The First Report of the SSAC Nordic Working Party on MRSA, Year 2004

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I. Background

Methicillin-resistant *Staphylococcus aureus* (MRSA) has become a persistent problem worldwide. MRSA has been established as a major hospital pathogen but it is also found increasingly in long-term health care facilities and in the community in persons having no connections to the health care setting. The incidence of MRSA is high in the US and in the majority of Southern and Central European countries, but has remained relatively low in Scandinavia and in the Netherlands. If MRSA becomes a common clinical finding in health care facilities, it affects the empiric treatment regimens needed and causes increasing economical and other resource requiring burden to the health care system. Strict MRSA control measures have been shown to be effective against MRSA spread, also in epidemic situations.

At the 20th meeting of the Scandinavian Society for Antimicrobial Chemotherapy (SSAC) in Odense in 2003, Professor Karl G. Kristinsson, Reykjavik, presented data indicating a significant increase in the number of MRSA cases in the Nordic countries over the last few years. In the following discussion it was decided that the Nordic countries should meet this threat by joining forces and form a "SSAC Working Party on MRSA" with the general goal of stopping this increase, or more specifically of keeping the percentage of MRSA in invasive isolates of Staphylococcus aureus below 1%.

The SSAC Working Party on MRSA was given the following tasks:

a) Suggest simple ways to
    1) report national epidemiological MRSA data to the Working Party
    2) report information to all stakeholders and to the public
b) Compare the current national guidelines and practices in the Nordic countries, including epidemiological registration practices, laboratory methodology and infection control, and identify similarities and discrepancies.
c) Suggest quantifiable (measurable) goals for the preventive strategies against MRSA in the Nordic countries.
d) Suggest measures to obtain these goals
e) Identify and prioritise areas where there are important gaps of knowledge and suggest studies in these areas
f) Report regularly to the SSAC board and at SSAC meetings.

Two representatives from each of the five Nordic countries were appointed by the SSAC board. The current Nordic MRSA Working Party members (January, 2005) are:

Denmark:

Dr. Hans Jørn Kolmos, Odense University Hospital, Odense

Dr. Robert Skov, Statens Serum Institut, Copenhagen, Chair

Finland:

Dr. Reijo Peltonen, Turku University Hospital, Turku

Dr. Jaana Vuopio-Varkila, National Public Health Institute KTL, Helsinki

Iceland:

Dr. Hjordis Hardardottir, Landspitali University Hospital, Reykjavik

Dr. Olafur Gudlaugsson, Landspitali University Hospital, Reykjavik

Norway:

Dr. Stig Harthug, Haukeland University Hospital, Bergen and National Institute of Public Health, Oslo

Dr. Yngvar Tveten, Telelab, Skien

Sweden:

Dr. Barbro Olsson-Liljequist, Swedish Institute for Infectious Disease Control, Stockholm

Dr. Christina Åhrén, Sahlgrenska University Hospital, Göteborg

The Working Party has met four times:

January 2004: Copenhagen – kick off meeting.

May 2004: Prague, during the ECCMID.

September 2004: Oslo, during the SSAC

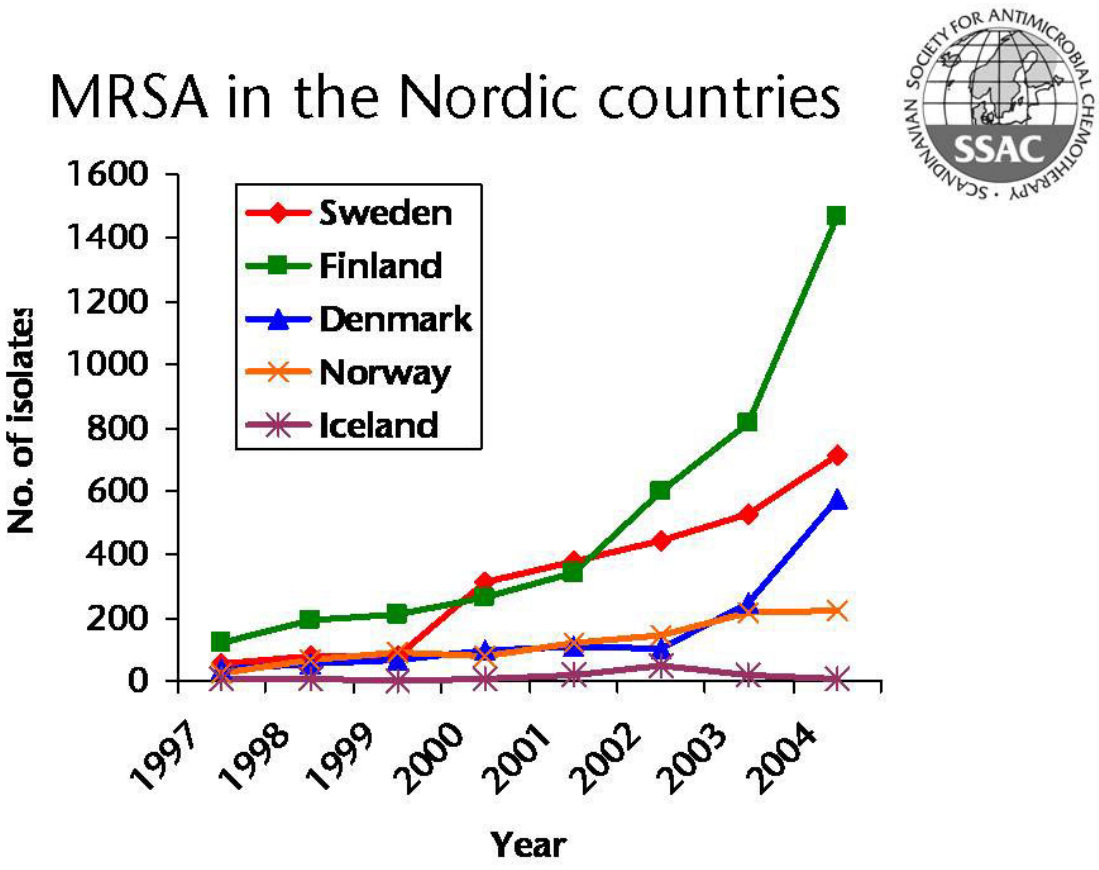
April 2005: Copenhagen, during the ECCMID.

The Working Group has focused mainly on items a) and b) on the SSAC task list, as these are prerequisites for some of the other tasks.

II. Current MRSA situation in the Nordic countries

In all five countries findings of MRSA are reported to National Institutes for surveillance as presented below. However, non uniform criteria for surveillance are used in the various countries. The increase in number of MRSA from 1997 to 2004 reported to the national institutes is shown in Figure 1.

Figure 1: Number of new cases of MRSA isolates reported to the national surveillance institutes in the Nordic countries from 1997 – 2004. Denmark, Finland, Iceland and Sweden report cases due to infection as well as colonisation, Norway only report cases due to infections.



Denmark:

During 2004 a total of 577 new cases of MRSA (infected and colonized persons) have been reported to the National reference Staphylococcus Laboratory, Statens Serum Institut. This is twice as many as in 2003 and 10 times as many as found in the mid-nineties. Simultaneously, the epidemiology has changed significantly. Previously, MRSA was predominantly contracted outside Denmark and was hospital associated, whereas in 2003 less than 10 % was contracted outside Denmark. More than 40% of infections had community onset (CO-MRSA) and about 60% of the patients with CO-MRSA apparently did not have any known risk factor for acquiring MRSA infection (based on discharge summaries or records from the general practitioner).
Clustering / outbreaks have been seen in three hospitals (one of these is on-going) and in one long term care facility.

Finland

During 2004 a total of 1468 new cases of MRSA (infected and colonized persons) have been reported to the national infectious disease register at the National Public Health Institute, KTL (www.ktl.fi). The majority of the cases (70%) have been reported in older persons ($\geq$ 65 years). The MRSA rate has increased over the past three years; 340 cases in 2001, 597 cases in 2002 and 847 cases in 2003. The annual incidence of MRSA has increased from 6.56 to 16.27/100.000 population, during these three years. There are considerable regional differences. It has been observed that the increase has been successfully restrained in areas where a very strict MRSA policy is upheld.

Iceland:

During the years 1986-1999 incidences were stable with 0-5 new cases a year (infected and colonized persons). A change was observed in the years 2000 – 2002 with a marked increase in the number of new cases. This was due to outbreaks (one in each of these years). In 2003 and 2004 the number of new cases fell again (from 46 cases in 2002 to 8 cases in 2004), mainly because of the absence of institutional outbreaks. In 2005 the number of MRSA has increased again with 12 new cases identified in the first 3 months.

Norway:

During 2004 a total of 221 new cases of MRSA infected persons have been reported to the National Institute of Public Health, Oslo (www.fhi.no). The MRSA rate has increased over the past years; 22 cases in 1995, 67 cases in 2000 and 221 cases in 2004. Simultaneously, there has been a major increase in the number of cases that contracted their MRSA infection in Norway (41% in 1995 up to 70% in 2004). Only 30% of the patients in 2004 were hospitalized.

Most of the isolates were from skin and soft tissue infections (88%). Invasive disease was reported in seven patients. MRSA outbreaks have been reported from nursing homes in several regions and from one hospital. Preliminary reports from two laboratories indicate that ST 80 is the prevalent MRSA clone outside hospitals.

Sweden

During 2004 a total of 712 new cases of MRSA (infected and colonized persons) were reported in Sweden. Information can be found at (http://gis.smittskyddsinstitutet.se/mapapp/build/21-151000/Disease.html). There has been a gradual increase in the number of notifications of MRSA since 2000 when MRSA became a notifiable disease; 319 cases in 2000, 424 in 2001, 441 in 2002, and 547 in 2003. During these years, the epidemiology has not shown any dramatic changes. According to information from the reported cases in 2004, 50-60% of the cases contracted their MRSA in Sweden, 20-35% of the cases contracted MRSA outside Sweden, and for the remaining 15-30% this information was not available at the time of notification. According to the more detailed information found in SWEDRES 2003 (A Report on Swedish Antimicrobial Consumption and Resistance in Human Medicine), the majority of the domestic cases contracted their MRSA in health care facilities. Since 2000, all MRSA isolates have been sent to SMI (Smittskyddsinstituttet) for verification and further typing.

III. Surveillance of MRSA

Currently the epidemiological terms and definitions vary between the Nordic countries. Uniformity in definitions, criteria and methods of MRSA surveillance is a necessary foundation for the acquisition of further knowledge on the epidemiology of MRSA. Thus, this is one of the most important issues that the Working Party is facing.

Uniform terms and definitions will also enable direct and confident comparison of data.

a) The current surveillance systems/terms:

1. All the Nordic countries register all individuals diagnosed with MRSA (both infections and carriers).
2. MRSA is notifiable by law in Finland, Sweden, and Norway and since summer 2004 also in Iceland. In Denmark, legislation is being prepared.
3. All countries search for new MRSA cases through laboratory-based records. Norway and Sweden also receive notices from primary physicians.
4. Background data collected for each MRSA case vary between countries.
5. All countries tend to classify each new case as either "infection" or "carrier" but the definitions are not uniform.
6. All countries tend to classify each new case as being either of "domestic" or "non-domestic" origin, but definitions are not uniform.
7. Not all countries define cases as being "community-" or "hospital-" acquired, and if the distinction is made the definitions used are not uniform.

For details see Table 1

b) Suggestions for the future

1. Areas where uniform definitions are needed

1. "Colonization" vs. "infection".
2. "Domestic" vs. "foreign" acquisition.
3. "Health care" vs. "long term care" vs. "community" related acquisition
4. Harmonization of typing (e.g. PFGE) nomenclature of strains to facilitate reporting of epidemiological information among areas/countries
5. Reporting of repeat cases (colonization/infection) and repeat isolates.

2. MRSA Surveillance Project

With a harmonisation of definitions it will be possible to compare the epidemiology of MRSA infections and obtain a better understanding of the MRSA situation in the Nordic countries.

We suggest that a coordinated MRSA-surveillance project be initiated. It must be built on the existing national infection surveillance systems, each of which is based on national legislation. It is proposed that each country selects a national coordinator to initiate and plan the project in collaboration with other country coordinators. The MRSA survey should be based on identification of laboratory-confirmed MRSA cases (both carriers and clinical cases) and on the collection of additional data through a questionnaire-based survey. The questionnaire-survey should target both epidemiological background information on MRSA cases and infection control measures taken. Data are preferably gathered through local infection control nurses or primary physicians depending on the country and local infection control practices. A common MRSA-questionnaire form (translated to all Nordic languages) should be developed.

IV. Laboratory methods

All countries but Norway have a central/National reference laboratory. In Norway the establishment of a National reference laboratory is in progress.
The National reference laboratories receive all MRSA isolates both from infected cases and from carriers.

a) Summary of the current national laboratory methods

1 All suspected MRSA isolates are confirmed by *mecA* or PBP2a detection.
2 MRSA isolates are typed in all countries. Pulsed field gel electrophoresis (PFGE) is the primary typing method (several use the same protocol, Harmony).
Sequence based typing of selected isolates i.e. multi locus sequence typing (MLST) and *spa* typing is performed nationally in Denmark, Finland and Sweden.
3 The national reference laboratories in Denmark and Finland routinely investigate all MRSA isolates for glycopeptide non-susceptibility using specialized tests.

For details see table 2.

b) Suggestions for a uniform and comparable methodology.

1. Nationwide laboratory based surveillance should be designated to one institution in each country.
2. Development of a uniform terminology for MRSA types based on PFGE patterns.
3. National exchange of information on characteristics of circulating clones.
4. Coordinate external quality control of susceptibility testing for methicillin resistance.
5. Development and/or implementation of faster methods for identifying MRSA carriers and non-carriers in order to reduce the time during which patients need to be isolated, and to facilitate compliance with MRSA control protocols.

V. Infection control and responses to infection or colonization

The control programs for MRSA in the Nordic countries are based on the epidemiological fact that many of the cases have been imported from abroad, often by patients being transferred from foreign hospitals or by health care workers (HCW) returning from a professional stay abroad. All countries have recommendations for managing MRSA-positive patients in hospitals. The recommendations from Finland, Norway and Sweden also include long term care facilities and homes for the elderly.

MRSA-positive patients (infected or asymptomatic carriers) are most often nursed while practicing contact isolation regimen. Eradication of MRSA carriage has been performed on an individual basis using local guidelines. Contact tracing within hospitals has been the rule in some national programs but in others it has only been applied in outbreak situations.
The screening and contact isolation procedures recommended for patients transferred from hospitals abroad and for health care workers (HCW) returning from work in foreign hospitals have until recently been considered sufficient control measures since only a few, relatively small and hitherto controlled outbreaks have taken place.

However, recent epidemiological data indicate, that many MRSA cases have no connection with either patients or HCW returning from abroad, but rather stem from the dissemination of MRSA within the Nordic communities. Furthermore, outbreaks in nursing homes, long-term care facilities and homes for the elderly are an increasing problem. We may be observing the birth of de novo community-MRSA strains, through horizontal spread of mobile genetic elements coding for methicillin resistance. The rate at which this occurs is not known. If it becomes frequent it will have major implications for infection control.

In spite of a marked increase in the incidence of MRSA in the Nordic countries during the last few years, it is still feasible to strengthen measures to maintain the favourably low prevalence, especially within our health institutions. However, the changing epidemiology of MRSA infections must lead to the extension of current preventive programs. The knowledge on which this process should be based is still partially lacking:

1. The prevalence of MRSA in the community (what is the scale of MRSA dissemination outside hospitals)?
2. The prevalence of MRSA in
    a. Long term care facilities (physically and mentally disabled) outside hospitals
    b. Homes for the elderly
3. How many of the community onset cases are truly community acquired?
4. Can the community acquired cases be linked to a stay abroad?

Knowledge of these factors is needed for more precise control programs to be developed. Several of the possible measures are expensive and may be inapplicable in health care settings outside hospitals and even less applicable in the community.

Some important questions are:

1. Should other groups be included in screening programs?
    a. patients in long term facilities as recommended in Finland, or
    b. household contacts
2. Is it feasible to have a common Nordic policy for eradication of MRSA carriers in the community?
3. Can carriers ever be declared free of MRSA colonisation i.e. do previously MRSA positive patients have to be isolated on all future admissions even if former screening samples have been negative?

a) Summary of the differences between the Nordic countries in infection control guidelines

1. National recommendations or regulations for handling MRSA cases exist in all five countries. There is agreement on the screening of patients who have been hospitalised abroad or in a hospital where MRSA is epidemic or endemic. There are differences between the countries regarding mandatory periods for screening (1-12 months), number and localisation of samples.

2. Most countries recommend that HCW who have served professionally abroad (or who have been hospitalised abroad) should be screened for MRSA. However, it is unclear as to how often this is actually performed, both among and within the five countries.
3. All five countries attempt eradicating MRSA carriage but are using different recommendations.
4. Handling of MRSA carriage among HCW, and the restrictions relating to them, vary.

For details see table 3.

b) Suggestions for a uniform response or a step in that direction

1. General considerations
   a. **It is possible to care for MRSA-positive patients without spread of MRSA.**
   b. **For the successful control of MRSA, it is imperative that the MRSA-positive patient has the same rights and access to medical care as the MRSA-negative patient.**
   c. Standard hygiene precautions should be applied in all patient care with a special focus on alcohol based hand hygiene.
   d. In order to enhance compliance and minimize confusion, identical measures should be applied within all health care institutions within the same area/region. These measures should be in accordance with national guidelines and regulations.
   e. General use of antibiotics:
      i. All sections of the health care system should contribute to the prudent use of antibiotics by applying regional or national guidelines.
      ii. The use of antibiotics should be monitored in order to ensure compliance.
2. Specific considerations
   a. Measures should be taken to ensure that all institutions involved in the care of the MRSA-positive patient are properly informed, i.e. by:
      i. Electronic reporting of previously MRSA-positive persons on presentation to Health Care Facilities.
      ii. Asking all patients on admission about history of MRSA (as in Iceland since 2002)
      iii. Issuing a card to MRSA patients with information on precautions to prevent transmission of MRSA in health care institutions,
      iv. Guidelines for declaring a patient as ”MRSA-negative” should be established.

3. Care of MRSA patients in hospitals
    a. Contact isolation in a single bed room should be applied for care of the following patients:
        i. MRSA culture-positive patients
        ii. Hospitalized patients waiting for MRSA screening result
        iii. Previous MRSA culture-positive patients if not declared MRSA-negative
4. Care of MRSA positive residents in long term care facilities
    a. A single bed room or cohorting.
    b. Emphasize the importance of proper infection control measures, especially regarding alcohol-based hand hygiene.
    c. A risk assessment for spread of MRSA to other residents should be performed and appropriate infection control measures implemented
5. Screening of patients for MRSA on admission to hospitals.
    a. All patients previously positive for MRSA
    b. Patients who have been hospitalized overnight or undergone invasive procedures (i.e. catheterization) in all types of health care facilities in foreign and/or in domestic hospitals/health care institutions with known endemic or epidemic MRSA within a defined time limit (6 months minimum requirement)
    c. Samples should be taken from nostrils, throat, urine (if catheter) and skin lesions if present (minimum requirement)
6. Screening of HCW for MRSA
    a. HCW who have worked in hospitals or health care facilities or who have been hospitalized outside the Nordic countries within a defined time limit (6 months minimum requirement)
    a. In case of outbreak situations where the route of transmission is not identified.
    b. Samples should be taken from nostrils and skin lesions (minimum requirement)
7. HCW positive for MRSA
    a. Eradication treatment should be offered to all HCW positive for MRSA
    b. An individual risk assessment should always be performed before a culture positive HCW can return to direct patient care

VI. Concluding remarks.

The work of the SSAC Working party on MRSA has shown that the Nordic countries share more similarities than dissimilarities in their problems, approaches and philosophy towards MRSA.

It is possible to care for MRSA positive patients without the dissemination of MRSA. For the successful control of MRSA it is imperative that MRSA positive patients are offered the same access to medical care as MRSA negative patients.

The information collected and shared in the MRSA Working Party has already been of great importance in the MRSA debate in the individual countries.

Based on observations in Finland, it seems that the increase can be successfully restrained and MRSA can be eradicated from institutions in areas where a very strict MRSA policy is upheld. This is consistent with the experience in Iceland.

The working party has defined the following areas of priority:

- To establish uniform definitions - this form the foundation for comparisons between the Nordic countries and the basis for future studies and interventions.
- To establish channels for the rapid exchange of information on epidemics and endemicity between the Nordic countries.
- To initiate and encourage studies on the impact of antibiotic use on MRSA epidemiology
- To increase our knowledge of the advent and epidemiology of community acquired MRSA (CA-MRSA).

VII Tables

Table 1. Definitions of different terms used in each country.

Term	Denmark	Finland	Iceland	Norway	Sweden
Isolates sent to the reference laboratory. Designation: Infection vs. colonization	All cases of MRSA i.e. both isolates from infections and those found by screening are included. Clinical information (discharge summaries, relevant GP notes) is retrospectively collected at the Staphylococcus laboratory (SSI). It is voluntary to send the data, the response rate is high. Based on the above data, designated as clinical infection or asymptomatic colonization	All cases of MRSA (regardless of specimen type i.e. clinical or screening sample) are referred to KTL since 1995. The KTL records the date, source of specimen, and the patient's birth date, sex, and place of treatment. Since 2004, the reason for taking the culture is also recorded (clinical infection, surveillance, outbreak investigation).	All cases of MRSA, i.e. both isolates from infections and those found by screening, are referred to a reference lab. (Dept. of Clinical Microbiology, Landspitali University Hospital, LUH) since 1986. All positive MRSA cultures prompt an investigation by the State Epidemiologist or the Dept. of Infection Control (LUH). Based on the investigations described above, each case is designated as clinical infection or asymptomatic colonization	All cases of MRSA (infections and colonization) are reported to Folkehelseinstituttet (FHI). Isolates from all new cases are sent to the reference laboratory (St. Olavs Hospital, Trondheim) for characterization	Mandatory reporting of findings of MRSA to Smittskyddsinstitutet (SMI) as of 2000, both from the primary physician and the laboratory. Reporting is done electronically through the system called "Sminet". All new patients / persons with positive cultures are reported. The reason for taking the culture is also recorded (clinical infection, surveillance, outbreak investigation).
Domestic vs foreign acquisition	Abroad is defined as MRSA acquired in conjunction with foreign travel	This information is not recorded by KTL. Local IC teams record this information for contact tracing and possible outbreak investigation purposes.	The case is listed as "Domestic" if no indication of acquiring colonization or infection abroad (in connection with travel, work or residence abroad). (Microbiology of strain is evaluated as well)	If another country is noted, it will be recorded as from abroad. If this information is lacking, the attending physician is contacted to find out.	Abroad if primary physician states foreign travel or treatment within the last 6 months.
Hospital acquired, Health care-related and Community acquired	No formal definition. Each case evaluated as for most likely acquisition and is categorized as Hospital acquired, Community onset infections with health care associated risk and Community acquired infections.	No formal definition.	No formal definition. Each case evaluated as for most likely acquisition and is categorized as Hospital acquired or Community acquired. Uncertain: if cannot be confidently categorized in one of the other.	An episode is categorized as hospital acquired if the test is reported as coming from a hospitalized person. All other cases, also patients in institutions for the elderly are recorded as community acquired.	No formal definition. Each case evaluated as for most likely acquisition and is categorized as Hospital acquired, Community acquired or unknown.

Term	Denmark	Finland	Iceland	Norway	Sweden
Reporting of MRSA rates	The incidence rates are available since 1988. Each patient is only included once unless investigations document that it is a new infection.	National MRSA incidence and prevalence rates (categorized by health district, month of isolation, age and gender) are available since 1995 from Finland through a www-based national infectious disease register. The time interval for recording a new case is 36 months.	Only new cases/colonizations recorded. Data available since 1986.	See above: only new cases i.e. first isolate unless information of a new disease episode for example septicaemia more than a year after first episode.	The summaries of data from SMI constitute only new cases for the given time period

Table 2. Laboratory methods summary for each country

Methods	Denmark	Finland	Iceland	Norway	Sweden
National Reference Laboratory					
National Reference Laboratory	Yes	Yes	Yes	Yes	Yes
Referral of isolates	Yes, all both from infections and colonization	Yes, all isolates from new cases, mandatory by law. All blood isolates and severe cases	Yes, from all cases, both clinical infections and asymptomatic carriers	Yes, from all new cases – both clinical infections and colonization	Yes, all both from infections and colonization
mecA confirmation	All isolates. EVIGENE hybridization kit	All isolates. MecA-PCR or MRSA Genotype. MRSAScreen has been used previously.	All isolates. PBP2´ LATEX agglutination test (Oxoid)	All isolates. PCR for *nuc*- and *mecA*-genes	All isolates. PCR for *nuc*- and *mecA*-genes
PFGE	All, Harmony protocol	All, Harmony protocol	All, Harmony Protocol.	All, Harmony Protocol	All, Harmony protocol
SSCmec typing	All, since 2003	Selected isolates, all epidemic strains and sporadic isolates	Not done	From 2005, selected isolates	From 2005, selected isolates
Phage typing	All	All isolates until July 2004. Not done currently.	Not done	Not done	Not done
spa typing and MLST	From 2005, selected isolates	MLST done on selected isolates (epidemic strains and sporadic isolates). *Spa* typing will start in 2005.	Not done	MLST done on selected isolates (epidemic strains and sporadic isolates). *Spa* typing will start in 2005	Selected isolates in the collection of strains from 2000 and onwards
Susceptibility testing	All isolates: Tablet diffusion, 12 antibiotics Screening for VISA by Etest macromethod – confirmation by PAP-AUC analysis	All isolates: Disk diffusion test (15 abs.) based on NCCLS criteria. E-test (oxacillin and vancomycin). Feasibility of cefoxitin disk is currently being tested.	On all isolates: Disk diffusion test (13 abs., incl. vancomycin). E-test (oxacillin, mupirocin, and teicoplanin) also for vancomycin in selected cases.	On selected isolates in reference laboratory. Routine susceptibility testing in local laboratories.	All isolates: Disk diffusion, 12 antibiotics including cefoxitin . Etest: Oxacillin

Methods	Denmark	Finland	Iceland	Norway	Sweden
Local / regional laboratories					
Guidelines for MRSA diagnostics					
Routine method for detection of methicillin resistance in – clinical specimens	All laboratories use cefoxitin disk or Neosensitabs tablet diffusion on routine media as primary test	Disk diffusion (NCCLS guidelines). Oxacillin 1 ug disk as the most common primary disk used for MRSA detection. Cefoxitin disk not commonly used.	a) LUH, Cefoxitin method. b) Besides a), 8 bact. laboratories exist in Iceland. These use oxacillin 1 ug disk according to NCCLS guidelines. Cefoxitin method is being introduced	17/18 laboratories use agar screen (2% NaCl and oxacillin 4 mg/l) 1 laboratory use cefoxitin as routine, 4/18 use cefoxitin as a supplement to agar screen.	Most (all) laboratories use cefoxitin disk diffusion on routine media as primary test
Extra methods used for screening samples	4 /15 laboratories use broth enhancement	Most laboratories use commercial screening plates (such as ORSAB). In some laboratories in house selective plates/broth enrichment techniques are used for screening samples	a) LUH, Dept. of Clinical Microbiology: Broth enhancement . b) Laboratories, other than LUH: Not done (screening swabs sent directly to ref. lab. at LUH)	9/18 laboratories use variants of broth enhancement	5 laboratories use broth enhancement followed by RT-PCR and/or selective agar, 7 laboratories use selective agar screen according to SRGA
mecA confirmation	7/15 laboratories perform confirmation using PBP2a kit, PCR or EVIGENE	Majority of laboratories use PBP2 agglutination test. 2/28 laboratories use *mecA*-PCR for confirmation		17/18 use PBP2a agglutination 12/18 confirm with PCR	12/29 laboratories use PCR, the others use PBP2a agglutination test
Typing	2/15 laboratories perform PFGE and/or sequence typing	Not done	Not done, except at the LUH	7/18 laboratories perform PFGE, 2 laboratories perform MLST	7/29 laboratories perform PFGE, AP-PCR by 1 and *spa* typing by 1

Table 3: Infection Control guidelines in each country

	Denmark	Finland	Iceland	Norway	Sweden
Legal regulations	None In preparation: Notifiable disease	National law and regulations on infectious diseases	MRSA a notifiable organism since summer 2004	National law and regulations	Notifiable disease.
National and / or regional guidelines	National recommendations on selected topics National guideline is in preparation Regional guidelines in all acute care hospitals.	National MRSA guidelines, 1995. Updated National MRSA guidelines, 2004. Regional guidelines in all acute care hospitals.	National guidelines first published summer 2002. Revised edition since Oct. 2003 Some regional guidelines exist.	National guidelines, preliminary in 2002, official as from December 2004.	National guidelines since 1999 and can be accessed at www.srga.org/mrb/index.html Revision is ongoing. Regional guidelines based on national guideline.
Patient isolation: in hospitals	Isolation precautions	Isolation precautions	Isolation precautions	Isolation precautions	Isolation precautions
Guidelines for infection control measures in long term care facilities and / or outpatients	LTCF: None Outpatients: Included in the National guidelines	Are included in the updated National MRSA Guidelines from 2004.	LTCF: None Outpatients: Included in the National guidelines	A preliminary national guideline was drawn in 2002 and revision is ongoing. Part of the revised national guidelines is expected to be distributed late autumn 2004.	National guidelines since 2002. Revision is ongoing. Regional guidelines based on national guidelines
Screening of patients on hospital admission of a patient with previous MRSA infection or colonization	< 1 month	Usually lifelong. Every time on hospital admission and during hospitalization at certain time points, unless considered as MRSA negative by the local IC physician. A MRSA alert notice is linked to electronic patient records.	Lifelong	< 6 months if no risk factors. Lifelong when risk factors.	Lifelong risk unless MRSA has been found only on one occasion (followed by two negative cultures) in a patient without skin disease/lesions. Regional guidelines sometimes vary from the national guidelines – some are more and some are less strict

	Denmark	**Finland**	**Iceland**	**Norway**	**Sweden**
Screening of patients performed in outbreaks	This is primarily performed by local infection control committees. Patients exposed and still in the hospital are examined	All close contacts of a MRSA patient in acute care and long-term facility are screened. If there are several MRSA-cases, if the epidemic involves a risk ward or if screening of close contacts does not prevent spread of the epidemic, screening can be broadened to include the whole ward/unit.	Screening: a. All room-mates of the index-case (then isolated in a different room/ rooms while awaiting results of screening). b. All patients with risk factors on the same ward c. All staff having attended the index case This first circle of screening is extended if required	Primarily performed by local infection control personnel. Patients exposed and still in the hospital are examined. If necessary, dismissed patients are examined after a positive risk assessment.	All patients in the affected ward(s) are screened immediately. Regional guidelines sometimes vary from the national guidelines – some are more and some are less strict
Screening of patients with a record of foreign - hospitalization within a defined period Length of period	Other than the Nordic countries 1 month	All countries 12 month	All countries 6 months	Other than the Nordic countries and Holland 6 months	Other than the Nordic countries 6 months
Number of sets of specimens	One	At least two sets; once a week during hospitalization.	Two sets of samples (1-4 hrs. interval)	Two recommended Most do 1	One
Specimens	Nostrils, throat, axillae, wounds if present	Nostrils, previous MRSA-colonisation sites, infection sites, skin around catheters and drainage exist sites, skin around umbilical cord in neonates. Skin lesions, urine (if catheter). Sometimes throat, perineum or axilla.	Nostrils, throat, perineum, wounds, skin openings around catheters or drains, excema or other skin lesions, urine (if catheter), sputum (if expectoration)	Nostrils, perineum, wound secretion, cicatrices or other dermal lesions, catheters, urine from catheter	Nostrils, perineum, wounds, skin openings around catheters or drains, excema or other skin lesions, urine (if catheter) and in some regional programs throat

	Denmark	**Finland**	**Iceland**	**Norway**	**Sweden**
Screening of contacts. Patient and health care workers	No national guideline, usually: Patient contacts of MRSA-positive in health care institutions, if precautions have not been applied. In outbreaks - HCW	All close contacts (patients) of a MRSA case in all health care institutions (including long term facilities) regardless if precautions have been applied. HCW are screened only on special indications (see below).	HCW and patient contacts of MRSA positive in health institutions if precautions have not been applied.	HCW and patient contacts of MRSA positive in health institutions if precautions have not been applied	Patient contacts of MRSA positive in health care institutions, if precautions have not been applied HCW with skin lesions In an uncontrolled outbreak HCW may be screened at a second stage
Screening of health care workers who have worked or been hospitalized in foreign countries	Other than the Nordic Countries	All countries	All countries	Other than the Nordic Countries and NL	Other than the Nordic countries
Period since risk	Last 1 month	Last 12 months	Last 6 months	Last 6 months	Last 6 months
Restrictions of work for health care workers who are suspected or proven to be a MRSA carrier	Allowed to work 2 days after institution of eradication treatment.	Restrictions to work in patient care usually needed only on certain risk wards or if the HCW is a long term carrier with colonized skin lesions.	Not allowed to work until at least one neg. test	Not allowed to work until neg. test	Personel with unknown carrierstatus while waiting for test results: Unless skin lesions ,HCW are allowed to work while waiting for test results. HCW postive for MRSA: – HCW is asked to avoid direct patient contact while positive for MRSA; for longterm carriers an individual plan is made together with an ID specialist and/or IC experts
Number of specimen sets used for screening	One	Based on consultation with IC team.	One	Two recommended most do one	One
Localization of specimens	Nostrils, throat or perineum, wounds and skin lesions	Nostrils, wounds and skin lesions.	Nostrils, wounds, eczema or other skin lesions	Nostrils, Eczema	Nostrils, perineum and skin lesions. In some regional programs throat

	Denmark	**Finland**	**Iceland**	**Norway**	**Sweden**
General guidelines for antibiotic therapy (all infections)	Regional (hospitals & primary health care)	Regional (mainly hospitals). Some national guidelines (GCP) exist.	Regional (mainly hospitals). Official guidelines exists for GCP.	General for hospitals, general for community medicine	Regional
Guidelines for treatment of MRSA		National and regional		National and Regional	Regional
Infection	No official guidelines, treatment based on antimicrobial susceptibility.	Same criteria as for MSSA infections, but based on antimicrobial susceptibility. Empiric therapy for severe MRSA infections is vancomycin.	No official guidelines. Treatment based on antimicrobial susceptibility	Vancomycin (systemic)	Same criteria as for MSSA infections, but based on antimicrobial susceptibility. Vancomycin is the empiric therapy for severe MRSA infections.
colonization	Mupirocin nasal + klorhexidin body wash	Topical treatment mainly for nose colonisation (mupirocin) Systemic antimicrobial treatment based on IC consultation.	Included in the National MRSA guidelines: Mupirocin in vaselin (Nasal) + Chlorhexidin wash + Chlorhexidin powder (for skin folds) ± mupirocin in polyethylenglycol (for skin) S± ystemic treatment, as appropriate according to the clinical circumstances in each case (detailed instructions in the guidelines).	Mupirocin nasal + klorhexidin body wash	Mupirocin nasal + klorhexidin body wash