



Review

Should healthcare workers be screened routinely for meticillin-resistant *Staphylococcus aureus*? A review of the evidence

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SUMMARY

Meticillin-resistant *Staphylococcus aureus* (MRSA) is considered endemic in the UK National Health Service (NHS), and routine MRSA screening of hospital inpatients has recently been introduced in both Scotland and England. The UK National Screening Committee states that public pressure for widening the eligibility criteria of a proposed screening programme should be anticipated and any related decisions scientifically justifiable. A literature review was conducted to examine whether MRSA screening in Scotland should be expanded to include the routine screening of healthcare workers (HCWs). There are no published prevalence studies reporting the overall MRSA carriage rate in HCWs in NHS hospitals. Estimates of HCW carriage from the worldwide literature vary widely depending on the country, hospital specialty and setting (endemic, non-endemic or outbreak). Recent studies conducted in endemic hospital settings report non-outbreak carriage rates of 0–15%. The role of HCW carriage in the transmission of MRSA is not well understood. Persistent carriage could act as a reservoir for infection and HCWs have been implicated as the source in a number of published outbreak reports. There are no published controlled trials examining the impact of routine HCW screening as an intervention in the prevention and control of MRSA infections in the endemic hospital setting. Most of the evidence for HCW screening comes from outbreak reports where the outbreak was brought to an end following the introduction of staff screening as part of a suite of infection control measures. Further research is required before a recommendation could be made to introduce routine MRSA screening of HCWs in the NHS in Scotland.

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Introduction

Both the Scottish Government Health Directorate (SGHD) and the Department of Health in England have introduced programmes for the routine screening of hospital inpatients for meticillin-resistant *Staphylococcus aureus* (MRSA). In Scotland, the majority of elective hospital admissions (excluding paediatrics, obstetrics and psychiatry), and acute admissions to four high-risk specialties (medicine for the elderly, dermatology, renal medicine, and vascular surgery) have been screened for MRSA since January 2010. In England, MRSA screening has been introduced for all relevant adult elective hospital admissions (excluding some selected day

case, dermatology and obstetrics patients); to be rolled out to all relevant acute admissions by no later than 2011.^{1–3}

In its criteria for appraising the viability, effectiveness, and appropriateness of a screening programme, the UK National Screening Committee (NSC) states that public pressure for widening the eligibility criteria of a proposed screening programme should be anticipated and any related decisions should be scientifically justifiable to the public.⁴

It may be anticipated that there will be calls to expand the MRSA screening programmes in Scotland and England to include the routine screening of healthcare workers (HCWs). A recent acceptability study, conducted as part of the MRSA Screening Pathfinder Project in Scotland, has addressed staff, patient and wider population acceptability for the first time in NHS Scotland and is due to be published shortly.⁵ A previous survey of UK doctors attending two national conferences has indicated that 63% of participants were in support of routine staff screening for MRSA.⁶

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Current UK guidelines state that routine staff screening for MRSA is not recommended.⁷ However, the authors acknowledge that screening can be valuable in the following circumstances:

1. If transmission continues on a unit despite active control measures; or if epidemiological aspects of an outbreak are unusual or suggest persistent MRSA carriage by staff.
2. If new MRSA carriers have been found among the patients on a ward, staff with skin lesions should be identified and screened.

To explore the issue of whether the national MRSA screening programme in Scotland should be expanded to include the routine screening of HCWs, Health Protection Scotland carried out a literature review to address three key questions:

1. What is the prevalence of MRSA carriage in HCWs in NHS Scotland?
2. What is the evidence for transmission of MRSA from a colonised HCW to a patient?
3. What is the evidence for routine screening of HCWs in the prevention and control of MRSA in the endemic setting?

Methods

MEDLINE was searched for articles published between January 1980 and March 2010 using the combination of search terms shown in Box 1. The search was limited to articles published in English. The titles and abstracts of articles identified by the MEDLINE search were then scrutinised, and relevant articles selected for review. Articles were excluded if they did not relate to the hospital setting or if they did not contain information relevant to the three key questions to be addressed by the literature review. The Cochrane Library was also searched for relevant articles. Finally, the reference lists of selected articles and reports were also reviewed.

Results

The MEDLINE search returned 578 hits, from which 74 papers were selected for review. Papers selected were from both endemic and non-endemic MRSA settings and included prevalence studies, observational studies, outbreak reports, review articles, and case reports. The majority (70%) of papers were from the USA or Western Europe.

Prevalence

In a recent review, Albrich and Harbarth estimated MRSA prevalence in HCWs to be 4.6% [95% confidence interval (CI): 1.0–8.2%].⁸ This estimate was calculated by pooling the results from 127 investigations, published between 1980 and March 2006, which reported MRSA carriage rates in HCWs in various specialties and in endemic and non-endemic settings. It should be noted that, to calculate the average prevalence rate, the authors used data from any paper which reported the total number of HCWs tested, and that there was therefore significant heterogeneity among the papers included. Most (95) of these studies were conducted in the outbreak setting, and the authors included reports from all over the world. The authors found that MRSA prevalence was higher in the endemic setting (8.1%) than during outbreaks (3.9%).

Our literature review identified a further 18 papers published between April 2006 and March 2010 which provided data on carriage rates in HCWs.^{9–26} Again, these papers provided data from a variety of specialties, settings (endemic and non-endemic), and countries; and included both prevalence studies and outbreak reports. The

Box 1.

MEDLINE search strategy

A standardised search strategy for MRSA and HCWs was used as follows:

1. MRSA.tw
2. Methicillin-Resistant *Staphylococcus aureus*/
3. Methicillin/
4. met*icillin.tw
5. Staphylococcal Infections/
6. *Staphylococcus aureus*/
7. met*icillin resist\$.tw
8. personnel.tw
9. health personnel.tw
10. "health care worker\$.tw"
11. hcw.tw
12. staff\$.tw (or/1–7) and (or/8–12)

This search was then combined with three searches relating to prevalence, transmission and screening as follows:

Prevalence

1. Prevalence/
2. Carrier state/
3. carriage.tw
4. (or/1–3)

Transmission

1. Disease Transmission, Infectious/
2. Infectious Disease Transmission, Patient-to-Professional/
3. Infectious Disease Transmission, Professional-to-Patient/
4. Cross Infection/
5. "cross infection".tw
6. (or/1–5)

Screening

1. screen\$.tw
2. Mass Screening/
3. surveillance.tw
4. (or/1–3)

Results from the three searches were de-duplicated and limited to English language and human articles published between January 1980 and March 2010.

number of HCWs tested ranged from 45 to 512, and the median carriage rate was 5% (range: 0.6–26%; interquartile range: 4–13%). Five papers reported prevalence rates in non-outbreak settings in hospitals where MRSA was endemic. These non-UK studies found HCW carriage rates ranging from 2% to 15%.^{10,17,18,24,26}

There are limited published data on the prevalence of MRSA carriage in HCWs in Scotland and the UK. In one study carried out in a Scottish teaching hospital, MRSA nasal colonisation was found in 46 (9%) of 512 HCWs swabbed.²³ This study included staff working in wards where MRSA was considered to be either endemic or sporadic. The authors reported no difference in colonisation rates between the two types of ward. No details were provided regarding which hospital specialties were included in the study or the categories of HCWs taking part (medical, nursing or other). In a prevalence study of MRSA carriage among UK doctors, Brady *et al.* screened 260 doctors attending two national medical conferences (the British Medical Association's Annual Representatives Meeting and the Association of Surgeons in Training Annual Conference).⁶ They identified 6 (2%) doctors who were positive for MRSA carriage; there was a statistically significant difference in

carriage rates between doctors from surgical specialties (4.8%) compared with the non-surgical participants (0.64%). In a study of junior doctors in one district general hospital in London, Wall *et al.* screened 39 junior doctors from various medical specialties for MRSA.²⁷ Swabs were taken from the doctors' anterior nares and palm of dominant hand at the start of a shift, the end of a shift, and the start of the following day. None of the doctors tested positive for MRSA.

No prevalence studies reporting the overall MRSA carriage rate in HCWs in the NHS were identified. In one hospital-wide prevalence study conducted in a tertiary-care hospital in France, Eveillard *et al.* found an overall MRSA prevalence of 6.2% in hospital employees.²⁸ In this point prevalence study, 965 hospital workers were screened with staff from all categories of personnel represented (clinical ward, laboratory, radiology, engineering and administrative personnel). The highest rate of carriage was found in clinical ward staff at 9% (95% CI: 6.7–11.3%). Nursing staff were more likely to test positive than medical staff (9.6% vs 6.3%).

Transmission

The principal site of MRSA carriage is the anterior nares; and carriage may be transient (lasting hours or days) or persistent.^{7,8,29–31} Persistent MRSA carriers may be reservoirs of infection and HCWs have been implicated as the source in a number of published outbreak reports.^{32–43} Staff with colonised skin lesions and other symptomatic MRSA infections are considered to be at greatest risk of transmitting MRSA to patients.^{7,40,44} In a systematic review of 191 outbreak reports, Vonberg *et al.* concluded that there was strong evidence that HCWs had been the source in only 11 (5.8%) of the outbreaks and, of these, only three had been caused by asymptomatic carriers.⁴⁵ In their review of 106 outbreak reports, Albrich and Harbarth concluded that there was clear evidence of MRSA transmission from HCWs to patients in 27 (25.5%) cases.⁸

Screening

Our search identified no published controlled trials examining the impact of routine screening as an intervention in the prevention and control of MRSA infections in the endemic setting. Most of the evidence for HCW screening is drawn from outbreak reports where the outbreak is brought to an end following the introduction of staff screening and decolonisation, usually as part of a suite of infection control measures.^{9,36,46–50} However, some authors have questioned the value of staff screening in the management of MRSA outbreaks.^{51,52}

HCW screening in the non-outbreak setting has been adopted as an infection control measure primarily in those countries where MRSA has not reached endemic levels. In The Netherlands, national guidelines on MRSA prevention and control advocate screening of HCWs after exposure to MRSA-positive patients, and pre-employment screening of any HCW who has previously worked in a foreign patient care facility.⁵³ Similar measures have been adopted in Western Australia.³⁶ In both instances, screening of HCWs has been implemented as part of MRSA 'search and destroy' policies which have been successful in achieving and maintaining low rates of MRSA colonisation and infection.^{36,54}

In a one-year intervention study of targeted MRSA control measures in an endemic hospital, staff and patients in two clinical areas (paediatric oncology and intensive care unit) were screened for MRSA, patient carriers isolated, and staff and patients decolonised.⁵⁵ During the year, the investigators observed a significant decrease in MRSA bacteraemia rates in these two clinical areas, which were not seen elsewhere in the hospital; it is not possible to determine what proportion of the observed decrease could be attributed to staff

screening and decolonisation. In an observational study conducted in a hospital with endemic MRSA, Cohen *et al.* described the MRSA control measures adopted by the hospital and the rate of new MRSA cases over a seven-year period.⁵⁶ Initial control measures included screening all HCWs exposed to an MRSA patient and decolonising those found to be positive; this was discontinued after four years, following which HCWs were only screened during major outbreaks. The authors reported that the incidence of MRSA infections declined during the seven-year period and that this reduction was maintained despite the cessation of routine HCW screening.

Bootsma *et al.* modelled the impact on MRSA prevalence of a range of infection control measures introduced in a stepwise fashion. They found that staff screening, with exclusion and decolonisation of those found to be positive, offered little additional benefit to the control of MRSA in high endemicity settings.⁵⁷

Discussion

The main limitation of this literature review relates to the search strategy adopted. The review was restricted to papers published in English and the electronic search limited to MEDLINE and the Cochrane Library, which may have resulted in some relevant studies having been missed.

We found no prevalence studies reporting the overall MRSA carriage rate in HCWs in NHS hospitals in Scotland or the UK. Estimates of HCW carriage from the worldwide literature vary widely depending on the country, hospital specialty and setting (endemic, non-endemic or outbreak). Recent studies conducted in endemic hospital settings report non-outbreak carriage rates of between 0% and 15%. The results of prevalence studies must be interpreted with caution, as transient nasal carriage may occur and so the timing of a screening test will have an important impact on the results obtained.³¹ In many of the papers we reviewed, the timing of the test was not stated. In others, HCWs were tested during or immediately following a work shift which may have led to misleadingly high estimates of MRSA carriage.

The principal route of transmission of MRSA in the hospital setting is considered to be from patient to patient via the contaminated hands of HCWs.^{29,33} HCWs have been implicated as the source of infection in a number of published outbreak reports; particularly where the HCW has had a colonised skin lesion or other MRSA infection. Such events are rare and the relative importance of the colonised HCW in the transmission of MRSA in the endemic setting is unclear.

UK and US guidelines advocate the use of HCW screening in selected situations, and recommendations for targeted MRSA screening of HCWs in the endemic setting have also been made elsewhere.^{7,38,44,58–62} We found no published controlled trials which assessed the impact of routine HCW screening as an intervention for the prevention and control of MRSA infection in the endemic hospital setting; and, at present, there is little evidence to support the expansion of HCW screening in the NHS beyond that currently recommended by national guidelines.

A number of practical and ethical issues relating to HCW screening have also been raised in the literature; these include:^{7,8,34,61,63–65}

- The optimum timing and frequency of HCW screening;
- Whether, and for how long, colonised HCWs should be excluded from work;
- The psychological impact on colonised HCWs;
- The potential impact of exclusions on staffing levels;
- The financial cost of providing cover for excluded HCWs;
- Whether screening and decolonisation should be extended to the families of colonised HCWs to prevent re-colonisation;

- Whether the home environments of colonised HCWs should be tested and cleaned to prevent re-colonisation;
- The management of HCWs found to be persistently colonised, and the occupational consequences for these staff members;
- The management of staff who refuse to be screened or treated.

In conclusion, there is some evidence to suggest that HCW screening is, in principle, acceptable to both patients and NHS staff. Evidence regarding its effectiveness in the prevention and control of MRSA in the endemic setting is limited. Further research is required to clarify the role of colonised HCWs in the transmission of MRSA and the cost-effectiveness of HCW screening as an infection control measure before any recommendations regarding the introduction of routine staff screening could be made; and the related ethical and practical issues need to be considered and addressed in full.

Conflict of interest statement

None declared.

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