



Neonatal Oral Antibiotics at Home

A Practical Guide for Neonatal Teams

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Resources

- ✧ NOAH Guideline
- ✧ NOAH Telephone Follow-up Proforma
- ✧ NOAH Staff Poster
- ✧ NOAH Patient Information Leaflet
- ✧ NOAH Driver Diagram
- ✧ NOAH Data Collection Tool
- ✧ References
- ✧ NOAH FAQs
- ✧ RDUH NOAH QI Poster

Purpose of this toolkit

The purpose of this toolkit is to support neonatal teams in implementing Neonatal Oral Antibiotics at Home (NOAH) in their own setting. It provides an overview of the Royal Devon University Hospital (RDUH) NOAH project, along with evaluation findings, practical tools, and guidance, in one accessible document.

Introduction to the project

What is NOAH?

Neonatal Oral Antibiotics at Home (NOAH) is a clinical management strategy for eligible neonates with suspected early-onset bacterial infection (EOI), enabling a switch from prolonged hospital-based intravenous (IV) antibiotics to home-based oral antibiotic therapy. It provides a safe, effective alternative to hospitalisation, ensuring that eligible neonates can complete their antibiotic course at home with appropriate monitoring and follow-up.

Background

Currently in the UK, standard management of suspected EOI involves a minimum of 36 hours of IV antibiotics. Antibiotics are typically stopped after 36 hours if the baby is well, C-Reactive Protein (CRP) results are reassuring, and any cultures taken are negative. However, when there are ongoing concerns about neonatal infection, intravenous antibiotics are continued for up to seven days.

IV antibiotics present several disadvantages including increased duration of hospital stay and multiple intravenous cannulations, a procedure which is both painful and may be technically challenging. Additionally, IV gentamicin, a recommended first-line antibiotic for EOI, poses potential risks to renal function and hearing.

Oral antibiotics have not been widely used in high-resource settings for the treatment of EOI due to concerns about efficacy, particularly around gastrointestinal absorption in the neonate. However emerging evidence supports the safety of a switch from IV to oral therapy in a specific cohort of babies receiving treatment for suspected EOI.

The NOAH pathway

In June 2024, Royal Devon University Hospital (RDUH) introduced a switch from IV to oral antibiotics after 36 hours of treatment for suspected EOI: Neonatal Oral Antibiotics at Home, or NOAH. The NOAH protocol based on the published evidence, outlines strict eligibility criteria to ensure safety. Babies must be born at term ($\geq 37+0$ weeks gestation) and currently be receiving IV antibiotics for suspected EOI. Babies must be clinically well and tolerating oral feeds. A falling CRP is required, with a peak CRP not greater than 50. Additionally, blood and cerebrospinal fluid (CSF) cultures must be negative. Other important factors include the absence of medical or social concerns that could compromise safe discharge. A template guideline based on the RDUH guideline is available [here](#).

The parents of babies discharged home on NOAH received a telephone follow-up at around day five of their seven-day course of antibiotics. Following a six-month pilot, a comprehensive evaluation was conducted, the results of which have further informed this toolkit. The full evaluation report is available [here](#).

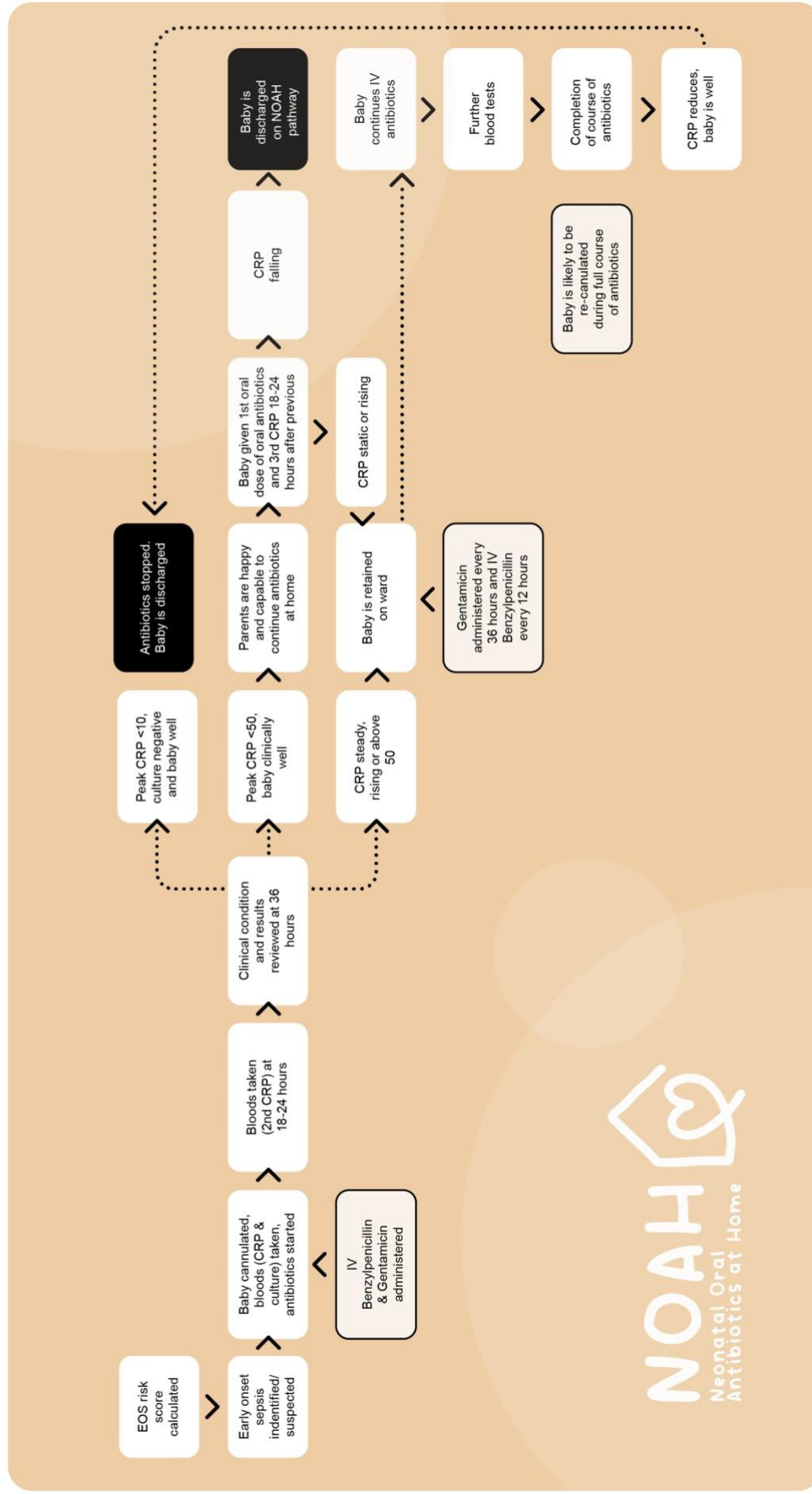


Figure 1. Pathways for babies with suspected early onset infection

About RDUH

For context, RDUH is a trust with two sites (one Local Neonatal Unit and one Special Care Baby Unit) with a combined birth rate of 4,735 per year (SW ODN 2023/24). The project was carried out at the East site which is a designated LNU with a total of 26 cots (8 intensive/high dependency, 14 special care and 4 transitional care). RDUH (Exeter) does not currently have an operational virtual ward or neonatal outreach team.

The RDUH Eastern site, located in Exeter, serves both urban and rural coastal areas in Devon. Limited transport options, including no train service, expensive car parking and irregular buses, make travel to the hospital challenging. While Devon has lower overall deprivation than the national average, its rural areas face higher deprivation than rural areas elsewhere in England. Low salaries, high housing costs, and additional expenses for fuel and transport contribute to financial hardship in Devon, particularly for low-paid working households.¹

The RDUH team saw the potential benefits of NOAH for both the hospital trust and the community it serves, inspiring them to implement it as an improvement project.

Dr David Bartle, Consultant Paediatrician at RDUH explains how this came about:

"I attended the REASON conference with a colleague in June 2023. The last lecture was presenting two papers on a switch from IV to oral antibiotics with an aim to get babies home earlier. There was a total of about 1,000 patients in these studies. The studies were backed up by a pharmacist who presented the pharmacokinetics emphasising the serum levels and safety. We felt this would be different to standard practice in the UK and would be a really innovative way to support families getting home earlier, help breastfeeding rates and bonding as well as reducing hospital bed days. We went through many processes to ensure regional support from a clinical and infection control process before implementing the process."

¹ Poverty in Devon 2024 - Devon Health and Wellbeing

Evidence & risk rationale

Implementing a change in practice can be daunting. While the potential benefits of adopting the NOAH pathway were compelling, maintaining a commitment to evidence-based medicine remained a priority, with newborn safety as the foremost concern. A thorough review of the published literature (summarised below) was conducted, along with a critical appraisal of the RAIN study (Keij et al) in a departmental journal club. The RDUH team concluded that the benefits of the NOAH pathway outweighed the risks, leading to the initiation of the NOAH pilot. The subsequent evaluation further reinforces the existing published evidence base, supporting both the safety and efficacy of the NOAH pathway.

"We know that the incidence of early onset infection in our setting is 0.4/1000 live births. We can't prevent EOI but need to ensure we treat it properly. This can be done effectively by appropriate courses of antibiotics, whether that is IV or oral. When Kaiser Permanente was introduced, there was a lot of anxiety around the risk of under-treating babies but has been shown to be safe and effective as well as significantly decreasing the numbers of babies treated. There is likely to be anxiety around introduction of oral antibiotics to go home with and if one baby was undertreated then this would be disaster. We have therefore started with what we would regard as safe parameters that are consistent with the initial studies. The numbers one would need to recruit into a research study to show a clinical significance make it unfeasible. If we have consensus from neonatal clinicians and infection control advocates, then this is the right way to treat babies and families. It will benefit babies and families by helping improve breast feeding rates and bonding as well as saving many bed days in every trust."

David Bartle Consultant Paediatrician RDUH

Evidence summary

The Neonatal Oral Antibiotics at Home (NOAH) strategy offers a clinical approach for neonates with suspected early-onset bacterial infection by switching from intravenous (IV) antibiotics to oral therapy at home. This project is aimed at reducing hospital stays while maintaining the efficacy of treatment. Historically, IV antibiotics have been used in neonates due to concerns about the efficacy of oral antibiotics in this population. However, emerging evidence supports the use of oral antibiotics in this context, with studies showing comparable serum concentrations and no increase in adverse events.

Key pharmacokinetic studies (Autret, Gras-le-Guen) demonstrate that oral amoxicillin can maintain effective therapeutic levels, even in neonates, with no significant adverse effects. The RAIN trial, a multicentre randomized trial, confirmed that early switching to oral amoxicillin-clavulanic acid was both safe and effective, reducing hospital stays significantly with no increase in adverse events, readmission or treatment failure. Similarly, Carlsen et al.'s cohort study in Denmark showed that switching to oral therapy after 36–48 hours. Additional smaller studies by Gyllensvärd et al. and Manzoni et al. also support the practice of early oral antibiotic switching, emphasizing reductions in antibiotic duration, hospital costs, and improved outcomes such as breastfeeding rates. Furthermore, a recent rapid evidence review published in the Archives of Disease in Childhood (Gifford) concluded that switching to oral antibiotics is acceptable for clinically stable, feeding well, term neonates with culture-negative early-onset infection, providing there is proper outpatient monitoring in place.

In conclusion, the evidence supports the safety and effectiveness of switching from IV to oral antibiotics in clinically stable neonates with early-onset infections. This strategy reduces hospital stays and promotes earlier discharge, without increasing the risk of adverse events.

This NOAH toolkit and the associated resources have been designed based on the evidence available.

Key benefits identified in the RDUH NOAH project evaluation

Patient perspective



Going home Sooner

Parents felt relieved and happy to leave the hospital earlier.

"I my husband, and he said it was great to be able to take him home sooner and feel reassured that the medical team felt he was well enough to go home with the oral antibiotics, and he didn't need to be in the hospital."



Better support for breastfeeding

Parents noted that hospital conditions often made breastfeeding more challenging, whereas being in their own space helped create a positive breastfeeding experience.

"...especially with breastfeeding and your milk coming in, and the emotions and needing all those good hormones to get the breastfeeding journey started. I think being at home definitely was really helpful for that."



More family support

"We were glad to get home at the end of it, because dad could then help with looking after [baby]."

Returning home meant parents could be with their partners, other children, and family members, rather than being separated due to hospital rules and visiting restrictions. Partners were also able to take a more active role in caring for the baby, and home life. Providing a more restful and supportive setting, facilitating improved sleep



Bonding with baby

Parents reported a stronger bond with their baby at home, where a calmer environment made connection easier.

"I mean, I felt like, when I was in the hospital, I wasn't really able to bond with her at all, to be honest. Like I really struggled with that while I was in that once I got home, I definitely started to bond with her a lot better."



Improved mental wellbeing

Being at home together created a calmer, less stressful environment, positively supporting the mental health of both parents.

"Having to stay in the hospital without my partner was really hard - both from a physical and emotional perspective. It felt much more natural to be new parents together than being the sole caretaker of a newborn."



Reduced anxiety about separation

In some hospitals, IV treatments require babies to be separated from their parents. Being able to stay together at home provided reassurance and reduced parental anxiety.

"Having to stay in the hospital without my partner was really hard - both from a physical and emotional perspective. It felt much more natural to be new parents together than being the sole caretaker of a newborn."



Reduced travel and associated costs

Fewer hospital visits saved families time and money on travel and parking.

"Having to stay in the hospital without my partner was really hard - both from a physical and emotional perspective. It felt much more natural to be new parents together than being the sole caretaker of a newborn."

Health equity impact

When implementing a new health service such as NOAH, it is vital for clinicians to prioritise health equity to ensure all babies and their families will benefit. This means actively considering how the service will impact **all** patient groups, particularly those who are historically underserved or face barriers to accessing care. Resources are available to support this process².

Although difficult to measure, it is likely that NOAH provides disproportionately greater benefits to economically disadvantaged families, particularly those in precarious employment or remote rural areas. By reducing transport and parking costs, minimising work absences, and easing childcare challenges, the pathway helps mitigate the greater burden that prolonged hospital stays place on these groups, compared to more affluent urban families. This is especially relevant in Devon, considering the rural geography and the relative deprivation of the rural population.

² HEAT <https://www.gov.uk/government/publications/health-equity-assessment-tool-heat/health-equity-assessment-tool-heat-executive-summary>
[Tackling Health Inequalities | Seven Priorities For The NHS | The King's Fund](#)

Clinical perspective

Stable re-presentation and readmission rates

A comparison between infants on the NOAH pathway and a similar cohort from the previous year indicates that its introduction at RDUH did not lead to an increase in hospital re-presentations or readmissions within the first 28 days of life.

Reduced hospital length of stay

The introduction of the NOAH pathway resulted in baby and parent avoiding an average of 2.7 days of hospital stay (145 days annualised). This results in increased cot capacity, which benefits both the local unit and the wider neonatal network.

Reduced gentamicin usage

Records of antibiotic usage show a reduction in gentamicin use following the implementation of NOAH, with each baby avoiding one or two doses of gentamicin.

Completion of full antibiotic courses

All infants included in the pilot successfully completed their full course of antibiotics.

Follow-up calls

Early in the pilot, two families did not receive a timely follow-up call, despite attempts being made. Following adjustments to timing and prioritisation, all subsequent families on the NOAH pathway received timely follow-up calls with no further loss to follow-up. Evaluation findings indicated that parents found these calls both helpful and reassuring.

Staff perspectives

In the evaluation survey, 97% of staff reported that the NOAH pathway had a positive impact on babies, families, and the hospital.

How does QI support a learning culture in the perinatal team?



“A learning culture is recognised as one where teams perform to their best – a culture in which people feel engaged because they have helped to develop a shared vision with other members of their team, and they are part of a psychologically safe environment where they feel they have a voice. This can lead teams to innovate, to come up with improvement ideas and suggest changes, to challenge the status quo and to give and receive feedback as part of the loop of learning.

Quality improvement (QI) as a way of working can support a learning culture because QI is most effective when it is a team activity - we agree our purpose for a QI project across our multi-disciplinary team, generate and test ideas for change and improvement and work together to decide what works, and what doesn't, by looking at our data and evidence. It's a dynamic approach in which we may need to adapt or abandon some ideas and adopt those which work - whichever of these happen, it's all part of the learning. A learning team inevitably has more 'capital' when it is comprised of individuals who are trained in different ways, who have a variety of views, perspectives and backgrounds – we can harness all of this to gain new insights and because of the networks and reach of the whole team, they are also able to deal with organisational challenges more effectively.”

Joanna Pendray, Culture Coach, Devon

Financial impact

The implementation of the NOAH pathway at RDUH (Exeter) led to an average reduction of 2.7 hospital days per baby, equating to **145 hospital days saved** annually. Based on an estimated daily cost of £452³, this translates to an annual cost avoidance of approximately £65,540. In addition, savings on equipment amount to an estimated further saving of £1,000 per year.

Environmental impact

Switching neonates from intravenous to oral antibiotics resulted in environmental benefits. These include lower carbon emissions due to a reduced hospital stay, fewer visitor travel emissions, and a decrease in medical equipment use associated with IV antibiotic preparation and administration.

Over the course of one year, implementing the NOAH pathway at RDUH (Exeter) is estimated to save approximately **8,230kg** of CO₂, which is equivalent to planting between 255 and 380 trees.



highly recommended
and valuable resources
to support this approach
are available from
the

³ https://www.england.nhs.uk/wp-content/uploads/2020/11/22-23NT_Non-mandatory-guide-prices.xlsx

How to implement NOAH in your hospital trust

Forming the team

Building the right team is key to a successful NOAH implementation. Start by identifying relevant stakeholders. Assess their level of influence and tailor your communication strategies, proactively addressing concerns and fostering collaboration. Engaging influential stakeholders early reduces resistance and strengthens project support.

Inspire your team by showcasing the value of NOAH. Consider departmental teaching sessions, journal clubs and posters to raise staff awareness. Adapt available toolkit resources, such as the evidence summary and benefits overview, to support your case. Finally, clearly define project roles and responsibilities within the QI team; NOAH champions are always welcome!

Stakeholders

What

Stakeholder management refers to the action of analysing the attitudes of stakeholders towards NOAH project

It will identify the key people who need to be aware of the project and level of engagement

When

It is frequently used during the preparation phase of a project to assess the attitudes of the stakeholders regarding the potential changes.

How

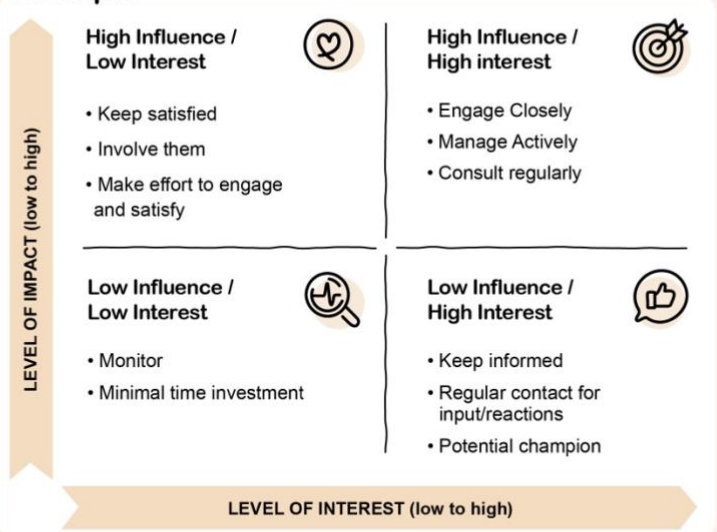
The first step in Stakeholder management is to identify who your stakeholders are.

Next, try to work out their power, influence and interest, so you know who you should focus on. Develop a good understanding of the most important stakeholders to predict how they are likely to respond and to really think through how they could support.

A stakeholder map can be useful

Who	From	Interest	Comms	Frequency
Tracey P	MNVP	Patient Feedback	Check in	Monthly
Sheila H	LMNS	Project awareness	Board update	Quarterly

Example



Tips

- Brainstorm who are your key stakeholders
- Plot them by power and interest
- The final stage is to get an understanding of what motivates your stakeholders and recruit them to your improvement effort!

Figure 2. How to map & consider your key project stakeholders

RDUH stakeholder list

Central Stakeholder

Neonatal Team Members

(Core implementers of the NOAH pathway)

Directly Involved Stakeholders

Pharmacy Team

(Medication management)

Microbiology & Infectious Disease Teams

(Antimicrobial stewardship & guidance)

Maternity Team

(Midwives & obstetricians supporting neonatal care)

Leadership & Governance

Relevant Managers

Governance Team

Quality Improvement Leads

Education & Engagement

Educators

(Training & competency development)

Maternity & Neonatal Voice Partnerships

(MNVPs) (Parent & patient representation)

Regional & System-Level Stakeholders

Neonatal Operational Delivery Network

(ODN) (Regional collaboration & standardisation)

Local Maternity & Neonatal System

(LMNS) (Integration into broader maternity-neonatal strategies)

Trust Sustainability Team

(Environmental impact & carbon measures)

Agreeing the improvement opportunity

Begin by agreeing that NOAH is an appropriate improvement opportunity for your local context in terms of relevance to your population and local support. In RDUH (Exeter), around 50 babies are estimated to be eligible for NOAH per year. Given the annual birthrate of around 3500, this suggests that approximately 1.5% of all babies may be eligible for oral antibiotics at home. This will help you to estimate the size of the impact you may have in your setting.

Establishing the aims

Clearly define what you are trying to achieve, including specific targets and timelines. For example, the neonatal team may aim to successfully identify and transition 95% of eligible babies onto the NOAH treatment pathway by a set date. A well-defined aim provides direction and helps measure progress.

A **logic model** can be useful to provide a structured framework, mapping out the relationship between resources, activities, outputs and expected outcomes. It can help teams to understand how interventions lead to desired improvements, ensuring alignment with overall goals. It supports planning, evaluation and visually communicates the QI rationale behind the project. An alternative tool is the NOAH driver diagram.

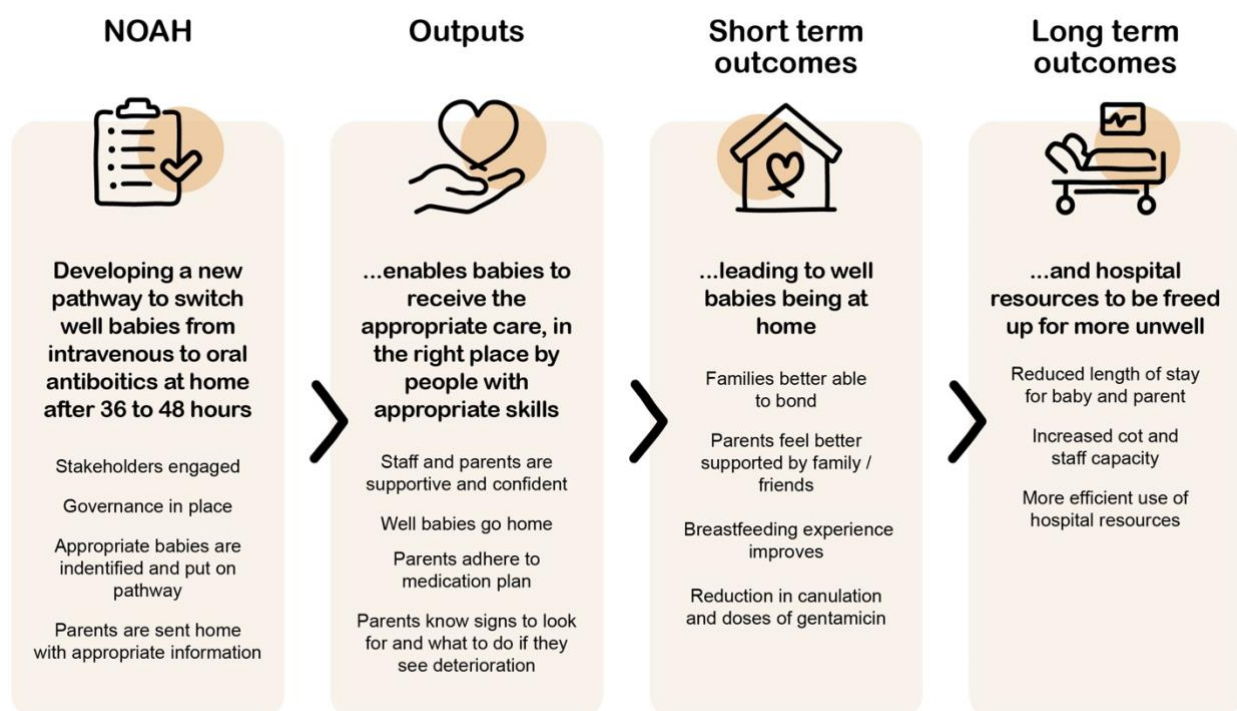


Figure 3. High Level Logic Model for NOAH

Measures

It is important to determine in advance what data you will collect to assess the impact of implementing a NOAH pathway in your hospital. Consider what outcomes you aim to capture and what evidence is needed to demonstrate that you have made improvements for your unit and for your patients. Think about what data will be useful in identifying areas that might be working less well, that can then be targeted for further improvement activity. What will your stakeholders need to know to feel confident that NOAH is beneficial?

Qualitative information is valuable too. Actively seek informal feedback from colleagues and patients and consider providing formal opportunities such as surveys or focus groups. Even casual conversations, like discussing NOAH over coffee, can offer useful insights.

Considering health equity and access to NOAH, collecting data such as postcodes, ethnicity, or languages spoken can help evaluate whether the pathway is being accessed equitably, and identify any gaps in reach or support.

Actions and interventions

Refining and adapting the NOAH pathway to suit your local setting is essential for successful implementation. Consider the following steps:

Integrating NOAH into handover and safety briefings

Modify existing handover and safety briefing processes to include babies eligible for and discharged on the NOAH pathway. Ensuring NOAH is embedded in routine communication helps maintain patient safety and team awareness.

Assign roles and responsibilities

Define key responsibilities within the team. Identify who will conduct follow-up phone calls, oversee governance processes, liaise with pharmacy, and lead staff education, and so on.

Develop a local trust guideline for NOAH

Work with governance leads to create a ratified trust guideline specific to your hospital. You may wish to adapt the template NOAH guideline available with this toolkit. It may also be necessary to review and adapt existing guidelines relating to neonatal infection to ensure alignment with NOAH.

Education and raising staff awareness

Plan how best to educate and engage medical and nursing staff about NOAH. Strategies may include dedicated teaching sessions, posters, email updates,

incorporating NOAH into team meetings, sharing information through the trust's communications team, and including NOAH updates in handovers or huddles. Tailor your approach to suit the culture and preferences of your unit.

Pharmacy and medication supply

Collaborate with your pharmacy team to arrange a supply of take-home packs of oral antibiotics for babies being discharged on NOAH. Address logistical considerations, including storage, re-stocking and prescribing processes. Consider how you will provide parental instructions for administering the medication at home. The NOAH parent leaflet includes useful links to [information for parents](#) going home with babies on NOAH⁴.

Readmission pathway and review mechanisms

Establish a clear process for reviewing babies discharged on oral antibiotics. If a baby discharged on NOAH requires an urgent medical review, determine whether this pathway will be through the emergency department, paediatric team, neonatal team, or via another mechanism. This depends on your local context and must be agreed in advance. Ensure parents are provided with the appropriate contact details to use if they have any medical concerns, so they know exactly where to seek advice or urgent care if needed.

Personalise your NOAH resources

Template NOAH resources have been developed based on those created for use at RDUH (Exeter). These can be adapted to meet your local needs.

- ♡ NOAH Guideline
- ♡ NOAH Telephone Follow-up Proforma
- ♡ NOAH Staff Poster
- ♡ NOAH Patient Information Leaflet
- ♡ NOAH Driver Diagram
- ♡ NOAH Data Collection Tool

Agree a Launch Date

Set a clear launch date in collaboration with key stakeholders. Ensure all necessary preparations, including staff training, guideline approval, and pharmacy arrangements, are in place before implementation begins.

Ensuring accessible and inclusive information for families

When educating families on administering oral antibiotics at home, it is really important to ensure accessibility for all. Use plain language, visual aids, and multilingual resources to support diverse literacy levels. Provide translators or bilingual educators

⁴ [Giving medicines to babies – Medicines For Children](#)

as needed and be mindful of cultural sensitivities. Address barriers by offering free or low-cost resources, digital tools, and alternative learning methods such as video demonstrations or in-person guidance from culturally competent professionals. Tailoring information to the needs of your specific population helps ensure all families receive the support they need.

To maximise accessibility, the English language version of the NOAH patient information leaflet has been written in simple, non-technical language. The key language needs in Devon were identified, and, in partnership with the Devon Local Maternity & Neonatal System (LMNS), the leaflet has been professionally translated into digital format in six additional languages: Polish, Romanian, Simplified Chinese, Arabic, Farsi (Dari), and Turkish.

Implement the pathway

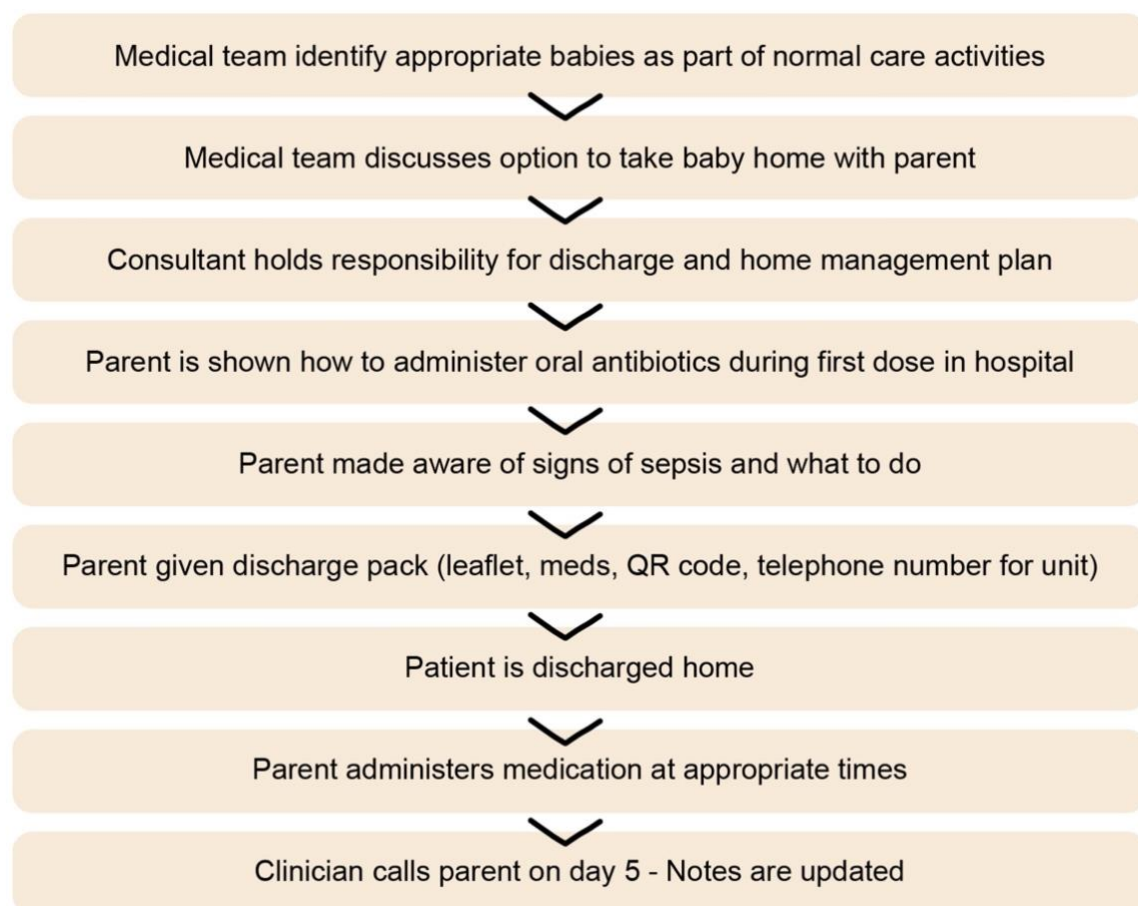


Figure 4. NOAH pathway

Plan, Do, Study, Act (PDSA)

Rapid learning cycles are a way to test your change ideas and make refinements to your quality improvement work. Please view NOAH PDSA visual [here](#).

PDSA cycle example:

Improving NOAH follow-up telephone calls

PLAN

It was decided that a member of the medical team would conduct follow-up telephone calls for families on the NOAH pathway.

DO

A structured telephone proforma was created, and this follow-up process was implemented as part of the NOAH pilot.

STUDY

After reviewing collected data, it was found that many families were not receiving calls until day 7 or 8, and multiple attempts were often needed. Informal feedback from resident doctors and Advance Neonatal Nurse Practitioners (ANNPs) revealed that the calls were frequently assigned to the most junior staff member, who was also managing other clinical responsibilities. Due to workload and conflicting priorities, calls were often delayed until later in the day, leading to unanswered calls.

ACT

To address this, follow-up calls were reassigned to middle-grade doctors or ANNPs and scheduled as part of the daily transitional care ward round. Additionally, the identification of babies due for a NOAH follow-up call was incorporated into the morning safety briefing to ensure accountability. These changes led to improved timeliness of follow-up calls, and the medical team reported greater satisfaction with the revised process.

Figure 5. PDSA cycle

Spread

Share your learning and highlight successes by showcasing data, case studies, and real world impact. Use patient stories and key outcomes to illustrate the benefits of NOAH in practice. Celebrating achievements not only provides evidence of success but also inspires further engagement and adoption.

Implementing NOAH using QI methodology

Using Quality Improvement (QI) methodology to support the implementation of NOAH provides a structured roadmap for implementing and sustaining all QI initiatives, guiding teams through key phases such as problem identification, analysing causes, developing interventions, testing changes (PDSA cycles), and sustaining improvements. It ensures a systematic approach to problem solving.

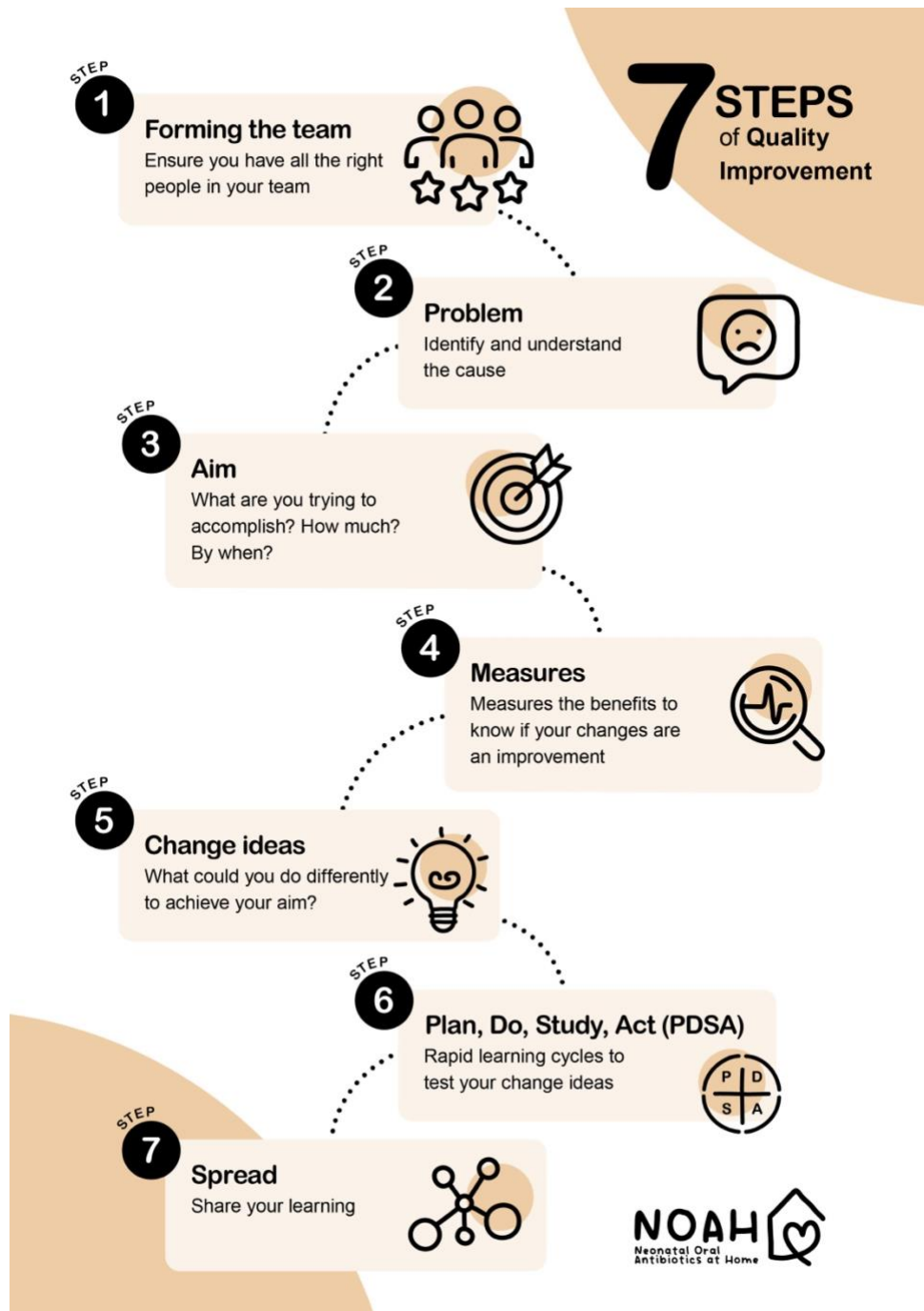


Figure 6. QI 7 steps

Further QI resources and information can be found in the [Institute of Health Improvement Quality Improvement Essentials Toolkit](#).

Lessons learned at RDUH

- ❧ Clearly define responsibility for follow-up phone calls. We found that assigning this to a middle-grade/tier two doctor or ANNP as part of the transitional care ward round responsibilities ensured timely and effective follow-up.
- ❧ Include babies on the NOAH pathway in morning neonatal handovers or huddles. This serves as a reminder to check for eligible babies and assign responsibility for follow-up calls.
- ❧ Involve key stakeholders, such as microbiology and infectious diseases teams, in early discussions to facilitate smooth implementation.
- ❧ This QI project is an opportunity to link with other project opportunities, for example, providing phototherapy at home.
- ❧ Align NOAH with perinatal culture QI goals by collaborating with culture coaches for additional support.
- ❧ Consider the environmental benefits of NOAH. Engage with your trust's sustainability team to highlight carbon reduction opportunities.
- ❧ Collaborate with your trust's translation team to identify key language needs and ensure parent information materials are accessible and accurately translated for the families you support.

Conclusion

NOAH was quickly embraced at RDUH, receiving positive feedback from both families and staff. Published evidence supports its safety, and the RDUH pilot evaluation found no increase in readmissions or adverse events. This toolkit shares key successes and findings from the pilot, along with resources to support the successful implementation of NOAH in your own clinical setting.

References & Websites

National Institute for Health and Care Excellence. (2021). *Neonatal infection: antibiotics for prevention and treatment (NICE guideline NG195)*. Retrieved from <https://www.nice.org.uk/guidance/ng195>

UK Government. National Criteria for Prompt Intravenous to Oral Switch (IVOS) of Antimicrobials in Children and Young People, Including Newborns. GOV.UK,

[National criteria for prompt intravenous-to-oral switch \(IVOS\) of antimicrobials in children and young people \(including newborns\) - GOV.UK](#)

World Health Organization. (2015). *Guideline: Managing possible serious bacterial infection in young infants when referral is not feasible*. WHO. Retrieved December 6, 2024, from https://iris.who.int/bitstream/handle/10665/181426/9789241509268_eng.pdf?sequence=1

Keij FM, Kornelisse RF, Hartwig NG, Reiss IKM, Allegaert K, Tramper-Stranders GA. [Oral antibiotics for neonatal infections: a systematic review and meta-analysis](#). J Antimicrob Chemother. 2019 Nov 1;74(11):3150-3161. doi: 10.1093/jac/dkz252. PMID: 31236572; PMCID: PMC6814091.

Keij, F. M., Kornelisse, R. F., Hartwig, N. G., Van der Sluijs-Bens, J., van Beek, R. H., van Driel, A., ... & Tramper-Stranders, G. A. (2022). [Efficacy and safety of switching from intravenous to oral antibiotics \(amoxicillin-clavulanic acid\) versus a full course of intravenous antibiotics in neonates with probable bacterial infection \(RAIN\): a multicentre, randomised, open-label, non-inferiority trial](#). The Lancet Child & Adolescent Health, 6(11), 799-809.

Keij, F., Kornelisse, R., Hartwig, N., Reiss, I., Allegaert, K., & Tramper-Stranders, G. (2019). [Oral antibiotics for neonatal infections: A systematic review and meta-analysis](#). Journal of Antimicrobial Chemotherapy, 74(10), 3150–3161.

Malchau Carlsen, E. L., Schultz Dungu, K. H., Lewis, A., Vissing, N. H., Aunsholt, L., Trautner, S., Stanchev, H., Dayani, G. K., Pedersen, A.-J. L., Bjerager, M., De Salas, M., Vestergaard, K., Pedersen, P., Frimodt-Møller, N., Greisen, G., Hansen, B. M., & Nygaard, U. (2023). [Switch from intravenous-to-oral antibiotics in neonatal probable and proven early-onset infection: A prospective population-based real-life multicentre cohort study](#). Archives of Disease in Childhood: Fetal and Neonatal Edition, 2023(0), F1–F7.

Gifford, A., Wooding, E. L., & Ng, K. F. (2024). [Is it safe for neonates with probable bacterial infection to be treated with oral antibiotics in high-income countries?](#). Archives of disease in childhood, 109(8), 681–687.

Manzoni, P., Esposito, S., Gallo, E., Gastaldo, L., Farina, D., & Principi, N. (2009). [Switch Therapy in Full-Term Neonates with Presumed or Proven Bacterial Infection](#). Journal of Chemotherapy, 21(1), 68–73.

Gyllensvärd, J., Ingemansson, F., Hentz, E., Studahl, M., & Elfvin, A. (2020). [C-reactive protein- and clinical symptoms-guided strategy in term neonates with early-onset sepsis reduced antibiotic use and hospital stay: A quality improvement initiative](#). BMC Pediatrics, 20, 512.

Gras-Le Guen C, Boscher C, Godon N, Caillon J, Denis C, Nguyen JM, Kergueris MF, Roze JC. [Therapeutic amoxicillin levels achieved with oral administration in term neonates](#). Eur J Clin Pharmacol. 2007 Jul;63(7):657-62. doi: 10.1007/s00228-007-0307-3. Epub 2007 May 12. PMID: 17497144.

Autret E, Laugier J, Marimbu J, Vaillant MC, Furet Y, Breteau M. [Comparaison des concentrations plasmatiques d'amoxicilline par voie orale et intraveineuse dans les colonisations bactériennes néonatales](#) [Comparison of plasma levels of amoxicillin administered by oral and intravenous routes in neonatal bacterial colonization]. Arch Fr Pediatr. 1988 Nov;45(9) :679-82. French. PMID :3233058.

Cohen, M. D., Raeburn, J. A., Devine, J., Kirkwood, J., Elliott, B., Cockburn, F., & Forfar, J. O. (1975). [Pharmacology of some oral penicillins in the newborn infant](#). Archives of Disease in Childhood, 50(3), 230–235.

Landersdorfer, C. B., Gwee, A., & Nation, R. L. (2023). [Clinical pharmacological considerations in an early intravenous to oral antibiotic switch: Are barriers real or simply perceived?](#) Clinical Microbiology and Infection, 29(9), 1120–1125. <https://doi.org/10.1016/j.cmi.2023.04.009>

Culture

<https://www.kingsfund.org.uk/insight-and-analysis/reports/embedding-culture-quality-improvement>

Montgomery, C., Parkin, S., Chisholm, A. and Locock, L., 2020. 'Team capital' in quality improvement teams: findings from an ethnographic study of front-line quality improvement in the NHS. *BMJ Open Quality*, 9(2), p.e000948.

Reed, J.E., Howe, C., Doyle, C. and Bell, D., 2018. Simple rules for evidence translation in complex systems: a qualitative study. *BMC medicine*, 16, pp.1-20.

Data

[NHS Maternity Statistics, England, 2022-23 - NHS England Digital](#)

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Environmental

[Greener NHS » Delivering a net zero NHS](#)

<https://www.gov.uk/government/publications/antimicrobial-intravenous-to-oral-switch-criteria-for-early-switch/national-criteria-for-prompt-intravenous-to-oral-switch-ivos-of-antimicrobials-in-children-and-young-people-including-newborns>

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