BMJ Open

Effective coverage of curative child health services in rural Burkina Faso

Note: The following files were submitted by the author for peer review, but cannot be converted to PDF. You must view these files (e.g. movies) online.

Questionnaires.rar

SCHOLARONE™
Manuscripts

Effective coverage of curative child health services in rural Burkina Faso

Koulidiati J-L[1]*, Nesbitt RC[1], Ouedraogo N[1], Hien H[2][3], Robyn PJ[4], Compaoré P[5], Souares A[1]§, and Brenner S[1]§

[1] Institute of Public Health, Heidelberg University, Im Neuenheimer Feld 130.3, 69120 Heidelberg, Germany

[2] Centre Muraz, 01 BP 390 Bobo-Dioulasso 01, Burkina Faso

[3] Institut de recherche en science de la santé (IRSS), 399, avenue de la liberté, BP 545, Bobo-Dioulasso, Burkina Faso

[4] The World Bank, 1818 H Street, NW Washington, DC 20433 USA

[5] Ministry of Health, 01 BP 7009 Ouagadougou 01, Burkina Faso

§ Joint senior authors.

Corresponding author: Jean-Louis Koulidiati

E-mail: jean-louis.koulidiati@uni-heidelberg.de

Address: Institute of Public Health, Im Neuenheimer Feld 130.3, 69120 Heidelberg, Germany

Tel: (+49) 6221 56 35039   Fax: (+49) 6221 565948

Summary

Objective: To estimate both crude and effective curative health services coverage provided by rural health facilities to under-five-year-old (U5YO) children in Burkina Faso.

Methods: We surveyed 1,298 child health providers and 1,681 clinical cases across 494 primary level health facilities, as well as 12,497 U5YO children across 7,694 households in the facilities' catchment areas. Facilities were scored based on a set of 25 functions along three quality of care dimensions: management of common childhood diseases, management of severe childhood diseases, and general service readiness. Linking service quality to service utilization, we estimated both crude and effective coverage of U5YO children by these selected curative services.

Results

Measured performance quality among facilities was generally low with only 12.7% of facilities surveyed reaching our definition of high and 57.1% our definition of intermediate quality of care. The crude coverage was 69.5% while the effective coverages indicated that 5.3% and 44.6% of children who sought care for an illness episode received services of only high or high and intermediate quality respectively.

Conclusion

Our study showed that the quality of U5YO child health services provided by primary level health facilities in Burkina Faso was low, resulting in relatively ineffective population coverage. Poor adherence to clinical treatment guidelines seemed to be main contributors to the gap between crude and effective coverage.

Strengths and limitations of this study

> This study brings new evidence on effective child health service coverage in low-income settings.

> Our findings are helpful to policy makers and health workers in adjusting current quality improvement processes.

> While our performance score accounted for both inputs and process elements related to technical quality of care, we were not able to include elements of outcome quality.

> While providing a thorough assessment of U5YO child service coverage provided by rural health care facilities at the primary level, our study does not provide any information on service coverage provided by higher levels of care such as district or regional hospitals.

1 **Introduction**

2 In spite of a recent decline in child mortality worldwide, Sub-Saharan Africa (SSA) continues

3 to be the region with the highest child mortality rates globally.[1] Most of these deaths occur

4 among under five-year-old children (U5YO) and are due to common infectious diseases

5 (malaria, diarrhoea, pneumonia) and neonatal complications (preterm birth, prolonged labour,

6 newborn sepsis) – all of which are preventable and/or treatable by commonly available and

7 cost-effective interventions.[1,2]

8 Availability of and accessibility to effective child health services (CHS) are essential in

9 reducing child mortality.[3-6] Child health interventions therefore need to ensure a combined

10 focus on both access (i.e. removal of financial, geographical, or cultural barriers) to essential

11 health services and high-standard quality of care provided by these services. While isolated

12 removal of existing barriers to care may improve crude service coverage (i.e. number of

13 service users able to access available services),[7] this may not result in an effective

14 improvement of health outcomes as long as available service quality remains substandard.[8,9]

15 By assessing the maximum possible health gain an individual can receive from a given health

16 service, the concept of 'effective coverage' therefore adjusts the commonly used crude

17 coverage estimates by the quality of the actual services received by a service user.[10,11]

18 Effective coverage has been increasingly used in the evaluation of maternal and child health

19 programs.[12-15] For instance, Nesbitt et al. compared crude and effective coverage of pregnant

20 women with facility-based obstetric services in Ghana and estimated that, although 68% of

21 the women studied had service access, only 18% received high quality care provided by a

22 skilled birth attendant.[16] Similarly, by comparing effective coverage of young children

23 receiving malaria-related care from formal and informal health providers across SSA

24 countries, Galactionova et al. found an enormous variance in estimates ranging from 8% to

25 72% depending on country.[8]

26 To further contribute to the effective coverage literature, we estimated both crude and

27 effective coverage of U5YO with CHS in Burkina Faso. Our focus hereby is on curative care

28 (as opposed to preventive care such as vaccinations or nutrition supplementation) provided by

29 primary level health facilities.

4

1   **Methods**

2   **Study Setting:**

3   In Burkina Faso, the health system follows a three-level pyramidal structure (central,

4   intermediate and peripheral)[17]. At the peripheral or lower level, the *Centres de santé et de*

5   *promotion sociale (CSPS)* function as entry point to the health system. CSPS represent health

6   centers that provide minimum preventive and curative services to the community. Each CSPS

7   serves a catchment area of several villages or sectors and employs a minimum staff consisting

8   of at least one nurse, one midwife, and one nurse assistant (*Agent Itinérant de Santé (AIS)*).

9   According to national quality assurance policies, both the nurse and midwife professionals

10   have to be qualified to provide U5YO services.[18 19] Curative care utilization by U5YO in 2010

11   was poor with only 50% of those children suffering from common infectious diseases (e.g.

12   malaria, diarrheoa, pneumonia) having sought care at a health facilities.[20] As user fees were

13   the main barrier to curative care utilization, the government started a subsidization program

14   for U5YO in 2016.[21 22]

15   **Study design and study participants:**

16   We used cross-sectional facility and household data from the baseline survey of a

17   government-led evaluation of a nation-wide performance-based financing program conducted

18   between October 2013 and February 2014.[23] Regions and districts included into the evaluation

19   study have been purposely selected on basis of low performance in identified maternal and

20   child health indicators: (i) contraceptive prevalence rate: (ii) assisted deliveries; (iii) antenatal

21   consultations (iv) post-natal consultations v) childhood vaccination coverage.

22

23   **Facility sample:** A total of 494 CSPS located in 24 districts across six out of thirteen regions

24   of the country were included, representing approximately 70% of all CSPS in these districts.

25   Recently opened facilities (less than six months old) or other forms of primary care services

26   (e.g. at high schools, colleges, garrisons or, prisons) were excluded. About 91% of selected

27   facilities were considered rural CSPS.

28

29   **Individual provider sample:** Across selected facilities, a total of 1,298 individual providers

30   were included. This sample represents the staff on duty at the day of study visit at a given

31   facility and included all CSPS employed staff cadres.

32

1   **U5YO case sample:** Across selected facilities, a total of 1,681 cases of U5YO children
2   presenting to the outpatient department on the day of the study visit were included following a
3   convenience sampling approach. Only first-time presentations (i.e. no follow-up visits) were
4   included.

5

6   **U5YO sample:** The household survey was conducted with a total of 7,694 households located
7   in the catchment areas of the sampled facilities. Households were identified using a two-stage
8   sampling technique. First, one village was randomly selected from all villages located within
9   a given catchment area. Subsequently, within the selected village 15 households were
10   randomly selected from all households identified to house at least one woman who had been
11   pregnant or given birth within the previous two years. Among these households, we identified
12   and included at total of 12,497 U5YO.

13

14   **Data Collection:**

15   The survey instruments used in this study are based on the Health Results Innovation Trust
16   Fund's (HRITF) impact evaluation toolkit and adapted to the Burkina Faso context[23] :

17   a) A facility inventory was conducted at each sampled facility assessing the availability of
18   staff, infrastructure, equipment, drugs, supplies, and consumables. Each facility head
19   verbally completed a structured checklist and a research assistant verified availability and
20   functionality of reported items. Inventory content was based on the service availability
21   and readiness assessment (SARA) framework;[24]

22   b) For each U5YO case, the patient-provider interaction during consultation was directly
23   observed and recorded by a trained research assistant using a structured checklist.[25]
24   Checklist items were based on clinical activities outlined by the integrated management of
25   childhood illness (IMCI) standards.[26] As the IMCI standards promote a generic approach
26   to the initial health status assessment of a child regardless the individual chief complaint,
27   health workers' adherence to this non-case-specific initial approach was observed in order
28   to allow comparison between different cases.

29   c) A vignette-based knowledge assessment [27] including three different case scenarios was
30   conducted with clinical staff to evaluate familiarity with specific IMCI standards as
31   related to the case management of severely ill children (i.e. dehydration, fever, respiratory
32   distress). A trained research assistant recorded steps in clinical management suggested by
33   the health worker on a structured checklist. Additional information related to a health
34   professional's qualification and IMCI training background, were also obtained.

6

1. d) A structured interview was conducted with the caregiver of each child in the U5YO population sample to collect information on any illness episodes and resultant care-seeking behaviour during the four weeks preceding the survey date.

4. Written informed consent was obtained from all study participants (i.e. health workers, patients, caregivers).

Measures and Analysis

7. Effective coverage (EC) is defined as the relationship between individual need, service utilization, and service quality [11][12][28] and can be described as:

$$EC_{ij} = \left(Q_{ij} \ U_{ij} | \ N_{ij} = 1\right)$$

9. Where EC_{ij} is the effective coverage of individual i with health service j; Q_{ij} is the expected quality of service j provided to individual i; U_{ij} is the probability of individual i receiving service j; and N_{ij} indicates all individuals i in need of service j.

12. For this study we defined *need N* as all U5YO reporting an illness episode during the past month. We defined *utilization U* as U5YO who actually sought care at the nearest facility. We defined *quality Q* as a facility or service specific score composed of three quality dimensions:[24][29]

16. a) Observed *management of common childhood diseases* (MCCD) consists of five process indicators related to health status review and four process indicators related to health status examination assessed by the case observation survey. Two of these process indicators (i.e. 'weight check' and 'temperature check') are further linked to the availability of essential input elements assessed by the facility inventory (i.e. 'functional scale' and 'functional thermometer');

22. b) Theoretical *management of severe childhood diseases* (MSCD) is based on provider knowledge on appropriate first-line management processes of 1) severe dehydration in a two-year-old (five process indicators), 2) breathing difficulties in a one-year-old (three process indicators), and 3) lethargy in a newborn (three process indicators) assessed by the three vignettes. Seven of these process indicators are further linked to the availability of essential input elements assessed by the facility inventory (see Table 1-B);

28. c) *General service readiness* is based on five structural indicators on availability of electricity, water, sanitation, patient transport, and waiting rooms assessed by the facility inventory.

31.

7

1   Composite score generation included the following steps. Each indicator measuring inputs, or

2   structures, was assigned a value of 1 if at least one unit of the observed item was available and

3   functional at a given facility, otherwise 0. To account for the multiple case observations and

4   vignettes conducted per facility, we averaged findings from multiple process measures at the

5   facility level into a single facility-specific process measure, by assigning a value of 1 when a

6   given process was observed in at least half of the observed instances and 0 if not. For those

7   quality measures where process indicators could be linked to input indicators, we assigned a

8   value of 1 only when both indicators were met, otherwise 0. Tables 1-A, 1-B, and 1-C provide

9   an overview of the three quality dimensions including the respective process, input, and

10   structural indicators together with overall facility performance across all sampled CSPS

11   facilities. To further categorize facilities, we adjusted the resulting MCCD and MSCD

12   performance scores by the characteristics of health professionals (i.e. professional

13   qualification and IMCI training background) providing U5YO consultations and responding

14   to the vignettes.

15

16   For each of the three quality dimensions, facilities were then grouped into one of three

17   categories of performance quality (high, intermediate, and low) based on the criteria shown in

18   Table 2. For facilities that met different criteria levels for each dimension, we assigned them

19   to the lower level. For instance, if a facility performed a high performance quality score but

20   did not met required staff characteristics, we assigned it to the intermediate level.

21   To estimate effective coverage, we defined *effective coverage* as the proportion of all U5YO

22   in need who actually sought care at a facility categorized as at least high or intermediate

23   performance quality.

24

25

26

1 **Results**

2 **Staffing**

3 In our study, the clinical staff observed independently managing U5YO consultations at CSPS

4 facilities included 64.1% nurses, 6.8% midwives and 29.1% AIS. Among health professionals

5 responding to the vignettes, 74.1% were qualified to provide child health services and 32.7%

6 reported to be trained in IMCI. In 66% of the studied CSPS, all observed U5YO consultations

7 were performed by qualified health providers, but in only in 42.5% of CSPS consultations

8 were provided by a health professional trained in IMCI.

9

10 **Quality of Care functions**

11 Table 1-A shows the percentage of facilities meeting each of the listed MCCD indicators. In

12 regards to symptom review (indicators 1-5), frequencies for overall performance were highest

13 for routine fever (94.1%), cough (83.4%), and diarrhoea (74.9%) reviews but not for routine

14 ear problems (25.9%) and danger signs (38.6%). In regards to patient examination (indicators

15 6-8), routine checks of body temperature and signs of anaemia were observed in 93.7% and

16 77.1% of CSPS, but body weight and vaccination status review were observed in only 67.4%

17 and 41.9% of CSPS.

18

19 Table 1-B presents the overall percentage of facilities meeting each of the listed MSCD

20 indicators. In scenario 1, providers would have administered appropriate initial treatment (i.e.

21 immediate fluid resuscitation by intravenous or enteral route) and would have withheld

22 immediate antibiotic administration given the viral cause of diarrhoea in the majority of CSPS

23 (86% and 71.4% respectively). In contrast, providers in only 32.7% of CSPS would have

24 withheld malaria treatments until further proof of parasitemia and in only 25.9% providers

25 would have initiated indicated further care (i.e. admission for further reassessment and

26 monitoring). In scenario two, providers in 76.1% of CSPS would have administered

27 antibiotics, but only in 14.1% of CSPS, indicated further care (i.e. outpatient treatment with

28 close follow-up) would have been implemented. In scenario three, although in the majority of

29 CPSP (78.5%) providers would have referred the ill infant to a higher-level care facility, in

30 only 39.2% and 7.2% of CSPS life-saving antibiotics and hypoglycaemia as potential cause of

31 lethargy would have been adequately addressed, although the necessary drugs to do so were

32 available in the majority of CSPS. .

1

2   Table 1-C presents the overall percentage of facilities meeting general service readiness

3   indicators. The majority of facilities met general infrastructural readiness. However, only

4   about half of facilities had water and soap for hand washing directly accessible in the

5   consultation rooms (56.8%), and only 23.3% could directly access a vehicle for emergency

6   patient transport.

7

8   **Overall quality of care categorization**

9   Applying the criteria outlined in Table 2 to assign each CSPS to a performance quality

10   category resulted in the distribution shown in Figure 1. For the MCCD dimension, 80.4% of

11   CSPS were categorized as meeting high or intermediate quality, while only 19.6% of CSPS

12   fell into the low quality category. A similar pattern was found for the general service

13   readiness dimension with 84.6% of CSPS meeting high or intermediate performance quality.

14   In contrast, only 49.4% of CSPS met high or intermediate MSCD quality, with more than half

15   of facilities providing relatively poor management to children with critical health conditions.

16   Taking all three dimensions together, 69.8% of CSPS met high or intermediate quality.

17

18   **Crude and effective coverage for curative CHS**

19   Out of the total U5YO population sample, 614 (4.9%) experienced an illness episode during

20   the four weeks prior to the survey date. Of these children in need for health care, 427 (69.5 %)

21   actually sought facility-based care (i.e. crude coverage). Given that the majority of CSPS fell

22   into the intermediate quality category, we estimated effective coverage for two scenarios:

23   scenario A only considering facilities in the high quality category and scenario B considering

24   both high and intermediate performing facilities. For effective coverage scenario A only 33

25   (5.3 %) U5YO received high quality services; for scenario B 274 (44.6 %) U5YO were

26   effectively covered (see Figure 2).

27

Discussion

Our study revealed two major findings regarding CHS provision in Burkina Faso. Firstly, there are existing gaps between crude and effective coverage. Secondly, performance quality related to the management of ill children provided by CSPS in our study area is generally sub-standard and varies greatly between quality dimensions.

Our study found that only about two thirds of ill U5YO presented to a CSPS, which in our study is assumed to be equivalent to crude service coverage. At this point, we were unable to explore the reasons of not seeking care for those non-using children in our sample – e.g. whether there are persisting access barriers or whether the child's illness was treated at home or elsewhere outside the formal health system. Additional research will therefore be warranted to better understand the health-seeking behaviour of households caring for ill children not seeking care provided free through the CSPS system.

More disturbingly, we found the gap in effective coverage to be considerably wide, especially when considering only high quality facilities. These estimates might be biased to some extent, as we assumed every sick child to be taken to the CSPS closest to the household when estimating service use (available data did not allow for a more specific assessment). While this would not have affected our crude coverage estimation, it might have diminished the effective coverage estimates in cases where caretakers actually bypassed the closest CSPS in favour of a more distant facility with better quality.[30] However, our assumption is supported by the literature on primary health care utilization in SSA and we trust that our effective coverage estimates are sufficiently representative of the situation in Burkina Faso.[31-35]

Effective coverage estimates are heavily influenced and can be easily modulated depending on the indicators selected to measure service quality. Although the process, input, and structural indicators included in our quality score are informed by the work of other authors, they still can be considered selective or biased towards technical elements of the care delivery process.[14 16] Still, we understand that for health care provision to be effective, evidence-based clinical protocols (such as IMCI) need to be adhered to and can therefore be considered the gold standard against which quality should be measured.

In doing so, we observed quite some quality differences across CSPS within and across the measured dimensions. While observed MCCD processes did not meet IMCI standards, it became nevertheless obvious that providers still follow an assessment approach that seems to

11

1 be focused on or informed by the leading causes and symptoms among the U5YO population.

2 The vignette-based assessment of MSCD, processes revealed that providers generally adhere

3 to treatment guidelines regarding the initial management of severely ill infants (except for the

4 newborn case in scenario 3), but deviate from protocol when making definitive care decisions.

5 Similarly weak or inconsistent adherence to treatment guidelines contributing to low service

6 quality in low-income settings has also been noted by other studies.[36-38]

7

8 Besides inconsistencies in protocol adherence, an additional contribution to the low

9 effectiveness of provided care might have been the fact that a large portion of observed U5YO

10 consultations was actually conducted by health workers without adequate qualifications (i.e.

11 AIS or providers without IMCI training) in the absence of any supervision by a more qualified

12 staff member. Officially, AIS are not authorized to independently provide any curative care in

13 Burkina Faso [19] and usually do not receive any specific skill trainings, such as IMCI.[39] In

14 addition, inadequate equipment and supplies might have also contributed to some of the

15 deviations from protocol, for instance many facilities had no malaria tests or otoscopes

16 available, which might explain the less differentiated use of anti-malaria drugs or the limited

17 focus on ear-related symptoms.[40]

18

19 As with all studies on performance quality, our study faces some limitations regarding the

20 assessment of the quality components included in our effective coverage estimates. To

21 determine the quality of curative CHS, we relied on both direct observations and vignettes.[25]

22 [27] A common bias to direct observation is the so-called Hawthorne effect, which describes

23 higher performance under observation compared to non-observed situations, and may cause

24 overestimation of actual performance.[41] In contrast, clinical vignettes might underestimate

25 actual clinical competence, as a testing format based on abstract case scenarios might be

26 unfamiliar to many health workers and has limitations in reflecting the realities of actual case

27 management. Still, both instruments are considered standard in the assessment of health

28 worker performance. In addition, to estimate the effective coverage for curative CHS, we used

29 only indicators of content of care to assess a potential health gain. Using this approach leads

30 to limitations because content of care may not directly translate into health gain.[12] Even

31 though our indicators measured the diagnosis and the treatment's process, they did not capture

32 patients' adherence to treatment or individual health outcomes (recovery, complications, etc.).

33 While our study focus was on primary level health care facilities in rural areas, study regions

34 and districts were purposely selected, which limits the generalizability of our results.

However the large sample available to this study (representing around one third of primary level health care facilities in the country) still provides a sufficiently representative overview on effective coverage in Burkina Faso. With this study adding new evidence on the effectiveness of child health service coverage in low-income settings, the future focus should certainly include the effective coverage of U5YO in more urban areas and the effectiveness of services provided by hospitals. Additional research exploring the determinants of effective coverage (both demand side factors and supply side factors), will be necessary and helpful to decision makers to tailor health interventions more specifically to improve effective service coverage.

Conclusion

Comparing crude and effective service coverage of U5YO in rural Burkina Faso resulted in two major findings. First, there are existing gaps between crude and effective coverage. Second, the effectiveness of services provided to U5YO is extremely low, even when considering a less strict definition of service quality. The main reason for inadequate service quality appears to be related to the extent to which providers are enabled to implement and able to adhere to treatment protocols and guidelines. To improve effectiveness of U5YO service provision, both policy makers and health workers should review both the enforcement of evidence-based clinical protocols (e.g. through trainings, performance evaluations, supervision and coaching) and the adequacy of equipment and supplies available at the CSPS level.

Author contributions

AS, SB, RCN, JLK conceived and designed the paper. AS, NO, SB, HH and JLK were involved in data collection. JLK analysed the data and wrote the first draft of the manuscript. JLK, RCN, NO, HH, JR, PC, AS and SB reviewed and approved the final version of the paper.

Data sharing statement

For access to the entire data set used for this article, please contact Paul Jacob Robyn (probyn@worldbank.org)

Ethics considerations

The National Ethics Committee in Burkina Faso as well as the Ethical Committee of the Medical Faculty at Heidelberg University approved this study. For this study, we obtain written consent of all the respondents.

Funding

This study was funded by the World Bank through the Health Results Innovation Trust Fund

Competing interests

We used data from the baseline survey of the impact evaluation of the Performance Based Financing program in Burkina Faso. The impact evaluation, including data collection for the survey, is funded by the World Bank through the Health Results Innovation Trust Fund (HRITF). Nobila Ouedraogo and Aurelia Souares, who was the scientific coordinator of the baseline survey received salary from the World Bank. Jean-Louis Koulidiati is a doctoral student at the University of Heidelberg and received payment from the World Bank during data collection. Stephan Brenner is currently partially employed on the abovementioned Impact Evaluation. Paul Jacob Robyn is a World Bank employee, based in Washington. Hervé Hien is employed at Centre Muraz and received payment from the World Bank during data collection only. None of the authors received any payment by the World Bank for the analysis presented in this manuscript and for the writing. The World Bank did not interfere with design, data analysis, and writing of this manuscript in any way.

References

1. United Nations Inter-agency Group for child mortality estimation. Levels trends in child mortality report. New-York USA http://www.childmortality.org/files_v20/download/IGME%20Report%202015_9_3%20LR%20Web.pdf (Accessed in May 17, 2016). 2013.

2. WHO. Countdown report Millennium Development Goals. Geneva, Switzerland: 2012.

3. O'Donnell O. Access to health care in developing countries: breaking down demand side barriers. *Cardenos de Saúde Pública*, 2007;**23**(12):2820-34.

4. Schellenberg JA, Adam T, Mshinda H, et al. Effectiveness and cost of facility-based Integrated Management of Childhood Illness (IMCI) in Tanzania. *Lance*t 2004;**364**(9445):1583–94.

5. Bryce J, Victora CG, Habicht JP, et al. Programmatic pathways to child survival: results of a multi-country evaluation of Integrated Management of Childhood Illness. *Health Policy Plan* 2005;**20 Suppl 1**:i5-i17.

6. Rakha MA, Abdelmoneim AN, Farhoud S, et al. Does implementation of the IMCI strategy have an impact on child mortality? A retrospective analysis of routine data from Egypt. *BMJ Open* 2013;**3**(1).

7. Tanahashi T. Health Service Coverage and its Evaluation. *Bull World Health Organ* 1978;**56**(2):295-303.

8. Galactionova K, Tediosi F, Savigny Dd, et al. Effective Coverage and Systems Effectiveness for Malaria Case Management in Sub-Saharan African Countries. *PLoS ONE* 2015;**10**(5):e0127818. doi:10.1371/journal.pone.18.

9. Lawn JE, Kinney MV, Black RE, et al. Newborn survival: a multi-country analysis of a decade of change. *Health Policy and Planning* 2012;**27**:iii6–iii28.

10. WHO. Tracking universal health coverage: First global monitoring report. Geneva, Switzerland: 2015.

11. Shengelia B, Tandon A, Adams OB, et al. Access, utilization, quality, and effective coverage: an integrated conceptual framework and measurement strategy. *Soc Sci Med* 2005;**61**(1):97-109.

12. Ng M, Fullman N, Dieleman JL, et al. Effective coverage: a metric for monitoring Universal Health Coverage. *PLoS Med* 2014;**11**(9):e1001730.

13. Colston J. The use of effective coverage in the evaluation of maternal and child health programs

A Technical Note for the IDB's Social Protection and Health Division. Washington DC: 2011.

14. Larson E, Vail D, Mbaruku GM, et al. Beyond utilization: measuring effective coverage of obstetric care along the quality cascade. *International Journal for Quality in Health Care* 2017; **29**(1):104–10.

15. Engle-Stone R, Nankap M, Ndjebayi AO, et al. Estimating the Effective Coverage of Programs to Control Vitamin A Deficiency and Its Consequences Among Women and Young Children in Cameroon. *Food Nutr Bull* 2015;**36**:S149–71.

16. Nesbitt RC, Lohela TJ, Manu A, et al. Quality along the continuum: a health facility assessment of intrapartum and postnatal care in Ghana. *PLoS One* 2013;**8**(11):e81089.

17. Ministère de la santé. Annuaire statistique 2014. Burkina Faso. Ouagadougou: DGESS, 2015:317p.

18. Ministère de la santé. Politque et normes en matière santé de la reproduction. Ouagadougou Burkina Faso, 2010:89p.

19. Ministère, de, la, et al. Programme national d'assurance qualite en sante. Ouagadougou Burkina Faso, 2003:p.87.

20. INSD. Measure DHS, ICF Macro Enquête démographique et de santé et à indicateurs multiples (EDSBF-MICS IV), Rapport préliminaire, Burkina Faso, 2010. Ouagadougou: 2011.

21. Ridde V. Fees-for-services, cost recovery, and equity in a district of Burkina Faso operating the Bamako Initiative. *Bulletin of the World Health Organization* 2003;81:532-538 2003;**81**:532-38.

15

22. Service d'information du gouvernement. Gratuité des soins pour les enfants de moins de cinq ans : Une réalité au Burkina Faso à partir du 02 avril 2016. Ougadougou, Burkina Faso: 2016.

23. Robyn PJ, Souares A, Hien H. Burkina Faso - Health Results-Based Financing Impact Evaluation 2013, Health Facility Baseline Survey. Washington DC: Health Results Innovation Trust Fund - HRITF http://microdata.worldbank.org/index.php/catalog/2761 (Accessed October 2nd 2017), 2014.

24. WHO. Service Availability and Readiness Assessment (SARA): An annual monitoring system for service delivery. Geneva, Switzerland: 2015.

25. Hermida J, Nicholas DD, Blumenfeld SN. Comparative validity of three methods for assessment of the quality of primary health care. *Int J Qual 1999*;**11**(5):429-33.

26. WHO. Handbook: IMCI integrated management of chilhood Ilness. Geneva: 2005.

27. Peabody JW, Luck J, Glassman P, et al. Comparison of Vignettes, Standardized Patients, and Chart Abstraction. *JAMA* 2000; **283**:1715-22.

28. Lozano R, Soliz P, Gakidou E, et al. Benchmarking of performance of Mexican states with effective coverage. *The Lancet* 2006;**368**(9548):1729-41.

29. Donabedian A. The quality of care: How can it be assessed? *JAMA* 1988;**260**(12):1743-8.

30. Kahabuka C, Kvale G, Moland KM, et al. Why caretakers bypass Primary Health Care facilities for child care - a case from rural Tanzania. *BMC Health Serv Res* 2011;**11**:315.

31. Feikin DR, Nguyen LM, Adazu K. The impact of distance of residence from a peripheral health facility on pediatric health utilisation in rural western Kenya. *Trop Med Int Health* 2009;**14**(1):54–61.

32. Noor AM, Zurovac D, Hay SI, et al. Defining equity in physical access to clinical services using geographical information systems as part of malaria planning and monitoring in Kenya. *Trop Med Int Health* 2003;**8**:917–26. .

33. Anselmi L, Lagarde M, and Hanson K.   Health service availability and health seeking behaviour in resource poor settings: evidence from Mozambique H*ealth Economics Review* 2015;**5**(26).

34. Shannon GW, Bashshur RL, Ca M. The concept of distance as a factor in accessibility and utilisation of health care. *Med Care Rev* 1969;**26**:143–61.

35. Tanser FC, Hosegood V, Benzler J, et al. New approaches to spatially analyse primary health care usage patterns in rural South Africa. *Trop Med Int Health* 2001;**6**:826–38.

36. Arifeen SE, Bryce J, Gouws E, et al. Quality of care for under-fives in first-level health facilities in one district of Bangladesh. *Bulletin of the World Health Organization* 2005;**83**:260-67.

37. Baiden F, Owusu-Agyei S, Bawah J, et al. An evaluation of the clinical assessments of under-five febrile children presenting to primary health facilities in rural Ghana. *PLoS One* 2011;**6**(12):e28944.

38. Bjornstad E, Preidis GA, Lufesi N, et al. Determining the quality of IMCI pneumonia care in Malawian children. *Paediatr Int Child Health* 2014;**34**(1):29-36.

39. Nguyen DTK, Leung KK, McIntyre L, et al. Does Integrated Management of Childhood Illness (IMCI) Training Improve the Skills of Health Workers? A Systematic Review and Meta-Analysis. *PLoS One* 2013;**8**(6):e66030.

40. Rowe AK, deSavigny D, Lanata CF, et al. How can we achieve nd maintain high-quality performance of health workers in low-resource settings? *The Lancet* 2005;**366**(1026-1035).

41. McCambridge J, Witton J, Elbourne DR. Systematic review of the Hawthorne effect: New concepts are needed to study research participation effects. *J Clin Epidemiol* 2014;**67**(3):267–77.

Table 1-A. Indicators and related performance of management of common childhood diseases (MCCD)

	Process Indicators	Number (percentage) of all facilities with observed process	**Input Indicators**	Number (percentage) of all facilities with observed input	**Overall Facility Performance** Number (percentage) of all facilities with observed performance *
1.	Provider asks for at least two general danger signs §	191 (38.6)	N/A	N/A	191 (38.6)
2.	Provider asks for presence of fever	465 (94.1)	N/A	N/A	465 (94.1)
3.	Provider asks for presence of cough	412 (83.4)	N/A	N/A	412 (83.4)
4.	Provider asks for presence of diarrhoea	370 (74.9)	N/A	N/A	370 (74.9)
5.	Provider asks for presence of ear problems	128 (25.9)	N/A	N/A	128 (25.9)
6.	Provider checks child's weight	366 (74.1)	Functional scale available	448 (90.7)	333 (67.4)
7.	Provider checks child's temperature	477 (96.5)	Functional thermometer available	480 (97.1)	463 (93.7)
8.	Provider checks for signs of anaemia (conjunctivae, palms)	381 (77.1)	N/A	N/A	381 (77.1)
9.	Provider checks child's current vaccination status	207 (41.9)	N/A	N/A	207 (41.9)

N/A = not applicable

∗ In instances where both process and input indicators were applicable, overall facility performance was positive once both indicators were met.

§ Per IMCI standard: four general danger signs need to be assessed (difficulties breastfeeding/taking any food, considerable vomiting, lethargy, convulsions). Due to generally low performance of this indicator if measured against this standard, we considered this process to be performed when at least two danger signs were reviewed.

17

Table 1-B. Indicators and related performance of management of severe childhood diseases (MSCD)

	Process Indicators	Number (percentage) of all facilities with observed process	Input Indicators	Number (percentage) of all facilities with observed input	**Overall Facility Performance** Number (percentage) of all facilities with observed performance *
Vignette-based scenario 1: Viral illness with severe dehydration in 2-year-old					
1.	Provider starts rehydration (either intravenous or enteral fluids)	445 (90.1)	Isotonic fluid [a] or oral rehydration salt and nasogastric tube in stock	486 (98.3)	439 (88.8)
2.	Provider administers a dose of paracetamol to lower fever	190 (38.4)	Paracetamol suppository in stock	424 (85.8)	165 (33.4)
3.	Provider recognizes viral origin of illness and withholds antibiotics until further evaluation.	353 (71.4)	N/A	N/A	353 (71.4)
4.	Provider withholds malaria treatment until parasitemia is confirmed	396 (80.1)	Malaria testing supplies in stock	203 (41.1)	162 (32.7)
5.	Provider admits patient for further observation and reassessment	128 (25.9)	N/A	N/A	128 (25.9)
Vignette-based scenario 2: Breathing difficulties in 1-year-old with simple pneumonia					
1.	Provider initiates antibiotic treatment at facility	380 (76.9)	Antibiotics in stock [b]	486 (98.3)	376 (76.1)
2.	Provider administers a dose of paracetamol to lower fever	331 (67)	Paracetamol suppository in stock	424 (85.8)	293 (59.3)
3.	Patient is discharged with close follow-up plan (opposed to admission or referral)	70 (14.1)	N/A	N/A	70 (14.1)
Vignette-based scenario 3: Lethargic 1-month-old					
1.	Provider administers a dose of injectable antibiotic	230 (46,5)	Ceftriaxone in stock	410 (83)	194 (39.2)
2.	Provider checks and controls hypoglycaemia	37 (7.5)	Dextrose solutions or dextrose containing IV fluids in stock	464 (93.9)	36 (7.2)
3.	Provider refers patient to higher level of care	388 (78.5)	N/A	N/A	388 (78.5)

N/A = not applicable

18

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

∗ In instances where both process and input indicators were applicable, overall facility performance was positive once both indicators were met.
[a] (Ringer lactate or normal saline)
[b] Amoxicillin or Cotrimoxazole or Ceftriaxone

Table 1-C. Indicators and related performance of general service readiness

	Process Indicators	Structural Indicators	Overall Facility Performance Number (percentage) of all facilities with observed performance
1.	N/A	Functional electricity source available	412 (83.4)
2.	N/A	Functional water source and soap available in the consultation room	281 (56.8)
3.	N/A	Functional toilet facilities available	480 (97.2)
4.	N/A	Functional emergency vehicle available	115 (23.3)
5.	N/A	Patient waiting room available	406 (82.2)

N/A = not applicable

20

Table 2. Categories of facility quality based on performance scores

Performance quality	Criteria MCCD [a]	Criteria MSCD [b]	Criteria General service readiness [c]
High	• Performance score ≥7 • All observed cases attended by a qualified HCW§ • All observed cases attended by a HCW trained in IMCI	• Performance score ≥8 • All vignettes based-scenarios answered by at least two-third* of qualified HCW§ • All vignettes based-scenarios answered by at least one HCW trained in IMCI	• Performance score ≥4
Intermediate	• Performance score 5-6 • All observed cases attended by a qualified HCW§	• Performance score 6-7 • All vignettes based-scenarios answered by at least two-third of qualified HCW	• Performance score = 3
Low	• Performance score <5	• Performance score <6	• Performance score <3

HCW = health care worker; **HF**= Health facility**;** MCCD = management of common childhood diseases; MSCD = management of severe childhood diseases

[a] maximum possible score = 9; [b] maximum possible score = 11; [c] maximum possible score = 5

§ Qualified healthcare worker: According to the national policy of quality assurance, nurse and midwife/midwife assistant are qualified to perform U5YO curative consultations.
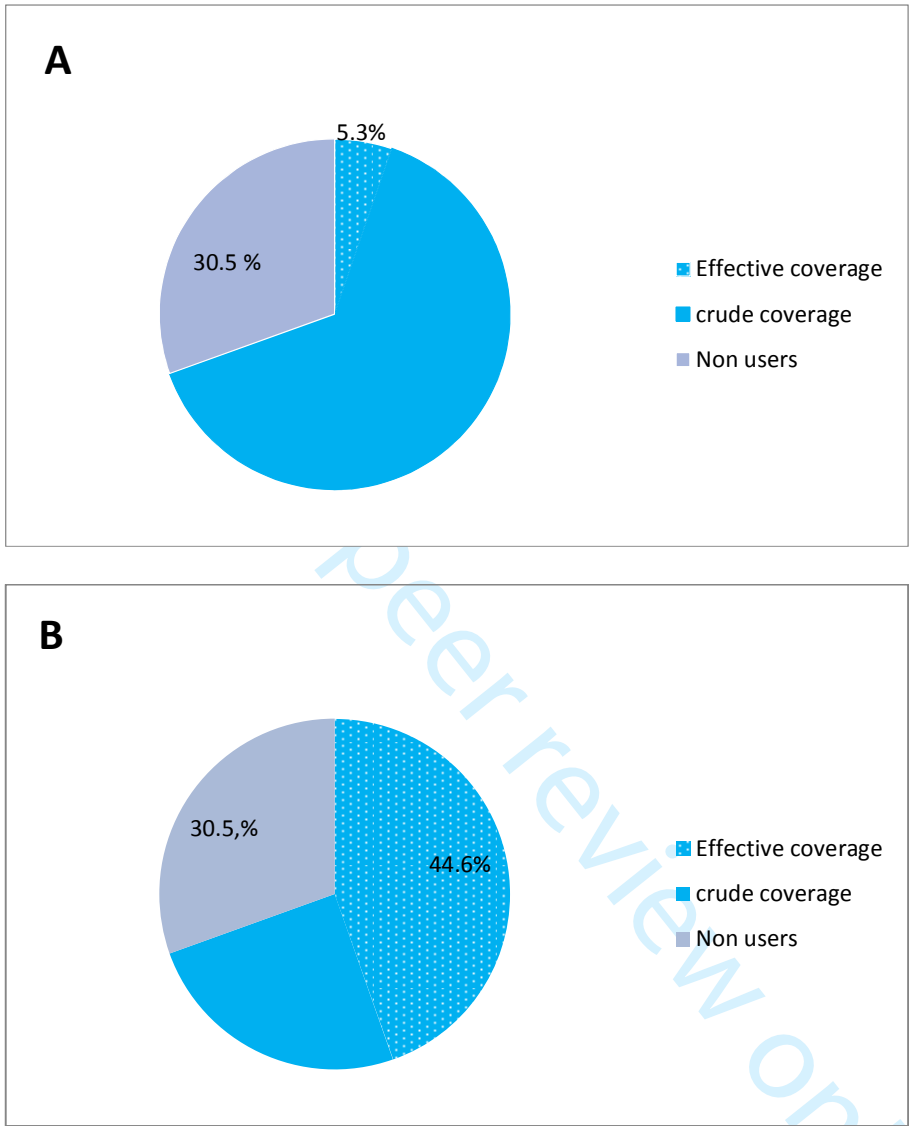
* We used the cut-off of two third because the minimum requirement staff at CSPS level is composed of two third of qualified HCW for U5YO curative consultations (1 nurse, 1 midwife /midwife assistant) and 1 AIS.

21

Figure 1. Proportion of health facilities per performance quality category (n=494)

Figure 2. Crude coverage and effective coverage for curative CHS:

A) Scenario 1, high quality only   **B)** Scenario 2, High and intermediate quality

BMJ Open

Measuring effective coverage of curative child health services in rural Burkina Faso: a cross-sectional study

SCHOLARONE™
Manuscripts

1
2
3
4

Measuring effective coverage of curative child health services in rural Burkina Faso: a cross-sectional study

Koulidiati J-L[1]*, Nesbitt RC[1], Ouedraogo N[1], Hien H[2][3], Robyn PJ[4], Compaoré P[5], Souares A[1]§, and Brenner S[1]§

[1] Institute of Public Health, Heidelberg University, Im Neuenheimer Feld 130.3, 69120 Heidelberg, Germany

[2] Centre Muraz, 01 BP 390 Bobo-Dioulasso 01, Burkina Faso

[3] Institut de recherche en science de la santé (IRSS), 399, avenue de la liberté, BP 545, Bobo-Dioulasso, Burkina Faso

[4] The World Bank, 1818 H Street, NW Washington, DC 20433 USA

[5] Ministry of Health, 01 BP 7009 Ouagadougou 01, Burkina Faso

§ Joint senior authors.

*Corresponding author: Jean-Louis Koulidiati

E-mail: jean-louis.koulidiati@uni-heidelberg.de

Address: Institute of Public Health, Im Neuenheimer Feld 130.3, 69120 Heidelberg, Germany

Tel: (+49) 6221 56 35039   Fax: (+49) 6221 565948

1

Summary

Objective: To estimate both crude and effective curative health services coverage provided by rural health facilities to under-five-year-old (U5YO) children in Burkina Faso.

Methods: We surveyed 1,298 child health providers and 1,681 clinical cases across 494 primary level health facilities, as well as 12,497 U5YO children across 7,347households in the facilities' catchment areas. Facilities were scored based on a set of indicators along three quality of care dimensions: management of common childhood diseases, management of severe childhood diseases, and general service readiness. Linking service quality to service utilization, we estimated both crude and effective coverage of U5YO children by these selected curative services.

Results
Measured performance quality among facilities was generally low with only 12.7% of facilities surveyed reaching our definition of high and 57.1% our definition of intermediate quality of care. The crude coverage was 69.5% while the effective coverages indicated that 5.3% and 44.6% of children reporting an illness episode received services of only high or high and intermediate quality respectively.

Conclusion
Our study showed that the quality of U5YO child health services provided by primary level health facilities in Burkina Faso was low, resulting in relatively ineffective population coverage. Poor adherence to clinical treatment guidelines combined with the lack of equipment and qualified clinical staff that performed U5YO consultations seemed to be contributors to the gap between crude and effective coverage.

Strengths and limitations of this study

- ➢ Using multiple data sources (direct observation, vignettes, facility inventories) this study comprehensively assessed U5YO child service performance of first line health facilities.

- ➢ We conducted this study in around five hundred of primary level health facilities and within seven thousands households across six regions in Burkina Faso.

- ➢ While our performance score accounted for both inputs and process elements related to technical quality of care, we were not able to include elements of outcome quality.

- ➢ Our study does not provide any information on service coverage provided by higher levels of care such as district or regional hospitals.

1 **Introduction**

2 In spite of a recent decline in child mortality worldwide, Sub-Saharan Africa (SSA) continues

3 to be the region with the highest child mortality rates globally.[1] Most of these deaths occur

4 among under five-year-old children (U5YO) and are due to common infectious diseases

5 (malaria, diarrhoea, pneumonia) – all of which are preventable and/or treatable by commonly

6 available and cost-effective interventions.[1 2]

7 Availability of and accessibility to effective child health services (CHS) are essential in

8 reducing child mortality.[3-6] Child health interventions therefore need to ensure a combined

9 focus on both access (i.e. removal of financial, geographical, or cultural barriers) to essential

10 health services and high-standard quality of care provided by these services. While isolated

11 removal of existing barriers to care may improve crude service coverage (i.e. number of

12 service users able to access available services),[7] this may not result in an effective

13 improvement of health outcomes especially if available service quality remains substandard.[8]

14 [9] By assessing the maximum possible health gain an individual can receive from a given

15 health service, the concept of 'effective coverage' therefore adjusts the commonly used crude

16 coverage estimates by the quality of the actual services received by a service user. [10 11]

17 Effective coverage has been increasingly used in the evaluation of maternal and child health

18 programs.[12-15] For instance, Nesbitt et al. compared crude and effective coverage of pregnant

19 women with facility-based obstetric services in Ghana and estimated that, although 68% of

20 the women studied had service access, only 18% received high quality care provided by a

21 skilled birth attendant.[16] Similarly, by comparing effective coverage of young children

22 receiving malaria-related care from formal and informal health providers across SSA

23 countries, Galactionova et al. found an enormous variance in estimates ranging from 8% to

24 72% depending on country.[8]

25 While in Burkina Faso U5YO service coverage has been previously assessed along crude

26 coverage [17 18], this is the first study to our knowledge that tries to estimate both crude and

27 effective coverage. We estimated both crude and effective coverage of U5YO with CHS in

28 Burkina Faso. Our focus hereby is on curative care (as opposed to preventive care such as

29 vaccinations or nutrition supplementation) provided by primary level health facilities.

4

Methods

Study Setting:

Burkina Faso is a low-income country[19] located in West Africa. This landlocked country covers an area of 274,200 square kilometers with a population of about 18.4 million, of which about 18% are U5YO children.[20] In 2015, the neonatal mortality rate and the under-five mortality rate were 26.2 and 88.5 per 1,000 live births respectively.[21] Malaria, diarrheoa and acute respiratory infections are the leading causes of deaths in U5YO.[22] In Burkina Faso, the health system follows a three-level pyramidal structure (central, intermediate and peripheral)[23]. At the peripheral or lower level, the *Centres de santé et de promotion sociale (CSPS)* function as entry point to the health system. CSPS represent health centers that provide minimum preventive and curative services to the community. Each CSPS serves a catchment area of several villages or sectors and employs a minimum staff consisting of at least one nurse, one midwife, and one nurse assistant (*Agent Itinérant de Santé (AIS)*). According to national quality assurance policies, both the nurse and midwife professionals have to be qualified to provide U5YO services.[24 25] Curative care utilization by U5YO in 2010 was poor with only 50% of those children suffering from common infectious diseases (e.g. malaria, diarrheoa, pneumonia) having sought care at a health facilities.[26] As user fees were the main barrier to curative care utilization, the government started a subsidization program for U5YO in 2016.[27 28]

Study design and study participants:

We used cross-sectional facility and household data from the baseline survey of a government-led evaluation of a nation-wide performance-based financing program conducted between October 2013 and February 2014.[29] Regions and districts included into the evaluation study have been purposely selected on basis of low performance in identified maternal and child health indicators: (i) contraceptive prevalence rate: (ii) assisted deliveries; (iii) antenatal consultations (iv) post-natal consultations v) childhood vaccination coverage.

Facility sample: A total of 513 CSPS located in 24 districts across six out of thirteen regions of the country were included, representing approximately 70% of all CSPS in these districts. We excluded 19 CSPS as they represented either recently opened facilities (less than six months in service) or did not provide general primary care services (e.g. at high schools, colleges, garrisons or, prisons), resulting in a final sample of 494 CSPS. About 91% of selected facilities were considered rural CSPS.

1

Individual provider sample: Across selected facilities, a total of 1,298 individual providers were included. This sample represents the staff on duty at the day of study visit at a given facility and included all CSPS employed staff cadres.

U5YO case sample: Across selected facilities, a total of 1,681 cases of U5YO children presenting to the outpatient department on the day of the study visit were included following a convenience sampling approach. Only first-time presentations (i.e. no follow-up visits) were included.

U5YO sample: Households were identified using a two-stage sampling technique. First, one village was randomly selected from all villages located within a given catchment area. Second, in each selected village households qualified for inclusion if at least one pregnant woman or a woman who gave birth within the previous two years was living in the household at the day of survey. All eligible households per village were then listed and 15 of them randomly selected to be surveyed. This way we identified 7,410 households, of which 60 households across 4 villages could not be surveyed for logistical reasons, while in 3 villages only 14 instead of 15 households were surveyed due to the limited number of eligible households. The resulting final sample therefore included only 7,347 households.

.

Data Collection:

The survey instruments used in this study are based on the Health Results Innovation Trust Fund's (HRITF) impact evaluation toolkit and adapted to the Burkina Faso context[29][30] :

a) A facility inventory was conducted at each sampled facility assessing the availability of staff, infrastructure, equipment, drugs, supplies, and consumables. Each facility head verbally completed a structured checklist and a research assistant verified availability and functionality of reported items. Inventory content was based on the service availability and readiness assessment (SARA) framework;[31]

b) For each U5YO case, the patient-provider interaction during consultation was directly observed and recorded by a trained research assistant using a structured checklist.[32] Checklist items were based on clinical activities outlined by the integrated management of childhood illness (IMCI) standards.[33] As the IMCI standards promote a generic approach to the initial health status assessment of a child regardless the individual chief complaint,

6

1　　health workers' adherence to this non-case-specific initial approach was observed in order

2　　to allow comparison between different cases.

3　c)　A vignette-based knowledge assessment [34] including three different case scenarios

4　　conducted with clinical staff to evaluate familiarity with specific IMCI standards as

5　　related to the case management of severely ill children (i.e. dehydration, fever, respiratory

6　　distress). Each scenario represented a typical cases relevant to IMCI [30 33] and was adapted

7　　to Burkina context [35]. A trained research assistant recorded steps in clinical management

8　　suggested by the health worker on a structured checklist. Additional information related to

9　　a health professional's qualification and IMCI training background, were also obtained.

10　d)　A structured interview was conducted with the caregiver of each child in the U5YO

11　　population sample to collect information on any illness episodes and resultant care-

12　　seeking behaviour during the four weeks preceding the survey date.

13　Written informed consent was obtained from all study participants (i.e. health workers,

14　patients, caregivers).

Measures and Analysis

16　Effective coverage (EC) is defined as the relationship between service utilization conditional

17　on true need and the service quality received [11 12 36] and can be described as:

$$EC_{ij} = (Q_{ij}\ U_{ij}|\ N_{ij} = 1)$$

18　Where EC_{ij} is the effective coverage of individual i with health service j; Q_{ij} is the expected

19　quality of service j provided to individual i; U_{ij} is the probability of individual i receiving

20　service j; and N_{ij} indicates all individuals i in true need of service j.

21　For this study we defined *true need N* as all U5YO reporting an illness episode during the past

22　month. We defined *utilization U* as U5YOs who actually sought care at the nearest facility.

23　Our definition of utilization conditional on true need followed the underpinnings by Shengelia

24　et al.[11] Given the data available to us, we defined true need based on reported illness[37 38],

25　while utilization is a function of perceived need among those with reported true need.

26　Based on Donabedian framework and the indices developed by Gouws et al. to assess the

27　quality of child healthcare, we defined *quality Q* as a facility or service specific score

28　composed of three quality dimensions:[39 40]

29　**a)**　Observed *management of common childhood diseases* (MCCD) consists of five process

30　　indicators related to health status review and four process indicators related to health

31　　status examination assessed by the case observation survey. Two of these process

32　　indicators (i.e. 'weight check' and 'temperature check') are further linked to the

7

1   availability of essential input elements assessed by the facility inventory (i.e. 'functional

2   scale' and 'functional thermometer'). This dimension reflects the validated indices 1 and 2

3   (Integrated child assessment based on IMCI guidelines and facility readiness to deliver

4   IMCI) developed by Gouws et al.

5   **b)** Theoretical *management of severe childhood diseases* (MSCD) is based on provider

6   knowledge on appropriate first-line management processes of 1) severe dehydration in a

7   two-year-old (five process indicators), 2) breathing difficulties in a one-year-old (three

8   process indicators), and 3) lethargy in a newborn (three process indicators) assessed by the

9   three vignettes. Seven of these process indicators are further linked to the availability of

10   essential input elements assessed by the facility inventory. This dimension reflects indices

11   3 and 4 (capacity to manage severe illness using vignettes and capacity to manage severe

12   illness given availability of essential drugs) developed by Gouws et al.

13   c) *General service readiness* is based on five structural indicators on availability of

14   electricity, water, sanitation, patient transport, and waiting rooms assessed by the facility

15   inventory. This dimension reflects structural elements relevant to essential facility

16   infrastructure based on the Donabedian framework.

17

18   Composite score generation included the following steps. Each indicator measuring inputs, or

19   structures, was assigned a value of 1 if at least one unit of the observed item was available and

20   functional at a given facility, otherwise 0. To account for the multiple case observations and

21   vignettes conducted per facility, we averaged findings from multiple process measures at the

22   facility level into a single facility-specific process measure, by assigning a value of 1 when a

23   given process was observed in at least half of the observed instances and 0 if not. For those

24   quality measures where process indicators could be linked to input indicators, we assigned a

25   value of 1 only when both indicators were met, otherwise 0. Tables 1-A, 1-B, and 1-C provide

26   an overview of the three quality dimensions including the respective process, input, and

27   structural indicators together with overall facility performance across all sampled CSPS

28   facilities.

29

30   To further categorize facilities, we combined the resulting MCCD and MSCD performance

31   scores with the characteristics of health professionals (i.e. professional qualification and IMCI

32   training background) providing U5YO consultations and responding to the vignettes. For each

33   of the three quality dimensions, facilities were then grouped into one of three categories of

34   performance quality (high, intermediate, and low) based on the criteria shown in Table 2.[14][16]

1   For facilities that met different criteria levels for each dimension, we assigned them to the

2   lower level. For instance, if a facility performed a high performance quality score but did not

3   met required staff characteristics, we assigned it to the intermediate level.

4   To estimate effective coverage, we defined *effective coverage* as the proportion of all U5YO

5   in need who actually sought care at a facility categorized as at least high or intermediate

6   performance quality.

7

8

9

1   **Results**

2

3   **U5YO characteristics**

4   Across the 7,347 households surveyed, we identified and included at total of 12,497 U5YO.

5   Of these children, 614 (4.9%) experienced an illness episode during the four weeks prior to

6   the survey date. Among these children, 463 (75.4%) had fever, 63 (10.2%) had diarrheoa, 20

7   (3.2%) had cough and 68 (11.07%) had other conditions.

8   **Staffing**

9   In our study, the clinical staff observed independently managing U5YO consultations at CSPS

10 facilities included 64.1% nurses, 6.8% midwives and 29.1% AIS. Among health professionals

11 responding to the vignettes, 74.1% were qualified to provide child health services and 32.7%

12 reported to be trained in IMCI. In 66% of the studied CSPS, all observed U5YO consultations

13 were performed by qualified health providers, but only in 42.5% of CSPS consultations were

14 provided by a health professional trained in IMCI.

15

16 **Quality of Care functions**

17 Table 1-A shows the percentage of facilities meeting each of the listed MCCD indicators. In

18 regards to symptom review (indicators 1-5), frequencies for overall performance were highest

19 for routine fever (94.1%), cough (83.4%), and diarrhoea (74.9%) reviews but not for routine

20 ear problems (25.9%) and danger signs (38.6%). In regards to patient examination (indicators

21 6-8), routine checks of body temperature and signs of anaemia were observed in 93.7% and

22 77.1% of CSPS, but body weight and vaccination status review were observed in only 67.4%

23 and 41.9% of CSPS.

24

25 Table 1-B presents the overall percentage of facilities meeting each of the listed MSCD

26 indicators. In scenario 1, providers would have administered appropriate initial treatment (i.e.

27 immediate fluid resuscitation by intravenous or enteral route) and would have withheld

28 immediate antibiotic administration given the viral cause of diarrhoea in the majority of CSPS

29 (86% and 71.4% respectively). In contrast, providers in only 32.7% of CSPS would have

30 withheld malaria treatments until further proof of parasitemia and in only 25.9% providers

31 would have initiated indicated further care (i.e. admission for further reassessment and

32 monitoring). In scenario two, providers in 76.1% of CSPS would have administered

33 antibiotics, but only in 14.1% of CSPS, indicated further care (i.e. outpatient treatment with

close follow-up) would have been implemented. In scenario three, although in the majority of CPSP (78.5%) providers would have referred the ill infant to a higher-level care facility, in only 39.2% and 7.2% of CSPS life-saving antibiotics and hypoglycaemia as potential cause of lethargy would have been adequately addressed, although the necessary drugs to do so were available in the majority of CSPS.

Table 1-C presents the overall percentage of facilities meeting general service readiness indicators. The majority of facilities met general infrastructural readiness. However, only about half of facilities had water and soap for hand washing directly accessible in the consultation rooms (56.8%), and only 23.3% could directly access a vehicle for emergency patient transport.

Overall quality of care categorization

Applying the criteria outlined in Table 2 to assign each CSPS to a performance quality category resulted in the distribution shown in Figure 1. For the MCCD dimension, 80.4% of CSPS were categorized as meeting high or intermediate quality, while only 19.6% of CSPS fell into the low quality category. A similar pattern was found for the general service readiness dimension with 84.6% of CSPS meeting high or intermediate performance quality. In contrast, only 49.4% of CSPS met high or intermediate MSCD quality, with more than half of facilities providing relatively poor management to children with critical health conditions. Taking all three dimensions together, 69.8% of CSPS met high or intermediate quality.

Crude and effective coverage for curative CHS

Out of the 614 children who experienced an illness episode, 427 (69.5 %) actually sought facility-based care (i.e. crude coverage). Given that the majority of CSPS fell into the intermediate quality category, we estimated effective coverage for two scenarios: scenario A only considering facilities in the high quality category and scenario B considering both high and intermediate performing facilities. For effective coverage scenario A only 33 (5.3 %) U5YO received high quality services; for scenario B 274 (44.6 %) U5YO were effectively covered (see Figure 2).

11

1 ## Discussion

2 Our study revealed two major findings regarding CHS provision in Burkina Faso. Firstly,

3 there are existing gaps between crude and effective coverage. Secondly, performance quality

4 related to the management of ill children provided by CSPS in our study area is generally sub-

5 standard and varies greatly between quality dimensions.

6

7 Our study found that only about two thirds of ill U5YO presented to a CSPS, which in our

8 study is assumed to be equivalent to crude service coverage. At this point, we were unable to

9 explore the reasons of not seeking care for those non-using children in our sample – e.g.

10 whether there are persisting access barriers or whether the child's illness was treated at home

11 or elsewhere outside the formal health system. Additional research will therefore be warranted

12 to better understand the health-seeking behaviour of households caring for ill children not

13 seeking care provided free through the CSPS system.

14

15 More disturbingly, we found the gap in effective coverage to be considerably wide, especially

16 when considering only high quality facilities. These estimates might be biased to some extent,

17 as we assumed every sick child to be taken to the CSPS closest to the household when

18 estimating service use (available data did not allow for a more specific assessment). While

19 this would not have affected our crude coverage estimation, it might have diminished the

20 effective coverage estimates in cases where caretakers actually bypassed the closest CSPS in

21 favour of a more distant facility with better quality.[41] However, our assumption is supported

22 by the literature on primary health care utilization in SSA and we trust that our effective

23 coverage estimates are sufficiently representative of the situation in Burkina Faso.[42-46]

24

25 Effective coverage estimates are heavily influenced and can be easily modulated depending

26 on the indicators selected to measure service quality. Although the process, input, and

27 structural indicators included in our quality score are informed by the work of other authors,

28 they still can be considered selective or biased towards technical elements of the care delivery

29 process.[40 47] Still, we understand that for health care provision to be effective, evidence-based

30 clinical protocols (such as IMCI) need to be adhered to and can therefore be considered the

31 gold standard against which quality should be measured.

32 In doing so, we observed quite some differences between the measured quality dimensions

33 used in this study. While observed MCCD processes did not meet IMCI standards, it became

34 nevertheless obvious that providers still follow an assessment approach that seems to be

focused on or informed by the leading causes and symptoms among the U5YO population. The vignette-based assessment of MSCD, processes revealed that providers generally adhere to treatment guidelines regarding the initial management of severely ill infants (except for the newborn case in scenario 3), but deviate from protocol when making definitive care decisions. Similarly weak or inconsistent adherence to treatment guidelines contributing to low service quality in low-income settings has also been noted by other studies.[47-49] While our study revealed that most of rural facilities had access to basic infrastructures, some structural differences may still remain not picked up by our survey.

Several studies have reported on the effectiveness of IMCI guidelines [5 6] and reasons of low adherence. Lack of IMCI-based training and shortage of equipment are commonly identified contributors to low adherence.[50] Some authors also point to that the lack of motivation to adhere to guidelines in combination with high workload.[51 52] Besides inconsistencies in protocol adherence, an additional contribution to the low effectiveness of provided care might have been the fact that a large portion of observed U5YO consultations was actually conducted by health workers without adequate qualifications (i.e. AIS or providers without IMCI training) in the absence of any supervision by a more qualified staff member. Officially, AIS are not authorized to independently provide any curative care in Burkina Faso [25] and usually do not receive any specific skill trainings, such as IMCI.[53] In addition, inadequate equipment and supplies might have also contributed to some of the deviations from protocol, for instance many facilities had no malaria tests or otoscopes available, which might explain the less differentiated use of anti-malaria drugs or the limited focus on ear-related symptoms.[54]

As with all studies on performance quality, our study faces some limitations regarding the assessment of the quality components included in our effective coverage estimates. To determine the quality of curative CHS, we relied on both direct observations and vignettes.[32 34] A common bias to direct observation is the so-called Hawthorne effect, which describes higher performance under observation compared to non-observed situations, and may cause overestimation of actual performance.[55] In contrast, clinical vignettes might underestimate actual clinical competence, as a testing format based on abstract case scenarios might be unfamiliar to many health workers and has limitations in reflecting the realities of actual case management. Still, both instruments are considered standard in the assessment of health worker performance.

13

1   Estimating effectiveness, we measured quality based on content of care focusing on both

2   health care inputs (infrastructure, supplies, provider knowledge) and processes (aspects of

3   actual or theoretical case management). While providing a comprehensive measure of

4   effectiveness of care, a content of care approach may only approximate an individual's health

5   gain in so far, as it does not capture aspects such as patient adherence to treatment or

6   individual health outcomes (recovery, complications, etc.).[12]. Nevertheless, the indicators

7   included in our quality score are considered measures relevant in reducing child mortality and

8   morbidity[4-6].

9   For the indicator on danger signs used in the MCCD dimension, we accepted positive

10   performance already when at least two danger signs were reviewed. This was done in order to

11   better facilitate score aggregation given the overall poor performance observed in respect to

12   danger sign assessment. It needs to be noted, that this approach actually overestimates

13   providers' overall performance. Similarly, the thresholds applied to categorizing facility

14   performance are relatively arbitrary even though we relied on the work of other authors.[14 16]

15   As the categorization approach affects heavily whether a facility was grouped as high or low

16   performing, we presented the two scenarios of effective coverage to again allow for some

17   room in our estimation.

18   Another limitation of this study is that although we focus on U5YO and infants, we

19   purposefully exclude early neonatal conditions directly related to birth. In addition, while our

20   study focus was on primary level health care facilities in rural areas, generalizability of our

21   findings might be limited given that study regions and districts were purposely selected. Still,

22   the relatively large facility sample available to us (around one third of primary level health

23   care facilities in the country) nevertheless provides a relatively broad overview on effective

24   coverage in Burkina Faso. With this study adding new evidence on the effectiveness of child

25   health service coverage in low-income settings, the future focus should certainly include the

26   effective coverage of U5YO in more urban areas and the effectiveness of services provided by

27   hospitals. Additional research exploring the determinants of effective coverage (both demand

28   side factors and supply side factors), will be necessary and helpful to decision makers to tailor

29   health interventions more specifically to improve effective service coverage.

30

31   **Conclusion**

32   Comparing crude and effective service coverage of U5YO in rural Burkina Faso resulted in

33   two major findings. First, there are existing gaps between crude and effective coverage.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1 Second, the effectiveness of services provided to U5YO is extremely low, even when

2 considering a less strict definition of service quality. While our quality assessment relied on

3 content of care measured as guideline adherence, we also assessed the availability of essential

4 equipment and supplies required to implement these protocol, as well as main provider-

5 specific characteristics. The pattern observed in our study is that lack of supplies hardly

6 seemed to influence non-adherence or IMCI guidelines. Non-adherence rather seems to be an

7 issue specific to the individual provider or service staffing with quite a number of unqualified

8 health workers actually providing clinical care to U5YOs. To improve effectiveness of U5YO

9 service provision, both policy makers and health workers should review and adjust the

10 implementation of evidence-based clinical protocols (e.g. through trainings, performance

11 evaluations, supervision and coaching) to the human and structural resources available at the

12 CSPS level.

13

14

15

16

17

Author contributions

AS, SB, RCN, JLK conceived and designed the paper. AS, NO, SB, HH and JLK were involved in data collection. JLK analysed the data and wrote the first draft of the manuscript. JLK, RCN, NO, HH, JR, PC, AS and SB reviewed and approved the final version of the paper.

Data sharing statement

For access to the entire data set used for this article, please contact Paul Jacob Robyn (probyn@worldbank.org)

Ethics considerations

The National Ethics Committee in Burkina Faso as well as the Ethical Committee of the Medical Faculty at Heidelberg University approved this study. For this study, we obtain written consent of all the respondents.

Funding

This study was funded by the World Bank through the Health Results Innovation Trust Fund

Competing interests

We used data from the baseline survey of the impact evaluation of the Performance Based Financing program in Burkina Faso. The impact evaluation, including data collection for the survey, is funded by the World Bank through the Health Results Innovation Trust Fund (HRITF). Nobila Ouedraogo and Aurelia Souares, who was the scientific coordinator of the baseline survey received salary from the World Bank. Jean-Louis Koulidiati is a doctoral student at the University of Heidelberg and received payment from the World Bank during data collection. Stephan Brenner is currently partially employed on the abovementioned Impact Evaluation. Paul Jacob Robyn is a World Bank employee, based in Washington. Hervé Hien is employed at Centre Muraz and received payment from the World Bank during data collection only. None of the authors received any payment by the World Bank for the analysis presented in this manuscript and for the writing. The World Bank did not interfere with design, data analysis, and writing of this manuscript in any way.

References

1. United Nations Inter-agency Group for child mortality estimation. Levels trends in child mortality report. New-York USA http://www.childmortality.org/files_v20/download/IGME%20Report%202015_9_3%20LR%20Web.pdf (Accessed in May 17, 2016). 2013.

2. WHO. Countdown report Millennium Development Goals. Geneva, Switzerland: 2012.

3. O'Donnell O. Access to health care in developing countries: breaking down demand side barriers. *Cardenos de Saúde Pública*, 2007;**23**(12):2820-34.

4. Schellenberg JA, Adam T, Mshinda H, et al. Effectiveness and cost of facility-based Integrated Management of Childhood Illness (IMCI) in Tanzania. *Lancet* 2004;**364**(9445):1583–94.

5. Bryce J, Victora CG, Habicht JP, et al. Programmatic pathways to child survival: results of a multi-country evaluation of Integrated Management of Childhood Illness. *Health Policy Plan* 2005;**20 Suppl 1**:i5-i17.

6. Rakha MA, Abdelmoneim AN, Farhoud S, et al. Does implementation of the IMCI strategy have an impact on child mortality? A retrospective analysis of routine data from Egypt. *BMJ Open* 2013;**3**(1).

7. Tanahashi T. Health Service Coverage and its Evaluation. *Bull World Health Organ* 1978;**56**(2):295-303.

8. Galactionova K, Tediosi F, Savigny Dd, et al. Effective Coverage and Systems Effectiveness for Malaria Case Management in Sub-Saharan African Countries. *PLoS ONE* 2015;**10**(5):e0127818. doi:10.1371/journal.pone.18.

9. Lawn JE, Kinney MV, Black RE, et al. Newborn survival: a multi-country analysis of a decade of change. *Health Policy and Planning* 2012;**27**:iii6–iii28.

10. WHO. Tracking universal health coverage: First global monitoring report. Geneva, Switzerland: 2015.

11. Shengelia B, Tandon A, Adams OB, et al. Access, utilization, quality, and effective coverage: an integrated conceptual framework and measurement strategy. *Soc Sci Med* 2005;**61**(1):97-109.

12. Ng M, Fullman N, Dieleman JL, et al. Effective coverage: a metric for monitoring Universal Health Coverage. *PLoS Med* 2014;**11**(9):e1001730.

13. Colston J. The use of effective coverage in the evaluation of maternal and child health programs A Technical Note for the IDB's Social Protection and Health Division. Washington: 2011.

14. Larson E, Vail D, Mbaruku GM, et al. Beyond utilization: measuring effective coverage of obstetric care along the quality cascade. *International Journal for Quality in Health Care* 2017; **29**(1):104–10.

15. Engle-Stone R, Nankap M, Ndjebayi AO, et al. Estimating the Effective Coverage of Programs to Control Vitamin A Deficiency and Its Consequences Among Women and Young Children in Cameroon. *Food Nutr Bull* 2015;**36**:S149–71.

16. Nesbitt RC, Lohela TJ, Manu A, et al. Quality along the continuum: a health facility assessment of intrapartum and postnatal care in Ghana. *PLoS One* 2013;**8**(11):e81089.

17. Druetz T, Ridde V, Kouanda S, et al. Utilization of community health workers for malaria treatment: results from a three-year panel study in the districts of Kaya and Zorgho, Burkina Faso. *Malaria Journal* 2015;**14**:71.

18. Druetz T, Fregonese F, Bado A, et al. Abolishing Fees at Health Centers in the Context of Community Case Management of Malaria: What Effects on Treatment-Seeking Practices for Febrile Children in Rural Burkina Faso? *PLoS ONE* 2015;**10**(10):e0141306. doi:10.1371/journal.pone.06.

19. World Bank. New country classifications by income level. The Data Blog. Washington DC: The World Bank https://blogs.worldbank.org/opendata/new-country-classifications-2016 (Accessed December 20th, 2017), 2016.

17

20. INSD. Annuaire statisitque 2015 Ouagadougou Burkina Faso: 383 p, 2016.

21. WHO. Global Health Observatory country views. Geneva, switzerland: 2017 http://apps.who.int/gho/data/node.country.country-BFA (Accessed November 14th 2017).

22. WHO. World health statistics 2015 Report. Geneva, Switzerland: 2015.

23. Ministère de la santé. Annuaire statistique 2014. Burkina Faso. Ouagadougou: DGESS, 2015:317 p.

24. Ministère de la santé. Politque et normes en matière santé de la reproduction. Ouagadougou Burkina Faso, 2010:89p.

25. Ministère de la santé. Programme national d'assurance qualite en santé. Ouagadougou Burkina Faso: 2003:p.87.

26. INSD. Measure DHS, ICF Macro Enquête démographique et de santé et à indicateurs multiples (EDSBF-MICS IV), Rapport préliminaire, Burkina Faso, 2010. Ouagadougou: 2011.

27. Ridde V. Fees-for-services, cost recovery, and equity in a district of Burkina Faso operating the Bamako Initiative. *Bulletin of the World Health Organization* 2003;81:532-538 2003;**81**:532-38.

28. Service d'information du gouvernement. Gratuité des soins pour les enfants de moins de cinq ans : Une réalité au Burkina Faso à partir du 02 avril 2016. Ougadougou, Burkina Faso: 2016.

29. Robyn PJ, Souares A, Hien H. Burkina Faso - Health Results-Based Financing Impact Evaluation 2013, Health Facility Baseline Survey. Washington DC: Health Results Innovation Trust Fund - HRITF http://microdata.worldbank.org/index.php/catalog/2761 (Accessed October 2nd 2017), 2014.

30. Vermeersch C, Rothenbühler E, Sturdy JR. Impact Evaluation Toolkit. Measuring the Impact of Results-Based Financing on Maternal and Child Health. http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTHEALTHNUTRITIONANDPOPULATION/EXTHSD/EXTIMPEVALTK/0,,contentMDK:23262154~pagePK:64168427~piPK:64168435~theSitePK:8811876,00.html (Accessed December 20th 2017) 2012.

31. WHO. Service Availability and Readiness Assessment (SARA): An annual monitoring system for service delivery. Geneva, Switzerland: 2015.

32. Hermida J, Nicholas DD, Blumenfeld SN. Comparative validity of three methods for assessment of the quality of primary health care. *Int J Qual* 1999;**11**(5):429-33.

33. WHO. Handbook: IMCI integrated management of chilhood Ilness. Geneva: 2005.

34. Peabody JW, Luck J, Glassman P, et al. Comparison of Vignettes, Standardized Patients, and Chart Abstraction. *JAMA* 2000; **283**:1715-22.

35. Ministère de la santé. Guide de diagnostic et de traitement. Ouagoudougou, Burkina Faso: 2009.

36. Lozano R, Soliz P, Gakidou E, et al. Benchmarking of performance of Mexican states with effective coverage. *The Lancet 2*006;**368**(9548):1729-41.

37. Leslie HH, Malata A, Ndiaye Y, et al. Effective coverage of primary care services in eight high-mortality countries. *BMJ Glob Health* 2017;2:e000424 doi:101136/bmjgh-2017-000424 2017.

38. Nguhiu PK, Barasa EW, Chuma J. Determining the effective coverage of maternal and child health services in Kenya, using demographic and health survey data sets: tracking progress towards universal health coverage. *Tropical Medicine and International Health* 2017;**22**(4):442–53.

39. Donabedian A. The quality of care: How can it be assessed? . *JAMA* 1988;**260**(12):1743-8.

40. Gouws E, Bryce J, Pariyo G, et al. Measuring the quality of child health care at first-level facilities. *Soc Sci Med* 2005;**61**(3):613-25.

41. Kahabuka C, Kvale G, Moland KM, et al. Why caretakers bypass Primary Health Care facilities for child care - a case from rural Tanzania. *BMC Health Serv Res* 2011;**11**:315.

42. Feikin DR, Nguyen LM, Adazu K. The impact of distance of residence from a peripheral health facility on pediatric health utilisation in rural western Kenya. *Trop Med Int Health* 2009;**14**(1):54–61.

43. Noor AM, Zurovac D, Hay SI, et al. Defining equity in physical access to clinical services using geographical information systems as part of malaria planning and monitoring in Kenya. *Trop Med Int Health* 2003;**8**:917–26. .

18

44. Anselmi L, Lagarde M, and Hanson K. Health service availability and health seeking behaviour in resource poor settings: evidence from Mozambique. *Health Economics Review* 2015;**5**(26).

45. Shannon GW, Bashshur RL, CA M. The concept of distance as a factor in accessibility and utilisation of health care. *Med Care Rev* 1969;**26**:143–61.

46. Tanser FC, Hosegood V, Benzler J, et al. New approaches to spatially analyse primary health care usage patterns in rural South Africa. *Trop Med Int Health* 2001;**6**:826–38.

47. Arifeen SE, Bryce J, Gouws E, et al. Quality of care for under-fives in first-level health facilities in one district of Bangladesh. *Bulletin of the World Health Organization* 2005;**83**:260-7.

48. Baiden F, Owusu-Agyei S, Bawah J, et al. An evaluation of the clinical assessments of under-five febrile children presenting to primary health facilities in rural Ghana. *PLoS One* 2011;**6**(12):e28944.

49. Bjornstad E, Preidis GA, Lufesi N, et al. Determining the quality of IMCI pneumonia care in Malawian children. *Paediatr Int Child Health* 2014;**34**(1):29-36.

50. Rowe AK, Savigny Dd, Lanata CF, et al. How can we achieve and maintain high-quality performance of health workers in low-resource settings? *Lancet* 2005; **366**:1026–35.

51. Lange S, Mwisongo A, Maestad O. Why don't clinicians adhere more consistently to guidelines for the Integrated Management of Childhood Illness (IMCI)? *Soc Sci Med* 2014;**104**:56-63.

52. Mæstad O, Torsvik G, Aakvik A. Overworked? On the relationship between workload and health worker performance. *Journal of Health Economics* 2010;**29**:686–98.

53. Nguyen DTK, Leung KK, McIntyre L, et al. Does Integrated Management of Childhood Illness (IMCI) Training Improve the Skills of Health Workers? A Systematic Review and Meta-Analysis. *PLoS One* 2013;**8**(6):e66030.

54. Rowe AK, deSavigny D, Lanata CF, et al. How can we achieve and maintain high-quality performance of health workers in low-resource settings? *The Lancet* 2005;**366**(1026-1035).

55. McCambridge J, Witton J, Elbourne DR. Systematic review of the Hawthorne effect: New concepts are needed to study research participation effects. *J Clin Epidemiol* 2014;**67**(3):267–77.

19

Table 1-A. Indicators and related performance of management of common childhood diseases (MCCD)

	Process Indicators (based on direct observation)	Number (percentage) of all facilities with observed process	**Input Indicators**	Number (percentage) of all facilities with observed input	**Overall Facility Performance** Number (percentage) of all facilities with observed performance *
1.	Provider asks for at least two general danger signs §	191 (38.6)	N/A	N/A	191 (38.6)
2.	Provider asks for presence of fever	465 (94.1)	N/A	N/A	465 (94.1)
3.	Provider asks for presence of cough	412 (83.4)	N/A	N/A	412 (83.4)
4.	Provider asks for presence of diarrhoea	370 (74.9)	N/A	N/A	370 (74.9)
5.	Provider asks for presence of ear problems	128 (25.9)	N/A	N/A	128 (25.9)
6.	Provider checks child's weight	366 (74.1)	Functional scale available	448 (90.7)	333 (67.4)
7.	Provider checks child's temperature	477 (96.5)	Functional thermometer available	480 (97.1)	463 (93.7)
8.	Provider checks for signs of anaemia (conjunctivae, palms)	381 (77.1)	N/A	N/A	381 (77.1)
9.	Provider checks child's current vaccination status	207 (41.9)	N/A	N/A	207 (41.9)

N/A = not applicable

∗ In instances where both process and input indicators were applicable, overall facility performance was positive once both indicators were met.

§ Per IMCI standard: four general danger signs need to be assessed (difficulties breastfeeding/taking any food, considerable vomiting, lethargy, convulsions). Due to generally low performance of this indicator if measured against this standard, we considered this process to be performed when at least two danger signs were reviewed.

20

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

Table 1-B. Indicators and related performance of management of severe childhood diseases (MSCD)

Process Indicators (based on vignettes)		Number (percentage) of all facilities with observed process	Input Indicators	Number (percentage) of all facilities with observed input	Overall Facility Performance Number (percentage) of all facilities with observed performance *
Vignette-based scenario 1: Viral illness with severe dehydration in 2-year-old					
1.	Provider starts rehydration (either intravenous or enteral fluids)	445 (90.1)	Isotonic fluid [a] or oral rehydration salt and nasogastric tube in stock	486 (98.3)	439 (88.8)
2.	Provider administers a dose of paracetamol to lower fever	190 (38.4)	Paracetamol suppository in stock	424 (85.8)	165 (33.4)
3.	Provider recognizes viral origin of illness and withholds antibiotics until further evaluation.	353 (71.4)	N/A	N/A	353 (71.4)
4.	Provider withholds malaria treatment until parasitemia is confirmed	396 (80.1)	Malaria testing supplies in stock	203 (41.1)	162 (32.7)
5.	Provider admits patient for further observation and reassessment	128 (25.9)	N/A	N/A	128 (25.9)
Vignette-based scenario 2: Breathing difficulties in 1-year-old with simple pneumonia					
1.	Provider initiates antibiotic treatment at facility	380 (76.9)	Antibiotics in stock [b]	486 (98.3)	376 (76.1)
2.	Provider administers a dose of paracetamol to lower fever	331 (67)	Paracetamol suppository in stock	424 (85.8)	293 (59.3)
3.	Patient is discharged with close follow-up plan (opposed to admission or referral)	70 (14.1)	N/A	N/A	70 (14.1)
Vignette-based scenario 3: Lethargic 1-month-old					
1.	Provider administers a dose of injectable antibiotic	230 (46,5)	Ceftriaxone in stock	410 (83)	194 (39.2)
2.	Provider checks and controls hypoglycaemia	37 (7.5)	Dextrose solutions or dextrose containing IV fluids in stock	464 (93.9)	36 (7.2)
3.	Provider refers patient to higher level of care	388 (78.5)	N/A	N/A	388 (78.5)

N/A = not applicable

21

∗ In instances where both process and input indicators were applicable, overall facility performance was positive once both indicators were met.
[a] (Ringer lactate or normal saline)
[b] Amoxicillin or Cotrimoxazole or Ceftriaxone

Table 1-C. Indicators and related performance of general service readiness

	Process Indicators	Structural Indicators	Overall Facility Performance Number (percentage) of all facilities with observed performance
1.	N/A	Functional electricity source available	412 (83.4)
2.	N/A	Functional water source and soap available in the consultation room	281 (56.8)
3.	N/A	Functional toilet facilities available	480 (97.2)
4.	N/A	Functional emergency vehicle available	115 (23.3)
5.	N/A	Patient waiting room available	406 (82.2)

N/A = not applicable

Table 2. Categories of facility quality based on performance scores

Performance quality	Criteria MCCD [a]	Criteria MSCD [b]	Criteria General service readiness [c]
High	• Performance score[d] ≥7 • All observed cases attended by a qualified HCW§ • All observed cases attended by a HCW trained in IMCI	• Performance score ≥8 • All vignettes based-scenarios answered by at least two-third* of qualified HCW§ • All vignettes based-scenarios answered by at least one HCW trained in IMCI	• Performance score ≥4
Intermediate	• Performance score 5-6 • All observed cases attended by a qualified HCW§	• Performance score 6-7 • All vignettes based-scenarios answered by at least two-third of qualified HCW	• Performance score = 3
Low	• Performance score <5	• Performance score <6	• Performance score <3

HCW = health care worker; **HF**= Health facility**;** MCCD = management of common childhood diseases; MSCD = management of severe childhood diseases

[a] maximum possible score = 9; [b] maximum possible score = 11; [c] maximum possible score = 5 [d] performance score: high (≥70% of the maximum possible score) ; intermediate (50-69%); low (<50%)

§ Qualified healthcare worker: According to the national policy of quality assurance, nurse and midwife/midwife assistant are qualified to perform U5YO curative consultations.

* We used the cut-off of two third because the minimum requirement staff at CSPS level is composed of two third of qualified HCW for U5YO curative consultations (1 nurse, 1 midwife /midwife assistant) and 1 AIS.

24

1
2
3
4
5 **Figure 1. Proportion of health facilities per performance quality category (n=494)**
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
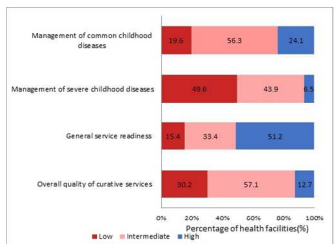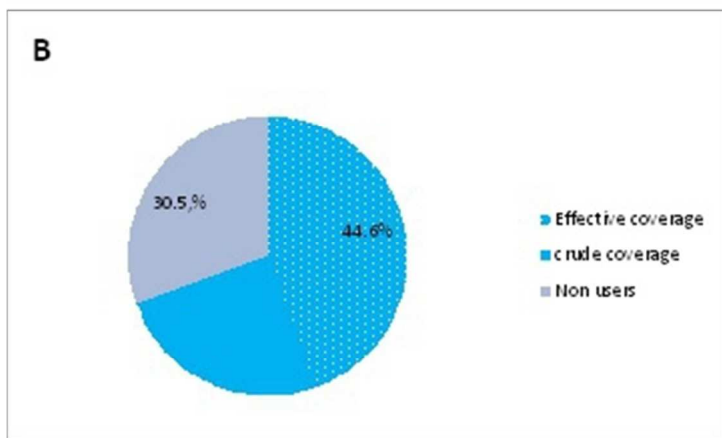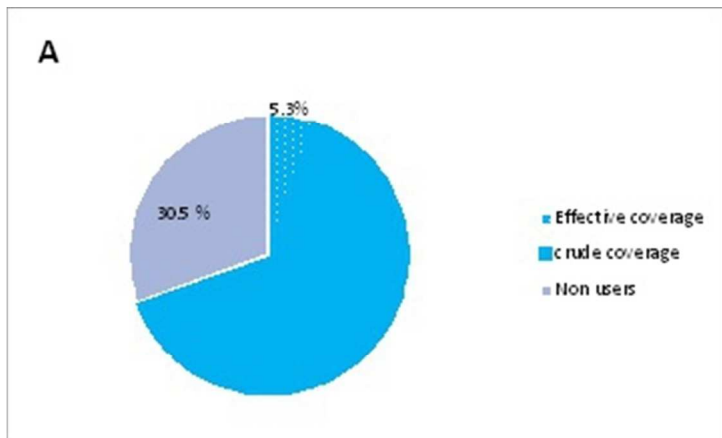
25

Figure 2. Crude coverage and effective coverage for curative CHS:

A) Scenario 1, high quality only   **B)** Scenario 2, High and intermediate quality

26

Percentage of health facilities(%)

137x101mm (300 x 300 DPI)

38x39mm (300 x 300 DPI)

Measuring effective coverage of curative child health services in rural Burkina Faso: a cross-sectional study

SCHOLARONE™
Manuscripts

1
2
3
4

Measuring effective coverage of curative child health services in rural Burkina Faso: a cross-sectional study

3

4 Koulidiati J-L[1]*, Nesbitt RC[1], Ouedraogo N[1], Hien H[2][3], Robyn PJ[4], Compaoré P[5], Souares
5 A[1]§, and Brenner S[1]§

6

7 [1] Institute of Public Health, Heidelberg University, Im Neuenheimer Feld 130.3, 69120
8 Heidelberg, Germany
9 [2] Centre Muraz, 01 BP 390 Bobo-Dioulasso 01, Burkina Faso

10 [3] Institut de recherche en science de la santé (IRSS), 399, avenue de la liberté, BP 545, Bobo-

11 Dioulasso, Burkina Faso

12 [4] The World Bank, 1818 H Street, NW Washington, DC 20433 USA

13 [5] Ministry of Health, 01 BP 7009 Ouagadougou 01, Burkina Faso

14
15 § Joint senior authors.
16

17 **Corresponding author:** Jean-Louis Koulidiati

18 E-mail: jean-louis.koulidiati@uni-heidelberg.de

19 Address: Institute of Public Health, Im Neuenheimer Feld 130.3, 69120 Heidelberg, Germany

20 Tel: (+49) 6221 56 35039   Fax: (+49) 6221 565948

21

22

23

1

Summary

Objective: To estimate both crude and effective curative health services coverage provided by rural health facilities to under-five-year-old (U5YO) children in Burkina Faso.

Methods: We surveyed 1,298 child health providers and 1,681 clinical cases across 494 primary level health facilities, as well as 12,497 U5YO children across 7,347households in the facilities' catchment areas. Facilities were scored based on a set of indicators along three quality of care dimensions: management of common childhood diseases, management of severe childhood diseases, and general service readiness. Linking service quality to service utilization, we estimated both crude and effective coverage of U5YO children by these selected curative services.

Results

Measured performance quality among facilities was generally low with only 12.7% of facilities surveyed reaching our definition of high and 57.1% our definition of intermediate quality of care. The crude coverage was 69.5% while the effective coverages indicated that 5.3% and 44.6% of children reporting an illness episode received services of only high or high and intermediate quality respectively.

Conclusion

Our study showed that the quality of U5YO child health services provided by primary level health facilities in Burkina Faso was low, resulting in relatively ineffective population coverage. Poor adherence to clinical treatment guidelines combined with the lack of equipment and qualified clinical staff that performed U5YO consultations seemed to be contributors to the gap between crude and effective coverage.

Strengths and limitations of this study

➢ Using multiple data sources (direct observation, vignettes, facility inventories) this study comprehensively assessed U5YO child service performance of first line health facilities.

➢ We conducted this study in around five hundred primary level health facilities and within seven thousands households across six regions in Burkina Faso.

➢ While our performance score accounted for both inputs and process elements related to technical quality of care, we were not able to include elements of outcome quality.

➢ Our study does not provide any information on service coverage provided by higher levels of care such as district or regional hospitals.

3

1 **Introduction**

2 In spite of a recent decline in child mortality worldwide, Sub-Saharan Africa (SSA) continues

3 to be the region with the highest child mortality rates globally.[1] Most of these deaths occur

4 among under five-year-old children (U5YO) and are due to common infectious diseases

5 (malaria, diarrhoea, pneumonia) – all of which are preventable and/or treatable by commonly

6 available and cost-effective interventions.[1 2]

7 Availability of and accessibility to effective child health services (CHS) are essential in

8 reducing child mortality.[3-6] Child health interventions therefore need to ensure a combined

9 focus on both access (i.e. removal of financial, geographical, or cultural barriers) to essential

10 health services and high-standard quality of care provided by these services. While isolated

11 removal of existing barriers to care may improve crude service coverage (i.e. number of

12 service users able to access available services),[7] this may not result in an effective

13 improvement of health outcomes especially if available service quality remains substandard.[8]

14 [9] By assessing the maximum possible health gain an individual can receive from a given

15 health service, the concept of 'effective coverage' therefore adjusts the commonly used crude

16 coverage estimates by the quality of the actual services received by a service user.[10 11]

17 Effective coverage has been increasingly used in the evaluation of maternal and child health

18 programs.[12-15] For instance, Nesbitt et al. compared crude and effective coverage of pregnant

19 women with facility-based obstetric services in Ghana and estimated that, although 68% of

20 the women studied had service access, only 18% received high quality care provided by a

21 skilled birth attendant.[16] Similarly, by comparing effective coverage of young children

22 receiving malaria-related care from formal and informal health providers across SSA

23 countries, Galactionova et al. found an enormous variance in estimates ranging from 8% to

24 72% depending on country.[8]

25 While in Burkina Faso U5YO service coverage has been previously assessed along crude

26 coverage [17 18], this is the first study to our knowledge that tries to estimate both crude and

27 effective coverage. We estimated both crude and effective coverage of U5YO with CHS in

28 Burkina Faso. Our focus hereby is on curative care (as opposed to preventive care such as

29 vaccinations or nutrition supplementation) provided by primary level health facilities.

1   **Methods**

2   **Study Setting:**

3   Burkina Faso is a low-income country[19] located in West Africa. This landlocked country

4   covers an area of 274,200 square kilometers with a population of about 18.4 million, of which

5   about 18% are U5YO children.[20] In 2015, the neonatal mortality rate and the under-five

6   mortality rate were 26.2 and 88.5 per 1,000 live births respectively.[21] Malaria, diarrheoa and

7   acute respiratory infections are the leading causes of deaths in U5YO.[22] In Burkina Faso, the

8   health system follows a three-level pyramidal structure (central, intermediate and

9   peripheral)[23]. At the peripheral or lower level, the *Centres de santé et de promotion sociale*

10   *(CSPS)* function as entry point to the health system. CSPS represent health centers that

11   provide minimum preventive and curative services to the community. Each CSPS serves a

12   catchment area of several villages or sectors and employs a minimum staff consisting of at

13   least one nurse, one midwife, and one outreach health worker (*Agent Itinérant de Santé*

14   *(AIS)*). According to national quality assurance policies, both the nurse and midwife

15   professionals have to be qualified to provide U5YO services.[24 25] Curative care utilization by

16   U5YO in 2010 was poor with only 50% of those children suffering from common infectious

17   diseases (e.g. malaria, diarrheoa, pneumonia) having sought care at a health facility.[26] As user

18   fees were the main barrier to curative care utilization, the government started a subsidization

19   program offering free services for all U5YO in 2016.[27 28]

20   **Study design and study participants:**

21   We used cross-sectional facility and household data from the baseline survey of a

22   government-led evaluation of a nation-wide performance-based financing program conducted

23   between October 2013 and February 2014.[29] Regions and districts included into the evaluation

24   study have been purposely selected on basis of low performance in identified maternal and

25   child health indicators: (i) contraceptive prevalence rate: (ii) assisted deliveries; (iii) antenatal

26   consultations (iv) post-natal consultations v) childhood vaccination coverage.

27

28   **Facility sample:** A total of 513 CSPS located in 24 districts across six out of thirteen regions

29   of the country were included, representing approximately 70% of all CSPS in these districts.

30   We excluded 19 CSPS as they represented either recently opened facilities (less than six

31   months in service) or did not provide general primary care services (e.g. at high schools,

32   colleges, garrisons or, prisons), resulting in a final sample of 494 CSPS. About 91% of

33   selected facilities were considered rural CSPS.

Individual provider sample: Across selected facilities, a total of 1,298 individual providers were included. This sample represents the staff on duty at the day of study visit at a given facility and included all CSPS employed staff cadres.

U5YO case sample: Across selected facilities, a total of 1,681 cases of U5YO children presenting to the outpatient department on the day of the study visit were included following a convenience sampling approach. Only first-time presentations (i.e. no follow-up visits) were included.

U5YO sample: Households were identified using a two-stage sampling technique. First, one village was randomly selected from all villages located within a given catchment area. Second, in each selected village households qualified for inclusion if at least one pregnant woman or a woman who gave birth within the previous two years was living in the household at the day of survey. All eligible households per village were then listed and 15 of them randomly selected to be surveyed. This way we identified 7,410 households, of which 60 households across 4 villages could not be surveyed for logistical reasons, while in 3 villages only 14 instead of 15 households were surveyed due to the limited number of eligible households. The resulting final sample therefore included only 7,347 households.

.

Data Collection:

The survey instruments used in this study are based on the Health Results Innovation Trust Fund's (HRITF) impact evaluation toolkit and adapted to the Burkina Faso context[29 30] :

a) A facility inventory was conducted at each sampled facility assessing the availability of staff, infrastructure, equipment, drugs, supplies, and consumables. Each facility head verbally completed a structured checklist and a research assistant verified availability and functionality of reported items. Inventory content was based on the service availability and readiness assessment (SARA) framework;[31]

b) For each U5YO case, the patient-provider interaction during consultation was directly observed and recorded by a trained research assistant using a structured checklist.[32] Checklist items were based on clinical activities outlined by the integrated management of childhood illness (IMCI) standards.[33] As the IMCI standards promote a generic approach to the initial health status assessment of a child regardless the individual chief complaint,

1 health workers' adherence to this non-case-specific initial approach was observed in order

2 to allow comparison between different cases.

3 c) A vignette-based knowledge assessment [34] including three different case scenarios

4 conducted with clinical staff to evaluate familiarity with specific IMCI standards as

5 related to the case management of severely ill children (i.e. dehydration, fever, respiratory

6 distress). Each scenario represented a typical cases relevant to IMCI [30 33] and was adapted

7 to Burkina context [35]. A trained research assistant recorded steps in clinical management

8 suggested by the health worker on a structured checklist. Additional information related to

9 a health professional's qualification and IMCI training background, were also obtained.

10 d) A structured interview was conducted with the caregiver of each child in the U5YO

11 population sample to collect information on any illness episodes and resultant care-

12 seeking behaviour during the four weeks preceding the survey date.

13 Written informed consent was obtained from all study participants (i.e. health workers,

14 patients, caregivers).

Measures and Analysis

16 Effective coverage (EC) is defined as the relationship between service utilization conditional

17 on true need and the service quality received [11 12 36] and can be described as:

$$EC_{ij} = (Q_{ij} \ U_{ij} | N_{ij} = 1)$$

18 Where EC_{ij} is the effective coverage of individual i with health service j; Q_{ij} is the expected

19 quality of service j provided to individual i; U_{ij} is the probability of individual i receiving

20 service j; and N_{ij} indicates all individuals i in true need of service j.

21 For this study we defined *true need N* as all U5YO reporting an illness episode during the past

22 month. We defined *utilization U* as U5YOs who actually sought care at the nearest facility.

23 Our definition of utilization conditional on true need followed the underpinnings by Shengelia

24 et al.[11] Given the data available to us, we defined true need based on reported illness[37 38],

25 while utilization is a function of perceived need among those with reported true need.

26 Based on Donabedian framework and the indices developed by Gouws et al. to assess the

27 quality of child healthcare, we defined *quality Q* as a facility or service specific score

28 composed of three quality dimensions:[39 40]

29 **a)** Observed *management of common childhood diseases* (MCCD) consists of five process

30 indicators related to health status review and four process indicators related to health

31 status examination assessed by the case observation survey. Two of these process

32 indicators (i.e. 'weight check' and 'temperature check') are further linked to the

7

1 availability of essential input elements assessed by the facility inventory (i.e. 'functional

2 scale' and 'functional thermometer'). This dimension reflects the validated indices 1 and 2

3 (Integrated child assessment based on IMCI guidelines and facility readiness to deliver

4 IMCI) developed by Gouws et al.

5 **b)** Theoretical *management of severe childhood diseases* (MSCD) is based on provider

6 knowledge on appropriate first-line management processes of 1) severe dehydration in a

7 two-year-old (five process indicators), 2) breathing difficulties in a one-year-old (three

8 process indicators), and 3) lethargy in a newborn (three process indicators) assessed by the

9 three vignettes. Seven of these process indicators are further linked to the availability of

10 essential input elements assessed by the facility inventory. This dimension reflects indices

11 3 and 4 (capacity to manage severe illness using vignettes and capacity to manage severe

12 illness given availability of essential drugs) developed by Gouws et al.

13 c) *General service readiness* is based on five structural indicators on availability of

14 electricity, water, sanitation, patient transport, and waiting rooms assessed by the facility

15 inventory. This dimension reflects structural elements relevant to essential facility

16 infrastructure based on the Donabedian framework.

17

18 Composite score generation included the following steps. Each indicator measuring inputs, or

19 structures, was assigned a value of 1 if at least one unit of the observed item was available and

20 functional at a given facility, otherwise 0. To account for the multiple case observations and

21 vignettes conducted per facility, we averaged findings from multiple process measures at the

22 facility level into a single facility-specific process measure, by assigning a value of 1 when a

23 given process was observed in at least half of the observed instances and 0 if not. For those

24 quality measures where process indicators could be linked to input indicators, we assigned a

25 value of 1 only when both indicators were met, otherwise 0. Tables 1-A, 1-B, and 1-C provide

26 an overview of the three quality dimensions including the respective process, input, and

27 structural indicators together with overall facility performance across all sampled CSPS

28 facilities.

29

30 To further categorize facilities, we combined the resulting MCCD and MSCD performance

31 scores with the characteristics of health professionals (i.e. professional qualification and IMCI

32 training background) providing U5YO consultations and responding to the vignettes. For each

33 of the three quality dimensions, facilities were then grouped into one of three categories of

34 performance quality (high, intermediate, and low) based on the criteria shown in Table 2.[14 16]

8

1   For facilities that met different criteria levels for each dimension, we assigned them to the

2   lower level. For instance, if a facility performed a high performance quality score but did not

3   met required staff characteristics, we assigned it to the intermediate level.

4   To estimate effective coverage, we defined *effective coverage* as the proportion of all U5YO

5   in need who actually sought care at a facility categorized as at least high or intermediate

6   performance quality.

7

8

9

1   **Results**

2

3   **U5YO characteristics**

4   Across the 7,347 households surveyed, we identified and included at total of 12,497 U5YO.

5   Of these children, 614 (4.9%) experienced an illness episode during the four weeks prior to

6   the survey date. Among these children, 463 (75.4%) had fever, 63 (10.2%) had diarrheoa, 20

7   (3.2%) had cough and 68 (11.07%) had other conditions.

8   **Staffing**

9   In our study, the clinical staff observed independently managing U5YO consultations at CSPS

10 facilities included 64.1% nurses, 6.8% midwives and 29.1% AIS. Among health professionals

11 responding to the vignettes, 74.1% were qualified to provide child health services and 32.7%

12 reported to be trained in IMCI. In 66% of the studied CSPS, all observed U5YO consultations

13 were performed by qualified health providers, but only in 42.5% of CSPS consultations were

14 provided by a health professional trained in IMCI.

15

16 **Quality of Care functions**

17 Table 1-A shows the percentage of facilities meeting each of the listed MCCD indicators. In

18 regards to symptom review (indicators 1-5), frequencies for overall performance were highest

19 for routine fever (94.1%), cough (83.4%), and diarrhoea (74.9%) reviews but not for routine

20 ear problems (25.9%) and danger signs (38.6%). In regards to patient examination (indicators

21 6-8), routine checks of body temperature and signs of anaemia were observed in 93.7% and

22 77.1% of CSPS, but body weight and vaccination status review were observed in only 67.4%

23 and 41.9% of CSPS.

24

25 Table 1-B presents the overall percentage of facilities meeting each of the listed MSCD

26 indicators. In scenario 1, providers would have administered appropriate initial treatment (i.e.

27 immediate fluid resuscitation by intravenous or enteral route) and would have withheld

28 immediate antibiotic administration given the viral cause of diarrhoea in the majority of CSPS

29 (86% and 71.4% respectively). In contrast, providers in only 32.7% of CSPS would have

30 withheld malaria treatments until further proof of parasitemia and in only 25.9% providers

31 would have initiated indicated further care (i.e. admission for further reassessment and

32 monitoring). In scenario two, providers in 76.1% of CSPS would have administered

33 antibiotics, but only in 14.1% of CSPS, indicated further care (i.e. outpatient treatment with

close follow-up) would have been implemented. In scenario three, although in the majority of CSPS (78.5%) providers would have referred the ill infant to a higher-level care facility, in only 39.2% and 7.2% of CSPS life-saving antibiotics and hypoglycaemia as potential cause of lethargy would have been adequately addressed, although the necessary drugs to do so were available in the majority of CSPS. Interestingly, for most combined indicators in Tables 1-A and 1-B high availability of input components (except isotonic fluid, malaria, scales) appeared not to be related to more frequent health worker performance in the respective to the related process.

Table 1-C presents the overall percentage of facilities meeting general service readiness indicators. The majority of facilities met general infrastructural readiness. However, only about half of facilities had water and soap for hand washing directly accessible in the consultation rooms (56.8%), and only 23.3% could directly access a vehicle for emergency patient transport.

Overall quality of care categorization

Applying the criteria outlined in Table 2 to assign each CSPS to a performance quality category resulted in the distribution shown in Figure 1. For the MCCD dimension, 80.4% of CSPS were categorized as meeting high or intermediate quality, while only 19.6% of CSPS fell into the low quality category. A similar pattern was found for the general service readiness dimension with 84.6% of CSPS meeting high or intermediate performance quality. In contrast, only 49.4% of CSPS met high or intermediate MSCD quality, with more than half of facilities providing relatively poor management to children with critical health conditions. Taking all three dimensions together, 69.8% of CSPS met high or intermediate quality.

Crude and effective coverage for curative CHS

Out of the 614 children who experienced an illness episode, 427 (69.5 %) actually sought facility-based care (i.e. crude coverage). Given that the majority of CSPS fell into the intermediate quality category, we estimated effective coverage for two scenarios: scenario A only considering facilities in the high quality category and scenario B considering both high and intermediate performing facilities. For effective coverage scenario A only 33 (5.3 %) U5YO received high quality services; for scenario B 274 (44.6 %) U5YO were effectively covered (see Figure 2).

11

1 **Discussion**

2 Our study revealed two major findings regarding CHS provision in Burkina Faso. Firstly,

3 there are existing gaps between crude and effective coverage. Secondly, performance quality

4 related to the management of ill children provided by CSPS in our study area is generally sub-

5 standard and varies greatly between quality dimensions.

6

7 Our study found that only about two thirds of ill U5YO presented to a CSPS, which in our

8 study is assumed to be equivalent to crude service coverage. At this point, we were unable to

9 explore the reasons of not seeking care for those non-using children in our sample – e.g.

10 whether there are persisting access barriers or whether the child's illness was treated at home

11 or elsewhere outside the formal health system. Additional research will therefore be warranted

12 to better understand the health-seeking behaviour of households caring for ill children not

13 seeking care provided free through the CSPS system.

14

15 More disturbingly, we found the gap in effective coverage to be considerably wide, especially

16 when considering only high quality facilities. These estimates might be biased to some extent,

17 as we assumed every sick child to be taken to the CSPS closest to the household when

18 estimating service use (available data did not allow for a more specific assessment). While

19 this would not have affected our crude coverage estimation, it might have diminished the

20 effective coverage estimates in cases where caretakers actually bypassed the closest CSPS in

21 favour of a more distant facility with better quality.[41] However, our assumption is supported

22 by the literature on primary health care utilization in SSA and we trust that our effective

23 coverage estimates are sufficiently representative of the situation in Burkina Faso.[42-46]

24

25 Effective coverage estimates are heavily influenced and can be easily modulated depending

26 on the indicators selected to measure service quality. Although the process, input, and

27 structural indicators included in our quality score are informed by the work of other authors,

28 they still can be considered selective or biased towards technical elements of the care delivery

29 process.[40 47] Still, we understand that for health care provision to be effective, evidence-based

30 clinical protocols (such as IMCI) need to be adhered to and can therefore be considered the

31 gold standard against which quality should be measured.

32 In doing so, we observed quite some differences between the measured quality dimensions

33 used in this study. While observed MCCD processes did not meet IMCI standards, it became

34 nevertheless obvious that providers still follow an assessment approach that seems to be

12

1 focused on or informed by the leading causes and symptoms among the U5YO population.

2 The vignette-based assessment of MSCD, processes revealed that providers generally adhere

3 to treatment guidelines regarding the initial management of severely ill infants (except for the

4 newborn case in scenario 3), but deviate from protocol when making definitive care decisions.

5 Similarly weak or inconsistent adherence to treatment guidelines contributing to low service

6 quality in low-income settings has also been noted by other studies.[47-49] While our study

7 revealed that most of rural facilities had access to basic infrastructures, some structural

8 differences may still remain not picked up by our survey. Comparing input and process

9 indicators, we observed that lack of supplies hardly seemed to influence non-adherence of

10 IMCI guidelines. Comparing eight low-income countries, Leslie et al. also found limited

11 correlation between structural aspects and the process of providing evidence-based maternal

12 and child health has also been care.[50]

13

14 Several studies have reported on the effectiveness of IMCI guidelines [5 6] and reasons of low

15 adherence. Lack of IMCI-based training and shortage of equipment are commonly identified

16 contributors to low adherence.[51] Some authors also point to that the lack of motivation to

17 adhere to guidelines in combination with high workload.[52 53] Besides inconsistencies in

18 protocol adherence, an additional contribution to the low effectiveness of provided care might

19 have been the fact that a large portion of observed U5YO consultations was actually

20 conducted by health workers without adequate qualifications (i.e. AIS or providers without

21 IMCI training) in the absence of any supervision by a more qualified staff member. Officially,

22 AIS are not authorized to independently provide any curative care in Burkina Faso [25] and

23 usually do not receive any specific skill trainings, such as IMCI.[54] In addition, inadequate

24 equipment and supplies might have also contributed to some of the deviations from protocol,

25 for instance many facilities had no malaria tests or otoscopes available, which might explain

26 the less differentiated use of anti-malaria drugs or the limited focus on ear-related

27 symptoms.[51]

28

29 As with all studies on performance quality, our study faces some limitations regarding the

30 assessment of the quality components included in our effective coverage estimates. To

31 determine the quality of curative CHS, we relied on both direct observations and vignettes.[32]

32 [34] A common bias to direct observation is the so-called Hawthorne effect, which describes

33 higher performance under observation compared to non-observed situations, and may cause

34 overestimation of actual performance.[55] In contrast, clinical vignettes might underestimate

13

actual clinical competence, as a testing format based on abstract case scenarios might be unfamiliar to many health workers and has limitations in reflecting the realities of actual case management. Still, both instruments are considered standard in the assessment of health worker performance.

Estimating effectiveness, we measured quality based on content of care focusing on both health care inputs (infrastructure, supplies, provider knowledge) and processes (aspects of actual or theoretical case management). While providing a comprehensive measure of effectiveness of care, a content of care approach may only approximate an individual's health gain in so far, as it does not capture aspects such as patient adherence to treatment or individual health outcomes (recovery, complications, etc.).[12]. Nevertheless, the indicators included in our quality score are considered measures relevant in reducing child mortality and morbidity[4-6].

For the indicator on danger signs used in the MCCD dimension, we accepted positive performance already when at least two danger signs were reviewed. This was done in order to better facilitate score aggregation given the overall poor performance observed in respect to danger sign assessment. It needs to be noted, that this approach actually overestimates providers' overall performance. Similarly, the thresholds applied to categorizing facility performance are relatively arbitrary even though we relied on the work of other authors.[14 16] As the categorization approach affects heavily whether a facility was grouped as high or low performing, we presented the two scenarios of effective coverage to again allow for some room in our estimation.

Further, by defining true need we assumed every reported U5YO illness episode would actually require a medical care visit (including milder forms of illness). This rather conservative estimation might have overestimated the actual true need in our study population and thus likely underestimated both crude and effective coverage.

Another limitation of this study is that although we focus on U5YO and infants, we purposefully exclude early neonatal conditions directly related to birth. In addition, while our study focus was on primary level health care facilities in rural areas, generalizability of our findings might be limited given that study regions and districts were purposely selected. Still, the relatively large facility sample available to us (around one third of primary level health care facilities in the country) nevertheless provides a relatively broad overview on effective coverage in Burkina Faso. With this study adding new evidence on the effectiveness of child health service coverage in low-income settings, the future focus should certainly include the effective coverage of U5YO in more urban areas and the effectiveness of services provided by

14

1 hospitals. Additional research exploring the determinants of effective coverage (both demand

2 side factors and supply side factors), will be necessary and helpful to decision makers to tailor

3 health interventions more specifically to improve effective service coverage.

4

Conclusion

Comparing crude and effective service coverage of U5YO in rural Burkina Faso resulted in two major findings. First, there are existing gaps between crude and effective coverage. Second, the effectiveness of services provided to U5YO is extremely low, even when considering a less strict definition of service quality. While our quality assessment relied on content of care measured as guideline adherence, we also assessed the availability of essential equipment and supplies required to implement these protocol, as well as main provider-specific characteristics. The pattern observed in our study is that lack of supplies hardly seemed to influence non-adherence of IMCI guidelines. Non-adherence rather seems to be an issue specific to the individual provider or service staffing with quite a number of unqualified health workers actually providing clinical care to U5YOs. To improve effectiveness of U5YO service provision, both policy makers and health workers should review and adjust the implementation of evidence-based clinical protocols (e.g. through trainings, performance evaluations, supervision and coaching) to the human and structural resources available at the CSPS level.

Author contributions

AS, SB, RCN, JLK conceived and designed the paper. AS, NO, SB, HH and JLK were involved in data collection. JLK analysed the data and wrote the first draft of the manuscript. JLK, RCN, NO, HH, JR, PC, AS and SB reviewed and approved the final version of the paper.

Data sharing statement

For access to the entire data set used for this article, please contact Paul Jacob Robyn (probyn@worldbank.org)

Ethics considerations

The National Ethics Committee in Burkina Faso as well as the Ethical Committee of the Medical Faculty at Heidelberg University approved this study. For this study, we obtain written consent of all the respondents.

Funding

This study was funded by the World Bank through the Health Results Innovation Trust Fund

Competing interests

We used data from the baseline survey of the impact evaluation of the Performance Based Financing program in Burkina Faso. The impact evaluation, including data collection for the survey, is funded by the World Bank through the Health Results Innovation Trust Fund (HRITF). Nobila Ouedraogo and Aurelia Souares, who was the scientific coordinator of the baseline survey received salary from the World Bank. Jean-Louis Koulidiati is a doctoral student at the University of Heidelberg and received payment from the World Bank during data collection. Stephan Brenner is currently partially employed on the abovementioned Impact Evaluation. Paul Jacob Robyn is a World Bank employee, based in Washington. Hervé Hien is employed at Centre Muraz and received payment from the World Bank during data collection only. None of the authors received any payment by the World Bank for the analysis presented in this manuscript and for the writing. The World Bank did not interfere with design, data analysis, and writing of this manuscript in any way.

References

1. United Nations Inter-agency Group for child mortality estimation. Levels trends in child mortality report. New-York USA http://www.childmortality.org/files_v20/download/IGME%20Report%202015_9_3%20LR%20Web.pdf (Accessed in May 17, 2016). 2013.

2. WHO. Countdown report Millennium Development Goals. Geneva, Switzerland: 2012.

3. O'Donnell O. Access to health care in developing countries: breaking down demand side barriers. *Cardenos de Saúde Pública*, 2007;**23**(12):2820-34.

4. Schellenberg JA, Adam T, Mshinda H, et al. Effectiveness and cost of facility-based Integrated Management of Childhood Illness (IMCI) in Tanzania. *Lancet* 2004;**364**(9445):1583–94.

5. Bryce J, Victora CG, Habicht JP, et al. Programmatic pathways to child survival: results of a multi-country evaluation of Integrated Management of Childhood Illness. *Health Policy Plan* 2005;**20 Suppl 1**:i5-i17.

6. Rakha MA, Abdelmoneim AN, Farhoud S, et al. Does implementation of the IMCI strategy have an impact on child mortality? A retrospective analysis of routine data from Egypt. *BMJ Open* 2013;**3**(1).

7. Tanahashi T. Health Service Coverage and its Evaluation. *Bull World Health Organ* 1978;**56**(2):295-303.

8. Galactionova K, Tediosi F, Savigny Dd, et al. Effective Coverage and Systems Effectiveness for Malaria Case Management in Sub-Saharan African Countries. *PLoS ONE* 2015;**10**(5):e0127818. doi:10.1371/journal.pone.18.

9. Lawn JE, Kinney MV, Black RE, et al. Newborn survival: a multi-country analysis of a decade of change. *Health Policy and Planning* 2012;**27**:iii6–iii28.

10. WHO. Tracking universal health coverage: First global monitoring report. Geneva, Switzerland: 2015.

11. Shengelia B, Tandon A, Adams OB, et al. Access, utilization, quality, and effective coverage: an integrated conceptual framework and measurement strategy. *Soc Sci Med* 2005;**61**(1):97-109.

12. Ng M, Fullman N, Dieleman JL, et al. Effective coverage: a metric for monitoring Universal Health Coverage. *PLoS Med* 2014;**11**(9):e1001730.

13. Colston J. The use of effective coverage in the evaluation of maternal and child health programs

A Technical Note for the IDB's Social Protection and Health Division. Washington: 2011.

14. Larson E, Vail D, Mbaruku GM, et al. Beyond utilization: measuring effective coverage of obstetric care along the quality cascade. *International Journal for Quality in Health Care* 2017; **29**(1):104–10.

17

15. Engle-Stone R, Nankap M, Ndjebayi AO, et al. Estimating the Effective Coverage of Programs to Control Vitamin A Deficiency and Its Consequences Among Women and Young Children in Cameroon. *Food Nutr Bull* 2015;**36**:S149–71.

16. Nesbitt RC, Lohela TJ, Manu A, et al. Quality along the continuum: a health facility assessment of intrapartum and postnatal care in Ghana. *PLoS One* 2013;**8**(11):e81089.

17. Druetz T, Ridde V, Kouanda S, et al. Utilization of community health workers for malaria treatment: results from a three-year panel study in the districts of Kaya and Zorgho, Burkina Faso. *Malaria Journal* 2015;**14**:71.

18. Druetz T, Fregonese F, Bado A, et al. Abolishing Fees at Health Centers in the Context of Community Case Management of Malaria: What Effects on Treatment-Seeking Practices for Febrile Children in Rural Burkina Faso? *PLoS ONE* 2015;**10**(10):e0141306. doi:10.1371/journal.pone.06.

19. World Bank. New country classifications by income level. The Data Blog. Washington DC: The World Bank https://blogs.worldbank.org/opendata/new-country-classifications-2016 (Accessed December 20th, 2017), 2016.

20. INSD. Annuaire statisitque 2015 Ouagadougou Burkina Faso: 383 p, 2016.

21. WHO. Global Health Observatory country views. Geneva, switzerland: 2017 http://apps.who.int/gho/data/node.country.country-BFA (Accessed November 14th 2017).

22. WHO. World health statistics 2015 Report. Geneva, Switzerland: 2015.

23. Ministère de la santé. Annuaire statistique 2014. Burkina Faso. Ouagadougou: DGESS, 2015:317 p.

24. Ministère de la santé. Politque et normes en matière santé de la reproduction. Ouagadougou Burkina Faso, 2010:89p.

25. Ministère de la santé. Programme national d'assurance qualite en santé. Ouagadougou Burkina Faso: 2003:p.87.

26. INSD. Measure DHS, ICF Macro Enquête démographique et de santé et à indicateurs multiples (EDSBF-MICS IV), Rapport préliminaire, Burkina Faso, 2010. Ouagadougou: 2011.

27. Ridde V. Fees-for-services, cost recovery, and equity in a district of Burkina Faso operating the Bamako Initiative. *Bulletin of the World Health Organization* 2003;81:532-538 2003;**81**:532-38.

28. Service d'information du gouvernement. Gratuité des soins pour les enfants de moins de cinq ans : Une réalité au Burkina Faso à partir du 02 avril 2016. Ougadougou, Burkina Faso: 2016.

29. Robyn PJ, Souares A, Hien H. Burkina Faso - Health Results-Based Financing Impact Evaluation 2013, Health Facility Baseline Survey. Washington DC: Health Results Innovation Trust Fund - HRITF http://microdata.worldbank.org/index.php/catalog/2761 (Accessed October 2nd 2017), 2014.

30. Vermeersch C, Rothenbühler E, Sturdy JR. Impact Evaluation Toolkit. Measuring the Impact of Results-Based Financing on Maternal and Child Health.

18

http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTHEALTHNUTRITIONANDPOPULATI
ON/EXTHSD/EXTIMPEVALTK/0,,contentMDK:23262154~pagePK:64168427~piPK:64168435~t
heSitePK:8811876,00.html (Accessed December 20th 2017) 2012.

31. WHO. Service Availability and Readiness Assessment (SARA): An annual monitoring system for service delivery. Geneva, Switzerland: 2015.

32. Hermida J, Nicholas DD, Blumenfeld SN. Comparative validity of three methods for assessment of the quality of primary health care. *Int J Qual* 1999;**11**(5):429-33.

33. WHO. Handbook: IMCI integrated management of chilhood Ilness. Geneva: 2005.

34. Peabody JW, Luck J, Glassman P, et al. Comparison of Vignettes, Standardized Patients, and Chart Abstraction. *JAMA* 2000; **283**:1715-22.

35. Ministère de la santé. Guide de diagnostic et de traitement. Ouagoudougou, Burkina Faso: 2009.

36. Lozano R, Soliz P, Gakidou E, et al. Benchmarking of performance of Mexican states with effective coverage. *The Lancet* 2006;**368**(9548):1729-41.

37. Leslie HH, Malata A, Ndiaye Y, et al. Effective coverage of primary care services in eight high-mortality countries. *BMJ Glob Health* 2017;2:e000424 doi:101136/bmjgh-2017-000424 2017.

38. Nguhiu PK, Barasa EW, Chuma J. Determining the effective coverage of maternal and child health services in Kenya, using demographic and health survey data sets: tracking progress towards universal health coverage. *Tropical Medicine and International Health* 2017;**22**(4):442–53.

39. Donabedian A. The quality of care: How can it be assessed? . *JAMA* 1988;**260**(12):1743-8.

40. Gouws E, Bryce J, Pariyo G, et al. Measuring the quality of child health care at first-level facilities. *Soc Sci Med* 2005;**61**(3):613-25.

41. Kahabuka C, Kvale G, Moland KM, et al. Why caretakers bypass Primary Health Care facilities for child care - a case from rural Tanzania. *BMC Health Serv Res* 2011;**11**:315.

42. Feikin DR, Nguyen LM, Adazu K. The impact of distance of residence from a peripheral health facility on pediatric health utilisation in rural western Kenya. *Trop Med Int Health* 2009;**14**(1):54–61.

43. Noor AM, Zurovac D, Hay SI, et al. Defining equity in physical access to clinical services using geographical information systems as part of malaria planning and monitoring in Kenya. *Trop Med Int Health* 2003;**8**:917–26. .

44. Anselmi L, Lagarde M, and Hanson K. Health service availability and health seeking behaviour in resource poor settings: evidence from Mozambique. *Health Economics Review* 2015;**5**(26).

45. Shannon GW, Bashshur RL, CA M. The concept of distance as a factor in accessibility and utilisation of health care. *Med Care Rev* 1969;**26**:143–61.

46. Tanser FC, Hosegood V, Benzler J, et al. New approaches to spatially analyse primary health care usage patterns in rural South Africa. *Trop Med Int Health* 2001;**6**:826–38.

47. Arifeen SE, Bryce J, Gouws E, et al. Quality of care for under-fives in first-level health facilities in one district of Bangladesh. *Bulletin of the World Health Organization* 2005;**83**:260-7.

48. Baiden F, Owusu-Agyei S, Bawah J, et al. An evaluation of the clinical assessments of under-five febrile children presenting to primary health facilities in rural Ghana. *PLoS One* 2011;**6**(12):e28944.

49. Bjornstad E, Preidis GA, Lufesi N, et al. Determining the quality of IMCI pneumonia care in Malawian children. *Paediatr Int Child Health* 2014;**34**(1):29-36.

50. Leslie HH, Sun Z, Kruk ME. Association between infrastructure and observed quality of care in 4 healthcare services: A cross-sectional study of 4,300 facilities in 8 countries. *PLoS Med* 14(12): 2017;**14**(2):e1002464. https://doi.org/10.1371/journal.pmed.64.

51. Rowe AK, Savigny Dd, Lanata CF, et al. How can we achieve and maintain high-quality performance of health workers in low-resource settings? *Lancet* 2005; **366**:1026–35.

52. Lange S, Mwisongo A, Maestad O. Why don't clinicians adhere more consistently to guidelines for the Integrated Management of Childhood Illness (IMCI)? *Soc Sci Med* 2014;**104**:56-63.

53. Mæstad O, Torsvik G, Aakvik A. Overworked? On the relationship between workload and health worker performance. *Journal of Health Economics* 2010;**29**:686–98.

54. Nguyen DTK, Leung KK, McIntyre L, et al. Does Integrated Management of Childhood Illness (IMCI) Training Improve the Skills of Health Workers? A Systematic Review and Meta-Analysis. *PLoS One* 2013;**8**(6):e66030.

55. McCambridge J, Witton J, Elbourne DR. Systematic review of the Hawthorne effect: New concepts are needed to study research participation effects. *J Clin Epidemiol* 2014;**67**(3):267–77.

Table 1-A. Indicators and related performance of management of common childhood diseases (MCCD)

	Process Indicators (based on direct observation)	Number (percentage) of all facilities with observed process	**Input Indicators**	Number (percentage) of all facilities with observed input	**Overall Facility Performance** Number (percentage) of all facilities with observed performance *
1.	Provider asks for at least two general danger signs §	191 (38.6)	N/A	N/A	191 (38.6)
2.	Provider asks for presence of fever	465 (94.1)	N/A	N/A	465 (94.1)
3.	Provider asks for presence of cough	412 (83.4)	N/A	N/A	412 (83.4)
4.	Provider asks for presence of diarrhoea	370 (74.9)	N/A	N/A	370 (74.9)
5.	Provider asks for presence of ear problems	128 (25.9)	N/A	N/A	128 (25.9)
6.	Provider checks child's weight	366 (74.1)	Functional scale available	448 (90.7)	333 (67.4)
7.	Provider checks child's temperature	477 (96.5)	Functional thermometer available	480 (97.1)	463 (93.7)
8.	Provider checks for signs of anaemia (conjunctivae, palms)	381 (77.1)	N/A	N/A	381 (77.1)
9.	Provider checks child's current vaccination status	207 (41.9)	N/A	N/A	207 (41.9)

N/A = not applicable

∗ In instances where both process and input indicators were applicable, overall facility performance was positive once both indicators were met.

§ Per IMCI standard: four general danger signs need to be assessed (difficulties breastfeeding/taking any food, considerable vomiting, lethargy, convulsions). Due to generally low performance of this indicator if measured against this standard, we considered this process to be performed when at least two danger signs were reviewed.

21

Table 1-B. Indicators and related performance of management of severe childhood diseases (MSCD)

	Process Indicators (based on vignettes)	Number (percentage) of all facilities with observed process	Input Indicators	Number (percentage) of all facilities with observed input	Overall Facility Performance Number (percentage) of all facilities with observed performance *
Vignette-based scenario 1: Viral illness with severe dehydration in 2-year-old					
1.	Provider starts rehydration (either intravenous or enteral fluids)	445 (90.1)	Isotonic fluid [a] or oral rehydration salt and nasogastric tube in stock	486 (98.3)	439 (88.8)
2.	Provider administers a dose of paracetamol to lower fever	190 (38.4)	Paracetamol suppository in stock	424 (85.8)	165 (33.4)
3.	Provider recognizes viral origin of illness and withholds antibiotics until further evaluation.	353 (71.4)	N/A	N/A	353 (71.4)
4.	Provider withholds malaria treatment until parasitemia is confirmed	396 (80.1)	Malaria testing supplies in stock	203 (41.1)	162 (32.7)
5.	Provider admits patient for further observation and reassessment	128 (25.9)	N/A	N/A	128 (25.9)
Vignette-based scenario 2: Breathing difficulties in 1-year-old with simple pneumonia					
1.	Provider initiates antibiotic treatment at facility	380 (76.9)	Antibiotics in stock [b]	486 (98.3)	376 (76.1)
2.	Provider administers a dose of paracetamol to lower fever	331 (67.0)	Paracetamol suppository in stock	424 (85.8)	293 (59.3)
3.	Patient is discharged with close follow-up plan (opposed to admission or referral)	70 (14.1)	N/A	N/A	70 (14.1)
Vignette-based scenario 3: Lethargic 1-month-old					
1.	Provider administers a dose of injectable antibiotic	230 (46,5)	Ceftriaxone in stock	410 (83.0)	194 (39.2)
2.	Provider checks and controls hypoglycaemia	37 (7.5)	Dextrose solutions or dextrose containing IV fluids in stock	464 (93.9)	36 (7.2)
3.	Provider refers patient to higher level of care	388 (78.5)	N/A	N/A	388 (78.5)

N/A = not applicable

22

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

* In instances where both process and input indicators were applicable, overall facility performance was positive once both indicators were met.
[a] (Ringer lactate or normal saline)
[b] Amoxicillin or Cotrimoxazole or Ceftriaxone

Table 1-C. Indicators and related performance of general service readiness

	Process Indicators	Structural Indicators	Overall Facility Performance Number (percentage) of all facilities with observed performance
1.	N/A	Functional electricity source available	412 (83.4)
2.	N/A	Functional water source and soap available in the consultation room	281 (56.8)
3.	N/A	Functional toilet facilities available	480 (97.2)
4.	N/A	Functional emergency vehicle available	115 (23.3)
5.	N/A	Patient waiting room available	406 (82.2)

N/A = not applicable

Table 2. Categories of facility quality based on performance scores

Performance quality	Criteria MCCD [a]	Criteria MSCD [b]	Criteria General service readiness [c]
High	• Performance score[d] ≥7 • All observed cases attended by a qualified HCW§ • All observed cases attended by a HCW trained in IMCI	• Performance score ≥8 • All vignettes based-scenarios answered by at least two-third* of qualified HCW§ • All vignettes based-scenarios answered by at least one HCW trained in IMCI	• Performance score ≥4
Intermediate	• Performance score 5-6 • All observed cases attended by a qualified HCW§	• Performance score 6-7 • All vignettes based-scenarios answered by at least two-third of qualified HCW	• Performance score = 3
Low	• Performance score <5	• Performance score <6	• Performance score <3

HCW = health care worker; **HF**= Health facility**;** MCCD = management of common childhood diseases; MSCD = management of severe childhood diseases

[a] maximum possible score = 9; [b] maximum possible score = 11; [c] maximum possible score = 5 [d] performance score: high (≥70% of the maximum possible score) ; intermediate (50-69%); low (<50%)

§ Qualified healthcare worker: According to the national policy of quality assurance, nurse and midwife/midwife assistant are qualified to perform U5YO curative consultations.

* We used the cut-off of two third because the minimum requirement staff at CSPS level is composed of two third of qualified HCW for U5YO curative consultations (1 nurse, 1 midwife /midwife assistant) and 1 AIS.

25

Figure 1. Proportion of health facilities per performance quality category (n=494)

26

Figure 2. Crude coverage and effective coverage for curative CHS:

A) Scenario 1, high quality only   **B)** Scenario 2, High and intermediate quality
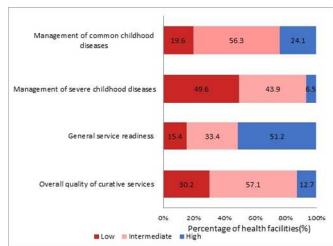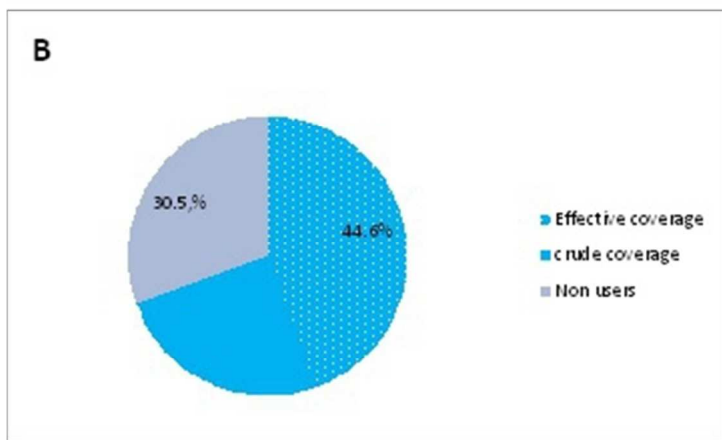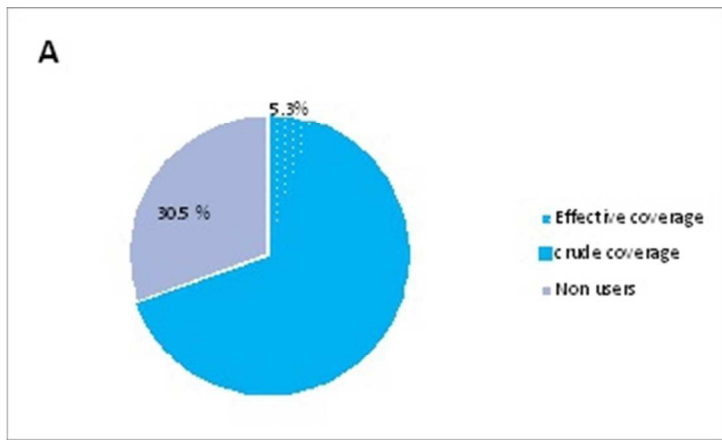
27

137x101mm (300 x 300 DPI)

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

A

5.3%

30.5 %

- Effective coverage
- crude coverage
- Non users

B

30.5,%

44.6%

- Effective coverage
- crude coverage
- Non users

38x39mm (300 x 300 DPI)