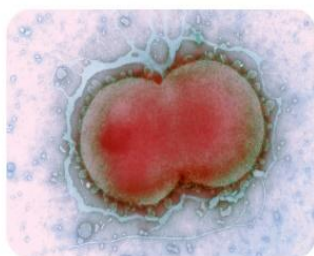
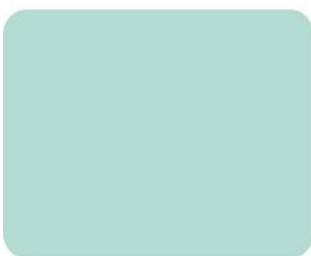
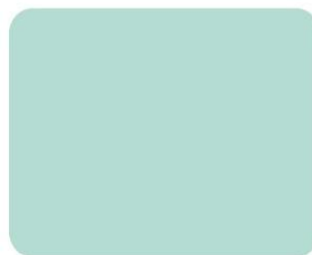
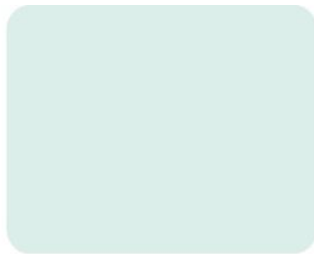




UK Health
Security
Agency

UK Standards for Microbiology Investigations

Identification of *Moraxella* species and morphologically similar organisms



Acknowledgments

UK Standards for Microbiology Investigations (UK SMIs) are developed under the auspices of UKHSA working in partnership with the partner organisations whose logos are displayed below and listed on [the UK SMI website](#). UK SMIs are developed, reviewed and revised by various Working Groups which are overseen by the UK SMI [Steering Committee](#).

The contributions of many individuals in clinical, specialist and reference laboratories who have provided information and comments during the development of this document are acknowledged. We are grateful to the editors for editing the medical and clinical content.

UK SMIs are produced in association with:

Applied
Microbiology
International

Association for
Laboratory
Medicine

BIAM
British Infection Association

BRITISH SOCIETY FOR
ANTIMICROBIAL
CHEMOTHERAPY

BRITISH SOCIETY FOR
MEDICAL MYCOLOGY
BSM

BSMT
BRITISH SOCIETY FOR
MICROBIAL TECHNOLOGY

BRITISH SOCIETY FOR PARASITOLOGY
BSP

FEICROBIOLEG CYMRU
WMA

Healthcare
Infection
Society

HSC Public Health
Agency

IBMS Institute of
Biomedical Science

MICROBIOLOGY
SOCIETY

PATHNET NI
Pathology Network, Northern Ireland

Public Health
Scotland

GIG Iechyd Cyhoeddus
CYMRU Cymru
NHS Public Health
WALES Wales

RCGP Royal College of
General Practitioners

The Royal College of Pathologists
Pathology: the science behind the cure

SAM
Society for Anaerobic Microbiology

Scottish Microbiology
and Virology Forum

THE UK CLINICAL
VIROLOGY NETWORK

UKAS
United Kingdom
Accreditation
Service

Displayed logos correct as of August 2026

Contents

Click on the links for the relevant sections.

Acknowledgments	2
Contents	3
Amendment table	4
1 General information.....	6
2 Scientific information	6
3 Scope of document	6
4 Introduction.....	7
5 Safety considerations	8
6 Identification	9
7 Storage	12
8 Reporting	12
9 Referral to reference or specialist testing laboratories	14
10 Public health responsibilities of diagnostic laboratories	14
Algorithm: Identification of <i>Moraxella</i> species and morphologically similar organisms	15
References	16

Amendment table

The amendments since the previous version of this UK SMI document are listed in the amendments table below.

Any alterations to this document should be controlled in accordance with the local document control process.

Amendment number/date	8/01.10.26
Issue number discarded	3
Insert issue number	4
Anticipated next review date*	01.10.29
Section(s) involved	Amendment
Whole document	Document has been presented in a new template and restructured. Hyperlinks have been updated to direct the reader to the RCPATH website. Public Health England replaced by UK Health Security Agency. References to NICE accreditation removed and UK Health Security Agency logo updated. Devolved administrations links have been updated.
Introduction	Information regarding characteristics of individual species has been summarised into table 1. Information and references have been updated. Target organisms section removed and replaced with section 4.1: Target organisms of clinical significance.
Safety considerations	Standard references have been replaced with a link to the relevant page on the website.
Identification	Section has been restructured to reflect identification procedures. Table 1 added to summarise morphology of target organisms. Technical information section has been removed and information has been moved into the relevant sections.

Reporting	Section headings and information has been updated as appropriate.
Public health responsibilities in diagnostic laboratories	Section has been added.
Algorithm	Algorithm has been updated to better align with current laboratory practices.
References	Updated where appropriate.

*Reviews can be extended up to 5 years where appropriate

1 General information

[View general information](#) related to UK SMIs.

2 Scientific information

[View scientific information](#) related to UK SMIs.

3 Scope of document

This UK SMI document describes the identification of *Moraxella* species and other morphologically similar organisms such as *Oligella* species and *Psychrobacter* species, using methods such as microscopy, matrix-assisted laser desorption ionisation-time of flight mass spectrometry (MALDI-TOF MS) and commercial identification systems or phenotypic approaches as required. Molecular methods are mentioned as an alternative method for identification and confirmation.

The test procedure for matrix-assisted laser desorption ionisation-time of flight mass spectrometry (MALDI-TOF MS) is covered in [UK SMI TP 40: Matrix-assisted laser desorption/ionisation - time of flight mass spectrometry \(MALDI-TOF MS\) test procedure](#).

Antimicrobial Susceptibility Testing (AST) is beyond the scope of this document. However, for effective antibiotic stewardship, laboratories should perform AST on all clinically significant isolates, particularly in cases of poor treatment response. For further information related to AST, please refer to the other UK SMI categories.

Please note, the use of some biochemical tests may not be required except in cases where confirmation by an alternative technique is needed or where automated methods are not available.

This document mentions the differentiation of *Moraxella* species from *Neisseria*, *Kingella* and *Acinetobacter* species. The identification of these genera is covered in [UK SMI ID 6 – Identification of *Neisseria* species](#), [UK SMI ID 12 - Identification of *Haemophilus* species and the HACEK group of organisms](#) and [UK SMI ID 17 - Identification of *Pseudomonas* species and morphologically similar organisms](#). For further information on specific organisms and their associated clinical syndromes, please refer to the relevant UK SMI in the [Syndromic](#) and [Bacteriology](#) categories.

This UK SMI should be used in conjunction with other UK SMIs.

4 Introduction

4.1 Target organisms of clinical significance

Moraxella species are generally considered commensals of human mucous membranes, including the respiratory and genital tract, however, some species can cause disease. The most clinically relevant species is *Moraxella catarrhalis*, which is associated with acute otitis media in children and lower respiratory infections associated with chronic obstructive pulmonary disease (COPD), pneumonia and sinusitis in adults (1-3). Colonisation by *M. catarrhalis*, is common in children, with the incidence decreasing with age. Colonisation is also more common in patients with COPD and is linked to COPD exacerbation (2).

Moraxella osloensis is commonly isolated in blood cultures. In immunocompetent patients, it often represents contamination. *M. osloensis* has been reported as a rare cause of invasive infection including endocarditis, meningitis, septic arthritis, osteomyelitis and bacteraemia, particularly in immunocompromised patients (4). Isolated *M. osloensis* bacteraemia is an uncommon clinical finding in immune competent patients. *M. osloensis* and *Moraxella nonliquefaciens* have been isolated in cases of keratitis, conjunctivitis, and endophthalmitis (4,5). *M. nonliquefaciens* can also be isolated from the human respiratory tract (6).

Moraxella lacunata is the main species that represents the genus, although it is not as frequently isolated as *M. catarrhalis* (7). *M. lacunata* has been associated in conjunctivitis, endocarditis and keratitis (6,8). Other *Moraxella* species, including *Moraxella atlantae* and *Moraxella lincolnii*, have also been isolated from humans, but are of less clinical relevance (6).

Of the other morphologically similar organisms, the genus *Oligella* only consists of two species: *Oligella urethralis* and *Oligella ureolytica* (7). They are mainly isolated from the genitourinary tract of humans and are unlikely to be pathogenic, although they have been associated with invasive disease in patients that are immunosuppressed or have underlying health conditions (9).

Psychrobacter species are found in a variety of habitats, ranging from marine environments to human microbiota, making them interesting organisms for the medical profession as well as microbiological and environmental research (10). They are considered part of the human microbiota. Human infection by *Psychrobacter* species is rare, with only six species known to have been isolated in humans at the time of review. These are *P. arenosus*, *P. immobilis*, *P. faecalis*, *P. phenylpyruvicus*, *P. pulmonis* and *P. sanguinis*.

4.2 Taxonomy and characteristics

Moraxella species are Gram negative rods or coccobacilli belonging to the *Moraxellaceae* family (7). *Moraxella* species are non-motile and aerobic, but some

strains may grow weakly under anaerobic conditions. Most species, except *M. osloensis*, are nutritionally fastidious. Growth on standard media may be sparse or fail completely and generally demonstrate a lack of colony pigmentation. Some species are stimulated significantly by fatty acids (bile salts, Tween 80). The optimum growth temperature is 33°C to 35°C. Pleomorphism is enhanced by lack of oxygen and by incubation at temperatures above the optimum (6). They are oxidase and catalase positive.

Oligella species are small rods, often occurring in pairs. The cells lack the plumpness of *Moraxella* species. They are aerobic, non-capsulated, non-spore-forming and mostly non-motile, but some strains of *O. ureolytica* are peritrichously flagellated (11).

Psychrobacter cells are non-motile, Gram negative coccobacilli. Unlike *Moraxella* species, many *Psychrobacter* species can form acid aerobically from glucose and several other sugars. They are psychrotrophic and therefore can grow at temperatures as low as 5°C, although optimal growth occurs closer to 20°C. They are generally unable to grow at 35°C - 37°C, although some strains have an optimal growth at these temperatures.

5 Safety considerations

The section covers specific safety considerations related to this UK SMI, and should be read in conjunction with the general [safety considerations](#) on the UK SMI website.

Refer to current guidance on the safe handling of all organisms documented in this UK SMI.

M. catarrhalis is a Hazard Group 2 organism, the processing of diagnostic specimens should be carried out at Containment Level 2.

Laboratory procedures that give rise to infectious aerosols must be conducted in a microbiological safety cabinet.

Consider *Neisseria meningitidis* from respiratory specimen. All work on suspected *N. meningitidis* which is likely to generate aerosols must be performed in a microbiological safety cabinet.

The above guidance should be supplemented with local COSHH and risk assessments.

Compliance with postal and transport regulations is essential.

6 Identification

In routine laboratory workflows, MALDI-TOF MS is the primary method used for species-level identification. When MALDI-TOF MS results are inconclusive, confirmation is required, or automated systems are unavailable, alternative characterisation may be achieved using phenotypic or biochemical tests performed from non-selective media. Real-time Polymerase Chain Reaction (PCR) and other nucleic-acid amplification test (NAAT) platforms may also be used when clinically appropriate.

6.1 Microscopic appearance

6.1.1 Gram stain

Refer to [UK SMI TP 39 – Staining procedures](#).

All species are Gram negative with a tendency to resist decolourisation.

- Some *Moraxella* species, such as *M. catarrhalis*, are coccobacilli usually occurring in pairs or short chains with one plane of division. They may also appear as cocci occurring singly or in pairs with adjacent sides flattened, forming tetrads. Other *Moraxella* species may be rod-shaped, such as *M. nonliquefaciens*.
- *Oligella* species are small rods or coccobacilli, often occurring in pairs. Cells lack the typical plumpness of *Moraxella* species.
- *Psychrobacter* species are rods, often coccobacilli that usually occur in planes with one plane of division. Microscopy can differentiate *Brucella* species (very small coccobacilli) from *P. phenylpyruvicus*.

6.2 Primary isolation media

Moraxella species, *Oligella* species and *Psychrobacter* species can grow on a range of media including CLED and chocolate agar, but the primary isolation media is blood agar. CO₂ is required for optimal growth. *Psychrobacter* species require incubation at 20°C - 25°C.

6.3 Colonial appearance

6.3.1 *Moraxella* species

Colonies vary with species. *M. catarrhalis* colonies are generally uniform, smooth, convex, buff and 1 - 2mm in diameter. *M. catarrhalis* colonies are cohesive enough that they can be pushed across the agar surface without collapsing, sometimes known as the 'hockey puck' or 'shove' test. This is not seen in *Neisseria*, *Oligella* or *Psychrobacter* species.

For colonial appearance of non-catarrhalis species, please see Table 1.

Note: On chocolate agar, colonies of *M. catarrhalis* are pinkish brown, and may resemble *N. gonorrhoeae*.

6.3.2 *Oligella* species

Colonies are small, white, opaque, entire and non-haemolytic after 24hr incubation.

6.3.3 *Psychrobacter* species

Colonies are small, smooth and opaque on blood agar. Growth is enhanced by bile salts or Tween 80 to form non-pigmented, smooth, opaque colonies.

Table 1: Microscopic and colonial appearance of *Moraxella* species and other morphologically similar species (6,11,12)

Species	Microscopic and colonial characteristics
<i>M. catarrhalis</i>	Cocci with division in 2 planes. May be fimbriated. Colonies are buff, opaque and non-haemolytic. Characterised by non-adherent colonies that slide across the agar when pushed.
<i>M. atlantae</i>	Variably sized diplococcobacillary to rod-shaped cells that are often fimbriated. Colonies are small, non-haemolytic and slightly opaque and show spreading/pitting of agar.
<i>M. lacunata</i> ,	Thick/plump rods, 0.8 - 1.2µm in diameter, occurring in diploid pairs and chains. Tendency to lose their Gram negative staining characteristics when left out for days. Small, semi opaque colonies that may pit agar.
<i>M. nonliquefaciens</i>	Plump rods with obtuse nearly square ends, often very short diplobacilli. Small, low convex colonies that occasionally spread and pit the agar. Non-pigmented and non-haemolytic.
<i>M. osloensis</i>	Shaped like <i>M. nonliquefaciens</i> , however some may show a more fusiform or lanceolate shape. Colonies appear similar to <i>M. lincolnii</i> but pitting of the agar is rare.
<i>M. lincolnii</i>	Plump rods, often occurring in pairs and may form short chains. Colonies are whitish, smooth, convex and circular. Some strains may have a flattened edge.
<i>Oligella</i> species	Small rods, generally not exceeding 1 µm and often occur in pairs. Colonies develop slowly and more overtly white than <i>Moraxella</i> . Non-haemolytic.
<i>P. immobilis</i>	Plump coccobacilli frequently showing diploforms.
<i>P. phenylpyruvicus</i> ,	Coccoid. Circular, slightly convex, cream-coloured colonies. Psychrotolerant and halotolerant
<i>P. faecalis</i> ,	Straight rods, occurring singly. On nutrient agar, colonies are circular, opaque, slightly raised and beige.
<i>P. pulmonis</i> ,	Coccus-shaped. Non-pigmented, smooth colonies on blood agar.
<i>P. sanguinis</i> ,	Non-haemolytic, non-pigmented coccobacilli. Colonies are moist, circular and smooth.

Species	Microscopic and colonial characteristics
<i>P. arenosus</i>	Ovoid cells. On blood agar colonies are monomorphic, small and grey. On TSA colonies are opaque, circular, convex and cream coloured. Psychrotolerant.

6.4 Matrix-assisted laser desorption/ionisation - time of flight mass spectrometry (MALDI-TOF MS)

MALDI-TOF MS is used to provide an accurate and rapid primary identification of *Moraxella*, *Oligella* and *Psychrobacter* species (13). This method should be appropriately validated, and all databases updated. Manufacturer's instructions should be followed. The use of an extraction step for more reliable identification should be considered.

Laboratories should follow local policies on whether MALDI-TOF MS is used primarily for identification, but any low identification scores should be retested with other biochemical tests

6.5 Further identification

6.5.1 Biochemical tests

Oxidase test

Refer to [UK SMI TP 26 – Oxidase Test](#)

Moraxella species are oxidase positive and may be misidentified as other oxidase positive isolates such as *Pseudomonas* species, *Neisseria* species and *Kingella* species.

Tributylin test

Moraxella species are tributyrin positive and can be used to differentiate *M. catarrhalis* from *Neisseria* species which is negative (14).

DNase test

Refer to [UK SMI TP 12 – Deoxyribonuclease Test](#)

Positive for *M. catarrhalis*.

The DNase test may be used as a supplementary test to differentiate *M. catarrhalis* from other *Moraxella* species.

6.5.2 Commercial identification Systems

Other identification systems including commercial kits may be used as a supplementary or confirmatory test. Laboratories should follow manufacturer's instructions and rapid tests and kits should be validated and be shown to be fit for purpose before use.

Note: Some commercial identification systems may misidentify *Brucella* species as *P. phenylpyruvicus* (15).

6.5.3 Molecular Methods

If identification using the previously described methodologies is not possible, 16S rRNA gene sequencing can be used for identification where required.

16S rRNA may also be beneficial for detection of *Moraxella* and other morphologically similar organisms directly from sterile clinical specimens.

NAATs may be used for the rapid detection and quantification of *M. catarrhalis* in nasopharyngeal secretions or other validated specimen types without the need for bacterial culture and when investigating mixed bacterial infection, e.g. with *M. catarrhalis*, *Haemophilus influenzae*, and *Streptococcus pneumoniae* in a single amplification assay.

7 Storage

If required, save pure isolate on blood agar slopes for referral to the Reference Laboratory. For information regarding retention and storage of pathological records and specimens, please refer to the Royal College of Pathologists – Best practice recommendations (16).

8 Reporting

8.1 Designated infection specialist

The infection specialist should be informed of presumptive or confirmed *Moraxella* species and morphologically similar organisms when the isolate is from a normally sterile site or in cases of invasive disease.

Identification of *Moraxella* species and other morphologically similar organisms may be representative of colonisation and therefore should be interpreted in light of the clinical and epidemiological picture.

Follow local protocols for reporting to clinician. For information regarding communication of critical and unexpected pathology results, refer to Royal College of Pathologists best practice recommendations (17).

8.2 Interim report

If interim or preliminary results are required in accordance with local policy, these may be issued on detection of clinically significant isolates as soon as growth is detected, unless alternative arrangements have been agreed with the requestor. Positive microbiological results should be released immediately in accordance with local policy. Where required, preliminary results should undergo specialist interpretation prior to release.

8.3 Final report

Final reports should be issued as soon as results are complete and clinically validated. Results should include appropriate interpretative comments and be communicated in accordance with local laboratory policy.

Any [notifiable disease](#) should also be notified to the relevant body in accordance with statutory requirements.

8.4 Reporting time

Please see text above.

8.5 Health Protection Team (HPT)

Refer to local agreements in devolved administrations.

8.6 UK Health Security Agency

Refer to current guidelines on Second Generation Surveillance System (SGSS) reporting (18).

8.7 Infection prevention and control team

N/A

9 Referral to reference or specialist testing laboratories

When sending away isolates to reference or specialist testing laboratories for processing, ensure that the specimen is placed in the appropriate package and transported accordingly. Follow local regulations and instructions provided by the reference or specialist testing laboratories for sending isolates.

Contact the appropriate reference laboratory (refer to the links provided below) for information on the tests available, turnaround times, transport procedure and any other requirements for specimen or isolate submission.

[England](#)

[Wales](#)

[Scotland](#)

[Northern Ireland](#)

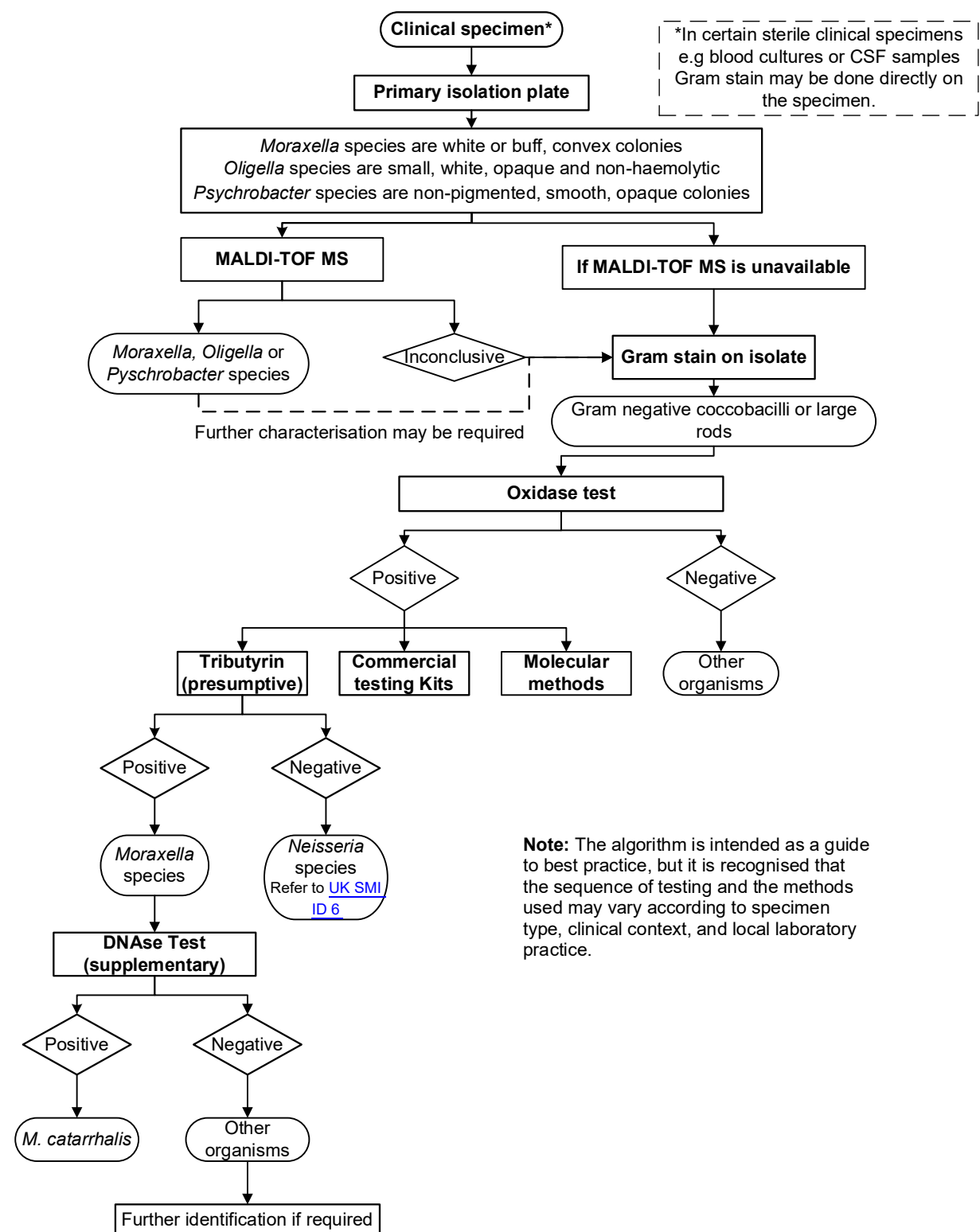
10 Public health responsibilities of diagnostic laboratories

Diagnostic laboratories have public health responsibility as part of their duties. Amongst these are additional local testing, or referral to further characterise the organism as required, primarily for public health purposes e.g., routine *Cryptosporidium* detection; serotyping or microbial subtyping; and a duty to refer appropriate specimens and isolates of public health importance to a reference laboratory.

Diagnostic laboratory outputs inform public health intervention, and surveillance data is required to develop policy and guidance forming an essential component of healthcare. It is recognised that additional testing and referral of specimen may entail some costs that have to be borne by the laboratory, but in certain jurisdictions these costs are covered centrally.

Diagnostic laboratories should be mindful of the impact of laboratory investigations on public health and consider requests from the reference laboratories for specimen referral or enhanced information.

Algorithm: Identification of *Moraxella* species and morphologically similar organisms



References

An explanation of the reference assessment used is available in the [scientific information section on the UK SMI website](#).

For suggested citation of UK SMIs, refer to [UK SMI Development](#).

1. Broides A and others. Acute otitis media caused by Moraxella catarrhalis: epidemiologic and clinical characteristics. Clinical Infectious Diseases 2009: volume 49, issue 11, pages 1641–7. **2+** 10.1086/647933
2. Murphy TF and others. Moraxella catarrhalis in Chronic Obstructive Pulmonary Disease. American Journal of Respiratory and Critical Care Medicine 2005: volume 172, issue 2. **2+** 10.1164/rccm.200412-1747OC
3. Murphy TF, Parameswaran GI. Moraxella catarrhalis, a human respiratory tract pathogen. Clin Infect Dis 2009: volume 49, issue 1, pages 124–31. **+** 10.1086/599375
4. Tabbuso T and others. Moraxella osloensis infection among adults and children: A pediatric case and literature review. Arch Pediatr 2021: volume 28, issue 4, pages 348–51. **2+** 10.1016/j.arcped.2021.03.003
5. LaCroce SJ and others. Moraxella nonliquefaciens and M. osloensis Are Important Moraxella Species That Cause Ocular Infections. Microorganisms 2019: volume 7, issue 6. **2+** 10.3390/microorganisms7060163
6. Fernández-Garayzábal JF and others. Moraxella. Bergey's Manual of Systematics of Archaea and Bacteria; 2022. pages. 1–28. **++**
7. Göker M and others. List of Recommended Names for bacteria of medical importance: report of the Ad Hoc Committee on Mitigating Changes in Prokaryotic Nomenclature. International Journal of Systematic and Evolutionary Microbiology 2025: volume 75, issue 10. **++** <https://doi.org/10.1099/ijsem.0.006943>
8. Ioannou P and others. Infective Endocarditis by Moraxella Species: A Systematic Review. J Clin Med 2022: volume 11, issue 7. **1+** 10.3390/jcm11071854
9. Farfour E and others. Oligella spp.: A systematic review on an uncommon urinary pathogen. European Journal of Clinical Microbiology & Infectious Diseases 2024: volume 43, issue 6, pages 1037–50. **1+** 10.1007/s10096-024-04797-9
10. Ioannou P and others. Psychrobacter Infections in Humans—A Narrative Review of Reported Cases. pages 140. 2025. **1+** 10.3390/antibiotics14020140

11. Kersters K, Vancanneyt M. Oligella. Bergey's Manual of Systematics of Archaea and Bacteria; 2015. pages. 1–8. +
12. Sood U and others. Psychrobacter. Bergey's Manual of Systematics of Archaea and Bacteria; 2025. pages. 1–30. ++
13. Rocca Maria F and others. MALDI-TOF MS experience with the identification of complex microorganisms using two devices in a National Reference Laboratory. Microbiology Spectrum 2025: volume 13, issue 5, pages e01677–24.2++ 10.1128/spectrum.01677-24
14. Perez JL and others. Butyrate esterase (4-methylumbelliferyl butyrate) spot test, a simple method for immediate identification of Moraxella (Branhamella) catarrhalis [corrected]. J Clin Microbiol 1990: volume 28, issue 10, pages 2347–8.2-
15. Al Dahouk S, Nöckler K. Implications of laboratory diagnosis on brucellosis therapy. Expert Review of Anti-infective Therapy 2011: volume 9, issue 7, pages 833–45.+ 10.1586/eri.11.55
16. The Royal College of Pathologists. The retention and storage of pathological records and specimens (6th edition). pages 1–59. 2025. ++
17. The Royal College of Pathologists. Best practice recommendations. The communication of critical and unexpected pathology results 2026. ++
18. UK Health Security Agency (UKHSA). Laboratory reporting to UKHSA: a guide for diagnostic laboratories. UKHSA 2025. pages 1–35. ++