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Problem and solution trees: a practical approach for identifying potential interventions to improve population nutrition

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SUMMARY

Population nutrition problems have a diversity of contributory factors and, ideally, multi-sectoral solutions should be developed by the relevant stakeholders, based on a common understanding of these factors. The problem and solution tree approach is a participatory process of working through the layers of determinants and then developing potential interventions for a specific issue, using the available data and expertise. We tailored this approach for non-communicable disease-related nutrition problems in Pacific Islands and applied it in several countries. The process led to the identification of a considerable range of determinants of unhealthy diets and potential interventions to improve the situation. This practical approach also offered the additional benefit of developing stakeholder awareness in the issues. Problem trees are a relatively simple tool to implement, easy to adapt to differing needs, can generate a wealth of information and can be more widely used.

Key words: interventions; diet; problem trees; participatory

INTRODUCTION

Poor nutrition is one of the most significant preventable contributors to the global burden of disease (Ezzati *et al.*, 2002). The determinants of unhealthy diets are complex, involving a range of both personal, cultural and environmental factors (Sobal *et al.*, 1998; Swinburn and Raza, 1999; Booth and et al., 2001; Glanz *et al.*, 2005). Multi-component interventions which tackle a number of significant areas are, therefore, needed (Kumanyika, 2001; Chopra *et al.*, 2002; Darnton-Hill *et al.*, 2004).

The identification of the determinants of poor diets is commonly the starting point for developing intervention efforts. Globally, there has been much research on attitudes, behaviour, knowledge, availability, cost and other factors affecting dietary choices. In many parts of the world, however, very little research has been undertaken to identify the local factors involved in poor diets. Even in countries where research has been extensive, there is unlikely to be information relevant to every population sub-group, and processes are likely to differ between populations (Kumanyika *et al.*, 2002). A limited understanding of the current situation is likely to hamper the development of effective public health activities (Nutbeam, 1997). It is essential, therefore, that methods exist that can simply but effectively pinpoint critical areas for actions to improve nutrition. Using a participatory approach to fill this information gap could offer the added benefit of engaging local communities and building capacity (Leung *et al.*, 2004) and can also be helpful in narrowing the gap between research and action (Israel *et al.*, 1998).

Participatory research is an orientation rather than a set of specific methods (Cornwall and Jewkes, 1995) which emphasizes the importance

of the knowledge and views of the community (Leung *et al.*, 2004). Tools which focus on visualizations are commonly used in participatory approaches to assist in the process (Cornwall and Jewkes, 1995; Rifkin *et al.*, 2000), and include mapping and diagrams (Rifkin *et al.*, 2000). Methods used to develop an understanding of the causes of a problem include spider diagrams, problem walls (International HIV/AIDS Alliance, 2005), flow diagrams (Rifkin *et al.*, 2000), mind maps (Start and Hovland, 2004) and also problem trees (Anyaegbunam *et al.*, 2004). These are similar in intent and process, and offer the options of also identifying potential solutions.

Problem and solution trees (PASTs) have been extensively used in developing countries, in part because of their role in logical framework analysis (LFA), and their value is therefore widely recognized. LFA [and the similar objective oriented project planning (Moussa, 2006)] has become a key tool for a number of major international and bilateral donor agencies (Aune, 2000; AusAID, 2003; Dey *et al.*, 2006). Initially LFA involved a matrix only, however it has expanded, and guidelines now include a number of additional tools, including PASTs (Norwegian Agency for Development Cooperation, 1996; DFID, 2002; AusAID, 2003).

Problem trees can help to 'determine the root causes of the main problem' (ESCAP/UNDP/ADB, 2007), identify the effects and also possible solutions (AusAID, 2003). PASTs have been recommended (Callens and Seiffert, 2003) and used for assessing diet and nutrition problems (Rutengwe, 2004).

Dietary problems in the Pacific Island countries are extensive, with extremely high rates of a number of micronutrient deficiencies, alongside significant and growing problems of overweight and other non-communicable diseases (Coyne, 2000; Hughes, 2003). There is, however, a general lack of data within each country regarding the causes of these dietary and lifestyle problems, and with limited resources and capacity, little opportunity to develop any. Available evidence within the region suggests a combination of contributory factors, including policy, environment (Swinburn and Raza, 1999; Gittelsohn *et al.*, 2003), cost (Evans *et al.*, 2003), availability and preference (Gewertz and Errington, 2007). The lack of information regarding the underlying causes may be hampering efforts to reduce these health problems, and identifying low cost ways to increase understanding of the issues would therefore be of benefit. This would allow locally relevant information to be used, instead of relying on global data. Problem tree analysis has been recommended and used within the region previously in regard to water issues (Mahanty and Stacey, 2004), but not for diet.

This paper reports on the use of a modified problem and solution tree (mPAST) approach implemented through a participatory process in several Pacific Island countries to assist with understanding and tackling unhealthy diets.

METHODS

The standard method of developing PASTs was modified to tailor it for use within a multi-stage research process in Fiji. The intent of using the PASTs was to identify potential interventions to improve NCD-related nutrition problems. Following its use in Fiji, it was then subsequently used in three other Pacific Island countries.

Standard methodology for developing problem and solution trees

The approach recommended for developing the tree is to work with a group of informed individuals or stakeholders in a workshop-style environment (AusAID, 2003). The first step in the process of developing a problem tree is to reach agreement on the specific starting problem to be addressed (AusAID, 2003), for example, high rates of anaemia in children.

The main word used to aid the development of a problem tree is 'why' (Thunhurst and Barker, 1999; Anyaegbunam *et al.*, 2004), why does that situation occur. Beginning with the starting problem, the factors contributing to the problem are identified by the group, and then what underlies these and so on. This builds up levels or layers of underlying factors or determinants (represented as roots). The process can continue until the analysis reaches a point where solutions become apparent, or when a certain number of levels, commonly three, have been detailed. The impacts of the problem, such as poor growth, early death etc. are also identified (represented as branches and leaves). The entire tree can be displayed as a stylized tree drawing, or as a series of boxes interlinked by lines or arrows (Figure 1). Once the roots and branches have been completed, the final check

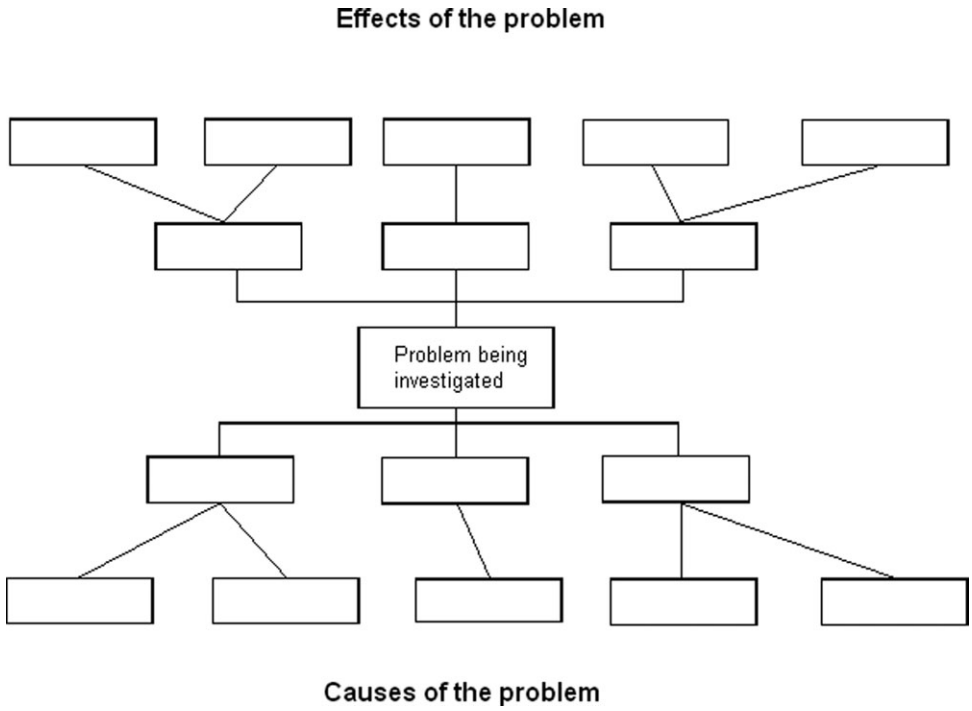

Fig. 1: Classic problem tree.

is done to ensure that it 'works', that the statements are logical and reasonable, and that identified factors do lead to the starting problem being discussed. Once the problem tree has been completed, the solution or objective tree can be developed (Figure 2).

The 'objective tree uses exactly the same structure as the problem tree, but with the problem statements (negatives) turned into objective statements (positives)' (AusAID, 2003). Most simply this is done by reversing the problem factor, so, for example, low intake of iron-rich foods is turned into high-intake. An entire solution tree which has the same number of solutions as there were problems is developed, not just focusing on one area (Gross *et al.*, 1997), so all the possibilities are included. This ensures a more comprehensive assessment, although not all the actions would necessarily be taken (Mahanty and Stacey, 2004). A stage of prioritization usually follows.

Modified problem tree and solution tree (mPAST) methodology for the Pacific Islands

The research in Fiji involved a multi-sectoral group of informed local stakeholders, and it was also expected that the process would increase their understanding of influences on diet.

The availability of the stakeholder group was limited, and therefore it was important to ensure that minimum time was spent for maximum gain. This meant that the process needed to be specific and also avoid overlapping with any of the other planned research steps. Based on this, there were three areas which seemed possible areas for modifications. The starting problem for developing the tree, could it be made more specific to the issues under consideration? Was there a need to develop both halves of the tree: causes and effects? Could the development of the solutions be simplified to reduce the need to develop an entire solution tree?

Starting the problem tree with something as non-specific as an unhealthy diet would have led to an overly complex tree, which would have been unwieldy and difficult to develop and might miss critical issues. Two modifications were therefore made: to develop a number of smaller trees and to provide the initial layer of factors. In order to develop a number of smaller trees, instead of one larger tree, the key components of an unhealthy diet were used as the

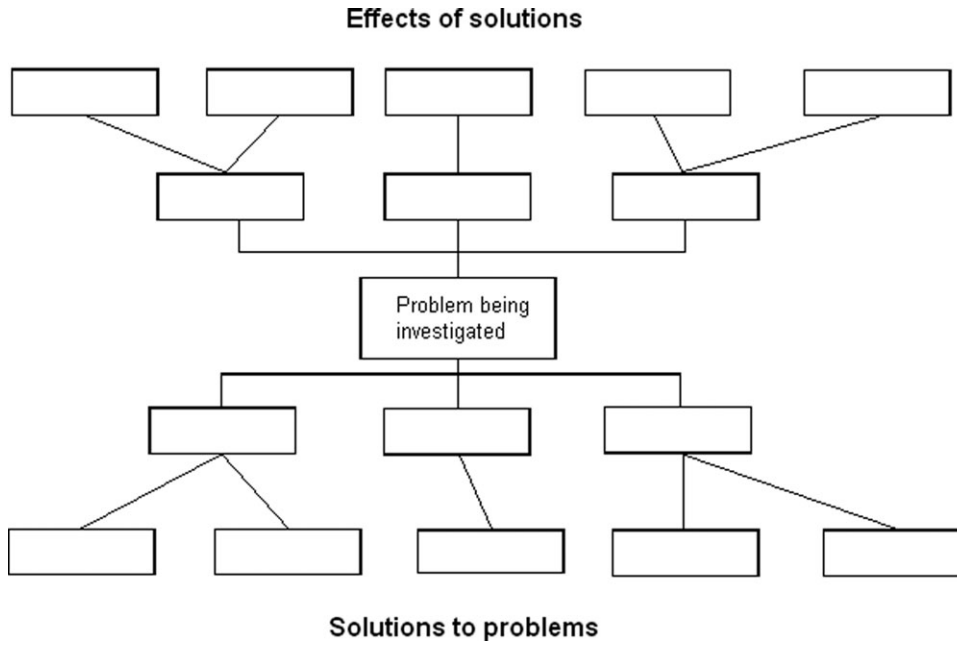

Fig. 2: Classic solution tree.

starting problems. A tree was developed for each food type that was over or under-consumed, such as fruits, vegetables, oils and fish. To reduce the time needed, while also increasing the specificity, three issues were provided as the first layer: cost, supply and preference, as shown in Figure 3. Cost or price, supply or accessibility and preference or choice are critical aspects of the food environment (Glanz *et al.*, 2005) and all the relevant factors would fit into one of these three categories. This also ensured that they did not only focus on preference, but also considered environmental influences.

The time required was further reduced by focusing only on the causes of the problem and not the effects, only the lower half of Figure 1. For the purposes of this research, the 'impacts' part of the standard problem tree was assumed to be known. Existing evidence regarding the effects of poor diets on non-communicable diseases (WHO, 2003; WHO, 2005), and also the resulting economic (Dalton and Crowley, 2000; Doran, 2003; Khaleghian, 2003) and social costs could be provided, rather than asking the group to generate this.

The final area of modification was in the development of the solution tree. The standard methodology requires at least as much time to develop the solution tree as the problem tree, although much of that time might be spent on only detailing the effects of a solution, rather

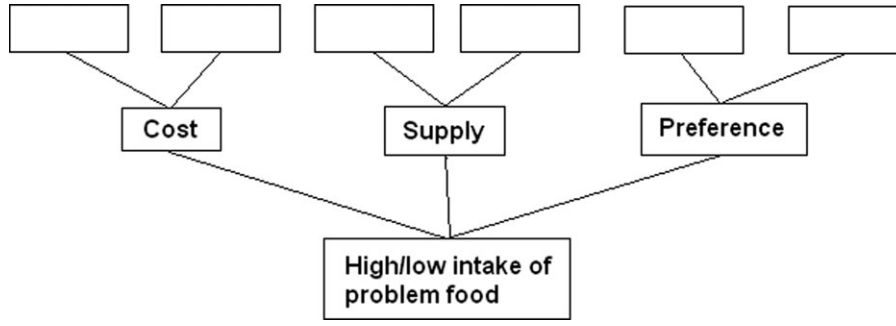

Fig. 3: Starting layer for modified problem trees.

than on generating ideas. The requirement to develop an entirely new solution or objective tree was therefore removed. Instead solutions were brainstormed only for the key underlying factors, and these were then placed adjacent to problem factors on the original problem tree, creating a combined tree. While this was done primarily to save time, it would also more easily allow for multiple solutions for any problem factor. Additionally, it allowed for the inclusion of 'floating' solutions, those which were not directly linked to a specific problem factor, but were felt to be relevant in affecting the underlying dietary problem.

The process of using the mPAST method was similar in the Pacific Island countries where it was used, and was consistent with standard problem tree and solution development. The method is quite simple, requiring an informed multi-sectoral group, facilitator and few materials. The process was guided by a facilitator who provided a quick initial introduction to the method, along with examples. The key guiding principles provided to the group to remember as they worked were that: problem factors could be gaps or inaction, the placement of lines/connectors was not critical and the focus was to be on identifying the problem factors and solutions. Additionally, the facilitator provided prompts and assistance when the participants became 'stuck', reminding them of the 'why' question.

The mPAST approach was used in four Pacific Island countries in 2007. This included the initially planned use in Fiji, and an additional three countries. Following its successful use in Fiji, it was decided to also use mPAST to assist in a project providing technical support to Samoa, Solomon Islands and Tuvalu, on increasing fruit and vegetable intake.

RESULTS

Fiji

The mPAST approach was used in Fiji within the policy component of the Pacific OPIC (Obesity Prevention in Communities) Project. The process involved a local multi-sectoral stakeholder group who were asked to identify and then prioritize policy options. The mPAST was included at the beginning of the process in order to identify problem policy factors, develop potential solutions and also to heighten the understanding of the group regarding the relevance of multi-sectoral policies to diet.

The problem food categories which were used as the starting problems for the problem trees were identified by a small group of local nutritionists, based on available dietary surveys and professional judgements. Identified food types included under consumption of fruits and vegetables, and over consumption of sweetened drinks, oil and high-fat meats.

The multi-sectoral stakeholder group was requested to develop one tree for each problem food. They were advised to try to focus on identifying the policy issues; continuing up a line (branch) until they reached a policy issue, and then stopping. Any lines which did not appear to be leading to a policy issue were stopped early (see Figure 4).

Once the problem trees were completed, the stakeholders brainstormed solutions to the policy issues only, writing the solution on a coloured note which was then placed over the policy issue. Some policy ideas were generated which did not directly relate to a problem food category being discussed; however, these were included as 'floating' solutions. The solutions developed were then prioritized based on likely effectiveness, feasibility and acceptability.

While there were many differences between the trees, there were some similarities and overlap. This multiple tree approach and resulting overlap helped to ensure that the key problem policy factors were identified, and that no major ones were missed. The specific problem foods used as the starting point for the problem trees were initially questioned by a number of the stakeholders, as they were not present during the meeting with the nutritionists. As the trees developed, however, it was apparent that these starting points were only tools in the process, and would not dictate all the potential objectives and activities, and that many of the issues identified were relevant to a broad range of foods.

Samoa, Solomon Islands and Tuvalu

The mPAST approach was used in a WHO-funded project in these three countries, focused on increasing the intake of fruits and vegetables. The approach was included within multi-sectoral workshops in each country which aimed to increase the understanding of the participants regarding the importance of fruits and

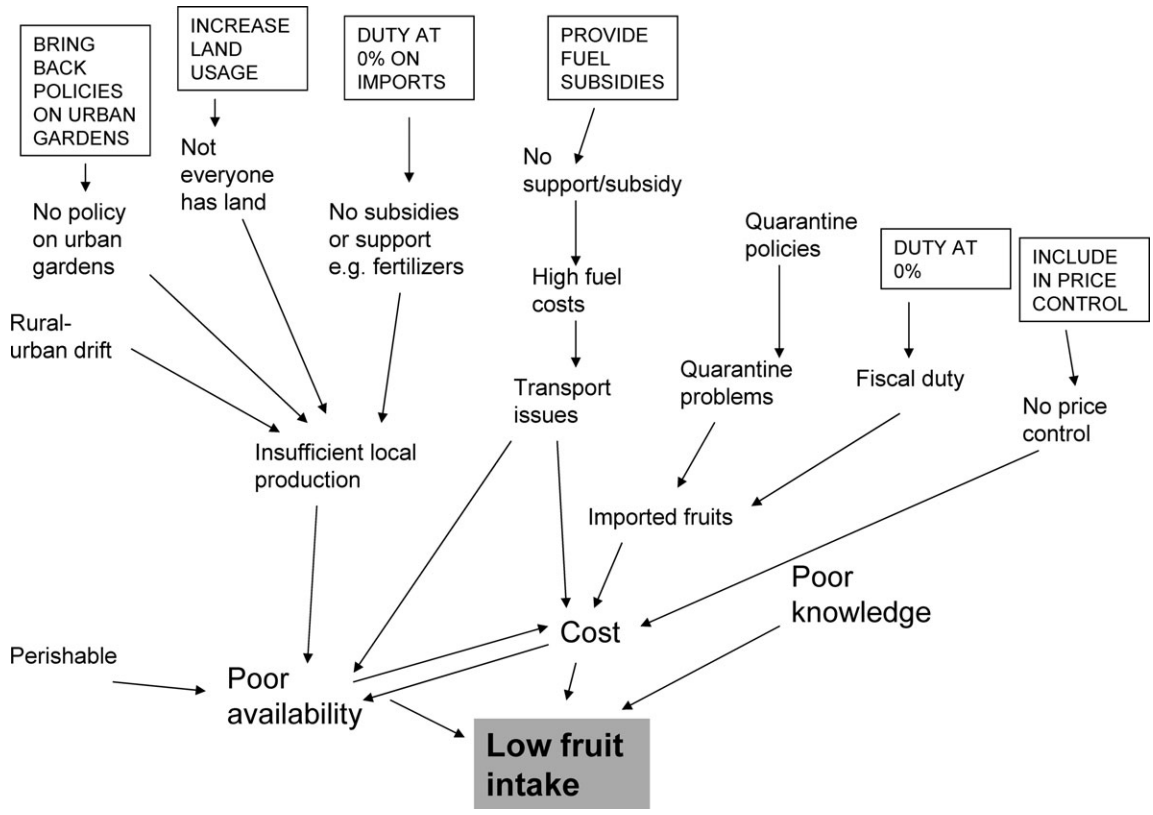

Fig. 4: Simplified example of modified problem and solution tree (mPAST) developed (solutions are shown in capitals in boxes).

vegetables, and also to develop a national strategy for improving intake.

The process used was similar to that in Fiji, except that the starting food problems for the problem trees were low intakes of fruits and vegetables (and therefore no nutritionist expert group was needed). Instead of producing one modified problem tree for fruits and one for vegetables, they also developed separate trees for adults and children. This was intended to further structure the process and to simplify the trees. The country support was not focused only on policy approaches, and therefore the participants were asked to consider all factors involved. The rest of the process was the same as that used in Fiji.

Again while there were some similarities between the trees, splitting the topic over four trees did generate additional ideas, and some issues were specific to one tree only. For example, issues within the school setting were only identified on the trees for children, and seasonality was an issue only for fruit.

The processes

The use of the mPAST approach in these countries demonstrated its value. An example of a combined mPAST is provided in Figure 4, with the solutions in boxes. In each of these four countries, the process led to the development of a more comprehensive set of recommended activities than had previously been considered. In particular, highlighting issues in areas such as finance and trade which had largely not been considered before, and ensuring a strong focus on environmental approaches. Evaluation showed that participants found the process interesting and informative, increasing their awareness of the range of issues involved and why there was a need for such a range of sectors to participate. It was a particularly

useful experience for those participants from sectors other than health and agriculture, heightening their awareness of their own potential role, and the need for them to consider nutrition when implementing policies and activities.

The approach was simple to explain, and once provided with a few examples, the participants were quickly able to begin working on the trees, with very little assistance. The process of identifying the gaps was also straightforward, with a few reminders being sufficient to generate a significant number of problem gaps. In Fiji, it was found that a number of policy issues for one food were gaps for another food. Participants also identified a number of activities or policies where poor implementation was contributing to poor diets. The solution developed for these was to strengthen or modify implementation.

The trees are also valuable resources in themselves. In Fiji, for example, some sectors were absent during the first workshop. In individual meetings with those sectors afterwards a brief introduction to the trees led not only to those sectors requesting to participate in the remainder of the research process, but also in them generating additional ideas which could be added onto the trees.

DISCUSSION

The mPAST approach was used in four Pacific Island countries to assist with identifying areas for action in order to improve diets and reduce NCDs. A multi-sectoral group was guided through the process of developing the modified problem tree, and then the modified solution tree. In all cases, they were able to quickly identify a wide array of factors which could be contributing to poor diets, and to then develop potential solutions. The solutions targeted individuals and the environment, across a range of sectors such as finance, education, trade, agriculture, fisheries and planning.

PASTs have previously been used independently of logical framework analysis (Barker *et al.*, 1998; Williams *et al.*, 2007), and are included within a number of participatory method guides (Anyaegbunam *et al.*, 2004; International HIV/AIDS Alliance, 2005), including ones developed by FAO (Callens and Seiffert, 2003; Food and Agriculture Organization, 2005). Their use, therefore, is well established in participatory approaches, and within the health field.

Participatory approaches are more action-oriented research methods than many more traditional methods (Cornwall and Jewkes, 1995), and are therefore especially relevant for practical planning in a country (World Bank, 2006). Stakeholder views are also becoming more acceptable as forms of evidence within public health, particularly for obesity prevention (Swinburn *et al.*, 2005) and in policy development activities (World Bank, 2006).

Problem trees should not be confused with causal models, although sometimes the names are used interchangeably (Gross *et al.*, 1997). Problem trees are simpler to develop than causal webs, and only intend to capture the most significant issues, rather than all the issues. The focus is on increasing understanding and developing solutions, and there is no requirement to prove a relationship or to indicate the size of an effect as there is in causal systems (Newell *et al.*, 2007; Vandenbroeck *et al.*, 2007). Problem trees are also intended to be developed through participatory processes, rather than just by 'specialist experts'. Causal webs for obesity have been developed (Kumanyika, 2001), however, developing these models can be extremely time-consuming and complex, as is apparent from the recently released Foresight obesity systems model (Vandenbroeck *et al.*, 2007).

The mPAST method suggested in this paper offers a number of advantages for developing strategies to improve diets, which may be of relevance in other small countries. The structuring of the problem into a number of smaller categories provides a clearer and more manageable task for stakeholders and results in simpler and easier to understand trees. Developing a number of PASTs may also ensure that critical issues are not missed. Smaller trees can be developed for population sub-groups (such as age groups or geographic locations) or for specific food categories or types.

Providing an initial layer of the tree (cost, supply and preference) minimizes the risks that it will become overly focused on just preference factors such as culture and knowledge. This is a common problem in the Pacific region (Hughes, 2003; Hughes and Lawrence, 2005) and also elsewhere.

Only including the causes and not the effects did not appear to affect the development process of the trees, it did however reduce the time needed and simplify the final appearance of the trees. The modification to the classic

method for developing a solution tree, also offered advantages in terms of time and clarity. The final combined solution and problem trees were clear and easy to interpret. Solutions are not always associated with a specific problem factor or identified determinant (Robinson and Sirard, 2005), and therefore allowing the inclusion of 'floating' solutions which were not attached to specific problems was also beneficial. This also removes the necessity found within standard solution trees to have logic in reading between layers; so that it should be possible to see that any solution can lead via series of steps back to the ultimate desired change.

The use of the problem tree in identifying areas of potential action to improve diets offers a number of benefits. The process can be undertaken when minimal data exists on the underlying factors involved in poor diets, and is therefore of particular use in resource-poor settings. The method provides a systematic approach to understanding diets and to identifying practical solutions to the problems. While it is unlikely to identify all the issues involved, it is unlikely to miss any significant ones. It is difficult though to assess how comprehensive the process is, as no gold standard method exists for undertaking this type of process. It is likely to identify a more comprehensive range of factors and interventions, than might otherwise have been considered. The process of developing a problem tree can also lead to a deeper understanding of the situation by those involved in the process, and is therefore a useful method of engaging with stakeholders, and building their capacity. The process is likely to be less effective and comprehensive if there is poor representation from key sectors.

We consider that the use of modified PASTs can be valuable in developing understanding about the factors involved in poor diets and in generating potential strategies to improve diets. The process can easily be incorporated into the development of strategies nationally and is likely to generate a more comprehensive set of interventions than might otherwise have been achieved.

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