

Introduction of an NIV Troubleshooting Guide for Acute T2RF

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Choice of Project

Review of Patients following initiation of Non-Invasive Ventilation:

An area of perceived weakness amongst medical SHOs at the BRI.

An area not addressed by the current BRI non-invasive ventilation pathway.

A common scenario, especially out of hours.

Patient population at significant risk of deterioration.

Choice of Project and Aims

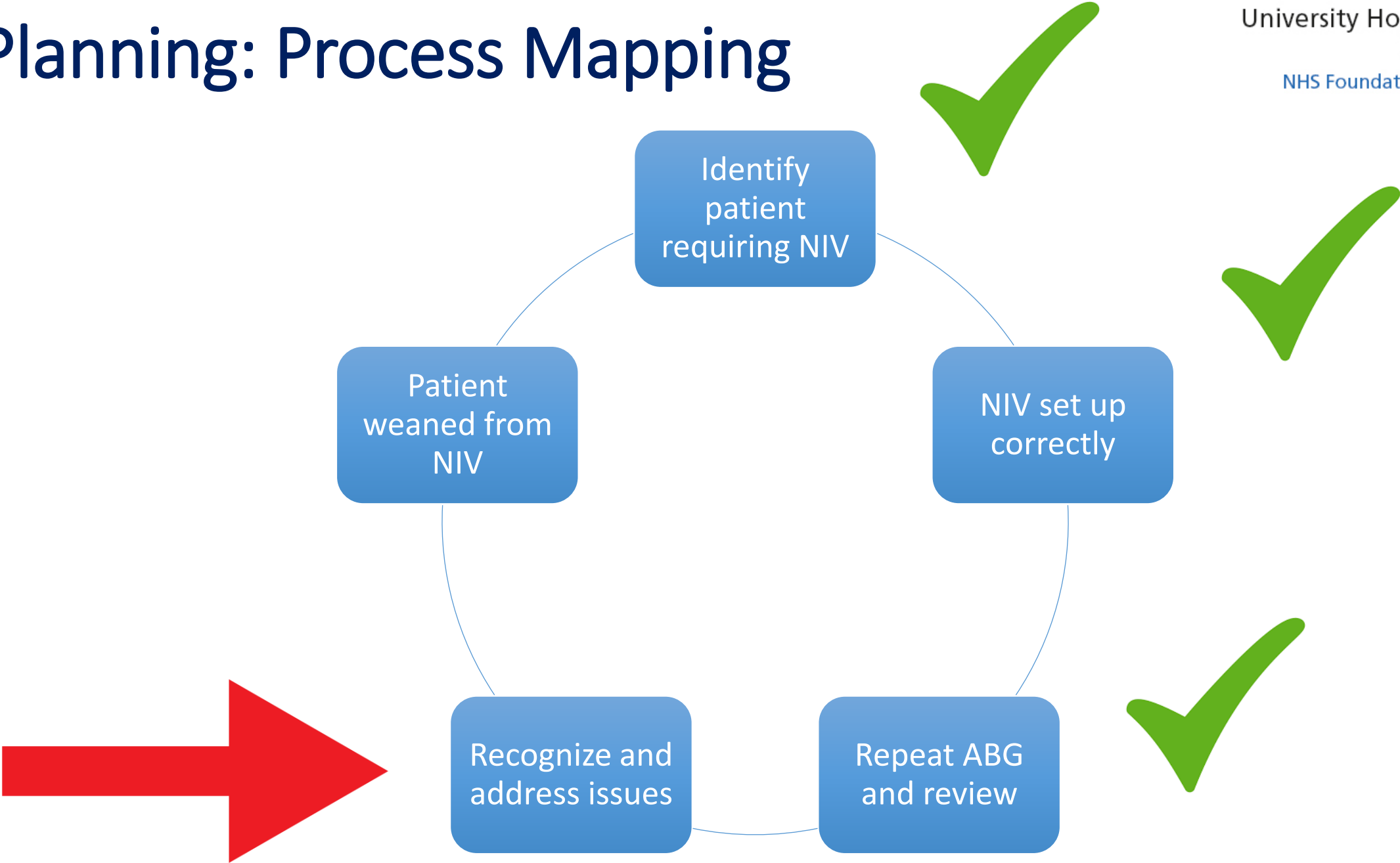
- Increase the availability of resources and the confidence of junior doctors when assessing and managing patients established on NIV.
- Assess the baseline confidence of junior doctors to manage such patients safely using a targeted questionnaire. Repeat to review response to interventions made.
- Design and implement a NIV troubleshooting tool by August 2017.



Planning

What are we trying to accomplish?	By August 2017: Design and introduce a non-invasive ventilation troubleshooting tool for use by junior doctors at the BRI.
How will we know that a change is an improvement?	<ul style="list-style-type: none">- Increase junior doctor awareness of available guidance (100% of juniors assessed to be aware of local pathway)- Increase junior doctor confidence to safely manage patients requiring NIV and escalate concerns appropriately
What changes can we make that will result in improvement?	<ul style="list-style-type: none">- Use BTS guidance to develop troubleshooting tool.- Multidisciplinary team involvement.- Access target audience by uploading troubleshooting tool to local intranet.- Local and regional education.

Planning: Process Mapping



Data Collection (1)

	November 2016
No. responses	42
No. who had worked in respiratory medicine in last 12 months	30% (13/42)
How confident do you feel reviewing a patient already commenced on NIV	
a) Very confident, would not need to seek advice	26% (11/42)
b) Confident but would probably need advice from a senior or a guideline	33% (14/42)
c) Not confident, would definitely need advice	40% (17/42)

Data Collection (1)

	November 16
Are you aware of any hospital guideline/policy for managing NIV?	
a) Yes, there is a guideline	9% (4/42)
b) No, there is no guideline	4% (2/42)
c) Not sure	85% (36/42)

Comments: November 16

“What to do if not triggering or desaturating. When exactly to repeat ABGs” [Core Trainee](#)

“An easy to access guideline would be helpful” [Core Trainee](#)

“My knowledge of NIV comes from experience as an SHO and is probably out-of-date as a 5th year SpR in another specialty. I've not had an NIV problem for years, but a troubleshooting guide would be welcome for the eventuality that this occurs in the future.” [Registrar](#)

“How often to perform ABGs” [Core Trainee](#)

“Knowing how fast to increase the pressure. And knowing how to do this on the machine!” [F2](#)

PDSA Cycle 1

- First draft of NIV troubleshooting tool using BTS Guideline
- Free text responses from questionnaire considered
- First draft reviewed by senior respiratory physio, respiratory high care ward sister, consultant respiratory physician
- Second draft with modifications
- Distribution to medical junior doctors via email with repeat questionnaire
- Presented locally to CMT's and respiratory department
- Presented regionally

Non Invasive Ventilation Troubleshooting Tool for use in Acute Type 2 Respiratory Failure

Repeat ABG following start of NIV therapy at 1hour, 4 hours and 12hours.

Usual starting pressure Inspiratory Pressure (IPAP) 10-12 cmH₂O, Expiratory Pressure (EPAP) 4 cmH₂O
Aim to increase pressures to target during first 30mins on NIV. Do this in 2-3 steps according to patient tolerance.
Target pressure usually IPAP 20, EPAP 8cmH₂O
Repeat ABG after 30mins on target pressure (this should coincide with the ABG at 1hour following start of NIV)

PaCO₂ Remains High: Persistent respiratory acidosis

- Is there too much oxygen? Adjust FiO₂ to target sats 88-92%.
- Is there excessive leak? Leak should be 20-40L/min. Consider total face mask.
- Is the patient rebreathing? Check the expiratory port is not occluded.
- Is the patient spending long enough on the machine? Address compliance issues (see below).
- Is the IPAP high enough? Maximum IPAP 25cmH₂O. (Some patients may need higher, discuss with senior).
Look at pressures used on previous admissions.
- Consider senior review and ITU.

PaCO₂ Improved but PaO₂ Low: Target PaO₂ >7

- Reassess for clinical deterioration: consider pneumothorax, aspiration, mucus plugging.
- Increase FiO₂
- Increase EPAP (increase IPAP also to maintain pressure support).
- Consider senior review and ITU.

Reduced Triggering of Machine

- Reassess patient.
- Check mask leak, check patient/ventilator synchronisation.
- Have you reached target settings?
- Many OSA patients require higher target EPAP 10cmH₂O (if patient uses home CPAP, clarify average EPAP with sleep unit within working hours).

Respiratory Effort not Coordinating with Ventilator:

- Is there excessive leak? Leak should be 20-40L/min. Consider total face mask.

Difficulty Inflating Chest:

- Reassess the patient. Consider bronchospasm, mucus plugging, pneumothorax, atelectasis, collapse, consolidation, pulmonary oedema, circuit tubing obstruction.
- Are there lots of secretions? Consider chest physio, saline nebs, suction.

Agitated / Non-Cooperative Patient: Formal capacity assessment and consider DOLs to treat in best interests.

- This may be due to hypoxia or hypercarbia
- 1:1 supervision
- Discuss with senior medic or ITU. Avoid benzodiazepines
- Consider High Flow Nasal Prongs as holding therapy whilst awaiting ITU.

Dry Nose or Mouth: Any patient on NIV >24hours should have humidified O₂.

Gastric Distension: Consider if IPAP can be reduced. Consider NG tube.

Hypotension:

- Reassess patient and senior review. Ensure adequate hydration.
- Consider reducing IPAP.

If a patient is acidotic and uses home NIV never use their own machine to facilitate transfer to high care setting – the reason they may have deteriorated could be a fault with their machine. Home machines are not licensed for treatment of acutely acidotic patients.

Respiratory Rate

Tidal Volume

Leak (amount of air leaking from system)

Trigger (% patient triggered breaths)

FiO₂: Press tab to increase or decrease



IPAP: Press on IPAP tab to increase or decrease and accept change. Do not exceed 25cm H₂O without discussion with senior doctor.

EPAP

Remember alarm settings may also need to be altered.

Data Collection (2)

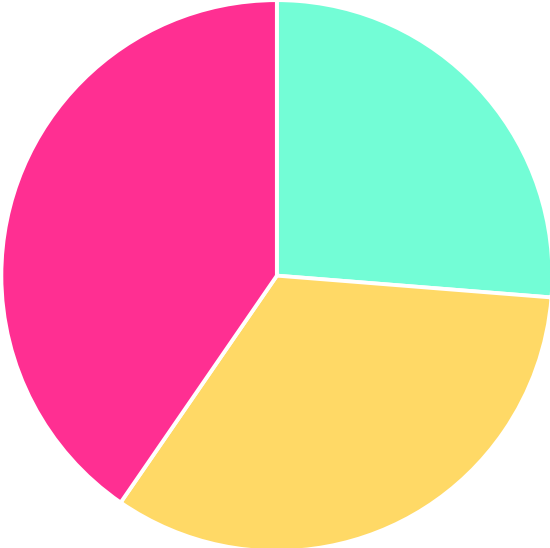
	November 2016: Pre Guideline	February 2017: Post Guideline
No. responses	42	35
No. who had worked in respiratory in last 12 months	30% (13/42)	34% (12/35)
How confident do you feel reviewing a patient already commenced on NIV		
a) Very confident, would not need to seek advice	26% (11/42)	38% (13/35)
b) Confident but would probably need advice from a senior or a guideline	33% (14/42)	47% (16/35)
c) Not confident, would definitely need advice	40% (17/42)	14% (5/35)

Data Collection (2)

	November 16: Pre Guideline	February 17: Post Guideline
Are you aware of any hospital guideline/policy for managing NIV?		
a) Yes, there is a guideline	9% (4/42)	97% (29/35)
b) No, there is no guideline	4% (2/42)	
c) Not sure	85% (36/42)	
a) Yes, there is a guideline and I know where to find it		71% (25/35)
b) Yes, there is a guideline but I would struggle to find it		25% (9/35)
c) No, there is no guideline		0%
d) Not sure		2.8% (1/35)

How confident do you feel reviewing a patient already commenced on NIV? If their blood gasses were not improving would you be confident to know whether the NIV settings needed to be changed, and what to adjust them to? If the patient was not triggering the NIV or desaturating would you know what to do?

Nov 16



Feb 17



- Very Confident
- Confident, but advice probably needed
- Not confident, advice definitiely needed

	Nov	Feb
a) Very Confident	26%	38%
b) Confident but advice probably needed	33%	47%
c) Not confident, advice definitely needed.	40.5%	14%

Comments: February 17

“Great work, had NIV case in resus this week and managed myself until PTWR. This helped.” [Core Trainee](#)

“Can it be on the goto/amu website as well please as this is a very quick way of finding documents. Good guideline, user friendly, addresses most common problems.” [Registrar](#)

“Good work! Definitely increased my confidence. Easy to follow and logical.” [Core Trainee](#)

“It would be helpful to have weaning advice for when we do ward cover incl when abgs should be done if the patient continues to improve.” [Core Trainee](#)

Troubleshooting the Troubleshooting

- Reaching appropriate juniors with questionnaires
- Bureaucratic system of approval for intranet
- Promoting ongoing awareness of the resource

- Balancing measures:

Avoiding over reporting of problems vs overconfidence to manage

Avoiding a paperwork burden

Ongoing Plans

- PDSA Cycle 2: 'Weaning of NIV Troubleshooting Guide'
- 'Away day' visit to regional centers of excellence
- PDSA Cycle 3: Comprehensive NIV Pathway
- Palliative care perspective: Documentation and communication of treatment escalation planning decisions