Addressing the climate emergency and a healthcare system in crisis; how can we optimise the blood culture pathway in microbiology to support healthcare sustainability?

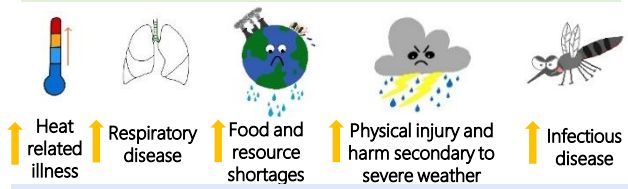
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The health of the planet and the health of humankind; an intrinsic link

Recognition of the interconnected and intertwined nature of the health of the planet and the health of those who inhabit it, is key to understanding and developing a sustainable healthcare system. Human activity, particularly following periods of industrialisation, is responsible for significant destruction and habitat loss, reduced biodiversity, contribution to climate change, and environmental degradation.

How does climate change effect human health?

These detrimental actions on the environment and planetary health, disrupting the delicate balance of the natural world, has directly and indirectly adversely effected human health, threatening the longevity of human existence on the planet; fundamentally, humankind is supporting its own extinction on planet earth, treating the planet in such a way that it will soon be incompatible with human life.



How has the NHS responded to the climate emergency?

Delivering a net zero NHS: A NHS strategy to reduce the carbon footprint that incorporates actions, targets, and policy, with the aim of achieving a net zero status as a healthcare service. This strategy recognises the relationship between the climate and human health, including the shared drivers of climate change and ill-health. Interventions and actions to reduce the carbon footprint of the NHS relate to many aspects of our healthcare service, including energy use, medical supplies and equipment, travel, construction, water use, waste management, medication, and procedural/speciality specific processes.

The strategy identifies a trajectory to achieving a net zero status in the NHS, with the aim of achieving net zero emissions (for the emissions directly controlled by the NHS) by 2040 (1)



Reflecting on our practices, what can we do as individuals and within our departments to support this?



AIM

To review the pre-analytical elements of blood culture pathway in Medical Microbiology at North Cumbria Integrated Care NHS Foundation Trust (NCIC) to determine how it can be optimised to support healthcare sustainability.

CONTEXT

Blood culture sampling and analysis is an integral part of the diagnosis and management of blood stream infections and sepsis. National guidelines state that in cases of suspected sepsis, a total of 40mls of blood should be obtained for blood culture analysis, requiring 4 blood culture bottles (2 x anaerobic bottles and 2 x aerobic bottles), each with a volume of 8-10mls (2). There is approximately a 3% increase in the yield for each ml of blood cultured, highlighting the importance and significance of obtaining appropriate blood volumes for detecting infection (3). In addition, the time the sample takes to reach the analyser from collection is also a focus; the viability of the sample and subsequent ability and time it takes to detect an organism is impacted by the time it takes to reach the analyser (2,3). The pre-analytical elements of the blood culture pathway directly and indirectly impact the patient, healthcare, and environmental sustainability, becoming a focus for review and optimisation.

WHAT WE DID

Reflecting on individual and departmental practices in the context of environmental and healthcare sustainability, a review of existing routinely collected information/data relating to the blood culture pathway was completed. Local data which is collected for both local and national governance and audit purposes was compared to national standards/guidelines and laboratory requirements for specimen analysis, to help identify areas for improvement and optimisation. Data from January, March, and November 2025 was reviewed from the Cumberland Infirmary (CIC) and West Cumberland Hospital (WCH).

MEASURES

Time to being loading onto the blood culture analyser: number of blood culture bottles loaded onto the analyser in <4 hours from specimen collection
Optimal blood volume: number of blood culture bottles with >8mls of blood
Under filled blood culture bottles: number of blood culture bottles with <5mls of blood (considered very under filled).
Blood culture bottle sets: number of blood culture bottle sets (4 x blood culture bottles) received

RESULTS

January 2025

136 blood culture bottles were received from CIC, and 70 from WCH
Of these blood culture bottles…

- **66%** at CIC and **94%** at WCH were loaded onto the analyser in <4 hours from collection
- **54%** at CIC and **53%** at WCH were optimally filled
- **30%** at CIC and **36%** at WCH had <5ml of blood volume
- 3 sets of 4 blood culture bottes were received at CIC, and 4 sets from WCH

March 2025

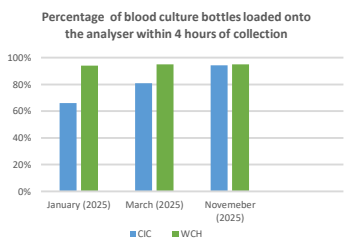
106 blood culture bottles were received from CIC, and 43 from WCH
Of these blood culture bottles…

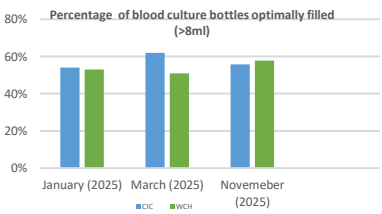
- **81%** at CIC and **95%** at WCH were loaded onto the analyser in <4 hours from collection
- **62%** at CIC and **51%** at WCH of blood culture bottles were optimally filled
- **19%** at CIC and **35%** at WCH of blood culture bottles had <5ml of blood volume
- 9 sets of 4 blood culture bottles were received from CIC, and 3 sets from WCH

November 2025

106 blood culture bottles were received from CIC, and 38 from WCH
Of these blood culture bottles…

- **94%** at CIC and **84%** at WCH were loaded onto the analyser in <4 hours from collection
- **56%** at CIC and **58%** at WCH of blood culture bottles were optimally filled
- **29%** at CIC and **29%** at WCH bottles had <5ml of blood volume
- 6 sets of 4 blood culture bottles were received from CIC, and 6 sets from WCH.





THE PROBLEM

Under filling and sending insufficient sample quantities has direct and indirect negative consequences for the patient and the environment. In addition to potential harm to the patient, longer hospital stays, inappropriate use of medication and treatment, and unnecessary investigations, all contribute negatively to our carbon footprint.

Diagnostic accuracy | **Inappropriate investigation and treatment** | **Diagnosis and treatment delay** | **Repeat sampling and analysis** | **Length of hospital stay** | **Single use plastics, waste, energy, water, medicinal supplies**

ACTIONS TO TAKE INTO PRACTICE

Written informatics/posters in clinical areas

AIM: The aim includes increasing compliance which will not only improve patient outcomes, but help support environmental sustainability; improvement in diagnostic accuracy, reduction in delays to diagnosis and appropriate treatment, and shorter hospital stays all decrease waste and energy expenditure associated with these processes, including reduction in single use plastics associated with repeat sampling which may be required if insufficient samples are sent

Clinical skills training sessions for blood culture sampling

AIM: The aim is to improve both knowledge and skills of blood culture sampling, to increase the number of samples which are sent with sufficient volumes and in the correct quantity, which again will help improve environmental sustainability. A key focus of the educational element is the environmental impact of the measures, including how to reduce and minimise use of plastics.

Medical Microbiology blood culture pathway inclusion in departmental induction/orientation processes

AIM: By equipping staff with this knowledge during there induction/orientation process, at the start of their employment with the trust, the aim is to increase the number of staff performing the skill in accordance with guidelines, from the outset.

MEASURING IMPROVEMENTS

An Increased number of blood culture bottles being filled to the optimal level (reduction in the number of under filled samples) compared to baseline data (before action/intervention), and an increase in the number of sets of 4 blood culture bottles (reduction in the number of sets being sent with <4 bottles where indicated) compared to baseline data (before action/intervention) can indicate improvement in the compliance with national blood culture pathway guidelines, which as discussed, is associated with both direct and indirect improvements for healthcare sustainability.

KEY LEARNING POINTS

- **We all have an individual responsibility to support and promote the sustainability of the NHS**
- **The positive impact of changes to practice on environmental sustainability may not always be directly evident or obvious,** but this demonstrates and highlights how there are often hidden opportunities for sustainability improvement, embedded within our practices and processes
- **Education is key to promoting and supporting change;** working in a healthcare system in a climate emergency requires adaptability, and individuals need to be empowered with the appropriate knowledge and skills to promote and support change for a greener, sustainable future.
- **Appropriate blood culture sampling being performed correctly, first time, will benefit both the patient, and the environment.**

REFERENCES
(1) NHS England. Delivering a "Net Zero" National Health Service [Internet]. 2022 Jul. Available from: https://www.england.nhs.uk/greenernhs/wp-content/uploads/sites/51/2022/07/B1728-delivering-a-net-zero-nhs-july-2022.pdf
(2) NHS England. Improving the Blood Culture Pathway [Internet]. 2023 Mar. Available from: https://www.england.nhs.uk/wp-content/uploads/2022/06/B0686-improving-the-blood-culture-pathway-executive-summary-v1-1.pdf.pdf
(3) UKHSA. UK Standards for Microbiology Investigations [Internet]. 2025 April. Available from: https://www.rcpath.org/static/3f51b8e5-1ebe-469d-a79f3a3323bfaec9/uk-smi-s-12i1-1-sepsis-and-systemic-or-disseminated-infection-april-2025-pdf.pdf