Health Systems Resilience: A Systems Analysis

Scripts to Support Group Model Building

A Guide for Participatory Systems Analysis

Version 1.1
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HEALTH SYSTEMS RESILIENCE

Health Systems Resilience: A Systems Analysis is a project which seeks to apply a systems dynamics approach to understand, predict and identify mechanisms that influence the resilience of health systems in contexts of adversity. Resilience has emerged as a dominant concept underpinning development assistance and humanitarian support in contexts vulnerable – through conflict or natural disaster – to crisis. A systems dynamic approach, which lends itself to group model building through intensive, participatory consultation with stakeholders and representation and refinement of models using graphical systems tools, offers an effective means of exploring the determinants of systems vulnerability and resilience.

The project was implemented by the, Columbia University in collaboration with the School of Public Health, University of the Western Cape. The work was funded by DFID through the ReBUILD program coordinated by the Liverpool School of Tropical Medicine and Queen Margaret University, Edinburgh.

A series of case studies was implemented during the course of the project: in Cote d'Ivoire following the disputed presidential election of 2010[1]; in the health sector in the Yobe State, northern Nigeria, in response to the Boko Haram insurgency between 2011 and the present day[2]; and in OR Tambo District in South Africa addressing a context of chronic adverity.[3]

[1] Lembani, M, de Pinho, H, Delobelle, P. Zarowsky, C. & Ager, A. (2014) A case study of technical assistance to HIV services in Cote d'Ivoire in the context of civil unrest following the disputed presidential election of 2010. Report to the ReBUILD Consortium. New York: MSPH, Columbia University

[2] Lembani, M, Mohammed, A, Abdulwahab, A, Garba, A,, de Pinho, H, Delobelle, P. Zarowsky, C. & Ager, A. (2014) A case study of Health Service Provision in Yobe State, Nigeria in the Context of the Boko Haram Insurgency. Report to the ReBUILD Consortium. New York: MSPH, Columbia University.

[3] Lembani M, de Pinho H., Delobelle P., Zarowsky C., Mathole T. & Ager A. (2015) A Case Study of Maternal Health Service Provision in OR Tambo District, Eastern Cape, in the Context of Chronic Poor Health Performance. Report to the ReBUILD Consortium. New York: MSPH, Columbia University.

GROUP MODEL BUILDING

All three studies piloted use of a participatory methodology using group model building. The goal was to develop a systems model representing the forces shaping health systems delivery in the specific context and consequently identify potential points of leverage to strengthen systems functioning.

The methodology was generally structured into four distinct phases. Phase 1 defined the scope for the case study and documented information on health systems challenges and strategies adopted to address them through structured interviews with diverse stakeholders (including patients, clinic workers, health managers and policymakers). Phase 2 involved convening a one-day Group Model Building (GMB) session. At this meeting material collated from interviews was reviewed with a sub-group of stakeholders and a preliminary systems model linking factors, challenges and strategies produced. Phase 3 involved the elaboration and refinement of this analysis using available HMIS data and other sources of information. Phase 4 involved the presentation of these refined models to stakeholders engaged in the GMB sessions and beyond and exploring strategies for intervention to strengthen health systems functioning suggested by the analysis.

In each of these phases of work – and especially within the GMB phase - analysis is supported by the use of specific guides or, in systems dynamics terms, scripts[4]. These serve to shape discussion in a way that prompts awareness of systems dynamics ('systems thinking') and provides insights that feed into subsequent steps of group model development. This guide documents twelve of the scripts that were found to be most valuable during the course of the completed case studies.

[4] Hovmand, P.S. Community Based System Dynamics. Springer: 2013; Andersen, D.F. and Richardson G.P. (1997). "Scripts for group model building." *System Dynamics Review* 13(2): 107-129.

WHEN TO USE SPECIFIC SCRIPTS

This is not intended as a comprehensive guide to participatory systems analysis through group model building, but rather an illustration of key scripts that may be used with such an approach.

The following illustrates the appropriate sequence of deploying the scripts subsequently detailed.

PHASE 1
Script 1: Developing a Scoping Brief
Script 2: Elicitation of Narratives

PHASE 2
Planning
Script 3: Preliminary Thematic Analysis
Script 4: Rich Pictures
Script 5: Interrelationship Diagraphs (IRDs)
Script 6: Development of a Seed Model

PHASE 2
GMB Session
Script 4: Rich Pictures
Script 7: Review & Confirmation of Thematic Elements
Script 8: Identifying Reference Modes
Script 5: Interrelationship Diagraphs (IRDs)
Script 9: Preliminary Model Development
Script 10: Consolidation of Preliminary Model

PHASE 3
Script 11: Systems Model Elaboration

PHASE 4
Script 12: Identifying Key Points of Leverage

Scripts shaded grey are suited for use within a GMB session either after prior deployment by the core modelling team in the preparation for group model building or, in some circumstances, deployed for the first time in the GMB session.

SCRIPT 1: DEVELOPING A SCOPING BRIEF

A scoping brief – a one-page summary document that details the scope of the analysis to which GMB will be applied – is a key tool to create focus and clarity during both data collection and modelling. A scoping brief is typically developed through negotiation between the modelling team and the representative of the agency or group that is supporting access to the setting that is the focus of the analysis. It guides identification of both interviewees relevant for data collection and, subsequently, stakeholders for group model building work.

Key questions to be addressed in the brief are:

- What is the core issue or concern that analysis seeks to address?
- What are the geographical bounds of the analysis? Within this defined area, are there specific Districts, zones, clinics etc. to be focused upon in more depth to represent variation across the area?
- Over what time period are changes to be considered?
- What are the particular health outcomes or aspects of service provision that will be focused upon?

An excerpt of a scoping brief for a related GMB case study is shown below:

HEALTH SYSTEMS RESILIENCE

A Study of UNRWA Health Systems Provision in Gaza During the 60 Day War of 2014

In the midst of a humanitarian crisis, health providers must overcome barriers and threats to continue delivering services to the people who need them. Wars, conflicts, and ongoing instability in Middle East are having major detrimental effects on the health of populations and the health systems that serve them. Understanding ways of strengthening the resilience of health systems through times of crisis is increasingly crucial.

The conflict in Gaza last summer, lasting from 8 July 2014 until 26 August 2014, placed significant strain the health system. Yet data indicates that UNRWA clinics continued to provide services to Palestine refugees as well as others who sought health care during the conflict. Through systematic case study, we aim to better understand the key threats to the functioning of the UNRWA health system during the Gaza conflict, as well as the areas of strength that served to mitigate those threats. Developing a shared understanding of these interactions within the operation of the UNRWA health system will provide a basis to plan strategies to secure effective future health provision.

The focus of this study will be July and August 2014, during the conflict, but our scope of enquiry will be from January 2014 until the present time in order that we understand the operation of the system before and after the war. Although our interest is impacts and responses across the whole of UNRWA health provision in Gaza, we will focus initial data collection on four clinics, selected on the basis of geographical spread. We have identified the clinics in Jabalia, Zaitun, Deir al-Balah and Tal-Sultan (Rafah) – along with the temporary peripheral health posts attached to them – as our focal points. We will be collecting qualitative information concerning threats to service provision and the strategies to address these. The collection of quantitative information will predominantly focus on indicators relevant to maternal and child health (antenatal and under-5services, specifically), NCD consultations and outpatient consultations.

SCRIPT 2: ELICITATION OF NARRATIVES

The narratives of key informants who have experience of the issue at the core of the scoping brief are a key source of data driving the group model building process.

The richness of these narratives, from informants with diverse roles within the system to be modelled, provides the basis for subsequent thematic and systems analysis. A script for the elicitation of narratives thus needs to be focused enough to ensure elaboration of experience relevant to the specified scope of the study but open enough to allow full and free elaboration from informants. Interview scripts may guide reflections by informants, but should not impose a framing related to specific concepts (which should rather be emergent from such interviews). The example below is a simple guide developed for interviews with stakeholders in the Cote d'Ivoire case study.


Interview and Participatory Discussion Guide

1. What were the circumstances that presented challenges to the operation of the health system during the period in question?

    a. *probe the background and nature of these circumstances*
    b. *probe the duration of adversity*
    c. *probe the geographical spread of the circumstances*

2. What were the specific difficulties faced by the health system as a result of these circumstances?

    a. *probe issues in clinical service delivery*
    b. *probe issues in drug supplies and logistics*
    c. *probe issues in staffing/human resources*
    d. *probe issues in financial flows*

3. Overall, how well do you consider the health system coped with these challenging circumstances?

    a. *What aspects of the system generally continued to perform well?*
    b. *What aspects of the systems generally struggled to perform well?*

4. Did some clinics/services manage to cope better than others?

    a. *If so, which did well, and why?*
    b. *Which did less well, and why?*

5. Reflecting on these circumstances, what do you see as the key factors contributing to a health system being able to continue providing services when faced by major adverse circumstances?

SCRIPT 3: PRELIMINARY THEMATIC ANALYSIS

Members of the modelling team, together with a member of the agency or group supporting access to the setting, should read transcript of all narrative interview. While there are many means of identifying preliminary themes arising in such data, the script specified below is generally efficient and effective for this purpose.

Individuals reviewing the narratives should identify recurrent elements of the transcripts, and note these on post-it notes (one element per post-it note). Elements are best expressed as variables – that is, factors that can take on different values (avoiding explicit positive or negative connotations). Thus 'healthworker workload' is preferable to 'heavy workload of health workers'. There is no limit to the number of elements that can be identified, but typically – with extensive narrative data available on which to reflect – twenty or more elements would not be inappropriate.

The modelling team (plus agency or group representative) then come together as a group, and compare elements identified. Similar elements are grouped together, with discussion serving to consolidate broader explanatory categories. Aiming to identify between 12 and 18 themes will be adequate for most circumstances. These themes should be clearly defined and short-hand labels agreed and posted using a set of distinctive coloured post-its (as per below).
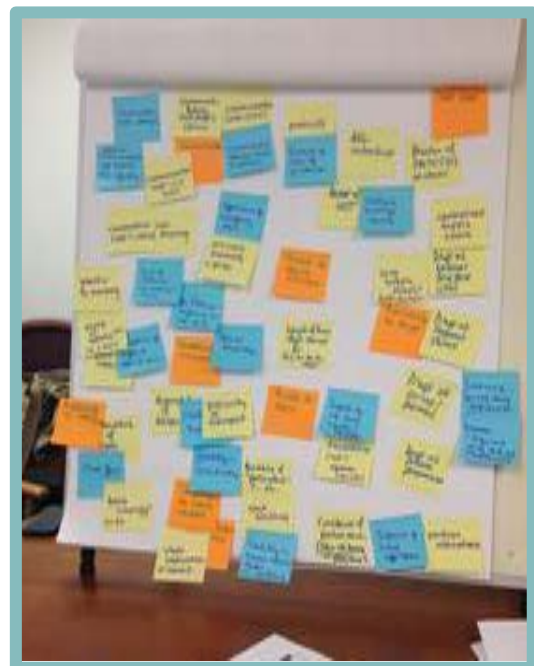
SCRIPT 4: RICH PICTURES

Groups are given large paper swatches and markers, and asked to depict typical scenes from the crisis and how they personally experienced them.

Group elaboration of "rich pictures" helps participants think beyond simply listing issues and problems to explore relationships and complexities. Participants are encouraged to represent all of the elements, relationships, emotions, and interactions relevant to the issue at hand. This process encourages participants to engage in rich discussions surrounding the issues they depicted, which will later create a basis for their model building process.

Pictures will often capture something of the dynamics of a situation by representing, in some way, the change of circumstances over time.

A rich pictures developed in the context considering barriers to pregnant women's physical access to health facilities in PR Tambo state is shown below.

SCRIPT 5: INTERRELATIONSHIP DIAGRAPHS (IRDS)

An interrelationship diagraph serves to identify likely linkage between identified variables, challenges existing assumptions about the issue, identifies key outcomes and drivers in a complex system, and forms the basis from which to develop a causal loop analysis.

This exercise is completed by placing the variables developed using script 3 in a circle using post-it notes. The modelling team then reviews each variable in turn, and considers whether the interviews (and any other data collected) suggest a direct connection between that variable and each other variable listed. If there is a direct linkage (indirect linkages should NOT be considered at this stage) an arrow is drawn denoting the direction of influence. If there is a suggestion that the connection can be in both directions, the more dominant influence only should be recorded.

Once the IRD is completed, the number of arrows to and from each variable should be noted. Those with the greatest net influence on other variables can be classified as drivers, while those predominantly influenced by other variable in the system can be classified as outcomes. The IRD can then be redrawn (by hand or by using systems modelling software) to position drivers at the lower part of the figure and outcomes at the higher part (as in the second figure below).
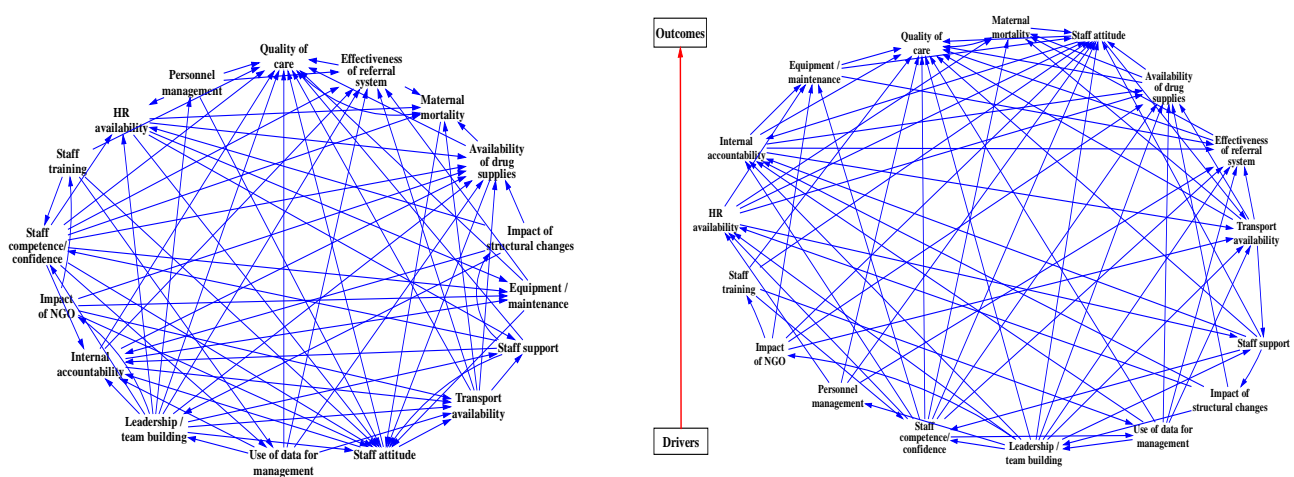
SCRIPT 6: DEVELOPMENT OF A SEED MODEL

Constructing an IRD – with key outcomes and key drivers highlighted – is a step towards creating a 'seed model' to support subsequent participatory group model building.

The seed model acts as a preliminary concept model for the group dynamic modelling exercise instead of starting with a 'blank slate'. It helps the group to have a starting point for their analysis.

Typically the seed model will feature one of the major outcomes identified through the IRD exercise and one of the major drivers of such an outcome. The most basic seed model features just two elements, but subsequent elaboration may be facilitated by adding in one or two more variables that are hypothesized to moderate this linkage between drivers and outcomes. The seed model is the structure which subsequently 'seeds' group model building, providing a basic structure on which to build, without unduly influencing model development.

The planning team aims to construct a seed model that represents a core dynamic that has emerged from analysis of interviews that will provide a helpful foundation for group model building. The more the planning team elaborates this model, however, the more it potentially constrains participatory work in the GMB session that follows.

The example given below (from our work in Eastern Cape) shows perhaps the highest level of complexity that should be reflected in a seed model. In our work in Yobe, a seed model that linked 'Insecurity' with 'Movement difficulties', which was then linked with 'Utilization of health services' was sufficient to support an effective participatory GMB process.
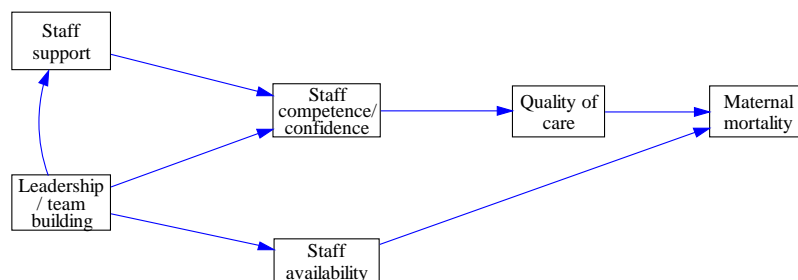
SCRIPT 7: REVIEW AND CONFIRMATION OF THEMATIC ELEMENTS

An important starting point early in the GMB session itself (after an orientation to goals, planned processes and the nature of dynamic systems) is presentation of the thematic elements/variables identified from thematic analysis by the modelling team. These will become the 'building blocks' of the subsequent participatory analysis, and it is important to have them confirmed (or elaborated) by GMB participants.

This is usually best done by reviewing in turn the variables identified, providing the definition, providing an example, and soliciting from the group illustrations of that element coming into play in the situation being analysed. Where participants have developed rich pictures, these can be referenced to identify missing variables or refined definitions.

Care should be taken NOT to propose specific linkages between variables at this stage. It is a straightforward listing of variables for use later. If GMB participants consider that there is an important element that has not been drawn out of the analysis by the modelling team, this should be added to the variable list (and a suitable definition agreed).

SCRIPT 8: IDENTIFYING REFERENCE MODES

Systems dynamics reflect changing circumstances over time. Any variable included in the analysis is likely to have changed its value over the period of time that is the focus of the case study.

Reference modes are representations of the change in the value of a variable over time which provide a 'reference point' for an evolving analysis. In can be helpful early in the GMB session to signal change over time in key variables that are parts of the systems analysis using simple line graphs. Trying to understand the relationship between the curves prompts the group to consider the linkages and influences between variables.

The first figure below shows attended deliveries reported in three local government areas of Yobe state during the course of the Boko Haram insurgency. Discussing the reasons for this pattern of increases in one area being accompanied by decreased in another led GMB participants to reflect on the movement of populations showing the same rhythm, which in turn reflected changes in the levels of insecurity in specific areas over time.
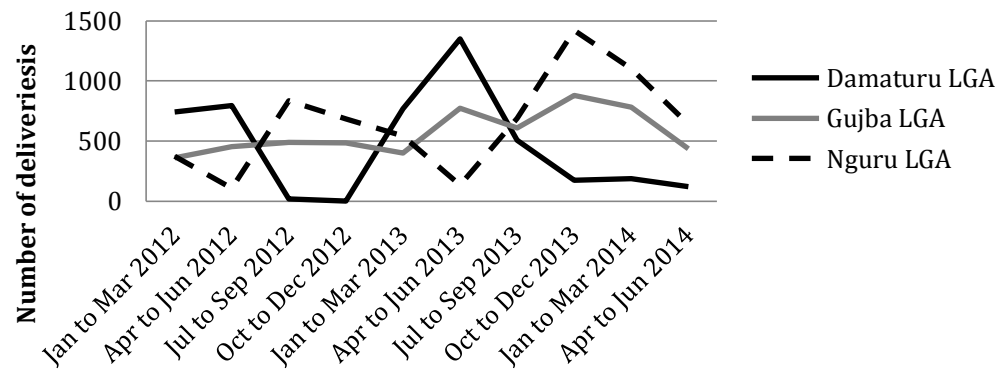
Although reference modes can be based upon hard data sources, they may also be usefully sketched by the group to elicit shared understanding of how a key variable changed over time, and the potential reasons for this.

Exploring reference modes for two or three variables – typically at least one key driver and one key outcome – will usually be sufficient to help group members grasp the idea of the influences that they will be seeking to capture trough group model building.

SCRIPT 9: PRELIMINARY MODEL DEVELOPMENT

Subgroups of no more than eight participants should be tasked with developing a preliminary systems model noting how the variables identified are linked. Subgroups can all work on the same scenario, or can be encouraged to reflect on the interaction of variables in a very particular setting (e.g. a particular District or clinic). The models developed with respect to these specific foci can, as is noted below, subsequently be integrated into a general systems model which maps the interaction of variables in multiple settings. However, it can be easier to generate this model reflecting general circumstances by reflecting on very specific ones.

Modelling begins by placing a depiction of the seed model on a flip chart and providing post-it notes of all other variables for appropriate placement by the (sub)group. It is best if all of these post-it notes (which can have been prepared earlier and added to – if necessary – with the identification of new elements) are the same colour.

Provide each subgroup with another set of blank post-its in a contrasting colour. These are for the group to add additional variables which, while not emerging from analysis of the narrative transcripts or from subsequent variable review, are seen as useful in developing a coherent model. In the example below, 'Health needs' was identified as a new variable to make the linkage between 'Insecurity' and 'Utilization of health facilities' more understandable.

Subgroups can be left free to define such additional variables themselves or – before modelling begins – the modelling team can suggest variables that may be useful for elaborating the models (which need not be used).

The key mechanism of elaborating the model is to identify any given variable and ask what influences it. If that variable is already on the flip chart, an arrow is drawn between the two, indicating the direction of influence. If the variable is not yet placed on the chart, the appropriate post-it is found, positioned, and an arrow drawn in the appropriate direction.

This process continues until all the variables identified through thematic analysis have been placed, and linked with other variables. Identifying the appropriate placement of variables and their linkages to other variables is an iterative process, so it is important to give plenty of time for this activity. As well as adding new variables to create a clearer explanatory model (as noted above), it is also not uncommon the meaning of existing variables to be renegotiated.

SCRIPT 10: CONSOLIDATION OF PRELIMINARY MODEL

One of the preliminary models developed by subgroups should
be transferred to a Vensim (or similar) causal loop diagram.
This can be prepared earlier by loading all predetermined
elements into a draft diagram and then adding variables,
shifting variable positions and connecting with causal arrows
to replicate the model developed on a flip chart.

This model can then be discussed by the full group, and
revisions made to reflect the variables and connections (i.e.
systems dynamics) identified.
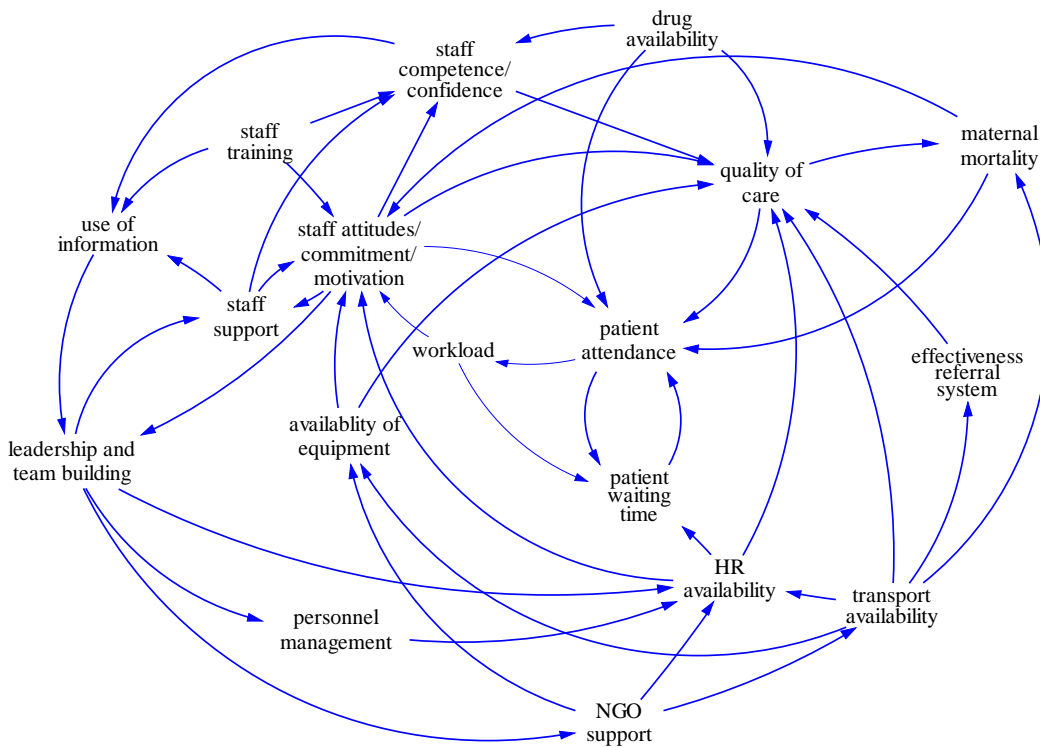
*Preliminary causal loop diagram representing factors influencing maternal mortality in OR Tambo
District developed during group model building*

SCRIPT 11: SYSTEMS MODEL ELABORATION

Usually AFTER the GMB (or in the second day of a two-day meeting) the systems model can be revisited to identify key feedback loops. Valences (whether an increase in one variable leads to an increase in another [+] or a decrease in another [-]) are first added. Then feedback loops – where arrows can be traced into a full cyclical path – are identified. These are generally differentiated as 'reinforcing loops' (if the net valence of the loop is positive or negative) or 'balancing loops' if the net valence of the loop is neutral.
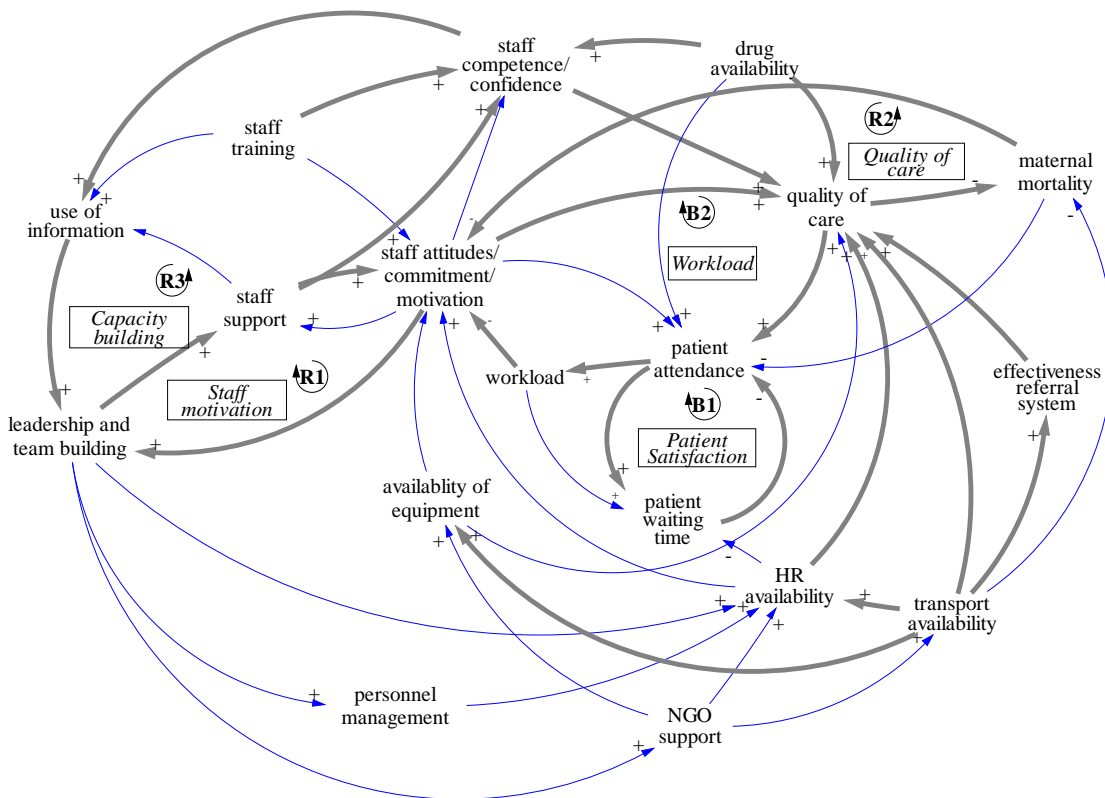

Causal loop diagram depicting key pathways of influence on maternal services within OR Tambo District

Note: An elaborated systems model can potentially be used to formulate simple stock-and-flow diagrams using a package such as Vensim. This requires focus upon a particular 'stock' (which could be medicines, patients, trained health workers etc.) and the factors that affect its 'flow' through the system. In the HSR case studies, HMIS data was generally inadequate to pursue such analyses (which involve setting parameters for each of the variables noted in the diagram) and scripts for such work are therefore not elaborated here. Our team plans to develop scripts for such analysis in subsequent studies, where HMIS and other data sources can support the development of quantitative modelling.

SCRIPT 12: IDENTIFYING KEY POINTS OF LEVERAGE

If processes of elaboration and refinement have led to the evolution of a preliminary systems model, it will usually be appropriate to feedback to initial stakeholders regarding this formulation. This is particularly the case where the model now more clearly indicates potential strategies to influence systems dynamics. This will often involve identifying not just key pathways of influence on key outcomes, but also the variables on that pathway that are more amenable to influence. This means identifying potential leverage points for creating systems influence.

In the Yobe case study the systems model was refined to identify key pathways of threat (blue and brown below) and also key pathways of response (pink. orange and red below). This vivid portrayal of the key pathways in which the Boko Haram insurgency was challenging the health system – and the means by which it was able to respond – was shared with stakeholders in Yobe after a further upturn in insecurity, including the murder of health workers. Presenting this model back to GMB participants and a wider audience of stakeholders convened for this event provided a structure for shared reflection at a critical moment. Those present were able to use the model to identify actions that had already been taken that were consistent with its implications (i.e. secure housing and life insurance for health workers to promote retention of indigenous staff). Further, they were also able to identify additional points of leverage suggested by the analysis, such as the strengthening of in-state education to enhance the stock of indigenous staff more likely to be retained in situations of adversity.
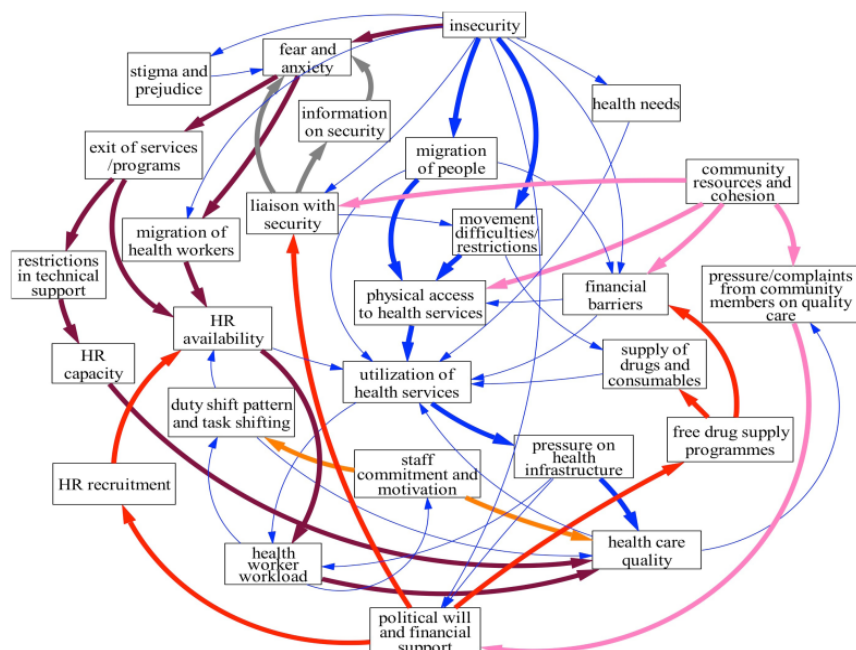
RESOURCE MATERIALS:

Helen de Pinho (2015) Systems tools for complex health systems: a guide to creating causal loop diagrams. Columbia University. Course materials for the Alliance for Health Policy and Systems Research, World Health Organization.

Simon Bell and Stephen Morse (no date) *How people use Rich Pictures to help them think and act*. Available: http://goo.gl/x77mgn

Vensim Personal Learning Edition (PLE). Available: vensim.com

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