Stanford | Program on Water, Health & Development

BRIEFING NOTE | MARCH 2020

Conrad N. Hilton Foundation Safe Water Initiative

STRATEGY MEASUREMENT, EVALUATION & LEARNING
SELECTING COMPARATOR DISTRICTS

Introduction

The Conrad N. Hilton Foundation's (Foundation) Safe Water Initiative invests in district-level partnerships to achieve universal safe and sustainable water coverage in Burkina Faso, Ethiopia, Ghana, Mali, Niger, and Uganda. In select districts, a set of partners — including local government, NGOs, and community-based organizations — co-creates and implements a plan to achieve safe and sustainable water services for all households, schools, and health care facilities by 2030. The Foundation's Safe Water Strategy Theory of Change hypothesizes that working in partnership at the district scale accelerates progress towards universal service and strengthens service delivery systems in a way that 'crowds in' additional financial and human resources. Since 2017 the Foundation has created partnerships in 12 districts across its 6 focus countries.

Stanford University's Program on Water, Health & Development (WHD) is working with the Foundation to evaluate aspects of its Safe Water Strategy. For example, the Foundation is interested in knowing whether access to basic and safely managed water services is expanding more rapidly in focus districts than in comparable districts where the Foundation is not currently active. This briefing note describes the approach that the WHD team has adopted to assess the impact of the Foundation's investment model on water service levels in focus districts.

Generating actionable evidence

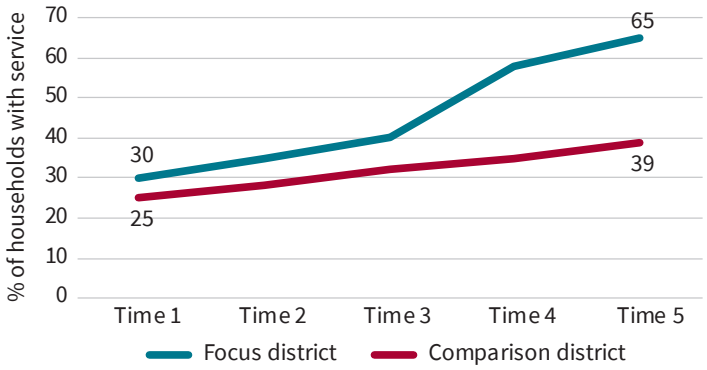
Effective Strategy Measurement, Evaluation & Learning (MEL) depends on the ability to discern changes that occur as a result of decision making. A key MEL goal for the Foundation is to understand how its investments contribute to achieving the Sustainable Development Goal for safe water in each of its focus countries. Specifically: If service levels improve in a focus district, is it *because* of the Foundation's investment or for some other reason? To answer this question, the WHD team will compare district-scale changes in water service coverage in focus districts against changes happening in other, comparable districts.

This type of comparison is regularly employed in the field of impact evaluation. Conceptually, *impact* refers to the difference (Δ) in an outcome (Y) that would be observed for a given person (or household, district, etc.) given that they participated in a program or intervention (Y | P=1) compared to the outcome for that same person when they do not participate (Y | P=0). In reality, it is often not possible to observe an outcome for both scenarios; a focus district that does not have Foundation investment cannot be observed, for example. Instead, a similar, non-focus district can serve as the *counterfactual,* to provide an idea of what would have happened in the focus district had it not benefited from the Foundation's resources.

Tracking change over time in both a focus and comparison district provides evidence regarding the extent to which the Foundation's investments accelerate expansion of water supply services (Figure 1). If progress were tracked only for the focus district (teal line), the data indicate an increase in access of 35 percentage points (65%-30%). This simple before-*versus*-after analysis, however, neglects the possibility that factors other than the Foundation's investment could be catalyzing service coverage expansion. Such factors could include rising household incomes or a national policy that subsidizes water connection costs.

Figure 1

Difference-in-differences analysis (Hypothetical example 1)



Including a comparison district that is expected to respond similarly to these external forces allows their effects to be 'netted out' in the analysis. In this hypothetical example, the red line reflects what happened in a comparison district that did not benefit from the Foundation's efforts. Over the same time period, service coverage also increased in this district, from 25% to 39%. Combining the evidence from the two districts into one analysis, the data suggest an incremental service expansion of 21 percentage points ((65%-30%) – (39%-25%)) for the focus district.

In practice, the analysis uses a multivariate regression model that includes terms for the time period (before versus after an intervention) and for treatment versus control group. It also includes covariates that may independently influence the outcome of interest. The approach is called "difference-in-differences" analysis because it compares the difference in an outcome both over time and between the treated and untreated group.

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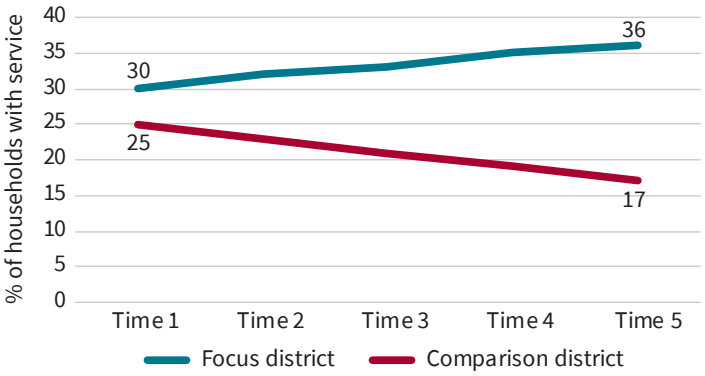
A difference-in-differences analysis can also be useful when the observed change in the treatment area (focus district, in these examples) appears to be negligible. Suppose that access to water services in the focus district increased by 6 percentage points during the period of interest (Figure 2), while coverage declined by 8 percentage points in the comparison district. Assuming that coverage in the focus district would have followed a similar trend without the Foundation's investments, the unadjusted attributable difference would not be 6, but rather 14 percentage points (6% – (-8%)).

Figure 2

Difference-in-differences analysis (Hypothetical example 2)



Executing a difference-in-differences analysis is straightforward conceptually but often challenging in practice. In the context of the Foundation's Safe Water Initiative, it requires the strong assumption that, with respect to the determinants of water service coverage, focus and non-focus districts differ only in terms of their 'exposure' to Hilton investment. This is often referred to as the *parallel trend assumption*. There is no statistical test for this assumption, but visual inspection of observations before the intervention can help evaluate the claim. One challenge for the Foundation is that, in some countries, there is not a clear point at which the Safe Water Strategy 'treatment' begins because grantees have been operating there for some time prior to receiving Foundation support.

Identifying matching factors

The WHD team is working to identify one or more comparison districts for each focus district to allow for a difference-in-differences analysis as part of the Safe Water Strategy assessment. Each comparison district will ideally be located in the same region as its counterpart. A comparison district should also be as similar as possible to the focus district with respect to factors that influence the rate of water service coverage expansion. WHD identified factors from academic and professional literatures, including both supply- and demand-side determinants of service coverage, along with key contextual features. This initial list was reduced to 11 key factors (Table 1).

To operationalize each factor the WHD team identified several possible indicators, then evaluated each one for validity, reliability, and data availability. Data on the indicators presented in Table 1 will be collected for all districts located in the same region as the focus district.[1] Data will be collected from national-level sources where available; otherwise, global data sources will be used. If no data are available either at the national or global level, the indicator will be excluded from further analysis.

[1] If a region has fewer than 6 districts, then districts in adjacent regions will also be included as comparator candidates.

Table 1[2]

Indicators used to identify comparison district candidates

	Construct	Indicator	Relevance
Supply	Area	Area of district (km^2)	Faster progress can be made where the *per-capita* cost of connecting an unserved household is relatively low, all else held constant.
	Population density	Population per km^2	
	Depth to groundwater	Mode of depth-to-groundwater classification among district parcels	
	Terrain ruggedness	Topographic ruggedness index value (root mean square elevation change)	
	Baseline coverage	% population with access to at least basic water services at baseline	The marginal cost of extending service is typically positively associated with share of the population served.
Demand	Population	Total population	The total number of people needing to be served.
	Population growth rate	Average annual population growth rate in recent years (%)	Expanding coverage is easier in a district that is growing relatively slowly.
	% urban	Share of the population living in areas designated as urban (%)	Effective demand for water supply services is typically greater for urban vs. rural households.
	Km of surface water	km of rivers, streams, and/or lake shoreline per km^2	Effective demand for improved water supply is lower in districts with available surface and rain water, all else held constant.
	Mm of rainwater/year	Average annual rainfall in prior several years (mm)	
Context	Service delivery capacity	Roads/km^2	Higher values signal capacity of local government to plan and execute infrastructure investments.
		Electricity/km^2	
	External development partner support	1 = Major, externally funded water project within the past 5 years 0=Otherwise	A development partner brings additional resources that can accelerate service expansion.
	Political alignment	1 = District is politically aligned with party in power at the national level 0 = Otherwise	Political alignment can lead to support of infrastructure initiatives.
	Economic base	Average nighttime light intensity in digital numbers (DN) ranging from 0 (no) to 200 (most intense) light.	Higher levels of wealth and economic activity generate taxes and revenues that can fund service provision, all else held constant.
		1 = A major commercial or industrial firm is located in the district 0 = Otherwise	
	Accessibility	Driving distance to regional capital (km)	Easy access to a regional hub is helpful for maintenance and repair needs

*Initial screening indicators: Districts that are +50% of the focus district value will be considered for further analysis.

Selecting comparison districts

Once data on all indicators have been collected, a composite measure will be calculated that reflects the degree of similarity between each comparison district candidate and the relevant focus district. First, the candidate district will be scored for each of the Table 1 indicators. For continuous variables such as population, the score will reflect the percentage difference between the value of the two districts. For categorical variables such as political alignment, the score will either be 1 if the focus and candidate comparison district have the same value, or 0 if they do not.

Once scores are assigned for each of the 17 indicators, they will be averaged across theme. For example, the mean of the first 5 indicators will reflect the degree of similarity between the candidate comparison district and the focus district with respect to supply-side considerations. Scores will be computed for demand-side and contextual features as well; then these 3 scores will be averaged together to yield an overall similarity score. Districts with the highest similarity scores will be identified as possible comparison districts. The candidates will be discussed with the Foundation and its in-country MEL partners (known as 'hub' organizations) so that a final decision can be made. In April 2020 the Stanford WHD team will share the list of comparison districts that have been selected for each country.

[2] The indicators included here should be viewed as provisional, as evaluation of additional datasets and indicator candidates is still underway.