Reaching Universal Health Coverage through District Health System Strengthening: Using a modified Tanahashi model sub-nationally to attain equitable and effective coverage
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Reaching Universal Health Coverage through District Health System Strengthening: Using a modified Tanahashi model sub-nationally to attain equitable and effective coverage

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ACRONYMS

CHWs        Community Health Workers
CRC         Convention on the Rights of the Child
DHMTs       District Health Management Teams
DHS         Demographic and Health Surveys
DRC         Democratic Republic of the Congo
HSS         Health System Strengthening
iCCM        Integrated Community Case Management
LMICs       Low and Middle Income Countries
LQAS        Lot Quality Assessment Survey
MBB         Marginal Budgeting for Bottlenecks
MDG         Millennium Development Goal
MICS        Multiple Indicator Cluster Surveys
MNCH        Maternal, Newborn and Child Health
MoH         Ministry of Health
PHC         Primary Health Care
UHC         Universal Health Coverage
WASH        Water, Sanitation and Hygiene
WHO         World Health Organization
BACKGROUND

In recent years, global initiatives and partnerships have tracked the encouraging progress made towards reducing mortality among children under-five in many countries. However, this progress and the policy adjustments made to redirect trajectories towards meeting the Millennium Development Goal for child mortality (MDG 4), have largely occurred at national levels. Lamentably, many of the countries that have made good progress in reducing their under-five mortality rates at a national level have also experienced worsening inequities between their wealthy and poor sub-populations, as well as widening disparities across other socio-cultural group attributes such as ethnicity, geography, food security, and citizenship. This, in turn, has significant implications for finishing the “unfinished agenda” of the MDGs for maternal and child health services, as well as for discussions on moving towards Universal Health Coverage (UHC) as a part of the post-2015 agenda.

In light of this, two questions should be answered when aiming to achieve UHC with equity. First, are UHC policies ‘equity focused’ so the path to UHC, i.e. the polices and strategies implemented, closes instead of widens disparities in use of services and health outcomes? Second, are the planning and monitoring processes implemented in a pro-equity manner? Achieving measurable progress necessitates identifying the reasons behind inequities in efforts to attain UHC, which in turn requires a comprehensive and more integrated assessment of health system functioning, particularly at sub-national and service delivery levels. It is essential to determine why certain sub-populations are less likely to receive effective coverage, meaning coverage that ensures each person utilises needed health services that are appropriate and with sufficient quality to have impact.

However, efforts to understand the underlying causes of poor health outcomes and address access and utilization gaps at these levels, including identification of bottlenecks preventing effective coverage, have been problematic for several reasons. First, district level data relating to health services’ coverage, access, and utilisation are often weak, unreliable, and incomplete. Second, with a few exceptions (mostly in middle income countries), tools and information systems to obtain the disaggregated data needed to systematically assess equity of services uptake are rarely present at the district level. In many cases, Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS) have served as the main source for sub-national (often regional or provincial) data disaggregated by gender, wealth and other socio-economic determinants of health. However the utility of these data for programme planning and monitoring is limited as they are only available every few years and, critically, are rarely analysed with contemporaneous household expenditure surveys to separate out financial from non-financial barriers to the uptake of health services.

In addition, efforts to understand UHC gaps within low and middle income countries (LMICs) have often focused solely on the technical functioning of the health sector and have overlooked, with a few notable exceptions, such as household wealth, the relevance of social determinants of health. Such a limited diagnostic view can lead to policy responses that exacerbate health inequities.
These reasons may in part explain why health systems in LMICs typically do not succeed in reaching the most marginalised and excluded.\textsuperscript{28, 29} Indeed, evidence shows that richer and more urban groups tend to capture a disproportionate share of public sector services and resources in many LMICs.\textsuperscript{16, 30} However, there are some well known exceptions. For example, Gwatkin and Ergo describe healthcare strategies based upon "Progressive Universalism," under which the most poor and disadvantaged have access to health services, and are the first to capture increases in health resources.\textsuperscript{11} They highlight Brazil’s Family Health Programme and Mexico’s Popular insurance initiative, two efforts that offer healthcare subsidies or free coverage to the most poor first, so as they are not left out of subsidized programs.

Equity in utilization of health services is more than a moral goal or a simple reflection of UNICEF’s rights-based approach to child health. There is compelling evidence indicating that an equity-focused approach also is the most effective way to achieve UNICEF’s mission to “advocate for the protection of children’s rights, to help meet their basic needs and to expand their opportunities to reach their full potential.”\textsuperscript{33}

This paper explains the development of an approach to evaluating the capacity, and more recently the equity, of health systems through the analysis of bottlenecks to effective coverage, first fully described by Dr. T. Tanahashi of the World Health Organization in 1978. Though revised over the ensuing years, Tanahashi’s approach to assess system bottlenecks is important since it moves attention beyond access to health services and brings focus to the quality, and thus the effectiveness, of interventions. This bottleneck analysis is foundational to UNICEF’s efforts to reorient District Health System Strengthening (DHSS) methods towards the attainment of equitable UHC. The sections below explain the development of a model for analysis of bottlenecks at the district level. Included are descriptions of experiences from its initial application as part of UNICEF’s efforts to support district health management teams in achieving equitable, effective and universal health coverage. The discussion and conclusions include suggestions on future directions for this work.

**REVISING THE TANAHASHI APPROACH FOR HEALTH SECTOR PLANNING**

While there are many national policies and guidelines for effective interventions to reduce maternal and child mortality, these interventions do not always reach those who need them most due to bottlenecks within and outside the health system. Even for those with access, care may not be of good quality or be fully utilised in a manner appropriate to their needs.\textsuperscript{34} This results in marginalised and at risk groups frequently lacking coverage, or getting less impact from the services they do manage to access and utilise.

Tanahashi’s 1978 work to clarify the concept of health services coverage and his approach to evaluate the effectiveness of coverage forms the basis of UNICEF’s conceptual model and approach to conducting analyses of health system bottlenecks. This seminal work put forth several principles that remain guidelines for how health system strengthening (HSS) can achieve national health goals effectively and efficiently. To orient HSS towards impact, Tanahashi emphasized the importance of assessing not simply the proportion of the population that could be covered by a health intervention, but instead emphasized the importance of “effective coverage”, that is, coverage of sufficient quality to achieve the desired health impact.\textsuperscript{35, 36}
Figure 1 illustrates Tanahashi’s description of coverage. To the left, the ratio of service capacity to the target population provides the measure of nominal or potential coverage of the current health system; that is, the proportion of the target population that could theoretically be provided with coverage. To the right, the ratio of service output to the target population provides the measure of effective coverage; that is, the proportion of the target population that uses services of sufficient quality to have an impact. Utilization measures the gap, if any, between what coverage could be in the existing system and what coverage actually is (i.e., effective coverage divided by nominal coverage). Tanahashi’s approach allows for assessment of the capacity of the health system to achieve effective coverage by assessing both the nominal (potential) capacity as well as the utilization of that capacity required to ensure effective coverage for the entire target population.

Figure 1 Assessing health intervention coverage relevant to a target population; adapted from Tanahashi. 1978 Source: adapted from Tanahashi T. Health service coverage and its evaluation. Bulletin of the World Health Organisation 1978; 56: 295-303.

Next, Tanahashi incorporated the notion that five measures of coverage can be used to assess the capacity of the health system to deliver the full effect of interventions; i.e. achieve effective coverage. These five measures of coverage reflect five distinct stages in the process of service provision and permit an assessment of the potential capacity to deliver effective coverage, as well as, “actual coverage” in terms of the health services output. He terms these measures “availability”, “accessibility”, “acceptability”, “contact”, and “effectiveness” coverages. As shown in Figure 2, Tanahashi proposed examining the slope of the curve between each stage of coverage to assess the relative size of coverage loss between each stage. A flatter curve (as illustrated in the slope between “contact coverage” and “effectiveness coverage”) indicates a larger loss of health system efficiency, drawing attention to an area in the process of service provision that should be prioritized. He refers to this loss of efficiency as a ‘bottleneck’ in the health system.

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In the above diagram, nominal coverage is measured by availability, accessibility and acceptability, while actual ‘effective’ coverage is measured by contact and effectiveness. The proportion of the target population that does not receive effective care is the gap needing to be filled, as shown by the blue horizontal arrow.

**Redefining stages of coverage into determinants of effective coverage**

Early in the 21st century, there were efforts to adapt Tanahashi’s approach for use in the Marginal Budgeting for Bottlenecks (MBB) tool. In 2002, in collaboration with the World Bank and World Health Organisation, UNICEF developed the MBB to prioritise national strategies for overcoming bottlenecks by evaluating various scenarios of estimated costs and potential impacts. The MBB tool was “developed in the context of HIPC and PRSP\(^1\) in response to requests from low-income countries to plan, cost and budget marginal allocations to health services and to assess their potential impact on health coverage, MDGs related health outcomes, and health outcomes of the poor.”\(^38\) For use in the MBB, researchers made several adaptations to the original Tanahashi model.\(^39\)

An early modification was to focus on determinants of effective coverage. Each determinant was analogous to a Tanahashi stage that leads towards the goal of effective coverage. In addition, ‘availability’ was divided into two determinants: availability of commodities and availability of human resources.

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\(^1\) HIPC: Highly Indebted Poor Countries initiative; PRSP: Poverty Reduction Strategy Papers
This modified model was easier for practitioners to use since it reflected the types of data that were available and permitted the identification of bottlenecks through a step-wise approach that evaluates six determinants of the effectiveness of coverage of an intervention:

1. Availability of essential health commodities
2. Availability of human resources
3. Accessibility of distribution points for the interventions
4. Initial utilization of interventions
5. Continuity/completeness in the continuous utilization of interventions
6. Quality of interventions delivered.

The first three determinants focus mainly on supply-side constraints, while the final three focus largely on demand-side barriers. Each of the six determinants are shown in Figure 3 and described in detail below.

Figure 3 A modified Tanahashi model based on analysing determinants of effective coverage


The six determinants currently used for assessing national level health system bottlenecks are:

**Availability of essential health commodities**: This represents the availability of critical health system inputs, such as drugs, vaccines, and related commodities, in sufficient quantities to cover the target population. The availability of commodities is critical to quality service delivery for maternal, newborn and child health and has an important influence on utilization.

**Availability of trained human resources**: The issue here is not simply sufficient staff, but staff trained in providing quality and effective interventions or services. It requires that supervisory and incentive systems be in place to motivate and enforce compliance with global and national norms and standards. An expanding body of evidence directly links increased availability of skilled health workers with improved maternal, newborn and child health outcomes.
**Accessibility—physical accessibility of service delivery points:** This represents the conditions determining physical access to health services such as distance, travel time or ease with which a client can access a facility, outreach session, or community-based provider (often expressed as the opportunity cost).

**Initial utilisation:** This represents the first use of, or contact with, services or interventions. For example, first antenatal contact, first polio immunisation, or initial breastfeeding. Understanding the reasons for a gap between available supply and this measure of initial demand, relative to that supply, is critical for assessing a major area of potential system weakness. In addition, when the analysis of the gap between supply and demand is made with data disaggregated by critical population attributes, such as gender, wealth assets or location (e.g. urban vs. rural), patterns of inequities begin to emerge. As Penchansky and Thomas have described, the ‘fit between characteristics and expectations’ of providers and clients is critical and has an important influence on utilization. They group these characteristics into five areas: affordability (clients’ ability and willingness to pay), accommodation (how well providers meet clients’ constraints and preferences) and acceptability (reflecting clients’ comfort level with the provider and service delivered), as well as two additional characteristics that are represented in this model by the supply side determinants above (availability and accessibility).

**Continuous coverage (including appropriateness):** This indicates the extent to which the full course of contact or intervention required to be fully effective (for example, proportion of women receiving four antenatal contacts) was achieved. In addition, a key consideration is whether the care received is appropriate. Appropriateness incorporates two dimensions: appropriateness of the service itself and appropriateness of the setting in which the care is provided.

### Appropriateness of coverage

An example of inappropriate service is directing poor patients to treatment interventions with lower impact than those accessed by richer groups. For example, substituting effective HIV/AIDS or malaria medicines with lower costs alternatives for the poor, such as less effective ART combination or chloroquine instead of ACTS for malaria. Achieving UHC with equity to reach the last child requires the provision of the same needed package of services regardless of a child’s circumstances, background or other attributes.

An example of inappropriate setting is directing poor patients to out-patient services instead of more effective in-patient alternatives, or if they are forced to use poorly stocked public facilities that offer limited treatment options, compared to a more effective set of interventions that richer or more urban groups can routinely access.

UHC with equity is not achievable through a piecemeal approach in which the poor are given the crumbs off a health services table set for the rich.
**Effective coverage:** In his original 1978 paper, Tanahashi described effectiveness coverage as the “number of people who have received satisfactory service”; in effect, those receiving a service or intervention of sufficient quality to achieve impact. In the revised model, we build on this concept and use the term effective coverage to represent the quality of the intervention defined as the minimum amount of inputs and processes sufficient to produce the desired health effects. For instance, complete immunization is necessary, but not sufficient, to represent effective coverage; the child should also have received all vaccines on time, received vaccines of good quality and potency, and all administered with a sterile syringe. The quality of service provided is critical in determining whether coverage is effective. Donabedian makes the refinement that quality has two further aspects, technical and interpersonal. This more in-depth assessment of what constitutes a quality intervention is driving efforts by UNICEF to develop a mixed methods approach to assessing the causes of bottlenecks to UHC. Qualitative methods supplement quantitative analyses of factors that correlate with insufficient use of services to measure and assess interpersonal aspects of quality based on client-provider interactions.

Importantly, the six determinants model retains Tanahashi’s critical distinction between nominal (potential) and effective (actual) coverage, as it highlights the gap between available supply (service capacity) and the three determinants of service output (initial utilisation, contact coverage, and effective coverage). Ultimately the combination of bottlenecks identified determines the quality, and hence the effectiveness, of coverage in any given setting. As long as these bottlenecks exist, programmatic interventions will fail to reach those in need and an effectiveness coverage “gap” will remain, with perpetuation of inequitable health outcomes. Removing the bottlenecks is, therefore, a mandatory step towards UHC and, by extension, to the achievement of equitable impact.

**Modifications made to the scope of the Tanahashi model**
The analysis of bottlenecks by Tanahashi was applied to discrete interventions across the health system, without any categorization or grouping of the interventions. The current method used by UNICEF has modified this in two ways.

First, beginning in 2004, an intervention was assigned to one of three health system delivery channels, also termed service delivery platforms, that reflect how the intervention is primarily provided. The three platforms of service delivery were initially designated as:

1. Family-oriented
2. Population-oriented
3. Facility-based.

Family-oriented was mainly comprised of home-based management of childhood illnesses and behaviour change efforts to promote hand washing, breast-feeding and child nutrition. Population-oriented comprised outreach services in communities provided by salaried staff who typically were based in health facilities. Facility-based care included inpatient or outpatient services given at primary, secondary or tertiary care facilities.
These channels were the basis for applying the Tanahashi model using the MBB, a spreadsheet-based software programme used to assess health system bottlenecks, to estimate the cost of reducing bottlenecks, and estimate the impact achieved in terms of women’s and children’s lives saved.

Reflecting evolutions in health system structures, particularly for countries with decentralised systems, the three channels are now often labelled:

1. Community-based
2. Outreach services
3. Facility-based.

The change in channel labels results from the recent shift in focus for the community platform from assessing bottlenecks to home-based care, to assessing them for integrated Community Case Management (iCCM), a specific set of child and maternally-oriented health services typically provided by Community Health Workers (CHWs). While there is much diversity in the scope of practice of CHWs, ranging from volunteers focused largely on community promotion, to paid and highly trained workers, the potential importance of iCCM in reaching UHC with equity is growing. For the outreach and facility-based channels, assessing human resources continues to refer to paid workers who are regulated or licensed by the state.

An early application of this modification was in Ethiopia. There it was used to assess the costs and impact of introducing a Health Extension Worker program designed to overcome identified bottlenecks in service capacity for remote communities and low utilisation due to demand side issues.

The diagram below depicts the three service delivery platforms currently used, with the vertical arrows indicating bundles of health interventions. Each vertical arrow represents a program-specific package of services, while the red crosses show which service delivery channels could be the primary channel or channels for delivery of selected interventions within that bundle. For example, iCCM by definition is given via the community platform; thus, a bottleneck analysis would focus on platform constraints specific to the delivery of iCCM services. Likewise, in the case of routine immunizations (vaccines), one would assess service delivery bottlenecks for two channels, outreach (e.g. immunization days in communities) and the facility platform, but typically not for the community channel as few countries permit CHWs to provide injectable immunizations to children. Some components of newborn care are delivered through the community channel (umbilical cord care and cleaning) and in facilities. In selected cases, as in nutrition, all three platforms are involved. Some nutrition interventions are provided in communities (e.g. Community Management of Acute Malnutrition), outreach (through child health days) and in facilities (treatment of Severe Acute Malnutrition), requiring bottleneck assessments for the relevant services primarily delivered by each of the three channels.
The second modification made to the Tanahashi model was the introduction of the concept of a tracer intervention, which makes the analysis more manageable and systematic. A tracer intervention is one that is representative of a set of health service interventions. An analysis of health system bottlenecks that constrain the effective coverage of the tracer can reasonably be generalised to assessing bottlenecks faced by all the interventions in that package. For example, assessing bottlenecks to effective coverage for polio vaccine can be a proxy for assessing health system bottlenecks impacting the entire set of immunizations a child is supposed to receive. It is reasonable to assume that many of the platform-specific problems that impact polio vaccine coverage will have a similar impact on measles vaccines, rotavirus vaccines, and other vaccines given to children through that platform. Thus, bottleneck analysis of oral polio vaccine as a tracer can serve as a proxy for all vaccines in that package (bundle).

Of note, it is critical that the service delivery platform is the same for all interventions in the bundle from which the tracer is taken. So in the case of routine immunizations, the tracer is used to assess all immunizations given through a single platform, facility-based contacts. However, for immunizations delivered through outreach, the bottleneck assessment targets outreach services, instead of the facility-based service delivery platform.

In general, for each of the three service delivery channels, certain interventions can be grouped together to assess the strength of that service delivery channel. This takes advantage of the fact that bundles of health interventions are typically processed similarly, and hence they are likely to face similar health system constraints (bottlenecks) that hinder the ability to attain high levels of effective (quality) coverage. The analysis of health system bottlenecks for the ‘tracer’ functions as a proxy for analysing the health system bottlenecks common to all the interventions in the package that the tracer represents.
Thus, use of the tracer greatly reduces the amount of analyses required, as each tracer is a proxy for several related interventions.

Criteria for selecting a robust and reliable tracer include:

1. Evidence of a high and measurable impact on outcomes (mortality, disease incidence, or coverage).
2. Internationally recommended intervention;
3. Nationally relevant and appropriate; and
4. Sufficient data available for all six coverage determinants for the tracer.

**Modifications due to differences in data on supply and demand**

Tanahashi fully intended his model to be used in a practical way to guide systematic evaluation of bottlenecks in service delivery and the constraining factors responsible for these bottlenecks, and in the selection of effective measures to improve services.\(^{14}\) Tanahashi suggested the model could be adapted for different diagnostic purposes by changing the denominator. For instance, a “population-specific” analysis could be carried out on urban and rural sub-populations of the total target group, in order to assess how differences in rural and urban service provisions could lead to different types of bottlenecks. In this example, the denominator is the proportion of the target population living in rural areas in the first instance, and the proportion in urban areas, in the second.\(^ {35}\) As shown below, bottlenecks might differ substantially depending on location. Despite having a larger proportion of the population in rural areas, the total availability coverage is disproportionately captured by the smaller urban population. If there were an equitable distribution of bottlenecks, the line tracing the constraints to full coverage for the rural area would have the same shape as the line for the total population.

**Figure 5 Population specific analysis by location (rural vs. urban)**

Tanahashi suggested that the model could also be modified to obtain information on specific sub-groups. For example, he noted that by setting the denominator to the target population that already had access, the analysis could be sharpened to focus on demand-side issues of acceptability, initial contact, and effectiveness of the coverage.\textsuperscript{35} This flexibility in the model was exploited in subsequent revisions.

An assumption in the original Tanahashi model that limits its application is that the data on service provision at each of the five levels of coverage uses the same denominator throughout. Moreover, it assumes the data used provides a comprehensive reflection of all services available, private and public. In short, the denominator does not vary across the original five stages, or the current six coverage determinants now used. In reality, much of the data used to represent the supply side of health services (i.e., availability and accessibility) come from public sector datasets, such as routine health information systems; thus, underestimating private sector services provisions which are important sources of care in many countries.\textsuperscript{58-60} There are a variety of non-state systems and providers such as Faith-Based and other Non-Governmental Organizations (FBOs/NGOs), other private for-profit and non-profit systems, Civil Society Organizations (CSOs), and services provided by donors and development partners (including services provide to refugees and other displaced populations). In contrast, much of the data used to represent the demand side of health services (i.e., acceptability, contact coverage, and effectiveness coverage) come from household surveys that capture issues related to utilisation, continuity of care, and quality of care by sub-populations, regardless of where they received care. As a result, the relationship among acceptability, contact coverage, and effectiveness coverage can readily represent drop offs in coverage (i.e. bottlenecks), whereas the supply side bottlenecks may be more difficult to capture as private sector data on NGOs and other non-state providers is rarely fully available.\textsuperscript{61}

In our model, there is no assumption of a linear causal relationship among the three supply side determinants: the adequacy of commodities, trained personnel and access points are usually not directly related, though trends in their levels tend to be positively correlated.\textsuperscript{62, 63} This has two implications. First, there is no downward left to right slope across the three supply side determinants; they can have varying and independent levels.

Second, the denominator does not necessarily include the entire target population, instead it is the proportion of the target population that the public sector has the capacity to serve. This reflects the reality that in most countries, while the public sector is ultimately responsible for ensuring everyone has an equitable opportunity to use a service or access an intervention,\textsuperscript{12} the private sector may actually provide a significant proportion of supply side inputs (e.g. commodities, human resources, and access points).\textsuperscript{60, 64, 65} However, under these circumstances, provision of essential primary health care (PHC) services, such as immunization, may be sub-optimal due to minimal profit incentives.\textsuperscript{66} The figure below shows that initial utilisation of 50% is achieved through the public sector providing 35% of the service capacity, and the private sector providing the remaining 15%.
It would not be feasible or realistic to build excess public sector capacity that duplicates what the private sector does, or could provide. Investments should focus on building public sector service capacity to fill gaps that the private sector cannot, or will not, fill.

Given that data on the private sector is incomplete, interpretation of the supply side data relevant to provision of PHC services must be made with a realistic estimate of what the private sector does provide, and what it could provide with innovative approaches. It requires a nuanced understanding of how ‘for profit’ and ‘not-for-profit’ private sector providers differ in the scope of PHC service provided and user fees charged. Importantly, it takes time and expertise to build an acceptably accurate estimate of private sector inputs, neither of which is readily available at the sub-national level. While eventually this problem should diminish as more complete data becomes available; for now, it is frequently the case that supply side data will not capture all providers, and the analysis of bottlenecks to the supply of services will have to be adapted accordingly.

As in the Tanahashi model, our model requires the denominator for the three demand side determinants to be the same, and there must be a cascade. For example, it would not be possible for the proportion of the target population receiving continuous or quality care to exceed the proportion that sought initial care.

In the figure below, Point 1 indicates that staff shortages limits the capacity of the system, so it can only deliver to 50% of the target population. Point 2 demonstrates that starting from initial utilisation coverage, the slope must either be flat (all use is effective) or cascading, meaning there is some loss of system efficiency in the utilisation of potential service capacity, resulting in a reduction of actual (effective) coverage.
The causality analysis, assessing the root causes of identified bottlenecks, is influenced by the distinction between supply and demand side data. Analysing supply-side factors looks closely at health systems processes and managerial competencies, as depicted below, whilst taking into account what the private sector does and could contribute. Analysing the reasons behind demand-side bottlenecks requires assessment of factors such as acceptability, perceived value, and trust from the perspectives of clients and communities. Assessing the effectiveness of final coverage, i.e. the impact achieved, examines how well interventions adhere to global and national quality protocols.

Figure 8 Analyses of causal factors leading to supply, demand and quality bottlenecks
Source: adapted from G. Fontana, DIVA training presentation, UNICEF, 2013
In summary, the assessment of bottlenecks is now categorized into supply, demand and quality determinants of coverage, as is the assessment of the causes of bottlenecks. This approach permits identification and assessment of the causes of bottlenecks to be adapted to data sets that frequently fail to capture all non-state service providers. With the shift from five measures of coverage to six determinants of effective coverage, and the flexibility to interpret results despite lacking important data on non-state provision of health services, the Tanahashi model provides a useful guide to assess supply and demand bottlenecks at national and local levels, and to tease out differences across various population groups. The accompanying causal analysis of the reasons for those bottlenecks sheds light on supply-side and demand-side issues that result in ineffective coverage.

UNICEF has incorporated this modified model into much of its programming over the past decade. The revised Tanahashi model, using the MBB method, has been used to assess bottlenecks in over 50 countries. Applications include program specific analyses, such as scaling up newborn care, and cost-effectiveness comparisons (in terms of child deaths and stunting events averted) between an equity-focused approach to health programming that prioritises the most deprived communities, against a mainstream approach representative of current national health strategies.

**EQUITY**

There is growing acceptance that equity has attributes that distinguish it from equality.

*Equality requires everyone to have the same resources. Equity requires everyone to have the opportunity to access the same resources. The aim of equity-focused policies is not to eliminate all differences so that everyone has the same level of income, health, and education. Rather, the goal is to eliminate the unfair and avoidable circumstances that deprive children of their rights.*

This is placed into the context of UNICEF’s work in the report *Re-focusing on Equity: Questions and Answers*, which states:

*Equity means that all children have an opportunity to survive, develop, and reach their full potential, without discrimination, bias, or favouritism. This interpretation is consistent with the Convention on the Rights of the Child (CRC), which guarantees the fundamental rights of every child, regardless of gender, race, religious beliefs, income, physical attributes, geographical location, or other status.*

Current discussions on equity are also derived from the work on social determinants by the World Health Organization (WHO). The WHO’s 2008 report of the Commission on the Social Determinants of Health identified three main requirements to "close the health gap": 1) "Improve the conditions of daily life – the circumstances in which people are born, grow, live, work, and age", 2) "Tackle the inequitable distribution of power, money, and resources", and 3) "Measure and understand the problem and assess the impact of action." The analysis of health system bottlenecks can help put into practice the third requirement through a better understanding of the factors creating health gaps.
The revised Tanahashi model, if used with data disaggregated by geographic area (urban vs. rural location), wealth, or other population attributes, can identify disparities in access and use of services. Recent work on understanding why the use of services varies across different groups has led to assessment of drivers of inequity, such as financial and non-financial barriers, and inequities in knowledge dissemination and awareness.74-77

However, the analysis of national survey data, while helpful in discerning major patterns of inequities for a country as a whole, is not typically granular enough to help district managers assess unfair and avoidable differences within their district. To reach the last child, the local barriers to reaching the last household must be identified and removed.

**APPLICATION OF THE MODEL AT THE DISTRICT LEVEL**

Since 2010, UNICEF and its global, national and local partners began testing the modified Tanahashi model, designed for use at the district level, to identify and understand critical bottlenecks in maternal, newborn and child health (MNCH) service delivery.78 The bottleneck analysis tools employed were not the same as the MBB used nationally, but instead represent a collection of locally-adapted tools, at the core of which is the modified Tanahashi model.79 In almost all cases, the costing and impact modules of the MBB have not been adapted for district level use, though the need for such modules is being assessed.

As with the national model, the DHSS approach is based on the notion that assessing bottlenecks can guide the development of responses and contribute to achieving UHC. By examining disaggregated data from sub-national areas such as districts, an equity dimension can be systematically introduced.80 When combined with a causal analysis that examines non-financial and financial access, and utilisation barriers at the point of service faced by at-risk sub-populations, a more equity-focused set of UHC policies, strategies, and investments can be developed.29

The revised Tanahashi approach has formed the basis for a DHSS approach developed by UNICEF. This flexible and outcome-based approach has been applied in more than ten countries to identify and understand critical bottlenecks in maternal, newborn and child health (MNCH) service delivery. It includes four steps (Diagnose, Intervene, Verify and Adjust) to help understand inequities, and identify and respond to health system and demand-side bottlenecks that arise at the district level.
While beyond the scope of this paper to discuss each step in detail, the key point is that each builds on existing processes within the district planning cycle to improve health outcomes by being more responsive to the specific needs of marginalised groups. For instance, in Botswana, the district-based bottleneck analysis led to implementing an equity-focused plan to scale up maternal and child survival interventions to directly address leading causes of death among at-risk groups with low effective utilisation of PHC services.

Using District Health System Strengthening to achieve Universal Health Coverage with equity

Frenz and Vega refer to Whitehead’s definition of inequity as the systematic “differences in health that are not only unnecessary and avoidable but, in addition, are considered unfair and unjust.” Inequities in health outcomes across population subgroups reflect varying abilities to access and use socially provided benefits and entitlements. Bottleneck analysis at sub-national and district levels can contribute to quality-oriented health care by identifying barriers to equity-based programming, which if overcome, can lead to equity focused UHC (by tackling inequitable distributions).

Because equity-based programming requires local knowledge of deprivation and coverage patterns, UNICEF is collaborating with ministries of health, district health management teams and their partners, to enhance district performance for equitable health programming. UNICEF is working with countries in sub-Saharan Africa and South Asia to adapt existing data collection tools to assess patterns of inequity at the district level. A Tanahashi-based approach is used to identify underlying causes and support district health management teams in using this information to improve their equity-focused programming in a systematic and informed manner.

The modified Tanahashi model is used to structure an initial analysis of bottlenecks in the “Diagnose” step and in the analysis that occurs during on-going monitoring in the “Verify” step. The information gleaned from these assessments supports district health management teams and their partners in setting priorities and targets for equity-based programming in a systematic and informed manner. Through the bottleneck analyses inequities are identified and
responses are designed to develop pro-equity strategies and activities that can be integrated into annual district operational plans.

The figure below illustrates how the bottleneck analysis can be applied to an equity-focused sub-national bottleneck assessment.

**Figure 10** Applying the bottleneck analysis to sub-national areas  
*Source: adapted from N. Ngongo and G. Fontana, DIVA training presentation, UNICEF, 2013*

The figure shows the initial division of the analysis into the assessment of supply and demand-side data for a single health intervention. This is a granular refinement of Tanahashi’s population-specific analysis in which he independently assessed bottlenecks for rural and urban sub-populations. In this example, two sub-national areas are compared to assess differences in supply-side and demand-side bottlenecks, as well as in the quality of the interventions. This analysis is from work in Uganda (see case study below) where district data is generated using Lot Quality Assessment Survey (LQAS) techniques.

LQAS is a small sample survey technique currently being evaluated to determine whether it is a cost-effective way to gather sub-national data. LQAS allows an estimate of the likelihood of the actual coverage falling between two thresholds, such as 50% and 80%, and is not typically used to provide a point estimate of coverage (e.g. 75%). In the figure above, when the LQAS-derived indicator exceeds the upper threshold, it is assigned a green colour. Falling within the thresholds is marked yellow, while falling below the threshold is marked red. In this way, critical bottlenecks (the red rectangles) are prioritised for urgent action; yellow ones for continued effort, and green ones are considered satisfactory for the time period being assessed. As progress occurs, more of the coverages should move into the green zone, prompting an upward revision of the thresholds.
LQAS has been increasingly used to assess patterns of inequity for sub-national planning. In the figure below, the district averages are assigned color-coded numbers, with LQAS derived values shown for its three constituent sub-districts. It is clear there are differences between areas A, B, and C that may lead to different strategies for overcoming identified bottlenecks. For instance, Sub-district C has a major problem with geographic access relative to A and B, which may point to an urgent need to scale up access points for ARV treatment. Sub-district B may instead decide to concentrate on removing financial barriers to starting services, while A may focus on increasing the number of person adhering to treatment protocols.

**Figure 11** Variances in bottlenecks for effective use of ante-retroviral medicines in three sub-districts
*Source: adapted from N. Ngongo and G. Fontana, DIVA training presentation, UNICEF, 2013*

<table>
<thead>
<tr>
<th>ARVs</th>
<th>Thresholds</th>
<th>District</th>
<th>Sub-district A</th>
<th>Sub-district B</th>
<th>Sub-district C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Target</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commodities</td>
<td>60</td>
<td>90</td>
<td>70%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human resources</td>
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<td>80</td>
<td>85%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geographic access</td>
<td>50</td>
<td>80</td>
<td>60%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial utilization</td>
<td>30</td>
<td>60</td>
<td>60%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuous utilization</td>
<td>30</td>
<td>60</td>
<td>35%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality/effective coverage</td>
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<td>35</td>
<td>30%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Case study 1: Modified Tanahashi model supports DHSS in Uganda**
In 2011, the Ugandan Ministry of Health (MoH) requested UNICEF’s support to operationalize their Health Sector Strategic and Investment Plan 2010/11-2014/2015 (HSSIP) through two district-based projects: Community and District Empowerment for Scale-Up (CODES) and Health for Poorest Quintile/Population (HPQ/HPP). Workshops, backstopped by UNICEF and run by local non-governmental organisations, engaged District Health Management Teams (DHMTs) in assessing local data, identifying bottlenecks and their causes, and developing solutions appropriate to decision and fiscal space limits. Community interviews elicited perceptions on financial and social barriers to accessing health services in order to better understand the causes of the demand-side bottlenecks.

Using the information gathered, participating DHMTs identified key barriers to health, nutrition and water and sanitation interventions at the facility, outreach and community levels of service delivery, as well as their underlying causes. These included illegal fees and bribes demanded of mothers for services that are supposed to be free, persistent stock-outs of anti-malarials and zinc, lack of community awareness of hand-washing and sanitation practices, lack of familiarity with pneumonia, malaria, and diarrhoea danger signs among both mothers of children under five and community health workers, and insufficient outreach sessions.

The example below shows preliminary data on inter-district differences in immunization using the LQAS approach. While the data may not be fully accurate since the LQAS data needs to be carefully validated and verified by other methods, it does strongly indicate that actionable data can be obtained through the use of a Tanahashi-based approach to sub-national assessments of inequities. For instance, districts A, D and E face chronic staff shortages due to low staff
retention, while more urban districts have better staffing. In part, this is due to inequitable investments, with some districts receiving more financing for human resources. Another factor is illegal user fees, which community members in all five districts identified as one of the greatest barriers to use of services, particularly in the case of poorer households.

Figure 12 Comparison of preliminary data on full immunization coverage in Uganda
Source: adapted from presentation on Community and District Empowerment for Scale-up in Uganda, UNICEF, 2013

Based on these and similar findings for other tracer interventions, as a direct result of the bottleneck analysis, the DHMTs developed locally tailored interventions they identified as feasible, such as improving initial utilisation and effective coverage through radio spots, VHT quarterly meetings chaired by local political and community leaders, increased messaging via churches/mosques, implementation of the SMS-based and community-empowering “uReport” monitoring system, expanded use of an SMS-based ‘mTrac’ system to report human resources and stock shortfalls, and complete birth registration for children under five. In addition, each facility will be regularly assessed by managers and community members (via SMS-based community oversight) to ensure the fee schedule is visible and complete, and that staff members wear name badges to improve accountability for the care they provide.
Case study 2: District Health System Strengthening in Democratic Republic of the Congo

UNICEF is also working with the Ministry of Public Health (MoPH) and district health management teams in the Democratic Republic of the Congo (DRC) to use DHSS to operationalize the strategies of the National Health Development Plan (NHDP) 2011-2015. Achieving the NHDP objectives is being pursued through increasing service capacity and utilisation using a mix of public and non-state providers, the latter largely consisting of Faith based Organization.

A core NHDP objective is strengthening district health management capacity and information systems. UNICEF’s Child Survival and Development Programme and the Health for the Poorest Populations Project were entry points for this work, under the leadership of the MoPH. UNICEF and the MoPH have engaged key partners including World Health Organisation, World Bank, European Union, the German Agency for International Cooperation, Management Sciences for Health, and the University of Kinshasa, to put the decentralised monitoring process on the agenda of health systems strengthening in 207 priority districts.

A phased approach to implementation started with field-testing of the methodology and tools in one district in March 2012, and then followed in May 2012 with methods refinement and implementation in five districts across five provinces. In a first phase district, bottleneck analysis was used to examine fifteen interventions: nine in health (antenatal care, preventing mother to child HIV transmission, skilled birth attendance, home-based newborn care, immunizations, bednets, CCM for diarrhoea); two in nutrition (exclusive infant breastfeeding, complementary feeding); two in WASH (hand-washing, improved sanitation); one in child protection (birth registration); and one in education (quality primary education).

Data were collected through health management information system (HMIS) and health facility surveys to identify supply-side bottlenecks (commodities, human resources, geographical access); while household surveys (using LQAS) and qualitative studies (using focus groups and key informant interviews) identified demand-side bottlenecks (utilisation, continuity, quality, and environmental factors such as financial and non-financial barriers).

The main bottlenecks identified were supply related: 1) districts lack essential drugs because of inadequate health financing, 2) health workers (in adequate numbers) lack the necessary skills since training curricula have not been updated through the many years of war and political instability, and c) geographic access is a critical problem due to a combination of low population density and lack of adequate infrastructure, except for programmes that have outreach activities.
The result is major variances in effective coverage across the districts, as a function of the varying levels of services capacity and services utilisation within each district. To address these challenges to equitable and effective use, the districts are working with partners to support one plan and one budget to address prioritised bottlenecks; mobilise resources to procure equipment and medicines; increase the frequency of outreach activities; establish an integrated training strategy to retrain staff in relevant MNCH issues (leveraging existing vertical program funds); and routinely verify implementation to track progress and coordinate multi-partner efforts to adjust as necessary.89

The enabling environment
Beginning in 2008, the initial work to assess equity of health service utilisation across different sub-populations showed that progress towards the MDGs, while impressive, had in many cases increased the gap between rich and poor, urban and rural, and between other sub-populations. This was highlighted in UNICEF’s 2010 seminal report, Narrowing the gaps to meet the goals.28

The core message of this report was that the MDGs can be reached, both more quickly and with greater equity, if the policy path to UHC focuses on investments that help the most disadvantaged catch up in terms of utilisation of quality and appropriate services. This led to a more systematic and expansive approach to the causal analysis that follows the identification of bottlenecks.

Originally, much of the work centred around technical solutions to supply and demand-side bottlenecks. The focus was on strategies to improve commodities and human resource
management, ways to extend access to service points, and steps to remove user fees and knowledge barriers that constrained use of available services. As DHSS efforts advanced, it quickly became apparent there was a need to systematically assess and resolve issues of management skills and capacities.\(^\text{81}\) As a result, much of the DHSS efforts in Botswana, DRC, Uganda and other countries include extensive efforts to build management competencies. Strategies include strengthening supervisory, data management and problem solving skills, and improving management of resources.\(^\text{82, 88 ENREF_7}\)

An evaluation of social factors is also increasingly included in the assessment of national and sub-national health systems bottlenecks. With the growing body of research on social determinants, environmental factors are recognised as critically influential in making progress towards UHC.\(^\text{27, 90, 91}\) Linking work on social determinants to HSS and DHSS focuses efforts on improving the enabling environment in which DHSS occurs. The enabling environment can be defined as the current policies, strategies, budgets and social factors (social, cultural and economic barriers that perpetuate health inequities) that constrain the decision space of district health managers and their teams in efforts to effectively address major bottlenecks to UHC. Creating more decision space for DHSS involves many factors, but a core thrust is advocating for “transparency and managing for results and accountability, through results-based public budgeting and evidence-based policy-making.”\(^\text{92}\)

Next steps
To date, UNICEF has conducted bottleneck analyses within the DHSS approach using the modified Tanahashi model in several countries including Botswana, Democratic Republic of Congo (DRC), Mali, Malawi, Niger, Nigeria, Sierra Leone, Uganda and Zambia. In all countries in which the approach has been implemented to date, positive feedback is emerging on how the process has increased DHMT capacity and willingness to monitor for results, and lead to improved operational plans and decision making. In DRC, for example, the information obtained via the bottleneck analysis supported a reprogramming of activities to maximize efficiency and effectiveness.\(^\text{89}\) The approach is also proving to be a powerful advocacy tool to demonstrate to donors and finance ministry officials why channelling resources to address bottlenecks leads to results. For instance, in March 2012 a district in Uganda used their analysis to secure increased funding from development partners in order to resolve major bottlenecks.\(^\text{93}\)

These initial experiences in DHSS underscore the importance of including an analysis of the broader social context within which inequities are generated, and expanding the decision space by improving the enabling environment. They also highlight the importance of both financial and non-financial barriers (including cultural/religious factors, maternal education, negative perceptions or distrust of services, and perceptions of value-added services) that might be underlying causes for insufficient demand or enabling factors that might promote effective coverage.\(^\text{21, 22}\)

Applying a framework to the causal analysis of bottlenecks assists DHSS efforts to incorporate social health determinants. One useful framework is described by Franz & Vega; it considers the broader social context and can inform future iterations of local bottleneck analyses and DHSS work.\(^\text{83}\) Based on a review of theoretical literature and evidence generated through health systems research on equity of access as it relates to UHC, their framework highlights the
complexity of the multi-stage process by which individuals recognise the need for health care, find available and acceptable services, make contact and ultimately receive an appropriate intervention. It builds on Tanahashi’s earlier model, incorporating several social dimensions and linking them to the goal of UHC.

Figure 14  UHC and Equity of Access. Effective coverage for all health needs as a result of supply and demand “fit”
Source: Frenz P & Vega J. Universal health coverage with equity: what we know, don’t know and need to know. Background paper for the global symposium on health systems research. 16-19 November 2010, Montreux, Switzerland.

The framework situates the dimensions of equity of access to UHC within universal health policies (including financing, manpower, organisation and education) and social policies (including those relating to education, housing, employment and work conditions, and cultural issues). The model illustrates the relationship between these policies and characteristics of the health delivery system, as well as characteristics of the population, and how these contribute to the realisation of UHC with equity.

UNICEF is using this model and other recent research on equitable pathways to UHC to further adapt the Tanahashi approach to determining causes of bottlenecks to the equitable uptake of primary health services at sub-national levels. The core methodology is based on the framework proposed by Frenz and Vega for analysing health systems and a Tanahashi approach linked to an assessment of the social determinants of health. Building on this equity-focused DHSS methodology, UNICEF seeks to incorporate the systematic use of data from this diagnostic process to support District Health Systems Strengthening (DHSS) efforts, and to generate evidence on social and financial inequities in order to influence national and sub-national political processes and policies. To accomplish this, UNICEF wishes to develop and test an
innovative analytical approach, robust enough for use in a wide range of contexts. The goals are to integrate qualitative and quantitative methods to assess and address causes of health system bottlenecks and barriers to UHC using selected tracer interventions, and to monitor progress towards their resolution.\textsuperscript{21, 22, 51}

CLOSING REMARKS

There are numerous publications on diagnostic approaches to delineating access barriers due to inadequate supply, insufficient demand, and out of pocket fees at the point of service. Some research also addresses the burden of indirect fees and other opportunity costs. And there, in terms of a comprehensive and holistic diagnosis of barriers to UHC, it tends to stop. Few authors expand the diagnosis to include non-financial institutional and social barriers to UHC, though Di McIntyre, and Frenz and Vega, have made vital contributions. Fewer researchers still have tried to apply a truly comprehensive view to sub-national monitoring and planning processes to deliver UHC.

Yet, anecdotal evidence and a few empirical studies show that inequitable patterns of bottlenecks, both institutional and individual, are serious impediments to UHC with equity. To support equity-focused programming, UNICEF uses the modified Tanahashi approach in more than 50 UNICEF programme countries for national and sub-national system strengthening efforts to achieve UHC. The evidence to date is consistent and clear: health interventions must have quality to be effective; that is, to achieve impact in terms of reducing preventable illness, suffering and death.\textsuperscript{94}

The Tanahashi model in its current revised form supports identification of critical health system bottlenecks that restrict UHC. Once bottlenecks are identified, a causal analysis (incorporating both qualitative and quantitative methods) is critical to understanding why bottlenecks exist and to inform strategic responses in order to achieve UHC with equity. Underlying causes may be financial or non-financial, or related to broader contextual factors, such as the social determinants of health. Addressing these requires multifaceted and synergistic solutions that often cross health system functions, and involve community participation and intersectoral action.

On going monitoring and action to redress bottlenecks requires this stronger and more systematic assessment of district level causes. This causal analysis remains grounded in Tanahashi's original approach to assessing insufficient accessibility, availability, acceptability, contact, and effective coverage of health services, but has been expanded to identify management and financial causes, and factors that differ among subpopulations which seem to correlate with observed inequities. Further, part of the movement towards UHC can involve use of real-time monitoring to provide a basis for actionable information, and a shift towards a more proactive and results-based approach to assessing and removing barriers. UNICEF has several initiatives exploring how Rapid SMS and other mHealth and eHealth approaches can improve the flow of data, help pinpoint and monitor inequities in access of and use of services, and improve the quality of services that are received.\textsuperscript{95} This will help reorient health programmes to better account for equity and social determinants of health.
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