
MRSA prevalence among healthcare personnel in contact tracings in hospitals

ORIGINAL ARTICLE

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BACKGROUND

In the Norwegian health services, comprehensive measures are taken to prevent the spread of methicillin-resistant *Staphylococcus aureus* (MRSA). We wished to investigate how many contact tracings are made around newly detected cases of MRSA in patients and employees in hospitals, and how often these contact tracings lead to further findings among healthcare personnel.

MATERIAL AND METHOD

In this retrospective observational study, the infection control units in eight health enterprises in the country's four health regions contributed information on findings of MRSA in healthcare personnel after contact tracings had been undertaken. Data were collected from 14 different somatic hospitals for the years 2012–15.

RESULTS

Altogether 10 142 health service employees were tested for MRSA, with positive findings in 31 employees (0.31 %). In 19 employees (0.19 %), the same MRSA strain as in the index case was found. No more than two out of 351 contact tracings (0.57 %) found the same MRSA strain in more than one employee.

INTERPRETATION

Contact tracing of MRSA in Norwegian hospitals is extensive, but MRSA is rarely detected in healthcare personnel as a result of contact tracing.

Main message

Unexpected findings of MRSA in Norwegian hospitals spurred comprehensive contact tracing activity

Contact tracing in hospitals rarely detected MRSA in healthcare personnel

A number of minor MRSA outbreaks were not reported to the health authorities

For many years, Norwegian health services have enacted strict measures to prevent the spread of methicillin-resistant *Staphylococcus aureus* (MRSA). In 2015, a total of 2 233 cases of MRSA (43 per 100 000 person-years) were reported to the Norwegian Surveillance System for Communicable Diseases (MSIS), a clear increase from 2014. Two-thirds of the cases represent colonisation (1). Although the prevalence of MRSA in Norway is increasing, the proportion of MRSA of all *S. aureus* detected by clinical tests remains low: 0.7 % in blood cultures and 1.2 % in wound material respectively (1).

Statutory requirements and clinical recommendations concerning the handling of positive MRSA findings are described in the MRSA manual published by the Norwegian Institute of Public Health (2), first issued in 2004. The objective is to prevent MRSA from establishing itself as a permanent component of the bacterial flora in Norwegian hospitals and nursing homes. Screening of certain high-risk groups and elimination of MRSA in carriers are therefore undertaken. If unexpected findings of MRSA are made in patients or employees, the hospital concerned is recommended to undertake contact tracing. The objective of contact tracing is to discover whether MRSA has been transferred to other patients or employees. Further spread can then be prevented through isolation measures, work restrictions for infected healthcare workers and carriage elimination in patients and employees.

The contact tracings entail testing of those who have been in close contact with the patient in whom the infection was first detected. This involves testing of other patients who have shared a room with the infected person, as well as employees who have cared for or examined that patient. If the contact tracing reveals new findings of MRSA, the MRSA manual recommends that the tracing be expanded to encompass all patients and employees on the ward. If carriage is detected in an employee, it is also recommended to test all patients and employees in the department in question.

The Norwegian MRSA manual recommends contact tracings that, in the authors' opinion, might become very extensive and resource-intensive. We therefore wished to find out how many MRSA contact tracings are undertaken and how often these tracings lead to new findings of MRSA in healthcare personnel in Norwegian hospitals.

Material and method

In April 2016, an invitation to participate was sent to 12 infection control units in South-Eastern Norway Regional Health Authority and the four university hospitals in the other health regions (Haukeland University Hospital, Stavanger University Hospital, St Olavs University Hospital Trondheim and the University Hospital of North Norway). Four infection control units were unable to provide the data requested (Innlandet, Ullevål, Vestfold and Østfold hospitals). Vestre Viken Hospital Trust provided data for Bærum and Ringerike hospitals. St Olavs University Hospital Trondheim supplied data for Orkdal Hospital as well as the

Øya Hospital in Trondheim. In Northern Norway we obtained data for Tromsø, Narvik and Harstad hospitals. Altogether 14 hospitals were included (Table 1). The participants were asked to report all data from contact tracings for each year, and to answer detailed questions on contact tracings undertaken in the period 1 January 2012–31 December 2015 (Box 1). It was specified that the questions pertained to MRSA testing undertaken as part of contact tracing spurred by unexpected cases of MRSA infection in the hospitals, not as part of mandatory screening of employees or patients who might have been exposed to infection by MRSA outside Norwegian hospitals. The participants were asked to provide information on the *spa* genotype of the isolated bacteria, since this analysis is used to determine relatedness between different strains of MRSA.

Table 1

Participating hospitals, number of contact tracings for MRSA undertaken per hospital per year and the annual volume of testing of employees in contact tracings

	Number of inhabitants in the catchment area	Number of beds in somatic wards	Number of contact tracings 2012–15	Number of positive employees (same <i>spa</i> type as the index case)	Number of employees tested	Number of employees tested in contact tracings per year			
						2012	2013	2014	2015
Akershus University Hospital	450 000	714	176	7 (4)	2 491	537	392	474	1 088
Haukeland University Hospital	440 000	1 100	Exact figures missing	8 (6)	2 762	768	638	670	686
Stavanger University Hospital	360 000	590	43	4 (1)	1 332	248	288	227	569
St Olavs University Hospital (Øya and Orkdal hospitals)	313 000	863	Exact figures missing	3 (2)	1 096	253	217	267	359
Sørlandet Hospital (Arendal, Flekkefjord and Kristiansand hospitals)	290 000	500	41	1 (1)	927	269	256	249	153
Vestre Viken (Bærum and Ringerike hospitals only)	245 000	330	13	0 (0)	205	18	130	29	28

	Number of inhabitants in the catchment area	Number of beds in somatic wards	Number of contact tracings 2012–15	Number of positive employees (same <i>spa</i> type as the index case)	Number of employees tested	Number of employees tested in contact tracings per year			
						2012	2013	2014	2015
University Hospital of North Norway (Harstad, Narvik and Tromsø hospitals)	188 000	499	59	5 (3)	1 056	266	173	347	270
Telemark Hospital	170 000	400	19	3 (2)	273	4	31	58	180
Total	2 456 000	4 996	351¹	31 (19)	10 142	2 363	2 125	2 321	3 333

¹St Olavs University Hospital and Haukeland University Hospital are excluded.

Box 1 Information collected

Number of contact tracings where the index case was a patient, by medical specialty

Number of contact tracings where the index case was an employee, by medical specialty

Number of patients and employees by profession (nurse, doctor, other) included in each contact tracing

Number of MRSA findings in each contact tracing, with *spa* type, by patients and employees in different groups of professions

Responsible for undertaking the contact tracings (infection control personnel/corporate health service/ward/other)

Criteria for inclusion in the contact tracing in each hospital

Handling of contact tracings when a positive finding is made in an employee during a contact tracing (e.g. are all employees on the ward screened?)

Changes to the criteria for contact tracing during the study period, if any

Reporting of findings of MRSA as an outbreak to the county medical officer and the Norwegian Institute of Public Health

Hospital size (number of beds in somatic wards, catchment area)

Among the participants, only Akershus University Hospital had prospectively recorded complete data on the number of contact tracings, the number of employees by groups of profession, the number of included patients and findings of MRSA with *spa* types. This was also the only hospital in which infection control personnel were in charge of all testing of employees. In the other hospitals,

contact tracing among employees was undertaken as a collaboration between infection control personnel, corporate health services and wards. In these hospitals, infection control logs and logs kept by the corporate health services or the working environment section, as well as laboratory data for which there were separate codes for requisitions or analyses of the hospital's contact tracings, were used to estimate the scope and results of the testing. The collected data were anonymised before being collated, and the study was undertaken as approved by the enterprises' data protection officers.

Results

Overall, the 14 participating hospitals encompass a catchment area with more than 2.4 million inhabitants and have a total of approximately 5 000 beds (Table 1). All the included hospitals were able to provide data on the number of employees who had been tested during contact tracings, but only five of the 14 hospitals could provide an estimate of the number of patients who had been included in contact tracings during the study period.

Indication for contact tracing

All the participating hospitals reported to apply the criteria in the MRSA manual (2) for decisions about when to initiate a contact tracing and whom to include in it. Infection control personnel decided who was to be included in an initial tracing circle around the index case, in consultation with the management of the wards concerned. How closely infection control personnel were involved in these decision-making processes varied between the hospitals, and some also reported that wards started contact tracings on their own initiative without first involving infection control personnel.

Half of the respondents reported that if findings of MRSA were made in the first circle, the testing would be extended to all employees in the department/ward concerned, while the other half reported that no such routine testing of the entire department was initiated in such cases. Four of the hospitals reported that they had introduced stricter requirements regarding inclusion in contact tracings during the study period. This implied that the MRSA manual was still used as a reference, but with a clearer specification that only clinical personnel who had been in close contact with the index patient should be tested.

Testing of employees and patients

The corporate medical service received results of contact tracing tests from employees in 12 hospitals, while in two hospitals the chief infection control officer received the results. Tests on employees were primarily undertaken by colleagues in ten hospitals, by the corporate medical services in three hospitals and by infection control personnel in one hospital.

Testing of patients was primarily undertaken by the ward employees. In three hospitals a copy of all results was sent to the infection control units, while the others reported that the infection control officer only received reports of positive results.

Contact tracings

Altogether 10 142 employees were tested in contact tracings in the 14 hospitals during the four-year study period (Table 1). According to the MRSA manual a nasal and a pharyngeal sample are collected as a minimum in employees as part of a contact tracing. Hence we can assume that at least 20 284 samples were analysed. MRSA was found in 31 employees (0.31 %). Only 19 employees (0.19 %) were infected with the same *spa* type as the index case, giving grounds to assume that cross-infection may have occurred between the index case and one or more employees. In other words, MRSA of a different *spa* type than the one that triggered the contact tracing was found in 0.12 %.

Scope and reporting of outbreaks

The 12 hospitals that were able to report the number of contact tracings they had undertaken had performed 351 contact tracings in four years (Table 1). Ten of 14 hospitals provided overviews of whether the index case for the contact tracing had been a patient or an employee. In total, these ten hospitals had undertaken 327 contact tracings during the study period, and employees were index cases in 16 of these (5 %).

The number and scope of the contact tracings varied considerably between the hospitals. From 13 to 176 contact tracings had been undertaken, the smallest of which encompassed three people and the largest 195 people. Many of the infection control units stated that they would not always report an outbreak if they found MRSA in only one additional person during a contact tracing. During the period, one outbreak was reported by St Olavs University Hospital, one by Haukeland University Hospital and three by Akershus University Hospital, while this study indicates that at least 19 cases of likely cross-infection ought to have been reported.

Findings of MRSA

Only two of 351 contact tracings (0.6 %) detected multiple employees with the same *spa* type. This indicates that the risk of MRSA transmission between colleagues is low. In both cases, only two MRSA-positive employees were found.

Discussion

The figures that have been collected provide an impression of extensive contact tracing activity affecting employees in Norwegian hospitals, and illustrate the fact that considerable resources are being devoted to this work. Likely MRSA transmission between the index case and employees were found in 0.19 % of the employees who were tested as part of a contact tracing.

We interpret these results as indicating that the criteria for inclusion in contact tracings are too wide and ought to be revised. The current MRSA manual recommends testing of the personnel that have examined, treated or cared for a patient with an unexpected finding of MRSA, and this paves the way for comprehensive testing. Many hospitals have included employees that most likely have had little direct skin contact with the patient. It is difficult to define precise criteria for the types of contact that should qualify for testing. Nor will it be

possible to recall who has cared for a patient one or two weeks previously. Consequently, some of the hospitals report to have limited the inclusion criteria during the study period.

If the index case is an employee, the MRSA manual recommends testing of all personnel at the department concerned. Our study shows, however, that the contact tracings that found MRSA in a healthcare worker found the same *spa* type in other employees in only two out of 31 cases (6 %). Although we have only few observations, this indicates that the risk of transmission between colleagues is low.

Assessing the risk of MRSA transmission between patients and employees is difficult. In a review article published in *The Lancet* (3), the authors conclude that healthcare workers who become colonised with MRSA at work rarely become long-term carriers, but they may serve as the source of an outbreak in a hospital and as a vector for transfer of MRSA from one patient to another. Chronic skin disease is reported as one of the risk factors for long-term colonisation and further spread of the bacteria.

However, results of studies undertaken elsewhere cannot be immediately transferred to Norway, partly because of differences in MRSA prevalence and virulence, as well as differences in terms of patient density and compliance with basic infection control routines.

In Norway, many of the major outbreaks known to have occurred in hospitals have affected neonatal intensive care departments and maternity wards (4, 5). Since the risk of infection and the consequences of an outbreak appear to be greatest in these departments, it seems reasonable to adapt the contact tracings in hospitals to the department affected.

In regular wards, we would recommend including employees in contact tracings only if they have individual risk factors for long-term MRSA colonisation. This is in line with Swedish guidelines, which in cases of unexpected MRSA findings recommend testing only employees with factors that put them at special risk of colonisation (active skin disorders), and not all employees who have been in contact with the index patient (6). We wish to emphasise that our findings are not immediately transferable to nursing homes, in which we here in Norway have also seen a number of major outbreaks with a high number of colonised people, employees as well as patients (7).

In 12 (0.1 %) of the 10 142 employees who were tested in contact tracings, MRSA with another *spa* type than that in the index case was found, and this finding therefore militates against the relevance of cross-infection. The low prevalence of MRSA carriage in our study is reassuring, since healthcare workers are presumably more exposed to MRSA and other antibiotic-resistant bacteria than the population in general.

Meta-studies from other countries find a far higher prevalence of MRSA carriage among healthcare personnel – from 1.1 % to 4 % (8). The low prevalence in our study most likely reflects the lower prevalence of MRSA in Norway when compared to other countries, and possibly also the fact that in Norway, routine screening is mandatory for healthcare personnel that may have been exposed to MRSA infection outside of Norwegian hospitals.

Findings of MRSA carriage in healthcare personnel entail considerable socioeconomic consequences. Today, detection of MRSA carriage will result in a ban on patient contact in hospitals and a sick note.

For a health sciences student, the consequence could be a disruption of his or her studies. In the authors' experience, MRSA carriage is effectively eliminated in most healthcare workers, but there are some who unfortunately remain carriers for very long periods despite elimination attempts with systemic antibiotics. Some may also be exposed to recolonisation if they live in a household with other people who are colonised and where elimination is impossible for various reasons.

In Sweden and Denmark, national guidelines permit healthcare workers infected by MRSA to continue to have patient contact, provided that they do not represent particular risk factors for infection (such as skin lesions and disorders) and do not work in especially vulnerable departments (dermatology, burn injury, intensive care, neonatal etc.) (6, 9). In other words, work restrictions are imposed on employees colonised by MRSA only in the most vulnerable departments (6, 9). This practice appears to function well, as seen by the fact that healthcare-related MRSA infection rates are no longer increasing in these countries.

The Public Health Agency of Sweden reports that MRSA infections originating in the health services now account for a very small proportion of all MRSA cases (10). In Denmark, the prevalence of hospital-derived MRSA remains at a stable low level, and the number of domestic MRSA infections has levelled off over the last three years, although major MRSA-related problems persist in pig farming (11). Given that this seems to function well in our neighbouring countries, we believe that Norwegian healthcare workers who are carriers of MRSA also should be permitted to work directly with patients in hospitals.

From the reports we have received, we can see that the recording of the contact tracings is often insufficient. Only four hospitals could provide an account of the number of fellow patients who had been tested. Furthermore, we see that minor outbreaks of MRSA often go unreported to MSIS and the county medical officer, in contravention of the MSIS regulations (12). As a result, overviews of outbreaks in Norwegian hospitals will not reflect reality. Many hospitals have very limited opportunities for extracting relevant data from laboratory data systems and patient records. This may represent a challenge to the implementation of appropriate surveillance.

This study shows that the contact tracings of MRSA infections among healthcare workers in Norwegian hospitals are unnecessarily comprehensive. MRSA infections are detected in no more than two per thousand employees tested. We believe that a revision of the national MRSA guidelines is called for. To avoid a one-sided focus on MRSA, such a revision ought to be harmonised with measures to combat other resistant microbes.

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