Reduction in methicillin-resistant *Staphylococcus aureus* colonisation: impact of a screening and decolonisation programme

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Abstract

Patients in care homes are often at 'high risk' of being methicillin-resistant *Staphylococcus aureus* (MRSA) colonised. Here we report the prevalence of MRSA, the effect of MRSA screening and decolonisation in Wolverhampton care-home residents. Eighty-two care homes (1665 residents) were screened for MRSA, three times at 6-monthly intervals (referred to as phases one, two and three). Screening and decolonisation of MRSA-colonised residents led to a reduction in the prevalence of MRSA from 8.7% in phase one, 6.3% in phase 2 and 4.7% in phase three. Overall, the study suggests that care-home facilities in Wolverhampton are a significant reservoir for MRSA; screening and decolonisation has reduced the risk to residents going for procedures and has indirectly impacted on MRSA rates in the acute Trust.

Keywords

Methicillin-resistant *Staphylococcus aureus* (MRSA), care homes, screening, decolonisation, community

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Introduction

Staphylococcus aureus is a major cause of healthcare associated infections worldwide (Simor, 2011; Simor and Loeb, 2009). Methicillin-resistant *S. aureus* (MRSA) has become prevalent in most parts of the world (Robotham et al., 2011; Simor and Loeb 2009). Despite the recent decline in incidence of MRSA in several European countries, infection remains a major cause of avoidable morbidity and mortality in patients admitted to hospital (Robotham et al., 2011). Robotham et al. (2011) reported MRSA infection increases the length of hospital stay, risk of death and treatment costs. Patients may also become colonised with MRSA but remain asymptomatic (Robotham et al., 2011). Colonised and infected patients may act as reservoirs for spread of MRSA within both hospitals and primary care facilities such as residential care homes (Baldwin et al., 2010; Robicsek et al., 2009). Isolation and decolonisation are the two main targeted control measures for reducing the transmission of MRSA in hospitals (Bode et al., 2010; Cepeda et al., 2005).

With government and public concern on the rates of MRSA infections between 2001 and 2004 in England and

Wales, legislation and various prevention and control interventions were introduced (Robotham et al., 2016). As a result, annual rates of MRSA bacteraemia fell from 17.7 to 7.8 cases per 100 000 bed-days between April 2005 and March 2009 (Coia et al., 2006; Robotham et al., 2016). Until April 2009, national guidance recommended targeted screening of patients admitted to high-risk specialties such as critical care or patients with known risk factors for MRSA carriage (Coia et al., 2006).

Increased age, previous hospital admission, residency in a nursing home and previous MRSA colonisation are the

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commonest risk factors associated with MRSA positivity on admission to hospital (Gopal Rao et al., 2007). Here we report the prevalence of MRSA in care homes within the Wolverhampton community. Screening for MRSA in care-home facilities and subsequent decolonisation treatment of positive residents, together with an educational and audit programme, led to a reduction in the prevalence of MRSA in this setting.

Materials and methods

Setting. The Royal Wolverhampton NHS Trust (RWT) is one of the largest acute and community providers in the West Midlands with more than 800 beds on the New Cross site including intensive care beds and neonatal intensive care cots. It also has 80 rehabilitation beds at West Park Hospital and 54 beds at Cannock Chase Hospital. The Trust provides its services from the following locations: New Cross Hospital, West Park Hospital, more than 20 Community sites and Cannock Chase Hospital. The current study was carried out in the Wolverhampton Care economy including 82 privately run care homes consisting of community nursing homes, residential care homes and mental health facilities located throughout Wolverhampton.

MRSA screening. Care-home residents were screened, three times (referred to as phases one, two and three) at 6-monthly intervals. Screening involved taking a swab (M40 compliant Transwab® in charcoal-containing Amies medium [Medical Wire]) from the nose, groin and axillae as well as any wounds or sites of any indwelling devices as per the local Trusts policy. The local Director of Public Health and the RWT CEO were instrumental in facilitating the initiative through dialogue with all the care homes involved. Every resident who was screened in the initiative was consented before screening.

MRSA screening. MRSA screens and clinical specimens were cultured using Public Health England standard microbiology investigations (SMI B 29). Swabs were directly plated on to Chromagenic agar (MRSA Select™, Biorad, UK) and incubated at 37°C in air for 18–24 h. Any potential MRSA isolates were sub-cultured onto SAID media (bioMérieux, Marcy l'Etoile, France) and incubated at 37°C in air for 18–24 h. All MRSA isolates were identified biochemically on the Vitek 2 Systems (bioMérieux, Marcy l'Etoile, France); latex agglutination (Staph Latex Kit, Pro-Lab Diagnostics, Bromborough, UK) and DNase Test Agar (Thermo Fisher Scientific, Loughborough, UK). Antibiotic susceptibility was performed by Vitek 2 Systems (bioMérieux, Marcy l'Etoile, France).

Decolonisation of MRSA-positive cases. All positive cases were decolonised with 5 days of nasal mupirocin 2% ointment (1 application, both nostrils, thrice daily) and chlorhexidine 4% body wash. A set of post-decolonisation screening swabs (nose, groin and axillae) were collected at least 48 h after treatment. Residents who were not decolonised after a

single course of treatment were prescribed another course; residents who failed the second decolonisation were prescribed a third and final single course of treatment. If the third treatment failed, the residents were considered chronic carriers of MRSA and were managed appropriately for an MRSA-colonised resident. Residents who were MRSA-positive and had successful decolonisation were screened weekly until three negative screen results were achieved. If during the weekly screens these patients became positive for MRSA, they would have a second course of decolonisation treatment. If a second and third course of decolonisation treatment failed, the residents were considered chronic carriers of MRSA. This mirrored the local Trust policy.

Results

Infection prevention in the community

An educational and audit programme named 'PREVENT charter' was set up to run alongside the MRSA screening in the care homes. The 'PREVENT charter' aimed to improve standards of infection prevention compliance year on year within the community, through a pledge of commitment by care-home managers/owners and through the dedicated support, audit and education training programme that the RWT infection prevention control team provided. The 'PREVENT charter' consisted of: P (Promote best infection control practice), R (Regularly monitoring of infection control compliance), E (Ensure high standards of hand hygiene), V (Visible compliance with dress code), E (Ensure environmental cleanliness), N (Never accept poor standards), T (Take action to protect patients). An integral component of the charter was the award of a compliance certificate dependent on the infection prevention audit score achieved.

MRSA was found in the care homes

In phase one, 1665 residents were screened for MRSA with 8.7% residents being colonised with MRSA. A decrease in the amount of residents being positive for MRSA was observed between phases one and two (Table 1). In phase two, 6.3% of the residents were colonised with MRSA. A further reduction in colonised residents was observed in phase three compared to phases one and two (Table 1). In phase three, 4.8% residents were colonised with MRSA.

The decolonisation treatment was successful for all phases

All 144 residents colonised with MRSA in phase one were subjected to a decolonisation regime. Only 23 of these residents remained colonised with MRSA after the first decolonisation treatment regime, 17 residents remained colonised after a second decolonisation treatment regime with 10 residents colonised after the third and final decolonisation regime (Table 1).

Table 1. Total number of MRSA-colonised residents in phases one, two and three. Effects of the decolonisation treatment in these groups is also shown.

			First decolonisation*	Second decolonisation*†	Third decolonisation*‡
Phase	Total number of residents screened	MRSA positive (%)	MRSA positive (%)	MRSA positive (%)	MRSA positive (%)
Phase one	1665	144 (8.65%)	23 (1.38%)	17 (1.02%)	10 (0.6%)
Phase two	1598	101 (6.32%)	17 (1.1%)	13 (0.8%)	11 (0.69%)
Phase three	1534	73 (4.76%)	12 (0.78%)	14 (0.91%)	15 (0.98%)

Patients positive after two decolonisation treatments are considered as chronically colonised.

*MRSA decolonisation treatment on all positive from the original screen.

†MRSA decolonisation treatment on all positive after one treatment regime failure.

‡MRSA decolonisation treatment on all positive after two treatment regimens which had failed.

Table 2. A cohort group of residents were identified in all three phases of the screening; the table shows the number of residents positive for MRSA.

		Phase one	Phase two		Phase three	
	Total number of residents screened	MRSA positive (%)	MRSA positive (%)	New MRSA cases*	MRSA positive (%)	New MRSA cases*
Cohort	903	65 (7.2%)	54 (5.99%)	33	42 (4.7%)	22

* Number of residents who had newly become MRSA-colonised.

Similarly, in phase two the 101 residents colonised with MRSA were subjected to decolonisation. Only 17 of these residents remained colonised with MRSA after the first decolonisation treatment regime, 13 residents remained colonised after a second treatment regime with 11 residents colonised after the third and final decolonisation regime (Table 1).

In phase three, the 73 residents colonised with MRSA were subjected to decolonisation. Only 12 of these residents remained colonised with MRSA after the first decolonisation treatment regime, 14 residents remained colonised after a second decolonisation regime with 15 residents colonised after the third and final decolonisation regime (Table 1). The numbers of residents being positive for MRSA fluctuated during the decolonisation regimes as some of the original positive residents became positive for MRSA again during the three weekly clearance screens.

The cohort resident group. As the care homes had been screened three times, a cohort group of residents (903 residents present in all three phases) could be identified. In phase one, 7.2% of the cohort residents were colonised with MRSA; this fell to 5.9% and 4.7% in phases two and three, respectively (Table 2). When the cohort patient group was analysed in more detail, out of the 65 residents who were colonised with MRSA in phase one only 21 of these were still colonised with MRSA in phase two. Of the 54 residents who were positive for MRSA in phase two, 33 had newly acquired MRSA. A similar pattern was observed in phase three. Of the 42 residents who were positive for

MRSA in phase three, 22 had newly acquired MRSA. Only 20 residents screened in phase three were previously MRSA positive in either both/or phases one and two.

Discussion

Early identification of patients colonised with MRSA and subsequent prevention of patient-to-patient spread through screening and decolonisation are potent interventions to control MRSA in hospitals (Coia et al., 2006). The Wolverhampton Health Care Economy set up an MRSA screening policy to combat the growing MRSA problem in the surrounding community and effects on the acute setting this population had, for example MRSA bacteraemias in this patient demographic being admitted to RWT. Nursing homes for older people provide an environment likely to promote the acquisition and spread of MRSA, with observational studies repeatedly reporting that being a resident of a nursing home increases the risk of MRSA colonisation and infection (Hughes et al., 2011). It is recognised that infection control strategies in such environments is arguably just as important as in the nosocomial setting in preventing and controlling MRSA transmission (Hughes et al., 2011). This study details the effect of screening for MRSA and decolonisation of colonised patients from care homes.

The majority of care home residents are 'frequent fliers' in and out of hospital and previous studies have shown they pose a significantly larger risk to developing MRSA bacteraemias compared to healthy individuals (Gopal Rao et al.,

2007). It is vitally important that these residents are screened regularly to reduce the risk of infection and reduce the risk of cross-infection to others in the care-home setting (Gopal Rao et al., 2007). Screening and decolonisation of MRSA-colonised care-home residents led to a reduction in the prevalence of MRSA. During phase one, 144 residents were colonised with MRSA, which fell to 73 residents being colonised at the end of the study. The results clearly indicate that screening and decolonisation, with an educational programme (PREVENT charter) reduces the prevalence of MRSA in the Wolverhampton care-home community.

A cohort group of residents were identified in the three phases. Although there was a less dramatic reduction in the numbers of patients being colonised in the cohort resident group compared to the overall screening figures there was still a reduction. In the cohort group >50% newly identified residents colonised with MRSA was observed in each phase of the study. There seems to be another environmental factor contributing to residents becoming colonised with MRSA in the care homes. One explanation could be that MRSA colonisation is either acquired from the previously positive residents or from new residents arriving to the care homes who are newly colonised with MRSA. Another possibility for the acquisition of new MRSA cases in the care homes could be that the hospital is seeding the community. To identify if the hospital is seeding the community molecular typing of the MRSA isolates would be needed to identify the epidemiological profile of these strains. This warrants further study.

The data presented in this study indicate screening and decolonisation of residents in the community results in a reduction of the prevalence of MRSA. A reduction in MRSA bacteraemias was observed in the community and in this group of patients admitted to the RWT throughout the time period of the study. During the study, three care-home residents were admitted to the local Trust with MRSA bacteraemias, once implementation of the screening programme this decreased to zero the following financial year. The reduction is related to a number of infection control factors both in the community and Trust, further work is needed to identify all the reasons for the reduction seen in the current study. An active screening programme of the care homes based on this study could be implemented by other Trusts/ Community Trusts throughout the country to reduce the burden of this important nosocomial pathogen in the care-home and acute trust settings. The cost benefit for the implementation of an active screening programme of care homes needs to be considered and further work around this is warranted.

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