Department of Health

Implementation of modified admission MRSA screening guidance for NHS (2014)

Department of Health expert advisory committee on Antimicrobial Resistance and Healthcare Associated Infection (ARHAI)

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Prepared by ARHAI MRSA Screening Implementation Group

Disclaimer

The **MRSA Screening Implementation Group**, comprising members from key professional groups, was established to determine how to give implementation guidance on MRSA screening to NHS England, in the context of recommendations from the NOW study.

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Contents

Executive summary

The following guidance outlines a more focused, cost-effective approach to MRSA screening. The recommendation for Trusts to move to focussed screening programmes has been designed to promote a more efficient and effective method for identifying and managing high risk MRSA positive patients. Importantly, focussed screening should be adopted in line with local risk assessments to ensure that Trusts concentrate on reducing negative patient outcomes for their own populations. Changes to current practice need to be undertaken with a commitment to improved compliance with focussed screening, which should be monitored and reported to Trust Boards and commissioners. Trusts will need to regularly review (and where necessary improve) their compliance with national screening guidance for each specialty, recent MRSA infection data, patient demographics and types of services provided within individual organisations. Continued surveillance through both local and national surveillance systems will be needed to monitor the levels of MRSA infection. The outputs of the NOW study could be used to inform policy making decisions should the prevalence of MRSA increase.

Introduction

In the last decade there have been very marked declines in morbidity and mortality related to MRSA infection in England. Annual MRSA bacteraemia rates fell from 17.7 (April 2005-March 2006) to 3.2 cases per 100, 000 bed days (April 2011-March 2012).[1] Significant declines have also been observed in surgical site infections (SSI) where MRSA was reported as the causative micro-organism (from 27% in 2004-6 to only 4% in 2011/12).[2,3] The number of death certificates in England and Wales mentioning MRSA infection has decreased each year since 2006, when the figure peaked at 1,652; in 2012, MRSA accounted for 292 mentions of MRSA on death certificates (a 20% decrease on the previous year).[4]

Until April 2009, national guidance in England recommended targeted screening of patients in high risk specialties.[5] There were no randomised controlled trials, however, to provide evidence on the most effective and cost-effective screening strategies. The Department of Health (DH) in England introduced mandatory screening of all elective and emergency admissions from April 2009 and December 2010, respectively. This decision was based on a DH impact assessment that modelled the cost-effectiveness of different screening and decolonisation strategies in preventing MRSA bacteraemias, wound infections and deaths. We note that in other settings (e.g. Wales), where mandatory screening has not been implemented, MRSA infection rates have fallen markedly.[6] The DH impact assessment committed to a review of this policy with additional data; thus, the NOW study was commissioned in 2011. The study report underwent peer review and its findings were endorsed by ARHAI.

A full report of the NOW study and a summary of its findings are available.[7,8,9] The study showed that compliance with the current mandatory screening policy was poor (e.g. only 61% were screened; about half of new positives were isolated when their result became known; and about a quarter did not receive decolonisation therapy) (Appendix, Table 1). The prevalence of MRSA in new admissions was low (1.5% overall), although this varied according to type of admission (2.1% in emergency admissions, 0.9% elective admissions and 0.7% in day cases admissions) (Appendix, Tables 2 &3). These observations mean that the numbers of patients needed to be screened in order to identify one new positive were high in all admission types (emergency n=102; elective n=180; and day case n=186).[8]

The NOW study went on to model the effectiveness and cost-effectiveness of six different screening strategies at a whole hospital level for the three categories of NHS Trust (acute, teaching and specialty) at four different levels of MRSA prevalence (the current prevalence; and twice, three and four times the current prevalence) and two levels of transmission (current and twice the estimated transmission rate). Six screening and intervention strategies were evaluated: 1) no screening (interventions applied to clinical cases only), 2) screening all admissions (emergency and elective), 3) screening all admissions to high risk specialties, 4) checklist activated screening of all admissions, 5) screening all admissions to high risk specialties plus checklist activated screening of other admissions, and 6) screening all admissions plus pre-emptive isolation of those known to be previously MRSA positive.

At current prevalence none of the screening strategies was likely to be cost-effective at conventional NHS levels of 'willingness to pay' (less than £30,000 per QALY). Costs per QALY for routine admission screening ranged from £86,000 - £170,000, and were consistently more costly and less effective than alternatives for all hospital types. However, of the strategies involving active screening, targeting high risk specialty patients was the optimal option; i.e. mean *incremental cost-effectiveness ratios (*ICERs) of approximately £45,000 and £48,000 in Acute, and Teaching Trusts, respectively (Appendix, Table 4) (see below for Specialist trust results). As prevalence rose, the cost effectiveness of this strategy increased, and fell within

the conventional NHS levels of 'willingness to pay' (Appendix, Table 4). The model results were strongly influenced by the assessment of the risk of infection, which is greater in high risk specialty patients, and has the largest impact on length of stay and mortality, the major determinants of cost and health benefits. Importantly, lack of screening of MRSA in patients admitted to low-risk specialties results in more transmission, but less proportionate risk of serious infection and death than in high risk specialties. Approximately 60% of MRSA colonised individuals will be detected by screening those known to be previously MRSA positive and high risk specialty admissions. For acute and teaching trusts, the most cost effective of the screening strategies is screening high risk specialties only, at both the current prevalence and up to 4 times current prevalence (~5%). For specialist trusts, at current and twice current prevalence, again the 'no screening' strategy has the greatest probability of being the most cost-effective option. However, of the active screening strategies, screening high risk specialities and performing check list activated screening of others is optimal. At higher prevalence (>3%), high risk specialty screening alone becomes the most cost effective strategy overall. However, the probability of cost-effectiveness for high risk specialty screening and high risk specialty plus checklist activated screening cluster together closely. Thus, the most pragmatic decision is that high risk screening for all trust types is the simplest and most cost effective of the screening strategies (Appendix, Table 5).

A recent study examined MRSA control in an ICU setting in the US, (where all patients were nursed in side-rooms), comparing screening and isolation with targeted or universal decolonisation.[10] Universal decolonisation was found to be effective at reducing rates of MRSA clinical isolates and any pathogen bloodstream infections in ICUs. However, universal decolonisation has not been validated in this way outside the US or outside of the ICU setting, and so no recommendation regarding this approach can be made at this time.

In summary, the results of the NOW study suggest that the current mandatory MRSA screening policy is followed in less than two-thirds of admissions, but that even if compliance was 100%, it would still not be cost-effective in any trust type or scenario. While no active screening strategy was optimal at current MRSA levels, the most cost effective policy is one based on screening admissions to high risk specialties; cost-effectiveness increases as MRSA prevalence rises. Trusts would need however, to take measures to ensure high compliance with this strategy.

Objective

To focus and maximise the clinical impact for patients (adults and children) who are most likely to benefit (i.e. those patients for whom MRSA colonisation carries the greatest risk of infection/poor outcome), it is recommended that the current practice of mandatory MRSA screening of acute and elective admissions to NHS hospitals in England is streamlined to the following:

- **All patients admitted to high risk units *(defined below)*.**
- **All patients previously identified as colonised with or infected by MRSA.**

High risk specialties/units

High risk specialties are defined as vascular, renal/dialysis, neurosurgery, cardiothoracic surgery, haematology/oncology/bone marrow transplant, orthopaedics/trauma, and all intensive care units (adult/paediatric ICUs, Neonatal Intensive Care Units, High dependency units, Coronary Care Units).

- In addition, local risk assessment should be used to define other potential high MRSA risk units/specialties; for example, according to provision of specialised services (e.g. transplant, neonatal), and units with a history of high endemicity of MRSA. Local risk assessment may increase the proportion of detected MRSA colonised individuals, notably those patients at risk of poor outcome from MRSA.

Interventions

1. Clear guidance on the local policy for MRSA screening should be made available to all staff; this should be used as a standard against which audit is carried out.

2. Trusts should identify and screen patients in high MRSA risk specialties (as above).

3. Trusts should identify and re-screen any patient previously known to be MRSA positive and isolate these pre-emptively, pending the results of laboratory tests.

4. NICE accredited Standards for Microbiology Investigations (SMIs) are available for MRSA screening.[11] The most commonly practised methods of MRSA screening that were recorded in the NOW study were based on culture on chromogenic agar (5% of trusts routinely used PCR for emergency screens; 15% used PCR for some emergency screening). Average MRSA screen turnaround times were 2.87 days for MRSA+ve and 1.75 days for MRSA-ve samples.

5. The most frequently sampled body sites included in current MRSA screening, as identified in the NOW Study (i.e. as practised by at least 75% of trusts), are the nose, groin/perineum and 'other' sites where appropriate (e.g. wounds, indwelling devices, throat, etc).

6. The frequency of (repeat) screening should be determined locally and made explicit in local guidance.

7. If MRSA transmission is detected/suspected in hitherto 'low risk' specialties then local risk assessment should be used to determine the need for and extent of MRSA screening, i.e. as befits normal infection prevention & control practice when investigating clustering of cases or transmission.

8. All patients identified as MRSA positive must receive decolonisation/suppression therapy; MRSA positive patients should normally be isolated until such time that MRSA colonisation has been shown to be no longer present or local risk assessment determines that isolation can be safely discontinued.

9. Local risk assessment in terms of isolation and decolonisation/suppression therapy will be required for some persistently positive MRSA patients.

10. Trusts should continue to monitor MRSA rates.

Compliance and audit

1. Trusts should make every effort to ensure very high levels of screening in the patient groups identified above.

2. Regular measurement/audit should be carried out to demonstrate compliance with local MRSA screening guidance.

3. Audit should specifically include measurement of the appropriateness of decolonisation (correct agents/dosages for correct time) and follow up.

4. Trusts should make performance/compliance data on MRSA screening and decolonisation widely available within their organisations.

5. The Director of Infection Prevention and Control should provide assurance to the Trust Board on the level of compliance with the local policy on MRSA screening /decolonisation.

6. A qualitative study on the patient experience of MRSA screening and the impact of a positive result found that the following are essential to securing and sustaining patients' satisfaction and confidence in the care they receive in relation to preventing MRSA infection:[1,2]

    i. patients need to be informed of the result of their screen, even if negative;
    ii. information needs to be provided in an individualised way (both written and verbal);
    iii. staff need to be sufficiently knowledgeable and confident to invite patients' and carers' questions and communicate information in a sensitive way;
    iv. specific and comprehensive guidelines for home-based decolonisation are required;
    v. patients expect to see that standards of cleanliness and infection prevention, such as hand hygiene, are practised; and
    vi. measuring and acting on feedback from the patient experience is necessary.

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MRSA Screening Implementation Group
April 2014
Updated post-consultation, June 2014

Appendix

Table 1. NOW Study: Proportion of admissions screened for MRSA

Admission Category	All	Acute	Specialist	Teaching
Emergency	52788/87165 (61%) Median 67.3% IQR (47.5-85.8%) n=132 trusts	38127/63577 (60%) Median 67.1% IQR (47.4-85.8%) n=91	657/1166 (56%) Median 85.9% IQR (68.3-100%) n=16	13736/21988 (62.5%) Median 59.4% IQR (48.9-89.2%) n=22
Elective (not including day-cases)	22773/27838 (81.8%) Median 90% IQR (58-118%) n=115 trusts	14477/16497 (87.7%) Median 92% IQR (59-136%) n=77	1652/2191 (75.4%) Median 86% IQR (62-100%) n=16	6569/9044 (72.6%) Median 73% IQR (30-102%) n=20
Day-cases (not including dermatology, endoscopy, ophthalmic and paediatrics)	22416/46777 (47.9%) Median 90% IQR (23.2-78.9%) n=110 trusts	14255/32927 (43.3%) Median 36.5% IQR (17.4-73.9%) n=77	1153/1568 (73.5%) Median 67.3% IQR (42.6-100%) n=13	6894/11927 (57.8%) Median 48.3% IQR (36.1-77.7%) n=19

Table 2. NOW Study: Proportion of Admission Screens MRSA positive

Admission Category	All	Acute	Specialist	Teaching
Emergency	1075/52064 (2.1%) Median 1.6% IQR (1.1-2.7%) n=129 trusts	836/37408 (2.2%) Median 2% IQR (1.2-2.7%) n=90	5/652 (1%) Median 0% IQR (0-0.2%) n=16	230/13736 (1.7%) Median 1.7% IQR (1.1-2.4%) n=22
Elective (not including day-cases)	188/20798 (0.9%) Median 0.7% IQR (0-1.9%) n=101 trusts	110/13532 (0.8%) Median 0.7% IQR (0-1.8%) n=68	25/1488 (1.7%) Median 0.7% IQR (0-2.5%) n=15	53/5703 (0.9%) Median 0.5% IQR (0.3-1.5%) n=14
Day-cases (not including dermatology, endoscopy, ophthalmic and paediatrics)	150/21501 (0.7%) Median 0% IQR (0-1%) n=112 trusts	58/13509 (0.4%) Median 0% IQR (0-0.6%) n=76	6/1062 (0.6%) Median 0% IQR (0-1.1%) n=16	85/6816 (1.2%) Median 0.7% IQR (0.3-1.2%) n=19

Table 3. NOW Study: Proportion of admission screens newly positive for MRSA

Admission Category	All	Acute	Specialist	Teaching
Emergency	498/50739 (1.0%) Median 0.9% IQR (0.4-1.3%) n=127 trusts	374/36083 (1.0%) Median 1.0% IQR (0.5-1.5%) n=88	4/652 (0.6%) Median 0% IQR (0-0%) n=16	119/13736 (0.9%) Median 0.8% IQR (0.5-1.3%) n=22
Elective (not including day-cases)	107/19283 (0.6%) Median 0.4% IQR (0-1.2%) n=98 trusts	68/12953 (0.5%) Median 0.4% IQR (0-1.7%) n=68	16/1346 (1.2%) Median 0.4% IQR (0-1.5%) n=14	23/4909 (0.5%) Median 0.5% IQR (0-1.4%) n=15
Day-cases (not including dermatology, endoscopy, ophthalmic and paediatrics)	79/20461 (0.4%) Median 0% IQR (0-0.1%) n=110 trusts	27/12469 (0.2%) Median 0% IQR (0-0.2%) n=74	5/1062 (0.5%) Median 0% IQR (0-0%) n=16	47/6816 (0.7%) Median 0.1% IQR (0-0.7%) n=19

Table 4. NOW Study: Cost-effectiveness of screening strategies by trust type and MRSA admission prevalence. Incremental cost per QALY gained is shown for strategies considered both cost-effective[†] and non-cost-effective. Any remaining strategies for each prevalence scenario were dominated[††].

Trust type	MRSA prevalence on admission	Cost-effective strategies : Mean (range[†††])*	Non cost-effective strategies : Mean (range[†††])*
ACUTE	Baseline	-	Strategy **3**: £45,198/QALY (£35,314-£61,390) Strategy **5**: £216,449/QALY (£112,948-£1,770,724)
	Moderate (x2)	-	Strategy **3**: £48,655/QALY (£38,417-£64,899) Strategy **6**: £70,930/QALY (£43,581-£161,673) Strategy **5**: £72,545/QALY (£42,552-£206,075)
	High (x3)	Strategy **3** :£29,565/QALY (£25,660-£34,389)	Strategy 5: £159,566/QALY (£95,476-£412,113)
	Very high (x4)	Strategy **3**: £28,708/QALY (£25,479-£32,609)	-

Trust type	MRSA prevalence on admission	Cost-effective strategies : Mean (range†††)*	Non cost-effective strategies : Mean (range†††)*
TEACHING	Baseline	-	Strategy **3**: £47,936/QALY (£34,585-£74,757)
	Moderate (x2)	-	Strategy **3**: £33,751/QALY (£26,828-£43,702) Strategy **2**: 1,425,323/QALY (£213,225-cost/health-loss)
	High (x3)	-	Strategy **3**: £43,686/QALY (£33,921-£59,612) Strategy **5**: £175,973/QALY (£78,509-cost/health-loss)
	Very high (x4)	-	Strategy **3**: £37,369/QALY (£31,218-£37,369) Strategy **6**: £239,808/QALY (£129,780-£11,238,684)
SPECIALIST	Baseline	-	Strategy **5**: £62,566/QALY (£47,979-£89,425)
	Moderate (x2)	-	Strategy **5**: £31,248/QALY (£27,276-£36,499)
	High (x3)	Strategy **3**: £24,009/QALY (£20,764 - £28,362) Strategy **5**: £26,411/QALY (£17,071-£54,549)	-
	Very high (x4)	Strategy **3**: £19,331/QALY (£17,295-£21,860) Strategy **5**: £24,503/QALY (£16,421 - £45,503)	-

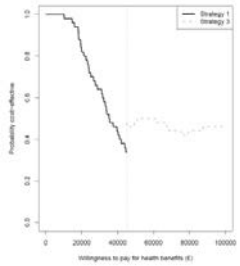
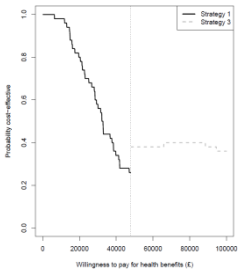
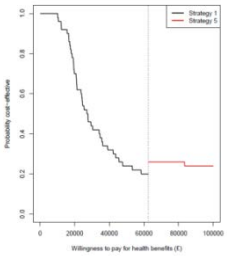
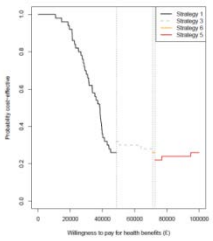
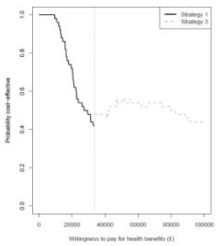
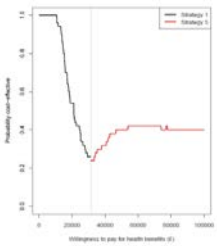
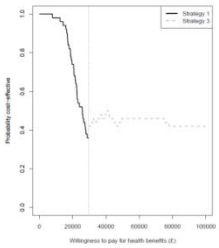
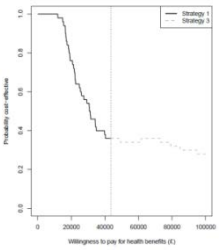
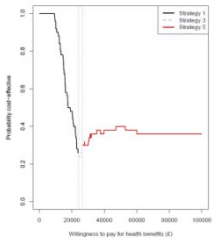
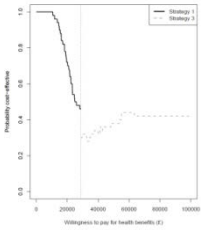
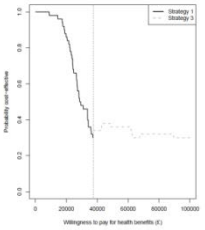
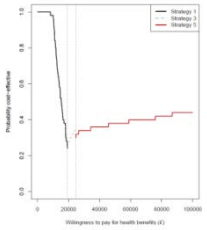
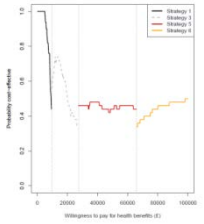
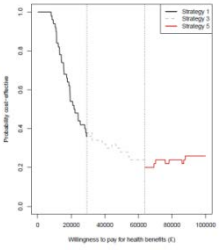
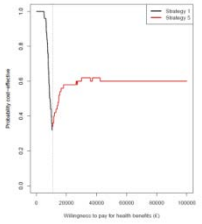
† An ICER of less than £30,000 per QALY is considered cost-effective. An ICER of more than £30,000 is not considered cost-effective. £30,000 is the upper limit of the usual NHS willingness to pay range.

†† Dominated strategies are those that are more costly **and** provide less benefit than one other strategy or a combination of two other strategies. Since it can never be cost-effective to pay more for less benefit, ICERs were not calculated for these strategies.

††† ICER ranges were calculated using mean costs and QALYs ±1standard error, where the minimum = smallest possible difference in cost / greatest possible difference in health benefits, and maximum = greatest possible difference in cost/ smallest possible difference in health benefits.

*Further bootstrapped confidence intervals will be added.

Table 5. Cost-effectiveness acceptability frontiers. Lines depict the optimal strategies (i.e. those with the highest expected net monetary benefit) dependent on the willingness to pay for health benefits, while dotted vertical lines show the willingness to pay values at which the decision changes.

	Acute	Teaching	Specialist
Baseline prevalence Acute: 1.4% Teaching : 1.3% Specialist: 1.04%			
2x prevalence Acute: 2.8% Teaching: 2.6% Specialist: 2.08%			
3x prevalence Acute: 4.2% Teaching: 3.9% Specialist: 3.12%			
4x prevalence Acute: 5.6% Teaching: 5.2% Specialist: 4.13%			
Twice transmission			

Annex: Consultation

Consultation on 'Implementation of modified admission MRSA screening guidance for NHS (2014)'

Comments (the names of individuals providing comments are withheld here)	**Response**
A sensible and well written document. However it is rather "England -centric" for the BIA. There is no mention of the Welsh experience where universal screening was always eschewed and where rates of MRSA have also fallen.	Thank you. Advice for Wales is not our remit. However, the observation about declining MRSA rates in Wales in the absence of a mandatory screening programme is pertinent – we have added a note to our discussion.
Thank you for these draft guidelines, I do support the strategies proposed. My only comment is that I would like to see similar guidelines provided in due course for community hospital and mental health settings as specific guidance has been previously issued, for example: http://webarchive.nationalarchives.gov.uk/20101125133833/http://www.clean-safe-care.nhs.uk/Documents/MRSA_Emergency_Screening_-_FAQs_-_Apr_2010.pdf Our own experience in mental health is that if all patients listed within the possible risk groups are screened, very few are detected that were not known MRSA positives. As such we have stepped down to screening only known previous MRSA positives on admission to our mental health wards. It would be useful to see a more cost effective strategy also advocated for non acute trusts.	Thank you. This is however beyond our remit.

We wish to respond as follows to 'Implementation of modified admission MRSA screening guidance for NHS (2014)', the consultation document prepared by the Department of Health's 'MRSA Screening Implementation Group', whose membership we note is not provided.	The omission of names was an oversight that has now been corrected.
A) One of the arguments cited in favour of targeted rather than universal screening is that compliance with universal screening is poor. However this is not in itself a reason to prefer a different strategy, unless there are reasons to believe that compliance with a different strategy would change in such a way that outcomes would improve. We can't think of any plausible reason why this should be so.	A) Universal screening has not been optimally implemented. Poor implementation is however not the most pressing reason to consider alternatives. We have altered the wording in the guidance document to make this point clearer and reflect the finding in the report that, even if compliance were 100%, routine screening would still be the least cost-effective policy in all trust types and scenarios. The NOW study concluded that a move to targeted screening of high risk plus checklist activated screening of low risk, which in certain circumstances in specialty hospitals is marginally more cost effective than high risk screening, would be even harder to implement.
B) A second argument cited is the low prevalence of MRSA. Unlike the poor compliance argument, this is relevant to choice of screening strategy, but only insofar as it affects the cost-benefit analysis - it is not an argument in its own right. It could also be turned on its head: it is possible that the current low prevalence is a consequence of universal screening and that, without universal screening, MRSA's 'R-nought' value would exceed one and the prevalence would begin to rise again. In other words we are at risk of abandoning a strategy simply because it has been successful. Under the 'targeted screening' proposal, is there a prevalence at which we would go back to universal screening?	B) The guidance clearly states the need to review screening policy based on prospective surveillance. A threshold has not been set. Even if MRSA prevalence quadruples universal screening remains cost ineffective.
C) The low prevalence of MRSA is also pertinent to the comparative performance of different screening methodologies (because prevalence affects the predictive value of the test) so it is a shame that the proposal says nothing about this. This is a missed opportunity to define best practice on questions that would benefit from a standardised NHS approach, such as pooled processing vs separate processing, nose only vs nose and throat vs nose/throat/perineum, selective media vs selective differential media, solid media vs broth enrichment, place of PCR etc. What were the	C) This is outside of the remit of the NOW study; its aim was to evaluate universal vs targeted approaches. i.e. who should be screened rather than how. However, the effect of prevalence on test predictive value was accounted for in the assumptions in the NOW study. The NOW study modelled what actually happens in the NHS, which is that PCR based screening is rarely used routinely. The use of standard methods is cited in the implementation

terms of reference of the MRSA Screening Implementation Group if not to debate such questions?	guidance.
D) The cost effectiveness modelling on which the group's proposals are based is very difficult to assess. The members have drawn heavily from the NOW study, but the NOW study has not been published in a peer-reviewed journal and seems to exist only as a 320-page document on the UCL and IDRN websites. It describes limited aspects of its modelling but directs the reader for further information to a reference (*Robotham JV, Graves N, Barnett AG, et al (2011). Model-based evaluation and cost-effectiveness analysis of MRSA intervention policies*) that again is not peer-reviewed and in fact doesn't seem to be available any longer. This is a serious criticism of a study that seeks to inform public policy, and of the current consultation process.	D) The reference that is mentioned is a DH report (from the 3 year DoH funded modelling study MECAMIP), which was peer reviewed; although it is no longer available online, it is available on request. This resulted in a BMJ publication (Robotham JV, et al. BMJ 2011;343:d5694. doi: 10.1136/bmj.d5694) and an accompanying editorial. There have been three associated publications further detailing the methodologies (Worby CJ, et al. Am J Epidemiol 2013;177:1306-13. Barnett AG et al. Am J Epidemiol 2009;170:1186-94. Deeny SR, et al. J Hosp Infect 2013;85:33-44). The NOW study report itself was peer reviewed by four referees including a health economist. The audit data from the NOW study have been published (Fuller C, et al. PLoS One 2013;8:e74219). The main study publication is in final stages or preparation before submission.
E) It is important that the membership of the MRSA Screening Implementation Group is disclosed. Have they been asked to appraise critically the NOW study or are they the same people who wrote it?	The current version of the NOW study report is available at www.idrn.org/audit. This reference has been updated in the implementation guidance.
F) Acknowledging that we are not given full details about the NOW study's modelling, the information that is provided leads us to regard the cost-effectiveness calculations with scepticism. In particular it is proposed that, compared to universal screening, high-risk area screening would save the NHS as a whole £250m per year and the average NHS trust £1.6m per year, at the cost of a small number of cases of infection. These figures seem designed to catch the chief executive's eye (or to justify withdrawal of funding from NHS trusts) but are implausible when set against the model's parameters of swabbing costs of £3.20, laboratory costs of £4.24 (negative test) or £7.24 (positive test), and an estimated universal screening load for the average 553-bed NHS trust of 790 screens per week. The answer is almost certainly in figure A3 (see below), which confirms that it is the costs of isolation, not the costs of screening, that make by far the largest impact on	We believe that it would not be ideal to wait for publication and then consider how to implement the findings of the study, not least considering the costing conclusions. E) The names of the Implementation Group have been added to the report, along with its remit. F/G) We agree that much of the anticipated savings come from reductions in isolation, and accept that this is a

the modelled costs of each strategy. These isolation costs themselves are plausible (£333 per day for a standard bed and an additional £88.43 per day for isolation nursing) but it is wholly disingenuous to use these to inform decisions about screening. The argument becomes essentially that we should screen fewer patients in order to isolate fewer patients. Setting aside the point acknowledged by the NOW study itself that many carriers identified are not isolated anyway (so these savings are not there to be had), as an attempt to inform national screening policy this is either cynical or muddle-headed. G) Using the modelling parameters in the NOW study, for the average acute trust we calculate that the saving in screening costs of high-risk area screening compared to universal screening would be about £260k pa. If we accept that only 61% of universal screens are actually taken then the saving would be at most £158k (if only 61% of targeted screens were taken) and possibly as little as £63k (if all targeted screens were taken). These calculations assume that the costs of laboratory processing are independent of screening volume – in reality the fixed nature of laboratory costs will mean that the savings are less – but as a ball-park figure we might say that targeted rather than universal screening has the potential to save the average trust about £100k per annum. This, not £1.6 million, and is the figure to weigh carefully against the costs and risks.	contentious issue. However, there is insufficient capacity to isolate patients for infection reasons. MDR GNB threat needs to be managed. The current recommendations help rather than hinder the MDR GNB challenge. The costs calculated from the model are not simply cost savings resulting from screens 'prevented'. They encapsulate all bed day costs, infection-related costs, and intervention related costs associated with onward transmission within the whole hospital population (and therefore differences in lengths of patient stay, movement around the hospital and risk of death). It is correct that the differences in cost of isolation outweigh differences in cost of screens. However, given that the effectiveness of any screening strategy is entirely dependent on the control measures that accompany the screening, screening and control were necessarily modelled, and evaluated, together. Screening in itself does not create any effect (i.e. health benefits), and so to evaluate the cost-effectiveness of screening in and of itself makes little sense in this case. The *only* difference in effect brought about by different screening options will be the difference in level of control imposed. It is therefore the effect that these differing levels of control result in, that are estimated. Both costs and effects therefore need to be evaluated in terms of both screening and accompanying control. This is also the practice used elsewhere - see for example the Scottish Pathfinder MRSA evaluation of MRSA screening. The more important point though, is that it is the difference in bed day costs, far exceed any intervention related costs (e.g. either screening or isolation costs), and it is differences in mortality and length of stay between infected and uninfected patients, that dominate the cost results.

H) As well as over-estimating the benefits of the proposed change, the proposal underestimates the costs and risks. In particular, knowledge that a patient's recent MRSA screen was negative is useful information when choosing empiric antimicrobials: absence of a negative screening result might lower the threshold for expensive (and potentially toxic) treatments such as linezolid and daptomycin in patients with suspected staphylococcal infections, while absence of a positive screening result might delay the initiation of appropriate anti-MRSA treatment and cause treatment failure. Another advantage of universal screening is that it facilitates detection of in-hospital MRSA acquisitions, events that can be a bell-wether for lapses in infection control practice generally. As far as we can tell, none of these was included in the modelling.	H) The perspective of the study is that of a regional or national level healthcare decision maker, i.e. with the whole health economy to consider. We agree that there may be other benefits of universal screening, not included in the model; for example, antibiotic choice. However, without data on these additional benefits, for example the impact of 'knowledge of MRSA status' on antibiotic decision making, and the subsequent effects that that decision making has (primarily on patient's length of stay and mortality) – any effect of screening on antibiotic choice could only be included as a scenario analysis. Given the given the current low prevalence of MRSA, the number of scenarios in which infections that would otherwise have been 'detected' (by 'universal' screening) is likely to be very small. The model does acknowledge that a very small number of MRSA infections will be missed. With reference to the reviewer's point regarding 'missing' any in hospital transmission – this is true. We acknowledge that the cost/QALY approach used here will not identify the 'best' policy if the desired outcome is monitoring (and subsequent reduction) of colonisation within the hospital. The evaluation was conducting to identify the 'best' policy option in terms of cost per quality adjusted life year gained (which, in this case, largely related to those policies best able to reduce *infections* as opposed to *colonisations*).
I) Finally, the proposed small increase in transmission events is impossible to affirm without seeing the calculation, but even if we take the figures at face value these will translate into real infections and real deaths in NHS patients. If that harm is really felt to be outweighed by the benefits then the Dept of Health must disavow its previous zero tolerance of MRSA infections.	I) There is no contradiction between the Government's stated policy of zero tolerance and an effective, targeted, evidence-based screening policy for MRSA bloodstream infections. The transmission dynamic modelling based approach was used specifically to capture the infections and deaths

In summary, we accept the suggestion that compared to universal screening, some kind of targeted screening strategy might detect 80% of colonised patients while incurring only half as many screens. However we do not accept that a robust cost-benefit assessment has yet been made – specifically we do not accept that the costs of isolation nursing are germane to a decision on screening strategy. Removing those costs, we calculate that this change would save the average NHS trust something like £100,000 per annum at the expense of increases in MRSA infections, empiric antibiotic costs, the consequences of delayed treatment of MRSA infections and other non-trivial adverse outcomes: this is the cost-effectiveness calculation that needs to be undertaken before an evidence-based policy change can be made. Finally, we wish to express surprise at the way in which the results of an unpublished and methodologically opaque study are being misrepresented to influence this important debate. Fig A3 (NOW study p72) showing that the cost-effectiveness modelling is overwhelmingly about the costs of isolation, not the costs of screening.	associated with each of the strategy options (and especially to the knock on infections and deaths brought about due to transmission). Total quality adjusted life years gained under each strategy are compared. The cost/QALY approach is therefore used *in order for* these infections and deaths to be included within the decision making process. The purpose of presenting health benefits as QALYs is to allow decisions across the health sector to be compared (using the same units) and so to enable rational decision making. The differences in the numbers of infections and colonisations are the output of the transmission dynamic model, simulating transmission throughout the hospital for each scenario over a 5 year period. i.e. 13,000 lines of computer code – run 1000's of times. It is therefore difficult to provide a 'calculation'. This is the case with any such model-based cost-effectiveness evaluation. It is the model structure and the inputs that are driving the simulation. The computer code itself is available on request. However, reassurance should come from the fact that the code has been developed by a team of mathematical modellers, subject to a multitude of checks, and resulted in numerous peer reviewed publications.
Methodology (A) We note that the recommendations are based on the findings of the NOW study. It would appear that the NOW report has not been published in any peer-reviewed format, although it is available on certain websites. Page numbers below refer to the copy of the publication on the idrn.org web site. Furthermore, the consultation paper refers to a "report on file" in the DH (reference 8).	A) Please see above answers (4) regarding NOW study availability, publication and peer review.

Assumptions (B) The rationale for some of the assumptions are puzzling. For example, "Direct infection from a susceptible state cannot occur in low risk specialty settings and patients must first become colonised" (pg 193) We have reviewed the assumed parameters (pg 210). Unfortunately, due to the time scales available, detailed review of the sources of the information, and the extent that the data could be extrapolated from one setting to another was not possible.	B) The value of this parameter for a high risk setting was extremely low, and therefore it can reasonably be assumed to be lower for low risk specialities. As this is such a rare event, it was computationally sensible to assume this to be zero. This assumption enabled transmission estimates for this setting to be estimated using hospital data. It is worth noting that patients could acquire colonisation on day x, and subsequently become infected on day x+1, and the probability of each of these transitions was estimated using individual level hospital data. Furthermore, given that susceptible and colonised patients were assumed equally infectious, there would be no difference in their transmission potential.
(C) The principal driver of changes in costs in the economic model appeared to be the bed day costs for the admission of individual patients, set at an average of £333 (pgs 210, 234) and incremental costs of placing a patient in an isolation room, set at £88.43/day. We note that 100% bed occupancy is assumed in the model (pg 193). Therefore, there would not be any *incremental* costs directly resulting from patient admission or placement in a single room. Indeed, if the report's conclusion that there will be an increase, however "minimal" (pg. 12), in infections consequent to the proposed changes in screening practice is accepted, a increase in total bed days would be expected, bed capacity permitting. It is therefore unclear why bed days costs would be lower in strategy 1 (pg 234).	C) Increases in numbers of infections resulted in (on average) longer patient stays. While we absolutely agree with the reviewer that under the assumption of 100% bed occupancy, this does not, in itself, result in increased bed day costs. However, it is the opportunity cost of bed days lost to treat other patients that we describe. Results presented are divided by the number of admissions. Therefore, longer stays will prevent admissions, decreasing this denominator, and increase bed day costs per admission.
(D) We also note that contact precaution costs *per se* were set at £19.53/day. In our experience, wards do not normally increase their staffing complement in reaction to small changes in the number of patients being nursed in single rooms. Furthermore, we presume that this cost cannot relate exclusively to consumables; if this includes costs such as enhanced cleaning, in a context where highest possible standards of cleaning are expected on an ongoing basis (and indeed *demanded* by regulatory authorities), it is difficult to see how such additional costs would be incurred. Indeed, if the consequence of a reduction in screening were to be considered to its natural conclusion, this	D) Contact precaution costs were taken from the Scottish MRSA Screening pathfinder study, in which they updated the estimates from the previous HTA Report (Ritchie K, et al. Consultation report on health technology: Clinical and cost effectiveness of screening for MRSA. NHS Quality Improvement Scotland, 2006. Available at: http://www.nhshealthquality.org/nhsqis/3780.html In brief, this included: 12 patient contacts per day by

will lead to a modest increase in infections, and logically a greater inevitable increase in *unrecognised* colonised individuals - cleaning standards would therefore need to be increased across the board, in order to compensate from the inevitably increased risk of transmission of MRSA.	healthcare staff (3 minutes per contact needed to ensure compliance). Plus consumables for each contact of one pair of gloves and one plastic apron. Providing a total daily cost including overheads. (see pg 64 of HTA report for more information).
(E) The report states that the average charge made by laboratories for MRSA screening was £5.68, (sd = £4.44), pg. 19. In the model, different costs were used, £7.24 for a positive, £4.24 for a negative test (pg.210). It is widely known that the cost of reagents and associated laboratory staff costs, ranging from specimen reception, through processing and result issue would scarcely lead to cash releasing savings of more than around £1 per screen set, as all fixed costs (ranging from estate and major equipment to managerial and medical costs) would still have to be met, but in the NHS economic model, these fixed costs would be included in quoted costs (only 2% of hospitals use private providers, where a reduction in total specimen volume might lead to a cash-releasing savings in excess of reagent and direct staff costs). Incidentally, the author recently attended a UEMS Microbiology section meeting where it was reported that *private* laboratories in Germany charge between Euro 1.50 to 3.50 per patient screen (these quoted costs would include a contribution to fixed costs), thereby providing some validation of the suggested true marginal costs above, assuming that UK laboratories are organised in an optimal efficient manner. Similarly, swabbing cost of £4.20 was used (pg. 210). Other than the true marginal costs of the swabs themselves, a reduction in nursing time spent swabbing a patient would not lead to any reduction in the staffing complement on the ward and would therefore not release any savings.	E) Again, screen costs were taken form the best available evidence, which was again from the Scottish Pathfinder study. It is worth reemphasising that all of these costs will be dwarfed by differences in cost brought about by differences in length of stay and mortality (due to differences in numbers of infections between strategies). Note the differences in scale between each of the cost components on any of the cost plots. Having said this, large reductions in testing could release estate/space/staffing, or make these available for other purposes e.g. CPE screening, nurse directed care, etc.
(F) Modelling No sensitivity analysis to changes in the cost parameters was presented. It would be instructive to see the effect of re-running the model with marginal costs to take into account reasonably expected cash releasing.	F) Indeed, it would be ideal to include uncertainty in these cost estimates, in the full probabilistic sensitivity analysis. However, it is unlikely that the decision between strategies would change under different cost assumptions (other than the cost of bed days which dominate the evaluation).

The model also appears to be static in time and does not take into account the reasonable expectation of an inevitable increase in colonisation rates that would occur over time in those strategies that entail lower screening and therefore detection rates. Over a period of several years, it can be expected intuitively that as colonisation rates increase, so will transmission, with an inevitable acceleration in infections.	Admission colonization rates fell in the years before implementation of the current screening guidance. Also, guidance states that local decisions about who/where to screen may be required according to local epidemiology.
(G) We could find no evidence that the model took into account changes in compliance with screening in the different models. One of the implicit criticisms of universal screening in the consultation paper is the observed compliance rate of 61%. Intuitively, compliance with various forms of check-list activated compliance is unlikely to exceed this figure. Experience of practitioners practising in the field of IPC would argue that compliance is very much aided when embedded in routine practice. Therefore a change away from universal screening can be reasonably expected to lead to a greater proportion of unisolated MRSA patients, with a consequently greater risk of transmission to others.	G) This is true. However, we took the decision early on in the NOW study to compare each of the strategies against one another 'on a level playing field' and to see how each fared under the assumption of 100% compliance. Actually, recently published evidence from Scotland (http://www.bmj.com/content/348/bmj.g1697/rapid-responses) provides further evidence that risk-based approaches to MRSA screening can be successful in clinical practice and maximise cost-effectiveness.
(H) Screening practice The consultation paper states that screening compliance at the time of the NOW study data collection period was 61%. However, the data collection period was in May 2011 (pg. 8), only a few months after the introduction of universal mandatory emergency admission screening. It is reasonable to assume that in the early months, Trusts were still developing their systems and that compliance has improved considerably since. It would therefore be inappropriate to use data that applied in 2011 to inform current practice, particularly as there is considerable anecdotal evidence from IPC practitioners in London who are members of this Forum, that compliance with established screening policies is very high in most organisations.	H) The modelling assumed 100% compliance with each policy.

(I) The report states that at the time of the survey, the turnaround time for a positive result was nearly 3 days, and nearly 2 days for a negative result (pg. 19). In our opinion, there is considerable scope for improvement, which may well have been achieved, at least in some laboratories, particularly those that have embraced continuous quality improvement initiatives. For example, in the author's laboratory (until 2013) negative results and presumptive positive results were routinely issued within 24 hours, 7 days per week. For patients whose results become available after discharge, in our experience, systems have been put into place in many hospitals to notify primary care of the result, enabling GPs to prescribe suppressive / decolonisation therapy should this be considered beneficial. In any case given the high frequency of re-admission, this provides additional useful information to inform patient placement immediately on presentation should re-admission be required.	I) This evaluation was an extension to previous work, and at the time of being conducted, the turnaround times represented synthesised estimates from a review of the available evidence in the literature; these accurately reflected the turnaround times for MRSA positive patients reported in the NOW audit. We acknowledge that these may indeed be reducing all the time. This is an inherent problem in the evaluation of screening, with ever faster (and cheaper) tests being developed.
(J) Patient placement and decolonisation / suppression management The report states that the one-day audit demonstrated that only 55% of new MRSA patients were isolated and that decolonsation / suppression therapy had been started in only 73% (pg. 19). The audit did not appear to collect data on time from MRSA detection to implementation of isolation and commencement of decolonisation / suppression treatment. It is therefore unclear whether these deficiencies were merely temporal and the proportion of unisolated / untreated patients at, say 6 and 24 hours does not appear to be know in this study cohort. Sensitivity analysis of costs at various colonisation rates The authors of the NOW report have run the model at various prevalence of colonisation. There are limited data on prevalence of MRSA among emergency admissions. However, a "very high" rate of 5% may well be less than the rate that may be encountered should national guidelines	(J) National audit data from individual patients were used here. The study recorded if all positive patients that week, or randomly chosen negative patients, were isolated before or after screening result became available. Isolation usually occurred as soon as a positive result was known, but many patients were home before results were available. The model reviewed multiple scenarios, including varying MRSA rates. Guidance clearly cites the need for prospective surveillance and review of policy. Note that previous modelling work (DH MECAMIP study) found that while screening and control is likely to be cost effective at a prevalence of 10% (including universal screening) in ICU settings, this was not the case in general medical wards. The NOW study included data on all emergency admissions in England during one week. We are

recommend selective screening once again. For example, G Rao *et al* (JHI. 2007; 66: 15) had observed MRSA colonisation rates of 8.6% among admissions (6.7% of individual patients). The author had also observed colonisation rates of 6-8% among emergency admissions in 2008 prior to introduction of universal MRSA screening at his hospital (unpublished data).	unaware of any more extensive data, including in the Scottish pathfinder study.
(K) Additional, practical, considerations Most experienced practitioners do not consider that it is practical or feasible to identify high risk patients in an A&E environment. There is published evidence to support this (for example G Rao *et al*. JHI. 2007; 66: 15).	(K) This is not true. Patients at high risk of infections are/can reasonably be screened in A&E e.g. influenza, viral gastroenteritis, SARS, etc. Infection control teams should turn their attention from screening everyone to ensuring that high risk patients are screened. For a fraction of the costs of routine screening, one could invest in audit and feedback systems to ensure that compliance with high risk screening is high.
(L) At high levels of bed occupancy, patients are frequently transferred between wards, including those that are classified as high and low risk. Allowance for this effect does not appear to have been made in the model. Practical considerations around this would be considerable. Experienced practitioners recognise that IPC operates in a human environment. Consequently, application of precautions intended to minimize transmission (*e.g.* effective hand hygiene) are more likely to be applied consistently when risks are known, such as in known MRSA colonised patients, who are being nursed with contact precautions. Knowledge of an individual patient's MRSA status is valuable in empirical antimicrobial choices, thereby potentially leading to increases in antimicrobial costs if this information is not available. This element was not included in the costing model.	(L) High risk and low risk ward transfers were estimated using individual-level hospital data, and therefore aimed to reflect real hospital movements. These transfers were included in the model. All of which comes at a cost. National audit data were used in order to make the modelling representative of clinical practice. This is not in accordance with the application and practice of standard precautions. Please see above response regarding empirical prescribing. The aim was to estimate the optimal policy; 'optimal' was defined in terms of cost/QALY. We agree that if the definition of optimal differed, e.g. instead the policy that best enabled monitoring (or reduction) of colonisations, then the decision would have differed.

(M) Centres that implemented universal MRSA screening at a time when 'avoidable' cases of MRSA bacteraemia had already been all but eliminated observed a rapid and marked reduction in true hospital acquired infections or colonisations. For example G Rao *et al*. JHI. 2007; 66: 15, Sarma *et al.* ARIC 2013; 2: 2, A. Mifsud unpublished observations.	M) The Rao et al study was observational over a one year period and noted 'The study was not designed to establish whether this reduction was causally associated with the screening programme.' In the Sarma et al single centre observational study, multiple interventions occurred ('Following the introduction of Root Cause Analysis in May 2006 a number of interventions were made in quick succession as part of the MRSA improvement programme'). Whilst there was a significant association with the introduction of screening, it is not possible to conclude that other measures drove or part drove the observed decline in MRSA infection.
(N) Once systems have been established for screening, these can be relatively easily adapted to take into account changing needs, such as screening for CROs and other emerging infections. Dismantling of universal programmes will make subsequent re-instatement difficult.	N) We are not advocating dismantling systems for screening. Targeted MRSA screening reasonably can release resources to implement other screening e.g. for CROs.
(O) It has been suggested that universal use of antisepsis may reduce the impact of reduced screening. However, the recent recognition of MRSA strains carrying the antiseptic resistance genes, such that they are clinically resistant to chlorhexidine, should strike a note of caution against its unfettered use (Edgeworth JAC. 2011: 66 s2: ii41)	O) We have not advocated 'universal use of antisepsis.'
(P) DIPC Forum recommendation We have concerns around the assumptions used in the economic model, such that we suspect that the financial case may not be as stark as presented. We are certain that genuine cash releasing savings may well ot ensue, and indeed, if the history of management of MRSA in the UK in the 1980s and 1990s is repeated, a large increase in infections and therefore costs can be anticipated with a high degree of probability.	P) There is no contradiction between the Government's stated policy of zero tolerance and an effective, targeted, evidence-based screening policy for MRSA bloodstream infections. Furthermore, nothing in this revised guidance negates the need for effective surveillance, screening and reporting generally. In fact, the guidance makes it clear that 'Trusts will need to regularly review (and where necessary improve) their compliance with national screening guidance for each

In principle we are not supportive of mandatory measures. However, in this particular case, we are convinced that withdrawal of universal MRSA screening will inevitably lead to an increase in MRSA colonisation rates which, over time, will lead to an increase in colonisation rates in the community and will impact on the spread of MRSA in other hospitals in the vicinity. Relaxed control of MRSA in one hospital can be expected to give rise to a geometric build up of cases within the community and will impact on cases in adjacent hospitals. Furthermore, the removal of mandated MRSA screening is incongruous in the context of the DH's stated objective of zero tolerance of avoidable infections. The current performance management regime around MRSA bacteraemia management includes stringent criticism and sanctions. A system that allows sub-ideal performance in some respects but not in others appears perverse. We would suggest that efforts are focussed on fine-tuning the current MRSA management pathways, for example by reviewing screening in situations where transmission is unlikely, *e.g.* in most day case surgeries, improvements in compliance with universal emergency admission screening (if poor performance still occurs), improving laboratory testing and reporting processes, such that cash releasing savings could be accrued by withdrawal of molecular testing , and improving the primary / secondary care interface to ensure good flow of information and action across the sectors.	specialty, recent MRSA infection data, patient demographics and types of services provided within individual organisations.' The guidance also clearly states need for continued local/national surveillance. If MRSA rates increase then can revisit case for screening. The guidance also states that local risk assessment can be used to make decisions about who/where to screen. Cost effectiveness is not perverse. It is one of the requirements of good management of public resources. The key reason to conduct evaluations such as the NOW study is to provide a rational basis for decision making and allocation of scarce resources. We do not have any other evidence from RCTs etc for whole hospitals based on representative national data. The model and report are from the perspective of the regional health policy maker who is considering the picture for the health economy. The suggested alternatives remain conjecture.
Introduction section * Not sure if this part will be included in final guidance?? Introduction section, 3rd paragraph * Re: The NOW study showing that 'compliance with current mandatory	Yes it will but modified as above.

screening policy was poor (e.g. only 61% were screened;...'	
o More informative to give the breakdown by admission type as given by NOW study: the NOW study showed this related to 61% of patients in the emergency admissions category and 41% in the eligible day case admissions category but it was highest in the elective admissions category (81% of patients).	The reader can refer to the NOW study for more detail if required - this is an overview.
* The next point: ..'about half of new positives were isolated when their result became known'	
o Better to make clear that overall, 55% of new positives were isolated once results were confirmed	OK.
* The next point: 'and about a quarter did not receive decolonisation therapy..'	
o First this information is not included in the Appendix of the consultation	Do not understand the point.
o Second, the result quoted is confusing. The NOW report showed that 34% of Trusts did not use pre-emptive suppression/decolonisation on any admitted patient (see Table 9 in NOW report). Or was consultation referring to 27% of patients that did not receive decolonisation once their MRSA result was known.	The latter.
Introduction section, 5th paragraph	

* Re: 'Approximately 60% of MRSA colonised individuals will be detected by screening those known to be previously MRSA positive and high risk specialty admissions'.	
o I did not see this result anywhere in the NOW report. This statement implies that three pieces of information needed, a denominator for all risk factors, the numerator for prior MRSA and numerator for high risk specialty. In fact if 60% refers to these two groups they must be mutually exclusive and another numerator should be included which comprises patients with both these risk factors present (even if 0). Is his based on Table 29a? Whatever the 60% refers to, this needs to be clarified.	This is calculated from data in the report. Simplistically, 50% are previous MRSA +ves plus high risk screening identifies a further 10%.
Summary	
* Re: 'Importantly, focussed screening should be adopted in line with local risk assessments..'	
o If focussed screening to be main national policy then better to say: 'Importantly, focussed screening should be adopted, where necessary, as indicated by local risk assessments..'	Suggested rewording is not what we mean.
* Re: 'Trusts will need to consider current compliance with mandatory screening guidance for each specialty...'	
o This sentence refers to the 'current' situation regarding compliance to existing guideline. Once the existing guideline (screening all admissions) becomes obsolete everything else will by association be irrelevant. Better to say: 'Trusts need to regularly review and where necessary, improve their compliance with national screening guidance for each specialty...'	OK.

After Objective, add a short Background section - this will include definition of MRSA/ habitat/transmission dynamics/impact on length of stay, morbidity/mortality	No, too much detail. This information is widely accessible.
The screening groups are confusingly written. Due to layout there is a possibility of misinterpretation. Solution advised as follows.	
After Background section, important to add a section called: Screening categories.	Formatting will be checked in published guidance.
* For clarity re-organise information under Screening categories:	
o Keep: 'Elective or acute admissions to high risk specialties (defined below)'.	
o Remove the sub-bullet point: 'all patients admitted to critical care units' - these are already included in the high risk specialties list.	
o Remove the sub-bullet point: 'all patients previously identified as colonised with or infected by MRSA' - these would be included in the local risk assessment component. (The NOW study in fact identified high risk specialty screening (reverting to previous strategy) as the most cost-effective strategy. The NOW report did not specifically have findings for 'prior MRSA' alone (in any case it was embedded in the strategy that included all admissions i.e. strategy #6).	We are not just charged with implementing the NOW findings but are to use our judgment in using that evidence to revise guidance.
o Add: 'Additional specified patient groups identified through local risk	

assessment' So the 'Screening categories' plus sub bullets would finally look like as follows: Screening categories * Elective or acute admissions to high risk specialties (defined below): o Sub-bullet point: High risk specialties are defined as vascular, renal/dialysis, neurosurgery, cardiothoracic surgery,.....Coronary Care Units * Additional specified patient groups identified through local risk assessment o Sub-bullet point: Local risk assessment should be used to define other potential high MRSA risk units/specialties; for example, according to provision of localised specialised services.....endemicity of MRSA. o Add after this: 'Include all patients previously known to be MRSA positive'. o The continue with: 'Local risk assessment may increase the proportion of detected colonised individuals, notably.....poor outcome from MRSA. (bold as	

found in consultation) Interventions, No.8, add word 'effective' * All patients identified as MRSA positive must receive effective decolonisation/suppression therapy Compliance and audit * Suggested edits as follows: o Remove i. and keep the statement: 'Trusts should make every effort....groups identified above' as opening descriptive statement. o The next point ii should now be i • vi (which is now v) should begin with: Patient feedback of results is important. A qualitative study on the patient experience.....experience is necessary' •	Unnecessary – we would not advocate ineffective therapy. Thank you for the suggestions, but we have elected to keep the original version as others have not commented on a need for change here.
(A) Concerns that the modelling used in the NOW study is flawed because of the underlying assumptions. Other modelling studies have suggested that a combined approach of isolation and screening confers efficacy (e.g. Bootsma-M et al. 2006 PNAS; 103: 5620–5625). Coia-J (BMJ 2014;348:g1697) wrote: “A prospective case-control study of more than 12000 patients showed that screening strategies	(A) Indeed, the transmission dynamic model was informed assuming that isolating patients is an effective control measure. Precisely, the model input was a 64% (S.D. 14%) reduction in transmissibility due to isolation. This is reflected in the model results – where reductions in transmissions, infections and deaths are seen for all strategies involving screening and isolation. Furthermore, the strategies were

of sufficient sensitivity require screening of 65% of admissions (Harbarth S at al. Evaluating the probability of previously unknown carriage of MRSA at hospital admission. Am J Med 2006;119:275.e15-23)	compared in terms of these effects combined with costs.
(B) Importance of Medical Devices in patients Members experience suggests that serious MRSA infections and bacteraemias have been seen in subgroups of patients with long term medical devices in situ especially those devices that patients take with them into community settings e.g. nephrostomies, central intravascular devices, long term urinary catheters. This is seen especially in patients with underlying malignancy. This needs to be factored in when writing screening guidance for practical use, maybe at the specific trust level.	(B) There is no clinical and cost-effectiveness evidence to support the screening of patients with medical devices and this was not considered by the NOW Study. However, the guidance allows local risk assessment to define other high MRSA risk groups, which may include these groups of patients.
(C) Practical problems in implementation In hospitals with >95% adult bed occupancy rate, many patients are transferred several times during an admission, including transfers between “low risk” wards and “high risk” wards. Thus, even if identifying populations at high risk for MRSA carriage may be feasible, universal screening may be easier to implement, as risk categorisation may have to change throughout admissions due to the mix of patients in different wards and clinical areas.	(C) Although it is recognised that the process may not always be straightforward, appropriate risk assessment should be able to categorise the majority of patient groups correctly. Issues with implementation are not a justifiable argument to sustain universal screening in the absence of cost-effectiveness data.
(D) Realisation of projected cost savings Cost savings make some assumptions that may not be practically realisable. In addition there are additional costs to not having MRSA status from recent screening. Savings are based on not screening (cost of implementing screening) and not therefore isolating patients. However many patients are not isolated in single rooms in low risk areas. Knowledge of MRSA status is	(D) Please see answers above. Briefly, savings are not due to not isolating patients, but instead due (primarily) to reductions in infections (and therefore length of stay). The cost figures demonstrate that any differences in isolation costs are dwarfed by the differences in bed day costs (brought about by reduction in length of stay – in turn brought about by reduction in infections). The potential costs of not knowing MRSA status are difficult to quantify, but are not likely to be significant in low risk patient groups. Issues with implementation are not a justifiable argument to sustain universal screening in the absence of cost-effectiveness data.

believed to prompt enhanced precautions in staff – encourages compliance i.e. modifying behaviour to reduce transmission risk. There is a cost in implementing selective screening in the training, auditing, time necessary to achieve a more complex system. It is likely to be hard to successfully implement and maintain compliance. Knowledge of MRSA screening results gives confidence in not using agents such as linezolid or daptomycin in the initial treatment of serious infections with a likely staphylococcal cause.	
(E) Long term implications Risk-based screening for MRSA carriage is likely to miss too many carriers of MRSA to achieve meaningful control of MRSA infections including prevention of MRSA bloodstream infections in the long term (5-10 years).	(E) There is no evidence to support that appropriate risk-based screening will fail to achieve meaningful control of MRSA. The guidance does advocate prospective surveillance to determine if revised risk assessment and policy change is required.
(F) Stratified Implementing of revised screening policies NHS hospitals that suffer from >95% adult bed occupancy rates and continue to have seen hospital-acquired MRSA bloodstream infection in the last 24 months, should continue with universal admission screening. NHS hospitals that have not seen any hospital-acquired MRSA bloodstream infection in the last 24 months could trial alternative practical strategies of screening for MRSA that are less costly.	(F) There is no evidence to support this statement. The guidance allows local risk assessment to identify appropriate high risk groups of patients who should be screened The guidance does advocate prospective surveillance to determine if revised risk assessment and policy change is required.