GIG CYMRU NHS WALES | Iechyd Cyhoeddus Cymru Public Health Wales	**Version Number:** FINAL Version (2) November 2018 **Date of next review: November** 2019

All Wales Guidance for Developing Policies and Procedures to Manage Multi Drug Resistant Organisms (MDRO) including MRSA

Guidance Statement

Provide Health Boards/Trusts across Wales with practical advice for local multi drug resistant organism (MDRO) policy development for the identification and subsequent management of patients with MDRO, including MRSA. This includes key requirements for clinical risk assessment (CRA), recommended screening requirements, and patient placement and management within acute and community settings. This will not address diagnosis and treatment of infection related to MDRO. This guidance has been developed in partnership with the All-Wales MDRO working group. Welsh Health Board/Trust current MDRO and MRSA policies have been accessed with permission to support these guidelines.

Commitment

This guideline will be reviewed at least every 2 years or sooner by the Healthcare-associated infection and antimicrobial resistance and prescribing programme (HARP) team, PHW, in collaboration with MDRO working group members. Additionally, the guidelines will be updated in light of new evidence, emergence of new MDRO's, changes to best practice or change in national direction. In line with Prudent Health[18] and 'One Wales' agenda, the standardisation of practice across Wales is to be encouraged to ensure all Health Boards, Trusts and Primary and Community Care establishments are taking the appropriate measures to prevent spread of MDRO and prevent harm to patients.

Supporting Evidence and Guidance

This guidance should be read in conjunction with the following documents:

Public Health England: Carbapenemase-producing Enterobacteriaceae: early detection, management and control toolkit for acute trusts (19th June 2014). GOV.UK link: https://www.gov.uk/government/publications/carbapenemase-producing-enterobacteriaceae-early-detection-management-and-control-toolkit-for-acute-trusts

Public Health England: Carbapenemase-producing Enterobacteriaceae: non-acute and community toolkit (30th June 2015). GOV.UK link:

https://www.gov.uk/government/publications/carbapenemase-producing-enterobacteriaceae-non-acute-and-community-toolkit

Together for Health –Tackling antibiotic resistance and improving antibiotic prescribing – A Delivery Plan for NHS Wales and its partners. Welsh Government, 2016: http://www.wales.nhs.uk/sitesplus/documents/888/Antimicrobial%20Resistance%20Delivery%20Plan.pdf

Welsh Health Circular 2016/021: Antimicrobial resistance delivery plan, Welsh Government (30th March 2016): http://www.primarycareservices.wales.nhs.uk/sitesplus/documents/1150/WHC%202016%20021%20-%20English.pdf

CMO letter – Code of Practice for the prevention and control of healthcare-associated infections (3rd June 2014): http://gov.wales/docs/phhs/publications/140812cmoletteren.pdf

Code of Practice for the Prevention and Control of Healthcare Associated Infections (Welsh Government, May 2014): http://gov.wales/docs/phhs/publications/140618appendixen.pdf

Welsh Health Circular 2016/007: Guidance on infection prevention and control of Carbapenemase-producing Enterobacteriaceae (CPE) and other multi drug resistant organisms (MDRO) (11th February 2016): http://www.wales.nhs.uk/sites3/Documents/254/16-02-11%20-%20HCAIs%20-%20WHCs%20%28007%20-%20CPE%20%20MDRO%20guidance%29%20-%20English.pdf

Welsh Health Circular 2018/020: AMR Improvement Goals and HCAI reduction expectations by March 2019: https://gov.wales/docs/dhss/publications/whc2018-020en.pdf

Public Health England: Guidance for the laboratory investigation, management and infection prevention and control for cases of *Candida auris* (August 2017, v2.0): https://www.gov.uk/government/publications/candida-auris-emergence-in-england/candida-auris-within-the-united-kingdom-updated-guidance-published

Scope

- Support Infection Prevention and Control Teams (IPCT) in the development of their local MDRO and MRSA policy and review process.
- Support healthcare staff working within primary and community care (P&CC) across Wales in the appropriate screening, care and management of patients suspected or confirmed with having MDRO.
- Provide examples of templates for use in the identification, screening and management of this patient group.
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2nd Draft V0A	Sept/Oct 2017	Circulated Sept 2017
3rd Draft V0C	November/December 2018	Amendments from MDRO WG Dec 2017
4th Draft V0D	January 2018	Current draft circulated Jan 2018
5th Draft V0E	May 2018	Circulated to MDRO WG May 2018
6th draft V0F	July 2018	Amended, appendices updated
FINAL V1	15 November 2018	Contents page, review appendices
FINAL V2	20 November 2018	Minor amendments to appendices 5, 6, 7, 11 and 12 - change reference from 'CPE' to CPO' for consistency

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1. INTRODUCTION AND BACKGROUND

Multi drug resistant organisms (MDRO) are defined as organisms that have become resistant to one or more antimicrobials from three or more antimicrobial categories or classes and also other micro/macro-organisms that have developed multi-drug and chemical resistance e.g. viruses, fungi and parasites.

The emergence of MDRO is recognised as a major Public Health threat[1,3,6,10,11,13]. Antimicrobial resistance (AMR) is a complex and global public health challenge with no current single or simple strategy available that will fully contain the emergence and spread of infectious organisms that become resistant to the available antimicrobial drugs[5, 10,12].

MDRO can develop through naturally occurring genetic changes and antimicrobial use that can preferentially select for MDROs, encouraging colonisation and infection. Secondary spread can opportunistically colonise and infect humans, with secondary transmission between patients, particularly vulnerable individuals in close proximity to one-another in any healthcare setting.

All Health Boards/Trusts across Wales are required to have a current working policy and relevant procedures for the management of MDRO, including MRSA[11] (WHC/2016/007), which should be reviewed a minimum of every 3 years in accordance with current best practice.

WHC/2016/007 (February 2016) recommends all Welsh Health Boards/Trusts adopt and adapt (to meet local need) Public Health England's (PHE) comprehensive guidance on CPE management for both Primary and Secondary Care settings within their own local MDRO policy[11]. These all-Wales guidelines have been developed in conjunction with PHE recommendations for acute and non-acute trusts and community settings (PHE, 2014/2015)[1,2].
It is essential that current evidence-based guidelines, training and supporting tools and resources are accessible to all healthcare staff that may suspect, encounter and/or care for a patient suspected or confirmed to have an MDRO[11]

Successful prevention and control of MDROs requires a high level of organisational leadership and commitment that can be visualised by all healthcare professionals. Financial and human resources commitment are also necessary. This includes:

- investment in infection prevention and control teams (IPCTs) including provision of Infection Prevention and Control specialists in community settings
- Efficient and effective Healthcare cleaning services
- Access to expert Microbiology advice

- Laboratory provision and specialist support for the identification and management of colonisation/infection with MDROs
- National and local surveillance of organisms alongside monitoring, data analysis and reporting with appropriate analytical support

Infections caused by MDROs are more likely to result in hospitalisation of the patient and this will generate significant costs for the NHS, require prolonged hospital stay and the potential for increased complications. Implementing strategies aimed at early identification of suspected cases, isolation, preventing device-associated and procedure-associated infections in these groups will greatly reduce the risk of spread.

Infections associated with MDROs are increasing worldwide, with some of the most common causing healthcare-associated infections (HCAIs) being:

MRSA - Meticillin **r**esistant ***S****taphylococcus* ***a****ureus*

VRE -Vancomycin **r**esistant ***E****nterococci* spp.

ESBL - Extended-**s**pectrum **b**eta (β)-**l**actamase producing Gram-negative organisms

CPO – **C**arbapenem **P**roducing **O**rganisms, including Carbapenem Producing Enterobacteriaceae (CPE)

CRAB – Carbapenem Resistant Acinetobacter baumanni

Further information and current PHE guidance can be accessed on PHW/HARP MDRO webpage:
http://howis.wales.nhs.uk/sitesplus/888/page/72809

Various acronyms are used to describe MDROs including, but not exclusively, CRO, CPO, CPE and CRE. The Venn diagram below aims to graphically summarise their various distinguishing features, including in relation to each other:

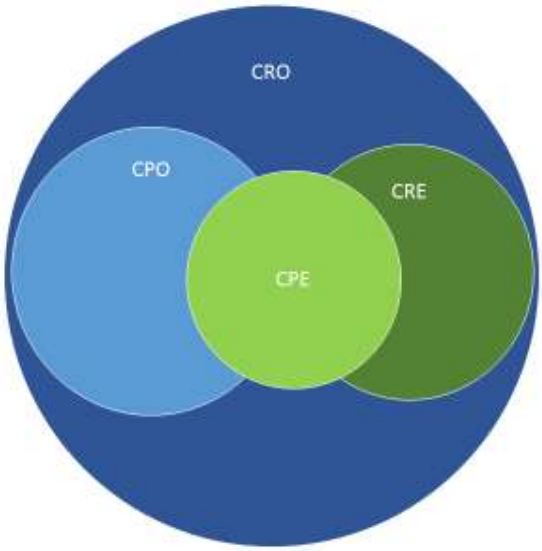
Venn diagram for CRO/CPO/CPE/CRE

Reproduced with permission of Mandy Wootton, Lead Scientist, SACU, PHW (June 2018).

CRO are Gram negative bacteria which are resistant to carbapenems. They can have natural carbapenem resistance such as *Stenotrophomonas maltophilia*
Or
They can acquire genes (carbapenemases) which give them carbapenem resistance. These are called **CPO**.

CRE refer to Enterobactericeae, a particular type of Gram negative organism which is resistant to carbapenems. These are part of the **CRO** group. Resistance can be caused by carbapenemases which would make them a:

CPE, a carbapepenmase producing Enterobactericeae



Examples:
CRO:
- *Stenotrophomonas maltophilia*
- *Elizabethkingia* species

CPO:
- *Acinetobacter baumanii* containing OXA-23 carbapenemase
- *Pseudomonas aeruginosa* containing a VIM carbapenemase

CRE:
- *Enterobacter cloacae* resistant to carbapenems but does not have a carbapenemase.

CPE:
- *Escherichia coli* containing a NDM carbapenemase
- *Klebsiella pneumonia* containing a KPC carbapenemase

2. OBJECTIVES

- To provide an outline of the clinical significance and risk factors associated with MDRO
- To provide key information that should be incorporated into local MDRO and MRSA policies and procedures
- To identify organisational requirements to enable early identification and subsequent management of suspected or confirmed patients with an MDRO
- To identify the roles and responsibilities of key staff in the identification, prevention and management of MDRO (Appendix 1)
- To outline the minimum requirements for screening of patients for MDRO, including MRSA, and provide a model template for use or local adaption (Appendix 2)
- To provide a resource toolkit of associated documents to support MDRO clinical risk assessment (CRA), screening, patient management, placement and information that may be adopted or adapted for local use (Appendix 2-16)

3. CLINICAL SIGNIFICANCE OF MDRO

Once MDROs are introduced into a healthcare setting, transmission and persistence of the resistant organism is determined by the availability of vulnerable patients, selective pressure exerted by antimicrobial use, increased potential for transmission from larger numbers of colonised or infected patients and the impact of implementation of infection prevention

measures[3]. In some organisms, the genetic material coding for the resistance is on mobile genetic elements that can transfer between organisms, particularly in the gut.

It is important to recognise that:

- MDROs are resistant to many first line antibiotics used in hospitals
- Treatment may necessitate second line antibiotics which may be less effective or have increased side effects
- Some MDROs can colonise the environment for long time periods
- Once a patient is colonised, it may not be possible to eradicate the organism
- Strains of MDRO already exist that are resistant to all known antibiotics and so cannot be adequately managed when they cause infections
- Colonisation will often precede infection; therefore interventions must target transmission prevention from colonised patients to other patients and healthcare staff
- Delay in identifying MDRO as the causative organism or managing suspected cases appropriately may result in significant morbidity and mortality

4. PATIENT RISK FACTORS

Local policy should identify patient risk factors including:

- Multiple hospital admissions
- Transfer from a hospital outside of the United Kingdom
- Transfer from hospitals within the United Kingdom who are known to have a high prevalence of MDRO cases
- Recent history of close contact with a person who has been within one of the identified 'high risk' hospitals
- Previous history of MDRO colonisation or infection
- Known exposure to MDRO and/or contact with a confirmed case
- Prolonged in-patient stays
- Prolonged stay in a long term care facility
- Indwelling devices, e.g. urinary catheter or central venous catheter
- Severe disease and multiple co-morbidities
- Admission to a critical care unit
- Open wounds
- Dialysis
- Structural lung disease/bronchiectasis
- Conditions that cause skin breakdown
- Multiple courses of broad spectrum antibiotics

5. SURVEILLANCE:

Day to day and proactive organism surveillance is important to:

- determine antimicrobial susceptibilities of targeted and emerging MDROs
- provide early identification to IPCT, Executive Lead and Medical Director when a novel resistance pattern for that organisation or facility is detected
- provide epidemiological data visualised in graphs, tables and timelines, to demonstrate if and when transmission is suspected or has occurred
- support incident and/or outbreak tracking and management
- understand facility-specific/organisation colonisation rates of MDROs and help define the local colonisation pressures
- maintain a local database for individual ward/facility/organisation, to include as a minimum; patient identification, date of identification, organism, antibiotic sensitivity and resistance
- maintain record of daily clinical surveillance and intervention
- provide record of clinical risk assessment (CRA) undertaken and subsequent actions taken

5.1. Use of ICNet across all Welsh Health Boards /Trusts to support MDRO surveillance:

A rule-base has been developed in ICNet to support early flagging of MDROs to IPCTs. Enhanced surveillance of CPOs is under development through Enterprise Monitor Module of ICNet[July 2018]

6. PREVENTION AND CONTROL OF MDRO IN HEALTHCARE SETTINGS

(*Recommended minimum Departmental responsibilities outlined in Appendix 1*)

6.1. Establishment requirements to safely manage patients:

Spread of MDRO is usually via direct patient contact and most commonly can be transmitted on the hands of healthcare workers or via objects and devices within the patients' environment[6,8,13].

All healthcare staff have a responsibility to comply with Infection Prevention Standards for all patients, and take the necessary environmental interventions within the healthcare setting, all of the time[8]. The establishment must provide the appropriate facilities, resources, equipment and tools to enable compliance with Infection Prevention Standard Precautions.

6.2. Isolation Precautions

- All patients confirmed with MDRO are high priority for prompt single room isolation
- If a patient is undergoing contact screening related to a suspected MDRO, an incident or outbreak, a CRA must be undertaken to determine if isolation room is required
- If a patient is known or suspected of being colonised with MDRO a CRA must be undertaken
- A single room should be en-suite with appropriate hand washing facilities and easy access to personal protective equipment (PPE)
- The door of the isolation room should be kept closed unless the patients' clinical requirements dictate otherwise and a local risk assessment is undertaken
- The isolation room should be clearly identifiable for all staff and visitors by means of locally agreed isolation signage
- Enhanced or negative pressure ventilation is not usually necessary but will require risk assessment in respect of the identified organism and patient symptoms
- If respiratory symptoms are present robust respiratory precautions must be instigated as per local policy
- Single patient use equipment should be used where possible

Each Health Board/Trust should consider the provision of an 'isolation ward' or the availability of a designated cohort ward or area, which could be promptly adapted for use should an MDRO outbreak, occur.

6.3. Environmental management

- An enhanced environmental cleaning and decontamination programme should be introduced for the duration of the patients' stay that adheres to local policy
- On patient vacation of a single room or cohort area the room(s) should receive the appropriate clean and decontamination as per local policy and in accordance with national standards25
- An appropriate disinfection method should be used for cleaning the environment in accordance with local policy
- Additional environmental decontamination processes as per local policy such as Hydrogen Peroxide Vapour (HPV) decontamination process or Ultra-Violet Light (UVL) decontamination process should be considered, following the cleaning process, if these systems are available within the facility and are safe to use
- All Health Boards/Trusts should consider an annual 'deep clean' programme for high-risk areas and augmented care
- Promote a 6-month curtain change rolling programme for all wards and departments, or follow local policy

All Health Board/Trust employees have a responsibility for maintaining high standards of cleanliness within the environment[25].

7. PREVENTION AND CONTROL MANAGEMENT

7.1. Standard Infection Prevention and Control Precautions (SIPCPs)

Existing national guidelines are unanimous in stating that SIPCPs should be used by all staff, in all care settings, at all times, for all patients (adults, children and infants), whether infection has been identified or not, in order to ensure the safety of those in our care, including staff and visitors. This is appropriate to any environment where care is given[8,13,15].
It is essential to control the emergence and spread of MDRO due to the limited therapeutic alternatives, the increasingly compromised in-patient population, and the potential for transfer of resistance to other pathogenic bacteria and development of further resistance. Once colonisation of the patient or the environment has been identified, control is complex[3,8].

Each Health Board/Trust and healthcare establishment must provide adequate and safe provision for staff to comply with SIPCPs, epic 3 (2014)[15] divide these into five categories:

- Hospital environmental hygiene
- Hand hygiene
- Use of personal protective equipment
- Safe use and disposal of sharps
- Principles of asepsis

None of the above are regarded as optional.

Epic 3 evidence-based guidelines can be accessed following this link: https://www.his.org.uk/files/3113/8693/4808/epic3_National_Evidence-Based_Guidelines_for_Preventing_HCAI_in_NHSE.pdf

NHS Scotland's National Infection Prevention and Control Model Policies (NIPCM)[8] on-line has been adopted by NHS Wales from April 2018 to replace all-Wales SIPCPs model policies.
NIPCM[8] further categorise SIPCPs to include:

- Respiratory and cough etiquette
- Safe Management of Care Equipment
- Safe Management of Linen
- Safe Management of Blood and Body Fluid Spillages
- Safe Disposal of Waste (including sharps)

NIPCM can be accessed following this link:
www.publichealthwales.org/nipcm www.iechydcyhoedduscymru.org/nipcm

In addition, please refer to your local infection prevention and control policies for further information, local guidance and recommendations.

7.2. Antimicrobial Stewardship

The emergence and spread of MDRO has been driven by the use of broad-spectrum antimicrobials[5,10]. Antibiotics should be prescribed and administered as per your local Health Board/Trust antimicrobial policy and in consultation with the all-Wales Delivery Plan[24] and the forthcoming new UK AMR strategy from 2019.

Primary and Secondary Care Clinicians involved in prescribing must ensure they are up to date with emerging evidence on antimicrobial resistance and appropriate antibiotic usage and are working towards delivery of Welsh Governments' AMR improvement goals (WHC/2018/020)[29].

All healthcare establishments should have an up-to-date local AMR action plan in place[12] to promote optimal and safe use of antibiotics to minimise acquisition and spread of resistance.

All acute care facilities should implement "Start Smart then Focus" as a key part of their antimicrobial stewardship programme.

Antimicrobial prophylaxis pre-surgery should be as narrow spectrum as clinically possible, preferably restricted to a single dose.

All prophylactic antimicrobials should be compliant with all-Wales policy/guidelines and reviewed regularly to prevent un-necessary long-term use[24].

7.3. Screening

Routine MRSA screening has been shown to detect MRSA colonisation early and provides the opportunity to eradicate carriage to prevent transmission and/or infection[35]. Targeted MRSA screening was implemented across Wales following Chief Medical Officer (CMO)/Chief Nursing Officer (CNO) letter (February 2013)[34], based on evaluation of Health Protection Scotland's Pathfinder Programme[33]. CMO/CNO letter[36] stipulates the introduction of routine MRSA screening for all patients in the following patient groups, as a minimum:

- Renal
- Cardiothoracic / Vascular
- Intensive Care
- Orthopaedics

A risk-based approach for all other patients is recommended.

For further MRSA screening guidance, see Appendix 3 and 4.

In addition, screening for CPO, including CPE, and other MDROs, is outlined in Welsh Health Circular WHC/2016/007[11] and should reflect local current guidance and recommendations.

For further guidance regarding screening for MDROs, see Appendix 2.

7.4. Contact Screening

Each Health Board/Trust must have an admission screening policy identifying patients who will require screening for MRSA, MDRO and CPO. An active screening programme for MDROs is recommended for high-risk specialties and local policy should provide clear guidelines for this[11].

A Clinical risk assessment (CRA) MUST be undertaken for all patient admissions to establish whether risk factors are present indicating carriage and/or infection with an MDRO[11] and to identify the need for screening. The following risk indicators should be included in all CRAs:

- In-patient in a hospital abroad in the last 12 months
- In-patient in a hospital within the United Kingdom in the last 12 months
- Received healthcare abroad within the last 12months, including dental care, cosmetic surgery, elective surgery, fertility treatment, renal dialysis and out-patient wound care
- Known to be previously positive with MDRO
- Inter hospital transfer from a hospital or long term care facility that is known to be in a MDRO high risk area
- Screening of patients may be recommended during outbreaks or clusters of MDROs, on the advice of the IPCT in conjunction with Consultant Microbiologist and Executive Lead for HCAI
- In some circumstances patients may be screened who have been in close proximity to MDRO colonised or infected patients, Microbiology/IP&C advice should be sought prior to undertaking any such MDRO screening or refer to local policy
- Contact cases within a specialist unit/augmented care should be high priority for isolation while awaiting screen results
- For contact cases outside of a Specialist Unit/augmented care it is not necessary to isolate whilst awaiting screening results
- Cohort of contacts may be considered if there are a number of contact cases and this will require expert advice from Microbiology and IPCT
- Screening of household contacts and healthcare staff is not necessary unless this is discussed and agreed at a multi-disciplinary meeting in response to an MDRO or MRSA incident or outbreak
- Informed consent from the person will be required prior to taking screens
- The type of screen to be requested must be agreed with the local laboratory who will be carrying out the testing

The above screening recommendations and those outlined in Appendix 2 and Appendix 4 are a minimum requirement. Some Health Boards/Trusts may require a more aggressive approach when a positive case is identified within a ward, which may include screening on re-admission of contacts, where lapses in IP&C are identified and/or transmission of the organism is

suspected. In these situations, screening of patient contacts should be instigated and an outbreak control team convened as soon as possible[1].

7.5. Sample Collection

Once MDRO has been suspected following CRA or the patient is identified as a possible contact, screening should take place without delay[1].
The following samples are required as a minimum:

- Rectal swab, ensuring faeces is visible on the swab
- Stool sample (if rectal swab is not feasible/acceptable)
- Wound swab and/or urine sample if the patient is catheterised

A rectal swab is the preferred sample type to achieve prompt results and should always be preferable to a stool sample. Stool sample should be taken for babies and children rather than a rectal swab.

It is essential for staff to clearly indicate the type of investigation requested and include any relevant patient clinical information and current antimicrobial therapy on the pathology request form to prevent any delay in obtaining results.
The laboratory request form should clearly indicate the specimen type and the organism being screened for. If there is a potential CPO, and if the sample is from a known positive case or a contact of a known case, please follow your local policy.

7.6. Environmental Screening

Routine environmental screening is rarely of value as the sensitivity is low and the potential risk of a given site acting as a reservoir is unpredictable. However, this will be determined by the IPCT, as it can be useful to determine the dynamics of environmental spread or as part of outbreak control. Due to the difficulties that are encountered with microbiological sampling of the environment, other technologies may be considered to provide indirect information regarding the likelihood of bacterial environmental contamination, including Adenosine triphosphate (ATP) bioluminescence or fluorescent gel markers. These methods can support audit programmes and outbreak surveillance and enable real-time feedback to be given to the appropriate teams so necessary remedial action can be taken promptly.

7.7. Staff Carriage

Screening of staff for carriage during an outbreak or as part of an investigation may be considered but can be unhelpful and may cause considerable stress especially if there is no decolonisation regime for the MDRO.
Any staff with significant risk factors that make them vulnerable if they are in contact with MDRO should be referred to their local Occupational Health team.

Routine screening of family contacts and staff is not recommended[13].

7.8. Clinical Risk Assessment (CRA) for isolation of patient

Clinical risk assessment (CRA) for prioritising isolation rooms depends on a number of factors that can potentially increase risk of transmission, including:

- Degree of resistance of the organism identified, for example, multi resistant vs extensive resistance vs pan-drug resistance
- Pathogenic potential, propensity of organism or resistant determinant to spread
- Presence of diarrhoea or faecal/urinary incontinence
- Discharging wounds/skin shedding conditions
- Presence of multiple invasive devices
- Patient assessed to be non-compliant with basic hygiene measures
- Whether patient is colonised or infected - assess the risk of cross contamination to other patients (exogenous transmission) and infection that may be acquired from a patients' colonisation status (endogenous transmission)
- Consideration of risk level of department
- For contacts of cases within a Specialist Unit or augmented care patient contacts should also be prioritised for isolation
- If single room is not possible contact your local IPCT for advice and follow local isolation risk assessment recommendations
- Priority for single room must be considered when respiratory symptoms are present due to the inability to control spread within a bay where patients are in close proximity to each other.

7.9. Patient management

Patients should be informed of their status for colonisation or infection with MDRO upon laboratory confirmation and be provided with an information leaflet (Appendix 5).

The responsibility for informing patients of their MDRO status and documenting this in the healthcare record lies with the clinical team caring for the patient. Healthcare records should be flagged to highlight the positive MDRO status, as per local policy.

If a patient is found to be infected or colonised with a Carbapenem Producing Organism (CPO), they should be issued with a copy of a patient card (Appendix 6) to assist with informing others offering healthcare to the patient of their status.

For further copies, please follow this link:
http://howis.wales.nhs.uk/sitesplus/888/page/72809

Information should be available for visiting family and friends prior to visitors entering the room so necessary preventative precautions and visiting restrictions are taken[1,2]. Refer to local policy and Appendix 5.

8. CLINICAL PRESENTATION AND TREATMENT

This depends on the causative organism. There is no presentation that rules out infection by a MDRO. Where there is increased prevalence or first line therapy has failed, MDRO's should be suspected.

These guidelines do not provide recommendations for treatment, however, the important factor in successfully treating MDRO and MRSA is prompt diagnosis and recognition that the bacteria causing infection are resistant to antibiotics, so that the most appropriate treatment can be prescribed without unnecessary delay.

Treatment options for MDRO's should be discussed with a Consultant Microbiologist and Antimicrobial Pharmacist at the earliest opportunity. Delayed commencement of appropriate therapy is the greatest potential for patient harm when a patient is infected with a MDRO.

9. LAST OFFICES

In most cases, special precautions are not required[35]. Recommendations for care of the deceased patient in relation to IP&C are within Appendix 12 of NIPCM[8], however, please follow your local Last Offices policy for agreed precautions and communication that may be required with your local mortuary.

10. NEW AND EMERGING MDRO

***Candida auris* (*C.auris*)** is an emerging fungus that presents a serious global health threat[16]. *C.auris* has also been associated with recent infection and outbreaks in healthcare settings[9]. *C.auris* appears to be highly transmissible between patients and from contaminated environments, highlighting the importance of instituting effective infection prevention and control practices[16].
For further information please access PHE Guidance for the laboratory investigation, management and infection prevention and control for cases of *Candida auris* (August 2017, v2.0):
https://www.gov.uk/government/publications/candida-auris-emergence-in-england/candida-auris-within-the-united-kingdom-updated-guidance-published

Colistin resistance conferred by a transferrable gene (*mcr*) in *Enterobactericeae* was discovered in China in 2016, posing a significant public health threat, requiring global monitoring and surveillance. Colistin

represents one of the few available drugs for treating infections caused by carbapenem-resistant organisms. However, CPO harbouring the mcr gene have been found in China and South East Asia, further limiting therapeutic options. Susceptibility testing of colistin is problematic and confirmation of resistance is required[31].

11. REFERENCES AND USEFUL LINKS

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12. APPENDICES

Appendix 1: Outline of recommended minimum departmental responsibilities for prevention and management of MDRO

Appendix 2: All-Wales MDRO screening algorithm

Appendix 3: Example of patient admission clinical risk assessment template *(courtesy of C&VUHB MDRO policy 2017)*

Appendix 4: Example all-Wales MRSA screening algorithm for elective orthopaedic surgery *(MDRO working group, August 2017)*

Appendix 5: All-Wales MDRO patient information leaflet
Author: Eleri Davies. Additions: Gail Lusardi (Updated August 2018)

Appendix 6: MDRO patient cards *(PHW, updated August 2016)*

Appendix 7: What are MDROs? Classified on the basis of their mechanism of resistance

Appendix 8: Management of a patient with suspected or confirmed MDRO *(reproduced with minor adaptations with permission from BCUHB's MDRO policy, November 2016)*

Appendix 9: Early recognition of individuals who may be colonised / have an infection with *carbapenemase-producing Organisms (CPO), including Enterobacteriaceae (CPE) (adapted from PHE CPE toolkit 2014/2015)*

Appendix 10: Early isolation of suspected and laboratory-confirmed CPO *(adapted from PHE CPE toolkit 2014/2015)*

Appendix 11: Example template GP in-patient letter *(reproduced with permission from ABUHB IPCT)*

Appendix 12: Example template GP patient discharge letter *(reproduced with permission from ABUHB IPCT)*

Appendix 13: Glossary and definitions

Appendix 14: NHS Organisations policies and resources accessed and adapted with permission to support development of all-Wales MDRO guideline

Appendix 1: Outline of recommended minimum Departmental responsibilities for prevention and management of MDRO

Health Board/Trust Executive Team:

- The Chief Executive has overall responsibility for ensuring effective procedures and resources are in place to enable appropriate screening and management of MDRO as per local and Welsh Government recommendations[11,12]
- The Executive Lead Nurse has strategic responsibility within their Health Board/Trust for the implementation of local MDRO policy and guidelines
- MDRO prevention and control must be an organisational priority
- Executive support to integrate MDRO into education programmes in relation to infection prevention and control for all healthcare staff disciplines, ensuring all front-line staff are mandated to attend
- A multi-disciplinary incident review process should be in place to investigate each patient case individually, sharing good practice and lessons learnt locally and across the healthcare system to support clinicians to use appropriate treatment plans to manage MDRO and prevent transmission
- Provide feedback to clinicians in respect of antimicrobial susceptibility and current trend analysis

Consultant Doctors, Heads of Nursing, Matrons, Ward and Departmental Managers:

Have responsibility for ensuring

- a robust process is in place so the Executive Team can be provided with assurance that all their staff are aware of and receive training in MDRO screening and patient management
- compliance with good infection prevention and control practices
- robust audit cycle is used to monitor and report compliance
- the clinical environment is consistent with the National Standards of Cleanliness[25]
- local and all-Wales screening and management protocols are adhered to
- prompt action is taken to rectify problems when compliance falls below acceptable standards and action plan instigated to improve compliance
- provision of appropriate and adequate resources and equipment to manage the MDRO patient, including PPE, designated single patient use equipment
- appropriate liaison and notification communication protocol is in place between HB/Trusts and Primary and Community care settings on transfer of patients between organisations

Microbiology Laboratory:

- work collaboratively with their local Health Boards/Trusts and Public Health Wales Laboratory to support development and implementation of their screening programmes for MDRO
- work collaboratively with Specialist Antimicrobial Chemotherapy Unit (SACU)[22] and Welsh Antimicrobial Resistance Programme Surveillance Unit[23]
- standardise laboratory protocols for determining antimicrobial or organism susceptibilities of targeted and emerging MDROs
- support rapid processing of samples and reporting of results
- establish systems to ensure prompt MDRO notification to IPCT
- responsible for reporting resistant isolates to Public Health Wales
- engage in National typing studies, where appropriate, to establish the epidemiology of MDRO through SACU and national reference laboratories, e.g. Public Health England Reference Laboratories.

Infection Prevention and Control Team (IPCT):

The IPCT will ensure:

- robust and current local infection prevention and control policies and guidelines are in place to support infection prevention standards
- will provide access for staff to National Infection Prevention and Control Manual (NIPCM) on-line[8]
  NIPCM link: www.publichealthwales.org/nipcm
- access for staff to local and PHW intranet for further information and guidance in relation to MDRO[27]
- a specific policy for MDRO and/or including MRSA detection and management is in place and up-to-date[11]
- clear guidelines are easily accessible to the workforce regarding patient screening and management on admission, based on all-Wales recommendations (Appendices) and local policy
- Provide specialist advice and support to staff in respect of IP&C aspects of MDRO management
- MDRO and MRSA management training should be integrated into mandatory Infection Prevention training programmes[11]
- local annual IP&C audit programme should include compliance with MDRO and MRSA patient screening and subsequent patient placement and management in line with national recommendations[1,2,] and local MDRO policy
- appropriate patient history and interventions is recorded within ICNet or as per local policy

Hotel Services:

Hotel services will ensure:

- local domestic service team managers provide a robust training programme for their staff in cleaning methodologies, including cleaning and decontamination procedures for known and suspected cases of MDRO in the clinical area

- cleaning staff are up to date with IP&C mandatory training
- cleaning is monitored and reported against the National Standards of Cleanliness[25] e.g. Credits for Cleaning (C4C)
- urgent actions taken if a shortfall in standards are identified
- appropriate evidence based cleaning, disinfection and decontamination methods and products are employed to eradicate MDROs from the clinical environment in line with current recommendations[1,2,8,25]
- cleaning staff and teams work closely with ward and departmental managers and their local IPCT to ensure timely and effective cleaning of the patient environment on a daily basis and on patient discharge
- new cleaning and decontamination technologies and products are evaluated and given due consideration in the elimination of environmental pathogens including MDROs e.g. ultra violet light (UVL) decontamination, hydrogen peroxide vapour (HPV) decontamination process. Due consideration for patient and staff health and safety should form part of the evaluative process
- consider use of Adenosine triphosphate (ATP) bioluminescence to validate the decontamination process
- adequate resources are available for cleaning process, such as appropriate personal protective equipment for staff and an adequate workforce trained in use of any specialised equipment
- requests for routine and terminal cleaning of areas where infected cases are managed are prioritised with a need to maintain patient safety, bed occupancy and bed flow
- consideration is given to the availability of rapid cleaning teams, including out of hours service
- availability of adequate supplies and replacement stock e.g. curtains, linen, waste disposal bags, should demand increase or when an outbreak is suspected/declared

Healthcare Workers:

All healthcare staff with direct patient contact, including healthcare staff within acute, primary and community care and Welsh Ambulance Service NHS Trust (WAST) staff will:

- have responsibility to ensure they adhere to the advice and guidelines provided within their local MDRO and MRSA policy
- be compliant with standard infection prevention and control precautions (SIPCPs) and transmission based precautions[8] at all times
- be up to date with mandatory training in IP&C (level 2 is recommended to be annual for clinically facing staff, refer to local mandatory training policy)
- comply with their local CRA for patient screening (where applicable), patient placement and appropriate management
- have access to all-Wales MDRO policy and guidelines and adapt for local use, e.g. WAST will apply to pre-hospital care setting

- discuss any deviations from local guidelines with a member of the IPCT and/or Consultant Microbiologist and undertake a risk assessment
- work closely with cleaning staff and teams to ensure access for timely and effective cleaning of the patient environment and equipment on a daily basis and on patient discharge
- communicate consistently the risks and procedures required for family relatives and visitors and provide information cards and leaflets as appropriate (Appendices 4 and 5)
- ensure clear communication links with other work colleagues, wards and departments to assess any risk and instigate necessary precautions prior to any patient movement, transfer or discharge
- Compliance with ANTT competencies for all healthcare staff, including inserting medical devices such as urinary catheter or peripheral vascular device as per PHW ANTT model policy[26] and local policy
- Risk assess whether the invasive device is required prior to insertion. Please refer to 1000 Lives STOP campaign for further information[28]: http://www.1000livesplus.wales.nhs.uk/stop
- compliance with device insertion and maintenance bundles, as per local policy, to prevent cross contamination and infection
- ensure robust communication links for healthcare settings within primary and community care including long term care facilities, particularly prior to patient transfers
- utilise appropriate procedures and products for the decontamination of medical devices and shared patient equipment
- report via local incident reporting mechanisms, e.g. datix, any breaches in practice which may increase risk of transmissions, for example, failure to isolate, lapses in cleaning or SIPCPs

Estates

- Estates department has a responsibility to ensure all new builds and refurbishments within healthcare settings conform to current Welsh Health Building Notes (WHBN)[20], and Health Technical Memorandum (HTM) in respect of recommendations for the provision of appropriate isolation facilities and compliance with infection prevention standards[17,20,21]
  Link to HBN 00-09:
  https://www.gov.uk/government/publications/guidance-for-infection-control-in-the-built-environment
  Link to Shared services Partnership:
  http://www.wales.nhs.uk/sites3/page.cfm?orgid=254&pid=64096
- IPCTs must be engaged with Estate department and any redevelopment programme teams early on in the process of any planned works within any healthcare setting that may impact on patient management, placement and the environment they will be in, and local policy should be in place to support this

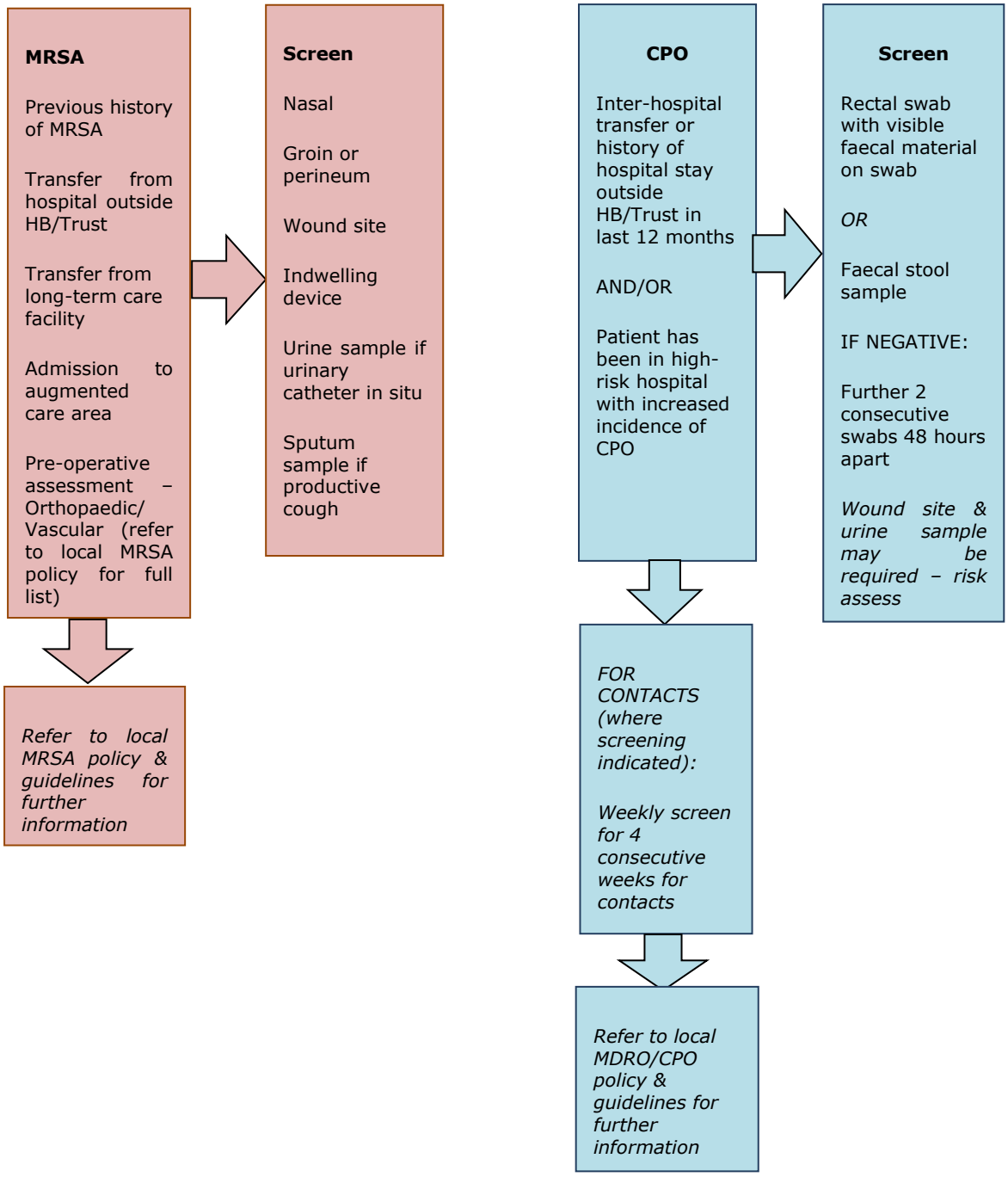
- consideration must be given within the Estates budget to support safe management of patients with MDRO
- where ward and isolation facilities are identified as sub-optimal priority should be given to improve such areas as per IPCT advice and recommendations with adherence to HBN 00-09 recommendations[17]

Appendix 2: All-Wales Screening Algorithm for Multi-drug resistant organisms (MDRO)

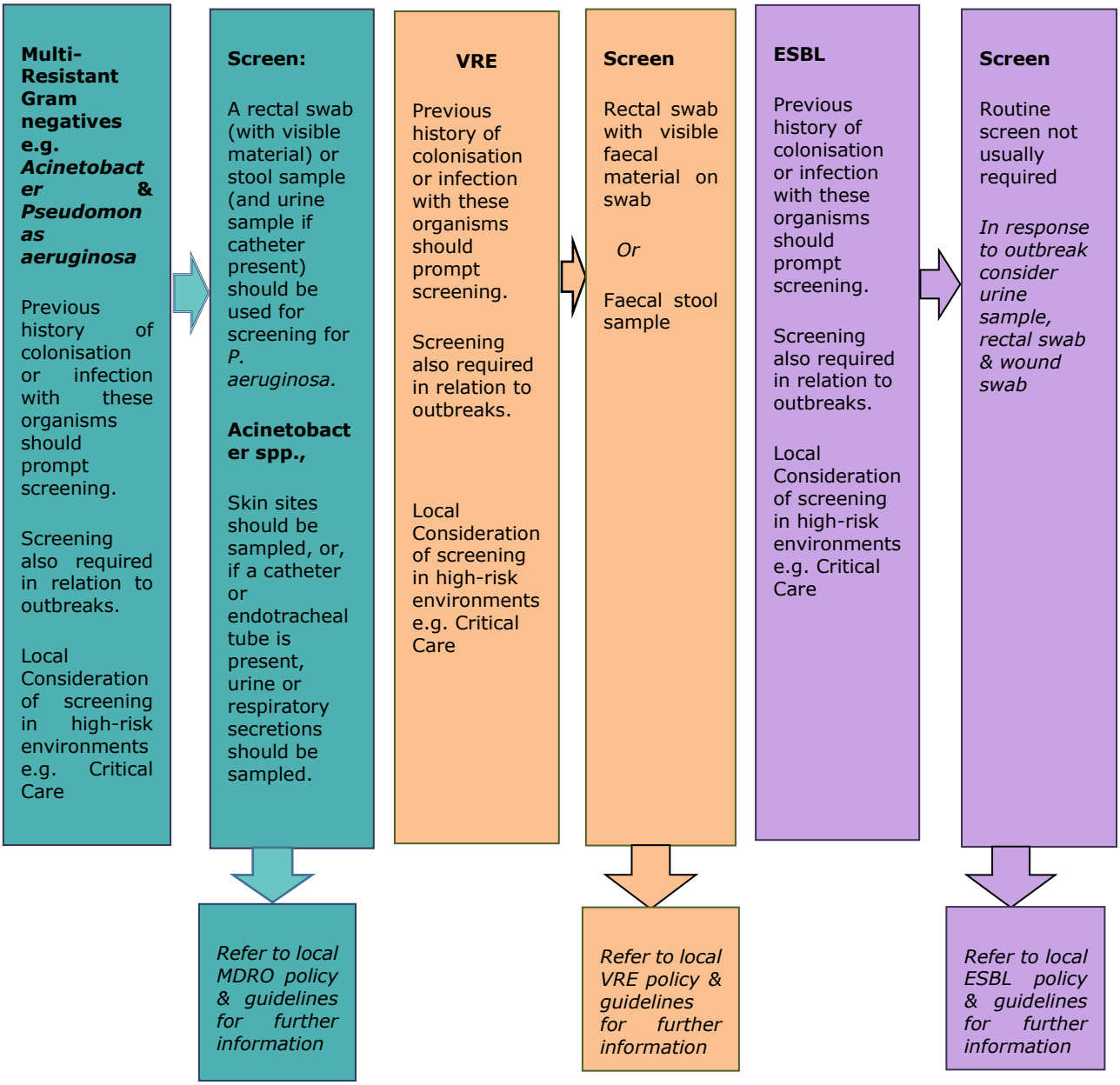
Including Meticillin-resistant *Staphylococcus aureus* (MRSA), Carbapenemase producing Organisms (CPO) and options for Vancomycin resistant Enterococci (VRE), Multi-Resistant Gram negative organisms such as *Acinetobacter* sp., *Pseudomonas aeruginosa* and Extended spectrum beta-lactamase (ESBL) carrying organisms.

ALL HEALTH BOARDS & TRUSTS SHOULD ENSURE A CLINICAL RISK ASSESSMENT IS IN PLACE

FOR MRSA & CPO WITH APPROPRIATE SCREENING TO FOLLOW



Additional Screening may be required in response to outbreaks or known imports



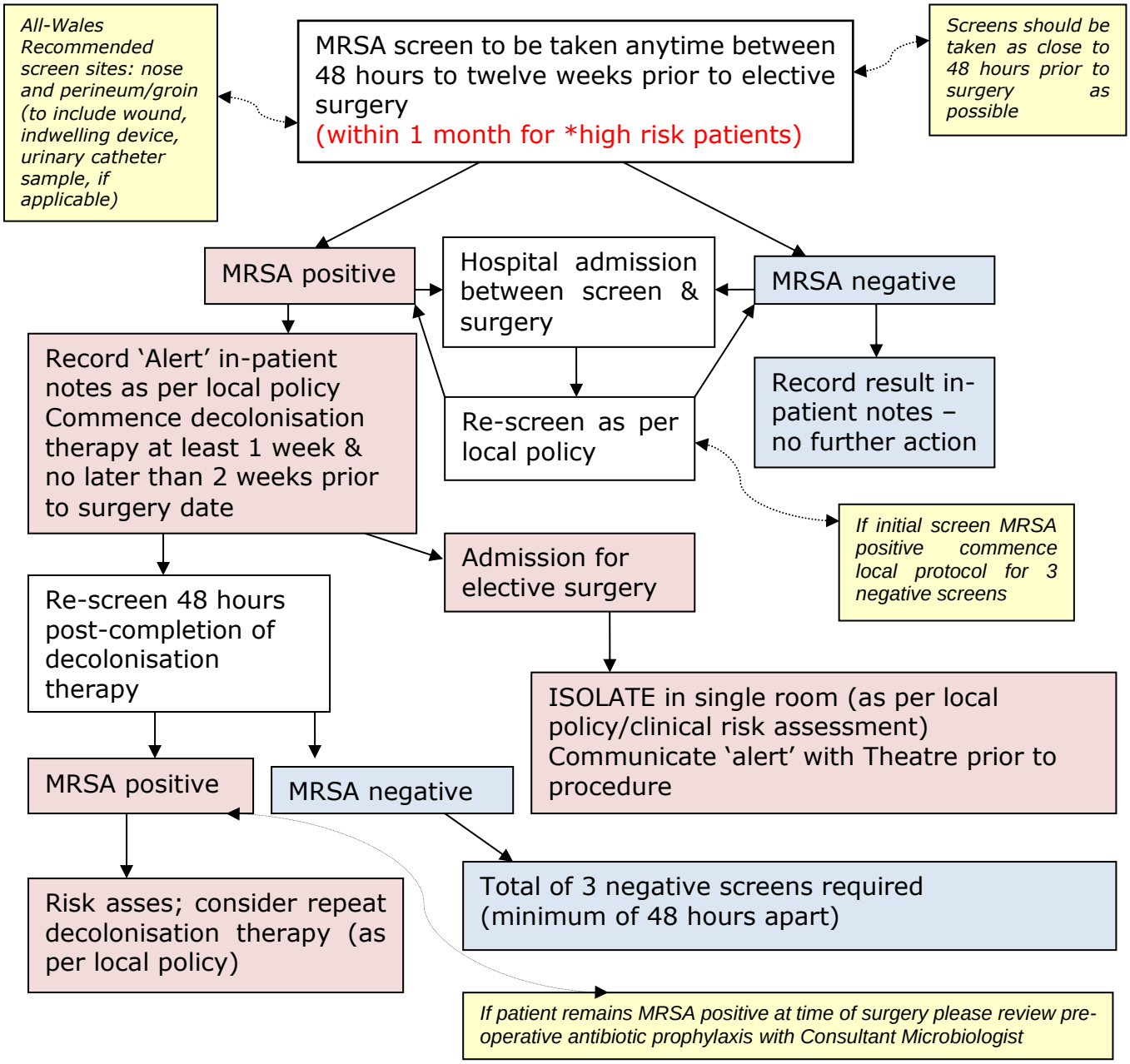
Appendix 3: PATIENT ADMISSION CLINICAL RISK ASSESSMENT TEMPLATE

Adapted with permission from Cardiff & Vale University Health Boards' MDRO procedure (November 2017)

Infection Prevention and Control (IP&C) Admission Risk Assessment	**NO**	**YES**	If '**YES**' to any question action the following immediately	Initial
Carbapenem Producing Organisms (CPO)				
In the last 12 months, has the patient had any healthcare contact outside of the U.K.? Healthcare abroad includes the whole range of in-patient care, also dental care, cosmetic surgery, elective surgery (including day surgery), renal dialysis and fertility treatments			Isolate (High priority) and contact precautions Seek advice from IP&C / Microbiology out of hours. Screen for CPO & MRSA	
In the last 12 months, has the patient been an in-patient in a hospital outside of the Health Board/Trust (NHS or Private)?			Refer to local MDRO Procedure Screen for CPO & MRSA Discuss with IP&C	
Does the patient have any IP&C flags (on Clinical Workstation) for any multi-drug resistant organisms?				
Does the patient have a history of MDRO infection/colonisation (inc. *Candida auris*)?			Isolate (High priority) and contact precautions Discuss with IP&C	
MRSA				
Is patient screened for MRSA routinely on admission to specific clinical areas or prior to specific procedures ?(e.g. Critical Care, Renal , Orthopaedic Surgery)			Screen for MRSA: Nose Perineum or Groin Invasive device site(s) Wound(s) ...../...../..... (Screen sent date / time / initial) Refer to local MRSA Procedure / Clinical Risk Assessment	
Does the patient have a previous history of MRSA?				
On admission does the patient have a wound or invasive device?				
Has the patient been transferred from a hospital outside of the Health Board/Trust?				
Has the patient been admitted from a Nursing Home or Long-term care facility?				
Diarrhoea and Vomiting				

Does the patient have a history of diarrhoea / vomiting within the last 48 hours that may be infectious?			Isolate / cohort (High priority) Contact Precautions Send two separate diarrhoea samples for Microbiology and Virology Refer to local Viral Gastroenteritis Procedure	
Any contact with someone with symptoms of D&V in the last 72 hours? (e.g. from a care home with an outbreak of D&V)			Isolate where possible Commence Stool chart Monitor closely	
Clostridium difficile				
Current diagnosis or suspected of having *Clostridium difficile* infection?			Isolate (High Priority) Refer to local *Clostridium difficile* Algorithm / Procedure	
Does the patient have a history of *Clostridium difficile* infection? (Check workstation flags)			Recurrence possible, isolate if diarrhoea develops	
Other infections				
Suspected or confirmed acute viral respiratory infection? e.g. flu (Check Admission notes)			Isolate or cohort Respiratory precautions Refer to Transmission Based Precautions	
Suspected or confirmed open TB?			Isolate (high priority) & Respiratory precautions Refer to local TB Procedure	
High-risk rash of infectious or unknown origin e.g. Chicken Pox, disseminated or exposed Shingles? (refer to Admission Notes)			Isolate (high priority) & Respiratory precautions Refer to Transmission Based Precautions Seek advice from IP&C	
If patient due to have surgery / endoscopy, has the patient ever been suspected or confirmed CJD or vCJD?			Refer to local CJD Procedure	
For Emergency Unit / Assessment Unit and Infectious Disease Ward only *(if applicable)*: Travel or clinical history consistent with very high-risk infection e.g. Ebola or Middle East Respiratory Syndrome? (Refer to Admission Notes)			Isolate (high priority) in a negative pressure isolation facility according to agreed pathway Inform IP&C / Microbiology	
Person completing assessment: Sign / Print:			Date:	

Appendix 4: All-Wales Recommendations for elective orthopaedic pre-operative MRSA screening



Please refer to local Health Board / Trust MRSA policy for further information

*High risk patients:

- Previous history of MRSA or MDRO
- Direct patient transfer from another hospital, long term care facility or high risk speciality ward
- Hospitalised in previous 3 months
- Serious underlying disease
- Wound or invasive device in situ

Appendix 5: Advice for Patients - Multi-Drug Resistant Organisms (MDRO) including Carbapenemase-producing organism *(*CPO)

What are Multi-Drug Resistant Organisms?

MDR Gram negative bacteria are bacteria (or germs) that are resistant to at least three different types of antibiotics. MRSA (Meticillin resistant *Staphylococcus aureus*) is a multi-drug resistant organism, but there are many other organisms that can become resistant and this information covers common organisms such as *Escherichia coli*, *Acinetobacter baumanii*, *Pseudomonas aeruginosa* and other organisms **that have** become resistant to three or more types of antibiotics.

Why does Multi resistance to antibiotics matter?

Some antibiotics e.g. Carbapenem antibiotics, can only be given in hospital directly into the bloodstream. Until now, doctors have relied on certain antibiotics to successfully treat particularly 'difficult' infections when other antibiotics have failed to do so. In a hospital, where there are many vulnerable patients, spread of resistant bacteria can cause problems. If the bacteria get into the wrong place, such as the bladder, bloodstream or open wound they can cause infection, which may be difficult to treat.

Does carriage of or infection with an MDRO need to be treated?

If a person is a carrier of an MDRO such as carbapenemase-producing organisms (sometimes called CPO), they do not need to be treated. However, if the bacteria have caused an infection then antibiotics will be required as advised by a Consultant Microbiologist.

How might I 'pick up' an MDRO?

These bacteria can sometimes be found, living harmlessly, in the gut and on the skin of humans and this is called 'colonisation'. It can be difficult to say when or where you picked it up. However, there is an increased chance of picking up these bacteria if you have been a patient in a hospital abroad **or** in a UK hospital that has had patients carrying the bacteria, **or** if you have been in close contact with a carrier in hospital **or** in the community **or** you have had repeated courses of antibiotics. If any of these apply to you, and you need to be admitted to hospital, screening will be arranged and you may be accommodated in a single room at least until the results of the tests are known.

How will I be cared for while in hospital?

You may be accommodated in a single room whilst you are in hospital and on any subsequent admissions. You may be asked to provide a number of samples to send to the laboratory to check if you are carrying or have an infection with the bacteria. These will probably be taken on a weekly basis during your stay. The samples might include swabs e.g. the site an intravenous drip enters the skin, a rectal swab i.e. a sample taken by inserting a swab briefly just inside your rectum (bottom), and/or a sample of faeces. You may also be tested if you have been in close contact with a patient during your hospital stay who has later been found to have a resistant organism. You will normally be informed of the results within two to three days but none of these measures will hinder your care in any way.

How can the spread of MDRO's be prevented?

If a patient in hospital is carrying these bacteria they can get into the ward environment and be passed on by direct contact to another patient. For that reason, you may be accommodated in a single room to help prevent spread. Healthcare workers must wash and

clean their hands regularly. They will use gloves and aprons (or gown) when caring for you. The most important measure for you to take is to wash your hands well with soap and water, especially after going to the toilet. You should avoid touching your medical devices (if you have any) such as your urinary catheter tube, any wound and your intravenous drip, particularly at the point where it is inserted into the body or skin. Visitors will be asked to clean their hands on entering and leaving the room and may be asked to wear gloves and apron (or gown) especially if they are assisting in your care.
Effective environmental cleaning and good hand hygiene by all, staff, patients and visitors, can reduce the risk of spread significantly.

What about when I go home?

While there is a chance that you may still be a carrier when you go home quite often this will go away with time. No special measures or treatment is required; any infection will have been treated prior to your discharge. You should carry on as normal, maintaining good hand hygiene especially after using the toilet. If you have any concerns you may wish to contact your GP for advice.

Before you leave hospital, ask the doctor or nurse to give you a letter or card advising that you have had an infection or have been/are colonised with an MDRO and which MDRO you have had. This will be useful for your future care and it is important that you make health and social care staff aware of it e.g. when attending an outpatient appointment or being visited by the community nursing team. Should you or a member of your household be admitted to hospital, you should let the hospital staff know that you are, or have been a carrier and show them the letter/card.

Where can I find more information?

Do ask your doctor or nurse to explain this to you in more detail. They may also contact the Infection Prevention and Control Team for you if you need further information about the management of MDRO and CPO.

The Public Health Wales and the Public Health England websites are another source of information:
http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/CarbapenemResistance

This information has been produced from the Public Health England Toolkit and with reference to the Guideline: Prevention and control of multi-drug-resistant Gram-negative bacteria: recommendations from a
Joint Working Party. APR Wilson et al. Journal of Hospital Infection 92 (2016) S1-S44
Author: Eleri Davies.
Additions: Gail Lusardi
April 2016, updated October 2018 (V2)
Update November 2018 (V3)

This leaflet is available in Welsh Language, follow this link: http://howis.wales.nhs.uk/sitesplus/888/document/460967

Appendix 6: MDRO Patient cards

Patient cards **(available in English and Welsh)** can be accessed via PHW link: http://howis.wales.nhs.uk/sitesplus/888/page/72809

If a patient is found to be infected or colonised with a Carbapenamase-producing Organism (CPO), they should be issued with a copy of the card below to assist with informing others offering healthcare to the patient of their status. This card can be cut out and folded in half to fit in a standard wallet.

CPO patient card:

GIG CYMRU NHS WALES | Iechyd Cyhoeddus Cymru Public Health Wales Important information about: carbapenemase-producing organism (**CPO**) Please show this card to health and social care staff	**For the Attention of Health and Social care staff** This patient is known to be colonised with **CPO**. Please follow your local infection control guidelines. For further advice please contact your local infection prevention and control team. Date Issued: _____ Organisation: _____ https://www.gov.uk/government/publications/carbapenemase-producing-enterobacteriaceae-early-detection-management-and-control-toolkit-for-acute-trusts

MDRO patient card can be accessed following this link: http://howis.wales.nhs.uk/sitesplus/documents/888/Public%20Health%20Wales%20Patient%20Card%20MDRO.pdf

Appendix 7:
Multi-Drug Resistant Organisms -What are Multi-Drug Resistant organisms?

There are different types of MDROs and they are classified on the basis of their mechanism of resistance:

Types of MDRO	Organism	Resistant to:-
Meticillin Resistant Staphylococcus aureus (MRSA)	Staphylococcus aureus	Has developed multi resistance to beta-lactam antibiotics including penicillins and cephalosporins.
Extended spectrum beta-lactamase (ESBL)	*E.coli* and *Klebsiella*	Generally resistant to cephalosporins. Frequently resistant to many other antibiotics including ciprofloxacin and aminoglycosides.
AmpC producing organisms	Enterobacter, Serratia and Citrobacter	Resistant to 3rd generation cephalosporins, beta-lactam combinations (i.e. co-amoxiclav and piperacillin/tazaobactam). Frequently resistant to many other antibiotics including ciprofloxacin and aminoglycosides
Carbapenemase Producing Enterobacteriaceae (CPE)	Organisms of most concern are:- Klebsiella pneumonia Escherichia coli.	These Gram-negative bacteria have the same resistance profile of ESBL/AmpC plus additional resistance to carbapenems and usually many other antibiotics. The treatment options are generally limited or, in rare cases, there may not be any option at all
Carbapenemase Producing Organisms (CPO)	Carbapenemase Resistance to a wide range of organisms resulting from production of enzymes that breakdown carbapenem antibiotic	Gram-negative bacteria resistant to the carbapenem group of antibiotics, which includes Meropenem. The treatment options are generally limited or, in rare cases, there may not be any option at all
Multi drug resistant Pseudomonas		Resistant to at least two of the following: ceftazidime, piperacillin /tazobactam, gentamicin and ciprofloxacin. Can also be resistant to carbapenems.
Multi drug resistant Acinetobacter		Resistant to 3rd generation cephalosporins and aminoglycoside. Some isolates may have additional resistance to carbapenems and many other drugs.
Glycopeptide Resistant Enterococci (GRE may also be referred to as Vancomycin Resistant Enterococci (VRE).	Enterococcus faecalis, Enterococcus faecium	GRE are enterococci that are resistant to one or both of the glycopeptides (Vancomycin and Teicoplanin). Organisms that colonise the bowel, may cause urinary tract infections, peritonitis, cholecystitis and endocarditis
Multi drug resistant tuberculosis (MDR-TB)	Mycobacterium tuberculosis	Multidrug-resistant TB (MDR-TB) is TB that does not respond to at least isoniazid and rifampicin,
Candida auris		Large number of isolates highly resistant to fluconazole Over 50% resistant to voriconazole. One third resistant to amphotericin, few resistant to echinocandins.

Appendix 8: Management of a patient with suspected or confirmed MDRO - Key aspects of management

Reproduced and adapted with permission from Betsi Cadwalader University Health Boards' MDRO policy (November 2016)

Infection Prevention Measure	Rationale
Single room isolation	• All patients with MDRO (colonised or infected) should be isolated in single rooms with en-suite facilities and should continue for the duration of the patient's stay. • All patients repatriated from a healthcare facility abroad or a UK hospital should be isolated and screening protocol commenced. • Patient's with a possible drug resistant Tuberculosis require isolation, preferably negative pressure
Hand Hygiene	• Hand hygiene is the **single most important practice** in reducing the transmission of infectious agents. • Patients should be encouraged to perform hand hygiene after using the toilet and before meals.
Personal Protective Equipment (PPE)	• PPE should be worn when there is a possibility of direct contact with blood or body fluids, or contact with items in the environment that may be contaminated.
Environmental Cleanliness	• Thorough and regular cleaning is the most effective way of preventing transmission. • On patient discharge the room must receive a terminal clean followed by Hydrogen peroxide vapour (HPV) decontamination or ultra-violet light (UVL) decontamination process if HPV is not available.
Equipment cleanliness	• It is best practice to dedicate equipment to an isolated patient. • Where possible equipment should be single use or single patient use, or should be cleaned/decontaminated in accordance with local policy
Patient movement	• Patient transfer should be kept to a minimum, but this should not compromise the patient's care. Risk assessment required. • Arrangements should be put in place to minimise contact with other patients and expedite their journey through that department.
Surgical/invasive procedures	• If the procedure is carried out in an operating theatre which provides the recommended minimum air exchanges and cleaning and disinfection can be carried out effectively, there is no reason to place patients at the end of the list during a procedure list
Communication	• All staff should check with the Nursing team regarding instructions prior to entering the room. • Patient and family should be given advice by medical team and information leaflet given to the patient.

Appendix 9: Early recognition of individuals who may be colonised / have an infection with *Carbapenemase*-producing *Enterobacteriaceae*

Adapted from Public Health England's CPE toolkit (2014/2015)

KEY MESSAGE: Include this risk assessment as part of the routine admission procedure to identify suspected cases of colonisation or infection with carbapenemase-producing Enterobacteriaceae
Assess each patient on admission, readmission *OR* on transfer from another healthcare facility
NOTE: if the patient is a recent laboratory confirmed case of carbapenemase-producing Enterobacteriaceae infection / colonisation (i.e. during this admission episode or confirmed at a transferring healthcare facility [UK facility only]) bypass this step, isolate the patient immediately and treat as a positive case IN THE LAST 12 MONTHS HAS THE PATIENT: Been an inpatient in a hospital abroad *OR* Been an inpatient in a UK hospital known to have had problems with spread of carbapenemase-producing Enterobacteriaceae *OR* Previously been colonised or had an infection with carbapenemase-producing Enterobacteriaceae or close contact with a person who has, if known
If <u>one or more</u> of above applies then:
The patient is considered to meet the criteria for being a suspected case of carbapenemase-producing Enterobacteriaceae colonisation or infection (as applicable) AND REQUIRES IMMEDIATE ISOLATION PLUS • instigation of *strict standard precautions* to prevent possible spread (as per local policy) • screening to assess current status for colonisation or infection (as per local policy) • assessment for appropriate treatment (*applies to infection only*) (as per local policy)
Acute setting management advice
ENSURE THAT assessment takes place and it is effective by: • including risk assessment in routine admission and transfer documentation • providing training for all relevant staff in: ➢ taking an effective admission history ➢ recognising patients who meet the criteria for a recent laboratory confirmed case or suspected case (as per local MDRO policy) ➢ the need to act promptly if a recent laboratory confirmed or suspected case presents

Appendix 10: Early isolation of suspected and laboratory-confirmed CPO.

Adapted from Public Health England's' CPE toolkit (2014/2015)

***KEY MESSAGE**: If you have a suspected case* or *laboratory confirmed case this step is needed to prevent spread within your organisation*
If the patient already has laboratory-confirmed infection or colonisation with carbapenemase-producing Enterobacteriaceae *OR* meets the criteria for a suspected case (following risk assessment) then:
Advise the patient (and relatives if appropriate) of the positive result or your suspicions (whichever applies) and your management plan – provide patient information leaflet (Appendix 4) *AND* Immediately place the patient into a single room with en suite facilities and send screening samples *AND* Apply strict standard precautions in all settings
Acute setting management advice
The patient is considered to meet the criteria for being a suspected case of carbapenemase-producing Enterobacteriaceae colonisation or infection (as applicable) AND REQUIRES IMMEDIATE ISOLATION PLUS • instigation of *strict standard precautions* to prevent possible spread (as per local policy) • screening to assess current status for colonisation or infection (as per local policy) • assessment for appropriate treatment (applies to infection only) (as per local policy)
Acute setting management advice
All suspected (including previously positive[9]) patients should be isolated until screening results are known. If the patient is **POSITIVE** on screening for carbapenemase-producing Enterobacteriaceae or is a laboratory-confirmed case (colonisation or infection): • they should remain in isolation for the duration of their hospital stay • Refer to the hospital Carbapenemase-producing Enterobacteriaceae policy • comprehensive awareness raising of the plan should take place amongst staff including doctors, nurses, physiotherapists, domestics and others with patient contact Strict standard precautions must be practiced (whether the patient has infection or colonisation) including: • good hand hygiene • where any part of a staff uniform, not protected by an ordinary apron, is expected to come into contact with the patient, a long-sleeved disposable gown should be used e.g. when assisting movement for a dependent patient • use of personal protective equipment (PPE) in line with standard precautions environmental cleaning and decontamination, with an enhanced focus on frequent cleaning of hand contact areas (follow local policy) If **NEGATIVE** a further two negative samples need to be achieved and a risk assessment undertaken before removing from isolation

Appendix 11: Example template letter to General Practitioner regarding in-patient confirmed with Carbapenemase-producing organism (CPO)

Reproduced with kind permission from ABUHB Infection Prevention & Control Team (June 2018)

Dear …

The above person is currently an in-patient on Ward X at X Hospital. During their admission, the patient was identified as having Carbapenemase-producing organism (CPO) from a swab collected on XX/XX/2018. The patient has been informed of the positive result and has been given an Alert card.

We would recommend you place an "Alert" of this organism in the patient's notes. If the patient is re-admitted to secondary care, please contact the admitting hospital or include details of the positive organism on your GP referral notification.

What is CPO?
Carbapenemase-producing organisms (CPO) are bacteria which usually live harmlessly in the gut, this is known as colonisation, however, if the bacteria enters the bloodstream or bladder they can sometimes cause infection. The bacteria produce carbapenemase (enzyme) which destroy carbapenem antibiotics and so the bacteria are said to be resistant.

If the patient is said to be colonised (screen positive) they do not require treatment, however if the bacteria have caused infection they will need treatment with antibiotics.

If you have any queries, please contact a member of the Infection Prevention Team on ********* or out of hours, contact the on-call Microbiologist via the hospital switchboard.

Further guidance is also available via the link below:-

https://www.gov.uk/government/publications/carbapenemase-producing-enterobacteriaceae-non-acute-and-community-toolkit

Yours sincerely

Appendix 12: Example template letter to General Practitioner regarding patient discharged with confirmed Carbapenemase-producing organism (CPO)

Reproduced with kind permission from ABUHB Infection Prevention & Control Team (June 2018)

Dear …

The above person was recently an in-patient on ward X at X Hospital. During their admission, the patient was identified as having Carbapenemase-producing organism (CPO) from a swab collected on XX/XX/2018. The patient is unlikely to be aware of this positive result. In line with National Guidelines (see below), it is advisable that the patient is notified of this result as this is a significantly resistant organism.

We would also recommend you place an "Alert" of this organism in the patient's notes. If the patient is likely to be admitted to secondary care, please contact the admitting hospital or include details of the positive organism on your GP referral notification.

What is CPO?
Carbapenemase-producing organisms (CPO) are bacteria which usually live harmlessly in the gut this is known as colonisation, however if the bacteria enters the bloodstream or bladder for instance, they can sometimes cause infection. The bacteria produce carbapenemase (enzyme) which destroy carbapenem antibiotics and so the bacteria are said to be resistant.

If the patient is said to be colonised (screen positive) they do not require treatment, however if the bacteria have caused infection they will need treatment with antibiotics.

If you have any queries, please contact a member of the Infection Prevention Team on ********** or out of hours, contact the on-call Microbiologist via the hospital switchboard.

https://www.gov.uk/government/publications/carbapenemase-producing-enterobacteriaceae-non-acute-and-community-toolkit

Yours sincerely

Appendix 13: GLOSSARY / DEFINITIONS

MDRO	Multidrug resistant organisms (MDRO) are defined as bacteria that have become resistant to more than one class of antimicrobial agents and usually are resistant to all but one or two commercially available antimicrobial agents, complicating treatment of illnesses they cause.
CRO	Carbapenem-resistant organisms (CRO) - Gram negative bacteria including Enterobecteriaceae (such as *Klebsiella pneumonia* and *Escherichia coli*) and non-fermenters (such as *Acinetobacter baumannii*, *Pseudomonas aeruginosa* and *Stenotrophomonas maltophilia*)
CPO	Carbapenemase Producing Organisms (CPO) - with resistance resulting from production of enzymes that breakdown carbapenem antibiotic – this makes the bacteria resistant to the carbapenem group of antibiotics, which includes Meropenem.
CRE	Carbapenem-resistant Enterobacteriaceae (CRE) – Enterobacteriaceae that are resistant to carbapenems by any mechanism, including the production of an acquired carbapenemase or the production of an ESBL or AmdC combined with porin loss
CPE	Carbapenemase Producing Enterobacteriaceae (CPE) – resistance resulting from production of enzymes that breakdown carbapenem antibiotics in the group of organisms that includes *E. coli* and *Klebsiella* spp.
ESBL	Extended Spectrum Beta-Lactamase are enzymes produced by certain bacteria that destroy, and so confer resistance to, a wide range of antibiotics. ESBL enzymes are most commonly produced by two types of bacteria – *E.coli* and *Klebsiella.*
MR-GNB	Multi Resistant Gram negative bacteria are a type of Gram-negative bacteria with resistance to multiple antibiotics. .
MRAB	Multi-resistant Acinetobacter baumannii – environmental organisms widespread in & outside healthcare settings. Prevalent in static water & found within hospital environment.
CRAB	Carbapenem Resistant Acinetobacter -

	resistance resulting from production of enzymes that breakdown carbapenem antibiotics in Acinetobacter sp.
MRSA	Meticillin Resistant *Staphylococcus aureus* is a Gram-positive bacterium that is highly resistant to meticillin, penicillin, and certain other antibiotics. MRSA is any strain of *Staphylococcus aureus* that has developed, through horizontal gene transfer and natural selection, multiple drug resistance to beta-lactam antibiotics.
GRE	Glycopeptide Resistant Enterococci – resistance to the Glycopeptide antibiotics Vancomycin & Teicoplanin. Often found as commensals of the gastrointestinal tract, lower urethra and female genital tract. Commonly cause urinary tract infections, in compromised patients may cause more invasive disease such as bacteraemia, endocarditis, wound infection, cholangitis and meningitis.
VRE	Vancomycin Resistant Enterococci may also be called GRE. Enterococci resistant to Vancomycin.
PVL	Panton Valentine Leukocidin is a toxin produced by some strains of *staphylococcus aureus.*
C. auris	*Candida auris* is an emerging fungus that presents a serious global health threat. Healthcare facilities in several countries have reported that *C. auris* has caused severe illness in hospitalized patients. Some strains of *C. auris* are resistant to all three major classes of antifungal drugs. This type of multidrug resistance has not been seen before in other species of *Candida*. *C. auris* can persist on surfaces in healthcare environments and spread between patients in healthcare facilities

Appendix 14: NHS Organisation policies and resources accessed, adapted and reproduced with permission to support development of all-Wales MDRO guidelines

Aneurin Bevan University Health Board – Infection Prevention and Control Policy – Control of Multi-Drug Resistant Gram-Negative Bacteria (Approved January 2016)

Betsi Cadwalader University Health Board – Multi-Drug Resistant Organisms Procedure (Other than MRSA) – *in draft*

Betsi Cadwalader University Health Board – MRSA protocol IPC15 (Approved June 2015)

Cardiff and Vale University Health Board – Procedure for the prevention, control and management of multi drug resistant organisms – Clinical risk assessment tool (Approved November 2017).

Hywel Dda University Health Board – Infection Prevention and Control of Multi-Drug Resistant Organisms (Approved March 2016)

Powys Teaching Hospital – Management of adults with MRSA (Approved August 2013)
Public Health Wales – MDRO patient information leaflet/MDRO alert cards (Updated October 2018).
MDRO Venn diagram, reproduced courtesy of Mandy Wootton, Lead Scientist, Specialist Antimicrobial Chemotherapy Unit (SACU), PHW (June 2018).