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Integrated eDiagnosis Approach (IeDA) for the management of illness in under-five children at the primary health care level in Burkina Faso:

Findings from a stepped-wedge cluster randomised trial

Final Report
Executive Summary

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Executive Summary

Background

Recent advances in Information and Communication Technologies (ICT) could potentially transform health care services in low- and middle-income countries. However, the experience with using such technology to improve adherence to the Integrated Management of Childhood illness (IMCI) guidelines is limited.

From 2014, Terre des hommes, in partnership with the Burkinabe Ministry of Health (MoH), implemented the Integrated eDi agnosis Approach (IeDA) package of interventions in primary health facilities of two regions of Burkina Faso with the objective of improving health care workers' (HCW) adherence to the IMCI guidelines. The IeDA package of interventions included: An electronic Clinical Decision Support System (eCDSS); A 6-day training course on IMCI guidelines, including 2 days on the use of the eCDSS; A quality assurance coaching system involving team meetings two to four times a year; A supervision system including monthly visits; A health information system based on under-five child consultation data collected through the eCDSS.

An evaluation was performed by an independent team from the London School of Hygiene and Tropical Medicine (LSHTM), United Kingdom, and Centre Muraz, Burkina Faso. The aim of the trial was to determine whether the IeDA package of interventions increased adherence to the IMCI guidelines during under-five child consultations in primary health care centres.

Methods

The evaluation was conducted in eight health districts of the regions Boucle du Mouhoun and Nord and used a stepped-wedge cluster randomised design, with districts ("clusters") receiving the intervention at different time points in a randomised order. Full implementation of the intervention was defined as having occurred when the eCDSS was provided to all facilities of the district and when all HCWs who were to be involved in conducting child consultations had been trained in its use and IMCI guidelines.

Nine steps were initially planned: a first step in the eight districts prior to the intervention (baseline), and one additional step per additional district receiving the intervention with data collection at each step in all districts. However, due to logistic issues, the roll-out of the intervention in the first district was delayed (completed at step 3 instead of step 2) and, due to a lack of funding available to the implementing agencies, the intervention was implemented in only four districts from steps 3 to 6. The baseline phase, therefore, included the first two steps. Eight rounds of data collection in all districts were nevertheless conducted up to step 8, but step 9 was not conducted.

Data collection was conducted from September 2014 to November 2017 by two teams of two trained independent nurses. Ten primary health facilities per district were randomly selected. Only primary health facilities with staff trained in IMCI were considered for selection, and all hospitals were excluded. At each step, all selected primary health care facilities in all eight districts, were visited once for data collection. Each visit lasted 1 to 2 days and data were collected for all under-five child consultations occurring during the visit.

After obtaining informed consent from the HCW and the child's caretaker, one independent trained nurse observed and recorded the HCW's practices during the consultation, and recorded the illness classification and prescription given to the child. Observations were passive, and the observer never intervened during the consultation. Validation data were collected by another independent trained nurse, who conducted a repeat consultation with the child, using the eCDSS. These validation data were intended to provide a "gold standard" classification for each child.

In addition, a shortened version of the WHO Service Availability and Readiness Assessment (SARA) questionnaire was completed at each visit to document the availability of essential medicines and equipment required to conduct a consultation in accordance with the IMCI guidelines.

All analyses included consultations for children aged two months to five years old only as very few consultations with children younger than 2 months were observed. In addition, all analyses excluded follow-up visits.

We focussed on the IMCI algorithms for danger signs, cough/difficult breathing, diarrhoea, fever and nutritional status, excluding algorithms related to HIV and ear problems due to their very low prevalence recorded during the trial period. With respect to anaemia, adherence to clinical assessment was evaluated only, excluding classifications, prescriptions and referrals/hospitalisations due to the difficulty of assessing anaemia reliably when laboratory testing was locally unavailable.

Primary outcomes included:

- Overall adherence to IMCI clinical assessment tasks;
- Overall correct classification ignoring the severity of the classifications;
- Overall correct prescription according to HCWs' classifications.

Secondary outcomes included:

- Adherence to danger signs' assessment tasks;
- Correct identification of at least one danger sign;
- Overall correct classification accounting for the severity of the classifications;
- Overall correct prescription according to validation nurses' classifications;
- Overall correct referral or hospitalisation according to HCWs' classifications or danger signs' identification;
- Overall correct referral or hospitalisation according to validation nurses' classifications or danger signs' identification;
- Overall correct treatment counselling.

Results

While the IMCI paper-form was used for 69% (471/686) and 68% (916/1,343) of the consultations at baseline and in the control arm respectively, it was used in only 3% (20/694) of consultations in the intervention arm while the eCDSS was used in nearly all consultations (97%, 674/694). The occasional use of the eCDSS at baseline (1%, 8/686) or in the control arm (9%, 120/1,343) reflects instances of early roll-out of the eCDSS prior to training.

Adherence to IMCI's clinical assessment

Overall, the average percentage of tasks completed by the HCWs across the six IMCI algorithms (danger signs, cough/difficult breathing, diarrhoea, fever, anaemia and nutritional status) was 48% at baseline, 54% in the control districts and 79% in the intervention districts with strong evidence for a difference between trial arms (cluster-level mean difference = 29.9%; P-value = 0.002). For all IMCI algorithms of interest, HCWs in the intervention arm completed more of the recommended tasks resulting in higher adherence indices compared to HCWs in the control arm. In particular, HCWs in the intervention arm completed more of the recommended tasks for assessing danger signs compared to the control arm: 95% versus 34% respectively (cluster-level mean difference = 71.2%; P-value = 0.002).

Correct identification of danger signs

The proportion of children correctly identified, by the HCWs, with at least one danger sign was 67% (16/24) at baseline and 56% (14/25) in the control districts. It appeared to be somewhat higher (75%, 12/16) in the intervention arm but this could be a chance finding given the small number of children with danger signs (cluster-level mean difference = 19.0%; P-value = 0.322).

Correct classifications

Overall, the proportion of children for whom the validation nurses and the HCWs recorded the same classifications (ignoring the severity of the classifications) was 75% (457/609) at baseline, 73% (767/1,049) in the control districts and 79% (450/572) in the intervention districts with strong evidence for a difference between trial arms (cluster-level mean difference = 10.1%; P-value = 0.004).

Accounting for the severity of the classifications slightly lowered the proportions of correct classifications at baseline (71%, 430/609), and in the control (70%, 732/1,049) and intervention (75% 427/572) arms (cluster-level mean difference = 9.1%; P-value = 0.038).

By IMCI algorithm and ignoring the severity of the classifications, HCWs in the intervention arm correctly classified children having diarrhoea, dysentery and malnutrition more often than those in the control arm: 77% (147/192) versus 66% (228/346), 83% (10/12) versus 44% (12/27), and 75% (89/118) versus 55% (91/165) respectively. Although based on a small number of children, HCWs in intervention districts also appeared to correctly classify children with severe malaria or severe febrile illness more often than those in control districts: 82% (14/17) versus 63% (15/24) respectively. HCWs in the intervention arm were also less likely to wrongly diagnose pneumonia as being present when it was not: 7% (38/521) versus 19% (209/1,113). For other conditions, false positive diagnoses were rare (<5%) in both arms.

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Correct prescriptions

The proportion of children who received at least all the recommended prescriptions in accordance with the HCWs' classifications was 76% (465/614) at baseline, 78% (836/1,074) in the control districts and 77% (437/567) in the intervention districts with no evidence for a difference between trial arms (cluster-level mean difference = -1.1%; P-value = 0.788). However, correct prescriptions for dysentery were much more common in the intervention arm (69%, 9/13) than in the control arm (11%, 5/45). Correct prescriptions for malnutrition (all classifications together) and severe malaria or severe febrile illness were also more common in the intervention arm, though still infrequent: 17% (19/112 versus 7% (9/124) for malnutrition and 33% (8/24) versus 8% (2/26) for severe malaria or severe febrile illness.

According to the validation nurses' classifications, the overall proportions of children who received at least all the recommended prescriptions were 65% (398/610) at baseline, 66% (693/1,049) in the control districts and 69% (392/572) in the intervention districts with no evidence for a difference between trial arms (cluster-level mean difference = 6.7%; P-value = 0.226). By IMCI algorithm, similar patterns were observed as for correct prescriptions according to the HCWs' classifications, with the exception of correct prescriptions for diarrhoea (all classifications together) which were higher in the intervention arm compared to the control arm: 77% (147/192) versus 65% (226/346) in the control arm.

Over-prescriptions

According to HCWs' classifications, the proportion of children who were not in need of an antibiotic but who were actually prescribed one (injectable ampicillin or gentamycin, cotrimoxazole, amoxicillin, ciprofloxacin or metronidazole) was 12% (81/682) at baseline, 15% (200/1,341) in the control arm and 9% (63/694) in the intervention arm. According to validation nurses' classifications, these proportions were 20% (137/676) at baseline, 27% (347/1,300) in the control arm and 12% (83/682) in the intervention arm. This suggests a reduction in over-prescription of antibiotics of about 6% to 15% points in the intervention arm compared to the control arm, almost all of which is explained by a reduction in over-prescription of cotrimoxazole and to some extent amoxicillin.

With respect to antimalarials, the proportion of children who were over-prescribed either injectable artesunate, artemether or quinine or ACT was low and similar at baseline and between trial arms, suggesting no reduction in over-prescription: around 2% to 4% according to HCWs' classifications and validation nurses' classifications.

Correct referrals or hospitalisations

The proportion of children in need of referral or hospitalisation according to the HCWs' assessment who were actually referred or hospitalised by the HCWs was 60% (21/35) at baseline, 52% (22/42) in the control districts and 61% (25/41) in the intervention districts but with no evidence for a difference between trial arms (cluster-level mean difference = 8.6%; P-value = 0.509). According to the validation nurses' assessment, these proportions were 55% (16/29) at baseline, 53%

(17/32) in the control districts and 68% (15/22) in the intervention districts, again with no evidence for a difference between trial arms (cluster-level mean difference = 15.1%; P-value = 0.398). Interpretation of these findings is hampered by the small number of children requiring referral/hospitalisation.

By classification warranting referral or hospitalisation, there were generally too few children to perform meaningful comparisons. The one possible exception to this is severe malaria/severe febrile illness for which HCWs in the intervention clusters appeared to perform better than in the control clusters: 96% (23/24) versus 73% (19/26) according to HCWs' assessment and 77% (13/17) versus 58% (14/24) according to validation nurses' assessment.

Correct treatment counselling

The proportion of children's caretakers to whom the HCWs mentioned both the number of doses a day and the number of days for all the relevant oral medicines prescribed for treating the child at home was 77% (473/612) at baseline, 92% (1,046/1,143) in the control districts and 88% (506/576) in the intervention districts with no evidence for a difference between trial arms (cluster-level mean difference = -4.1%; P-value = 0.355).

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Availability of essential medicines and equipment

Availability of essential equipment at the health facilities was high: 87% at baseline, 87% in the control arm and 91% in the intervention arm. However, the proportion of facilities with all equipment available, although better in the intervention arm, was still very low: 20% (33/166) versus 10% (29/290) in the intervention and control arms respectively.

The average proportion of essential oral medicines that were observed to be available at the health facilities was 98% at baseline, 94% in the control arm and 89% in the intervention arm. Although there was a relatively good availability of each medicine in both arms (about 70% or more), deworming treatments, amoxicillin, ORS and zinc as well as multivitamins were less frequently available in the intervention arm compared to the control arm. The proportion of facilities with all oral medicines available was only 29% (47/165) in the intervention arm compared to 53% (149/284) in the control arm.

Discussion

The IeDA intervention improved substantially HCW's adherence to IMCI's clinical assessment tasks, including the assessment of danger signs, which led to some overall increase in the proportion of children being correctly classified but to little or no improvement in overall proportion of children receiving correct prescriptions.

Achieving correct classification depends, at least in part, on the clinical skills of the HCWs, which may be more difficult to improve than task adherence itself. This may have limited somewhat the effect of the intervention on correct classification. Nevertheless, substantial improvements were observed with respect to classification of and prescriptions for dysentery and malnutrition. The data were also consistent with an improvement in danger sign identification, correct referrals/hospitalisations and management of severe malaria or severe febrile illness (classification, prescriptions and referral/ hospitalisation), although these are based on small numbers of children, limiting our ability to draw firm conclusions. Lastly, the intervention appeared to have reduced over-prescription of antibiotics, most or all of which is explained by a reduction in over-prescription of cotrimoxazole and to a lesser extent of amoxicilline

Two limitations of our evaluation approach should be acknowledged. First, the "gold standard" classifications were provided by a repeat consultation after the initial consultation and it is possible that the clinical status of some children (e.g. respiratory rate, temperature, current convulsions) may have changed in the interval between the initial consultation and the repeat consultation simply because of the time delay between the two. In addition, some clinical signs are more subjective than others (e.g. stridor, chest indrawing) and therefore we should not expect full agreement between HCWs and validation nurses. Thus, our "gold standard" is certainly less than perfect and some consultations in which the HCWs correctly classified the child based on their status at the initial consultation may have been recorded as having resulted in an incorrect classification. This would tend to reduce the apparent magnitude of any improvement in classifications.

Second, it is likely that the behaviour of HCWs was impacted by the fact that they were observed. The high proportion of HCWs observed using paper-based IMCI forms in the control arm (68% overall) compared to routine practice suggest that HCWs in this arm were motivated to perform better than usual. However, the frequent use of IMCI paper-based forms in the control arm did not seem to have resulted in better HCWs' performance. In the intervention arm, the behaviour of HCWs may also have been affected by the presence of observers. Therefore, our findings may over-estimate how well HCWs perform in the absence of an observer but it is difficult to assert whether or in which direction this may have affected the comparison of intervention and control arms.

Bigger improvements tended to be observed for less common conditions for which HCWs in the control arm performed relatively poorly. For the most common, conditions (e.g. malaria and pneumonia), HCWs in the control arm, who may have been influenced by a Hawthorne effect, performed relatively well, limiting the scope to detect an overall impact.

The IeDA intervention had a positive impact on some aspects of HCWs' practices. However, these are complex behaviours that have many potential influences. Lower availability of some essential medicines in the intervention arm, pressure from children's caretakers, the presence of multiple conditions, professional norms, experiences and beliefs, or incomplete coverage of some components of the intervention (training and supervision) are some of the possible contextual and intrinsic factors that may also have limited the effect of the intervention on correct classification and prescription.

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