

# Are humans exposed to livestock becoming a reservoir of MRSA?

## Introduction

Since its first detection in 2003 in pigs and pig farmers,<sup>1,2</sup> livestock associated MRSA (LA-MRSA) has become a worldwide threat to humans. This new MRSA lineage first detected in humans in France<sup>1</sup> and subsequently found to be associated with animal to human transmission in The Netherlands,<sup>2</sup> rapidly emerged in many European countries,<sup>3</sup> Canada and the US.

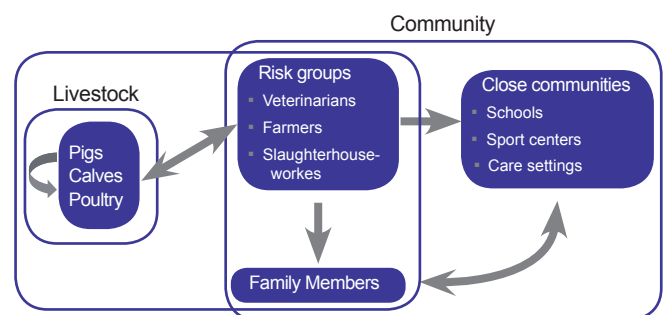
Most of the initial studies performed showed a high prevalence of human and animal LA-MRSA carriage among persons in contact with livestock,<sup>4,5</sup> and a low occurrence of LA-MRSA-associated diseases among healthy animals and people colonised with LA-MRSA. Still, case-reports with invasive infections due to LA-MRSA have recently been published,<sup>6</sup> as well as studies showing the acquisition of resistance- and virulence-factors by LA-MRSA strains.<sup>7,8</sup> Moreover, some of those infections have been reported in people without any known contact with livestock or farm settings, suggesting that unknown and undetected reservoirs may be present.

Humans in contact with livestock are the first logical target population to be tested, and studies performed so far confirm that they are indeed at high risk to become colonised by LA-MRSA. However data related to the pattern of human colonisation and transmission to secondary contacts has not yet been addressed.<sup>5</sup> In this

European study, PILGRIM partners revealed the longitudinal epidemiology of LA-MRSA in livestock farmers and their household members for the first time. Knowledge of the risk for LA-MRSA carriage is needed to adjust infection control measures, based on the 'search and destroy' strategy. Those living on farms would constitute the primary line of population at high risk to become colonised and in turn to act as a vehicle of transmission to other communities outside the farm environments.

If this is the case, specific control measures need to be developed to avoid the spread and transmission outside the farm settings and to avoid importation of LA-MRSA into the health care settings (Figure 1).

Figure 1. Suspected transmission routes of LA-MRSA from colonised animals to humans





## Objectives of the study

MRSA in livestock is a potential health threat to those people in direct contact with infected animals. In order to adjust existing infection control guidelines and possibly develop new control measures, insight into the epidemiology of LA-MRSA is a basic requirement.

- Prevalence of MRSA in persons working and/or living inside the farm settings (including health-care workers (HCWs) in direct or indirect contact with livestock).
- Frequency of transmission between members of the same family.
- Risk moments for acquiring MRSA.
- Role of companion animals as vehicle of MRSA transmission from the livestock accommodation to the farm house.
- Role of the house environment in human to human transmission.

## Epidemiology of LA-MRSA in the farm settings

A longitudinal study was performed in 4 farms from Belgium, The Netherlands and Denmark. Farmers, employees and household members were monitored for a total of 6 months, during which at 8 points in time they were screened for MRSA-ST398 carriage. The sampling moments of the study corresponded with the different occupational activities in the farm, starting at the moment of a herd birth and finishing before slaughter (Table 1). Next to the farmers and their family, cultures were taken in their home environment and livestock accommodation. Companion animals were monitored as well as high frequency hand touch environmental sites inside the house.

Table 1: Timetable of the study		
Week of study period	Sampling moment	Description actions in the farm
0	1	Move sows to farrowing house, pigs birth
2	2	Castration, ear tags
5	3	Weaning
8	4	3 weeks after weaning
11	5	Piglets to fattening house
15	6	Fattening
20	7	Fattening
25	8	Before slaughter

## Main results of the study

Carriage of livestock associated MRSA is highly prevalent among pig farmers and their employees in Belgium, Denmark and The Netherlands and depends on the contacts with animals. Farmers, with daily exposure to livestock by working in the livestock accommodation, were carriers of LA-MRSA in 79 % (at least half of sampling moments tested MRSA positive). These results may not reflect the entire situation of the farm production system in each country since the studies were carried out in high prevalence farms and may differ from farm to farm. However, the results prove that MRSA might pose a threat for certain groups of people who need to be protected. Whether carriage is due to a persistent colonisation or to a daily re-contamination was not examined since the farmers had no absence from work during the study period. Interesting, most of the workers tested LA-MRSA positive in the morning before starting work, suggesting that they carried LA-MRSA into their houses and thereby represent a risk for contaminating the farm house environment and their household members.

Results from the household members varied, depending on the country. LA-MRSA carriage among household members (without direct livestock-contact/work in the livestock accommodation) was generally very low, from nearly non-existing in Denmark, to a low percentage in Belgium. Interestingly, even those that never were in contact with livestock were sometimes MRSA positive, possibly due to transfer of LA-MRSA from human to human, or to indirect contamination via the house environment surfaces. The risk for becoming a carrier increased with the number of occasions in contact with livestock. Individual risk factors, such as personal hand hygiene habits or antibiotic consumption could also influence the carriage. This was not studied in this research.

Environmental contamination with LA-MRSA has been found in all samples taken in livestock accommodation in all participating countries but not in all private homes of the farmers. Companion animals seem to play a key role in the transmission of LA-MRSA as they have access to both, the livestock accommodation and the farm house and they are frequently in contact with all the members of the family. At least this was clearly observed in Belgium. Obviously, contamination of the livestock accommodation environment and measures to control them are a key factor for the control of LA-MRSA. A future PILGRIM factsheet will present results and ideas of PILGRIM partners on this topic. Since the environment, animate and inanimate, can be a source of contamination and transfer to and within household members, further research is needed to identify the reasons for the differences found in contamination of the private homes, in order to invent preventive measures.



## LA-MRSA in other populations at risk

LA-MRSA could be an occupational concern, not only for people who are daily exposed in livestock farms, but also for other professionals exposed to livestock. Previous studies have pointed out veterinarians, people working in the slaughterhouses, and transporters of livestock as potential groups at risk.<sup>9,10</sup> Veterinarians risk the acquisition of bacteria due to the direct exposure to a number of animal species. In addition they can have a potential impact in the community, since they could act as a LA-MRSA reservoir and contribute to the dissemination of the animal associate lineage from inside the farms settings to outside the agricultural communities. PILGRIM partners have addressed this question in a study conducted in two countries; Belgium and Denmark, with a low MRSA prevalence in the general population (0.5% and 0.2% respectively), but with a large tradition of animal farming and different MRSA infection control policies, based on research done in The Netherlands<sup>9</sup>.

Results from the study have revealed that LA-MRSA prevalence in veterinarians was significantly higher (7.5%) in Belgium but not in Denmark (1.4%), compared to their LA-MRSA prevalence into the general population (0.5 - 0.2%, respectively). Moreover, only veterinarians exposed to livestock, in specific to pigs in both countries and in addition to bovines in Belgium are at risk to be colonised by LA-MRSA. Interestingly, carriage seemed to be of a short duration therefore posing a relatively risk to the veterinarians.

Therefore this particular group should be taken into consideration when developing or adapting control measures. Longitudinal studies to assess the pattern of colonisation, persistent versus intermittent are ongoing.

## General conclusions

Preliminary findings of the study

- Livestock farmers, their employees and veterinarians are new groups to be seriously considered as LA-MRSA carriers.
- Household members of livestock farmers seem to have a lower risk, possibly due to the low transmissibility of this livestock associated clone outside of the pig accommodation. However, they are not free of risk, and should be considered as susceptible population even if they do not have any contact with livestock animals or enter the livestock accommodation.
- Specific occupational risk moments, and the exact role of the environment and pets remain to be elucidated. Seen the rate of contamination, the home environment may have a potential role in transmission.

## Perspectives

Although the risk of LA-MRSA transmission from human to human is presently low, the risk of individual carriers to develop an infection upon hospitalisation has to be taken seriously, as should be the acquisition of the strains of other resistance genes that would result in a more resistant and virulent bacteria with clinical and antimicrobial therapeutic consequences.

Further analysis of predisposing individual risk factors and the potential role of environmental transmission inside the farm settings are ongoing. Based on these data, guidelines to protect the persons daily exposed to farm animals will be elucidated and summarised in the upcoming Pilgrim factsheet.



## References

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