

Overcoming the complexity of multiple barriers to appropriate typhoid diagnosis in a low resource setting; a multi-disciplinary approach to behaviour change in Segbwema, Sierra Leone.

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Context:

Typhoid (enteric fever) imposes a significant global burden, with increasing accounts of multi-drug and quinolone resistance.¹ A lack of specific symptoms and reliable diagnostics leads to both over-diagnosis and incidence underestimation.² This report presents the complexity of barriers to appropriate outpatient diagnosis at Nixon Memorial Hospital, Segbwema, Sierra Leone and details the implementation of a multi-disciplinary improvement strategy.

Improvement Issue:

From outpatient clinic ledgers, 46.3% of patients were coded as being prescribed antibiotics. Further prescriptions were found after hand-searching clinical notes (63.4% of new attendances). In January 2017, 31.9% of 160 outpatients were formally diagnosed with typhoid, contributing to hospital reports and therefore national statistics. Typhoid diagnoses were responsible for 42.4% of all antibiotic prescriptions, costing patients 2.9 working-days) per case.³

Process:

Widal Request: Retrospective hand-searching of notes from outpatient typhoid diagnoses revealed that they mirrored neither the demographics nor the clinical features normally considered typical. The average age was 38 years; 3-19 year-olds account for the majority of cases in other endemic countries.² Only 61.5% of patients reported fever and objective temperature readings were rarely documented. Temperatures that were documented were all below 37.5°C. Abdominal pain was reported in 46.2%, headache 30.8% and cough 26.9%. A duration of symptoms usual for typhoid cases (3-60 days) was recorded in 7.7% of patients.⁴

Widal Procedure: Widal tests were performed on 100% of patients who eventually received a typhoid diagnosis, with H-antigen reported as reactive in 92.3% of patients and O-antigen in 100%. Unconventional quantitative recordings (for example '1:115') lead to laboratory observation and staff interview. Observation of laboratory staff revealed not only the use of *Salmonella* H Paratyphi b and *Salmonella* O Paratyphi c reagents but also the documentation of 'titre' depending on time-to-agglutination, rather than by performing titration itself, invalidating all results.

Widal Interpretation: At interview, hospital clinicians relied heavily on Widal test results for diagnosis, mirrored by 96.2% of patients with reportedly positive tests receiving antibiotics. Even if the Widal tests were performed correctly, clinicians reported that they would consider a single titre of $\geq 1:80$ to be highly significant and were not aware of the limitations of the Widal test with respect to sensitivity and specificity.

Improvement Strategy:

A multi-disciplinary quality improvement strategy was implemented at Nixon Memorial Hospital considering Michie et al's behaviour change model (capability/opportunity/motivation-behaviour), targeting the three key behaviours identified that lead to inappropriate typhoid diagnosis (Table).⁵

Behaviour	Widal Request	Widal Procedure	Widal Interpretation
Motivation	Clinical improvement/development Resource conservation	Development of expertise Increase of diagnostic value	Clinical improvement/development Antimicrobial stewardship
Capability	Clinical typhoid/Widal education Observations on arrival, triage and protocols	Widal procedure education Access to reagents/pipette	Clinical typhoid/Widal education Reliable titres and titre threshold education
Opportunity	1 Nurse-lead fever/sepsis protocol 1 Typhoid diagnostic aid	Scheduled Widal training Increased availability with fewer requests	1 Typhoid diagnostic aid 3 Improvement Of clinical coding

Hospital protocols were developed based on antimicrobial guidelines from Connaught Hospital (the Government's most heavily resourced hospital in Freetown), resulting in nurse-lead initiation of treatment and triage. Protocols prompted clinicians to focus on a source of sepsis to improve diagnosis and included the criteria of possible and probable cases of typhoid fever.

A Gilson pipette was sourced for the laboratory and time allocated for repeated pipette/Widal test training.

Legibility of documentation was poor, resulting in incorrect coding on Governmental ledgers, often with multiple, incorrect diagnoses for each presentation. A hospital stamp was designed to address this and implemented in the hospital's outpatient registry. The stamp draws the coders eye to the clinician's true primary diagnosis and reduces the rate of errors whilst transcribing to hospital ledgers from clinical notes.

Future Steps:

Outcomes will be determined through re-audit in February 2018, which will be one year post-audit and six months post-intervention. Laboratory education and quality control is being continued during the interim. This project has highlighted complex, multi-disciplinary failings that would otherwise have gone unnoticed, leading to inappropriate diagnoses contributing to national statistics and interpretation of health burden. It has also highlighted a significant source of inappropriate antibiotic prescribing. These findings are likely representative of similar hospital settings country-wide; future national antimicrobial stewardship programmes should include targeting outpatient prescription behaviour in district hospitals.

1) Breiman et al. Population-based incidence of typhoid fever in an urban informal settlement and rural area in Kenya: Implications for typhoid vaccine use in Africa. PLOS ONE 7(1): e29119.
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 4) Public Health England. Typhoid and paratyphoid: guidance, data and analysis. Available at: <https://www.gov.uk/government/collections/typhoid-a-paratyphoid-guidance-data-and-analysis> (accessed 16th April 2017).
 5) Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. Implement Sci. 2011;6:42.