ORIGINAL ARTICLE

A predicted outbreak in an overcrowded, administratively neglected and run-down haemodialysis unit as an offer of "New Public Management" in Norwegian hospitals

Bjørg Marit Andersen[1], Bente Seljordslia[1], Kjersti Hochlin[1], Mette Rasch[1], Gaute Syversen[2]

1. Department of Hospital Infections, Oslo University Hospital-Ullevål, Oslo, Norway. 2. Department of Medical Microbiology, Oslo University Hospital-Ullevål, Oslo, Norway

Correspondence: Bjørg Marit Andersen. Address: Department of Hospital Infections, Oslo University Hospital-Ullevål, Oslo, Norway. E-mail: UXBJND@ous-hf.no

Received: March 11, 2013 **Accepted:** April 20, 2013 **Online Published:** April 24, 2013
DOI: 10.5430/jha.v2n4p15 **URL:** http://dx.doi.org/10.5430/jha.v2n4p15

Abstract

Background: Scandinavian countries had a low rate of vancomycin- resistant enterococci (VRE) until 2007. Since 2007, there has been an alarming spread of VRE in Sweden and later on in Norway. From 2002 on, public hospitals in Norway were transferred from the County administration to a few regional state enterprises, drifted and organized according to the "New Public Management" (NPM), to save money. Four hospitals in Oslo, including Ullevål University Hospital, were, of the same reason, further merged into a 1500 beds Oslo University Hospital in 2009.

Methods: This study included the hospital management of infection control and attitudes to reports from routine inspections in a haemodialysis unit at Oslo University Hospital (OUS) - before and after an outbreak of VRE in 2011.

Results: Before the outbreak of VRE, repeated site inspections by infection control personnel revealed overcrowding, a poor hospital design, a low hygienic standard, and an imminent risk for hospital infection in a haemodialysis unit at OUS. Reports concerning deviation from proper infection control were sent to the hospital administration. Two project groups were set down consecutively within a year to solve the problems. They were both nearly immediately put on hold because of lack of economic resources. The Board of Health in the Counties of Oslo and Akershus (having the overall supervision of the health care in the Counties) was then notified by the infection control doctor. The outbreak of VRE was detected in May 2011 in this haemodialysis unit. It was promptly stopped after one month, by using a combination of several restrictive infection control methods. All VRE cases were negative after repeated negative samplings for a year. The outbreak resulted in a response from the hospital administration to the serious conditions in this unit. One and a half year later, an extended, refurbished new unit was ready for the patients.

Conclusion: A low hygienic standard in an overcrowded and run-down haemodialysis unit was neglected by an administrative organization lacking economic resources after following the ideas of NPM through many years. This situation finally led to an outbreak of VRE. An early and restrictive intensive intervention leads to a rapid termination of the outbreak.

Key words

Hospital administration, Hospital design, Overcrowding, Infection control, Outbreak of VRE, Risk factors, Haemodialysis unit, New public management

1 Introduction

Vancomycin-resistant enterococci (VRE) have increased in the United States and Europe during the last 10 years [1-3]. VRE affects debilitated, often elderly patients, especially during high colonization pressure and the use of anti-anaerobic antibiotics [1-6]. Enterococci are long-living, robust survivors for up to four years in the environment [7, 8].

In Scandinavia, the rate of VRE has been low. In Norway, a patient survey in 1998 demonstrated no VRE [9]. This was in contrast to a high prevalence of VRE among poultry farms [10, 11].

Since 2007, there has been an alarming spread of VRE in Swedish healthcare institutions [12]. In 2010 an outbreak of VRE started in the west of Norway with further increase in 2011 and 2012 [13-15]. In Oslo County, there were only five cases of VRE from 1998 to 2011. During springtime 2011, an outbreak of 13 cases of *Enterococcus faecium vanA* (gene cluster) was registered at the haemodialysis unit at Oslo University Hospital (OUS), Oslo.

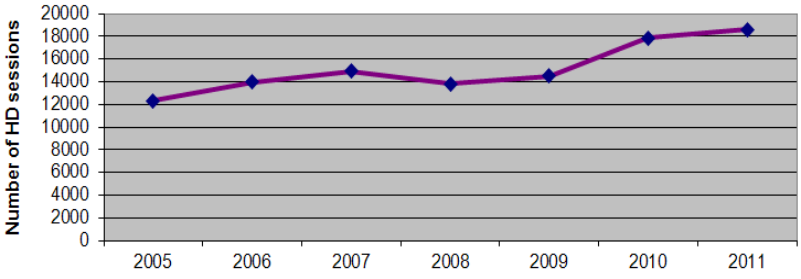

Figure 1. The development of haemodialysis sessions at Ullevål University Hospital 2005-2011 (Annual report 2011, The norwegian Renal Registry).

The need for haemodialysis treatment has increased rapidly in Norway during the last 5-10 years. In Oslo this has occurred without any increase in the capacity (Figure 1).

Since 2002, public hospitals in Norway were transferred from the administration of the responsible County to a few regional state enterprises to be more effective and save money; according to “New Public Management”. For the same reason, four hospitals in Oslo, including Ullevål University Hospital, were further merged into a 1500 beds hospital; Oslo University Hospital in 2009.

The aim of this study is to describe the hospital design, and economic and administrative management of an old, overcrowded and open haemodialysis unit at OUS. Furthermore, to describe risk factors noticed by infection control site inspections and the response to deviation reports by the hospital administration. In addition, methods to terminate and eliminate an outbreak of VRE that occurred during this period are described.

2 Materials and methods

2.1 New public management (NPM) in Norwegian hospitals

In 2002, all public hospitals in Norway were transferred from the administration of the responsible County to five regional state enterprises; North, Central, West, South and East. This was done to be more effective and save money, according to “New Public Management”.

In 2007, there was a further merging to four regional state enterprises by merging the largest ones; South and East, to South-East. Within each region, hospitals merged further into larger units, also called enterprises.

 ISSN 1927-6990 E-ISSN 1927-7008

In 2009, for the same reason -to save money-, four hospitals in Oslo; Aker (400 beds), Rikshospitalet (500 beds), Radiumhospitalet (400 beds) and Ullevål University Hospital (1000 beds), were further merged into a 1500 beds hospital; Oslo University Hospital. This hospital was situated in more than 40 locations in Oslo.

The regional state enterprise's task is to make economic contracts with each hospital/merged hospitals, using a combination of volume controlled- and activity-based funding and to control the activities and production of the same hospitals. The hospital, on the other hand, is the supplier of the contracted health services to a certain dedicated part of the population in the region. The hospital's "production" is then limited by the commission documents and agreement with the regional state enterprise.

2.2 Infection control site inspection

A regular infection control site inspection is performed by the infection control doctor (ICD) and infection control nurse (ICN) for each department of the hospital; at least every other year. The site inspection is performed more often in departments with infection control problems like a high prevalence of hospital infections, problems with hygienic and sterile routines, outbreaks of infections, isolation problems, overcrowding, understaffing, and so on.

The inspection is announced and implemented in collaboration with the department's leadership and safety representative, and a representative from the cleaning department.

Every room and corridor in the department is inspected for hygienic and infection control conditions, concerning hospital design and ventilation, cleanliness, implementation of hygienic routines, necessary space and rooms for patients and equipment, and the access to service rooms. Furthermore, the service rooms for textiles, equipment, storerooms for sterile equipment, liquids and medications, the kitchen and the room for waste disposal, and toilets for patients, visitors and personnel are all inspected for hygienic conditions. In addition, bed occupancy and the patient to personal ratio are registered.

A written report is made by the infection control personnel with description of the department and the results of the site inspection. Discrepancies according to the recommended hygiene and infection control level in the hospital's infection control programme are described and documented. Deviations are recommended closed as soon as possible or within a certain deadline. The report is addressed to the leadership of the actual department and to the head of the clinic where the department is located, with a copy to the hospital administration (the quality director, the director responsible for the medical field, and the administrative director). In certain situations, also the main safety delegate, the occupational health and representatives for the employee are informed. Dependent on the risk for patients or personnel, the ICD may also have access to notify the Board of Health in the County that have the overall supervision of the health care in the County.

2.3 Setting and types of patients

Oslo University Hospital (OUS) is a result of merging four separately located hospitals in Oslo in 2009. The haemodialysis units are located at two of the former four hospitals; Ullevål University Hospital and Rikshospitalet.

The VRE – outbreak occurred at the haemodialysis unit at OUS-Ullevål. The building structure and design of this unit had been the same the last 30 years. An increasing number of patients with non-Norwegian ethnicity and drug users were treated at the unit. Chronic carriers of blood-borne virus infections (Hepatitis B, C and HIV) made up ca 25% of the patients. The unit treated both patients in beds from other departments and outpatients.

There was one nurse per two patients during day shift and one per three during the evening shift of dialysis treatment. They took care of the patient; registered, treated, washed and disinfected each treatment place, and made food and drinks to the patients. They used gloves during connection with the machine and the dialysis work, and gown, gloves and mask when treating patients with infections.

3 Results

3.1 Description of risk factors - from an infection control point of view-before the outbreak

This unit treated ca 70 mostly outpatients, 3-5 hours, three times per week. There were 20 dialysis places, used by 22 patients per shift in two shifts during the day; one morning and one afternoon (Figure 2). The unit was designed for only 13 patients per shift. Ten patients were treated in an open, common area and four in a connected area. The space per patient was only 5.5 m^2.

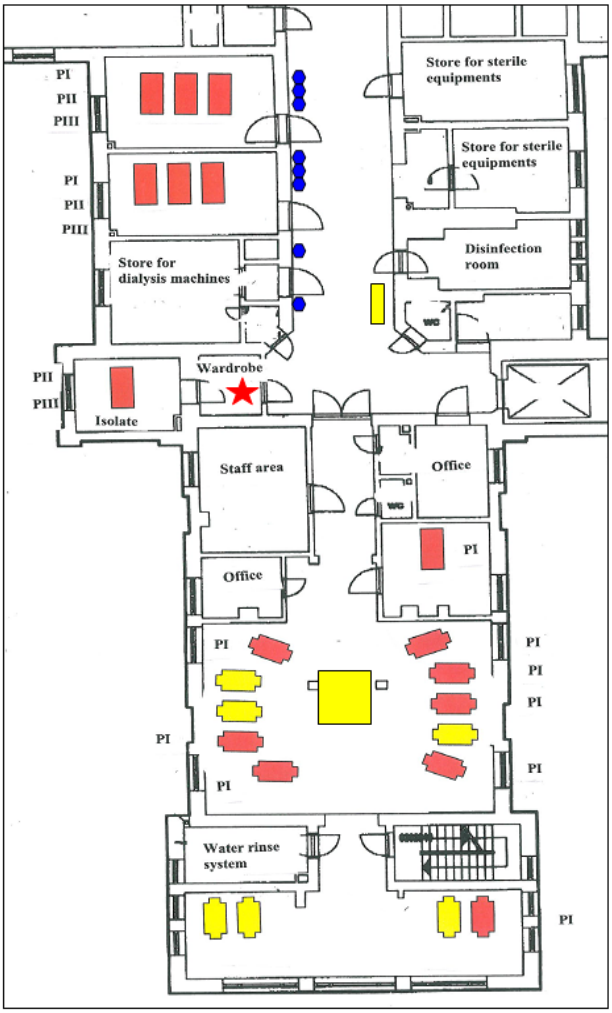

Figure 2. Dialysis unit at OUS-Ullevål 2011. Red coloured beds and chairs for dialysis patients indicate where the first three VRE-infected patients have been treated. ★ The red star is the common wardrobe for all patients. It was placed outside the isolation room, where the door mostly stood open. ⬣ The blue figures are dialysis machines placed on the corridor. The yellow squares indicate storage of 5 litre cans with sterile dialysis liquid, on the floor in the corridor and in the common hall for 10 dialysis patients.

PI: Patient I, the index patient was first time detected VRE-positive February.2011. Treated at the single acute room, on seven out of ten dialysis chairs, and in both three-bed rooms. The patient was treated 36 times in the unit before isolated form other patients.

PII: Patient II, was detected VRE-positive in May 2011. The patient had been treated at both three-bed rooms and in the isolate. The patient had been treated 46 times in the unit before isolated from other patients.

PIII: Patient III, was detected VRE-positive June 2011. The patient was treated at both three-bed rooms and in the isolate; 42 times treated in the unit before isolated from other patients. Patients I, II, and III were at the same time on the unit in March 2011. Patient II and III were treated together at the same time and same room 17 times.

Two rooms were designed for two patients each, but mostly used for three. There were two single rooms; one used as an "isolate" for patients with blood borne infections or cases with multi –resistant bacterial organisms (MDRO). There was no isolate with sluice. The door between the "isolate" and a common wardrobe used by all outpatients was usually open, even during isolation for infections. This could be a risk for the other patients using the wardrobe.

The unit had a few service rooms, like a very small textile room (3 m^2). The store for the dialysis machines was too small. Therefore, more than 10 machines usually were placed on the corridor, including machines designated to the nearly 25% of patients with blood borne infections (Figure 3). The dialysis machines were decontaminated inside and washed with soap and water outside between each patient, but usually not decontaminated outside between patients. They were often

moved between patient rooms and the storage at the corridor. A contaminated outer part of the machine could therefore be a risk for the environment, patients and personnel.

Figure 3. Storage of dialyse machines on the corridor in the unit

Figure 4. Storage of 10 liter cans with sterile dialyse liquid at the main dialyse room and on the corridor

The department did not have a common system for dialyse liquid and used 5 litre cans. Because of lack of storage rooms, the cans were placed on the corridor floor or in the common area for dialysis patients (Figure 4). Because of lack of treatment places, some patients had to share room with patients with blood borne infections during dialysis.

The floor was not cleaned between each shift of patients; only once a day. The patient chair and treatment table were always cleaned between each patient. The environment was often dirty because of a high activity and a low and insufficient cleaning. In addition, the poor building maintenance made the cleaning very difficult.

3.2 Infection control site inspections and reports

Three inspections were done by the infection control doctor and nurse during February, June and November 2010.This included three reports with descriptions of serious risk factors detected repetitively at this unit.

The most serious deviations from a good hygienic standard and proper infection control were lack of satisfactory isolation of patients with infectious diseases, overcrowding and understaffing, lack of storage of the dialysis machines and dialysis liquid, lack of service rooms, poor and old hospital design, and a lack of good routines for housekeeping.

The written information was sent to the head of the Department and of the Medical Clinic with a copy to the hospital administration. The deviation had to be closed within three months. The first project group was immediately set down, but put on hold because of lack of economic resources.

The Director of the hospital was then directly informed and advised to close this unit because of a high risk of hospital infections and lack of acceptable hygienic conditions for patients and personnel. The head of the Medical Clinic responded that they could not take care of the most alarming risk factors, unless a new and larger department was established.

The hospital was in deficit of several hundred million NOK. The Director was again notified about this situation in January 2011. He was informed that the situation was now so serious that the infection control doctor would contact the Board of Health in Oslo County. A second project group to solve the problems was then established in March 2011, but was nearly immediately put on hold again because of lack of economic resources. The Board of Health of Oslo and Akershus were notified by the infection control doctor in March 2011, with a copy to the Director of the hospital, and a complete report was sent in June 2011.

3.3 The VRE-outbreak

The index patient (PI) was a long-term patient, staying at different places of the four hospitals in the merged OUS. *Enterococcus faecium VanA* was detected in February 2011 after being treated for several months with different antibiotics. The patient was contact isolated at another department. During this "isolation period" of three months (February to May 2011), the patient was treated without any preventive measures at the haemodialysis unit. He had been around on most dialysis places in the unit and was treated 36 times in the unit before isolated from other patients (Figure 2).

The second patient (PII), was an outpatient detected VRE-positive in May 2011. He had been treated 46 times in the unit before isolated from other patients.

The third patient (PIII) was detected VRE-positive in a faeces sample taken in June 2011, because of contact with patient I and II (Figure 2). He was treated 42 times in the unit before isolated from other patients.

Patients I, II, and III had been at the same time on the unit. Patient II and III were treated together at the same time and in the same room 17 times.

By tracing all the 70 dialysis patients, additional 10 patients were found. They were carriers of VRE in the stool. A total of 13 patients were found during the investigation period of one month. Patients 4-13 were mostly outpatients, detected by the tracing 15-16 June. They had been treated on many places, all over the unit.

3.4 Measures used to stop the outbreak

The dialysis unit was immediately declared contaminated and treated as such during the further dialysis treatment. The outbreak could not stop the necessary treatment of the patients. The use of vancomycin and other selective antibiotics were avoided. The situation was treated nearly like an outbreak of methicillin-resistant *Staphylococcus aureus* (MRSA) [16].

Transmission to other dialysis departments was avoided. It was decided not to move VRE-infected or VRE-exposed patients to other dialysis units, to avoid the spread of infection.

 ISSN 1927-6990 E-ISSN 1927-7008

Hand hygiene and general infection control routines were immediately reinforced and facilitated for all personnel, patients and visitors. The personnel were informed to follow new routines for barrier treatment for all patients. This included the change of the uniform daily, or more often, if necessarily. The common wardrobe was closed for all patients (Figure 2).

Room disinfection was started immediately and consecutively done with perasafe (peracetic acid) or chloramine 5% for the whole department, including all rooms, with a priority for the rooms supposed to be most contaminated [17]. Afterwards, the cleaning and decontamination the department was sustained reinforced, increased to twice a day; after each shift of patients. All medical reusable equipment was important to disinfect both inside and outside [18].

Isolation of VRE-carriers. All outpatients and inpatients infected with VRE were isolated in single rooms or in cohort on the same room with contact infection barrier. The personnel used single use personal protective equipment (PEP) like gown, gloves, cap and mask when entering the room. VRE-infected outpatients went directly to the isolate and did not use the common waiting room which was closed. All equipment used was treated as contaminated. After each dialysis, the room was decontaminated like a room with air and contact contamination [17].

Exposed, but VRE- negative patients were treated on the ordinary dialysis places in the unit. They were followed with repeated samples over a period of several months. The personnel used single use PPE to avoid transmission of VRE in case they were carriers. The treatment places, including tables, were disinfected after each use.

Food and drink service for the patients was immediately transferred to a dedicated kitchen educated person who prepared the meal for all patients and who had no direct contact with the patients.

Defining the VRE-strain. All the VRE strains were successively identified; they were all genotypic indistinguishable by use of the pulsed –field electrophoresis method.

Tracing infected cases. Faeces samples and clinical samples were taken first from all patients that had been in direct contact with patients I-III. Afterwards, all patients at the haemodialysis units were included. VRE-exposed patients were declared VRE negative if five or more samples over several months were negative and they did not use antibiotics. VRE positive patients were followed with repeated samples. After 12 months with repetitive and only negative samples they were declared VRE negative.

Personnel were not tested for carrier state since there were no routines for decontamination of carriers among healthcare personnel, like the MRSA-routines [16, 17].

Written information was given to all patients; infected and exposed in the unit; to the personnel, to the Director, to all departments and wards and the ambulance division at our hospital, and to other hospitals, nursing homes and home care. All with a common responsibility for the dialysis patients were notified. Advices were given directed to the risk of transmission of this robust and long-living bacterium and the need for following the routines for infection control used at the haemodialysis unit.

3.5 Further development

The last cases were detected at this unit 16 June 2011. All patients were followed up with repetitive samples during 2011, and no more cases were found. The 13 VRE- positive cases have now been negative for one year.

One and a half year after the outbreak, a new and larger haemodialysis unit was established at the hospital.

4 Discussion

The outbreak of VRE at the haemodialysis unit at Oslo University Hospital-Ullevål was predicted because of the poor structural condition of the dialysis unit, the overcrowded situation with a rapidly increasing number of patients that needed

treatment, and the open-room area, lack of cleaning and disinfection and of isolation facilities, and the lack of administrative organization and economic resources.

This situation was unfortunately combined with lack of routines for alerting and making note about the presence of VRE in the index patient. During the "isolation period" of three months at another medical department, this patient was transferred to and treated more than 30 times without any preventive measures at the haemodialysis unit, being around on most dialysis places. The haemodialysis unit had not been informed about the VRE status of the index patient. Therefore the index patient was not detected before other patients in the unit were infected.

4.1 The effect of "New Public Management"

The merging of the four large hospitals in Oslo to an even bigger one in 2009 was associated with a significant reduction of economic resources. The health authorities planned to save more than one billion Norwegian kroner and 4000 work positions by merging the four hospitals in 2009. However, in 2011, the total number of beds was reduced by 25%, the number of work positions was not reduced, and the total operating cost for the merged hospital was increased by nearly 8%, compared to the costs of the four hospitals separately in 2009 [19, 20]. Thus the fusion of hospitals created larger costs, an increasing debt, did not save work positions, and resulted in significantly fewer beds for patients than in 2009, in spite of an increasing population in the Oslo region. In addition, the personnel were often divided between several locations even if they belonged to the same department, and this solution was both time- and cost-consuming.

Thus, the hospital had to save even more money. This resulted in a nearly complete stop in basic activities like cleaning, maintenance work and other services necessary to run the hospitals in a proper manner. The lack of a proper hygienic response, and the reluctance and hesitation of the administration to react on the repeated warnings from the infection control personnel, may partly be related to the special merging and economic situation of the hospital. The increasing need of more treatment places for haemodialysis in Oslo occurred without any response from the hospital administration or the regional state enterprise.

The poor condition of this dialysis unit was, however, well known for several administrators over many years before the hospital fusion. The former Ullevål University Hospital had been through repetitive severe economic savings since 2002, when all public hospitals in Norway were transferred to a few state enterprises. This resulted in fewer beds, more corridor patients, and a lower staff: patient ratio, a significant reduction of service and technical function personnel, and a significant increase of hospital infections and extra costs [20].

The understanding of economic managements and consequences of changing hospital organization models is probably an overestimated knowledge among decision makers. In this situation, it was worryingly to observe that economic savings in one of the richest countries in the world could cause administrators to close eyes to the warning of severe infection risks for patients and personnel.

Haemodialysis units have, like intensive units, a high infection risk, a high use of antibiotics and often a rich mixture of resistant bacteria and blood borne infections. Furthermore, they usually treat the most expensive and costly patients in the hospital. It is therefore an inconsequence not to put enough money into those exposed departments to prevent infections. Especially when it may be, in addition, cost effectively [20].

4.2 After the outbreak

The VRE outbreak was promptly stopped in this case after one month, and all 13 cases were negative after repeated negative samplings for a year. But larger outbreaks may be more difficult to handle, as shown by others [5, 21-23]. A rapid action is important; tracing all infected, screening and re-screening, isolation treatment of all cases and exposed patients, barrier treatment by personnel using PEP, and establishing a dedicated cleaning and disinfection system and kitchen service for the unit, as also shown by others [21-23].

One and a half year later, an extended, refurbished unit was ready for the patients. However, a new dialysis department especially dedicated and facilitated to infection control and anonymity of each patient is still wanted. It may perhaps come up one day.

Acknowledgements

Thanks to Aud-Eldrid Stenehjem and Berit Ramstad, OUS-Ullevål, for effective tracing of patients, rapid implementation of control measures to terminate the outbreak, and for following up all infected and exposed patients. Thanks for active work and initiative to improve hygienic conditions for the patients in the haemodialysis unit.

References

[1] Deshpande L, Fritsche TR, Moet GJ, Biedenbach DJ, Jones RN. Antimicrobial resistance and molecular epidemiology of vancomycin-resistant enterococci from North America and Europe: a report from the SENTRY antimicrobial surveillance program. Diagnostic Microbiol Infect Dis. 2007; 58: 163-170. PMid:17368801 http://dx.doi.org/10.1016/j.diagmicrobio.2006.12.022

[2] Chavers LS, Moser SA, Benjamin WH, et al. Vancomycin-resistant enterococci: 15 years and counting. J Hosp Infect. 2003; 53: 159-171. PMid:12623315 http://dx.doi.org/10.1053/jhin.2002.1375

[3] Harbarth S, Cosgrove S, Carmeli Y. Effects of antibiotics on nosocomial epidemiology of vancomycin-resistant enterococci. Antimicrob Agents Chemotherapy. 2002; 46: 1619-1628. PMCid:127216 http://dx.doi.org/10.1128/AAC.46.6.1619-1628.2002

[4] Arias CA, Murray BE. The rise of the Enterococcus: beyond vancomycin resistance. Nature Reviews Microbiol. 2012; 10: 266-278. PMid:22421879 http://dx.doi.org/10.1038/nrmicro2761

[5] Bonten MJ, Slaughter S, Ambergen AW et al. The role of "colonization pressure" in the spread of vancomycin-resistant enterococci: an important infection control variable. Arch Intern Med. 1998; 158: 1127-1132. PMid:9605785 http://dx.doi.org/10.1001/archinte.158.10.1127

[6] Donskey CJ, Chowdhry TK, Hecker MT et al. Effect of antibiotic therapy on the density of vancomycin-resistant enterococci in the stool of colonized patients. New Engl J Med. 2000; 343: 1925-1932. PMid:11136263 http://dx.doi.org/10.1056/NEJM200012283432604

[7] Bonilla HF, Zervos MJ, Kauffman CA. Long-term survival of vancomycin-resistant Enterococcus faecium on a contaminated surface. Infect Control Hosp Epidemiol. 1996; 17: 770-771. PMid:8985758 http://dx.doi.org/10.1086/647230

[8] Noskin GA, Stosor V, Cooper I, Peterson LR. Recovery of vancomycin-resistant enterococci on fingertips and environmental surfaces. Infect Control Hosp Epidemiol. 1995; 16: 577-581. PMid:8568202 http://dx.doi.org/10.1086/647011

[9] Simonsen GS, Andersen BM, Digranes A et al. Low fecal carrier rate of vancomycin resistant enterococci in Norwegian hospital patients. Scand J Infect Dis. 1998; 30: 465-468. PMid:10066045 http://dx.doi.org/10.1080/00365549850161449

[10] Kruse H, Johansen BK, Rørvik LM, Schaller G. The use of avoparcin as a growth promotor and the occurrence of vancomycin-resistant Enterococcus species in Norwegian poultry and swine production. Microbial Drug Resistance. 1999; 5: 135-139. PMid:10432274 http://dx.doi.org/10.1089/mdr.1999.5.135

[11] Borgen K, Simonsen GS, Sundsfjord A, Wasteson Y, Olsvik Ø, Kruse H. Continuing high prevalence of vanA-type vancomycin-resistant enterococci on Norwegian poultry farms three years after avoparcin was banned. J Appl Microbiol. 2000; 89: 478-485. PMid:11021580 http://dx.doi.org/10.1046/j.1365-2672.2000.01137.x

[12] Søderblom T, Aspevall O, Erntell M et al. Alarming spread of vancomycin resistant enterococci in Sweden since 2007. Euro Surveill. 2010; 15(29). PMid:20667301

[13] Nasjonalt Folkehelseinstitutt. Haukeland Universitetssjukehus; Pågående utbrudd av vankomycinresistente enterokokker (VRE); en oppdatering og råd om screening av pasienter. FHI.no. 09.06.2011.

[14] Nasjonalt Folkehelseinstitutt. Nasjonal anbefaling: Håndtering av vankomycinresistente enterokokker (VRE) ved norske sykehus og sykehjem. 25.08.2011.

[15] Nasjonalt Folkehelseinstitutt. Oppdatering om forekomst av vankomycinresistente enterokokker (VRE) i Norge. FHI.no. 12.06.2012.

[16] Andersen BM, Syversen G, Rasch M. MRSA is increasing in Oslo, Norway- caused by changed infection control strategy? J Infection. 2007: 55: 531-538. PMid:18029021 http://dx.doi.org/10.1016/j.jinf.2007.09.008

[17] Andersen BM. Handbook in hygiene and infection control for hospitals. Ullevål University Hospital, Oslo. 2008; 234-239.

[18] Andersen BM, Hochlin, K, Daling JP. Cleaning and decontamination of reusable medical equipments, including the use of hydrogen peroxide gas decontamination. Microb Biochem Techn. 2012; 4: 57-62.

[19] Norwegian Statistic Central Buerau. Oslo.

[20] Andersen BM, Rasch M, Hochlin K, Tollefsen T, Sandvik L. Hospital-acquired infections before and after healthcare reorganization in a tertiary university hospital in Norway. J Publ Health. 2009; 7: 1-7.

[21] Pearman JW. 2004 Lowbury lecture: The Western Australian experience with vancomycin-resistant enterococci – from disaster to ongoing control. J Hosp Infect. 2006; 63: 14-26. PMid:16563562 http://dx.doi.org/10.1016/j.jhin.2005.10.017

[22] Pereira GH, Muller PR, Zanella RC, de Jesus Castro Lima M, Torchi DS, Levin AS. Outbreak of vancomycin-resistant enterococci in a tertiary hospital: the lack of effect of measures directed mainly by surveillance cultures and differences in response between Enterococcus faecium and Enterococcus faecalis. Am Infect Control. 2010; 38: 406-409. PMid:20006408 http://dx.doi.org/10.1016/j.ajic.2009.08.010

[23] Grabsch EA, Mahony AA, Cameron DRM et al. Significant reduction in vancomycin-resistant enterococcus colonization and bacteraemia after introduction of a bleach-based cleaning-disinfection programme. J Hosp Infect. 2012; 82: 234-242. PMid:23103245 http://dx.doi.org/10.1016/j.jhin.2012.08.010