MRSA Infection Control in a Low-Endemic Area

Prof. Bjørg Marit Andersen, Olso University, Norway

A Webber Training Teleclass

MRSA- infection control in a low-endemic area

Epidemiology
MRSA screening
Isolation
Sanitation/decolonization
Follow-up

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Hosted by Martin Kiernan
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Methicillin-resistant *Staphylococcus aureus*- MRSA

- *S aureus* is the most common bacteria causing serious diseases in the community
- MRSA is *S aureus* resistant to most good antibiotics like
  - Penicillins – (beta - lactam antibiotics),
  - Cephalosporins,
  - Carbapenems (imipenem/meropenem)
  - and other good antibiotics
- MRSA have special *mecA* genes and a few have *mecC*

MRSA is spread by

- **Contact**
- **Air (30%)**
- **Environment**
  - **80% of rooms of MRSA carriers** (French et al 2004)
- **Animals**

"Stick the other end of this in your mouth and say 'Ahh.'"

Airborne infections- more than we believe - 30% of air samples may be positive!

MRSA is spread by air from MRSA positive cases

1. **After 1 day the environment is contaminated –ca 80% of the area in rooms** French et al JHI 2004 *and others-*
2. **MRSA – aerial dispersal - all over the room – 30% of air samples**
3. **Room-mates are at risk for being infected in 10-45%**

Gehanno et al JHI 2009; 71:256-262, *and others*

The skin flora is rich – and may contain MRSA in carriers

Reichel et al. JHI 2011; 78: 5-10

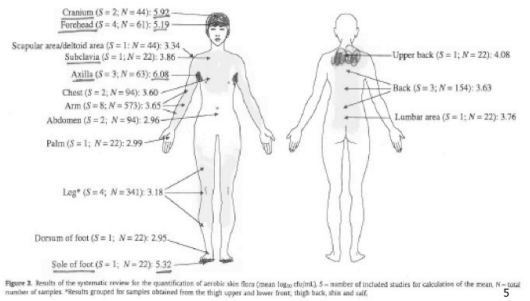

Figure 2. Results of the systematic review for the quantification of aerobic skin flora (mean $\log_{10}$ cfu/mL). S – number of included studies for calculation of the mean, N – total number of samples. *Results grouped for samples obtained from the thigh: upper and lower front, thigh back, shin and calf.

Skin - borne microbes –also MRSA- may be liberated in the air during movement

Tammelin et al. J Hosp Infect 2000; 44: 119-126

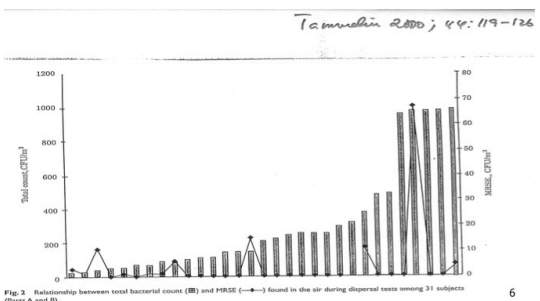

Fig. 2 Relationship between total bacterial count (■) and MRSE (—•—) found in the air during dispersal tests among 31 subjects (Parts A and B).

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MRSA inside and outside healthcare

HA-MRSA = Healthcare associated	CA-MRSA = Community associated
▪ More resistant	▪ Less resistant
▪ Less virulent	▪ Can be more virulent-PVL
▪ Other SCC mec –'s	▪ SCC mec- IV
▪ Contact with healthcare	▪ No contact with healthcare

Today: Often a mixture of HA and CA inside and outside healthcare—HACO (healthcare associated community onset)------ 7

MRSA may be found in chronic eczema and in abscesses

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Impetigo and other skin diseases

Impetigo with attack rate 75%
if HCW is the source of MRSA

9

Postoperative wound infections with MRSA are causing extra costs, extra days in hospital care and a higher risk of death

Anderson et al. ICAAC 2008,K-597

- **1998-2003- 7 hospitals, retrospective study from USA**

Results from 90 days postoperative period	Patients with postop wound infect		
	MRSA	Not-MRSA	p-value
	N=150	N=231	
Days in hospital-median	21	5	p<0,0001
Transferred to other healthcare	34,3 %	21,5 %	p<0,0005
Re-admitted	77,5 %	10,2 %	p<0,0001
Death	16,70 %	3,0 %	p<0,0001

- **Extra cost per MRSA patient: 50 000 USD**

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Death from MRSA in high-endemic areas- like USA

- **MRSA can cause a serious disease – attack rate –25-30%**
- **MRSA is *endemic* in USA; ca 2 mill infections/year**
- **19 000 dies from MRSA in USA every year** (Klevens 2010)
  - **6,1 per 100 000 of the population in USA**
  - **More Americans die every year from MRSA than from HIV/AIDS and influenza H1N1!**
  - **and from group A streptococci and pneumonia and meningitis, together!**
- **A reduction in deaths from MRSA is shown in 2011,**
  - **estimated to 11 300 cases; 3,4/100 000** (Dantes et al 2013)

Klevens et al. *Publ Health Rep* 2007;122:160-166. CDC March 12, 2010, Graham et al. 2006, Dantes et al JAMA 2013

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How have we fallen so far behind in the battle to beat MRSA? – in UK? Telegraph 22.1.2007

"A new strain of *lung-eating* MRSA is spreading rapidly through our hospitals, augmenting the 8 000-plus cases in the UK last year"

Kill 5 000/year in UK

As a new and deadly strain of the superbug is identified, Victoria Lambert examines Britain's track record

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MRSA Epidemiology

Global infections with

- ***Staphylococcus aureus:*** **2 billions**
- **MRSA: >5-53 millions**

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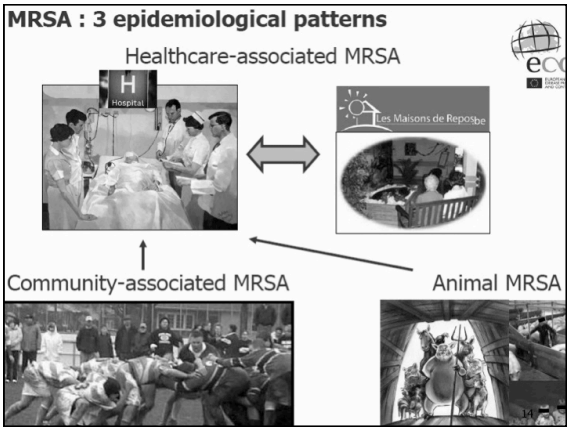
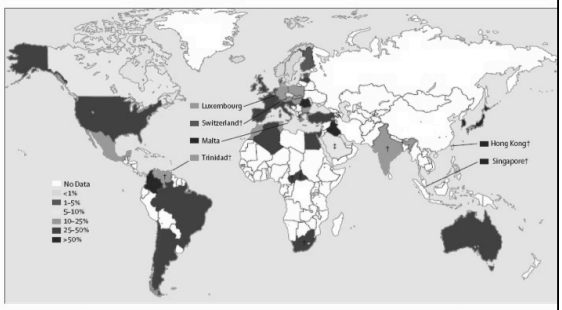
MRSA : 3 epidemiological patterns



MRSA was a global health threat -2006



Grundmann H et al. Emergence and resurgence of meticillin-resistant Staphylococcus aureus as a public-health threat. Lancet. 2006 Sep 2;368(9538):874-85

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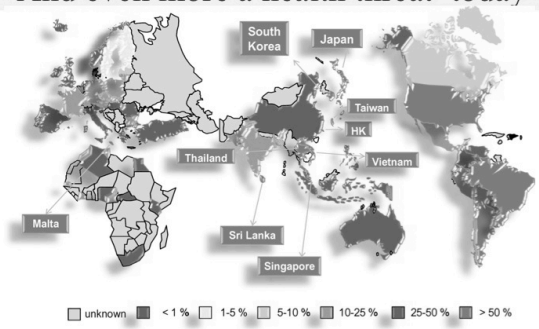
And even more a health threat today



Worldwide prevalence of hospital-acquired meticillin-resistant Staphylococcus aureus

HK, Hong Kong. Stefani et al. Int J Antimicr Agents 2012

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MRSA in Europe 2013

This report has been generated from data submitted to TESSy, The European Surveillance System on 2013-08-29. Page: 1 of 1. The report reflects the state of submissions in TESSy as of 2013-08-29 at 16:00

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The French battle against MRSA started in 2001

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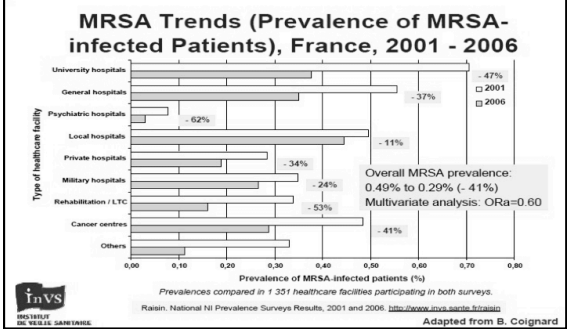
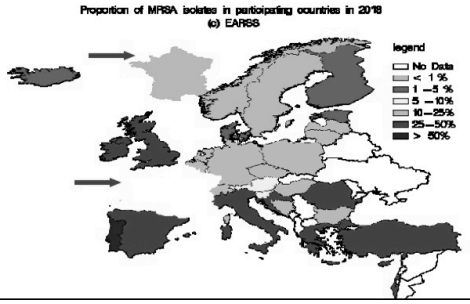
France reduced their MRSA infections from 2001 to 2006!



Adapted from B. Coignard

France is now trying to become MRSA-green like Norway in 2018!



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While superbug-panicked britons are driven abroad for treatment in Scandinavia or Holland? 2005

Record 50,000 patients buy treatment overseas amid fears of NHS superbugs

BRITONS GO ABROAD TO BEAT MRSA

FEARS of lethal hospital infections such as MRSA are driving a record 50,000 patients a year abroad for treatment.

Despite billions being poured into the Health Service, patients are now spending £163million a

By Jenny Hope
Medical Correspondent

among the most popular destinations for medical tourists.

Dentistry tops the list of treatments, followed by cosmetic surgery, hip replacements, IVF and heart treatment.

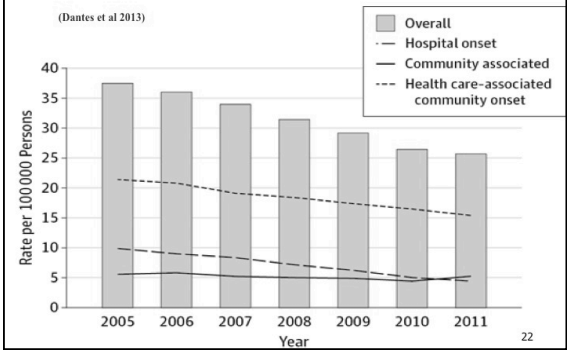
The figures come from a survey of medical tourism providers by the

lengthening waiting lists were partly behind the trend, as well as the fact that private surgery was cheaper abroad.

"We are getting reports that worries about hospital infections such as MRSA are driving people abroad," said Mr Pollard.

"There seems to be a perception that NHS hospitals are not a safe environment." He said he was contacted by

USA:National Estimated Incidence Rates of Invasive MRSA Infections, Stratified by Epidemiologic Category. MRSA isolated from a normally sterile source



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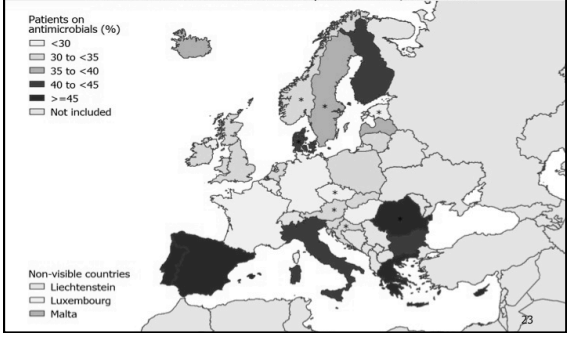
The MRSA-problem is partly associated with overuse of antibiotics

Prevalence of antibiotic use in Europe 2011-2012, ECDC2013



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There is a global increase of MRSA-reservoirs in Long-term care facilities

- Ireland 2000: 8.6%
- France 2001: 21%
- Germany 2002: 1.1%
- Slovenia 2005: 9.3%
- Iowa/US 2005: 1.3%
- England 2007: 22%
- Baltimore 2008: 28%
- Italy 2009: 19%
- Spain 2008: 16.8%
- Norway 2009: 0,2% (63/38 000)

- **Special problems are:** decubitus ulcers, catheters and skin infections – and multiple - site colonization
- **The epidemiological impact** of MRSA – is related to hospital admissions and severe infections

- Manzur &Guidol Clin Microbiol Infect 2009; 15 (suppl 7): 26-30, Bradly S, Ann Intern Med 1991;115:417-422, Monaco et al, JHI 2009, O'Sullivan &Keane JHI 2000; 45: 322-329, Furuno et a. AJIC 2008; 36: 468-471.

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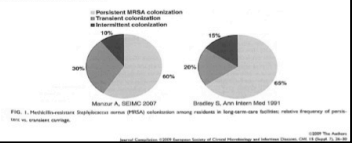
Persistent MRSA predominates in nursing homes - without infection control

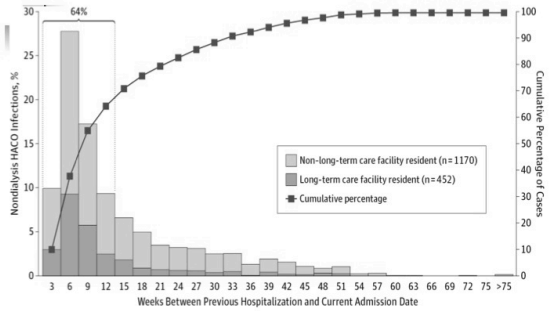
Manzur & Gudiol Clin Microbiol Infect 2009; 15:26-30

- More than half (60-65%) have persistent colonization
- Nearly 1/3 colonized develop infection
- Long-lasting
- Can transmit MRSA to others



"Among cases with prior hospitalization, nearly two-thirds developed their MRSA infections within 3 months of hospital discharge"

Healthcare-associated community-onset (HACO) infections



Dantes et al.: National Burden of Invasive Methicillin-Resistant Staphylococcus aureus Infections, United States, 2011 JAMA sept 16 2013

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Health care personnel is another important source of MRSA infections!

Albrich & Harbarth Lancet inf dis 2008; 8: 289-301

Geographic regions			
Northern Europe (including the Netherlands)	101	1910	5·3%
Western Europe	291	10 851	2·7%
Southern Europe	151	3121	4·8%
Eastern Europe	8	511	1·6%
North America	328	7886	4·2%
South America	13	201	6·5%
Africa	105	678	15·5%
Middle east	136	2233	6·1%
South and central Asia	17	513	3·3%
East Asia	132	1005	13·1%
Australia, New Zealand	196	2017	9·7%
Total	1545	33 318	4·6%

ICU=intensive care unit.

Table 2: Prevalence of MRSA in health-care workers

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MRSA prevalence and spread from health-care workers

Albrich og Harbarth Lancet Inf Dis 2008;8: 289-301

- **33 300 HCW from 37 l-lands**
- **4,5% were MRSA carriers**
  - **5,1% with clinical infection**

Risk factors

- Chronic skin disease
- Low hygiene
- Work in countries with endemic MRSA

Outbreaks – associated with transient and persistent carrier state among HCW

- **Spread of infection** from HCW to the patients: 93% out of 63 studies
- **MRSA-decolonisation** in 510 HCW: 88% completed negative result
- **Extra nasal colonization** – associated with persistent carrier state

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Epidemiology in the "green countries"

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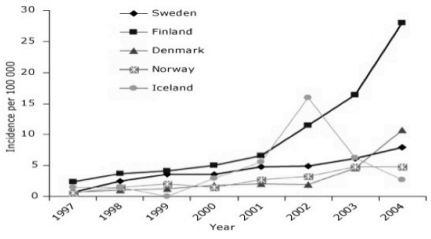
MRSA infections are increasing in the Nordic countries!

Robert Skov[1] on behalf of the SSAC MRSA Working Party:
Eurosurveillance, Volume 10, Issue 31, 04 August 2005



Incidence of MRSA reported to the national surveillance institutes in the Nordic countries from 1997-2004. Denmark, Finland, Iceland and Sweden reported infections and colonisations; Norway only reported infections

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The observed increase of MRSA----

- "-has occurred despite --**no changes in the strict infection control policies" in the Nordic countries.**

Robert Skov[1] on behalf of the SSAC MRSA Working Party: Eurosurveillance, Volume 10, Issue 31, 04 August 2005

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"Major changes in MRSA epidemiology in the Nordic countries" (Skov et al 2005)

1. **Most MRSA patients do not have a connection to foreign healthcare facilities.**
2. **Onset of MRSA infections is no longer confined to hospitals.**
3. **A significant proportion is community onset–**
4. **The increase of MRSA in the community in otherwise healthy people has led to increased introduction of MRSA to hospitals, which has resulted in an increasing number of intra-hospital transmissions or outbreaks.**
5. **Outbreaks of MRSA have been reported from nursing homes--**

Robert Skov[1] on behalf of the SSAC MRSA Working Party: Eurosurveillance, Volume 10, Issue 31, 04 August 2005

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Skov et al: " observed that the MRSA increase---"

- **"- seems to be more limited in areas**
  - **where strict MRSA infection control policies have been upheld,**
  - **and in areas where there is vigorous eradication of MRSA carriage in community-acquired cases.**
- **This indicates that containment may be possible."**

Robert Skov[1] on behalf of the SSAC MRSA Working Party: Eurosurveillance, Volume 10, Issue 31, 04 August 2005

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But, what did really happen in the Nordic countries after 2003?

- **There were new guidelines – not so strict as earlier!**
- Changed infection control strategy outside hospitals!
  - Lack of infection control routines in nursing homes
  - No infection control in primary health care
- Increased prevalence of MRSA in health-care workers
- More vacation - and "tourist medicine" – from abroad

- Andersen BM et al. *J Hosp Infect* 2006;64: Suppl 1: 69. Abstract
- Andersen BM, Syversen G, Rasch M.. MRSA is increasing in Oslo, Norway- caused by changed infection control strategy. *J Infection* 2007: 55: 531-538

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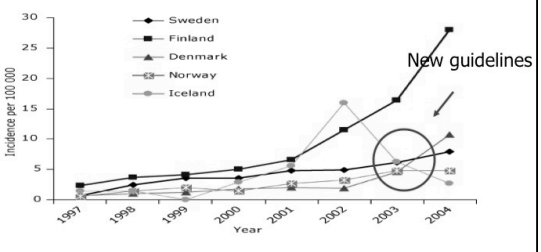
New MRSA guidelines - reduced the infection control in the Nordic countries –from 2003!

Andersen BM et al. *J Infection* 2007: 55: 531-538



Incidence of MRSA reported to the national surveillance institutes in the Nordic countries from 1997-2004. Denmark, Finland, Iceland and Sweden reported infections and colonisations; Norway only reported infections

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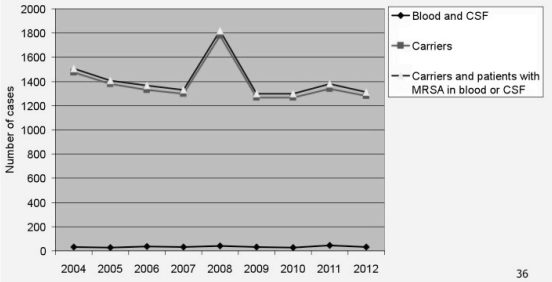
Finland 2004-2012

Only MRSA in blood and CSF is registered, in addition to MRSA carriers. Screening is usually not done in exposed HCW

MRSA registered in Finland 2004-2012



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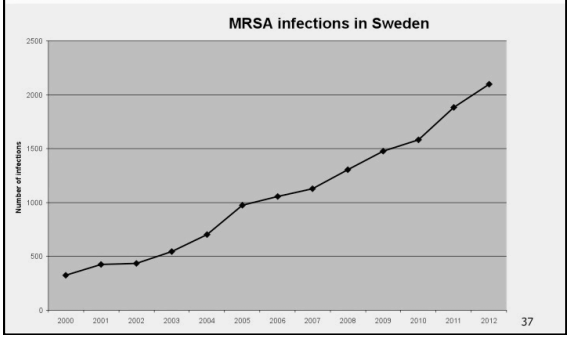
Sweden 2000-2012

MRSA infection in 21,9/100 000 inhabitants in 2012



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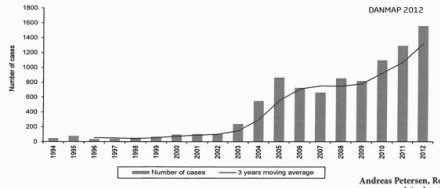
Denmark 1994-2012

-including colonized and infected; 27,9/100 000 in 2012

- **"This is the highest number of cases observed in over 25 years!"**
- **An increase of 20% since 2011!**
- **Among 1556 new cases, 29 (2%) were HCW**

Figure 8.7. Number of MRSA cases, with a three years moving average, Denmark



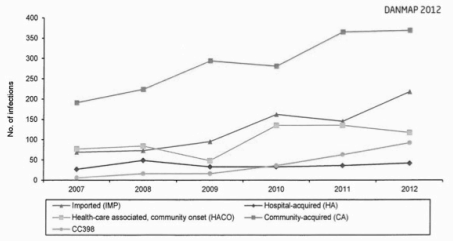
Andreas Petersen, Robert L. Skov and Anders Rhod Larsen

DANMAP 2012

Denmark 2007-2012: Infections

Among the community-acquired MRSA, more than 50% had known exposure.
The animal-associated CC398 is increasing and is 100% tetracycline resistant.
MecC – instead of *mecA* is found in 24 cases in Denmark in 2012

Figure 8.8. Number of MRSA infections according to epidemiological classification, Denmark



Andreas Petersen, Robert L. Skov and Anders Rhod Larsen

DANMAP 2012

MRSA belonging to the clonal complex CC398 has been closely connected to livestock animals, especially pigs, and increasingly affects people in direct contact with pigs, in Denmark

The prevalence of MRSA in pigs at slaughter has increased to 77%!

Table 8.7. The ten most prevalent *spa* types demonstrated in MRSA cases, Denmark DANMAP 2012

spa type	CC group[a]	No. of cases	No. causing infections (%)
t034	CC398	185	75 (41)
t002	CC5	141	88 (62)
t008	CC8	130	73 (56)
t019	CC30	97	74 (76)
t032	CC22	89	45 (51)
t304	CC8	74	23 (31)
t044	CC80	45	34 (76)
t127	CC1	42	19 (45)
t024	CC8	42	20 (48)
t223	CC22	37	13 (35)

a) CC = Clonal complex

Andreas Petersen, Robert L. Skov and Anders Rhod Larsen

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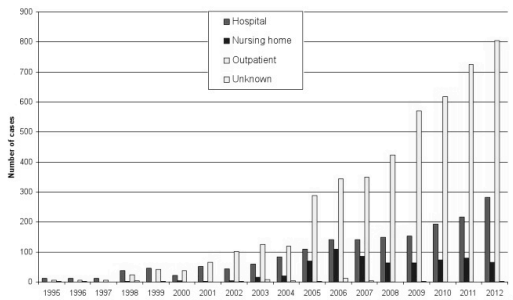
MRSA increases rapidly in Norway

Data from: Norwegian Institute of Health Care 2013

Development of MRSA in Norway (carriers and infected)



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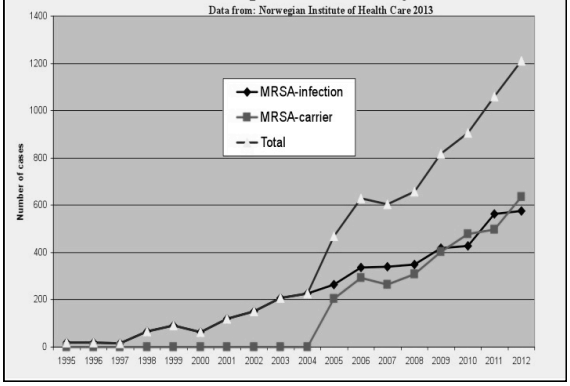
MRSA development in Norway 1995-2012

Data from: Norwegian Institute of Health Care 2013



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Norway 2006-2012:

Still a high number is infected abroad

Total, including infections and and colonized (NORM 2012)

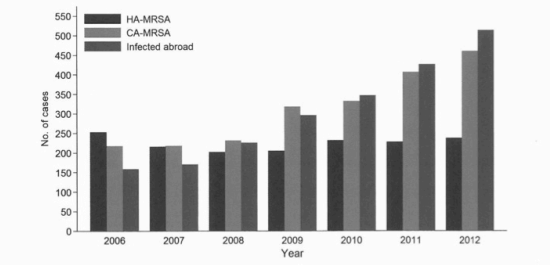

FIGURE 51. Reported cases of MRSA infections and colonisations in Norway 2006-2012, by health-care associated, community associated and imported cases.

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Norway 2012

Data from: Norwegian Institute of Health Care 2013 and NORM 2012

- **Humans**
  - **21,1/100 000 inhabitants are infected !**
  - **MRSA cases: 50% are infected, 50% are carriers**
  - **Livestock/animal-associated MRSA has now been detected in five human cases in 2012**
  - **There is still only two cases with *mecC* instead of *mecA*.**
- **Animals**
  - **MRSA was not found in bovine mastitis**
  - **MRSA was in only one sample (CC398) from swine (0,6%)**
  - **But a slaughterhouse was contaminated with CC398 !**

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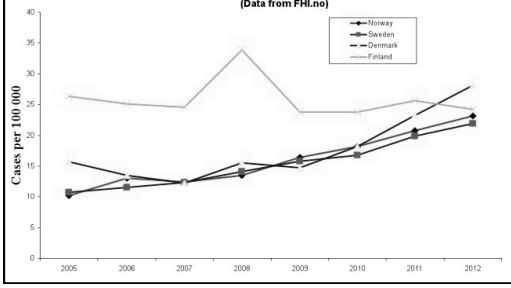
The incidence of MRSA is still increasing in Sweden, Denmark and Norway

MRSA cases per 100 000 inhabitants in Nordic countries

(Data from FHI.no)



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MRSA prevalence increases among HCW in Norway

MRSA-positive HCW may spread infections by hands, nose, uniforms, equipments, environment, air etc.

Among 3620 new cases of MRSA in Norway (2006-2010)

- 7% of all cases were HCW !
- 20% of cases in nursing homes (71/356) were HCW !

▪Elstrøm et al 2012, FHI

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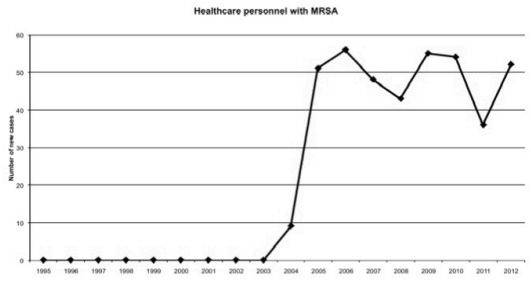
MRSA among HCW in Norway

Incidence ca 20/100 000 HCW-
all personnel working in healthcare included

Healthcare personnel with MRSA



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The population, including HCW, are protected against MRSA infection **by Law in Norway**

- **MRSA is hazardous to the public**
- **MRSA should be <1% of *S aureus* strains**
  - **The population should not be exposed unnecessary to MRSA**
    - Infection control act/regulation in Norway
  - **Health care workers should not be exposed unnecessary to MRSA**
    - Work environment act/regulation in Norway

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MRSA screening

Nose
Throat
Perineum
Hands/wrists
Wounds, catheters, eczema etc.

Andersen BM et al *J Infection* 2007: 55: 531-538
Andersen BM et al. Rapid MRSA test in exposed persons- *J Infection* 2010; 60: 293-299.
Andersen BM et al. Handbook in hygiene and infection control for hospitals 2008; 422-450
Andersen BM. Handbook in hygiene and infection control for long-term institutions 2013; 255-279

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MRSA screening

- Samples for growth in cultures
- Parallel samples for rapid PCR test –72 minutes
  - GeneXpert MRSA Polymerase Chain Reaction (PCR) method (Cepheid, USA)

MRSA rapid test 72 min "bedside"-test

Andersen BM et al. *J Infection* 2010; 60: 293-299.

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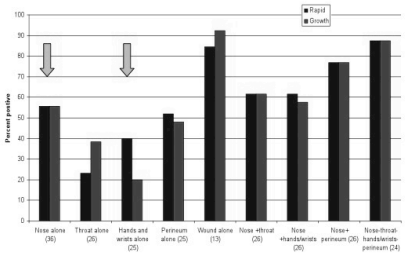
Body site colonization may vary-- from time to time

Distribution of MRSA between anatomical sites. Number in parenthesis are persons tested



Andersen BM et al. *J Infection* **2010; 60: 293-299. Rapid MRSA test in exposed persons: Costs and savings in hospitals.**

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Correspondence between rapid test and growth test is 92.8% in MRSA cases from Norway (prevalence 0.01%)

- **Sensitivity**, specificity, positive and **negative predictive values** for
  - **Xpert MRSA**: **87%,** 99.6%, 68.5%, **99.9 %**
  - **Growth**: **76%,** 100%, 100%, **99.8%**
    - (prevalence in Norway: 0.01%)
- **Detection rate of MRSA in MRSA- cases was lower than 50% in samples from**

	Xpert	growth
nose:	44.6%	40%,
throat	38.2%	45.5%,
hands/wrists:	30.8%	11.5%
perineum:	44%	38%
combination of 4 sites:	87.5%	87.5%

Andersen BM et al. *J Infection* **2010; 60: 293-299.**

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Costs and savings of rapid tests

In a low-endemic country like Norway:

- **The rapid test saved at least**
  - **€ 925 per personnel and**
  - **€ 550 per patient that were MRSA negative.**
- **The cost per test for the Xpert and growth test was €50 and €6.25, respectively**

Andersen BM et al. *J Infection* **2010; 60: 293-299.**

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MRSA contamination and density

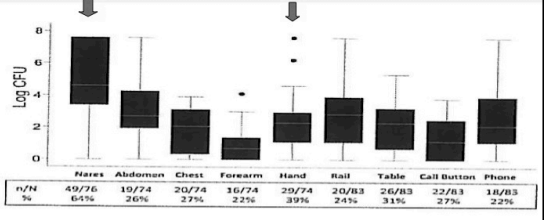

FIGURE 1. Prevalence of contamination of commonly examined skin sites and environmental sites with methicillin-resistant *Staphylococcus aureus* (MRSA) and the density of colonization. Data at

Chang et al. *ICHE* **2010; 31: 607,**

Also studied by: Yang et al. *Clin Microbio Infect* **2010;16:425-431**

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Therefore, screen from several anatomic sites!!

MRSA Screening Saves Lives –
MRSA Epidemic Spreading Globally

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Exposed or earlier MRSA??

Table I MRSA screening – Ullevål Standard

Patients and personnel (HCW) are screened with the same procedure.

No examination or treatment is delayed because of suspected MRSA!

Ask the patient/personnel	Answer	What to do
1:Import? Has the patient/person been treated*/worked in health care abroad - last 12 months?	Yes	Direct in isolate/single room and screen for MRSA (policlinic or admitted). Personal protection: mask, gloves, gown
2: Earlier been MRSA positive - ever?	Yes	As above
3: Exposed for MRSA –last 12 months?	Yes	As above

*Examined/treated at hospital, as outpatient or in primary care abroad.

Andersen BM et al *J Infection* 2007: 55: 531-538, Andersen BM et al. Rapid MRSA test in exposed persons- *J Infection* 2010; 60: 293-299. Handbook in hygiene and infection control for hospitals 2008; 422-450, Handbook in hygiene and infection control for long-term institutions 2013; 255-279.

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MRSA Screening

MRSA screening

If the patients answer yes on question 1, 2, or 3
Prefer screening before admittance. If necessary, isolate and screen in hospital. Use personal protective equipment (PPE) when screening of suspected MRSA.

Personnel and outbreak of MRSA
Personnel are screened like patients during outbreak in the hospital.
The doctor in charge of the actual department is the internal coordinator.
Make a list of exposed persons (directly exposed).
Inform the laboratory of number persons that may be tested.
Inform other departments that may have been in contact with the patient.

Important
Personnel who has been in unprotected contact with MRSA-patients or their equipment/bed are screened. When waiting for answer (3-5 days), exposed personnel are using mask, gloves and gown when in contact with patients.

Test equipment
Sterile swab, transport medium, sterile water/ saline.
The swab is moistened before every sampling.

Sampling sites
Nostrils – inside, outermost part
Throat – tonsils and above uvula
Hands and wrists
Perineum
Eczema, wound, cicatrie or other dermal lesions, catheters. and drainages
One test set: nostrils, throat, hands/wrists, perineum, etc

Andersen BM et al *J Infection* 2007: 55: 531-538,
Andersen BM et al. Rapid MRSA test in exposed persons- *J Infection* 2010; 60: 293-299.

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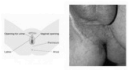
Screening procedure

Screening procedure
Nostrils– both
Moisten the swab
Roll the swab three times around in each nostril's outer part

Throat
Moisten the swab
Swab tonsil region and above uvula x 3

Hands/wrists – both
Moisten the swab
Swab both hands, between fingers, fingertips and wrists



Perineum
Moisten the swab
Swab between urethra and rectum x 3
Personnel take own sample

Wound/eczema/cicatrics
Moisten the swab and swab over actual sites

All types of catheters drainages
Moisten the swab and swab around actual sites and take secret samples

Andersen BM et al *J Infection* 2007: 55: 531-538,
Andersen BM et al. Rapid MRSA test in exposed persons- *J Infection* 2010; 60: 293-299.

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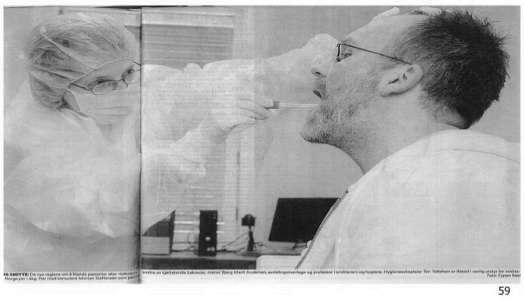
Testing the patient – use personal protective equipment! - PPP



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Information to the laboratory-doctor in charge

Laboratory information
A single schema per test set (per patient/person).
Write name, date, sampling site on the schema and on samples.
Mark the schema MRSA (import etc).

The doctor in charge at the actual department is the subscriber on the laboratory schema. Infection control personnel are informed directly when positive results.

Sample set
Schema and samples bunted together for each person.
Direct delivery to the laboratory.

Andersen BM et al *J Infection* 2007: 55: 531-538,
Andersen BM et al. Rapid MRSA test in exposed persons- *J Infection* 2010; 60: 293-299.

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Results of screening – what to do

Screening result

Negative test set

1. No MRSA, treated as ordinary patient/personnel.
2. If earlier MRSA positive or the sampling is performed during treatment or sanitation: more follow-up tests/isolation will be done

Positive test

1. Further isolation and start disinfection of the patient and flag out the journal. Inform all MRSA contacts not having used PPE -to be screened .
2. After 3 negative test sets (3-7 days apart) of the MRSA patient, starting 7 days after treatment: "inactive MRSA", - further follow-up.
3. Further follow-up for 12 months (3, 6, 9, 12 months) - all consecutive test sets (15) are negative: probably MRSA negative

Andersen BM et al *J Infection* 2007: 55: 531-538,

Andersen BM et al. Rapid MRSA test in exposed persons- *J Infection* 2010; 60: 293-299.

61

Isolation and the use of personal protective equipment

Andersen BM et al *J Infection* 2007: 55: 531-538

Andersen BM et al. Rapid MRSA test in exposed persons- *J Infection* 2010; 60: 293-299.

Andersen BM et al. Handbook in hygiene and infection control for hospitals 2008; 422-450

Andersen BM. Handbook in hygiene and infection control for long-term institutions 2013; 255-279

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Isolation – is the specific infection control problem

Because- patients need contact and treatment, shortage of isolates, shortage of nurses, knowledge and personal protective equipment. M Thorstad et al. MRSA: A Challenge to Norwegian Nursing Home Personnel. *Interdiscipl Perspect Infect Disease,* 2011 (2011), Article ID 197683

However, patients in short-term isolation in hospitals had a positive attitude towards isolation. Wassenberg *J Hosp Infect* 2010;75: 124-127

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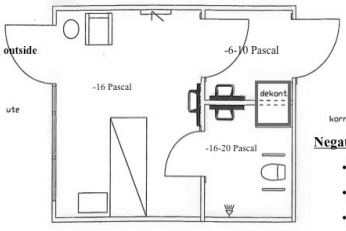
Isolate and use PPE - when needed

-negative air pressure for airborne infections



Negative pressure isolate: 29m²

- **Sluice**
- **Patient room**
- **Bathroom with through-put decontamination**

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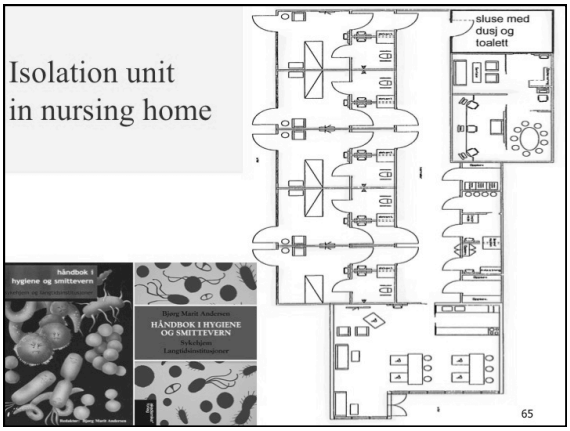
Isolation unit in nursing home



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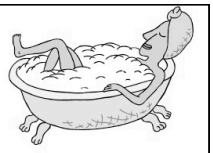
PPE: Gown, gloves, cap and mask

Gloves with long cuff

-adjusted to the suspected microbe/ infection

Learn/train to dress and undress PPE! --

66



Sanitation/ decolonization

Andersen BM et al *J Infection* 2007: 55: 531-538.
Andersen BM et al. Handbook in hygiene and infection control for hospitals 2008; 422-450
Handbook in hygiene and infection control for long-term institutions 2013; 255-279

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Sanitation of MRSA- positive cases
- all cases should be offered decolonization !

Table II Sanitation of MRSA - positive cases

- Screen all relevant anatomical sites (nose, throat, perineum, hands, cutan lesions, secretes etc) with one or more test sets for MRSA before sanitation to confirm the finding and for mapping out positive sites
- Antibiotic sensitivity schema for actual MRSA isolate is present
- Inform patients and relatives
- Start all sanitation procedures at once and as early as possible, with or without addition of antibacterial treatment
- Decontaminate environment each day- to reduce recontamination from environment
- Follow-up with control test sets, starting 7 days after finished sanitation/treatment (see screening)

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Regular sanitation

Regular sanitation: 10 (14) days

1) Decontaminate hole body and hair x 1/day - 10 days

- Disinfection agents: Hibiscrub or Stellisept
- Not to be used if dermatological side effects- and not inside ear!
- Hole body washing two times – 2 minutes each time- with thorough cleaning with water between and after each wash. Hair, perineum, between toes, umbilicus is important, use Q-tips in narrow sites
- Disinfect the outer site of the bottle after use
- Rinse the walls of the cabinet with warm water. Place the feet on a clean towel or a disinfected area,- dry with a clean towel. Both towels are treated as contaminated
- Change to clean personal- and bed clothes after each hole body disinfection
- Textiles (personal, bed, towels etc) should be washed at 65-85ºC

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Disinfection of nose and throat

2. Disinfect the nose with Bactroban nasal (mupirocin) x 3/day in 10 days

- Disinfect hands and the outside of the tube with alcoholic hand disinfection
- Use a Q-tip or a single clove to treat the nasal cavity with Bactroban

3. Disinfect the mouth and throat x 3/day in 10 days

- Use chlorhexidine mouth rinse or other mouth rinses (hydrogen peroxide mouth rinse etc).
- Disinfect hands and outside of the bottle
- New cup for each rinse
- Rinse the mouth thoroughly, place the head backwards while gurgling the rinsing water. Do no swallow.

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Toothbrushing, combs, glasses etc

4). Toothbrushing and cleaning of tooth prothesis, etc x 2 in 10 day:

- Disinfect hands and outside of the tooth pasta – (or tooth pasta in small single cups
- New cup or single use cup for mouth care each time
- Rinse the toothbrush in water at > 65ºC for 1-2 minutes or in alcoholic chlorhexidine (70% alcohol,5 mg/ml chlorhexidine) followed by rinse in water afterwards etc.

5) Disinfect all personal equipment x 2/day in 10 days

- Combs, glasses, eye lenses, and avoid wearing watch, jewellery, makeup, etc.
- Use skin cream in small single cup portions to avoid recontamination
- Hand soap may be contaminated

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Hand hygiene, environmental hygiene, change of beds and own textiles

6) Handhygiene with alcoholic based disinfectants with glycerol

- Alcoholic chlorhexidine (70% alcohol, 5 mg/ml chlorhexidine with glycerol) or other alcoholic based disinfectants with glycerol: 10-20 times/day, or use hand tissues with disinfectants

7) Environmental disinfection (70% alcohol etc) x 1/day in 10 days

- Surfaces, bed railings, door handles, knobs etc

8) Remember: change of bed and personal textiles each time after sanitation!

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Decolonize MRSA positive carriers

Before birth and before elective operations

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Be care of possible soap-inactivation when using Hibiscrub

- Hibiscrub = Chlorhexidine gluconate 40 mg/ml
  - Use no soaps in addition – may inactivate the disinfectant!
  - Use no anion containing lotions at the same time

For body lotion- use Sterisol or DAX bodylotion

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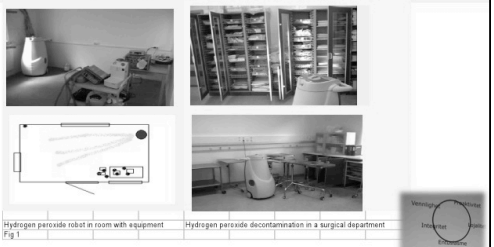
Gas disinfection – 5% hydrogen peroxide dry mist



Hydrogen peroxide robot in room with equipment | Hydrogen peroxide decontamination in a surgical department

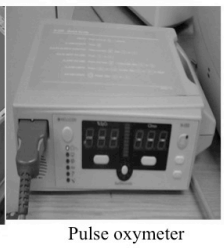
Fig 1

References

Andersen BM et al. *J Hosp Infect* 2006; 62:149-155
Ray A et al. *Infect Control Hosp Epidemiol* 2010; 31: 1236-124161.
Andersen BM et al.. *Microb Biochem Techn* 2012; **4**:57-62.

Disinfect medical equipments - internal parts –dry hydrogen peroxide gas

Respirator



Pulse oxymeter

CPAP

Andersen BM et al. *J Hosp Infect* 2006; 62:149-155
Andersen BM et al. *Microb Biochem Techn* 2012; **4**:57-62.

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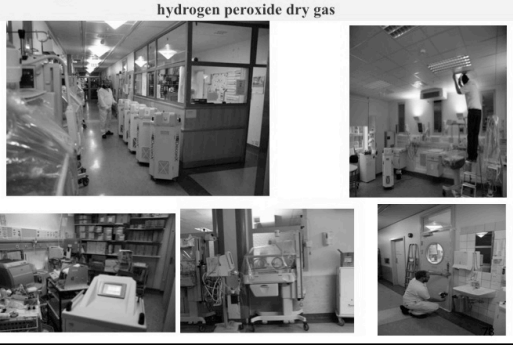
Disinfection in clinical departments, ambulances and operation theatres- after MRSA outbreak

hydrogen peroxide dry gas



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Follow-up

Andersen BM et al *J Infection* 2007: 55: 531-538.

Andersen BM et al. Handbook in hygiene and infection control for hospitals 2008; 422-450

Handbook in hygiene and infection control for long-term institutions 2013; 255-279

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Follow-up after sanitation

- 7-14 days after completed sanitation
  - Screening (nose, throat, perineum, hands, other) once a week in one month
  - If MRSA negative samples: screening after 3, 6, 9 and 12 months. Each time three sample sets taken with 1-2 days interface.

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The effect of strict infection control

Nursing home A and B – with the same MRSA strain

A STRICT

- **January 2004 – an index case from hospital in Oslo to a nursing home**
- ***National guideline used***
- **November 2004: ca 20 new MRSA cases; 7 HCW**
- ***Ullevål-standard from medio November 2004***
- **0 more cases**
- **all were negative after one year**

- **1 HCW Jan 2007 –in an hospital sample**
- Andersen et al. *J Infection* 2007
- van der Werff et al *Tidsskr Nor Legeforen* 2008

B NOT STRICT

- **Springtime 2004 – a few cases**
- ***National guideline used***
- **2005 even more cases**
- ***National guideline still used***
- **2006 summer – more than 60 cases, including personnel**
- **2006 autumn still ongoing outbreak**
- **2009 still a huge problem**
- ***National guideline still used***
- **This ended in closure of the health institution – and still problems in several nursing homes in and around Oslo**

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MRSA in the green countries - like Norway

- **Prevalence of MRSA is still low, but increasing**
- **According to the Norwegian infection control law, patients and healthcare workers (HCW) from healthcare abroad are screened for MRSA, and also when exposed to MRSA in Norway.**
- **MRSA carriage may lead to unemployment in Norwegian healthcare.**
- **Identification and sanitation is therefore important**

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Thank you, for your attention!

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31 October **TEN TIPS FOR INCORPORATING SCIENTIFIC QUALITY IMPROVEMENT INTO EVERYDAY WORK**
Dr. Carmen Lucia Pessoa da Silva, World Health Organisation, Geneva

06 November *(FREE - WHO Teleclass - Europe)*
ANTIMICROBIAL RESISTANCE ISSUES WORLDWIDE AND THE WHO APPROACH TO COMBAT IT
Dr. Carmen Lucia Pessoa da Silva, World Health Organisation, Geneva

07 November **OCCUPATIONAL INFECTION CONTROL IN CORRECTIONAL SETTINGS**
Robert Marton, Miami-Dade County, Florida

14 November **DENTAL UNIT WATER CONTAMINATION - HEALTH RISKS AND METHODS OF CONTROL**
Prof. Raghu Puttaiah, Managed Care Concepts, L.L.C.

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