help to design a nudge and to facilitate subsequent nudge evaluation, which otherwise, due to the inherent subtle nature of nudges, can be challenging. Consequently, in planning projects which aim to use nudges, sufficient budget should be allocated for the evaluation process, thus providing the opportunity to generate evidence on nudge effectiveness for both current and future work.

1 Introduction

Since its inception and formalisation by Thaler and Sunstein in 2008, nudge theory – a sub-field of behavioural economics – has been used in various settings to guide personal choice through a process of paternal libertarianism¹. The core tenant of nudge theory is to create an environment – through choice architecture – that guides people to make choices with greater individual and societal benefits without limiting individual freedom. Examples of nudge application in the food and healthcare sector include the use of food positioning to improve healthy food choice (Arno and Thomas 2016; Carroll et al. 2018; Van Gestel et al. 2018; Winkler et al. 2018), prompting devices to improve vaccination uptake (Dubov and Phung 2015; Lorini et al. 2020; Oakes and Patel 2020), and framing to improve outcomes in medical decision making (Aggarwal et al. 2014).

In the livestock and food chain sector, elements of nudge theory have been identified in food safety interventions in Vietnam (Hennessey et al. 2020) and European animal health policies (Garza et al. 2020). However, these studies identified nudges retrospectively from pre-existing interventions/policy, and to date little work has been done in this sector to create new interventions using nudge frameworks prospectively.

This document is a practical guide to the design, implementation, and evaluation stages of food safety nudges by the SafePORK project (ACIAR LS 2016/143) or other projects with a focus on food safety in livestock value chains. We draw on case studies from the SafePORK project that, among other things, uses nudges to improve food safety in the pork value chain in Vietnam to provide context for the discussion of each stage.

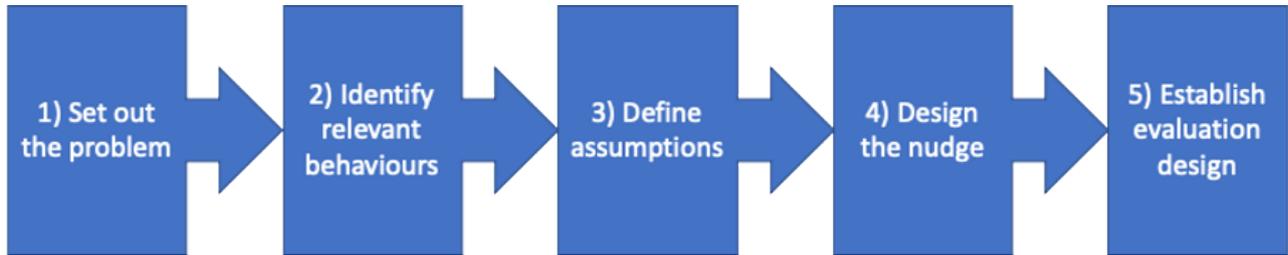
Figure 1. Retailer interacting with a customer in a traditional wet market in Vietnam (photo credit: ILRI/Trong Chinh).



¹Libertarian paternalism refers to the concept of public and private institutions guiding people's behaviour without limiting freedom of choice (Thaler and Sunstein 2003)

The following five steps will be described; setting out the problem, identifying relevant behaviours, defining assumptions, designing the nudge, and establishing the evaluation design (Figure 2).

Figure 2. The five steps for implementing food safety nudges.



For each step, background and theoretical information is given as well as practical advice. Experiences from case studies from the SafePORK project in Vietnam are discussed at each step.

2 Guide

2.1 Step 1: Set out the problem

2.1.1 Background knowledge: Theory of Change

During the initial stages of nudge design, it is important to clearly set out the problem to be addressed and to identify the expected outputs to be observed. For this we look to the theory of change, which is a description of how change is expected to happen in a system over time – including the pathways and assumptions taken to reach a desired change - and how the desired impact can be achieved. It can be represented using diagrams, narratives, or a combination thereof. A useful framework in the context of nudges is the one set out by Mayne (2015). This framework allows examination of the various elements needed to achieve a change, beginning with a change to the environment, followed by a change in behaviour, and the resulting direct and longer-term welfare benefits.

2.1.2 Practical application

Applying the theory of change to a particular problem allows conceptualisation of the sequence of events needed to achieve the outcome.

2.1.3 Case study (illustration of context and theory of change)

Setting out the problem:

Studies have shown a high prevalence of *Salmonella* contaminated pork purchased from wet markets (28.6-44%), resulting in a high salmonellosis incidence rate (17% per year) within the Vietnamese population (Dang-Xuan et al., 2017). The high *Salmonella* contamination rate is attributed to a variety of factors which occur along the pork value chain, including: (1) contaminated water sources on farms and in slaughterhouses, (2) slaughterhouse and retail practices which allow contamination and cross-contamination of carcasses, and (3) unhygienic pork handling and cooking practices by the consumer (ibid).

Example of targeted behaviour: retail practices (the process of selling pork to consumers) which results in the contamination of pork with *Salmonella*

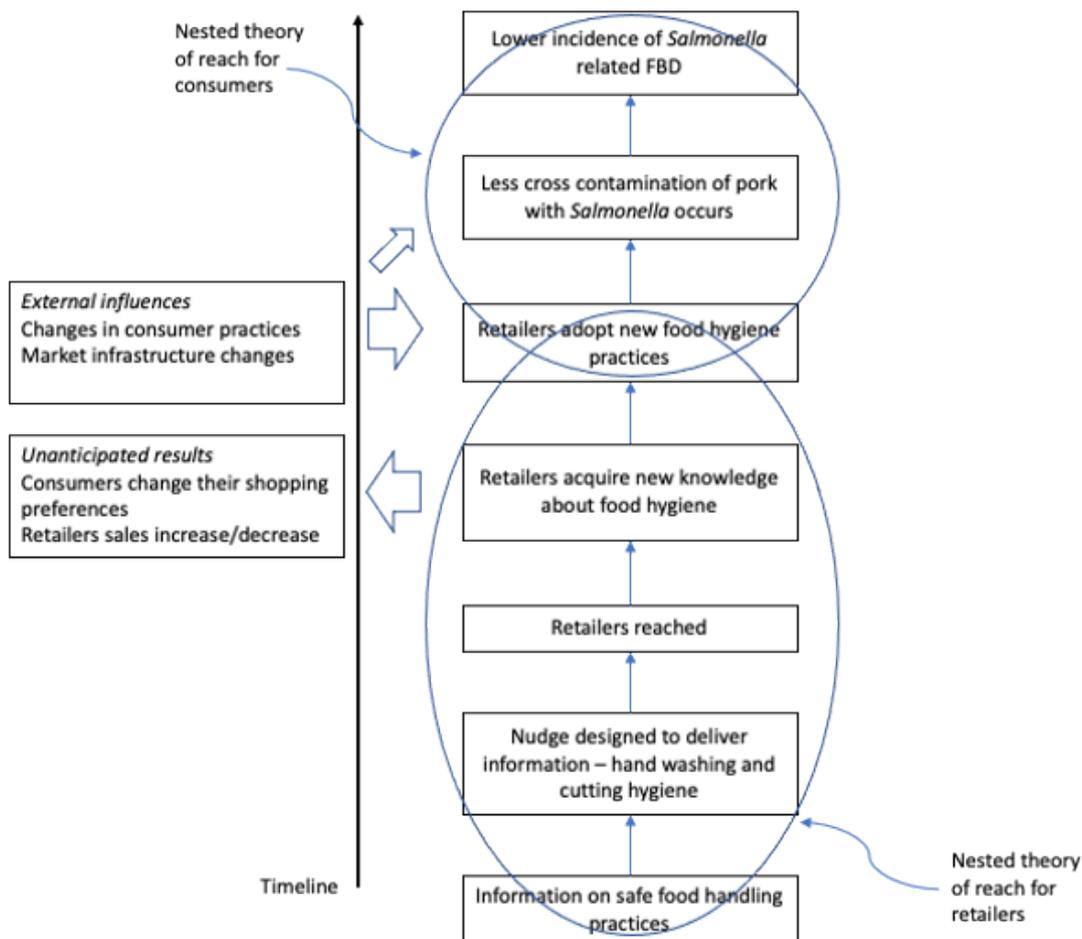
Possible expected outputs:

1. Change in environment - information available to retail workers on safe food handling
2. Behavioural change – retail workers adopt new food hygiene practices, e.g. increased frequency of hand washing
3. Direct immediate benefits – less cross-contamination of pork with *Salmonella* occurs

4. Welfare benefits – reduction in the incidence and negative economic impact of *Salmonella* related foodborne disease

Applying the theory of change framework to this case study it is possible to populate the generic framework set out by Mayne (2015) to produce Figure 3. Here, information on safe food handling practices is built into a nudge designed to deliver information to the target audience – retailers, the expected outcome is a behavioural change resulting in more hygienic handling of food. This should have a direct benefit of reducing contamination of pork with *Salmonella* and a longer-term welfare benefit of a reduction in *Salmonella* related foodborne disease. The blue ovals illustrate the nested theory of reach for retailers and consumers. These nested theories demonstrate the role of different actors in the overall theory of change.

Figure 3. Theory of change for retailers working in wet markets: adapted from Mayne (2015).



2.2 Step 2: Identify relevant behaviours

2.2.1 Background knowledge: Theoretical domains framework

To identify and understand relevant behaviours to be changed we look to two psychological frameworks - the theoretical domains framework (Atkins et al. 2017) and the COM-B model of behavioural change (Michie and West 2013). These frameworks provide insights into behavioural change and can be used to identify suitable nudges in food safety interventions.

The theoretical domains framework separates factors influencing behaviour into 14 domains, each consisting of various constructs (Table 1) (Atkins et al. 2017). The authors of the framework identified numerous theoretical constructs which were then grouped together into domains.

Table 1. Description of the theoretical domains framework – adapted from Atkins et al. (2017)

Domain	Construct
1. Knowledge	Knowledge of condition/scientific rationale, procedures and environment
2. Skills	Skills development, competence, and ability
3. Social/professional role and identity	Professional boundaries and confidence, group identity, leadership
4. Beliefs about capabilities	Self-confidence, self-esteem, professional confidence, empowerment
5. Optimism	Optimism (and pessimism), realistic expectations
6. Beliefs about Consequences	Characteristics of outcome expectancies, consequences and anticipated regret
7. Reinforcement	Rewards and incentives, consequences and sanctions
8. Intentions	Stability of intentions, stages of change within the model
9. Goals	Goals and targets, action planning and implementation intention
10. Memory, attention and decision processes	Attention control, decision making, cognitive overload
11. Environmental context and resources	Environmental stressors, access/barriers to resources, personal interaction with the environment
12. Social influences	Social pressure and norms, group norms and conformity, intergroup conflict and alienation
13. Emotion	Both positive and negative emotions
14. Behavioural regulation	Anything aimed at managing or changing objectively observed or measured actions

The COM-B framework describes the sources of behaviour within three groups: capability, opportunity, and motivation (Michie and West 2013):

- Capability – Individuals need to have the capabilities to contribute to positive change - both psychological and physical
- Opportunity – Individuals need to have the opportunity to enact the change – both socially and physically
- Motivation – Individuals need to be motivated to make a change – both automatically and reflectively

Here, capability and opportunity can be considered in their effect on the interaction between motivation and behaviour. Individuals must possess both the capability and opportunity to be motivated towards or away from a certain behaviour. These relationships can also have feedback loops, for example, once a behaviour is undertaken an individual may develop certain skills which increase their capability to engage with that behaviour in the future.

2.2.2 Practical application

Once the desired behaviour to be changed has been identified and described in the theory of change, it can be examined in detail using the two frameworks to understand the range of factors influencing that behaviour.

2.2.3 Case study (illustration of behavioural factors using the hygienic handling of food in wet markets)

Applying these frameworks to our case study of food-borne disease in the pork value chain in Vietnam allows a detailed enquiry into the aspects of behaviour which need to be considered to produce a behavioural change. This process can produce a series of questions which may need to be addressed during the nudge design and implementation. In Table 2 we present each of the theoretical behavioural domains described by Atkins et al. (2017), how these relate to the COM-B model, and pose possible questions to be answered when considering a behavioural change relating to hygienic food handling by retailers in Vietnamese wet markets.

Table 2. Behavioural aspects relating to hygienic food handling by retailers in Vietnamese wet markets

Theoretical domain	C	O	M	Questions to be considered during nudge design and implementation
Knowledge	■			What is the current level of knowledge of hygienic food handling by retailers in markets?
Skills	■			What skills are involved in hygienic food handling – do retailers need to receive additional training?
Social/professional role and identity		■		Who are the leaders in the markets?
Beliefs about capabilities			■	Do retailers feel empowered and feel confident to make different decisions regarding food handling?
Optimism			■	Do retailers feel optimistic or pessimistic about changes to food handling?
Beliefs about consequences			■	What do retailers believe about the consequences of changing their practices?
Reinforcement			■	What external factors may reinforce behaviour which is aligned food hygiene or punish that which is not?
Intentions			■	Is there any pre-existing intention to change food hygiene? If so, do barriers exist against this?
Goals			■	What are the factors which are driving retailer's behaviours?
Memory, attention, and decision processes	■			How prescient is the issue food hygiene to retailers? Do retailers need regular reinforcement to change their behaviours?
Environmental context and resources		■		What environmental interactions may be affecting food hygiene? Does the culture of particular organisations, e.g. market leaders - affect decisions?
Social influences		■		What are the social and group norms affecting food hygiene? What conflicts may exist between retailers and consumers Who holds the power in these relationships?
Emotion			■	What are the emotional elements influencing food hygiene? Do people feel anxious or fearful of going against the status quo or fear of losing business? Do people feel optimistic about introducing positive change?
Behavioural regulation	■			Are food hygiene practices being monitored?

C: Capability, O:Opportunity, and M: Motivation (COM B model)

2.3 Step 3: Define your assumptions in relation to the food safety intervention

2.3.1 Background knowledge: Assumptions

The theory of change details several assumptions within the chain of events. Formation of these assumptions allow the subsequent steps within the theory of change to be connected and would typically occur at the start of a project, though this process is not always set out explicitly. Assumptions may be formed using a variety of existing evidence – published literature, expert opinion, surveys, interviews, focal group discussions – i.e. the strength of evidence behind them can vary.

Mayne (2015) set out five levels of assumptions within the theory of change:

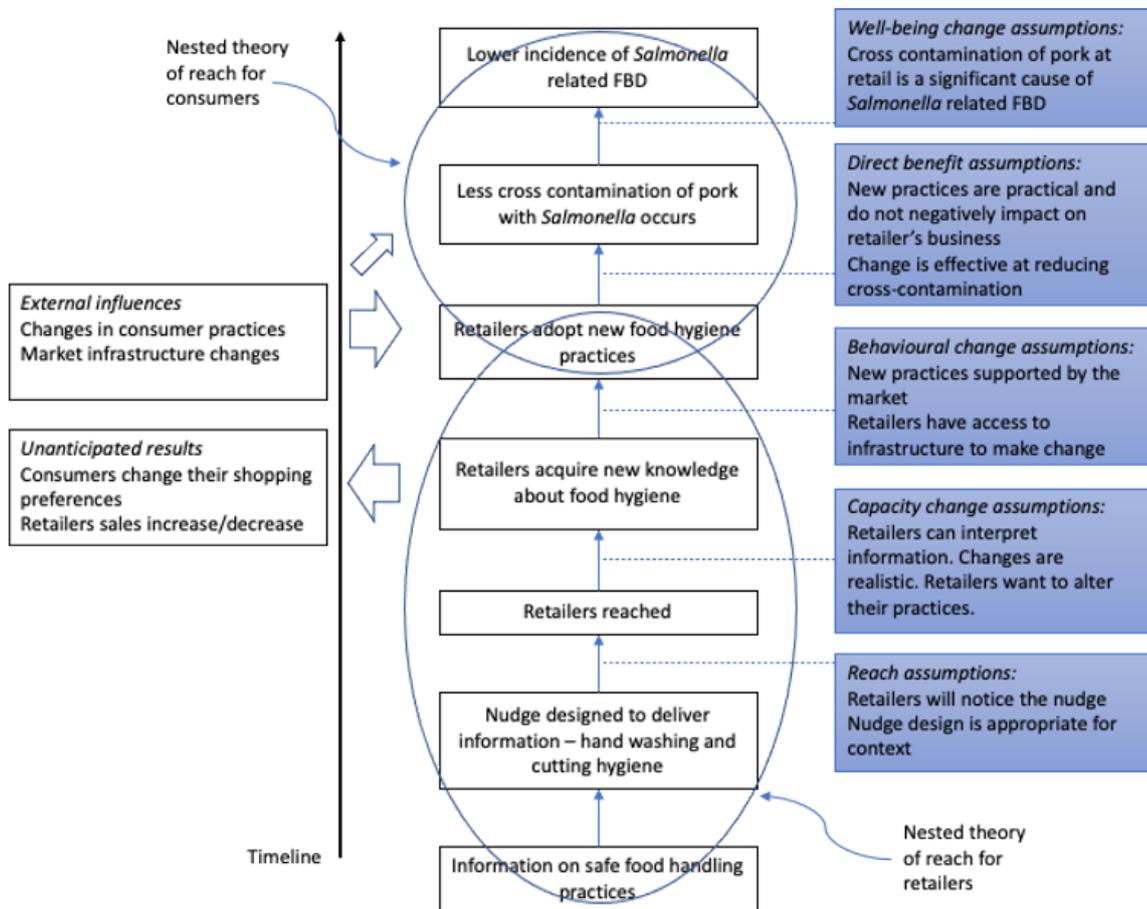
1. A 'reach' assumption is made that the intervention will be effectively received by the target audience, i.e. the nudge is observed
2. A 'capacity change' assumption is made that the target audience have the capacity to interpret the intervention correctly
3. A 'behavioural change' assumption is made that individuals are able to change their behaviour – that they have the capability, opportunity, and motivation to do this for example

4. A 'direct benefit' and,
5. A 'well-being change' assumptions which describe how the change in the target behaviour are expected to implement a positive societal benefit.

Setting out each of these assumptions explicitly allows a critical appraisal of each step, to identify potential weaknesses in the theory of change. In a similar way to a court case, evidence is collated to both support and challenge each assumption. Following this process an assessment can be made about the validity of the assumptions allowing a cumulative evaluation of the entire theory of change.

Figure 4 shows the theory of change developed in Step 1 with the addition of blue boxes to illustrate different types of assumptions made in this pathway to the desired change.

Figure 4. Theory of change for retailers working in wet markets with assumptions: adapted from Mayne (2015).



2.3.2 Practical application

Each step in the theory of change pathway can be examined for the assumptions needed to move through the whole change pathway from start to finish. Each identified assumption should be backed up with appropriate evidence – for example from appropriate literature or expert opinion, and when none exists, additional information gathered to test the assumption.

2.3.3 Case study illustration (assumptions)

The table below shows the different assumptions that apply to the behavioural change needed in our case study of pork contamination at wet markets in the pork value chain in Vietnam (Table 3).

Table 3. Assessment of assumptions for the case study

Type of assumption	Assumption	Evidence
Reach assumption	Retailers will notice the nudge Nudge design is appropriate for context	Nudge design tested in a stakeholder workshop to examine impact of images, language, and colour on salience and feasibility of introducing posters to market workplaces (Hennessey et al. 2020)
Capacity change assumption	Retailers are able to interpret the information in the nudge and relate this to their actions Changes are realistic Retailers want to alter their practices	
Behavioural change assumption	Retailers have access to infrastructure to enact change New practices are supported by the market environment Consumers react positively to the changes and are not negatively impacted by the presence of nudges discussing food hygiene	Retailers access to water has been observed to vary across markets; some have easy access to clean running water, others do not and have to use water stored in a bucket. Retailers will be provided with additional equipment – coloured chopping boards and knives – during the intervention. During the stakeholder workshop – retailers had concerns that negatively framed language in nudge posters could potentially deter customers (Hennessey et al., 2020)
Direct benefit assumption	Change in retail practice will result in a lower rate of cross-contamination of pork with <i>Salmonella</i>	High <i>Salmonella</i> contamination rate is attributed to slaughterhouse and retail practices which allow contamination and cross-contamination of carcasses (Dang-Xuan et al., 2017). Intestinal offal has a higher contamination rate with bacterial species, especially <i>Salmonella</i> , which can be responsible for food borne disease and can lead to the cross-contamination of non-intestinal offal and skeletal meat products (Erickson et al., 2019).
Well-being change assumption	Cross contamination of pork with <i>Salmonella</i> at retail is a significant cause of <i>Salmonella</i> related foodborne disease	Studies have shown a high prevalence of <i>Salmonella</i> contaminated pork purchased from wet markets (28.6-44%), resulting in a high salmonellosis incidence rate (17% per year) within the Vietnamese population (Dang-Xuan et al., 2017).

2.4 Step 4: Design the nudge intervention

2.4.1 Background knowledge: Nudge frameworks

Once the theory of change has been set out and the behavioural aspects considered, nudge frameworks - Nuffield intervention ladder, EAST, and MINDSPACE - can be used to begin the process of designing the nudge intervention.

Nuffield intervention ladder

The Nuffield intervention ladder can be used to classify interventions depending on the level of intrusiveness they exert on personal choice (Table 4). Interventions with a low level of intrusiveness include 'guiding choice through changing the default', 'enabling choice', and 'providing information' were counted as nudges in line with existing nudge theory (Nuffield Council on Bioethics 2007).

Table 4. Nuffield intervention ladder (Nuffield Council on Bioethics 2007)

Interventions (from highest to lowest level of intrusiveness on personal choice)
Eliminate choice e.g. banning the use of something or making an activity illegal
Restricting choice; limiting the options available to people
Guiding choice through disincentives
Guiding choice through incentives
<i>Guiding choice through changing the default</i>
<i>Enabling choice</i>
<i>Providing information</i>
Do nothing, simply monitor the situation

EAST framework

Service et al. (2014) use the EAST framework to describe four elements which should be included in each nudge design – *easy, attractive, social, and timely*.

The MINDSPACE framework

The MINDSPACE framework, described by Dolan et al. (2012), considers nine behavioural elements – *messenger, incentives, norms, defaults, salience, priming, affect, commitments, and ego* – which should be considered when designing a nudge (Table 5).

Table 5. MINDSPACE framework of behavioural elements present in nudges (Dolan et al. 2012)

Messenger	We are heavily influenced by who communicates information
Incentives	Our responses to incentives are shaped by predictable mental shortcuts such as strongly avoiding losses
Norms	We are strongly influenced by what others do
Defaults	We 'go with the flow' of pre-set options
Salience	Our attention is drawn to what is novel and seems relevant to us
Priming	Our acts are often influenced by sub-conscious cues
Affect	Our emotional associations can powerfully shape our actions
Commitments	We seek to be consistent with our public promises
Ego	We act in ways that make us feel better about ourselves

2.4.2 Practical application

Once the type of nudge – provision of information, enabling choice, or changing the default – has been selected, aspects of the MINDSPACE framework should be examined and the most appropriate elements for the setting used to design the nudge intervention. Each nudge intervention should aim to satisfy all of the EAST framework elements.

2.4.3 Case study illustration (designing a nudge for pork value chain retailers)

Example of targeted behaviour: retail practices which result in the contamination of pork with *Salmonella*

Nudge – a poster to provide information of hygienic handling of pork and hand washing (Figure 5). This poster was designed for the stakeholder workshop, during which posters with a variety of colours (red, yellow, green, blue), framing of language (positive, negative), and images (photos, cartoons) were trailed. Participants were asked to rank

colours on a numerical scale from 1 (indicating dirty) to 7 (indicating clean), the results of which demonstrated that participants associated red with being dirty and blue and green as being clean (Hennessey et al. 2020). Participants preferred posters with photos instead of cartoons and stated that photos should be appropriate for the local context (Figure 6).

Figure 5. One of the posters designed during the SafePORK nudge workshop.

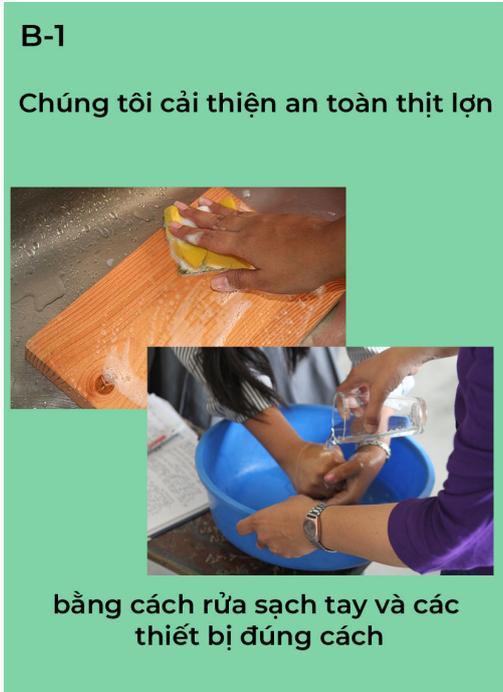
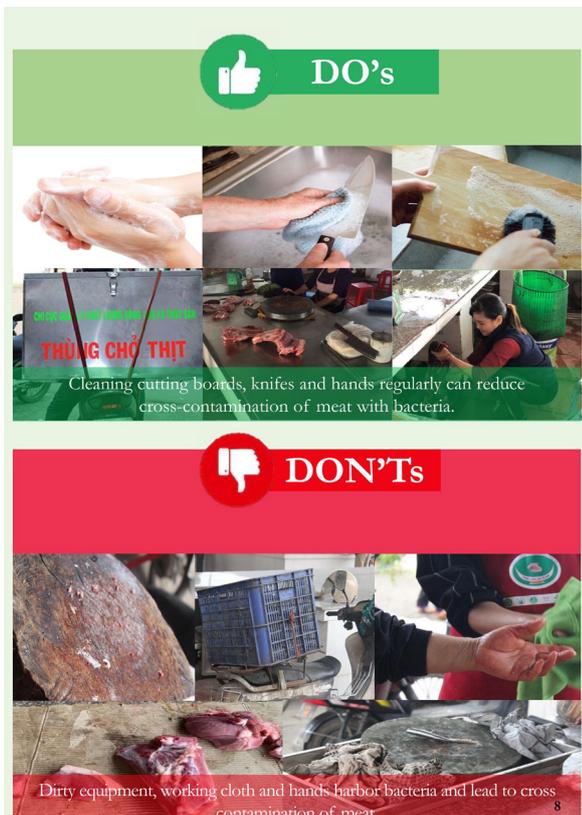


Figure 6. One of the final posters included in a retailer handbook '5 Keys to Retailers for Safer Pork in Traditional Markets in Vietnam'.



Consideration of EAST elements

1. *Easy* – The language used to convey the nudge information must be clear and easily understood
2. *Attractive* – Images used on the posters need to reflect the local context to increase engagement
3. *Social* – Use respected actors to deliver information on the nudge, such as vets or actors peers
4. *Timely* – Posters to be placed at convenient places around the market so that retailers interact with them regularly

The following MINDSPACE elements could be considered important for the nudge:

1. *Messenger* - Selecting the most influential actors to deliver information to retailers could improve compliance with the nudge, previous work has suggested these to be veterinarians or retailers peers (Hennessey et al. 2020).
2. *Incentives* – Actors’ reputation has been reported as an effective incentive for behavioural change (ibid), by adopting an intervention which engages with the topic of food safety, retailers may be able to improve their reputation both within the market and with customers.
3. *Salience* - If the colours used are bold and appealing this may increase engagement with the nudge.
4. *Prime* - Several studies into the use of colour to indicate choices have shown green to be associated with healthy options (Levy et al. 2012; Temple et al., 2011), while other studies found colour to have no effect on actor behaviour (Sacks et al. 2011). Results from a stakeholder workshop of pork value chain actors in Vietnam found actors to perceive blue and green as being a clean colour, yellow, orange, purple as neutral and red as a dirty colour (Hennessey et al. 2020).

2.5 Step 5: Establish evaluation strategy

2.5.1 Background knowledge: Evaluating nudges

In some settings it may be possible to implement nudge interventions in a way which can be evaluated as part of a controlled before and after or randomly controlled trial. However, when used in settings when nudge interventions occur as part of a package of broader interventions alternative strategies of analysis may need to be considered.

Contribution analysis, an evaluation technique developed by John Mayne, differs from more traditional analyses in that it does not seek to infer a direct causal relationship between a particular intervention and an outcome. Instead, it seeks to build a logical argument for how aspects with an intervention or intervention package could have contributed to an observed outcome (Mayne 2012). This approach is described in six steps. The first three steps of contribution analysis - 1) setting out the problem, 2) developing the theory of change and risks to it, and 3) gathering evidence of the theory of change – have already been described in this guide and used to inform the design of the nudge intervention. The subsequent steps - 4) analysis of the contribution story, 5) gathering of additional evidence to support or refute contribution claims, and 6) revise and strengthen the contribution story – form the core of the evaluation strategy. Steps four to six are repeated in an iterative manner until a satisfactory argument can be built. Ton (2021), describes an initial preceding step to acknowledge the multiple perspectives of stakeholders, which are then used to inform steps 1 to 3 of the process.

As Ton (2017) writes, contribution analysis ‘requires reflection on the question, “what would have happened without the intervention?”’. Applying this question to food safety nudges, this implies an evaluation of the contributory role of the nudge in inducing behavioural change and longer-term benefits and attempting to disentangle the effect of the nudge from the wider package of food safety interventions being implemented.

2.5.2 Practical application – before and after or randomly controlled trial

Should resources be available to implement a controlled before and after or randomly controlled trial, then validated methods of measuring behavioural outcomes can be used to collect evaluation data.

2.5.3 Case study illustration (evaluation design for the case study of food borne disease in the pork value chain in Vietnam and nudge intervention to change retailer's food handling practices using a controlled before and after approach)

Example of targeted behaviour: retail practices which result in the contamination of pork with *Salmonella*

Nudge – poster to provide information of hygienic handling of pork and hand washing

Data collection

Observation of retailer's behaviour during a typical working day before the implementation of the nudge, monitoring:

1. Frequency and quality of handwashing
2. Handling of meat products and the use of mobile phones, personal equipment without washing of hands

Observe retailers' behaviour during a typical working day at four time points (day 0, then around days 7, 14 and 28) to measure participants compliance with the nudge, and to see if any non-participants within the market voluntarily adopted the change in practice. Spend one hour observing each stall where the nudge has been implemented. Ideally, a longer term follow up would be implemented to investigate whether people revert to their former behaviours, i.e. the nudge stops working over time.

Figure 7. A customer purchasing pork from a retailer in a traditional wet market in Vietnam (photo credit: ILRI/Trong Chinh).



Monitored indicators:

- Count of certain practice e.g. washing of cutting board, frequency, and quality of hand washing
- Is the nudge poster still visible?
- Gain information on sales at the start & end of the intervention, in addition to observations, using a short questionnaire with sellers
- Gain information from consumers to find out they were influenced by poster, e.g. through a short questionnaire to examine their experience of interacting with a retailer using the nudge intervention
- Obtaining information on the incidence of salmonellosis in target populations, i.e. consumers of pork purchased at the Vietnamese wet markets

2.5.4 Practical application – contribution analysis

The following section is intended to provide an overview of how contribution analysis could be applied to the use of food safety nudges in wet markets in Vietnam to support the hygienic handling of pork. It is expected that a complete contribution analysis would be more extensive and detailed in its design and implementation.

2.5.5 Case study illustration (evaluation design for the case study of food borne disease in the pork value chain in Vietnam and nudge intervention to change retailer’s food handling practices using contribution analysis)

Table 6 provides an outline for how the steps in contribution analysis relate to the design and evaluation of food safety nudges in their ability to change retailer’s food handling practices.

Table 6. Steps in contribution analysis and relation to the evaluation of food safety nudges

Contribution analysis step	Description	Evaluation of food safety nudge interventions
0	Acknowledge the multiple perspectives of stakeholders	Identify all stakeholders and identify their perspectives of the problem being addressed and the proposed theory of change.
1	Set out the problem to be addressed	Steps 1 to 3 of the contribution analysis have been utilised to design the nudge so may not need to be repeated. Additional evidence may need to be gathered to strengthen the theory of change assumptions.
2	Develop theory of change and risks to it	
3	Gather existing evidence on the theory of change assumptions	
4	Assemble and assess the contribution story, and challenges to it	What contribution did the nudge have to the contribution story? What would have been the effect of not having the nudge in place?
5	Seek out additional evidence	If weaknesses exist in the theory of change, what evidence needs to be gathered to understand the role of nudges in the contribution study?
6	Review and strengthen the contribution story (and the repeat steps 4 to 6)	Can a strong enough argument be built to support the contribution of food safety nudges to the package of food safety interventions?

Contribution analysis step 0: Acknowledge the multiple perspectives of stakeholders

A stakeholder workshop, held in Hanoi in 2019, with value chain actors (n=32) from various parts of the pork value chain, including slaughterhouse workers, retailers, veterinarians, government officials, and researchers, explored the slaughterhouse and retail processes relating to food safety. The workshop found that the slaughterhouse workers and retailers appeared to be aware of the major issues surrounding foodborne disease in their industry, highlighting, during the discussions, many of the key points in the pork production chain where meat contamination with microorganisms can occur.

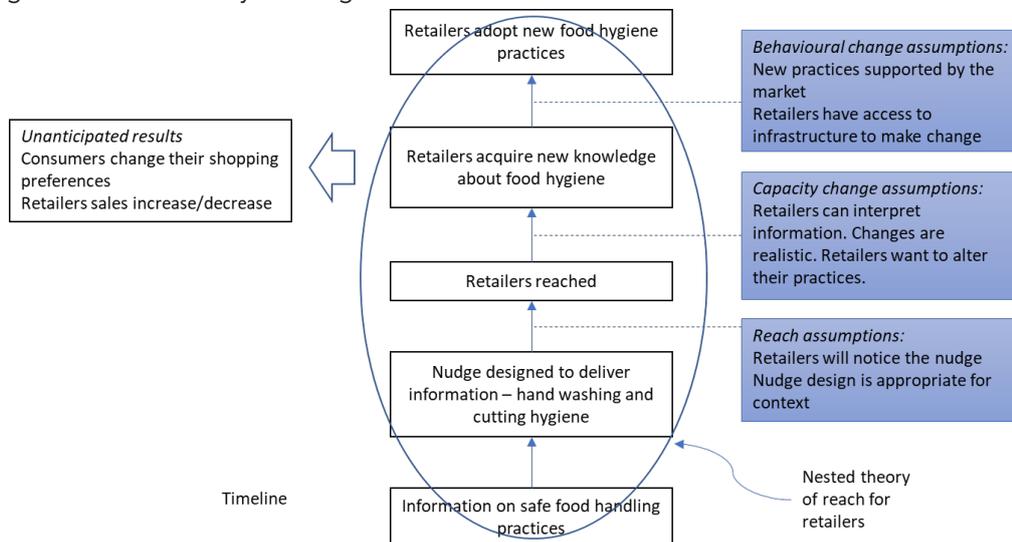
Contribution analysis step 1: Set out the problem to be addressed

The food safety nudges have been designed to support a package of interventions intended to improve food safety in the pork value-chain in Vietnam, with an overall aim of decreasing the burden of *Salmonella* related foodborne disease. Assuming there has been a beneficial impact of the package of interventions, the purpose of this contribution analysis is to determine what contribution the food safety nudges have had on pork retailer's hygienic handling of food.

Contribution analysis step 2: Developing the theory of change and risks to it

The contribution of the posters designed to nudge retailers into adopting hygienic food handling can be considered by examining the nested theory of reach for retailers described in the overall theory of change (Figure 1 on page 5 of this document). Within this nested theory the nudge can be considered to contribute to the *reach assumption* and part of the *capacity change assumption* (Figure 8). If there has been an observed positive change in food safety practices then the other assumptions in the theory of change can be considered to have been met, i.e. changes were realistic, and retailers had access to the infrastructure needed to make a change.

Figure 8. Nested theory of change for retailers.



Here it is assumed that the nudge posters will deliver information of safe food handling practices – hand washing and cutting hygiene, and this information will be noticed and interpreted by the retailers and motivate a behavioural change.

Challenges to the assumptions:

- **Reach assumption:** The nudges will not be noticed by retailers if they are not salient enough. Consequently, they may be ignored, or retailers may become accustomed to them over time. It is assumed that the content of the nudge (text, framing of language, colour, pictures) will be salient to the retailers. Failure to achieve this is likely to decrease the reach of the nudge.

- Capacity change assumption: Retailers need to have the psychological capacity to interpret the food safety nudge correctly before a behavioural change can be induced. Considering this factor, what is the level of awareness of food hygiene issues in retailers working in wet markets?

Contribution analysis step 3: Gather existing evidence on the theory of change

Evidence from existing literature, the ongoing research project itself, or from expert opinion is used to support (or refute) the relevant assumptions in the theory of change.

Existing nudge theory literature

To date there is little published literature on the use of behavioural nudges in the food safety sector.

In their study of behavioural nudges in supermarkets to impact sales of nutritious foods, Chapman et al. (2019), describe how the nudges - arrows to direct customers, informational signage, and product placement – had no effect when used on their own but were associated with an increased sales when used in combination. This could suggest that a single informational poster in marketplaces may not be effective at inducing a behavioural change.

Evidence from the research project

During the stakeholder workshop, participants were shown several potential nudges (posters, arrows, and footprints) and asked to evaluate these through discussion and a scoring exercise. After each activity a plenary session took place to allow dissemination of feedback to the entire group. The concept of using posters to display information was well received by the workshop participants. Both positive and negative framing of information were thought to be effective, the choice of which dependent on the target audience. However, when scored by participants, the negatively framed posters scored significantly higher than the positively framed posters, indicating a greater anticipated impact on actor's behaviour. All participants discussed the need to have site specific photos to reflect the real context of the setting to increase engagement with the media. When considering the effect of colour on salience; red was considered dirtiest, yellow, orange, and purple considered neutral colours, and green and blue considered the cleanest colours. The participants thought that the prospect of upscaling nudges to a broader audience of retailers and consumers could be implemented but would need to be supported by competent food safety authorities.

Discussions during the workshop with market retailers demonstrated an awareness of stakeholders to the food safety issues surrounding handling of pork. Additional evidence would be needed to investigate how widespread this knowledge is within other retailers, e.g. focal group discussions or observations of retailer behaviour in other markets.

Contribution analysis step 4: Assemble and assess the contribution story and challenges to it

Assuming a positive change has been observed in retailer's hygienic handling of food, what contribution did the nudges have within the package of interventions? Due to the subtle nature of nudges, the main criticism to the contribution story would be that the outcomes would have occurred regardless of the placement of the nudge. Additionally, was there any possibility that the nudge had any undesired impact on retailer's behaviour – could the posters have reduced the overall effectiveness of the food safety interventions?

Contribution analysis step 5: Seek out additional evidence

Can additional evidence be gathered to remove the weaknesses from the contribution story? This may require further data collection from stakeholders, such as through knowledge, attitude, and practice (KAP) studies, interviews, or focal group discussions to understand how people perceived and interacted with the food safety nudge posters at the marketplace.

Contribution analysis step 6: Review and strengthen the contribution story

Steps 4 to 6 are repeated in an iterative manner until a conclusion can be made about the contribution effect of the food safety nudges on the effectiveness of the wider package of interventions.

In order for the food safety nudges to be evaluated in their contribution to the reduction in incidence of salmonellosis, then a broader and more detailed contribution analysis must take place that considers the entire theory of change and all challenges to it.

Figure 9. Stamping pork for verification (photo credit: ILRI/Vu Ngoc Dung).



3 Discussion

This document details the various steps to be considered when designing, implementing, and evaluating a behavioural nudge to support food safety interventions in the Vietnamese pork sector.

In settings where resources limit the application of before and after or randomly controlled trials, contribution analysis provides an alternative approach to gather evidence to support the claim that nudges make a necessary contribution to desired outcomes.

The initial steps within contribution analysis – the incorporation of multiple stakeholder perspectives, clearly setting out the problem to be addressed, developing the theory of change, and gathering evidence to support the theory of change assumptions – can form the foundations of both nudge design and subsequent analysis. The latter stages of contribution analysis seek to assemble and assess the contribution story and challenges to it, gathering data in an iterative manner until a conclusion can be made on the contribution of the nudge.

Due to nudges being focused on individual behaviour there is a tendency to overlook the underlying structural elements which create societal behaviours (Prainsack 2020). A growing body of social science literature highlights weaknesses in ‘knowledge deficit models’ of behavioural change (Tompson and Chandler 2021), where individual’s behaviour can be modified simply by providing information to fill a knowledge gap. Consequently, it is increasingly recognised that behaviours or practices are shaped by underlying structural factors. Failure to address these structures is likely to limit, or prevent, behavioural change through nudging.

Consideration of the steps outlined in this document from the outset of behavioural nudge design may help to facilitate subsequent nudge evaluation, which otherwise, due to the inherent subtle nature of nudges, can be challenging. Consequently, in planning projects which aim to use nudges, sufficient budget should be allocated for the evaluation process, thus providing the opportunity to generate evidence on nudge effectiveness for both current and future work.

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ISBN: 92-9146-674-9



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