Considerations for COVID-19 testing for outbreak management and surveillance in hospitals and care homes

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For CMO SAG 30/4/20

1. Situation

1.1 Testing to date in hospitals and care homes in Scotland has been based on identifying suspected cases (symptoms) and confirming clinically, or by laboratory test. This is being done to enable patient management within hospitals and resident management in care homes, as part of the outbreak management response overall.

1.2 Identifying those patients and residents who are positive for COVID-19, enables adoption of transmission based precautions, inclusive of placement in isolation or cohorts where isolation capacity is exceeded.

1.3 There is an identified need to better understand the healthcare associated COVID-19 epidemiology and emerging evidence, in order to identify any additional, or specifically targeted, infection prevention and control (IPC) measures which are needed.

2. Current challenges with data on HAI in hospital inpatients and care home residents

2.1 There is no agreed international consensus on definitions for HAI (nosocomial) COVID-19. PHE have asked if the International Health Regulations (IHRs) can consider this, however there has been no decision to date.

2.2 HAI would usually be those infections, not present or incubating on admission, therein arising after 48 hours of admission to hospital or a care home. The nature of COVID-19 presentation, the incubation period and pandemic context needs to be taken account of.

2.3 The incubation period for COVID-19 is longer than the 48 hour after admission period for defining HAI. Current estimates suggest a median incubation period from 5–6 days for COVID-19, with a range from 1–14 days. The median incubation period from a recent study was 5.1 days and 97.5% had onset within 11.5 days[1]. The 2.5 percentile was 2.2 days. 25 and 75 percentiles were 3.8 and 6.7 days respectively. Another modelling study confirmed that it remains prudent to consider the incubation period to be up to 14 days[2].

This means that COVID-19, arising before day 14 in hospital or care settings, may not be HAI.

2.4 It is important to manage all positive COVID-19 cases in hospitals and care homes to prevent the risk of cross transmission in these settings. This includes identifying those that: present on admission, arise during a stay, or are healthcare associated.

3. Testing purposes and current policy and guidance

3.1 Testing for COVID-19 in hospitals and care homes can be done for two main purposes: case management support for the outbreak and wider surveillance purposes.

3.2 A number of SGHSCD policy and PHE (PHS) guidance decisions to date have impacted on current COVID-19 testing in hospital and care homes with respect to case management:

- Testing of all suspected cases (Symptomatic)
- Testing more widely in the context of outbreaks and clusters either at the care home level or ward level (inclusive of contacts)
- Discharge testing from hospital and before admission to care homes (care home admission screening)
- Admission testing pilot of all hospital admissions >70 years (hospital admission screening)

3.3 Admission screening, to support effective patient placement at the earliest opportunity, is a key component of IPC in hospitals and many countries are considering this currently. NHS England introduced hospital admission screening of all non-elective patient admissions this week. There is a wealth of intelligence on hospital admission screening for MDROs in Scotland to consider in future COVID-19 (or specifically SARS-CoV-2 screening) testing logistics and strategies for universal testing or risk assessment to be considered.

3.4 Testing for risk of HAI COVID-19 in high risk specialties, or high risk patients, in hospitals should also be considered. The types of specialties where suspected nosocomial clusters have occurred in non-COVID ward settings in Scotland to date include specialties where patients are likely to have longer lengths of stay, such as care of the elderly and psychiatry (unpublished NSS ARHAI management information). A focus solely on screening at the point of admission will likely under-represent those patients at risk of nosocomial acquisition and associated onward transmission.

4. Hospital definitions for HAI

4.1 Criteria currently used by countries or hospitals looking at HAI (nosocomial) COVID-19 cases vary widely, from very specific cut-offs for date of onset from more than 14 days, to more sensitive cut-offs of more than 6 or 7 days.

4.2 The origin of a COVID-19 case can be community-associated (CA-COVID-19) or healthcare-associated (HA-COVID-19), based on the number of days until the onset of symptoms, or positive laboratory test, whichever is first, after admission to a healthcare facility (on day 1). This is informed by current knowledge regarding the distribution of incubation periods. If required, a case-by-case evaluation of the origin should take into account COVID-19 prevalence in the institution/ward, contact with known cases in the community or the healthcare facility, and any other data that plausibly indicate the source of the infection (including the potential application of whole genome sequencing).

4.3 The case origin definitions now included in the ECDC surveillance protocol are as follows:

Community-associated COVID-19 (CA-COVID-19) in hospital

- Symptoms present on admission or with onset of day 1 or 2 after admission
- Symptom onset on day 3-7 and a strong suspicion of community transmission.

Indeterminate association

- Symptom onset on day 3-7 after admission, with insufficient information on the origin of infection to assign to another category.

Probable healthcare-associated COVID-19 (HA-COVID-19)

- Symptoms onset on day 8-14 after admission
- Symptom onset on day 3-7 and a strong suspicion of healthcare transmission.

Definite HA-COVID-19

- Symptom onset on day ≥14 after admissions

Cases with symptom onset within 14 days of discharge from a healthcare facility (e.g. readmission) may be considered as community-associated, probable or definite HA-COVID-19, or to have an indeterminate association. The designation of such cases should be made after a case-by-case evaluation.

5. Long term care facilities (LTCF)

5.1 Definitions for long term care facilities are more challenging as the evidence is that there is a wide spectrum of clinical syndrome. Many small single centre studies in the UK (unpublished) have indicated that many residents and care workers were positive for COVID-19 without any symptoms.

5.2 An ECDC expert HAI meeting for COVID-19 on 20/4/20 had expert consensus that symptoms are not the key to COVID-19 testing or surveillance in care homes, and further control measures may need considered. Countries, such as France, are considering lockdown of care homes without cases and daily screening of staff. Other countries reported considerations for care homes with any cases, move to transmission based precautions, screen all residents and staff in the care home i.e. make a presumption that all residents are positive.

5.3 ECDC are developing a protocol for surveillance of HAI COVID-19 for use in care homes and other long term care facilities, this is expected to be issued next week.

6. Key challenges

6.1 Asymptomatic COVID-19 PCR positive and a wide clinical syndrome of presentation.

6.2 Absence of evidence for the most effective COVID-19 screening strategies in hospitals and cares homes. Balancing the needs for operational management of the outbreak with the need to understand the epidemiology through testing.

6.3 Isolation capacity: Guidance indicates suspected cases should be isolated, however many countries are cohorting suspected cases with known COVID-19 positive cases, due to insufficient isolation capacity within hospitals. Isolation in care homes is also a challenge. Patient flow and the possibility of suspected COVID-19 wards (in addition to positive and negative wards) or designated COVID-19 hospitals/ care homes are all being considered by countries now.

6.4 Testing capacity: There is a finite testing capacity currently available in Scotland and a need to ensure that any new ask against that capacity is evidence based and targeted, to ensure it is best used to attain the required outcomes of early treatment and intervention to prevent transmission.

7. Key evidence gaps for Scotland

7.1 Descriptive epidemiology using the ECDC definition of HAI COVID-19

7.2 Evidence to establish the most effective risk assessment criteria for hospital admission screening

7.2 Transmission dynamics in hospitals and care settings for COVID-19 and how much of this is HAI in Scotland

7.3 Epidemiology and key risk factors for HAI COVID-19 in hospitals and care homes

7.4 Validity of testing asymptomatic patients or residents and the risk of transmission of SARS-CoV-2 from asymptomatic patients or residents. Emerging evidence (unpublished) indicates that this is a potential factor in onward transmission of the virus, and further, that testing apparently asymptomatic cases will identify positive samples.

7.5 Healthcare worker testing strategy beyond an outbreak context. This requires further policy considerations with occupational health and operational management colleagues in care homes and hospitals in the light of recent WHO guidance on this matter[3,4].

8. Recommendations

8.1 Adopt the ECDC COVID-19 HAI case definition in Scotland and prepare the descriptive epidemiology, inclusive of HAI incidents and outbreaks, to enable a better estimation of risk and comparison with other countries – routinely report these data for hospitals in Scotland.

8.2 Evaluate the optimal admission screening approach for SARS-CoV-2 in asymptomatic hospital patients. Options for consideration beyond the current pilot of patient >70 yrs in hospitals are included in the appendix. This needs considered inclusive of current state and future state, should wider NHS activity be reactivated. This also needs to be reviewed in line with available testing capacity. The opportunity to use these data for better understanding of the epidemiology in hospitals should not be underestimated and so needs carefully planned as a sentinel study in selected sites in the first instance (a PHE protocol is available to use for this).

8.3 Consider additional COVID-19 screening options in high risk specialties and high risk patients in hospitals with unexpected incidents and outbreaks.

8.4 Consider evaluation of COVID-19 screening of admissions to care homes. The discharge testing from hospitals and other admission screening intelligence in care homes should be used to inform an evaluation of this. Those admitted still required to be quarantined for 2 weeks and so the value of this screening, and any unintended consequences at the system level, need evaluated too. The priority for testing is currently for incident and outbreak management requirements.

8.5 Point prevalence testing for SARS-CoV-2, of residents in care homes more widely, needs further consideration to better understand the level of asymptomatic COVID-19 PCR positive cases and what the value of knowing this is for future required interventions. Work in underway in England (PHE) evaluating this currently and should be considered for use in Scotland when available.

8.6 Consider adopting the ECDC LTCF (care homes) national surveillance of HAI COVID-19 protocol when available.

8.7 Consider whole genome sequencing (WGS) merits in understanding the transmission within clusters and incidents reported in health and care settings and consider implementing this in pilot sites.

References

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Appendix: Assessment of approaches to hospital admission screening for SARS-CoV-2

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Introduction

Implementation of an admission screening programme in Scotland would have two important purposes. Primarily the programme would be used to identify patients who were not confirmed or suspected to have COVID-19 on admission who are carrying SARS-CoV-2 to enable them to be managed appropriately. Secondly, to provide an opportunity to fill gaps in the evidence base relating to prevalence of COVID-19 PCR positive on admission to hospital; risk factors for COVID-19 PCR positive; COVID-19 outcomes including nosocomial infection and deaths. This could be achieved using a prospective study similar to that undertaken during the MRSA Screening Pathfinder Study using a representative sample of patients.

In the context of a screening programme to support patient management, Table 1 describes the possible options for screening strategies and the pros and cons of each option. All of the options are based on screening patients who have not been identified as suspected or confirmed of COVID-19 on admission to hospital. Patients identified as COVID-19 during this screening process would likely be asymptomatic or have atypical presentation of COVID-19.

Table 1. Options for hospital admission screening for SARS-CoV-2

Option	Pros	Cons
Universal screening on admission to hospital	Identification of patients with asymptomatic SARS-CoV-2 or atypical presentation in all admissions to support management across the total inpatient population Prevalence of SARS-CoV-2 on admission in total population could be estimated Risk factors for SARS-CoV-2 on admission in all patients could be described (and with sufficient sample size could inform development of a	Laboratory capacity Logistical considerations for frontline care (see below)

	future clinical risk assessment) Less requirement on busy frontline staff to interpret current screening policy.	
Targeted screening on admission to hospital - Emergency admissions - Admission to pre-defined specialties e.g. Care of the Elderly - Admission to specialties where there have been unexpected clusters - Emergency admissions to pre-defined specialties	Reduced number of patients tested compared with universal screening Focused screening on areas or patients with likely higher prevalence on admission or where atypical presentation has been reported. Focused screening on areas where there is a high risk of nosocomial transmission Reduces burden of application of a CRA to each patient on admission Target to specialties where there have been issues with clusters in non-COVID wards	Laboratory capacity Logistical considerations for frontline and patient management (see below) Population level risk factors currently unclear. Targeted population may change as more evidence emerges. Targeting based on clusters may indicate areas of nosocomial transmission rather than high admission prevalence (though identification of patients on admission would reduce nosocomial
Clinical risk assessment based screening using known patient risk factors and applying to patients who are not suspected or confirmed COVID. - Over 75s - BAME - Admitted from somewhere other than home	Reduced number of patients compared with targeted and universal screening Pre-emptive isolation until test results are back CRA-based screening for MRSA and CPE are already implemented and ongoing as part of routine admission processes (acute hospitals only)	Laboratory capacity Logistical considerations for frontline care (see below) Application of a CRA in a busy clinical environment Patient level risk factors currently unclear (including difference between risk of asymptomatic COVID-19 PCR positive and the risk of

- Contact with known positive (suspected too?)		more severe disease requiring hospital admission). Targeted population may change as more evidence emerges.

Logistical considerations for frontline application of screening:

- Logistics of obtaining samples from a high volume of patients.
- Consent for screening- patient information leaflets and availability of staff to discuss and clarify, particularly in the context of patient placement and management if positive.
- Management of patients with asymptomatic or atypical presentation who test positive alongside confirmed COVID-19 patients- an understanding of the risk of transmission from asymptomatic carriers
- Appropriate placement of a potentially high number of patients- insufficient single rooms
- Retrospective review of contacts on identification of a patient with asymptomatic /atypical presentation during inpatient stay- experience from MRSA and CPE admission screening indicates that there can be high volumes of contacts for screening and often there needs to be pragmatic decisions made about which contacts to screen.
- Compliance with screening is often lower when screening is first implemented and requires improvement initiatives to increase uptake.
- Routinisation of screening in patient pathways has been shown to enable implementation
- Changes to screening protocols (targeted or CRA based screening) as evidence base develops may prove challenging to implement in a timely manner
- Consideration for when a patient needs to be screened is required. The timeframe in which to screen should reflect the threat posed by having patients who are not known to carry SARS-CoV-2 not being managed as such.

Assessment of current data to inform the screening programme:

Data held in the RAPID dataset (data on all hospital admissions updated in real time) can be used to describe the current hospital population. This is important as published and historical data relating patients admitted to hospital will predominantly be based on activity prior to the SARS-CoV-2 pandemic. The RAPID data can be used to inform the development of a hospital admission screening programme though it is important to consider that the hospital

population will continue to evolve as the situation changes. These changes in current hospital activity should be monitored to assess the impact on hospital screening.

Patients aged 75 years and older accounted for 22.8% and 23.9% of all admissions during March and April, respectively; accounting for an average 590 and 353 admissions per day in March and April, respectively. Patients aged 70 years and older accounted for 32.6% and 33.3% of all admissions during March and April, respectively. This accounted for an average 844 and 493 admissions per day in March and April, respectively. Patients aged 65 years and older accounted for 41.2% and 41.3% of all admissions during March and April, respectively accounting for an average 1065 and 612 admissions per day in March and April, respectively.

The majority of patients are admitted into general medical, general surgical and acute medical specialties, likely reflecting the patient pathway into secondary care via medical and surgical admission/receiving units. Patients are often assessed in these units before being transferred to the care of a specialty and named consultant. For this reason, the admission specialty of a patient recorded in the RAPID dataset may not reflect the specialty the patient is ultimately cared for during their stay. Targeting of SARS-CoV-2 screening to specialties at the point of admission would likely be possible only at a high level e.g. medical specialty, surgical specialty rather than more specific specialty. A more appropriate population for targeted screening may be elective or emergency admissions. At the time of writing this paper, these data were not available but consideration should be given for targeting elective or emergency patient groups.

Any SARS-CoV-2 screening programme should targeted patients who are not suspected or confirmed of having COVID-19 on admission to hospital. The number of admissions reported in this paper include both patients who have been identified as suspected/confirmed COVID-19 on admission (and were tested) and those who were not suspected/confirmed COVID-19 (and were not tested). To fully inform the development of a screening programme, it is necessary to also account for patients admitted to hospital who receive a test on admission. Currently available data indicated that 7.7% of patients admitted to Scottish hospitals between 1st March and 20th April 2020 received a test on admission or within 5 days of admission (the majority on admission).

Other considerations for screening:

Consideration must also be given to patients who are currently in hospital and have been for extended periods of time. The types of specialties where suspected nosocomial clusters have occurred in non-COVID ward settings include specialties where patients are likely to have longer lengths of stay. Whilst less than 10% of wards in Scotland are reported to have had an unexpected cluster of COVID-19, 60% have occurred in Care of the Elderly or Psychiatric specialties. A focus solely on screening at the point of admission will likely under-represent these patients at risk of nosocomial acquisition and associated onward transmission. A screening strategy that includes a rescreening protocol during a patient's admission to

hospital would include patients who have already been admitted for extended periods of time, enabling the risk to be managed in this population.

Recommendations:

Screening patients for SARS-CoV-2 on admission to hospital provides an opportunity to identify pre-symptomatic individuals, asymptomatic individuals and patients with an atypical presentation of COVID-19 and to manage them appropriately to reduce the risk of in-hospital transmission.

Universal screening, whilst most favourable in terms of providing an opportunity to fill evidence gaps in the Scottish epidemiology of SARS-CoV-2, is likely unfeasible due to the number of patients that would require to be tested on admission and managed appropriately should they test positive. The evidence relating to risk of being COVID-19 PCR positive on admission to hospital in the Scottish population is not well developed, therefore any clinical risk assessment would be based on sparse evidence that will evolve over time; this may make the practical implementation more difficult in the longer term.

The most pragmatic approach to screening in an environment where there is uncertainty in the evidence would be to adopt a targeted screening based on age with further work to develop a clinical risk assessment that could be used to identify high risk patients on admission to hospital in future.

Consideration should be given for undertaking an epidemiological study that universally screens a cohort of patients and follows them up and determines risk factors for both COVID-19 PCR positive on admission and for adverse outcomes during the inpatient stay.

Irrespective of the strategy selected, there are important considerations to support the implementation of a new screening programme:

- Support for local teams in patient pathways for manageing those identified as positive
- Education and training for frontline staff to ensure patients can give informed consent to screening
- Patient information to support informed consent
- Routinisation of the process using, for example, an extension of the national Clinical Risk Assessment document developed for MRSA and CPE during the Excellence in Care pilot
- Resources in the form of a screening team and coordinator in each health board to support implementation