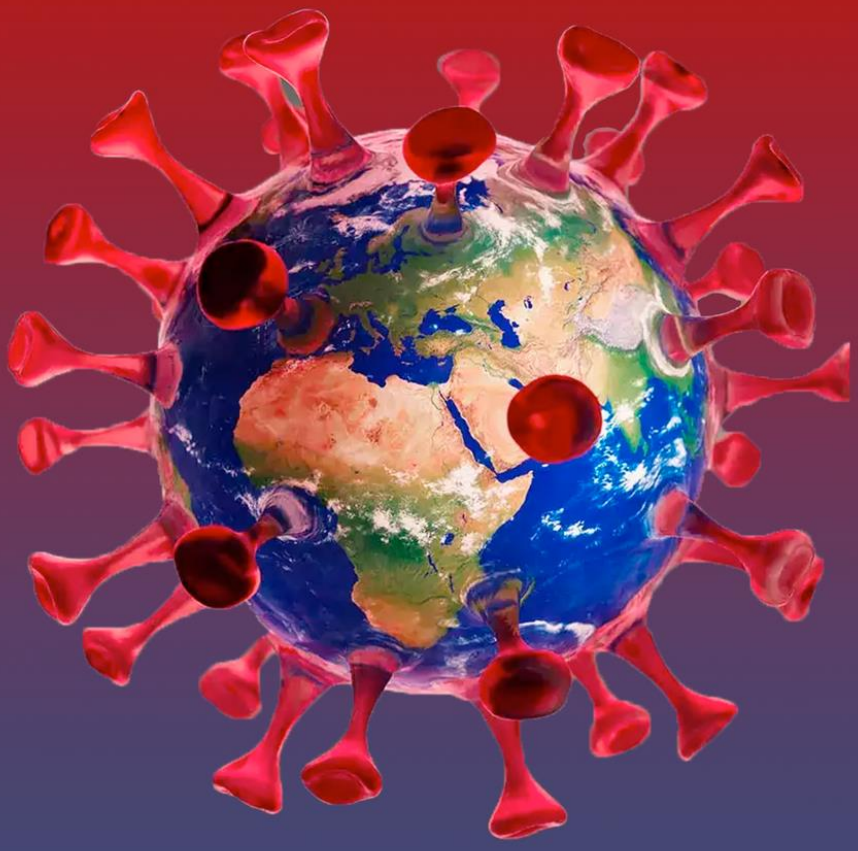
COVID-19

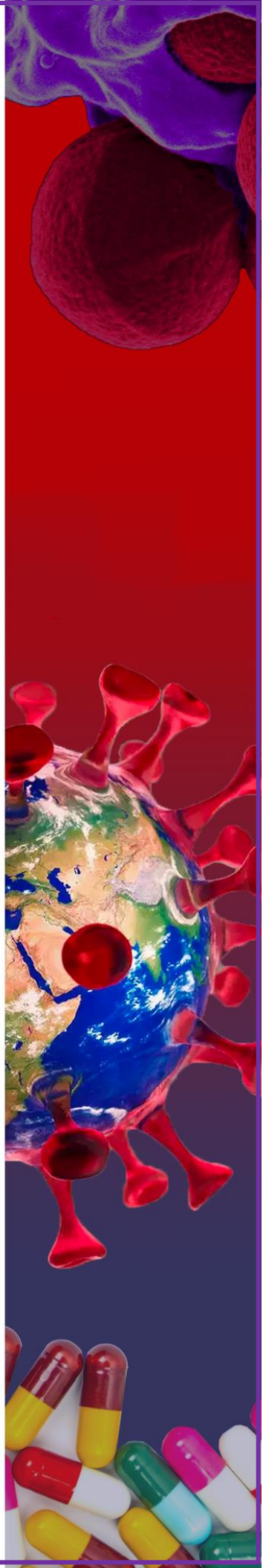
Impact on Antimicrobial Stewardship



2023 Special Report

COVID-19

Impact on Antimicrobial Stewardship



Contents:

Effective Antimicrobial stewardship During the COVID-19 Pandemic at Bedfordshire Hospitals NHS Foundation Trust

COVID-19 Impact on Antimicrobial Stewardship Report: Research Project Outcome

Report Outline:

- This report highlights key findings from the research project, "Antimicrobial Stewardship (AMS) Implementation during the COVID-19 Pandemic in an Acute Care Setting."
- The document offers insights into the hospital's experiences with AMS during the pandemic, aiming to guide health professionals in refining their AMS practices during similar challenges.
- It also presents feedback from health professionals, highlighting the remarkable outcomes achieved through their concerted efforts in the survey response.
- There's a critical need to understanding how the COVID-19 pandemic influenced AMS practices. Learning lessons from these effects is vital for optimising AMS, refining antibiotic prescribing habits, and fighting antimicrobial resistance – a global challenge that healthcare professionals are central to combating.

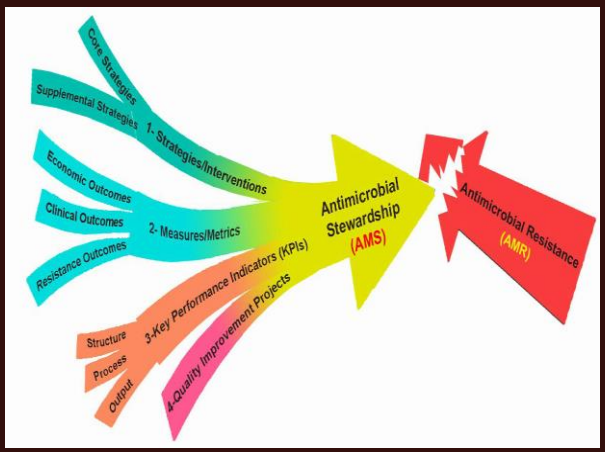
Background

- Antimicrobial resistance (AMR) is a major global public health threat that can lead to treatment failures, deaths, and escalating healthcare costs (www.england.nhs.uk, 2020).
- Antimicrobial stewardship refers to coordinated efforts to promote appropriate antibiotic use to improve patient outcomes, reduce resistance, and decrease unnecessary costs (NICE, 2019) (Figure 1).

Forward:

- As academic researchers and members of the healthcare community, with firsthand experience on the frontlines, we have a profound understanding of antimicrobial resistance—where bacteria become resistant to the antibiotics intended to kill them. Even before the COVID-19 outbreak, antimicrobial resistance stood as a paramount public health issue, and it remains so.

Figure 1. Antimicrobial Stewardship Implementation

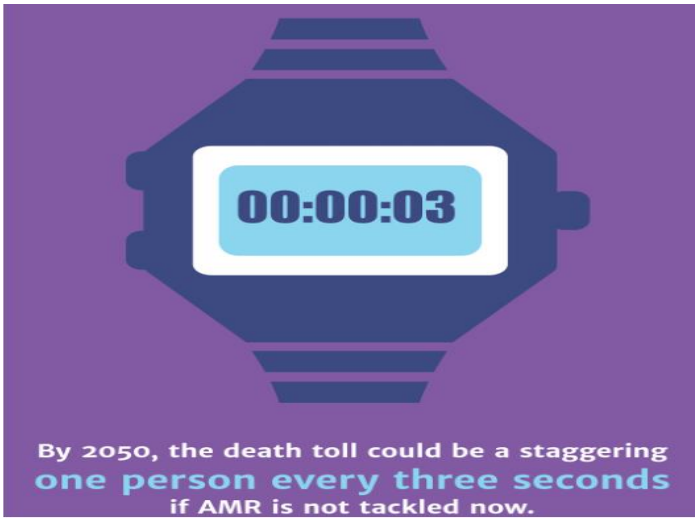


- Both COVID-19 pandemic & antimicrobial resistance - silent pandemic are two sides of the same coin (ISRCTN., 2022) (Figure 2).

Figure 2. COVID-19 Pandemic & Antimicrobial Resistance - Silent Pandemic: Two Sides of the Same Coin.

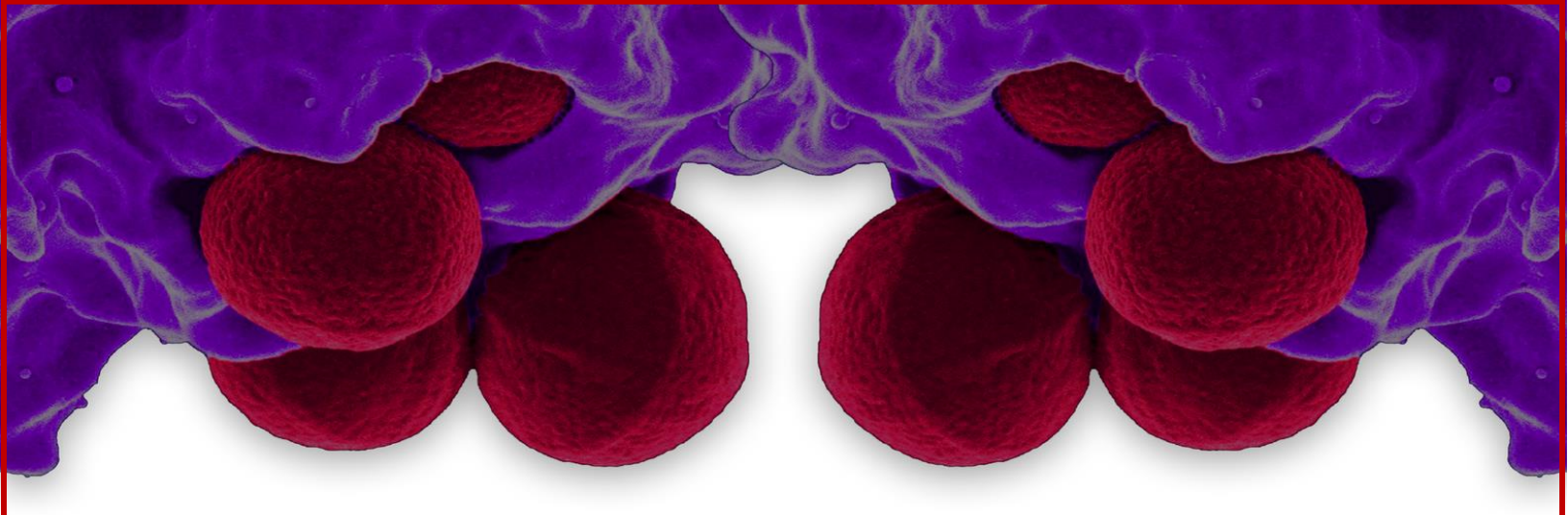
- Figure 3 below grabs our attention with a clear message: time is ticking on the fight against AMR. Imagine, by 2050, one person might die every **three seconds** if we don't act now. The bold countdown and standout purple shade emphasise how crucial and urgent this issue is. This isn't just a warning; it's a call to action (O'Neill, 2014).

Figure 3. Antimicrobial Resistance: A Global Threat with Potential Devastating Consequences if NOT Tackled (O'Neill, 2016)



Objectives

- The primary aim of this research project was to investigate the implementation of antimicrobial stewardship and antibiotic prescribing practices prior to and during the COVID-19 pandemic at Bedfordshire Hospitals NHS Foundation Trust.
- Additionally, this research aimed to identify healthcare professionals' attitudes and perceptions towards antibiotic prescribing, AMR, and AMS practices to enhance antimicrobial stewardship.
- This research project was registered with ISRCTN in accordance with the WHO criteria (registration number 14825813) (www.isrctn.com, 2021).

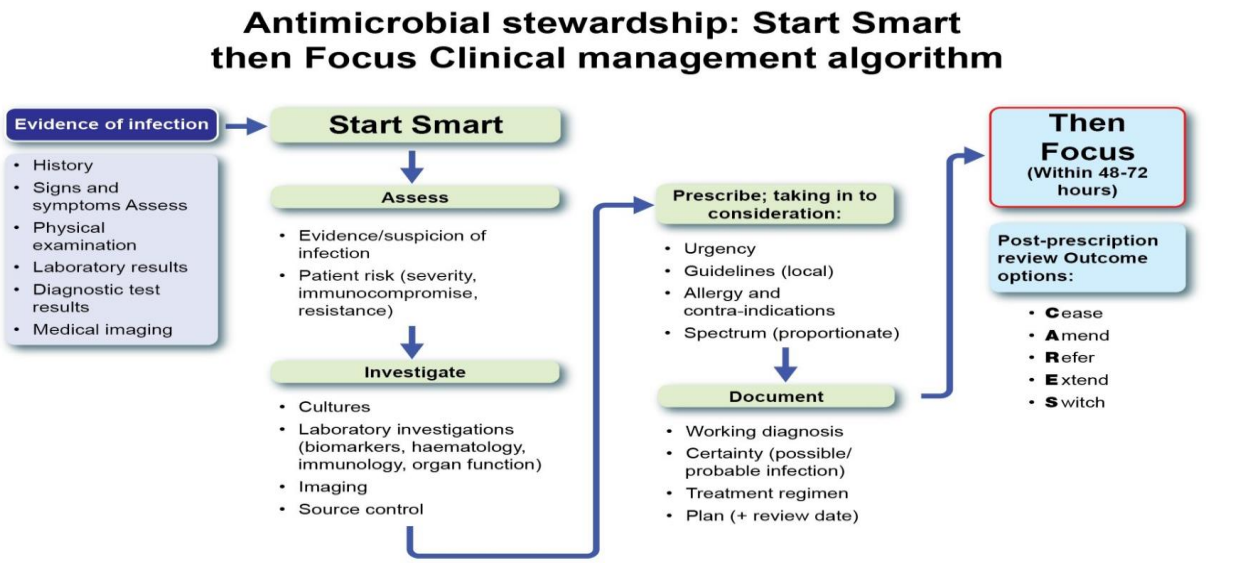


Public Health England (PHE) 'Start Smart- Then Focus' Antimicrobial Stewardship Toolkit

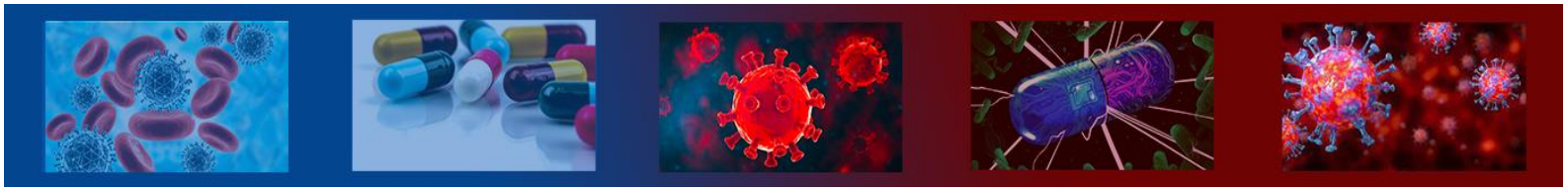
The PHE **'Start Smart - Then Focus' antimicrobial stewardship toolkit'** provides guidance to facilitates judicious antibiotic use through timely initiation, review, and AMS implementation in acute care (GOV.UK, 2023) (Figure 4).

- **'Start Smart'** promotes responsible INITIAL antibiotic use with thorough assessment, appropriate prescribing per guidelines, and documentation.
- **'Then Focus'** involves actively reviewing and revising treatment after 24-72 hours based on new information.

Figure 4. AMS clinical management algorithm (GOV.UK, 2023).

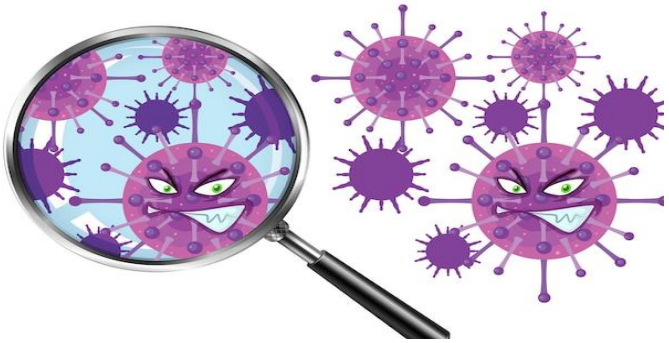


Antimicrobial stewardship: Start smart - then focus



The **'CARES'** framework guides **antibiotic review** outcomes:

- **C**ease treatment if no infection.
- **A**mend prescription with narrower spectrum agents.
- **R**efer to outpatient services like COPAT or virtual wards.
- **E**xtend treatment with clear future review dates.
- **S**witch from intravenous to oral agents where appropriate.



Antimicrobial Stewardship Strategies in Hospitals

- Antimicrobial stewardship involves strategies and interventions aimed at improving appropriate antibiotic prescriptions in all healthcare settings. The literature provides tools, interventions, and activities collectively termed "strategies" to streamline and improve antimicrobial use and educate prescribers (Department of Health ESPAUR SSTF subcommittee, 2015). These strategies include "front-end" and "back-end" approaches. Front-end strategies require an approval process for antimicrobials, while back-end strategies involve reviewing therapy after initiation, often using prospective audit with intervention and feedback. Research indicates that back-end strategies are widely practiced, easily accepted by clinicians, and offer greater educational opportunities. Back-end strategies are likely to provide a more sustained impact in improving antimicrobial prescribing quality (Chung et al., 2013).
- Employed to encourage judicious antibiotic use and prescriber education (The British Society for Antimicrobial Chemotherapy, 2018) (Figure 5), all these strategies have been discussed in detail in the Systematic Literature Review (Rasha Abdelsalam Elshenawy et al., 2023). However, this chapter focuses on the retrospective study and will only evaluate the back-end strategies.

Antimicrobial stewardship strategies aim to improve appropriate antibiotic prescribing across healthcare settings. These strategies facilitate judicious antibiotic use through timely AMS initiation, review, and implementation. Strategies include:

- **"Front-end"** approaches requiring antibiotic approval and "back-end" approaches reviewing therapy after initiation.

- **"Back-end"** strategies, such as audit/feedback are more easily accepted, offer educational opportunities, and provide sustained impact. These strategies encourage judicious antibiotic use and prescriber education.

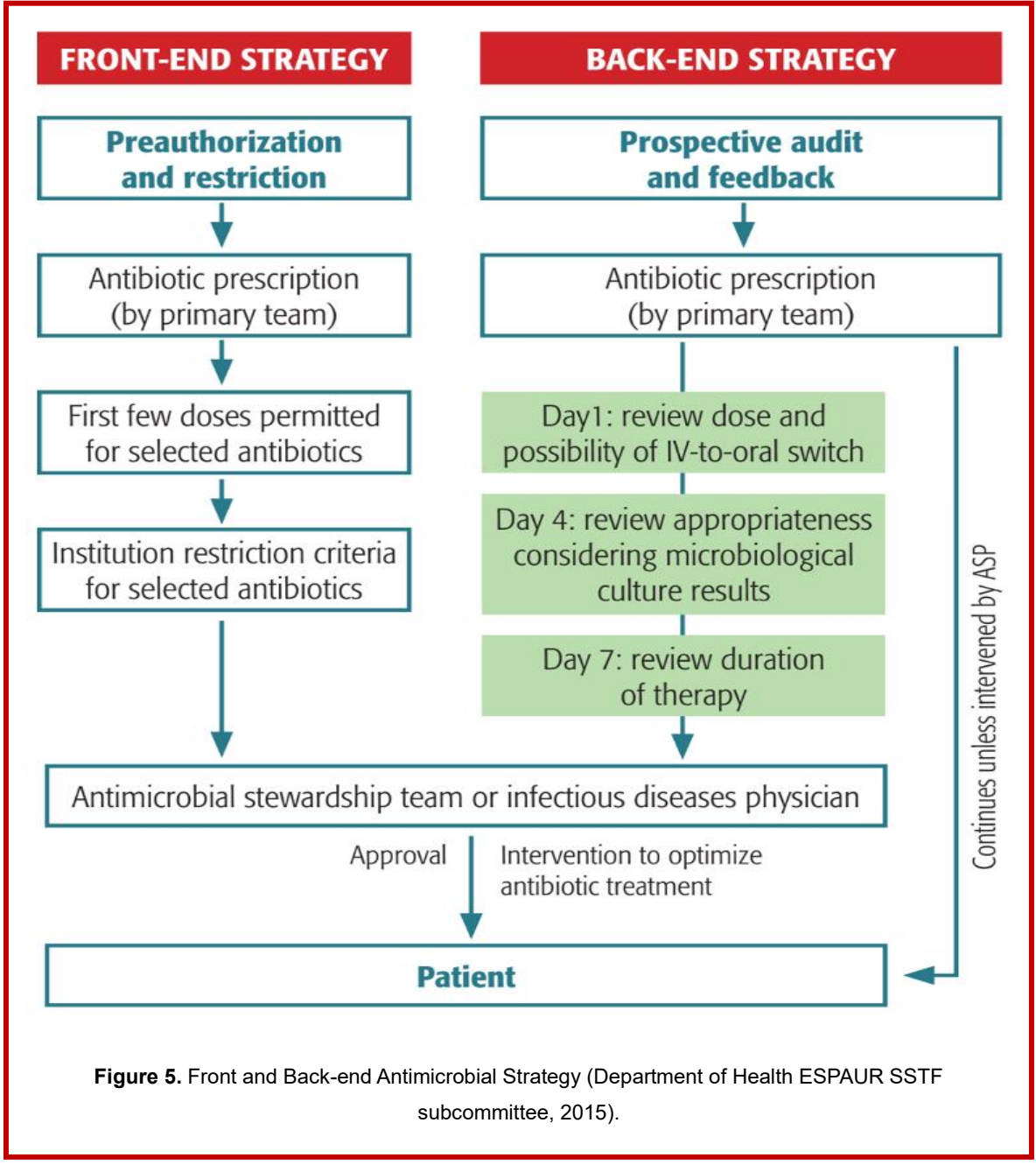
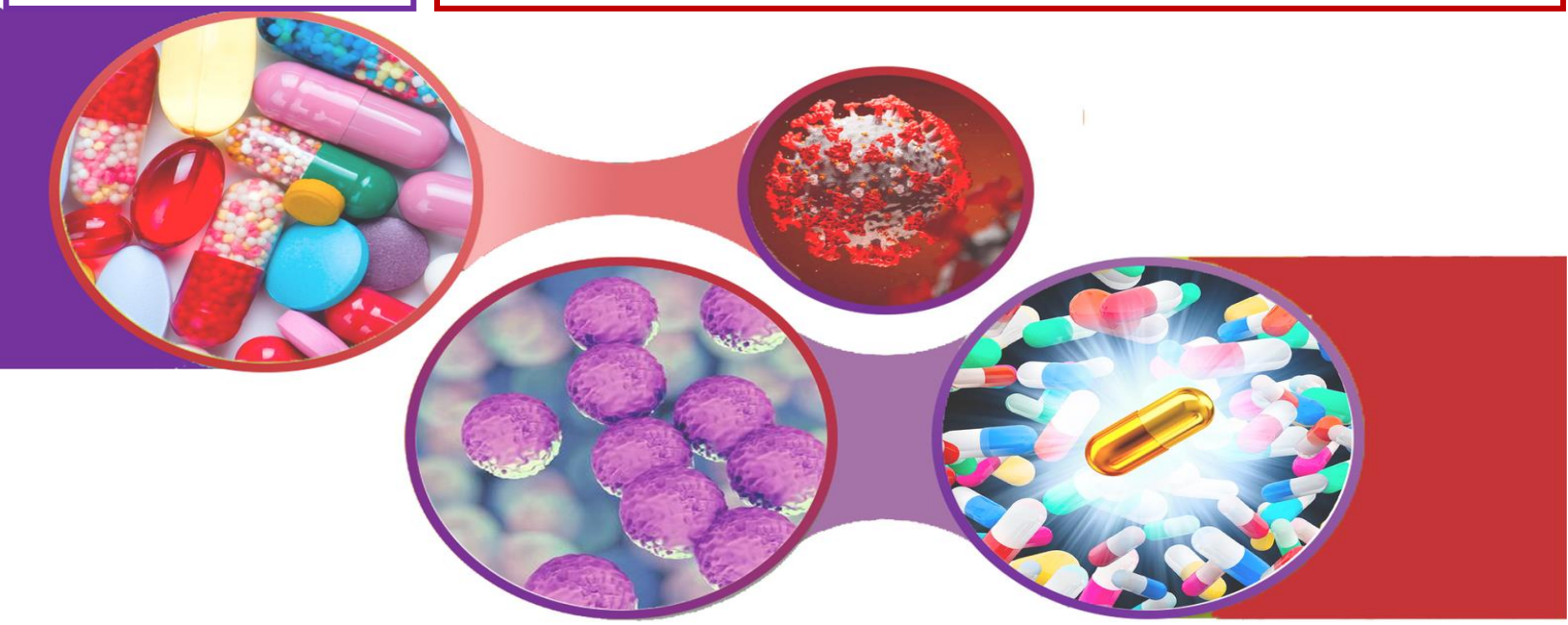


Figure 5. Front and Back-end Antimicrobial Strategy (Department of Health ESPAUR SSTF subcommittee, 2015).



Registration

- This study has been registered in the ISRCTN registry, which is a primary registry recognized by WHO and ICMJE that accepts all clinical research studies. Additionally, this research is published in Octopus.

Patient and public involvement

- Prior to conducting the study, the study protocol was sent to representatives of the Citizens Senate, a patient care organization with a good representation of many older people. They reviewed it and provided feedback. Study results will be shared through the communication team within the Trust.

Public benefits:

- In 2019, over 1.2 million deaths were attributed to AMR. By October 2023, the COVID-19 pandemic had resulted in more than 6 million deaths. The pandemic exacerbated the AMR situation, amplifying the threat it posed. This research centered on the implementation of AMS both before and during the COVID-19 pandemic in acute care settings, offers pivotal insights for public health. It emphasizes the importance of optimizing antibiotic use to combat antibiotic resistance and ensure the sustained effectiveness of treatments. These insights not only advance better patient outcomes but also protect essential antibiotics for future generations and highlight lessons learned from the COVID-19 pandemic. The findings of this study will assist policymakers in their decision-making, guide healthcare professionals in responsible antibiotic prescribing, and enhance public awareness about AMR. Appropriate antibiotic use is pivotal in tackling the AMR challenge and safeguarding lives.

Provenance and peer review

- Commissioned, internally and externally peer reviewed.

Ethics approval

- Ethical approval for this study was granted by the Health Research Authority (HRA), with the Research Ethics Committee (REC) assigning reference number 22/EM/0161. In compliance with this approval, the study protocol underwent review and received approval from the University of Hertfordshire (UH) ethics committee under the reference LMS/PGR/NHS/02975.

Description of research methods, this research project consists of THREE sequential studies:

A Systematic literature review

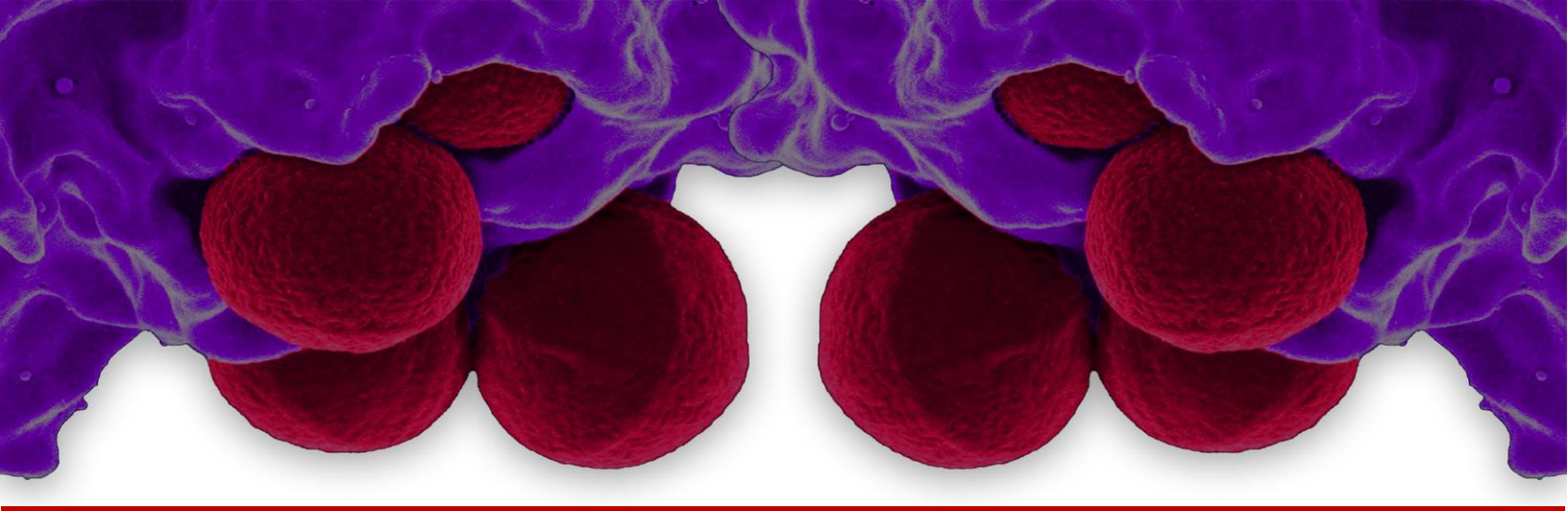
A systematic literature review of studies on antimicrobial stewardship (AMS) implementation has been conducted to investigate AMS strategies in acute care settings over the past 20 years. This review encompasses research conducted in acute care settings both prior to pandemic (PD) and during the COVID-19 pandemic (DP) on a global scale. The systematic literature review was registered with PROSPERO (registration number CRD42021242388) (York.ac.uk, 2022). The study has been successfully published in the PMC (PubMed Central) Journal.

A retrospective study

A retrospective study was undertaken at Bedfordshire Hospitals NHS Foundation Trust to assess antibiotic prescription patterns and AMS implementation before and during the COVID-19 pandemic. The study used medical records from adults aged 25+, pregnant women, and immunocompromised patients admitted in 2019 and 2020 with certain respiratory conditions. Exclusions included short A&E stays, non-prescription of antibiotics, and children. In total, 640 records (320 annually) were examined, each taking around 45 minutes. Data collection spanned 8 distinct periods, including four each from pre-pandemic and pandemic times. The review employed the PHE 'Start Smart - Then Focus' toolkit for validation.

A prospective survey study

A prospective survey study was conducted among healthcare professionals to gauge their understanding and perspectives on antibiotic prescription, AMR, and AMS during the COVID-19 era. The questionnaire was crafted from the PHE's report on secondary care hospital antibiotic prescriptions. The Royal Pharmaceutical Society and AMS pharmacists at the Trust validated the survey content. It targeted 240 healthcare professionals, specifically doctors, nurses, and pharmacists aged 25+. These professionals had to be registered with bodies like the GMC, GPhC, or NMC. Those lacking pandemic-era experience at the Trust were excluded. The chosen sample size ensured robust data collection for thorough analysis.



1- Key Findings from the systematic literature review

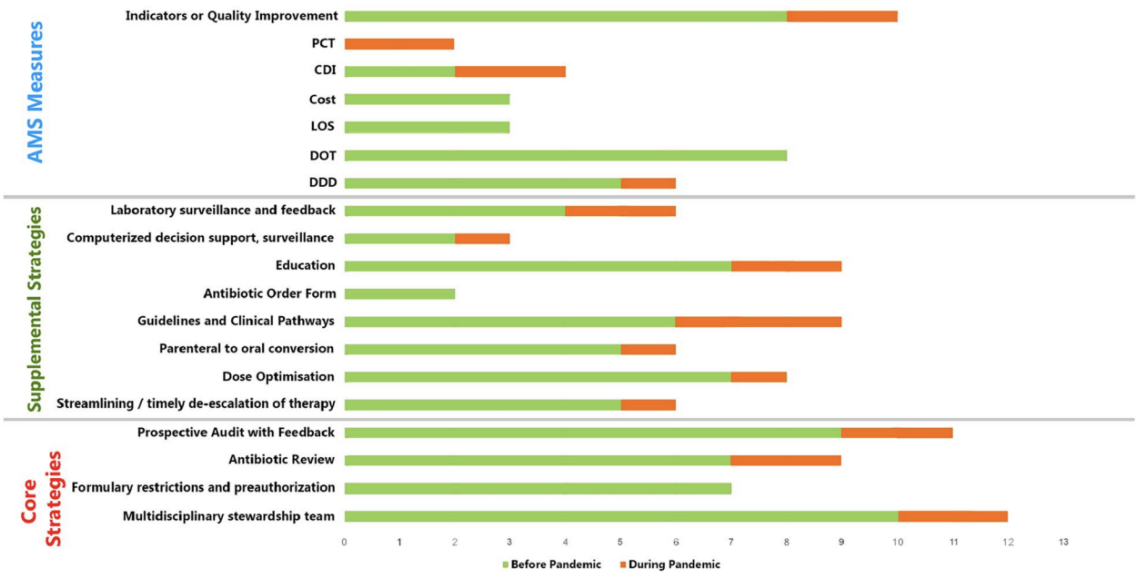
Key findings from the systematic literature review on impacts of COVID-19 on AMS implementation globally. The review analysed AMS strategies in acute care settings, comparing pre-pandemic and pandemic periods. The insights from the COVID-19 era emphasised the continued importance of AMS initiatives even post pandemic era. Key takeaways include:

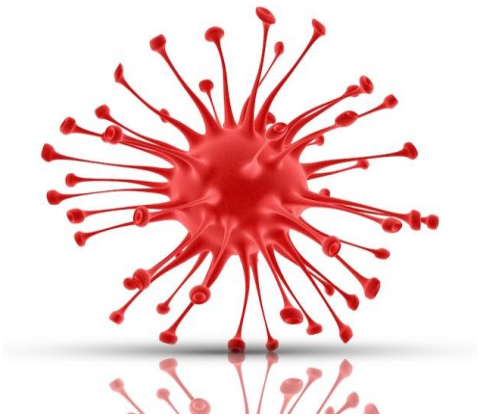
- A multidisciplinary team is essential for AMS structure and governance.
- For new stewardship programs, begin with core strategies and gradually incorporate supplemental ones.
- Hospitals should tailor AMS interventions based on local resources and expertise.
- Prospective audits and antibiotic reviews showed positive results in AMS implementation during the pandemic.
- Guidelines, clinical pathways, and education is vital for AMS success.
- National prescribing indicators, like the UK's National Action Plan, aim to reduce antibiotic use.
- New measures like Procalcitonin-guided antibiotic prescribing have proven effective.
- DDD and DOT are prevalent AMS measures, but standardization is required for comparative outcomes.
- Integrated tech support is crucial for sustained AMS and preparation for future emergencies.

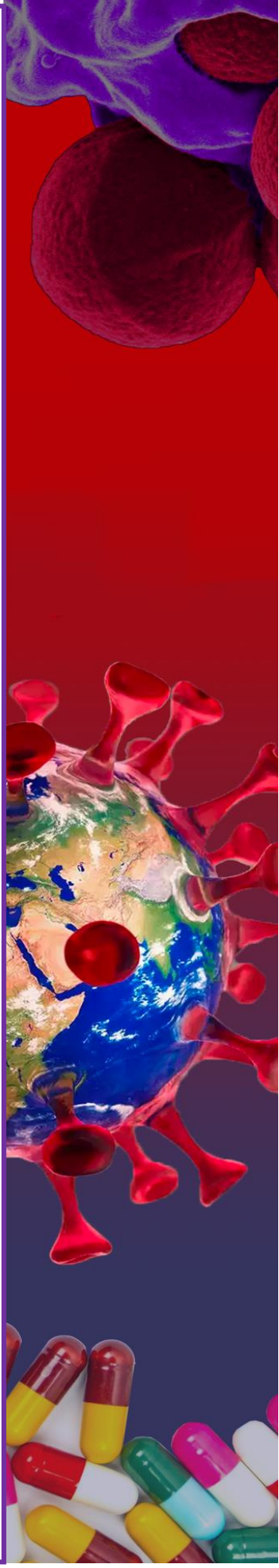
Summary of the Antimicrobial Stewardship Strategies and Measures from the Literature

- The Defined Daily Dose (DDD) is used globally to reflect antimicrobial usage, standardised by WHO as the average adult dose per day.
- DDD allows healthcare providers to calculate the total days of antimicrobial therapy by dividing the total used amount by the DDD for each drug.
- This standardisation enables comparison of antimicrobial usage across hospitals and countries.
- Hospitals should choose appropriate AMS metrics, considering the pros and cons of each, to ensure effective AMS implementation.
- Prior to the COVID-19 pandemic, DDD was referenced in five studies, Days of Therapy (DOT) in eight, Length of Stay (LOS) in three, costs in three, and Clostridioides difficile infection (CDI) in two.
- Quality Improvement indicators were noted in eight studies before the pandemic.
- During the pandemic, the use of DDD, CDI, Procalcitonin (PCT), and Quality Improvement indicators in studies dropped, with DDD featured in one study, CDI in two, PCT in one, and Quality Improvement indicators in two (Figure 6).

Figure 6. AMS before and during the COVID-19 pandemic in acute care settings (Total studies 13)







2- Key Findings from the Retrospective Medical Records Review Study

Summary of Results

- Community-acquired pneumonia (CAP) remained a prevalent diagnosis.
- COVID-19 pneumonia showed a statistically significant increase in 2020.
- Comorbid conditions as hypercholesterolemia and heart failure presented significant odds ratios, but there was no significant change in the duration of antibiotic therapy.

Increased Inappropriate Antibiotic Prescribing:

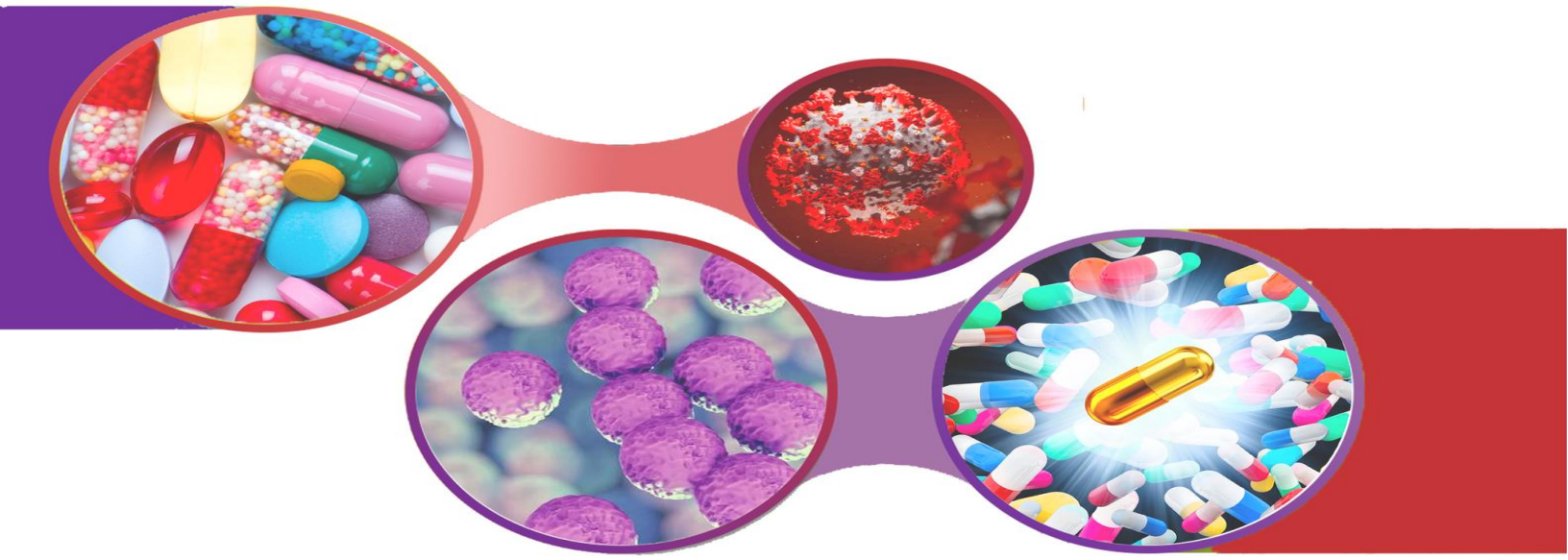
- Inappropriate antibiotic prescribing increased significantly during the COVID-19 pandemic compared to pre-pandemic for both pneumonia and upper respiratory tract infections.
- For pneumonia, inappropriate prescribing was 36.1% pre-pandemic and increased to 46.9% during the pandemic peak.
- Odds ratios indicated higher chances of 'Continue Antibiotics' and 'De-escalation' decisions during AMS interventions.

Factors Affecting Antibiotic Prescribing

- Factors associated with inappropriate prescribing included older age, presence of comorbidities, ICU admission, and pneumonia diagnosis.
- Unclear diagnoses at admission affected appropriate antibiotic choice, but laboratory tests showed no significant differences except for Chest X-ray findings for pneumonia, which were more notable during the pandemic.
- During the pandemic, antibiotic therapy was commonly not aligned with culture and sensitivity report recommendations, which require further training and education.
- Antibiotic review after 48-72 hours is pivotal, to maintain AMS implementation and improve antibiotic prescribing.

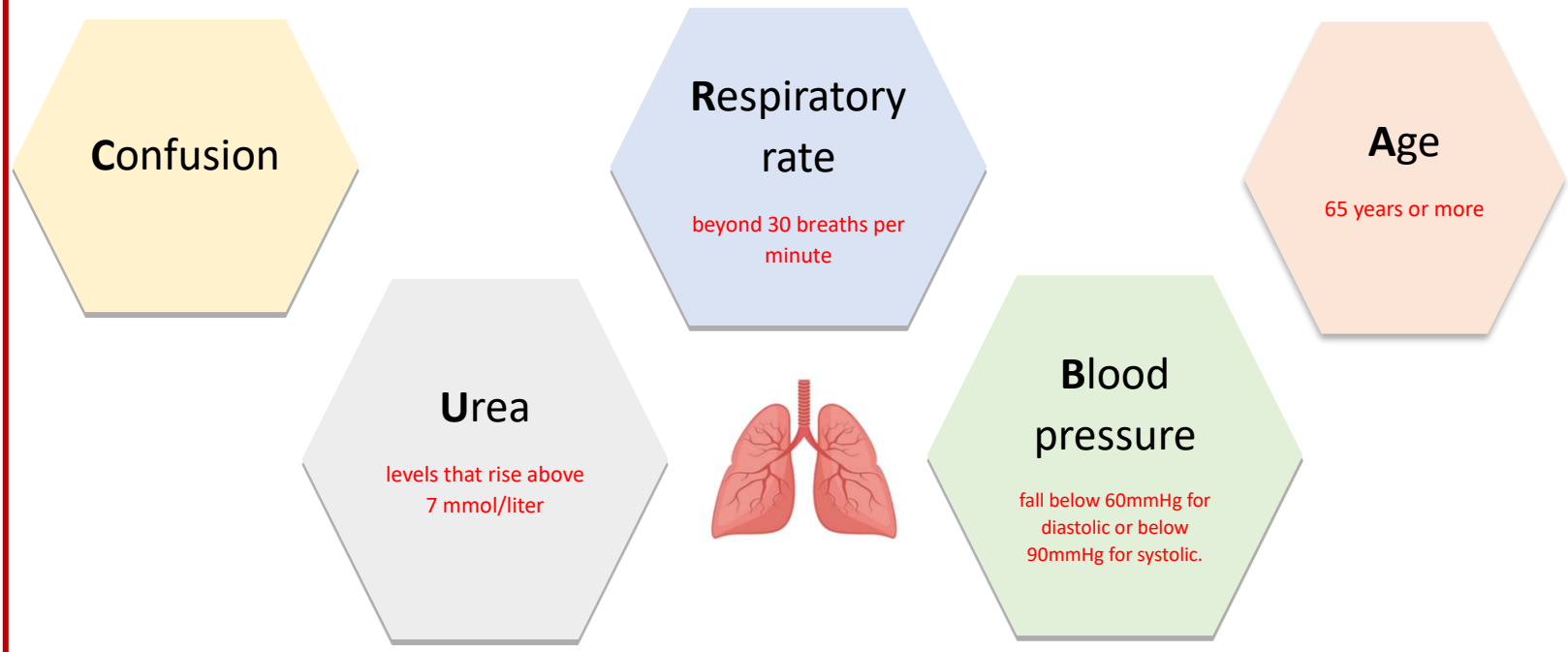
Generalisability of the Findings:

- The study setting, Bedfordshire Hospitals NHS Foundation Trust, suggests that the findings may be generalisable to other similar healthcare settings within the NHS system.



Antimicrobial Prescribing in Community-acquired Pneumonia

- The analysis revealed a tendency towards over-diagnosis of pneumonia. Community-acquired pneumonia (CAP) accounted for roughly 40% (128 out of 320) of prescribing indications in 2019, with a slight rise to 42% in 2020.
- The severity of CAP and the subsequent treatment approach is ascertained based on the **CURB65** score (Figures 7-8). Each of the ensuing prognostic indicators is allocated a **single point:**



In adult patients, the severity of CAP is appraised through clinical judgement, guided by mortality risk scores such as **CURB65 score:**

Figure 7. The CURB-65 Risk Assessment Framework for Community-Acquired Pneumonia

A CURB-65 score of 0 or 1 signifies low severity.

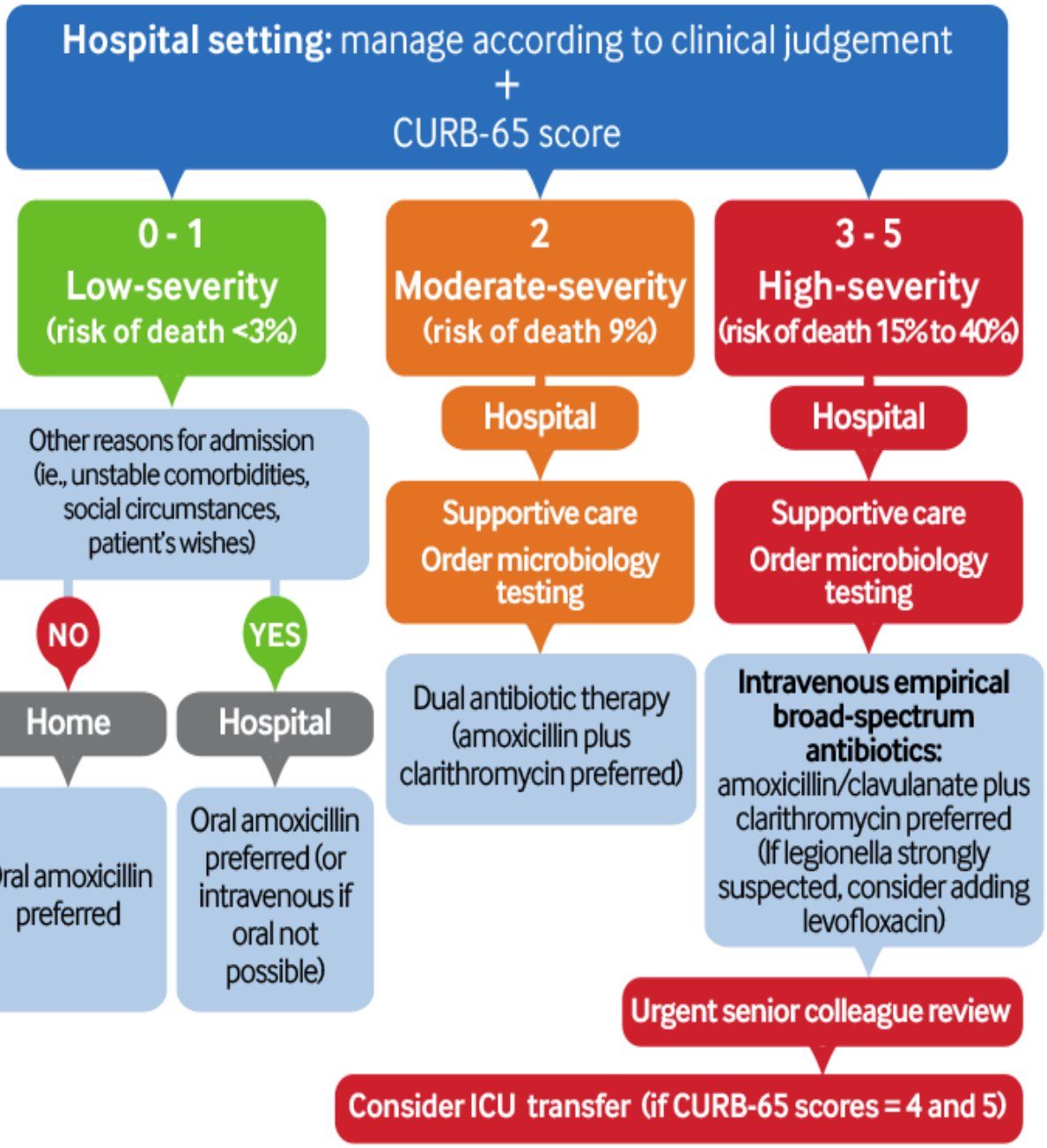
Moderate severity is associated with a CURB-65 score of 2.

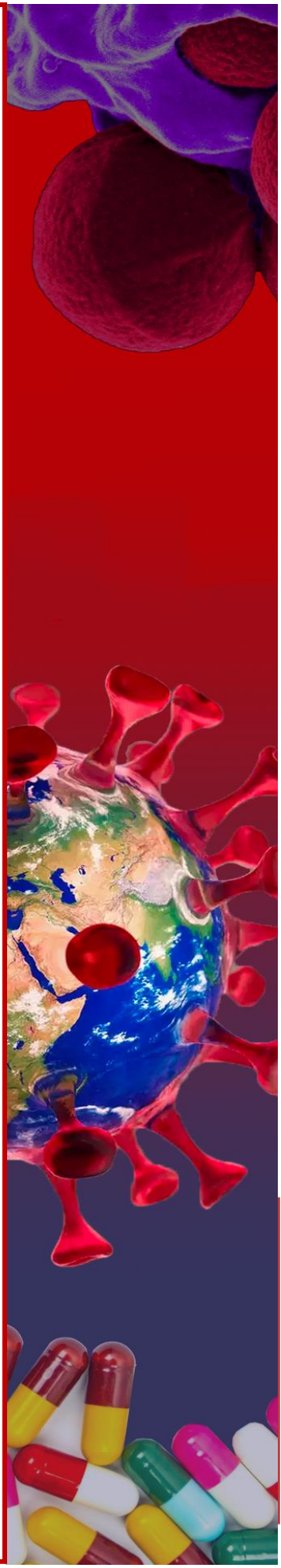
High severity is denoted by a CURB-65 score ranging from 3 to 5.

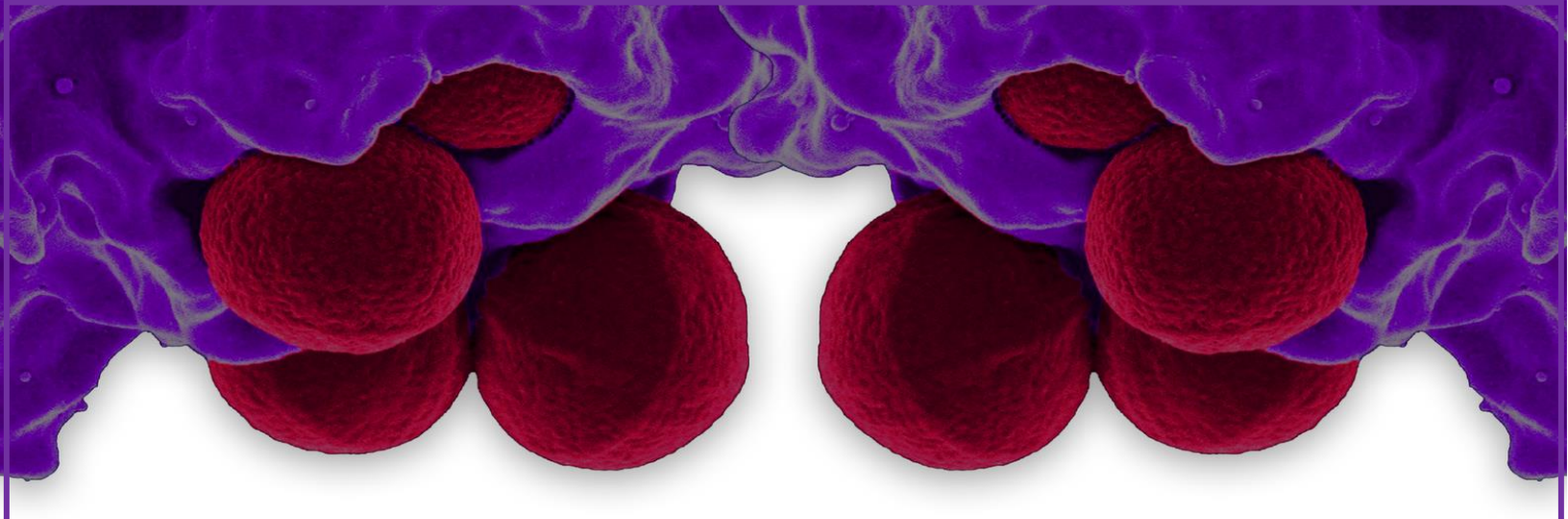
CURB-65	Clinical Feature	Points
C	Confusion	1
U	Urea>7 mmol/L	1
R	RR≥30	1
B	SBP≤90 mm Hg OR DBP≤60 mm Hg	1
65	Age>65	1

- The local antimicrobial guidelines, in conjunction with the National Institute for Health and Care Excellence (NICE), dictate that antibiotic prescribing for CAP according to the CURB-65 score (Bedfordshire, 2019).
- As such, the selection of antibiotics is escalated concomitant with an increase in the CURB-65 score. However, within the data procured from the study population, the CURB-65 score was only reported in three instances. This scarcity of data may potentially influence the appropriateness of antibiotic prescribing for patients diagnosed with CAP (NICE, 2016).

Figure 8. Risk assessment and management of CAP in the first 4 hours of admission in an acute care setting (Bestpractice.bmj.com, 2020)

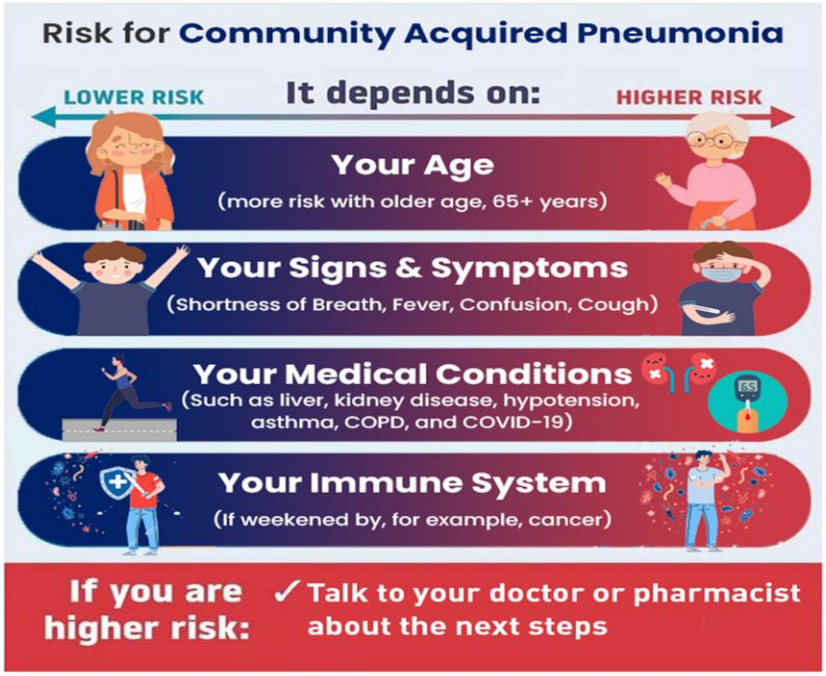






- Upon analysing the assembled data and the CURB-65 score, it was found that age of 65 or above, confusion, and hypotension were the most salient factors escalating the risk severity of CAP. Moreover, key symptoms upon admission, such as shortness of breath (SOB), fever, and cough, experienced an increase in 2020 compared to 2019. For instance, incidences of SOB rose to 33% (106 out of 320) in 2020, as opposed to the pre-pandemic level of 22.5% (72 out of 320) in 2019.
- Furthermore, the presence of other clinical conditions could influence the prescribing of antibiotics for CAP. Notably, respiratory conditions such as Chronic Obstructive Pulmonary Disease (COPD), Asthma, and COVID19 significantly impacted antibiotic prescribing patterns in 2020. Conditions that compromise the immune system, such as cancer, also play a pivotal role. Lastly, incidents such as accidental falls can exacerbate the severity of illness and consequently affect the appropriateness of antibiotic prescribing. However, it's essential to note that these findings necessitate further investigation to fully understand this complex issue.
- Public and Patient Involvement in promoting awareness and education regarding the risk of CAP is crucial. This poster is designed to help health professionals emphasize the importance of informing the public and patients about the risks and symptoms of CAP, with a particular focus on vulnerable populations (Figure 9)

Figure 9. Assessing Risk Factors for Community-Acquired Pneumonia: A Guide for Patients and Healthcare Providers



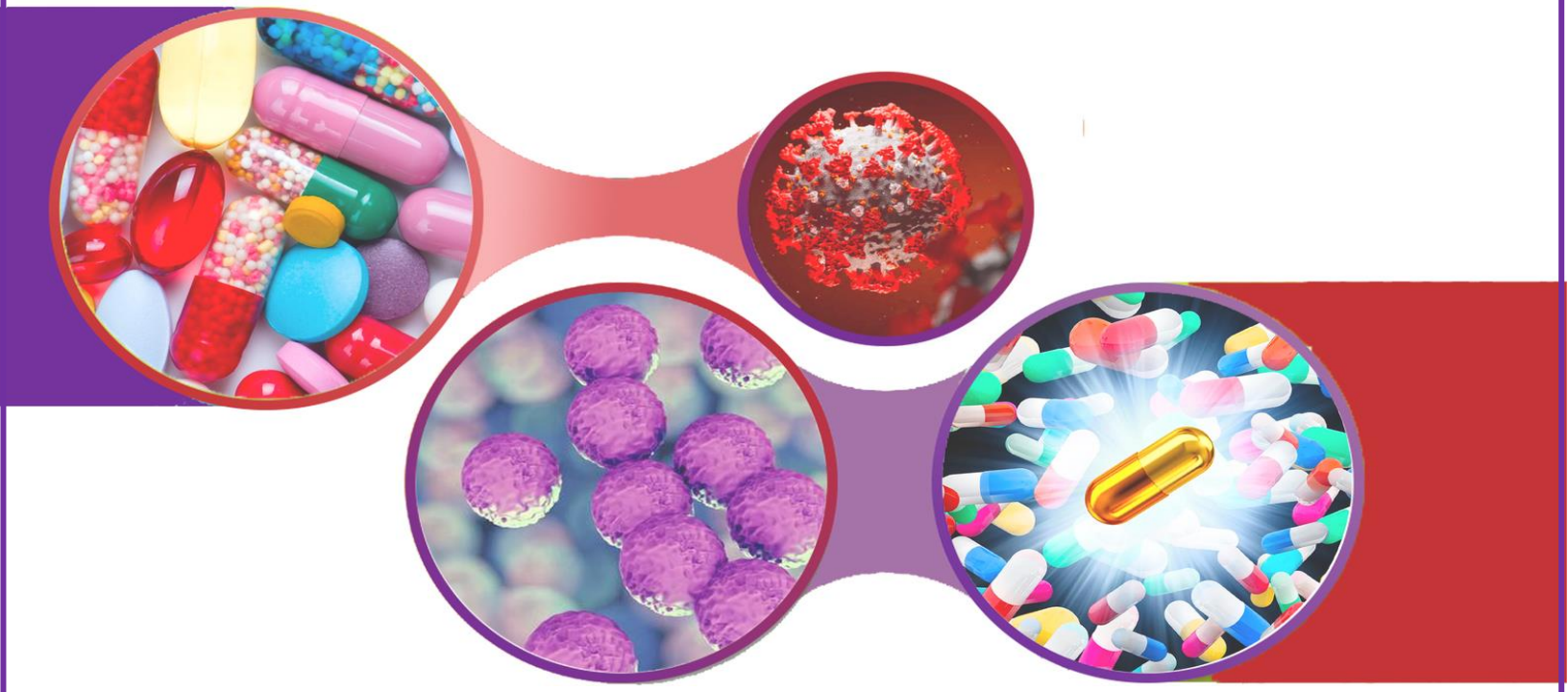
Antimicrobial Prescribing in Hospital-Acquired Pneumonia

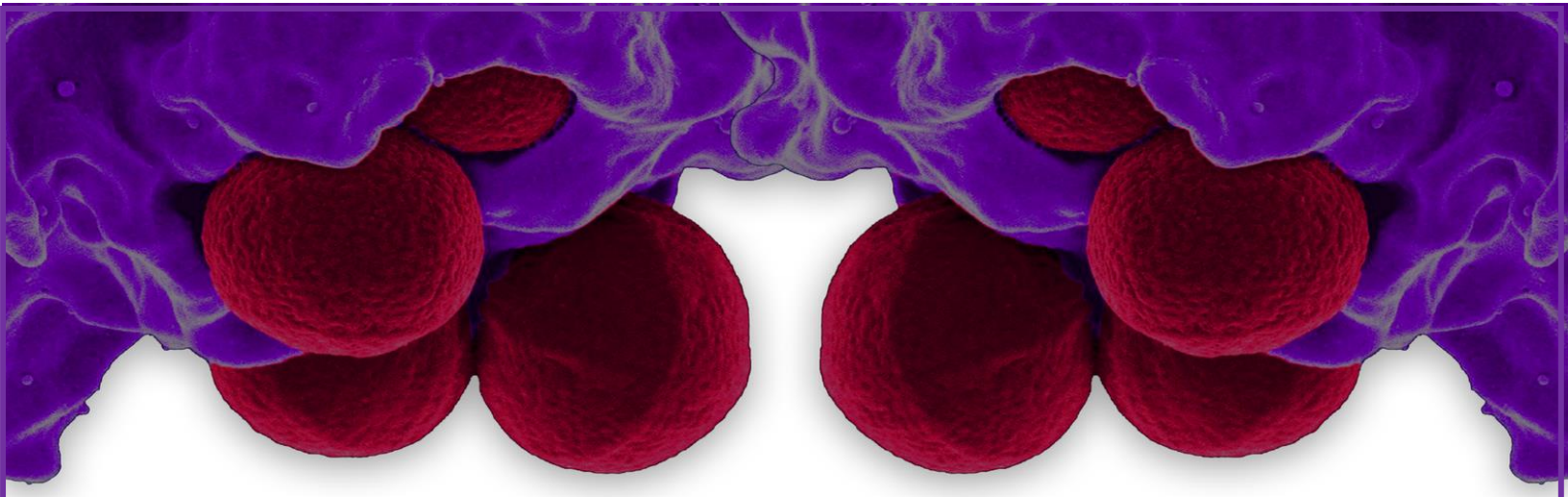
- Hospital-acquired pneumonia was the second most indication among the study population. It is a specific type of pneumonia that manifests 48 hours or more subsequent to hospital admission and was not in the incubation phase at the time of admission, background, prescribing considerations (NICE, 2019).
- According to local antimicrobial guidelines, **it is categorised into:**

1. **Early-onset** Hospital Acquired Pneumonia, which emerges **between 48 to 96 hours** from admission, with no prior antimicrobial treatment.

2. **Late-onset** Hospital Acquired Pneumonia, which appears **after 5 days** from admission or follows previous antimicrobial treatment.

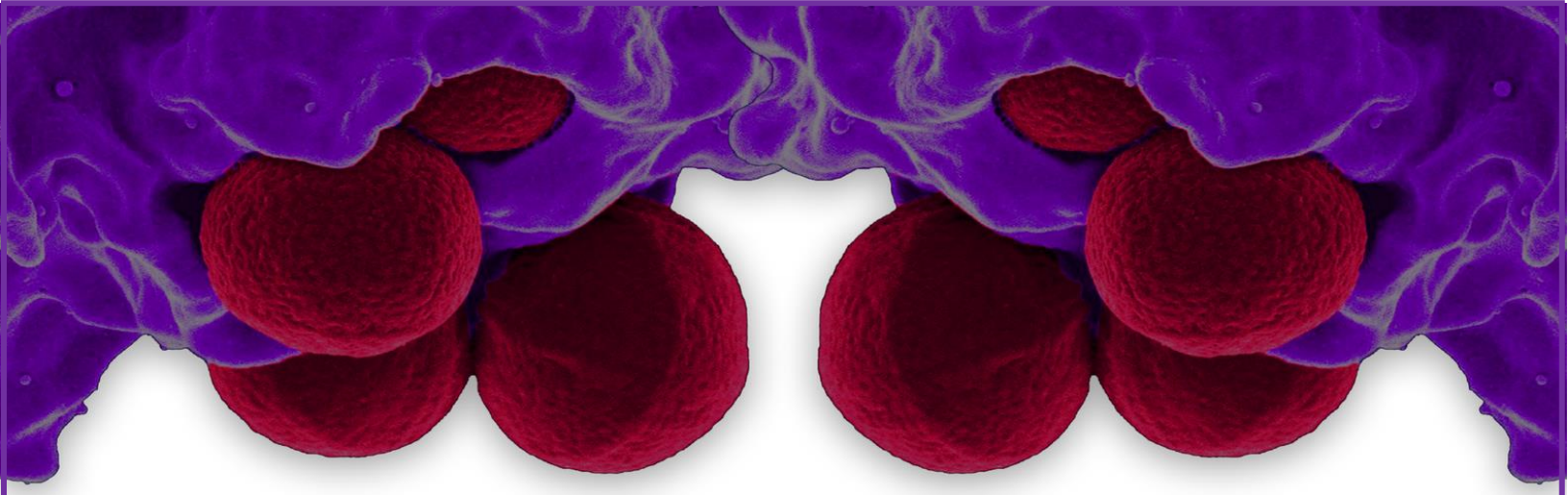
- The choice of antibiotics is contingent upon the classification of HAP. The antibiotics selection escalates with the increase in the patient's length of stay in the hospital.
- The analysis from this study has suggested that the incidence of Hospital-Acquired Pneumonia (HAP) saw a decline from 21% (equating to 67 out of 320 cases) to 16% (which represents 52 out of 320 cases) in the year 2020 (Table 4).
- Conversely, the prevalence of early-onset HAP was found to be 5% (equivalent to 5 out of 106 cases) among all the participants of the study. Nonetheless, the incidence of late-onset HAP was significantly higher, standing at 95%.





Further results have been evolved from the retrospective medical record review will be published soon, including:

- Prevalence of inappropriate antibiotic prescribing by indication.
- Prevalence of Healthcare-Associated Infections (HCAI).
- The Challenge and Risk of Interpreting Uncertain Diagnoses.
- Descriptive analysis of the prescribed antibiotics in 2019 and 2020.
- AWaRe Classification and Antibiotic Trends during the COVID-19 Pandemic.
- Defined Daily Dose (DDD) and trends of antibiotic prescribing in 2019 and 2020.
- The Seven Most Commonly Prescribed Antibiotics Before and During the Pandemic.
- Prevalence of Inappropriate Antibiotic Prescribing and the Impact of COVID-19.
- Factors Affecting Inappropriate Antibiotic Prescribing, such as IV-to-Oral Switch, Antibiotic allergy.



3- Key Findings from the Prospective Survey Questionnaire Study

1. Awareness and Education on AMS: There's a critical need for enhanced awareness and education on AMS interventions, especially concerning the use of 'IVOS', 'De-escalation', and 'Stop' strategies in antibiotic use. Healthcare professionals demonstrated good overall knowledge related to antimicrobial resistance, however, AMS attitudes and perceptions require further training and education.

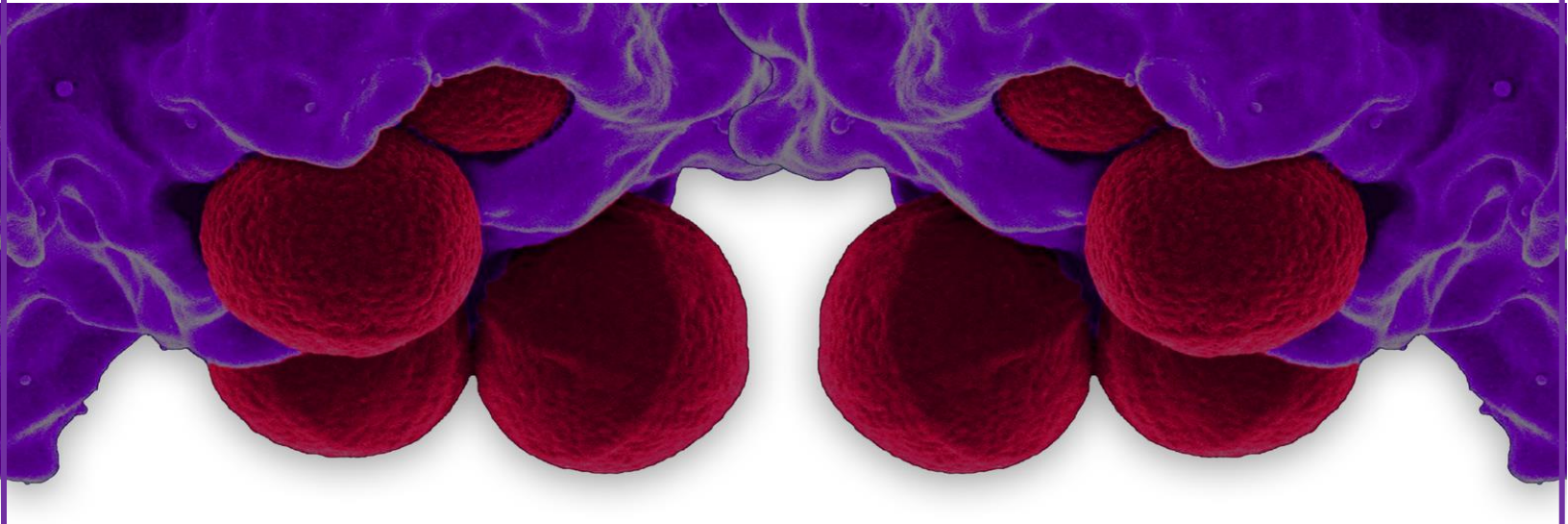
2. The Pivotal Role of Pharmacists in AMS: It is interesting to note that pharmacists possess a strong foundation of knowledge, as well as positive attitudes and perceptions toward antibiotic prescribing and AMS practices. This highlighted the essential role pharmacists play in co-leading AMS implementation alongside microbiology teams, thereby fostering interprofessional collaboration that facilitates appropriate antimicrobial use.

3. Impact of COVID-19 on AMS: AMS interventions, including ward rounds, education, guidelines, and auditing, experienced significant disruptions due to the negative impact of the COVID-19 pandemic.

4. Barriers and Adaptations in AMS: A profound understanding of healthcare professionals' perceptions and the factors affecting AMS implementation is necessary. Perceived barriers to optimal stewardship including workload % time constraints. COVID-19 impacted AMS activities, such as ward rounds, audits, and education, may have long-term effects on AMR trends.

5. Educational Initiatives and Targeted Interventions: The study identified a lack of robust educational programmes on AMS and a need for targeted interventions, especially for healthcare professionals lacking in specific AMS-related knowledge and practices. However, pharmacists showed the highest knowledge levels, for this reason, their role in maintaining AMS implementation is pivotal.

6. The Future of AMS Post-Pandemic: Innovations in educational resources, awareness, & collaborative efforts crucial to support AMS practices in the post-pandemic era. Additionally, supporting role of pharmacists in domain is essential, particularly in preparing for any future emergencies or crises, to sustain responsible antibiotic use & mitigate the threat of AMR, thereby safeguarding patient lives.



INNOVATIVE Survey Dissemination at Bedfordshire Hospitals NHS Foundation Trust:

- Special thanks to the R&D department at Bedfordshire Trust for their recommendation to employ innovative methods in the survey distribution, which helped to boost participation among HCPs (Figure 10). Collaboration among the R&D team, AMS pharmacists, and the microbiology consultant was key in using a variety of distribution channels, such as:

1. **Email invitations sent to group lists of pharmacists, doctors, and nurses.**
2. **Survey posters placed strategically in wards, medicine trolleys, nurse stations, MDT rooms and notice boards.**
3. **Inclusion in the weekly newsletter circulating the survey link/package.**
4. **Select optimal distribution times - early morning, lunchtime, and after duty.**
5. **Participants could withdraw before submitting, but responses were anonymised after.**
6. **Efforts made to ensure confidentiality and consistently encourage participation.**
7. **Emails AMS pharmacists and newsletter reminders by "Communication Team' before the survey closed.**
8. **WhatsApp, emails, and other channels are also used to disseminate the survey link among HCPs.**
9. **Multi-modal distribution strategies aimed to optimise survey participation.**

Figure 10. Innovative Distribution Strategies in Antimicrobial Resistance Survey Distribution in the Trust.

Maximising Survey Participation: Novel Distribution Strategies in Antimicrobial Resistance (AMR) Research

Notice boards (pharmacy board, doctor board)

Staff rooms (MDT rooms, doctor rooms, nurses rooms)

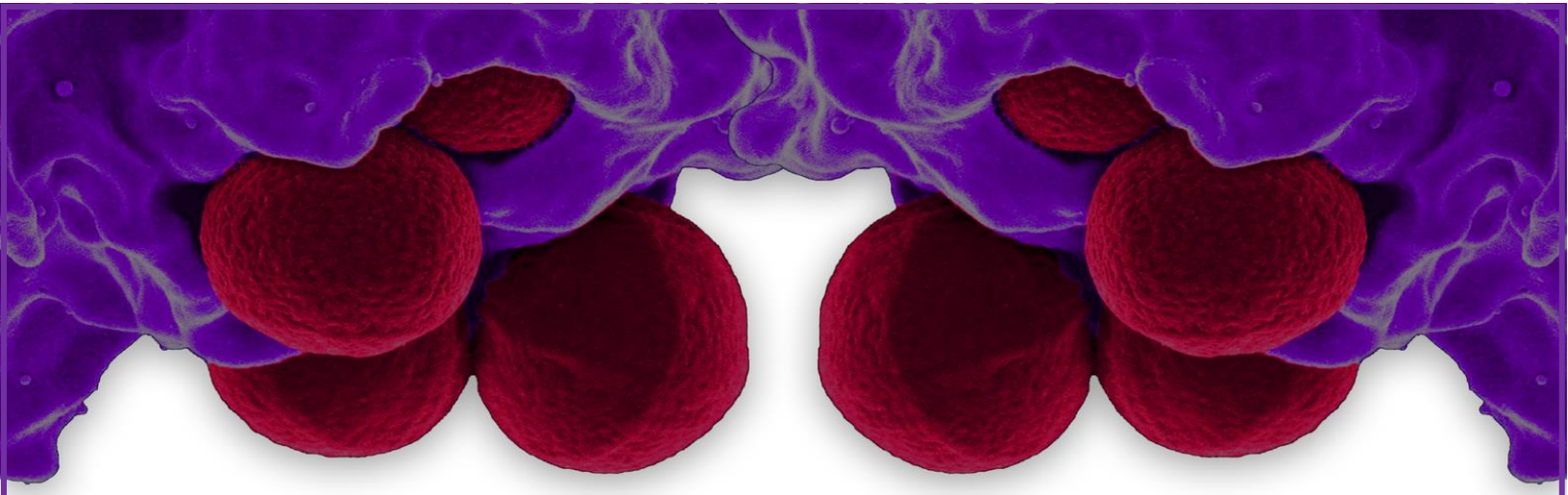
Clean rooms in the wards (medicine room, clean room, treatment rooms)

Desktop Computers (mouse pads, infront of the computers)

Medicine trolleys in the bays of the wards

Nurses' stations

This poster showcases innovative strategies for increasing participation in Antimicrobial Resistance (AMR) research surveys across various hospital locations. By strategically placing posters in high-traffic areas such as MDT rooms, staff, and treatment rooms, notice boards, and nurses' stations, visibility is maximized. The creative use of mouse pads and prominent displays in the pharmacy enhances engagement, demonstrating a collaborative effort to spread awareness and gather data for AMR research.

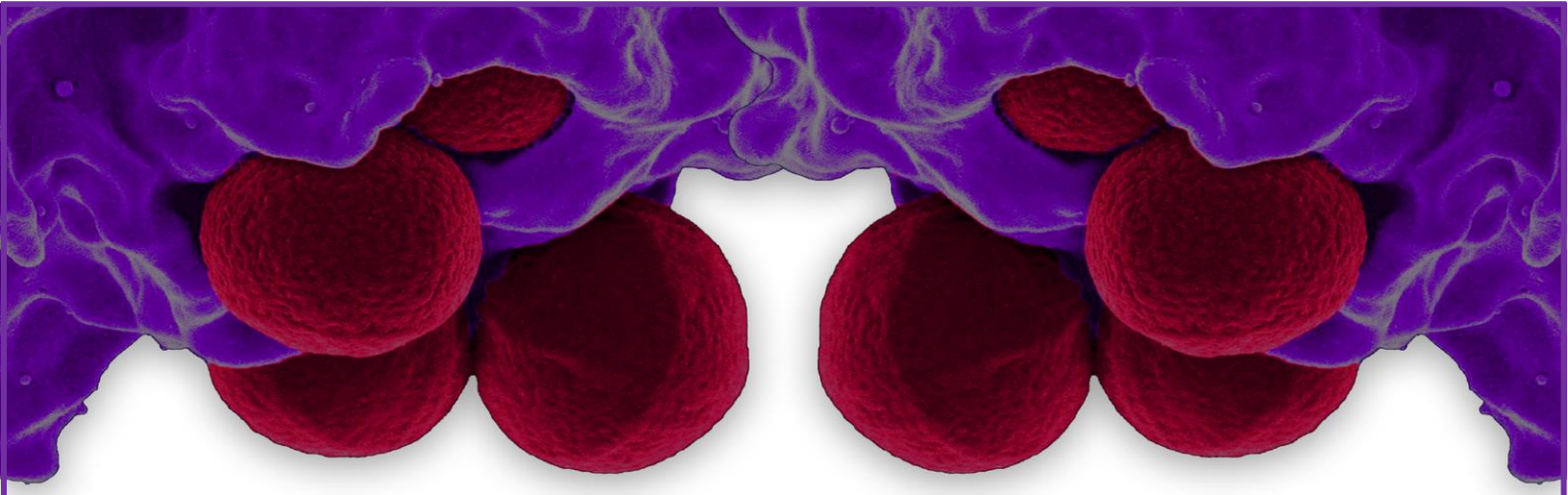


Highlights of the survey questionnaire study results

1. The survey highlights the need to increase awareness and knowledge among healthcare HCPs towards antibiotic prescribing through positive attitudes and effective practices.
2. Factors such as age, gender, background, and experience influence knowledge, attitudes, and practices (KAP).
3. Lack of robust AMS education and training worsens AMR. Establishing impactful educational initiatives is critical.
4. The survey provides new insights into COVID-19's impacts on antibiotic prescribing, AMR, and AMS activities.
5. Significant disruptions occurred in AMS ward rounds, audits, and education during the pandemic.
6. Consequences of decreased AMS on rising AMR may become apparent in coming years, requiring vigilant monitoring.
7. The pandemic highlighted the importance of innovative tools, education, awareness, and collaboration to strengthen AMS and pharmacists' roles in the future.

Overall

The preceding **THREE** studies emphasised the critical need to tackle the rise in inappropriate antibiotic usage, highlighting the necessity for effective AMS strategies and education. This is particularly urgent given the COVID-19 pandemic's significant disruption of prescribing habits and AMS efforts.



Recommendations from This Research Project

Healthcare Policy

- Establish AMS multidisciplinary committees in each Trust.
- Regularly update local antibiotic guidelines based on antibiograms and surveillance.
- Conduct regular AMS ward rounds with effectiveness measures.
- Provide training to enhance AMS skills of healthcare professionals.
- Promote research into AMS interventions.
- Develop connections between secondary and primary settings.
- Incorporate AMS measures into electronic prescribing systems.
- Promote AMS auditing tools as the Start Smart Then Focus.

Academic

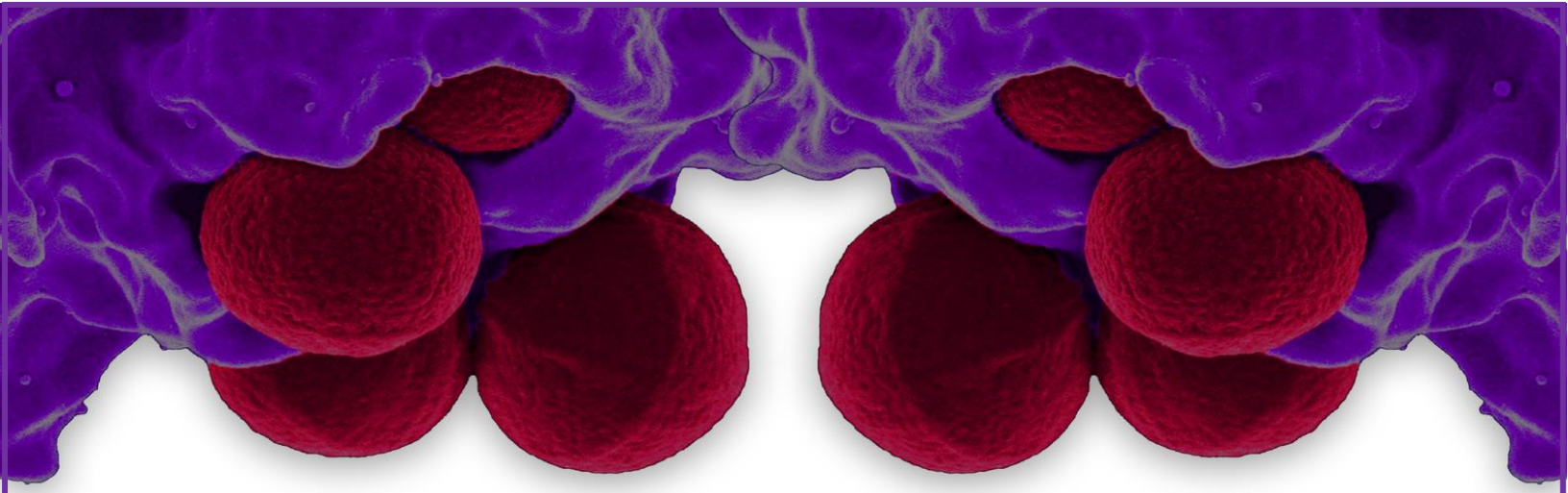
- Incorporate AMS into undergraduate curricula for medicine, pharmacy, nursing.
- Promote interprofessional AMS education at the undergraduate level.
- Develop AMS curricula for postgraduate and continuing education.
- Establish AMS-focused registration programs.
- Encourage AMS professional development and use of metrics.

Clinical Practice

- Designate AMS leads/teams and identify barriers.
- Conduct regular antibiotic reviews and AMS ward rounds.
- Promote antibiotic reviews at 48-72 hours and 5-7 days post admission.
- Improve documentation of AMS interventions and diagnosis.
- Develop local antibiotic policies aligned with guidelines and antibiograms.
- Make local antibiotic guidelines easily accessible through digital methods.
- Note prior antibiotic use from primary care in hospital systems - Emphasise patient empowerment and public involvement.

Public Health

- Conduct public campaigns to increase AMS/AMR awareness year-round.
- Cultivate patient/public advocacy and involvement in AMS.
- Provide AMS/AMR educational materials in healthcare facilities and waiting areas.
- Incorporate AMS information and updates on hospital websites.

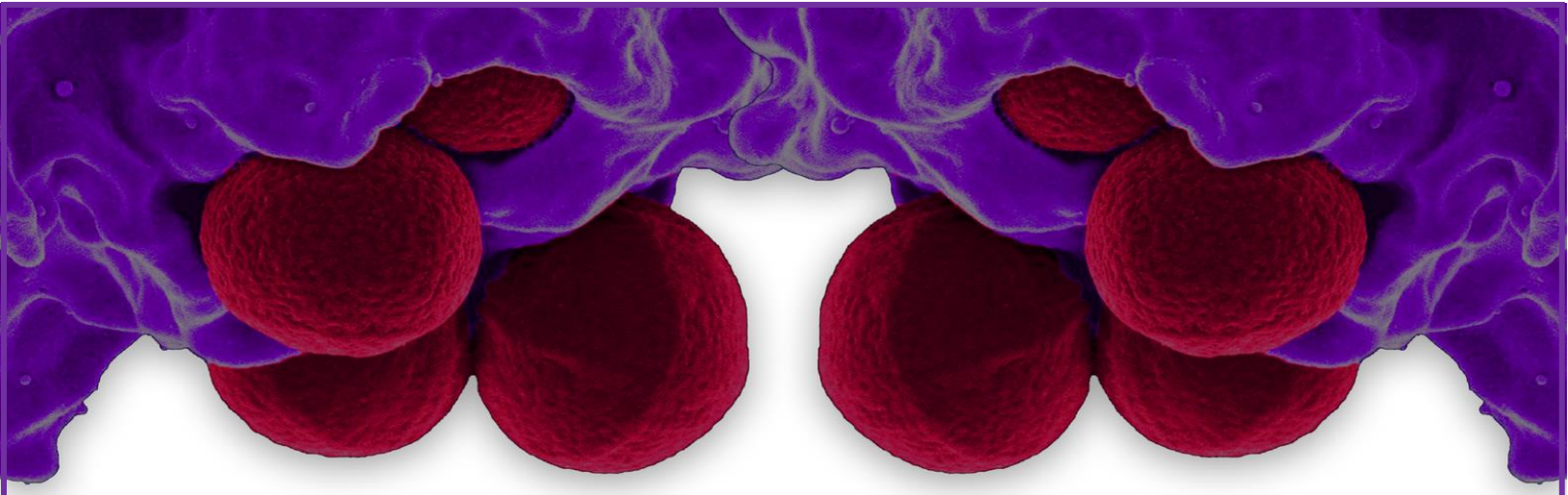


Research Project Outputs

1- Antimicrobial Stewardship Roadmap

- **AMS Gap Analysis Tool**: Identifies strengths and weaknesses in current antimicrobial practices to target areas for improvement.
- **AMS Strategic Plan**: Develops a comprehensive vision and objectives for stewardship based on gap analysis findings.
- **Action Plan**: Translates strategic vision into concrete initiatives and steps, supported by scientific evidence.
- **AMS Toolkit:** Provides resources and tools to support the implementation of the action plan, promoting judicious antibiotic use.

- **AMS Implementation:** Executes the action plan, applying interventions to promote optimal antibiotic prescribing practices.
- **AMS Measures:** Utilises dashboards, metrics, and KPIs to evaluate the effectiveness and sustainability of AMS interventions.
- **Continuous Improvement Cycle:** Allows for reassessment and re-evaluation to maintain the relevance and effectiveness of AMS implementation.
- **AMS Training Program**: Proposes ongoing education and training for healthcare professionals to sustain and improve AMS practices.
- **Challenges and Adaptation:** Acknowledges the impact of crises as COVID-19 pandemic on AMS and the need for adaptive strategies.
- **Communication and Education:** Highlights the importance of sharing AMS progress and education with both healthcare professionals and the public for broader awareness.



Research Project Outputs

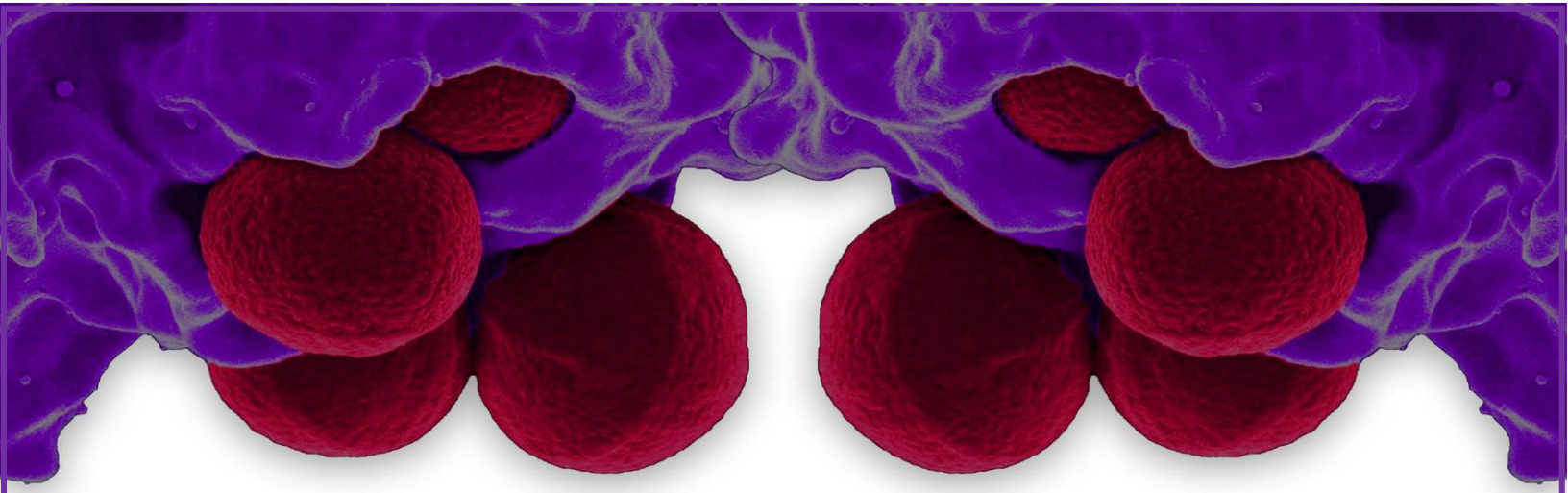
2- Antimicrobial Stewardship Dynamic Dashboard:

- **AMS and Antibiotic Prescribing:** Essential for assessing AMS impact and benefits for patients. Measurements serve as KPIs, quality assurance, and improvement tools.
- **Data Extraction and Dashboard Utility:** AMS Dashboard supports consistent assessment and identifies improvement areas.
- **Impact of COVID-19 on AMS:** The pandemic affected AMS education and audit feedback negatively. Rise in broad-spectrum antibiotics use, HCIs and resistance concerns.
- **Importance of the Dashboard:** Facilitates smart starting with broad-spectrum antibiotics when necessary. Supports targeted treatment based on clinical evidence.
- **Dashboard Contents:**

1. Selection Filters: Interactive controls for data segregation (by month, main diagnosis, wards).
2. Hospital Admissions: Bar graphs for age groups and diagnoses.
3. Antibiotic Allergies and Prescriptions: Graphs and charts for allergies and prescription frequency.
4. AMS Interventions: Visuals on interventions and antibiotic review frequency.
5. Professional Reviews: Pie charts roles in antibiotic reviews

- **Features of the AMS Dashboard:** Real-time visualization for immediate action and promotes informed decision-making by hospital leadership.
- **Targeted Therapy and Length of Stay:** Details interventions and antibiotic use during hospital stay and upon discharge and provides insights into patient hospital stay duration.
- **Persistence of AMS Principles:** Necessary across hospital sectors during and post-pandemic, and aids in maintaining AMS practices during emergencies.

The description provided offers a comprehensive overview of the functionalities and the significance of the Antimicrobial Stewardship Dynamic Dashboard, underpinning its role in enhancing antimicrobial usage, supporting AMS initiatives, and addressing challenges in antibiotic prescribing practices, especially in the context of the COVID-19 pandemic.



Research Project Outputs

3. Antimicrobial Stewardship Comprehensive Training Program

Background and need for AMS Education:

- Recent studies indicate challenges in AMS education during the COVID-19 pandemic.
- There is a noted rise in inappropriate antibiotic dosing and a decline in adherence to prescribing guidelines.
- The course is designed to address educational gaps and improve stewardship practices.

Course Structure:

- Integrates insights from key studies on AMS practices during the pandemic.
- Provides a step-by-step guide through the AMS Roadmap for strategy implementation.

Educational Framework:

- Based on the "Start Smart, Then Focus" toolkit and the UK AMR 5-year action plan.
- Aimed at comprehensive understanding and application of AMS strategies.

Course Aims: To develop AMS knowledge applicable across health systems. To empower learners to lead AMS interventions. To promote systematic patient management approaches.

Proposed Outcomes:

- Ability to apply AMS strategies against AMR.
- Skill to assess and improve AMS practices.
- Competence in managing infectious conditions using current guidelines.
- Capability to use AMS tools for stewardship and quality improvement.

Learning Topics: 20 'Essential' topics covering a comprehensive AMS framework. Learning topics are detailed in the course material.

Target Audience: Healthcare professionals, including pharmacists, doctors, nurses, and AMS leads.

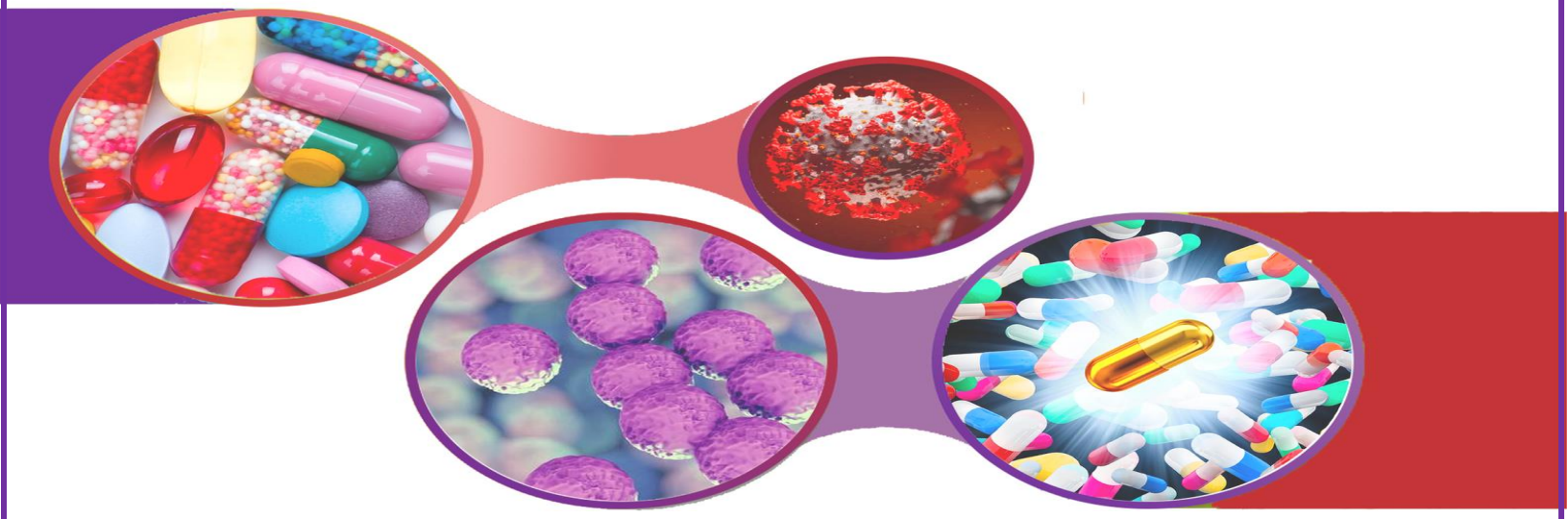
Accreditation and Learning Methodology: Proposed to be CPD accredited for practical workplace application. Project-based learning module for peer collaboration and engagement.

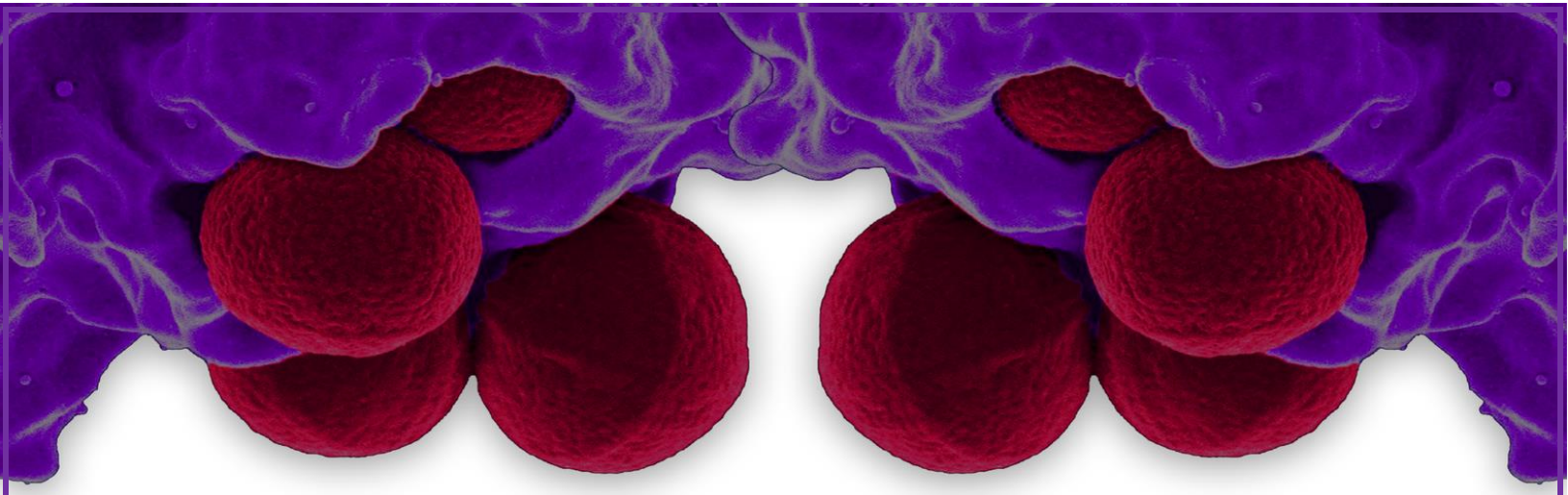
Delivery and Support: A blended learning approach with face-to-face and self-directed modules. Includes case-based discussions and learner support systems.

Research Project Outputs

4. Antimicrobial Stewardship Card

- Utilisation of a QR code for the survey questionnaire study, prominently displayed for HCPs, as an essential contribution to the research project's success provide an impressive outcome.
- The presence of mobile tools, internet resources, and hospital systems notwithstanding. However, the high workload and numerous distractions call for an easily accessible AMS card as a potential practical solution.
- The AMS card could aid in enhancing antibiotic prescribing practices and streamline the implementation of AMS.





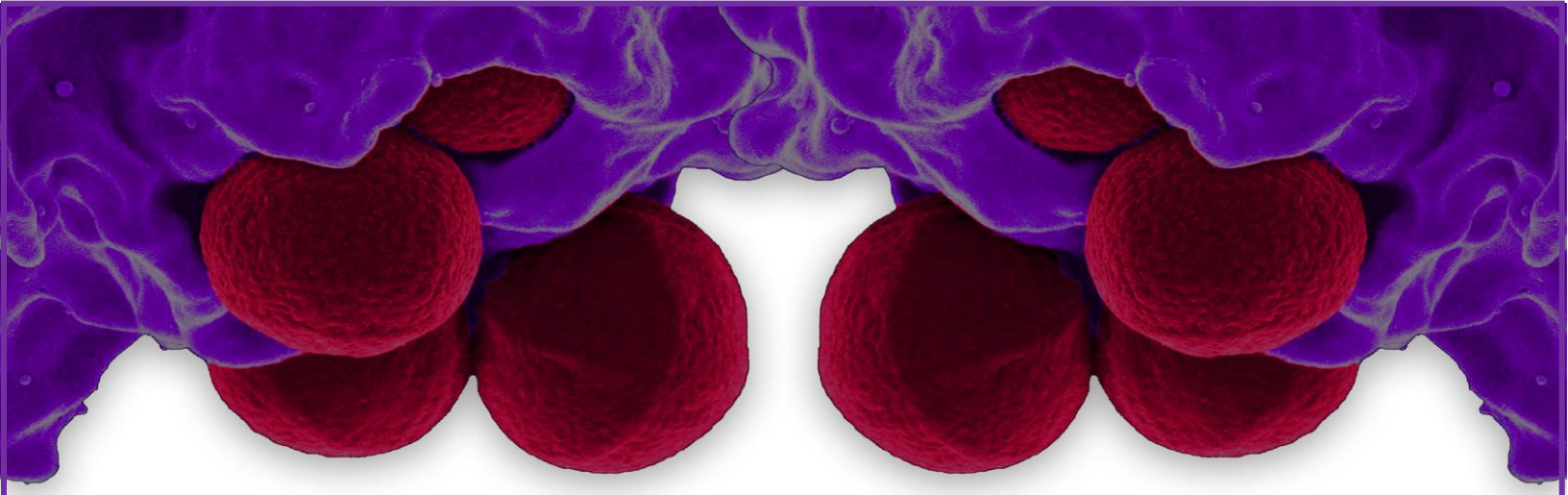
Pharmacist Role in Antimicrobial Stewardship

Pharmacists in AMS: Critical Contributions in Implementation

- Results from these three studies elucidate the role of pharmacists in AMS implementation and emphasise the importance of involving pharmacists in the AMS multidisciplinary team.
- Their role in co-leading AMS alongside microbiology and in AMS advisory committees is highlighted. Pharmacists also require an intensive and comprehensive AMS training program to prepare them to lead AMS implementation, share results with health professionals, and effectively utilise the AMS dynamic dashboard. This will enable them to visualise AMS practices on a frequent basis, share results with hospital leaders, and contribute to the national AMR action plan. Pharmacists need a toolkit, education, and skills that equip them to spearhead AMS implementation.
- The tools produced from this research project could enable pharmacists to excel in their workplace.
- This includes a roadmap for AMS implementation tailored for HCPs and health systems, guidance on using the dynamic dashboard, a comprehensive training program, and the AMS Card. The findings from these three studies highlight the pivotal role of pharmacists in co-leading AMS implementation, especially during the pandemic.

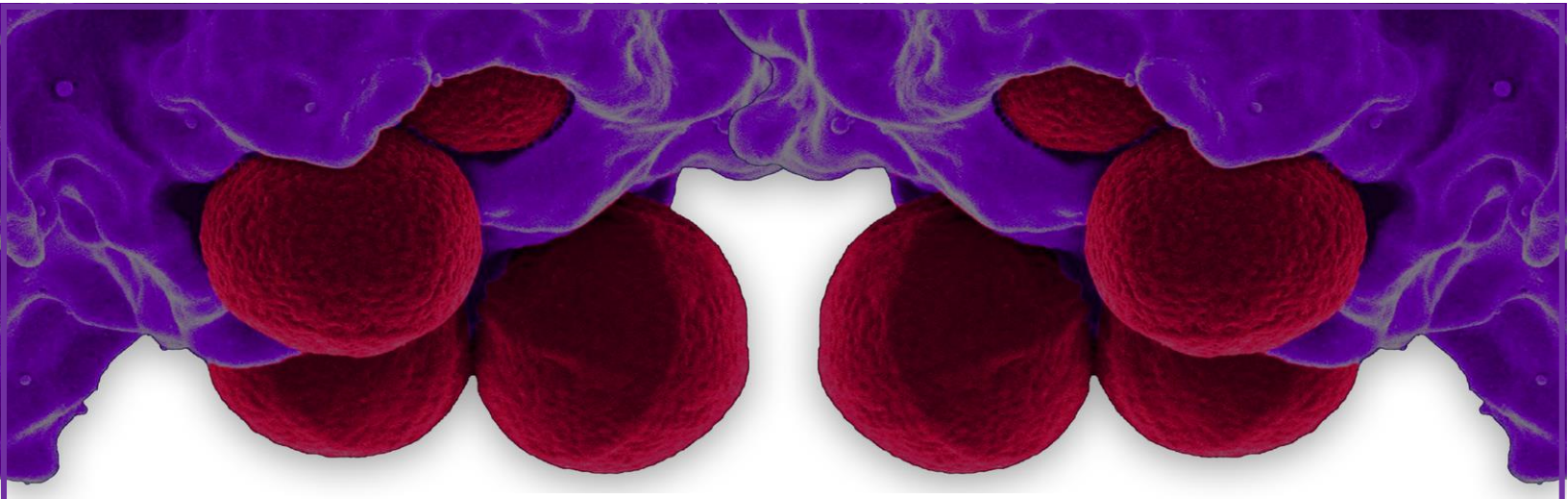
Pharmacists' Role in AMS Implementation in the Post-COVID-19 Era

- Certainly, the indispensable roles of pharmacists will continue even after the COVID-19 world. They will follow the gradual return to everyday life carefully and continue improving global health so the world can rebuild trust and return to interconnectedness as before.
- In the post-COVID-19 world, pharmacists play an increasingly vital role in AMS implementation. Their contributions have become even more essential given the pandemic's emphasis on effective antimicrobial use and the dangers of AMR.
- As the world transitions back to normal, pharmacists collaborate more with multidisciplinary teams to enhance AMS practices, maintain appropriate antibiotic prescribing, and judicious antibiotic use. AMS efforts in the future.



Future Research

- Future research is required to investigate practically the effect of AMS implementation post pandemic, to make sure of preparedness for any future or upcoming crisis.
- Future survey is also required to explore HCPs attitudes and perceptions after comprehensive training and education and AMS implementation.
- Investigate the long-term and short-term impacts of AMS globally, especially on clinical and non-clinical outcomes, as well as its efficacy in mitigating AMR and protecting patients.
- Regularly review and update antimicrobial medicine guidelines in line with national guidelines, surveillance reports, and local antibiograms.
- Explore the suitability of AMS implementation across different healthcare settings.
- In the UK, focus AMS research on interventional aspects such as evaluating pre- and post-implementation impact and designing AMS dashboards.
- Assess AMS impact on economic, clinical, and resistance outcomes like reduced hospital stays, decreased infections, and lower antibiotic-resistant bacteria.
- Expand AMS surveys to hospitalized children and their caregivers to understand perspectives on post-discharge antibiotic use.
- Measure AMS program effectiveness through further surveys on AMS practices and prescribing patterns after implementation.
- Conduct discussions on AMS implementation to foster acceptance into national action plans, and continually evaluate AMS interventions like IV-to-oral switches.
- Identify the most effective AMS education methods to increase engagement and mitigate AMR.
- Evaluate virtual vs. in-person AMS education and virtual AMS interventions to ensure sustainability during crises.



CONCLUSION

- This research provided an in-depth understanding of antimicrobial stewardship and factors affecting inappropriate antibiotic prescribing in acute care settings, including understand the impact of COVID-19 pandemic on antibiotic prescribing, and lessons learnt from the COVID-19 pandemic, in order to improve antibiotic prescribing and mitigate the antimicrobial resistance challenge, and be prepared for any future or upcoming emergency or crisis.
- This research project stressed on the effectiveness of audits, feedback, and antibiotic reviews. Despite disruptions, maintaining guidelines and education proved critical for AMS continuity. Emphasis on computerised systems, AMS champions, and addressing prescribing influences was highlighted.
- Findings reveal a knowledge gap in AMS among healthcare professionals, particularly doctors and nurses, and the need for enhanced educational programs.
- Additionally, this research showed the pivotal role of pharmacist in AMS implementation and education.
- The study advocates for strengthened AMS through regular measures, and a strategic roadmap.
- It calls for collaborative efforts across the healthcare spectrum to combat antimicrobial resistance, ensure responsible antibiotic use, and sustain AMS amidst future challenges.

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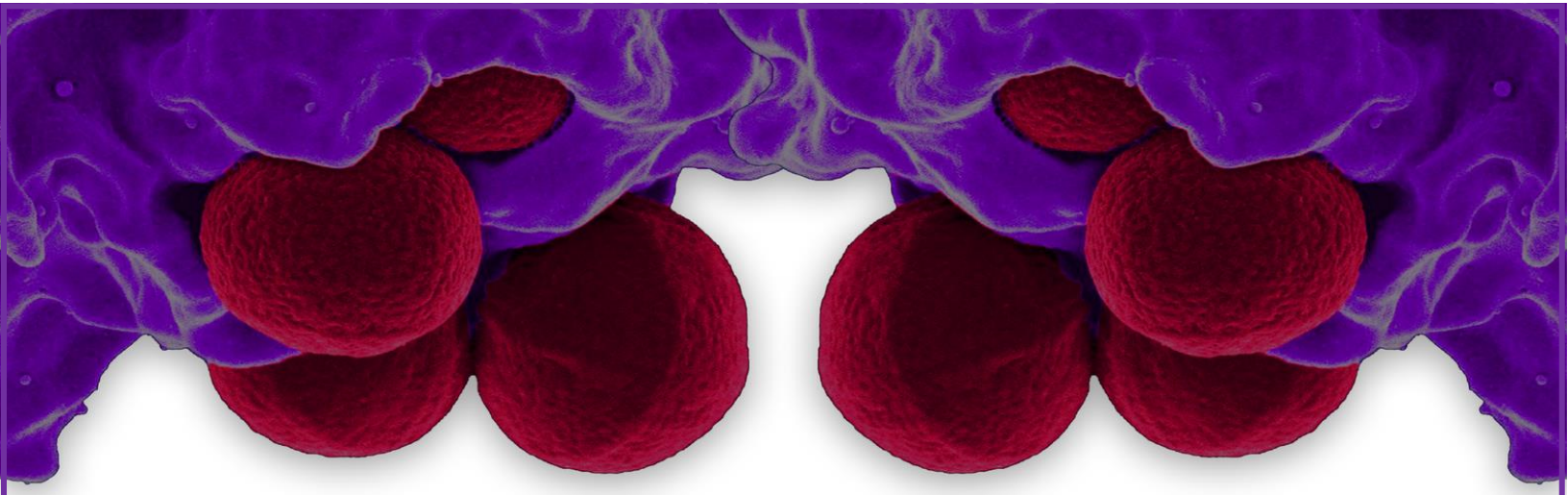
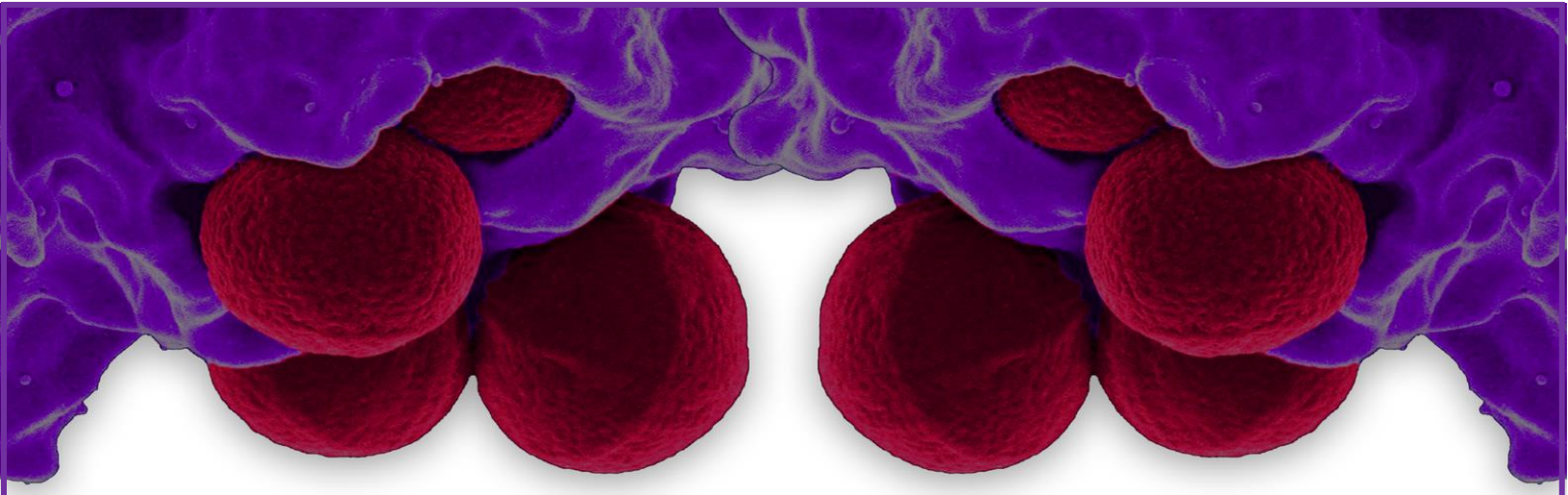
Dissemination of this Research Project

- An investigation into the effectiveness of antimicrobial stewardship during a pandemic- COVID-19 in acute care setting: Published in Prospero.
- Antimicrobial stewardship before and during the COVID-19 pandemic: Published ISRCTN Medicine Blog.
- Antimicrobial stewardship implementation before and during the COVID-19 pandemic in the acute care settings: A systematic literature review.
- Antimicrobial Stewardship Implementation Before and During the COVID-19 Pandemic in Acute-care settings: Published in Springer Community related to the United Nations sustainable goals.
- Antimicrobial stewardship implementation before and during the COVID-19 pandemic: Published in WHO AMR Exchange on Antimicrobial Stewardship & COVID-19.
- How did the COVID-19 pandemic impact antibiotic prescribing and antimicrobial stewardship in acute care settings?: Published in Octopus.
- An investigation into factors affecting antibiotic use during the COVID-19 pandemic in two hospitals: Published in ISRCTN related to WHO criteria.



Future Dissemination of the research findings

- Essential dissemination of research findings on AMS to amplify study impact.
- Publication of insights and data across academic and clinical platforms for wide accessibility.
- Presentation of results at national and international conferences for professional dialogue.
- Engagement with networks and interest groups to extend the reach of our findings.
- Open invitation for further engagement with the research team for discussions and collaborations.
- Aim to inspire action and continued research into AMS optimisation amidst global healthcare challenges.



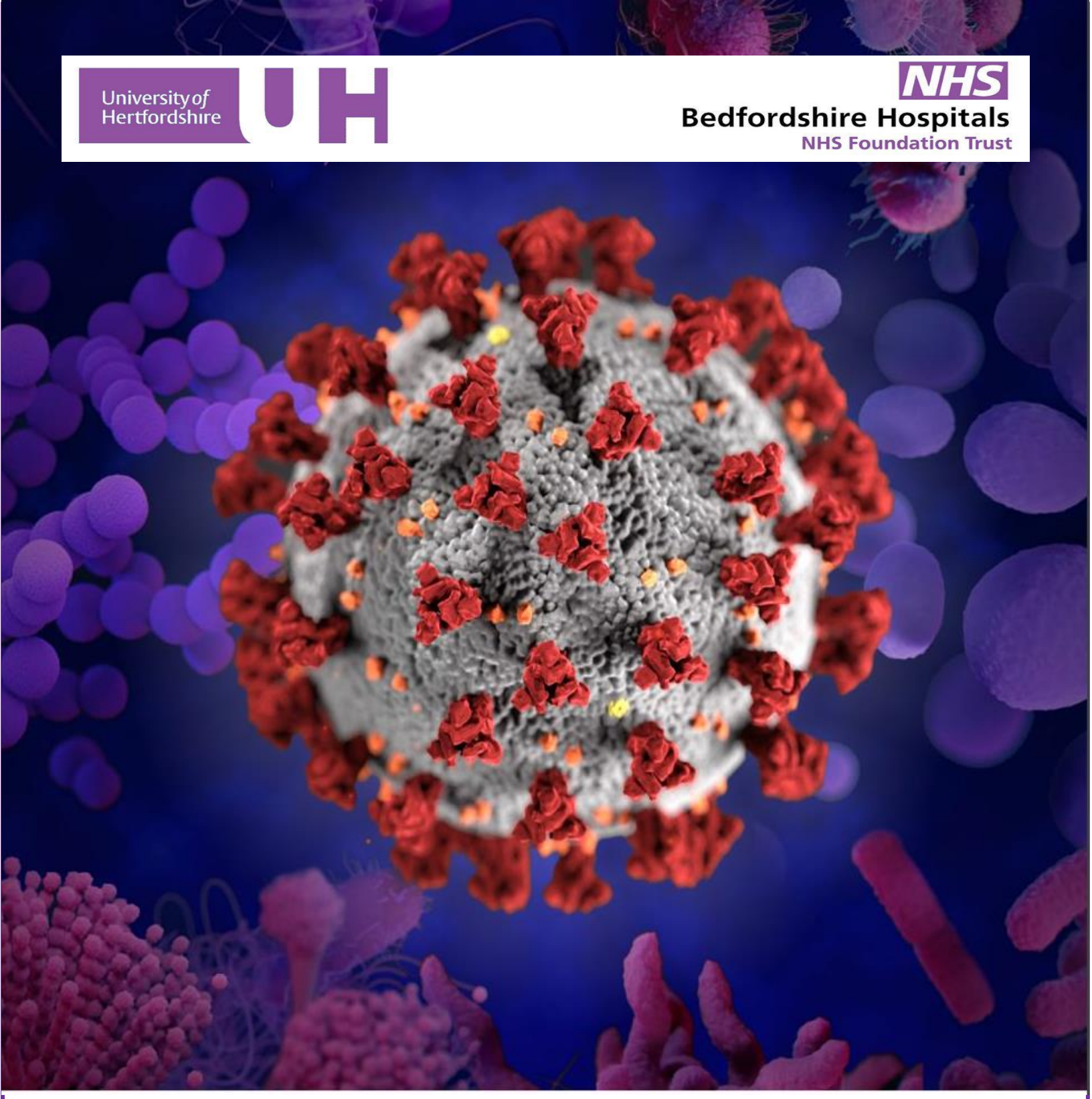
This report is dedicated to the healthcare professionals working at Bedfordshire, who gave tirelessly of themselves and risked their lives during the COVID-19 pandemic.

These individuals give selflessly of their time and safety to protect patients from emerging disease threats.

Thank you for your sacrifices and willingness to serve.

University of Hertfordshire

NHS
Bedfordshire Hospitals
NHS Foundation Trust



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Publication Date: November 2023

COVID-19 Impact on Antimicrobial Stewardship Report: Research Project Outcome

COVID-19

Impact on Antimicrobial Stewardship