


Quality improvement initiative approach to decrease the unindicated usage of antibiotics in a neonatal intensive care unit of a tertiary care teaching hospital in Hyderabad, India

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ABSTRACT

Antimicrobial resistance is an emerging global problem concerned with patient safety. It is even more challenging in developing countries like India. Antibiotic stewardship initiative is the best arrow in the quiver to prevent and control this antimicrobial resistance. We observed 61% of the neonates admitted to neonatal intensive care unit of Niloufer hospital, Hyderabad, India were receiving improper antibiotics with respect to choice of drug or dosage or duration. Subsequently, an antibiotic stewardship team was formed to address the antibiotic misuse. Team consisted of neonatology faculty, residents, staff nurses, infection control nurses and microbiologist. We identified problems related to staff awareness, policy issues like lack of display of the antibiotic policy and lack of antibiotic lock, process issues like low rate of documentation of indication for initiation or escalation of antibiotic and a lack of dynamic review plan regarding continuation or de-escalation. We used the Plan-Do-Study-Act cycles to test and adapt solutions to these problems. Within 10 weeks of starting our quality improvement (QI) project, the proportion of unindicated antibiotic usage decreased from 61% to 27%. Timely de-escalation of antibiotic is a neglected intervention in neonates, and yielded the maximum result in our study. We conclude that QI projects are simple, doable yet powerful effective tools to address the burning problems like antibiotic misuse. This result was very satisfying and encouraging boosting our team's faith in the effectiveness of QI approach.

PROBLEM

Niloufer hospital is a part of Osmania Medical College in Hyderabad. It is an exclusively women and child tertiary care government hospital. It is the highest referral centre for the entire Telangana state. The department of neonatology here is a large unit catering to around 350 neonates (inborn and outborn) at any given point of time.

In November 2019, baseline data were collected to assess the magnitude of unindicated prescription of antibiotics, in the babies admitted to neonatal intensive care

unit (NICU) of department of neonatology, Niloufer Hospital. It was found that 61% of neonates were receiving unnecessary or inappropriate antibiotics in terms of choice of drug, dosage or duration. A quality improvement (QI) initiative was designed to address this problem and reduce the incidence of unindicated usage of antibiotics by 50% in the next 10 weeks among the neonates admitted to the inborn NICU. The purpose of this report is to describe how the team handled the challenging issue of unindicated antibiotic use by adopting a simple and doable QI initiative.

BACKGROUND

Antimicrobial resistance is an emerging global problem concerned with patient safety. It is even more challenging in developing countries like India.¹ There is a surge in the infections caused by antibiotic resistant bacteria, but huge limitation with respect to the pipeline of new classes of antibiotics.^{2,3} The emergence of antibiotic resistance is related to the exposure to the antimicrobials. A meta-analysis by Costelleco *et al* showed a good link between the antimicrobial resistance and prescription of antibiotics in primary care. The likelihood of growing a drug resistant organism from an individual is associated with the number and duration of antibiotic courses prescribed in the recent past.⁴ The infections caused by these resistant organisms are associated with higher morbidity and mortality, increased hospital duration and healthcare burden.⁵

Therefore, we need a multifaceted approach with a dedicated individual commitment to curb the problem of antibiotic resistance. Antibiotic stewardship initiative is the best arrow in the quiver to prevent and control



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antimicrobial resistance. The main goals of antibiotic stewardship are to enhance efficacy, decrease adverse effects and unintended consequences of antimicrobial use and limit the spread of antimicrobial resistance.

BASELINE MEASUREMENT

Unindicated prescription of antibiotics was the outcome measure and was defined as inappropriate drug choice, dosage or duration as per the hospital antibiotic policy. The case records of all the babies admitted to inborn NICU unit of Niloufer hospital were reviewed to note the unindicated antibiotic usage magnitude. Data collection was done by a staff nurse and it was verified by a resident doctor over a period of 4 weeks retrospectively. A total of 200 babies were analysed for obtaining the baseline data. The data captured included, whether the choice of antibiotic was in accordance with the antibiotic policy of the hospital, was the correct dose prescribed, was the indication for initiation of antibiotic documented, was there any review plan regarding continuation or de-escalation of the prescribed medicine. Data were reviewed by the QI team on a weekly basis.

DESIGN

In November 2019, team identified that 61% of neonates admitted to the inborn NICU received unnecessary or inappropriate antibiotics. Staff in the NICU decided to use the WHO Point-of-Care QI Model to solve this problem.⁶ We formed a team consisting of consultants and resident trainees (from neonatology and paediatric departments) and nurses posted in NICU. The team was led by the neonatologist in charge of the NICU and

was supported by infectious disease control team of the hospital. The team set an aim of reducing the unindicated usage of antibiotics in the inborn NICU by 50% from a baseline in 10 weeks duration. We then used process flow diagrams and fishbone diagrams (figure 1) to identify factors contributing to problem. These analyses identified a number of challenges that could potentially contribute to antibiotic misuse, including lack of awareness among the healthcare professional regarding the antibiotic policy of the unit and the importance of antibiotic stewardship, rotation of residents in the unit, limitation of human-resource, time constraints. The team used the Plan-Do-Study-Act (PDSA) cycles to test and adapt possible solutions to these contributing factors.

STRATEGY

The following PDSA cycles were executed one after the other to implement the desired change ideas. Each PDSA was conducted over a 2-week duration. Unindicated prescription of antibiotics was the outcome measure used and was defined as inappropriate drug choice, dosage or duration as per the hospital antibiotic policy. Various process measures used were proportion of neonates receiving antibiotic with a clear indication for initiation documented (10 audits/week), proportion of neonates receiving antibiotic with review plan regarding continuation or de-escalation of the prescribed medicine (10 audits/week).

PDSA cycle 1—The existing antibiotic policy was revised based on the last 6 months culture sensitivity data. The newly framed antibiotic policy was displayed in the unit as a reminder for the healthcare professionals. The soft copy

FISHBONE ANALYSIS

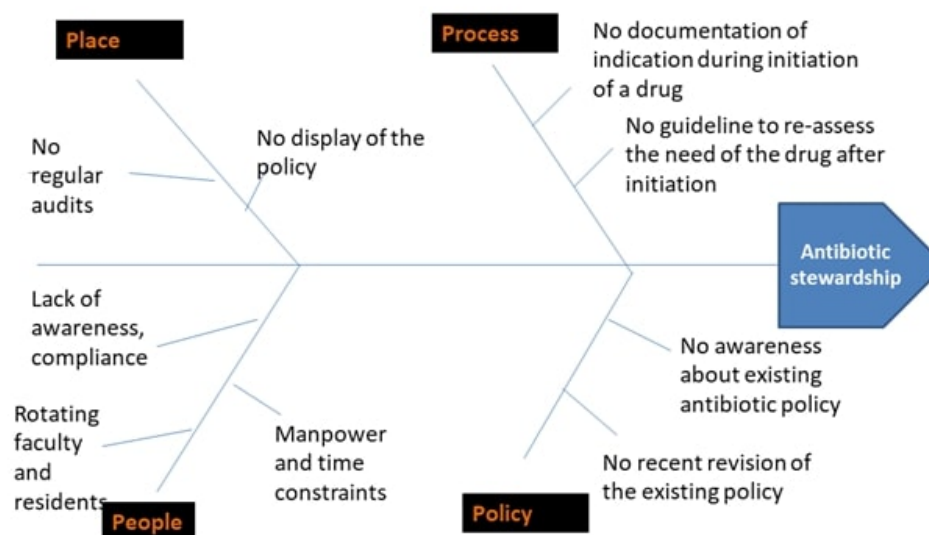


Figure 1 Fish bone analysis to identify contributing factors.

of the policy along with the dose of the drugs was also sent to phones of all the staff through 'Whatsapp' interface, so it would be always available in their pocket for quick and immediate review while prescribing the drugs. The rationale of this intervention is being a teaching hospital with many residents and rotating faculty, there is a constant need to remind and reinforce the antibiotic policy and other protocols for uniformity of practice. This intervention was adopted and it led to a decrease in proportion of unindicated usage of antibiotics by 5%.

PDSA cycle 2—We intended to create awareness among the healthcare professional regarding the importance and the necessity of antibiotic stewardship practice. A total of six meetings were conducted in week duration by our QI team and all the staff were asked to attend the sessions in turns so that the patient care was not hampered. Each meeting lasted for about 30 min duration where the importance and need for antibiotic stewardship was addressed. The residents, who are considered as the backbone of the department, were given the status of the antibiotic guardians by our QI team, which was assumed to motivate them yielding a stronger commitment from them. This intervention was adopted and it led to a decrease in proportion of un-indicated usage of antibiotics by 5%.

PDSA cycle 3—We identified that documentation of indication or justification before initiation of antibiotic was a major missing in the case records and implementing the same would let a person think twice before prescribing a drug. A compulsory need to document the indication for the initiation of antibiotic in the case records was started as a guideline. Any doctor (resident or a consultant) who initiates a new antibiotic for the baby had to document the indication or justification for the initiation of the drug. Sisters administering the drugs reminded the doctors if the indication was not mentioned. The change had a positive impact with fall in the unindicated antibiotic use by 9% and the intervention was adopted.

PDSA cycle 4—In order to discourage the unnecessary and improper usage of high end antibiotics, we implemented a lock model. A resident was allowed to start a first line antibiotic by himself, but required an approval of a faculty to consider a second-line drug and opinion of two consultants for prescribing a third-line drug. When a third-line drug was prescribed, the hospital microbiologist was also informed with a justification for initiation. This lock model was tested in 26 neonates. As many non-septic conditions like Patent ductus arteriosus or apnoea of prematurity also mimic sepsis in neonates, inexperienced residents may be deceived and tempted to unnecessarily escalate antibiotics. Hence, consulting a higher authority for escalation of antibiotic was intended to decrease the antibiotic misuse. The change caused a decline in antibiotic misuse by 4%, and adopted as it prevented the exposure of neonates to reserved drugs.

PDSA cycle 5—There are many sepsis mimickers in neonates, and erring on the side of caution, we end up initiating or escalating antibiotics many times during episodes of acute deterioration. Therefore, not just initiation of medication, but a timely de-escalation is an important component of antibiotic stewardship. All the neonates with symptoms mimicking sepsis were started or escalated on antibiotics after sending appropriate laboratory investigations. All the staff was asked to review and document the plan, for either continuation or de-escalation, every 72 hourly after initiation of the drug, based on the clinical condition of the infant and the lab reports. It may be better to review it more frequently, but we had chosen at least one review in the plan every 72 hours due to the workforce constraint. All the faculty and residents were also educated regarding the importance of switching over to the narrowest spectrum drug available or discontinuation whenever feasible. This intervention had a maximum impact with a decrease in unindicated antibiotic usage by 11% and was adopted as a routine practice.

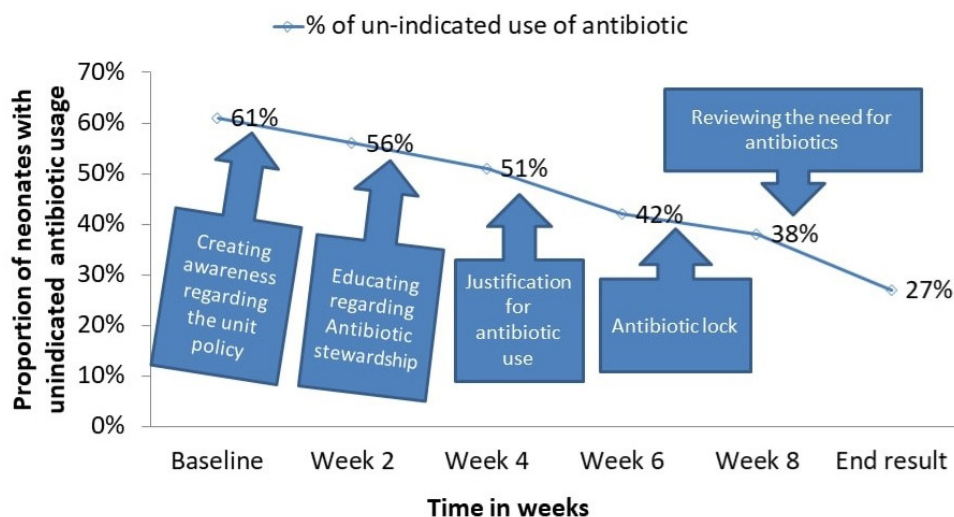


Figure 2 Run chart of the QI with various interventions implemented. QI, quality improvement.

The team met every Wednesday to discuss regarding the status and progress of the QI project. The team also provided a continuous feedback to the prescribers by alerting them to incompletely filled antibiotic prescriptions. The team also encouraged the staff to keep up their spirit by acknowledging the good performers and issuing them certificates and super hero badges as a sign of motivation.

RESULTS

The unindicated use of antibiotics decreased from a baseline of 61%–27% after the five PDSA cycles (figure 2). A maximum decline of 11% was seen when doctors were asked to document and review the need for continuation of the medication. The documentation of justification or indication for starting an antibiotic and reviewing the need for continuation or de-escalation rates improved from a baseline of 12% and 3% to 87% and 74%, respectively.

LESSONS AND LIMITATIONS

Our team was successful in handling a burning problem of antibiotic misuse with a simple and practical QI approach. Though all the healthcare professionals were aware of the need of antibiotic stewardship, it was never put into practice due to logistic issues. Using a QI approach, we had decreased the unindicated usage of antibiotic frequency from a baseline of 61%–27% in a period of 10 weeks duration. QI is a simple, systematic, practical and an effective way of dealing with such an issue. Second, neonates are the most vulnerable population who have a similar presentation for multiple problems. Sepsis in neonates has a varied presentation and so there is broader antibiotic coverage in higher usage. For the best outcome, we err on the side of overtreatment, but we definitely should avoid antibiotic misuse. Antibiotics should be started after sending a septic screen and blood culture and should be de-escalated depending on the clinical picture and laboratory reports. Our intervention led to a phenomenal outcome, bringing down the antibiotic misuse. We believe that this initiative could be reproducible in other units. We hope that our work leaves a positive impact and motivates other institutions to take up this project to curb the global problem.

We had many challenges during the implantation of QI approach. Ours is a medical college hospital where the staff and residents are constantly under rotation in various stations. So we had to constantly update and educate every healthcare professional regarding the protocol of the ongoing QI. Though we have circulated the antibiotic policy and reminders in whatsapp among the doctors, we did not have a feedback or closed loop communication system that it was registered by them. Another important challenge was to convince the doctors regarding the importance of QI. Many were not well versed with the methodology and it took quite a time to convince them this is an effective tool. We showcased the results and

celebrated our success to keep up the morality. At times, though the laboratory reports were negative, the infant was labelled septic based on the subjective findings and continued on antibiotics. This decision was at the discretion of the consultant neonatologist on call and a second opinion was also taken by the lead neonatologist of the team. So in neonates, sepsis cannot be objectified with clear guidelines all the time and sometimes being proactive forms the cornerstone for successful outcome.

CONCLUSION

Prevention of antibiotic misuse is the need of the hour. Implementation of antibiotic misuse in neonates is a herculean challenge as neonates are a group of vulnerable population with a high sepsis rate and need proactive management for a successful outcome. By adopting a simple yet effective QI approach, our team was successful in decreasing the unindicated use of antibiotic from 61% to 27% in a span of 10 weeks duration. In a manuscript published in 2012 on antibiotic stewardship programme, it was rightly emphasised ‘Start Smart—Then Focus’.⁷ Timely de-escalation of antibiotic is a neglected intervention in neonates, and yielded the maximum result in our study. Also documenting the indication for initiation of the drug, imposing antibiotic lock model, along with educating, reinforcing and motivating the doctors regarding the importance of antibiotic stewardship collectively led to the final outcome. This result was very satisfying and encouraging, boosting our team’s faith in the effectiveness of QI approach.

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REFERENCES

- 1 Ghafur A, Mathai D, Muruganathan A, *et al.* The Chennai declaration: a roadmap to tackle the challenge of antimicrobial resistance. *Indian J Cancer* 2013;50:71–3.
- 2 Finch R. Innovation - drugs and diagnostics. *J Antimicrob Chemother* 2007;60 Suppl 1:i79–82.
- 3 Boucher HW, Talbot GH, Bradley JS, *et al.* Bad bugs, no drugs: no ESKAPE! an update from the infectious diseases Society of America. *Clin Infect Dis* 2009;48:1–12.
- 4 Costelloe C, Metcalfe C, Lovering A, *et al.* Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: systematic review and meta-analysis. *BMJ* 2010;340:c2096.
- 5 Yeo JM. Antimicrobial stewardship: improving antibiotic prescribing practice in a respiratory ward. *BMJ Open Quality* 2016;5:u206491–w3570.
- 6 Deorari A, Mehta R, Livesley N. *Improving the quality of care for mothers and newborns in health facilities: point of care quality improvement. coaching manual.* New Delhi, India: World Health Organization, Regional Office for South-East Asia, 2017.
- 7 Ashiru-Oredope D, Sharland M, Charani E, *et al.* Improving the quality of antibiotic prescribing in the NHS by developing a new Antimicrobial Stewardship Programme: Start Smart--Then Focus. *J Antimicrob Chemother* 2012;67 Suppl 1:i51–63.