Strengthening Evidence-Based Planning of Integrated Health Service Delivery Through Local Measures of Health Intervention Delivery Times

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Background. Immunization services in developing countries are increasingly used as platforms for delivery of other health interventions. A challenge for scaling up interventions on existing platforms is insufficient resources allocated to the integrated platform with the risk of overburdening a health worker. Determining the length of time to deliver priority interventions can be useful information in planning integrated services and mitigating this risk. We designed and tested a methodology for collecting the time needed to deliver selected interventions.

Methodology. At 18 health facilities in Mali, Ethiopia, and Cameroon, we observed delivery of 11 maternal and child health interventions to determine delivery times. We interviewed health workers to estimate self-reported delivery times.

Results. Based on observations, vitamin A supplementation (median, 2:00 minutes per child) and vaccinations (median, 2:22 minutes) took the least amount of time to deliver, whereas human immunodeficiency virus counseling and testing and sick infant treatment interventions were among the longest to deliver. Health worker–reported times to deliver interventions were consistently higher than observed times.

Conclusions. Using locally-obtained data can be useful to step for planners to determine how best to use existing platforms for delivering new interventions, particularly since these interventions may require substantially more time to deliver compared to immunizations.

Integrated delivery of maternal, neonatal, and child health (MNCH) interventions is a strategy increasingly included in country action plans to help reduce maternal and child morbidity and mortality. Several studies have described how existing delivery platforms can be used to provide other MNCH interventions [1, 2]. One such platform is routine immunization services, which can be provided at fixed posts or through periodic outreach activities (eg, Child Health Days, periodic intensification of routine immunization) [3, 4].

Immunization services reach a majority of infants and their mothers worldwide; in 2009, an estimated 82% of the world’s infants received 3 doses of diphtheria-tetanus-pertussis vaccine through routine immunization services [1]. In recognition of the potential benefits of improving MNCH in developing countries by utilizing immunization service contacts for delivery of additional services, integration of other essential health services is included as a key strategy of the World Health Organization (WHO)/United Nations Children’s Fund Global Immunization Vision and Strategy, 2006–2015 [5].

Although integrated service delivery can accelerate coverage of new and underutilized MNCH interventions to close to the level of established interventions and efficiently use health sector resources, challenges exist [5–9]. One of the identified bottlenecks of using immunization...
services as an integrated service delivery platform is limited human resources to fully scale up a package of health interventions. Additional services create a risk of health workers becoming overburdened, which consequently impacts service quality and supply [5]. This concern has also been raised in the context of Child Health Days when discussing the appropriate mix of interventions to deliver [10, 11].

Collecting information on the time needed to implement an intervention (ie, intervention time requirements) can be a useful step in the planning of integrated service delivery. Review of past experience developing health planning tools for country policy makers identified key challenges, including appreciation of local context, clarity of criteria, and transparency of data. Therefore, collecting data on time needed to implement an intervention locally might be useful for a country to assess the capacity and operational gaps of existing health service platforms to deliver other interventions.

This paper presents a methodology we used to collect the observed time and the health worker self-reported time to deliver various interventions as well as the results of these observations and interviews. Using data collected in 3 countries (Mali, Ethiopia, and Cameroon), we compared duration of delivery times for various MNCH interventions and described the lengths of tasks within interventions (eg, update health register, prepare syringe) to illustrate considerations when policy makers plan integrated service delivery.

METHODS

Definitions
An individual intervention is defined as the delivery of a single service, such as administering all vaccines scheduled to be administered at a particular age, administering a standard set of prenatal care services, or administering vitamin A supplements to a single beneficiary. A group intervention is defined as delivery of a single service to multiple beneficiaries (eg, breastfeeding education session to multiple mothers). A visit is defined as the continuous delivery of ≥1 interventions to a beneficiary or mother/child pair while at a single healthcare setting. For the purpose of establishing timing, a visit begins once the beneficiary is called for the service by the healthcare worker and ends when the healthcare worker completes delivery of the last intervention to the beneficiary. We divided each intervention into specific measurable tasks (eg, taking a medical history, providing counseling, administering an injection, educating the beneficiary) [12, 13] and measured each task duration within an intervention.

Interventions
To create the list of health interventions to observe in each country, we reviewed a study of MNCH intervention service delivery by Bhutta et al [1], which proposed interventions that could be delivered by vaccinators. We also reviewed additional literature to identify other health interventions considered a priority based on their potential impact to decrease maternal and infant mortality. We included interventions delivered by health workers who provide vaccinations or antenatal care (Table 1). In Ethiopia, an integrated delivery package has been delivered nationally since 2003. At the time of the study, neither Mali nor Cameroon had fully implemented a national integrated package of services involving immunization services.

Site Selection
The study was conducted in 1 country selected from each of the 3 WHO-defined African subregions based on existing service integration and feasibility for conducting the study: Cameroon (Central region), Mali (West region), and Ethiopia (Southern-East region). Within each country, districts and health facilities were purposely selected based on operational feasibility and ethnic, geographic, and socioeconomic population diversity. The facilities selected were representative of the usual facility type found at a subdistrict level, which make up the majority of public health facilities found in each country (ie, no hospitals were selected).

Data Collection
From December 2009 through March 2010, data were collected during a 2–3 week period in each country. A list of tasks for each intervention was initially created based on existing literature [1, 2, 12, 13]. In the first country (Mali), the first 2 days were devoted to piloting and refining the task lists while observing delivery of various interventions at health facilities. The final lists were used for the rest of data collection in all 3 countries. The protocol and tools are available upon request from the authors. The range of times for an intervention’s delivery was estimated by investigators directly observing health workers providing the intervention. At each selected facility, health workers were continuously observed by 2–3 data collectors who used stopwatches to measure the time required to perform each task for the interventions. Time was expressed as minutes:seconds. Health workers were informed of the study and gave consent to participate; no health workers refused participation. Additionally, investigators interviewed health workers and asked them to estimate the duration of delivery of an intervention. Health workers were also asked to estimate the duration of other work activities that were not directly observed, including the length of formal training received for each intervention and the length of time for activities that occur infrequently (eg, filling monthly reporting forms to be sent to the district level, preparation and clean-up of the intervention area).

Analysis
In analysis of the observed time to deliver an intervention, we only considered interventions with ≥6 observations (or ≥6 beneficiaries for group interventions). Because the number of observations were small, we computed median times and the
interquartile range required to deliver each intervention for the 3 countries combined and, for interventions with multiple tasks, the proportion of time spent on each task. Where tasks were shared by multiple interventions provided at the same visit, we equally divided the shared task time by the number of interventions given. Where the sample size was large enough to allow for appropriate analysis, we compared the difference in intervention duration between countries using a nonparametric test (Wilcoxon rank-sum) and measured significance using a 

\[ P \text{ value} \]

of .05. Only infant vaccination was considered for this latter analysis due to its sample size of greater than 20 per country. For selected interventions, the proportion of time spent on each task was also determined. Health worker estimates of the time to deliver an intervention were compared with observation data. All data analysis was completed in SAS software version 9.2 (SAS Institute) and Excel 2007 (Microsoft Corp).

The protocol was exempt from review by the Centers for Disease Control and Prevention (CDC) Institutional Review Board because it examined public health implementation of existing interventions.

**RESULTS**

Site visits were made to 18 health facilities. In Cameroon, 2 urban facilities and 4 rural facilities were visited (range for annual target population for vaccination services at visited facilities: 720–2998 infants <1 year of age); in Ethiopia, 1 urban and 4 rural facilities were visited (range for annual target population for vaccination services at visited facilities: 139–1881 infants <1 year of age); and in Mali, 2 urban and 5 rural facilities were visited (range for annual target population for vaccination services at visited facilities: 166–1080 infants <1 year of age). Among 26 interventions of interest, 10 were not observed, and 5 had <6 beneficiaries receiving the intervention; these 15 interventions were excluded from analysis of intervention length. Of 9 nongroup interventions with ≥6 beneficiaries (bed net distribution, antenatal...
care, infant vaccination, vitamin A supplementation, infant growth monitoring, treatment for illnesses of sick infants, family planning using recurrent methods, family planning using intrauterine device (IUD) methods, and human immunodeficiency virus (HIV) counseling and testing, a total of 401 visits by 401 beneficiaries with 485 interventions and 2232 tasks were observed and subsequently analyzed for intervention and task duration (Table 2, Figure 1). Of 2 group interventions with \( \geq 6 \) beneficiaries (newborn care education, breastfeeding promotion), 77 beneficiaries were observed during 8 visits.

Fifty-six percent of observed visits included delivery of \( \geq 2 \) interventions to a beneficiary. The 2 most frequently used interventions for delivery of other interventions were infant vaccination and antenatal care; 73\% of observed infant vaccination interventions included an additional intervention, and 38\% of observed antenatal care interventions included an additional intervention.

**Observed Intervention Delivery Time**

In Mali, 9 of the 11 interventions were observed; in Ethiopia, 7 of 11 were observed; and in Cameroon, 10 of 11 were observed (Table 3). Antenatal care, infant vaccination, growth monitoring, HIV counseling and testing, and family planning (recurrent methods) were observed in all 3 countries. The median time to deliver interventions ranged from 2:00 for vitamin A supplementation to 12:14 for insertion of an intrauterine device for family planning (Table 3). Interventions in Cameroon were generally longer than those in Mali or Ethiopia; interventions in Mali were generally shorter than those in Cameroon or Ethiopia.

Median times to provide infant vaccination across all 18 health facilities visited in the 3 countries ranged from 1:40 to 5:06. Within Ethiopia, median times to provide infant vaccination between health facilities ranged from 2:59 to 4:04. Median times to provide infant vaccination between health facilities ranged from 1:19 to 3:59 in Mali and from 3:02 to 3:08 in Cameroon. Median times to provide antenatal care across all 18 health facilities visited in the 3 countries ranged from 2:35 to 9:11; in comparison, median times to provide vitamin A across all 18 health facilities ranged from 1:18 to 6:32. Median times to provide treatment of sick infant across all 18 health facilities ranged from 2:59 to 9:24.

Tasks within interventions differed in number and level of complexity, depending on the type of intervention delivered. For example, antenatal care and family planning (recurrent method) included 9 tasks whereas newborn care education and breastfeeding promotion included 2 tasks (Figure 1). Interventions included, on average, 6 tasks. The interventions with few tasks (<4) involved giving advice/education, record-keeping, and administering the commodity/service. Those with many tasks (>6) involved the previously mentioned tasks plus physical examination, commodity preparation, prescribing drugs, referrals to other services, and diagnosis. Among the 4 interventions that had \( \geq 40 \) observations (antenatal care, bed net distribution, vitamin A distribution, and vaccination), 2 tasks (providing education and record-keeping) constituted 28\%–64\% of the total time to deliver the intervention. Giving advice/education was the 1 task present in all 11 interventions; updating register/health card was present in 10 interventions.

**Self-reported Intervention Delivery Time**

Health worker–reported time to deliver interventions averaged 2.5 times longer (range, 1.1–3.7 times longer) than observed time for the 11 interventions (Table 3). Health worker time estimates for nonservice delivery activities included preparation time (median, 15 minutes per day; range, 5–20 minutes), clean-up of intervention sites (median 15 minutes per day; range, 5–45 minutes), compilation of monthly immunization reports to send to district health teams (median, 60 minutes per month; range, 25–180 minutes), and compiling monthly reports for all other health interventions (median, 50 minutes per month; range, 10–90 minutes).

The median length of formal training for interventions reported by health workers was 3 months for immunization (range, 0.16–9 months), 3 months for antenatal care (range, 0.33–9 months), 3 months for bed net distribution (range, 0.33–9 months), 3 months for family planning (recurrent method) (range, 0.33–9 months), 8.5 months for treatment of infants (range, 0.33–9 months), 1 month for newborn care promotion (range, 0.33–9 months), 2 months for HIV testing and counseling (range, 0.33–9 months), and 2 months for vitamin A supplementation (range, 0.33–3 months).

**DISCUSSION**

We designed and tested methodologies for collecting time estimates of service delivery for MNCH interventions based on direct observation and on healthcare worker recall. We found that health workers overestimated service delivery time compared with the directly observed times. Direct observations can also be more time-intensive than interviewing health workers, and not all interventions and tasks can be properly or efficiently observed. Using both sources of data might be necessary to plan for integrated service delivery, and recognition should be made of the differences in delivery time between interventions. Use of evidence-based estimates of resource requirements for each MNCH intervention is critical for guiding the decision-making process inherent in service delivery planning, particularly in limited-resource settings.

The methodologies we used required 2 weeks visiting health facilities in each country, and generally differed only in the amount of time required at a health facility to collect the data. Direct observation of interventions usually required 2–3 days per facility, whereas health worker estimates of delivery times...
<table>
<thead>
<tr>
<th>Intervention Category</th>
<th>Observed Interventions</th>
<th>Description of Typical Intervention</th>
<th>Target Beneficiary</th>
<th>% of Observations That Were Integrated</th>
<th>When Integrated, Other Common Interventions Given</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual intervention</td>
<td>Vitamin A supplementation&lt;sup&gt;a&lt;/sup&gt;</td>
<td>HCW provides initial counseling. HCW uses scissors to cut top of vitamin A capsule and administers fluid into the infant’s mouth. Capsule is discarded after use, and HCW updates the health register and health card.</td>
<td>Infant</td>
<td>70%</td>
<td>Infant immunization</td>
</tr>
<tr>
<td>Individual intervention</td>
<td>Infant vaccination (all vaccines according to national vaccination schedule)</td>
<td>For injectible vaccine (DTP, BCG, measles, yellow fever): HCW prepares syringe with vaccine dose; infant is injected with syringe. For oral vaccine (polio), drops are administered in the open mouth of infant. Mother receives counseling for when to return for next vaccination visit. HCW updates child health register and vaccination card. The syringe and vial are discarded in safety box.</td>
<td>Infant</td>
<td>73%</td>
<td>Vitamin A supplementation; family planning (recurrent method); growth monitoring; infant care education; breastfeeding education, treatment of sick infant</td>
</tr>
<tr>
<td>Individual intervention</td>
<td>Family planning (recurrent methods)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>HCW documents the weight/age of woman. HCW provides family planning counseling. HCW prepares syringe with injectible contraceptive; woman is injected with syringe; used syringe is discarded into safety box. Family planning register is updated. Woman is told when to return for the next family planning visit.</td>
<td>WCBA</td>
<td>29%</td>
<td>Infant immunization</td>
</tr>
<tr>
<td>Individual intervention</td>
<td>Growth monitoring&lt;sup&gt;a&lt;/sup&gt;</td>
<td>HCW provides initial counseling. Caretaker places infant in sling that is attached to weight scale. HCW writes weight in infant register and updates infant health card.</td>
<td>Infant</td>
<td>30%</td>
<td>Infant immunization; treatment of sick infant; infant care education; breastfeeding education</td>
</tr>
<tr>
<td>Individual intervention</td>
<td>Antenatal care</td>
<td>HCW provides initial counseling. HCW checks blood pressure, testing blood for anemia and syphilis and measuring weight. Women also usually receive education on diet, breastfeeding, and infant caretaking practices. The antenatal care register and antenatal card is updated and the woman is told when to return for the next antenatal care visit.</td>
<td>Pregnant woman</td>
<td>38%</td>
<td>Bed net distribution; adult vaccination (neonatal tetanus vaccine); malaria treatment</td>
</tr>
<tr>
<td>Individual intervention</td>
<td>Bed net distribution&lt;sup&gt;a&lt;/sup&gt;</td>
<td>HCW provides counseling on how to use net. HCW provides bed net and updates infant register and health card.</td>
<td>Infant, pregnant woman</td>
<td>71%</td>
<td>Infant immunization</td>
</tr>
<tr>
<td>Individual intervention</td>
<td>Treatment of sick infant</td>
<td>HCW updates register and health card. HCW documents infant’s weight and age and then physically examines the infant. HCW sometimes also checks to see if infant requires vaccinations or other interventions. HCW provides diagnosis and counseling to infant caretaker. HCW refers infant to other services if necessary. HCW cleans up intervention area.</td>
<td>Infant</td>
<td>29%</td>
<td>Growth monitoring; infant immunization</td>
</tr>
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could be collected from one health worker in about half an hour. Our finding that health workers overestimated service delivery time compared with direct observation is consistent with reports from other studies. For example, Bratt et al found that clinicians overestimated patient contact time by 32% compared with observed contact time [13–15]. One aspect of both methodologies is use of local data as opposed to global estimates derived from expert opinion or from other countries. Using local data can possibly lead to more optimal planning outcomes [16]. Service delivery planners should consider the costs involved in collecting these local data using a method similar to the one presented here. In an effort to minimize costs, we attempted to keep this methodology simple. Data collectors were required to learn how to operate a stopwatch and understand intervention definitions. The main costs of implementing the method were transport, lodging, and data collector salaries over the 2-week period. Since self-reports of time estimates from health workers may be unreliable, the extra costs associated with direct observation may be worthwhile because of the improved accuracy of the time data.

There are a number of ways these methods could be improved. For example, measuring staff nonproductive time would be useful to determine excess capacity available to accommodate additional interventions. In addition, information on when services are delivered throughout a workday could be used to better determine the per-worker time available for service delivery. For example, if mothers usually come for services only in

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<tr>
<td>Individual intervention</td>
<td>HIV testing &amp; counseling</td>
<td>HCW provides counseling on HIV services to beneficiary. For new patient, HCW prepares a syringe and withdraws blood to be sent for HIV testing. For existing HIV-positive patients, HCW provides medication. HCW examines and interviews patient for any symptoms related to HIV. HCW informs beneficiary when to return for test results or for next refill of medications. HCW updates health register and health card.</td>
<td>Mother, pregnant woman, infant</td>
<td>67%</td>
<td>Antenatal care</td>
</tr>
<tr>
<td>Individual intervention</td>
<td>Family planning (IUD methods)</td>
<td>HCW provides family planning counseling and options to beneficiary. Blood pressure and weight are measured. IUD is inserted. The woman is told when to return for follow-up checkout. The family planning register is updated by HCW.</td>
<td>WCBA</td>
<td>29%</td>
<td>Bed net distribution</td>
</tr>
<tr>
<td>Group intervention</td>
<td>Breastfeeding promotion</td>
<td>HCW conducts a multiperson session to teach pregnant women and mothers the benefits of breastfeeding, how to breastfeed, length of breastfeeding, and special requirements for HIV-positive mothers. HCW updates maternal register.</td>
<td>Mother, pregnant woman</td>
<td>60%</td>
<td>Infant immunization; growth monitoring</td>
</tr>
<tr>
<td>Group intervention</td>
<td>Newborn care education</td>
<td>HCW conducts a multiperson session to teach pregnant women and mothers how to care for the infant, including food/nutrition recommendations, cleansing the infant, response to illness, and recommended preventative health visits.</td>
<td>Mother, pregnant woman</td>
<td>100%</td>
<td>Infant immunization; growth monitoring</td>
</tr>
</tbody>
</table>

Abbreviations: DTP, diphtheria-tetanus-pertussis; HCW, healthcare worker; HIV, human immunodeficiency virus; IUD, intrauterine device; WCBA, woman of childbearing age.

* Proposed for delivery by vaccinators by Bhutta et al [1].
the morning, then using a 6-hour workday to deliver these services would not be appropriate. Community demand is also important, and we have addressed this in a complementary work exploring community perceptions of integrated services [17]. In this evaluation, we did not measure the relationship between demand and efficiency. Health workers in high-volume clinics might perform duties more quickly, whereas those in low-volume settings might be less efficient because of less pressure to work quickly. However, with more available time, workers in such settings may establish stronger relationships with clients, thereby increasing client satisfaction. Finally, information on disease burden, facility availability, current workforce demographics, and
Training initiatives were not captured in our resource matrix. The methods presented here may best serve as a useful complement to other instruments for health system planners [12, 13, 18].

We observed that health workers require relatively less time to provide vaccinations than other MNCH interventions, which can be an important consideration for health service planners. In these locations, using immunization services as the integrated delivery platform will increase visit length and workload. If additional health workers are not employed, beneficiary wait times might increase, which could harm beneficiary satisfaction with health services [19–24]. If the same health worker delivers the new intervention, delivery complexity of the new intervention should be considered, and additional training may be necessary. If instead the same health worker only provides a referral, then the consideration becomes including additional staff to receive these referrals and deliver the additional intervention(s). If service delivery planners directly observe servicedelivery time estimates in their country, this process may also compel them to consider the intervention workload capabilities and requirements. For example, in our health facility visits, we observed that HIV testing services took 3–4 times longer to deliver than immunization services.

Planners may need to take steps to optimize patient flow, including the addition of health workers, and to understand that longer beneficiary wait times may occur, which can affect patient satisfaction [19].

Understanding the extent and periodicity of unused capacity in the healthcare delivery system is a critical first step before adding new interventions onto an existing platform. A large proportion of healthcare visit time was spent updating charts, registers, health cards, and tally sheets; this is an area where time savings and efficiency could occur. Managers should recognize that adding interventions will often entail additional record keeping; using administrative staff for these tasks might help alleviate burden on health providers. Although we did not measure patient waiting times, recent studies in a similar setting suggest that the majority of time at a health clinic is spent waiting for services; adding more time to the healthcare delivery system could be a critical first step before adding new interventions onto an existing platform. A large proportion of healthcare visit time was spent updating charts, registers, health cards, and tally sheets; this is an area where time savings and efficiency could occur. Managers should recognize that adding interventions will often entail additional record keeping; using administrative staff for these tasks might help alleviate burden on health providers. Although we did not measure patient waiting times, recent studies in a similar setting suggest that the majority of time at a health clinic is spent waiting for services; adding more time to the healthcare delivery system could be a critical first step before adding new interventions onto an existing platform.

Table 3. Intervention Delivery Times per Beneficiary (in Minutes:Seconds) Observed in Health Facilities and as Reported by Health Workers, in Cameroon, Ethiopia, and Mali, December 2009–March 2010

<table>
<thead>
<tr>
<th>Intervention</th>
<th>No. of Observations</th>
<th>Median (IQR)</th>
<th>Median (n = 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A supplementation</td>
<td>37</td>
<td>2:00 (1:18, 2:42)</td>
<td>2:18 (1:43, 2:42)</td>
</tr>
<tr>
<td>Infant vaccination</td>
<td>201</td>
<td>2:22 (1:39, 3:38)</td>
<td>2:53 (1:20, 3:17)</td>
</tr>
<tr>
<td>Family planning (recurrent methods)</td>
<td>34</td>
<td>3:11 (1:40, 4:60)</td>
<td>7:32 (0)</td>
</tr>
<tr>
<td>Antenatal care visit</td>
<td>103</td>
<td>4:44 (2:10, 7:30)</td>
<td>3:50 (2:35, 7:12)</td>
</tr>
<tr>
<td>Bed net distribution</td>
<td>14</td>
<td>5:52 (1:52, 7:12)</td>
<td>5:54 (1:34, 7:19)</td>
</tr>
<tr>
<td>Treatment of sick infant</td>
<td>34</td>
<td>7:08 (4:31, 9:24)</td>
<td>9:24 (7:50, 10:20)</td>
</tr>
<tr>
<td>HIV counseling &amp; testing</td>
<td>9</td>
<td>7:12 (3:20, 10:44)</td>
<td>6:28 (3:10, 10:44)</td>
</tr>
</tbody>
</table>

Abbreviations: HIV, human immunodeficiency virus; IQR, interquartile range; IUD, intrauterine device.

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supervisors and trainers in all 3 countries. Because health workers were aware of the presence of data collectors, they may have modified their behavior, thus affecting our observed delivery times. Variability existed across interventions in the definition of what constituted an intervention. For example, vitamin A distribution was a relatively circumscribed activity; however, antenatal care and treatment of sick children had a more diverse range of tasks, which increased the complexity of data collection and was a limitation to compiling the time data across locations.

Development and utilization of planning tools and methods can assist countries facing health resource constraints to improve integrated delivery of MNCH interventions using existing service platforms. Part of the planning process is making evidence-based decisions that, ideally, are grounded in local data and that realistically incorporate all requirements necessary to support an integrated health service package at the service delivery level. The methods should be adapted and applied to such situations as Child Health Days, where service delivery time is even more critical, and should be considered by planners as the integration strategy continues to be applied in developing countries.

Notes

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