## 2. Diagnosing a Gap and Designing an Intervention



Clinical research suggests how to effectively improve health and quality of life. Initial steps in translating research findings into improved clinical practice are to diagnose the gap or problem and design an intervention. Diagnosis results in the identification of actionable factors contributing to performance gaps and actionable reasons for failures in implementing innovations. Intervention design is the process of choosing a specific focus (e.g., patients, clinicians, information systems) for initiating change.

For example, while we might first observe a performance gap in a regional-level (or Veterans Integrated Service Network (VISN), in the Department of Veteran Affairs (VA) performance measure, further analysis might show that the problem is most closely related to a lack of patient knowledge or motivation. Still further analysis may indicate that the most effective practical solution would be the development of an intervention to activate patients. Or, we might first identify a failure to fully implement an innovation in individual provider practice, but further analysis might indicate a need to redesign communications between VISN leadership and facility management. Variation studies tell us the relative level of adherence to best practices across observation units (e.g., VISNs, facilities, clinic, practice teams, providers, and patients) and are very useful in identifying performance gaps, which then can be the subject of diagnosis.

Diagnosis and intervention design should always precede change efforts, but sometimes it is not readily apparent. For example, many times diagnosis and intervention design are implicit: a performance gap is observed and a decision is made to focus change efforts at persons or systems based on expert judgment or historical precedent. The problem with implicit methods is they are not transparent -- others who do not share our expertise or culture may not understand why we have made the choices we have. This chapter will focus on explicit, formal diagnosis, and intervention design.

Remember, diagnosis and intervention design are not all-or-none ventures. You can do just enough to determine that you may not need to do more.

### A. An Introduction to Systems Thinking

#### What is a "System?"

A system is an entity that maintains its existence through the mutual interaction of its parts. Systems exhibit *emergent* properties; these are characteristics that emerge from the interactions between the parts of the system and cannot be found in any of its parts alone. Being aware of how multiple systems and sub-systems might interact will help with relevant aspects of the implementation task. Systems can be described in terms of their goals, inputs, outputs, processes, and component parts or sub-systems. Systems can sometimes be observed or named (for example, the Veterans Health Administration is an integrated system of care made up of many component parts), but they are often not easily observed and not always named. There are many resources on the Internet to help understand systems and systems thinking; we suggest searching using the term "systems thinking."

For more comprehensive information on systems thinking, one suggested resource is a cyberseminar by Jennifer Terpstra and Luci Leykum on *Systems Thinking for Implementation Research and Practice* (http://www.hsrd.research.va.gov/for_researchers/cyber_seminars/archives/qir-070709.pdf , http://www.hsrd.research.va.gov/for_researchers/cyber_seminars/archives/qir-070709.cfm ).

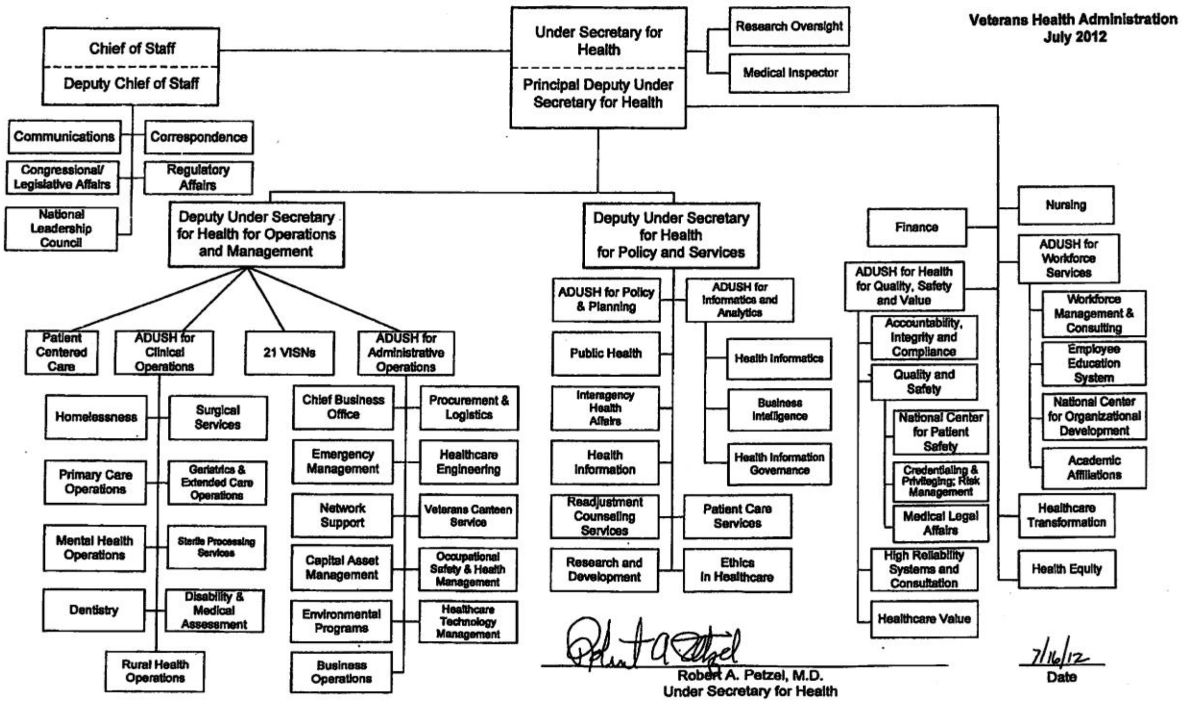
We will use a **colorectal cancer screening and follow-up system** to illustrate a system. A colorectal cancer screening and follow-up system maintains its existence through the mutual interaction of primary care, laboratory, and GI specialty clinics, as well as the more diffuse and external systems of patient adherence to appointments, and interactions with numerous other components of the medical center. Colorectal cancer screening and follow-up includes the referral/scheduling process. Productive communication among lab, GI, and primary care does not wholly reside in any one of these sub-systems, but is an emergent property of their interaction. Any agent (person or organizational entity) may simultaneously be a component in multiple systems. A primary care provider who is part of the colorectal cancer screening system also will play a role in other clinical sub-systems that originate in primary care. The provider also may be a part of administrative systems.

The goal of a colorectal cancer screening and follow-up system is to improve patient survival and quality of life through early detection and prompt treatment of colorectal cancers and pre-cancerous polyps. The inputs into the system are patient health status, patient and provider knowledge and attitudes, and clinic resources, etc. Processes within the system include: patient healthcare seeking, patient-provider shared decision-making, clinical informatics, communication and specialty referral, and patient education. The outputs of the system are screening rate, complete diagnostic evaluation colonoscopy (CDEC) rate, treatment rates, mortality, and quality of life effects.

**Formal and Informal Systems**

It is important to identify and consider both formal and informal systems when translating research into practice in clinical settings. Formal systems are objective in that they exist apart from any external observer. They are systems that are prescribed, mandated, or formally incorporated and/or organized. They include, but are not limited to, organizational entities (divisions, departments, etc.), professional societies, organized advocacy groups, and so forth. The nominal goals, inputs, outputs, processes, and component parts or sub-systems of formal systems are typically documented and may evolve over time to differ significantly from the documented components. While documented nominal components are a good introduction to formal systems (see org. chart below for example), effective implementation work requires understanding the functional components; in other words, how a particular system actually operates.

Veterans Health Administration (VHA) Organizational Chart:




In contrast to formal systems, informal systems are subjective; they only "exist" as observer constructs. They are descriptions of observed goals, processes, interactions among entities, and behaviors. Some examples of formal and informal systems may serve to illustrate. VHA is made up of multiple embedded, overlapping, and interacting systems, both formal and informal.

Examples of *formal care systems* that exist within VHA include VISNs (Veterans Integrated Service Networks), the regional organizations for VHA, service lines, facilities (i.e., medical center and affiliated community-based centers), stations (specific community-based outpatient clinics or medical centers), care units within a facility (e.g., clinics such as primary care or gastroenterology), and support units (chaplaincy, patient education, pharmacy, etc.).

Examples of *informal care systems* may be groups of providers who interact regularly, but are not part of a formal organizational network, or patient social support during regular transportation to clinics or in waiting rooms. The goals, processes and behaviors represented by both formal and informal systems have profound effects on healthcare and outcomes. Both are vital mediators of change, and both formal and informal systems should be considered in diagnosis and in intervention design.

**Examples of formal systems**

*Formal management systems*:

- Veterans Health Administration (VHA) http://www.va.gov/health/default.asp
- Patient Care Services (PCS) http://www.patientcare.va.gov/
- Office of Research and Development (ORD) http://www.research.va.gov/
- Operations and Management (10N) (available on VA Intranet only: http://vaww.dushom.va.gov/index.asp)
- Office of Information & Technology (OI&T) http://www.oit.va.gov/

*Formal provider systems*:

- Professional groups organized by discipline (i.e., dentistry, nursing, physicians, psychology, and osteopathy)
- Professional groups organized by practice specialization (i.e., primary care, mental health, and surgical)
- Clinic care teams or firms
- Gastroenterology department

*Formal patient systems:*

- Biological and legal family units
- Patient advocacy groups

**Examples of informal systems and system resources**

*Informal care systems*:

- Patient social support
- Friends
- Spiritual community
- Neighbors
- Under some circumstances, patient self-care can be viewed as a system

*Informal staff networks:*

- Patient-focused ad hoc teams; for example, the nurse refers the patient to a specific patient care representative, or the physician says "you ought to talk to nurse X in extended care." These represent how knowledge moves across local experts.
- Sometimes merely acting like one has knowledge is equally valuable. This leads to secretive, defensive behavior to preserve the illusion of power.

*Informal provider systems:*

- Provider-focused systems to improve job satisfaction and/or performance.
- Social support on and off the job.
- Dysfunctional cases may include implicit or explicit manipulation of others.

**B. What Does Systems Thinking Contribute to Diagnosis and Intervention Design?**

Systems-thinking helps us with problem diagnosis and intervention design by allowing us to recognize when a system is not functioning as designed.

**How to diagnose:** We can map out a task model and/or performance model (also called a process map). Analysis of the effectiveness of the system at each point in the system tells us what needs to be fixed. We may find that a specific observation unit (i.e., clinic) has skipped a step in the process.

**Intervention design or targeting:** The results of diagnosis point to specific individuals or points in the system or process that need to be addressed. Sometimes the entire system needs to be redesigned. Understanding inputs, outputs, and goals of embedded sub-systems will help:

- Identify low-hanging fruit,
- Point to mutual dependencies that may require sequencing of interventions, and
- Identify missing sub-systems or stakeholder groups that need to be involved.

If there are serious deficits at each step in the performance model, redesigning the system may be necessary. Repair may not be feasible, especially if the deficits are restricted to a specific sub-system. What appear to be isolated large deficits will have so many downstream consequences and sub-system interdependencies to work through that system redesign would be called for in these cases, too.

Systems thinking allows us to understand how the normal functioning of an intact system may result in performance gaps or innovation lags.

If we map out the system's functional goals, inputs, outputs, processes, and component parts or sub-systems, we can often find logical errors, barriers, or resource deficiencies.

We can perform virtual "tests" on potential interventions using our system models to determine how much improvement we might reap from each potential intervention.

Systems thinking allows for understand how normal functioning of multiple systems can produce performance gaps through conflict.

If we map out the system’s functional goals, inputs, outputs, processes, and component parts or sub-systems, conflicts can often be found between dependent inputs and outputs, conflicting goals, or attempts to access the same limited resources. Using systems models, check to see if proposed interventions resolve one set of conflicts only to create new conflicts.

**C. Conducting Diagnosis and Intervention Design**

**How Do You Conduct Diagnosis and Intervention Design? How Do You Map Out Systems?**

**Identify the problem**

There is usually some trigger that leads to the effort to conduct diagnosis and subsequent intervention design. Implementation efforts may be triggered either by observations of substandard or sub-optimal performance, or by observations that proven innovations are not being applied in the field. Diagnosis and intervention design efforts are often influenced by the impetus for the implementation effort. Some examples:

The observed performance gap:

The performance gap is a deficiency in one of the outputs of the main system of interest. In the colorectal cancer screening example, fewer than one-third of patients with positive fecal occult blood test (FOBT) findings received necessary complete diagnostic evaluation colonoscopy (CDEC).

Identifying an innovation lag or problem:

A new device, drug, policy, or process is deployed to a setting and is not being used, is being used incorrectly, or is being used and is having undesirable effects.

**Specify the task model**

Use means-ends analysis to develop a basic sequential task model or sub-goal structure. For example,

- We want patients to complete CDEC after positive FOBT findings.
    - What conditions must they satisfy immediately prior to the CDEC?
        - They must be adequately prepped and show up for the appointment.
            - What must they do to be adequately prepped?
                - They must do the at-home prep protocol,
                - Have the materials for the prep, and
                - Understand how to do the prep.

**Specify the performance model**

How is each node of the task model accomplished or represented in each setting? Representation of concepts such as nodes in a task model is called *instantiation*.

- Describe how each step in the task model is accomplished at each setting.
- Identify the appropriate formal systems that provide input or processes to the system.
- Identify and document informal systems.
- List the inputs and processes that link the sub-goals of the task model.

**Construct a decision-tree to model choice processes that connect each sub-goal to the next**

Decision-trees are frameworks for making explicit decisions when choices must be made, and for differentiating the frequency with which different paths between sub-goals are pursued. For example, with CDEC at Facility A: Patients are assessed for transportation support at the time of scheduling and are diverted to flexible sigmoidoscopy or barium enema, if no escort is available and the patient is considered low-risk. High-risk, unescorted patients have CDEC done as inpatients. This represents a decision point at which three different things may happen, depending on the circumstances:

1) If transportation is available, proceed with outpatient CDEC;
2) If no transportation is available and the patient is deemed low-risk, divert to outpatient flexible sigmoidoscopy or barium enema; or
3) If no transportation is available but the patient is at higher risk, schedule an inpatient CDEC.

Sometimes decision-tree models incorporate the cost or value associated with each choice as an aid in making new decision rules. For an example, go to: http://www.mindtools.com/dectree.html

**Measure outputs at each step of the performance model**

- Identify the desired output at each step.
- Identify sources of data for determining output at that step.
- Collect data.
- Include outputs in description of the performance model to assist in diagnosis.

Don't overlook the possibility of using existing datasets and using the VA Information and Resource Center (VIReC) http://www.virec.research.va.gov/ to find out more about VA datasets. These datasets have a wealth of information that may already be sufficient to estimate performance levels at each process node, and they include*:

- Veterans' Integrated Health Systems Technology and Architecture (VistA),
- VHA Corporate Data Warehouse, http://www.virec.research.va.gov/CDW/Overview.htm
- Data approval access through Data Access Request Tracker (DART), http://www.virec.research.va.gov/DART/Overview.htm
- Decision Support System (DSS), and
- External Peer Review Program (EPRP).

*Note that VA datasets change consistently, so please consult the VIReC website for up-to-date information.

In the CDEC example, we obtained data on:

- Number of FOBTs processed (NPCD),
- Number of positive FOBTs (VistA),
- Number of referrals for CDEC (VistA),
- Number of completed CDECs (NPCD),
- Endoscopic prep adherence rate (VistA),
- Endoscopic appointment adherence rate (DSS),
- Clinic wait times (DSS),
- Clinic staffing levels (DSS),
- Mapping of providers to clinics (NPCD), and
- Number of other endoscopic procedures (NPCD).

The benefits of using existing data include:

- Financial economy;
- Availability, although getting data may require specialized knowledge of the databases and data extraction techniques; and
- Data collection will not affect clinic operations.

Another tool that uses existing data to identify potential targets for interventions and resource utilization is Systems Dynamics Modeling. Dr. Kristen Hassmiller Lich presented a VA Cyberseminar on System Dynamics Modeling on January 25, 2011 entitled, "Using System Dynamics Tools to Integrate Evidence in VA Stroke Care."
(http://www.hsrd.research.va.gov/for_researchers/cyber_seminars/archives/qir-012511.pdf , http://www.hsrd.research.va.gov/for_researchers/cyber_seminars/archives/qir-012511.cfm ).

VA's Stroke-QUERI http://www.queri.research.va.gov/str/default.cfm utilized System Dynamics Modeling for its Center strategic planning. Briefly, originally coined by Jay Forrester at MIT (*Industrial Dynamics*, 1961), System Dynamics Modeling is a tool that utilizes mathematical models to inform strategic planning. The modeling describes trends and anticipates new trends and policy consequences. It is a tool that may be utilized to facilitate stakeholder discussions about resource allocations and strategic plans.

However, if there are no existing data sources that meet the needs, then primary data collection will be necessary to complete this part of the diagnosis. However, perhaps not all steps require the output measures. Think about potential sources of data broadly. Having some information through discussions with clinic staff may offer an estimate that is enough to serve your purposes for determining the extent of the problem. For example, in the tale of two CDECs, there are no data on the proportion of persons for whom having an escort is an issue – so we don't know how much of a problem this presents. Perhaps asking patients and tracking this for a short period of time would be sufficient for purposes of the diagnosis.; or a discussion could begin with those persons who do the scheduling, and who may already be able to estimate whether it is 5% or 30% of persons who have a problem.

**A Tale of Two CDECs**

Hypothetical data for two imaginary healthcare facilities are presented in the table below (data are taken from actual findings across multiple facilities). There are performance gaps at both facilities. At Facility A, 30% of persons with a positive FOBT receive a CDEC, and at Facility B, 34% of persons with a positive FOBT receive a CDEC. Performance models (how each facility accomplishes each step in the task model) for each facility were determined using the questions above. Effectiveness at each step is included if known.

| **Performance Model, Facility A** | **Performance Model, Facility B** |
|---|---|
| • Provider looks up CPRS lab result (rate unknown).<br>• Provider issues CPRS consult request to GI endoscopy (50% of FOBT-positive cases).<br>• GI clinic schedules patients (100% of orders are scheduled for either flexible sigmoidoscopy or CDEC).<br>• Nurse educator instructs all patients in home prep (100% of those scheduled receive instruction).<br>• No other prep support is given (90% of patients who arrive in the clinic are properly prepped).<br>• Patients are assessed for transportation support at the time of scheduling and are diverted to follow-up using flexible sigmoidoscopy or barium enema if no escort is available and the patient is considered low risk. High-risk, unescorted patients have CDEC done as inpatients.<br>• An appointment reminder phone call is made three days before the CDEC appointment (67% of patients arrive for their appointment).<br>• 50% referral rate * 67% appointment adherence * 90% adequate prep = 30% | • Lab result emailed to all providers (100% of FOBT-positive, unknown whether all are noted by providers).<br>• Provider issues CPRS order to GI endoscopy (75% of FOBT-positive cases).<br>• GI clinic schedules patients (100% of orders are scheduled for either flexible sigmoidoscopy or CDEC).<br>• No pre-CDEC education.<br>• No other prep support is given (70% of patients who arrive at the clinic are properly prepped).<br>• No transportation support or screening is offered.<br>• No appointment reminders are used (65% of patients show up for the appointment).<br>• 75% referral rate * 65% appointment adherence * 70% adequate prep = 34% successful CDEC |

| | |
|---|---|
| successful CDEC | |

**Preliminary conclusions (Kochevar and Yano 2006)**

Although the performance gaps are similar, the contributions of subtasks in the performance model are different between Facility A and Facility B. Facility A needs to improve its referral system more than Facility B, while Facility B needs to improve patient completion of prep. Both facilities could improve appointment adherence. Facility A has already implemented several strategies in these areas that Facility B has not yet deployed, and Facility B has implemented a change in how providers are notified of positive results.

**Before making the diagnosis: Is it really sub-standard performance?**

Before making final conclusions, let's investigate further. Pick up where the diagnosis left off, then diagnose a little more. The referral rate for Facility B was 75%. Is this adequate? Additional probing identified known causes of lower GI bleeding in half of the non-referred cases, a recent colonoscopy in another 10% of cases, and significant comorbidities that ruled out colonoscopy in another 15% of cases. So providers were appropriately excluding approximately 20% of patients with positive FOBTs from the referrals. The suspected failure rate for referrals is probably closer to 5%, and providers may be able to justify these exclusions as well. While we may need to come back to this in the future, changing referral patterns at Facility B is not recommended. The referral rate at Facility A was 50%. Only about 10% of the non-referral cases could be explained by adequate referral exclusion reasons. Therefore, referral rate improvement at Facility A should be targeted.

**Identify actionable factors for intervention**

In the tale of two CDECs, the overall performance gaps were found to be similar, but there were differences in the contributions of subtasks – so that the factors identified for intervention were as follows:

- Facility A needs to improve the referral system and appointment adherence.
- Facility B needs to improve completion of prep and appointment adherence.

**Intervention design**

An intervention target is specified in the following way – it includes both the target people/system involved (patients, clinicians, clinic system) and the subtask. Start with diagnosis of a gap in performance and other possible gaps. However, some performance gaps are not readily amenable to "repair" approaches, and may require more extensive work – sometimes full-scale system redesign. The following is a brief discussion of instances in which more extensive work is required.

**Intervention design: How do I do this? (A tale of two CDECs continues.)**

Intervention design is the process of choosing a specific focus for initiating change. An intervention target is specified in the following way – it includes both the target people/system involved (patients, clinicians, clinic system) and the subtask. For example, an intervention might target patients' contributions to appointment adherence, providers' contributions to making patients aware of the required prep for the exam, clinic systems' contributions to setting up appointments, or providers' contribution to ordering colonoscopy exams.

**Low hanging fruit: What is the easiest course of action?**

The rate at which providers in Facility A look up lab results is unknown. It could be measured, and if we find out that the rate is low, an intervention to change the providers' behavior could be undertaken. But emailing results to providers (feedback intervention) is associated with a higher referral rate in Facility B. Targeting a system change that supports providers by lessening the effort required to do their jobs is an example of low-hanging fruit.

**Sometimes you don't cross a chasm in two steps.**

In Facility B, the diagnostic analysis shows a diffuse set of gaps across the GI prep and appointment adherence part of the process. No single intervention target stands out as a major contributor to the performance gap. If both prep adherence and appointment adherence in GI at Facility B need to be changed, then this may be more readily accomplished as a single system redesign effort, rather than successive piecemeal interventions.

**Staging sequential interventions -- Sometimes you DO cross a chasm in two steps (but do so carefully).**

Think about what effect the proposed intervention will have on downstream nodes in the task model. You may need to target your first intervention at a point further along in the task model to prepare for increased demand that may result from the main intervention. For example, Facility A's low referral rate and the availability of a low-cost intervention make the referral system a reasonable intervention target. But what effect will this have on nodes further along in the process model? Facility A has a 67% appointment adherence rate and a 90% prep adherence rate, and increased referrals will put more demand on the prep education and appointment reminder systems. Will the current rates hold up or decline? What kind of intervention targeted at the prep education and appointment reminder systems will maximize their ability to deal with demands generated by increased referrals?

**"How-to" summary:**

*Diagnosis:*

- Construct a generic task or process model.
- Construct a performance model that shows how the task model is accomplished in each setting.

- Evaluate the level of performance at each node in the task model in each setting.

*Intervention design:*

- Harvest low-hanging fruit and, when possible, take the course of least resistance.
- Look for opportunities to combine multiple interventions into a cohesive system re-design, BUT…..
- Make sure the observed deficits don't have a rational explanation, and
- Make sure the fix for one problem doesn't cause another problem downstream – fix the downstream problems first.

The case study, as illustrated, shows the process after completion, but how do you generate a diagnosis and intervention-targeting plan from scratch? Some tools discussed later in this section were implicitly used in the above example (i.e., use of existing data, means-ends analysis, and decision-trees). However, the fundamental concept running through this example is the necessity of systems-thinking. The task model represents the generic system. The performance model represents a setting-specific system. Evaluating effectiveness at each process step is a systems approach. Making the business case, finding the low-hanging fruit, and knowing how to sequence sequential interventions are all systems concepts.

**D. Tools for Implementation Strategy Design**

There are multiple tools available for implementing strategy designs. Some are identified below, although the literature in this area is evolving rapidly, and it is important to search for current literature.

- Tools/process models – Tools and process models are available to assist with implementation strategy design. (Gaglio B., 2012)
- Intervention Mapping (Bartholomew, 2006)
- Pragmatic-Explanatory Continuum Indicator Summary (PRECIS) (Thorpe, Zwarenstein et al., 2009)
- Use of theory/frameworks to guide implementation targeting/planning
    - Implementation Intervention Mapping and Design – Intervention mapping is a planning framework that utilizes theory, evidence, and practical strategies to design implementation interventions and may target multi-level changes. The tools/process models include steps to target and design an intervention.

  Developed originally for Health Promotion Programs (Bartholomew, 2006)
    - Includes 6 Steps:
        1. Needs Assessment
        2. Create Matrices of Expected Change Objectives and Specify Determinants
        3. Identify theory based methods and practical strategies to design intervention strategies
        4. Program plan – develop and pretest materials

5. Specify adoption and implementation plan
6. Generate an evaluation plan

- Applied across fields, including healthcare (Schmid, Andersen et al., 2010)
- Examples – VA/HSR&D cyberseminar on June 21, 2012, Damush TM, "The Role and Selection of Theoretical Frameworks in Implementation Research" (http://www.hsrd.research.va.gov/for_researchers/cyber_seminars/archives/eis-062112.pdf http://www.hsrd.research.va.gov/for_researchers/cyber_seminars/archives/eis-062112.cfm) includes examples of implementation mapping and intervention design.

- Example Change Matrix (Step 2) on Secondary Stroke Prevention (Schmid, Andersen et al., 2010): http://www.implementationscience.com/content/5/1/97

| Provider Performance Objectives | Community Resources for Stroke Risk Mangagement | Delivery System Design |
|---|---|---|
| Assesses patient stroke risk factors during hospitalization for acute stroke | Access to local resources available to assess stroke risk factors | Work flow of discharge planning includes stroke risk factor assess/education |
| Orders lab tests as needed | Access to lab tests and interpretation of results | System alerts lab results; prescribes based on results |
| Prescribes appropriate medications | Access and provides patient education materials on medications | Medication reconciliation prior to discharge |
| Motivates patient to modify lifestyle | Write orders for home equipment | Motivational interviewing is built into patient education |
| Refers patient to local programs | Recommends and refers patient to local support programs | Access to local programs is available and up to date |

- Example Change Matrix (Step 3) Theory based methods and practical strategies (Schmid, Andersen et al., 2010) http://www.implementationscience.com/content/5/1/97

| Provider Performance Objectives | Theoretical Strategies of (Theory of Planned Behavior) | Practical Strategies (From provider interviews) |
|---|---|---|
| Assess patient stroke risk factors during hospitalization for stroke | Perceived Social Norms – clinical champion promotes; added into annual competency evaluation<br>Attitudes, Beliefs, Values – training<br>Self-efficacy – role playing to | Stroke risk factor assessment template is included in electronic medical record;<br>Checklist available at neurology workstation where discharge |

| | | |
|---|---|---|
| | improve skills, vicarious/peer modeling<br>Behavioral Intentions – ask commitment to perform | planning for stroke patients occurs |

## E. Web Resources

**Web Resources for Systems Thinking**

- http://www.thinking.net/index.html
- http://www.systems-thinking.de

**Engineering/Design/Quality Management Methods**

Theory of Constraints/Throughput Analysis: Systems models that are focused on converting "inputs" to "outputs."

- http://www.ciras.iastate.edu/library/toc/

**Task Theories/Task Analysis:** A variety of concrete methods for deriving task and performance models.

- http://www.cdc.gov/niosh/mining/content/taskanalysis.html
- http://www.psych.upenn.edu/~saul/a+p.xx.pdf

**Risk Analysis and Systems Analysis:** Methods based on the concept of risk. Although usually applied in a safety context, "demand" is a type of risk. How might risk analyses be used to represent demand for services? How does this view differ from through-put analysis?

- http://www.sra.org/
- http://www.hcra.harvard.edu/

**Root Cause Analysis Methods** of attributing causation to sequential processes within systems. Root causes are best candidates for interventions.

- http://www.patientsafety.gov/
- http://www.systems-thinking.org/rca/rootca.htm

**Performance Theories/Behavior Analysis:** Behavior analysis and behavioral task analysis focus on motivational factors (i.e., stimuli, reinforcement, etc.) in system processes.

- http://www-ee.uta.edu/hpi/page1/page3/page7/page7.html
- http://www.coedu.usf.edu/~behavior/tlall397.html

**Knowledge Engineering/Knowledge Acquisition:** Knowledge engineering and acquisition methods seek to understand the basis of decision-making within system processes, which might include motivational and factual components.

- http://kremer.cpsc.ucalgary.ca/courses/CG/

- http://carlisle-www.army.mil/usacsl/divisions/std/branches/keg/keg.htm

**Means-Ends Analysis:** Means-ends analysis may be used as a tool to map out system sub-goals, or as a problem solving method.

**Social Cognitive Theory** seeks to understand system processes as part of a social context. This is useful for mapping out goals and relationships among persons who are active participants in multiple systems; also useful for understanding conflicting goals. Pajares gives a good overview of social cognitive theory and of self-efficacy at the following link: http://www.uky.edu/~eushe2/Pajares/eff.html

**Management Science/Operations Research Methods:** Cost-effectiveness analysis is a diagnostic measurement approach that considers resource utilization. Effectiveness may include estimates of the "utility" or value of outcomes.

- http://www.ahrq.gov/research/findings/factsheets/costs/costeff/

**Technical Efficiency Analysis:** A diagnostic measurement approach that considers resource utilization, but allows each observation point to optimize different criteria. For example, some clinics may produce shorter wait times given the number of patients they see, while other clinics might complete more procedures annually given their patients' multiple comorbidities. This helps identify different strategies of approximating "best practice" when there are multiple system inputs and outputs, as well as scaling relative efficiency of observational units.

- http://www.deazone.com/http://www.queri.research.va.gov/implementation/section3