



# Postnatal Management of well babies with a cardiac murmur: A pan-London prospective service evaluation.

NEONATAL TRAINEE LED RESEARCH AND QUALITY IMPROVEMENT PROJECTS  
(NEOTRIPS)

STUDY PROTOCOL

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## **Postnatal management of well-babies with a cardiac murmur: A pan-London prospective service evaluation.**

### **Introduction:**

All newborn infants have a physical examination (Newborn Infant Physical Examination; NIPE) within 72 hours of birth [1]. This includes cardiac examination to check for murmur and palpation of femoral pulses. Approximately 1-2% of clinically well, asymptomatic infants are identified as having a heart murmur on NIPE [2, 3]. Such a finding necessitates further paediatric review and investigation to exclude a diagnosis of congenital heart disease. Evidence suggests that the incidence of pathology requiring immediate attention in asymptomatic infants is low, especially in centres with good antenatal screening detection rates [4]. However, given that congenital heart disease is a leading cause of death in newborn infants, [5] early identification and treatment can lead to significantly reduced morbidity and mortality.

There is currently no nationally agreed pathway or guidance for how asymptomatic infants with a cardiac murmur should be managed, either in hospital or following discharge. Paediatric trainees report different approaches at a unit level. For example, some unit guidelines require all infants with a murmur to have a chest x-ray (CXR), electrocardiogram (ECG) and four limb blood pressure. This is despite there being no evidence to support their efficacy in detecting congenital cardiac lesions [6]. While more units are now routinely performing pre and post ductal oxygen saturations on all babies prior to discharge as a screening tool for congenital cardiac disease, this practice is currently not recommended by the national screening committee [7].

### **Background to the project and research need:**

The proportion of clinically well infants with a cardiac murmur who go on to have a cardiac pathology diagnosed is unknown. This study will therefore begin to fill this knowledge gap. We will aim to characterise the common investigations performed and follow-up pathways, which currently are thought to vary significantly between units.

A trainee-led pan-London unit level telephone questionnaire performed in early 2021 identified significant variation in current practice across all 27 neonatal units in London with regards to postnatal management of otherwise well infants with a cardiac murmur [8]. This questionnaire demonstrated a wide variation in practice for investigation and management of newborn infants with a cardiac murmur as follows:

- 100% of units performed pre and post ductal oxygen saturations in newborns with a murmur.
- Half of units perform four limb blood pressure, despite only four unit guidelines recommending this.
- Three units perform ECGs.

Of all units surveyed, 31% did not have a written guideline for the investigation and follow-up of infants with a cardiac murmurs.

This variation in practice also extends to the timing of investigations, with some units performing them on all infants, and others only on infants in whom the murmur persists after 24 hours. As maternity practice moves towards earlier discharge for mothers and babies, the management of infants with murmurs will significantly impact on length of stay. This project also aims to capture whether stay is prolonged unnecessarily for investigations that may have limited clinical significance.

### **Aims and Objectives:**

- 1) To identify the proportion of newborns with a murmur that are subsequently diagnosed with cardiac pathology.
- 2) To characterise what investigations are routinely performed, the timing of these, and identify predictors of cardiac pathology.
- 3) To provide evidence to help rationalise investigations and follow-up pathways to minimise unnecessary length of stay.

### **Predicted sample size**

Chelsea and Westminster NHS Foundation Trust (two sites covering both Chelsea and Westminster and West Middlesex) had 11,935 deliveries 2020-2021 [9]. Evidence suggests the incidence of cardiac murmurs in newborn infants to be between 0.6% [3] and 1.4% [10]. Therefore, assuming a conservative incidence of 1%, we would expect to pick up approximately 120 infants with a cardiac murmur over one year. Over a two-month period this equates to collecting data from approximately 20 infants from one trust. Since each study will be run locally rather than across trusts, we therefore estimate somewhere in the region of at least 10-15 infants per local study site. If we assume that all sites in the London ODN (<https://www.londonneonatalnetwork.org.uk/>) network take part, over a three month data collection period we would anticipate having approximately 250-300 babies in the study. We will review recruitment rates at one month with the option of extending the service evaluation time-frame from two to three months should recruitment be below that which we would expect.

### **Audit inclusion and exclusion criteria:**

#### **Inclusion criteria:**

Well-appearing infants from 34 weeks gestation found to have a cardiac murmur during NIPE or (other routine examination), within the first 72 hours of life

#### **Exclusion criteria:**

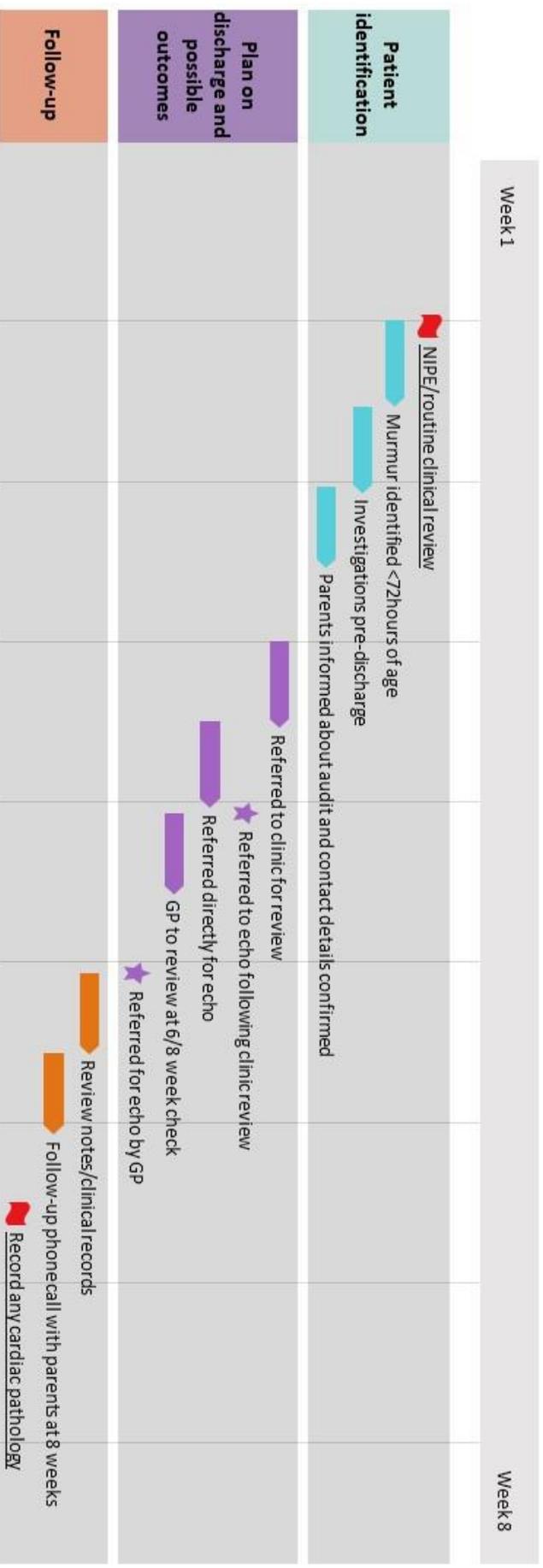
Infants <34 weeks gestation  
Any antenatally diagnosed cardiac anomaly

### **Methods:**

- i) **Basic unit level questionnaire:** Unit level data regarding current practice will be collected as per appendix 1. Units will additionally be asked to provide their current guideline on the management of infants with a cardiac murmur and how these are imp. For example, if a unit routinely does four limb blood pressures and ECGs, where are these being performed and by which health care professionals. Participating units will be asked to provide the number of births (>34 weeks gestation) that occurred during the two-month data collection period.
- ii) **Prospective service evaluation:** Two-month prospective service evaluation capturing patient level data of all infants meeting inclusion criteria detailed above. Data will be collected for each infant as per appendix 2.

A data collection timeline is shown in figure 1.

## NeoTRIPS murmur audit: data collection pathway



### **NeoTRIPS audit network and organisation:**

Given this is a pan-London service evaluation, local trainee and consultant supervisors will be appointed at each participating site to oversee local data collection. All data will be centrally collected and held by the NeoTRIPS project lead group.

- Local trainee leads will be responsible for identifying infants for inclusion in study, recording data as specified in the data collection form and sending this (in an anonymised format) to the Neotrips lead group.
- Consultant supervisors will be responsible for overseeing the data collection, troubleshooting locally and ensuring data is sent on to the NeoTRIPS lead group.
- Anonymised patient level data will be recorded locally and then sent electronically (using nhs.net email addresses) to the NeoTRIPS lead group who will record the data on an excel data base.

### **Data Analysis:**

Data on London wide investigations and outcomes for neonatal heart murmurs will be reported on together for each hospital, local neonatal network and London as a whole.

### **Approvals:**

Research Ethics approval is not required as this is a service evaluation project and involves collecting anonymised patient data. Only clinicians at each hospital site will have access to parents contact details for follow-up phone call at eight weeks. Parents will be told that they will receive a phone call from a member of the clinical team to find out if their baby's murmur needed any further investigation and to evaluate their experience.

Clinical information for each study participant will be stored anonymously in the following format:

Study site initials followed by order of recruitment. For example, Chelsea and Westminster would be CW01, CW02 etc. St Thomas' STH 001, 002 etc. Site leads will be asked to keep one excel document on their local hospital server with patient details and study ID but all clinical data submitted to the NeoTRIPS central team will be anonymised.

### **Governance:**

All participating sites will need to register the service evaluation locally. The NeoTRIPS project lead group will have access to the data from all sites and will be responsible for collating the data and analysis. Each individual unit will only be able to access their own data. All data submitted to the NeoTRIPS project lead group will be in an anonymised format.

### **Publications:**

All individuals involved in the NeoTRIPS project will be acknowledged in any publications/presentations directly related to this project.

## References:

1. England, P.H. *Newborn and infant physical examination: programme handbook*. 2021 [cited 2022 March]; Available from: <https://www.gov.uk/government/publications/newborn-and-infant-physical-examination-programme-handbook/newborn-and-infant-physical-examination-screening-programme-handbook>.
2. Lardhi, A.A., *Prevalence and clinical significance of heart murmurs detected in routine neonatal examination*. J Saudi Heart Assoc, 2010. **22**(1): p. 25-7.
3. Ainsworth, S., J.P. Wyllie, and C. Wren, *Prevalence and clinical significance of cardiac murmurs in neonates*. Arch Dis Child Fetal Neonatal Ed, 1999. **80**(1): p. F43-5.
4. Fenster, M.E. and J.S. Hokanson, *Heart murmurs and echocardiography findings in the normal newborn nursery*. Congenit Heart Dis, 2018. **13**(5): p. 771-775.
5. Bairoliya, N. and G. Fink, *Causes of death and infant mortality rates among full-term births in the United States between 2010 and 2012: An observational study*. PLoS Med, 2018. **15**(3): p. e1002531.
6. Shenvi, A., J. Kapur, and S.V. Rasiyah, *Management of asymptomatic cardiac murmurs in term neonates*. Pediatr Cardiol, 2013. **34**(6): p. 1438-46.
7. Ewer, A.K., et al., *Potential benefits and harms of universal newborn pulse oximetry screening: response to the UK National Screening Committee public consultation*. Arch Dis Child, 2020. **105**(11): p. 1128-1129.
8. Carr, D. and A. Kundu, *882 Variability of cardiac investigations for neonates with suspected innocent murmurs across London*. Archives of Disease in Childhood, 2021. **106**(Suppl 1): p. A148-A148.
9. *NHS Maternity Statistics, England*. 2020-2021 [cited 2022 7th March ]; Available from: <https://digital.nhs.uk/data-and-information/publications/statistical/nhs-maternity-statistics/2020-21#>.
10. Farrer, K.F. and J.M. Rennie, *Neonatal murmurs: are senior house officers good enough?* Arch Dis Child Fetal Neonatal Ed, 2003. **88**(2): p. F147-51.

## Appendix 1: Unit Level Questionnaire

Study Site	
X	
UNIT DEMOGRAPHICS	
Level of Care	SCBU                      LNU                      NICU
Number of livebirths >34 weeks during data collection period (1/5/22 – 30/6/22)	
MURMUR PATHWAY	
Is there a murmur guideline?	Yes                      No <i>If yes please attach a copy when submitting your unit paperwork</i>
ECHO PROVISION	
Number of neonatal/ paediatric consultants that routinely perform echo	
Provision of neonatal echo ( <i>is it possible to get an urgent inpatient echo within 24hrs</i> )	Neonatal unit consultants Inpatient paediatric echo service Outpatient paediatric echo service Referral to alternative echo service (tertiary hospital) Other (please specify):
ROUTINE PRE/POST DUCTAL SATURATION SCREENING	
Routine pre/post ductal saturations screening in all babies?	Yes                      No
Is there a guideline for this?	Yes                      No <i>If yes please attach a copy when submitting your unit paperwork</i>
Timing of screening?	With NIPE Specified timings Non-specified timings Other (please specify):
Who performs the screening? (please tick all that apply)	Midwifery team Nursery nurses/ HCAs/ MCAs Person who performs the NIPE Doctors only Other (please specify):
COMMENTS	

## Appendix 2: Local Baby Data Collection Form

Study Site				
X				
PATIENT DEMOGRAPHICS				
NHS Number				
Surname				
Date & Time of Birth				
Gender	Male	Female		
Gestation	weeks			
Routine Anomaly Scan	Yes	No	Unknown	
Foetal Echo	Yes	No	Unknown	
	<i>(If abnormal please exclude from study)</i>			
Mode of Delivery	Elective LSCS	Emergency LSCS	SVD	Instrumental
MURMUR CHARACTERISTICS				
Age of Murmur identification	< 24 hours of life		> 24 hours of life	
Date & time of Murmur identification				
Identified at NIPE?	Yes	No		
	If No please specify when?			
Professional who identified murmur	Midwife	ANNP	SHO	SpR
	Other (please specify who):			
Grade of Murmur	1	2	3	4+
Other murmur descriptors (please detail if documented)				
Femoral pulses	Normal	Weak	Absent	Not palpated
Brachial pulses	Normal	Weak	Absent	Not palpated
Murmur resolved by 24 hours?	Yes	No	N/A	
Senior Review performed?	Yes	No		
	If Yes please specify grade of reviewer and when reviewed performed:			
INVESTIGATIONS				
Were any investigations performed?	Yes	No		
Timing of Investigations	< 24 hours of life		> 24 hours of life	
	Other (please specify):			
O2 Saturations	Yes (as part of murmur work-up) Yes (as part of routine screening)* No			Date/ Time
	If Yes: pre-ductal =			post-ductal =
	*for departments where all babies undergo routine pulse oximetry screening (ie: not only those with murmurs)			
4 limb BP	Yes	No		Date/ Time
	If Yes: RUL =		LUL =	
	RLL =		LLL =	
ECG	Yes	No		Date/ Time
	If Yes: normal		abnormal	
	If abnormal please specify:			

Chest X-ray	Yes If Yes: If abnormal please specify:	No normal abnormal	Date/ Time
Inpatient Echo	Yes If Yes: If abnormal please specify:	No normal abnormal	Date/ Time
Any other Investigations	Yes If yes please specify investigation and results:	No	Date/ Time
Was baby admitted to NICU?	Yes	No	
Reason for admission	Abnormal investigation Clinical deterioration Any other reason, please specify:		
<b>DISCHARGE PLANNING</b>			
Did murmur delay discharge? (Defined as an additional night or more in hospital)	Yes (due to staying for 24hr review) Yes (due to awaiting investigations) No Unknown		
Follow-up Plan	No follow-up (murmur resolved prior to discharge) No follow-up (murmur present at discharge) No follow-up (normal echo as inpatient) Routine GP review at 6-8 weeks Local SHO/SpR led follow-up clinic Local Consultant led follow-up clinic Local Joint Cardiology follow-up clinic Specialist paediatric cardiology follow-up clinic Referred for outpatient echo without further clinical review Any other follow-up pathway (please specify):		
Written Safety net information provided?	Yes	No	
<b>FINAL OUTCOMES (completed later by lead trainee)</b>			
Clinic appointment attended?	Yes	No	N/A Unknown
Date of clinic appointment	Still awaited (please record date):		
Murmur present at clinic?	Yes	No	Unknown
Echo performed at clinic?	Yes	No	Unknown
Echo planned as outpatient?	Yes	No	Unknown
Echo results	Structurally normal heart Structurally abnormal heart (please specify diagnosis): Awaiting echo (please record date): Unable to obtain results		
<b>COMMENTS</b>			