

Defining systems and system change

System change can be challenging to evaluate because systems are everywhere and various fields define systems in different ways. We highlight one definition that is particularly relevant for TPP program developers, implementers, and evaluators:

“A system is an interconnected set of elements that is coherently organized in a way that achieves something (function or purpose).”

— *Donella Meadows (2015)*

Building on this definition, systems achieve their function through system element actions and interactions. For example, a health care system consists of multiple elements, including public and private health care providers, equipment and infrastructure, policies and protocols, concerned groups such as advocates and community leaders, and wider societal and cultural norms related to health. These elements act and interact with one another through a web of relationships to produce an overall system function that is greater than the sum of any of its parts; in this case, the elements function to improve health and well-being. These actions and interactions that generate the system function are referred to as the system dynamics.

System change is an intentional process to alter or improve a system’s function through interventions that focus on shifting the underlying dynamics of the system. In the example of a health care system above, the system function is “improved health and well-being.” If a particular health care system is not achieving its desired health outcomes, not improving health and well-being efficiently, or generating inequitable health outcomes, staff and other collaborators might want to intervene. They might need to shift the actions and interactions of system elements to better achieve improved health and well-being. These types of interventions are often called “system change interventions” or “system change efforts.”

One key feature of systems is that all elements are connected through a web of relationships. This means that changing one element of a system will also change other system elements, sometimes in surprising ways. For instance, in the example above, implementers might intervene with health care providers to provide them with knowledge and skills to better reach teens with culturally responsive information and messaging about risk behaviors; they would expect that changes around information and messaging among providers would eventually affect teens’ risky sexual activity. Alternatively, staff or program leaders might intervene by collaborating with influential community members, such as local church leaders, school officials, and local business leaders, to affect change in public perceptions of sexual health care, which would influence teens’ sexual health behaviors and practices.

In these two examples, the entry points in the system were different than where implementors expected to observe a change. Implementers’ and evaluators’ level of confidence that intervening in a particular part of the system or in a particular way will lead to a desired change is based on the underlying system dynamics, or their ability to understand and predict the cause-and-effect relationships between system elements. In simple situations where system dynamics

System features and definitions

System boundaries are the lines program developers or evaluators draw to determine who (or what) is and is not part of the system in which they aim to intervene or evaluate efforts. These boundaries are both necessary and arbitrary, so it is important to consider multiple stakeholder perspectives when setting boundaries.

System elements, sometimes referred to as the parts or components of a system, can be both tangible and intangible. They can include people, organizations, resources, and services, as well as societal and cultural norms.

System dynamics are the patterns that emerge at the system level as a result of the particular ways a system’s elements act and interact with one another.

are more organized and predictable, evaluators might have a high level of confidence in how a particular intervention will lead to an intended effect, such as how a specific training course will lead to changes in clinic staff knowledge about teen health. In more complex situations in which system dynamics are less predictable, evaluators might be less sure about how an intervention might affect change, such as how changes in health care provider practices or public perceptions of sexual health care influence teens' sexual health behaviors. As a result of this uncertainty, evaluators might be interested in evaluating how particular interventions unfold and influence underlying system dynamics. In the following sections, we describe how concepts from systems thinking can help in planning these types of evaluations.

Planning for a system change evaluation

There are four main steps when planning for a system change evaluation (Figure 1). This section explains each step and when to move from one step to the next.

■ **Figure 1. Steps for planning a system change evaluation**



Step 1. Establish system boundaries related to the intervention.

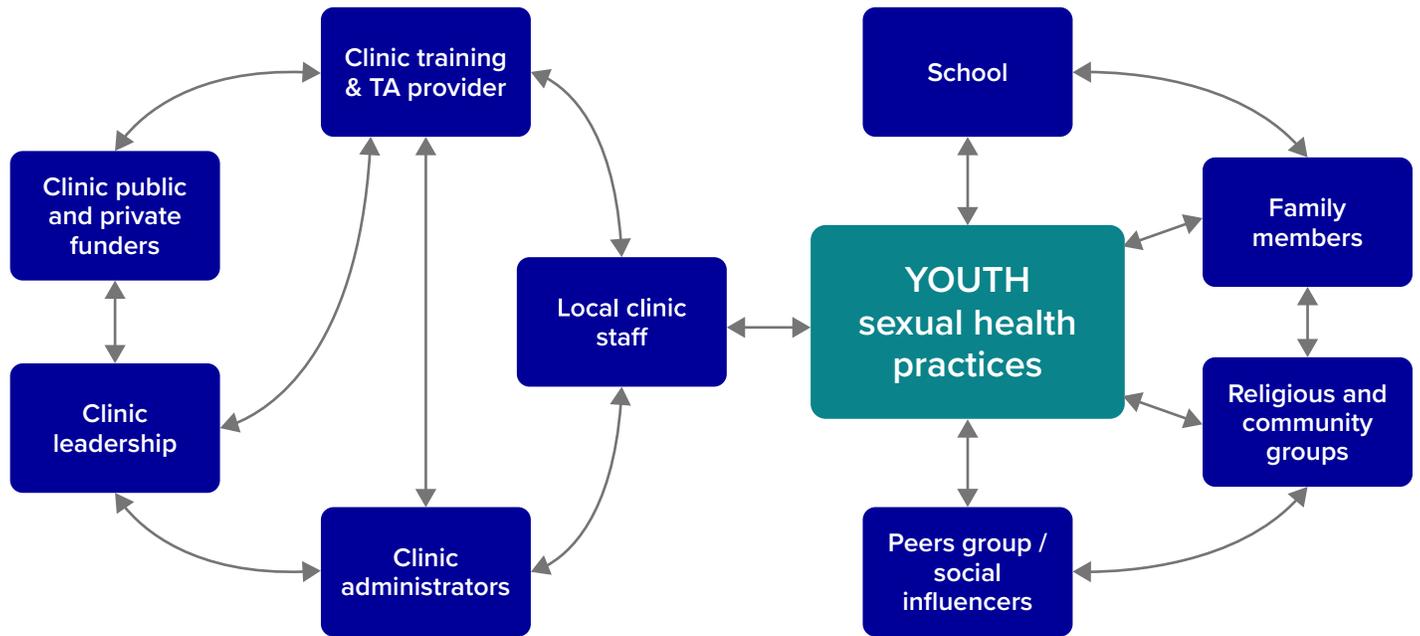
A system change evaluation begins with establishing the boundaries of the system that the intervention will affect.² Boundaries identify the system elements and relationships relevant to a particular intervention and thus provide some structure for evaluators to determine where to focus their evaluation efforts. Systems are infinitely complex and bounding the measurement effort to include only the essential pieces will help you conduct a feasible and informative evaluation. At the same time, it is important to balance inclusivity and selectivity when drawing boundaries around your system of interest to ensure you consider the perspectives of all concerned groups.

To establish system boundaries as part of an evaluation, consider the system dynamics, or the system elements and relationships that are relevant to the intervention and overall system function on which the program or practice intervenes. For instance, imagine you designed an innovative training program for clinic staff that intends to increase communication about sexual and reproductive health among youth and local clinic staff. Although the training program primarily might target the communication skills of clinic staff, by using systems thinking to design your innovation and to establish system boundaries, you might hypothesize that clinic staff are not effectively communicating with youth about sexual and reproductive health for two additional reasons: (1) they don't feel prepared to have those conversations, and (2) they don't feel supported by their administrators to have those conversations.

² If you are evaluating an intervention that was intentionally designed as a system-level intervention, system boundaries were likely established during the program design phase; evaluators should keep in mind however that systems are dynamic, and boundaries may shift over time. For interventions that were not designed through a systems lens, but where there is a desire to understand whether the intervention led to any system-level effects, evaluators will need to establish the system boundaries as part of their evaluation planning activities.

When drawing your system boundaries for this evaluation, it would be important to include staff who provide training and technical assistance to clinic staff, as well as administrators and the immediate influences on them (such as their superiors, the funding streams supporting their positions, and so on). Equally you may want to consider the other system actors who influence youth beyond clinic staff, such as their peer group and other social influencers, family members, and other community and religious groups (Figure 2).

■ **Figure 2. System boundaries around youth sexual health practices**



Step 2. Identify the theory of change for the intervention.

After establishing system boundaries, hypothesize how you expect change to occur on the pathway from the intervention to the desired change in system function. In the example above, the intervention aims to provide training to local clinic staff to address inequities in teen pregnancy rates. In this instance, you recognize that reductions in teen pregnancy rates and inequities are long-term changes that may not be feasible to measure from a time and resource perspective. A theory of change can help you identify the shorter and more medium-term causal steps on the pathway from the intervention to a change in system function that may be more feasible to measure.

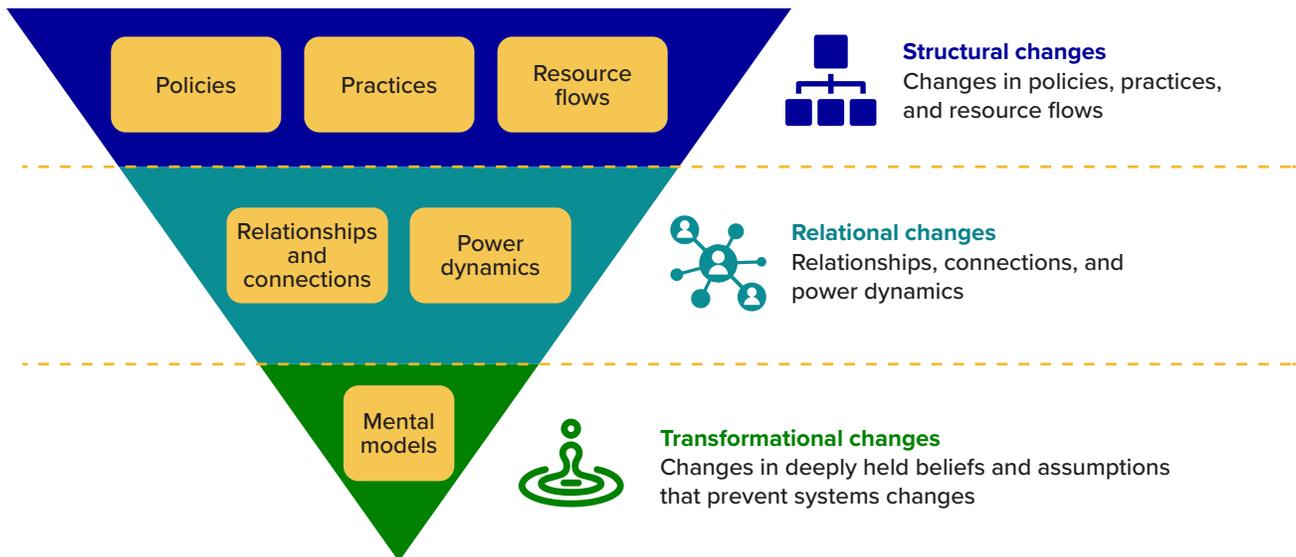
In simple situations in which underlying system dynamics are more organized, you can outline a more linear theory of change, such as a logic model that illustrates the pathway from program inputs, activities, and outputs to a specified change. For instance, you could make a reasonable hypothesized theory of change for an intervention that has a strong evidence base indicating that a particular training is effective in changing the knowledge and skills of local clinic staff to deliver specific types of messages to teens. See Figure 3 for an example of a theory of change for this type of situation.

Figure 3. Hypothesized theory of change for a simple situation



In more complex situations where the underlying system dynamics are less predictable, the theory of change should articulate a) the *hypothesized* causal pathway from intervention to changes in underlying system dynamics; and b) the *possible* causal pathways from changes in system dynamics to changes in the overall system function. A framework that can help you identify how interventions might lead to changes in underlying system dynamics is the six conditions of system change (Figure 4).³ These six conditions, grouped across structural, relational, and transformational changes, are a guide for evaluators to determine which aspects of the underlying system dynamics might change because of a particular intervention and which system dynamics might not be directly affected. Even though certain aspects of a system might not be targeted by an intervention, it might be important to include those aspects in the theory of change.

Figure 4. Six conditions of system change

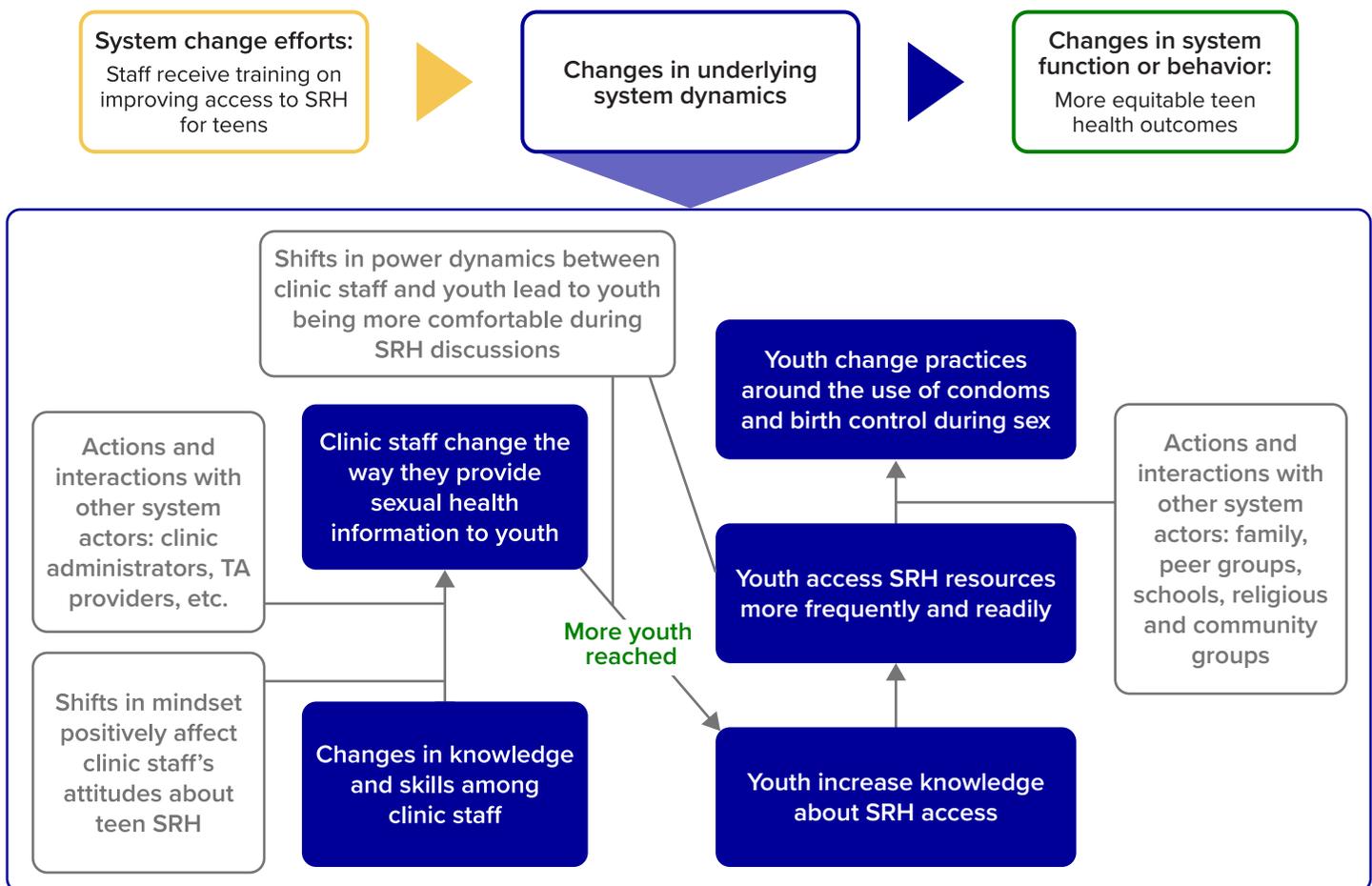


³ In their 2018 publication *The Water of Systems Change*, Kania and colleagues—drawing from the work of system thinkers including Jay Forrester, Donella Meadows, and others—posit six conditions of systems change articulated at three levels: structural or explicit changes (changes in policies, practices, and resource flows); relational or semi-explicit changes (changes in relationships and connections and changes in power dynamics); and transformational or implicit changes (changes in mental models).

Using the example above, a theory of change that attempts to hypothesize the causal pathway from the training to changes in teen pregnancy rates would first articulate how the intervention was expected to lead to *structural changes* in the underlying system dynamics: (1) changes in the knowledge and skills of local clinic staff which would lead to changes in health care provider practices in terms of the way they provide sexual health information to youth and (2) increases in youth knowledge and accessing of sexual health resources. These structural changes will, in turn, contribute to changes in teens' sexual health practices and thus alter the system function. The theory of change would document these expected changes (Figure 5).

Yet, the structural changes detailed above might not be enough to shift the system from its initial state to a new state. For instance, you might hypothesize that in this particular context, there are additional factors that require *relational* and *transformational changes* to influence teens' sexual health practices. For instance, power dynamics between providers and teens, or providers' attitudes about teen sexual and reproductive health might be conditions that hold the system in place. In this case, although the intervention is not targeting these conditions, it would be important for your theory of change to include these system dynamics because they influence whether the system function changes. Equally, the system boundaries established in Step 1 identified other system actors that influence both clinic staff and youth. Understanding changes in the actions and interactions between these system actors over time and how they might influence changes in clinic staff and youth would be equally important to include.

Figure 5. Hypothesized theory of change for a complex system



SRH = sexual and reproductive health; TA = technical assistance.

Step 3. Identify research questions about system dynamics.

The theory of change is a useful guide for establishing research questions to evaluate the system change intervention. When selecting research questions, be sure to reflect on areas within the theory of change where you feel less certain about the hypothesized cause-and-effect relationships between system elements. This might include system dynamics within the system change intervention pathway and system elements outside the intervention that you've identified as important (such as the relational and transformational changes described above). Rather than focusing your research questions on areas that already have strong research and evidence, focus your questions on the areas where you are less certain about the cause-and-effect relationships between the intervention and the hypothesized drivers of system change. Using the example above, some potential research questions might include:

- **Structural change research questions.** What was the policy for clinic staff participation in the training? What was the level of engagement at the training? Did clinic staff participants improve in their provision of sexual health information to teens?
- **Relational change research questions.** Do clinic staff feel supported by administrators in their provision of sexual health information to teens? Have power dynamics shifted between providers and teens so teens feel more comfortable and honest discussing sexual health with providers?
- **Transformative change research questions.** Have clinic staff and administrator beliefs about provision of sexual health information to teens changed after participating in the training? Have teens' attitudes about the risk of pregnancy changed?

Step 4. Select appropriate evaluation methods and data sources for your research questions.

Once you determine your research questions, the next step is to identify a set of evaluation methods or existing data sources that are appropriate for informing the system-level changes you want to measure. We next discuss methods and data sources to measure the six conditions of system change described above. See Table 1 for more details on **data sources** and **analytic methods**.

- **Structural changes**, or changes in policies, practices, and resource flows, are observable. Thus, evaluators can more easily rely on existing, or secondary, data sources to understand whether changes are occurring. For instance, organizations interested in evaluating changes in funding for TPP programs over time might use **program and administrative data** to quantify funds earmarked for TPP programming from 2012 to 2022 at the local, state, or national level. Primary data collection methods might also inform structural changes. For instance, evaluators might conduct **key informant interviews** or **focus groups** with network leaders to evaluate how resource flows have changed over time throughout a network of partners.
- **Relational changes**, or changes in relationships, connections, and power dynamics, are harder to observe than structural changes. Here, evaluators must rely more on collecting primary data and thoughtfully evaluating those data. For instance, evaluators might collect **survey** or **interview** data and then use **system maps** to assess any new organizations that actively engage in network activities. System maps can also identify whether new connections are forming among network members. **Social network analysis** offers a way to capture these changes formally and quantitatively.
- **Transformational changes**, or changes in deeply held beliefs and assumptions, can be challenging to assess. However, these changes might be the central goal of your system change efforts because of their ability to exert key influences over the entire system. Imagine your goal is to reduce stigma around sexual and reproductive health care in a community. For a low-burden approach, evaluators might conduct yearly **surveys** with influential members of the system and then analyze changes over time in responses to questions about stigmatic beliefs. A more intensive approach to assess if your innovative intervention is moving the needle on stigma is to conduct **focus groups** with

people affected by and involved with the intervention. You can use focus group data to evaluate whether beliefs and assumptions about stigma are changing. In addition, using an approach such as appreciative inquiry (Coghlan et al. 2003) in your focus group protocol creates space for participants to reflect on what they have learned since engaging with the intervention, which you can use to document mindset shifts over time.

Using a participatory approach to examine system change

Participatory approaches, such as human-centered design and community-based participatory research, can be used alongside any of the data sources and analytic methods described in this primer. Participatory approaches emphasize the inclusion of and attention to voices and lived experiences of people and communities affected by a problem or situation of interest. For instance, if you are working on health care clinic system change, people who work in and engage with the clinic are key voices to include in a participatory approach to designing the evaluation; determining appropriate data to collect; and measuring, analyzing, and reporting findings related to system change.

Table 1 outlines a variety of data sources and analytic approaches evaluators could use when assessing structural, relational, and transformational system changes. There is no one-size-fits-all way to measure system change. We recommend taking a thoughtful approach that considers the factors you identified in your theory of change, your research questions, and a variety of measurement and analysis opportunities. The table offers a handful of examples of data sources that are meant to inspire rather than limit your planning for your system change evaluation. Many of the data types and analytic methods can be used to assess multiple types of change. When selecting methods and data sources, keep the following considerations in mind:

- **Prioritize feasibility.** There are many approaches you can use to evaluate system change, each requiring varied time and resources. When selecting a measurement approach, identify one that works within your resource constraints. It is unlikely, and not expected, that you will be able to measure every potential moving part in your system of interest, so use the theory of change and research questions as a guide to focus your evaluation.
- **Mixed-methods approaches are optimal.** Numbers and narratives can complement and contextualize each other when you are trying to capture and make sense of small gains toward your ultimate system change goal. When possible, use quantitative and qualitative data to answer your research questions.

Table 1. Primary and secondary data collection and analytic approaches

Data source/approach		Purpose and analytic method	Examples of data sources
Primary data analysis: Collecting and analyzing new data			
Qualitative data	Key informant interviews and focus groups	Key informant interviews and focus groups provide rich qualitative data about how the system has changed over time and factors that contributed to these changes. These data can inform additional analytical approaches, such as systems mapping and stakeholder power analysis.	<ul style="list-style-type: none"> • Interviews with network leadership teams • Focus groups with frontline health care staff, youth, etc.
Quantitative data	Surveys	Surveys can be quickly and uniformly administered and analyzed to capture changes in underlying system dynamics or functioning over time.	<ul style="list-style-type: none"> • Web-based surveys with program participants, network partners, frontline staff; etc.

When sharing findings, remember to contextualize them by describing any evidence of progress toward the ultimate system change goal. The six conditions of system change framework is a useful tool for an organization or network to use when discussing the contributions of their system change efforts to addressing complex problems. Consider framing findings from a system change evaluation using the following structure, in which you distill information across each of the six conditions within the reporting categories:

- **Describe your efforts.** What interventions did you employ, and what system conditions or underlying systems dynamics did they address?

Example: “Our network worked collaboratively to better coordinate services across health, education, and other social supports for teens. We met monthly, invited new groups to our meetings, and developed joint action plans to better coordinate our services. By coordinating our services, we expanded each organizations’ ability to make referrals and connect teens to services in our network, reducing a key barrier to access for many of our teens.”

- **Document what happened as a result of these efforts.** Summarize the evidence you gathered on the efforts that addressed conditions of system change.

Example: “This effort led to structural changes in the system in the form of new connections between organizations that were previously not collaborating. In addition, a number of new members joined our network. The intervention also led to relational changes; it strengthened relationships between existing members, as evidenced by the new referral mechanism that we developed and have been using as a standard part of our daily clinical work. After implementing this referral mechanism together, we began to see more teens receiving multiple mutually reinforcing support services across several network members.”

- **Describe how these results can eventually contribute to system change.** Draw plausible links to describe how this change in conditions reflects a potential shift of the system in the right direction. Use your theory of change as a guide when contextualizing the changes you have observed and the changes you expect to observe in the future.

Example: “As we intensify the breadth and depth of services reaching teens in our community, we expect that teens’ perceptions of access to sexual and reproductive health care will begin to change, which we will examine through focus group data collected one year after implementing our service coordination approach. We expect that eventually we will see an increase in the number of teens who access sexual and reproductive health care in our community, which will be reflected in patient health record data and annual clinic reports. These changes will ultimately lead to a reduction in teen pregnancy rates.”

Conclusion

System change approaches aim to address the root causes of persistent problems, such as stagnating declines and disparities in unintended teen pregnancy in communities across the United States. Such approaches emphasize the interrelated web of relationships through which programs operate. Evaluating a system change effort requires thoughtful planning. It starts with mapping out the system in which you are trying to intervene and developing a theory of change that articulates how you expect your interventions to affect the wider system’s dynamics and overall functioning. This provides a foundation for identifying questions to answer around areas where you are more or less certain of how change might happen. You can answer these questions using a variety of data sources and analytic approaches. Remember that although system change takes time, partners, decision makers, and communities benefit from incremental learning that you can report along the path to change.

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Appendix: Resources for System Change Evaluation

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