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## The association of ESBL-producing Enterobacteriaceae (ESBL-E) carriage in humans with pigs – a reply

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### The association of ESBL-producing Enterobacteriaceae (ESBL-E) carriage in humans with pigs – a reply

To the Editor:

In their recent letter, Denkel *et al.* [1] pointed out that contact with livestock animals can indeed be a risk factor for the acquisition of colonization with extended-spectrum  $\beta$ -lactamase-producing Enterobacteriaceae (ESBL-E) among humans. This has been demonstrated for pig farmers and poultry farmers, for whom ESBL-E carriage rates reached 6–33% [2, 3], which exceeds carriage rates expected for the general population [4, 5].

Of course, the main site of human colonization with Enterobacteriaceae is considered to be the colon or rectum. In consequence, it is reasonable that most studies focus on assessing ESBL-E colonization by screening for rectal carriage [6].

In contrast, our study was planned to investigate nasal carriage of ESBL-E among farmers [7]. The rationale for this was that it is known that dust samples from farms are often contaminated with ESBL-E. Therefore, we hypothesized that dust inhalation may also facilitate colonization of the nares (as an atypical site of ESBL-E carriage). This was observed before for livestock-associated (LA-) methicillin-resistant *Staphylococcus aureus* (MRSA), which nasally colonize at least 80% of German pig farmers [8], but nobody had investigated this issue for ESBL-E.

Interestingly, we found that nasal carriage of Enterobacteriaceae among pig farmers was more frequent than expected, but, as summarized by Denkel *et al.*, we did not find any ESBL-E among these nasal isolates. As discussed, this does of course not rule out that the farmers included in the investigation

were rectally colonized and it should not obscure that pig contact could be a risk factor for ESBL-E carriage at other body sites. Hence, it was not the aim of our study to find out the overall prevalence of ESBL-E carriage among farmers. However, we can conclude that, despite a high likelihood of frequent occupational inhalation exposure towards ESBL-E, nasal ESBL-E carriage as a transient reservoir among farmers seems to be rare. We think that this finding is important, because (1) our study suggests that investigations aiming to assess ESBL-E carriage among farmers can indeed neglect screening the nares (as assumed) and (2) our results indicate that ESBL-E spread via ‘farmer’s nose to farmer’s hand to community’, which might be even more effective than faecal–oral transmission, seems rather unlikely.

In their letter, Denkel *et al.* [1] report on data from the German National Reference Center for the Surveillance of Nosocomial Infections (KISS) in hospitals, which indicate that the federal state of North Rhine-Westphalia (NRW) was among the risk factors for a significantly increased proportion of nosocomial infection due to ESBL-E (odds ratio 1.41) [9]. Denkel *et al.* discuss that ‘this observation suggests a relationship between the production farming of pigs and the emergence of ESBL-E infections in the same regions’, because the state of NRW also comprises regions with a high density of livestock production. We agree that this finding warrants attention. However, surveillance systems usually lack detailed information about the population addressed. We would like to stress that NRW is the largest German federal state in terms of population (>17 million), comprises many non-rural metropolitan regions (e.g. ‘Ruhr Area’) and has a very high density of healthcare infrastructure with 370 hospitals, > 120 000 hospital beds and >4.4 million inpatients annually (data for 2013; www.destatis.de). This high density of hospital-care might also facilitate the nosocomial spread of

ESBL-E in this region independently from livestock production. Hence, a direct epidemiological link between regional livestock and ESBL-E in human clinical specimens is prone to a confounding bias and causal interpretation should be avoided. However, we agree that these findings should inspire future epidemiological studies aiming to assess differences in the occurrence of ESBL-E infections both in hospitals and the general population to yield geographical differences on a more regional/district level. In addition, representative data at the population level would be required for making causal interpretations. As suggested by Denkel *et al.*, such surveillance studies should also include data about molecular characteristics (genotypes and resistance plasmids) of regional ESBL-E isolates in order to enable discussion about the impact of zoonotic ESBL-E for human infections. For MRSA such a study was recently performed in the federal state of NRW: data from a state-wide surveillance programme on MRSA bacteremia isolates indicated that in more rural districts characterized by a high density of pig farming, clonal lineages typical for LA-MRSA accounted for a substantial proportion (>10%) of human bloodstream infections, whereas these MRSA clones were rarely found among bacteraemia isolates from other districts [10].

#### Declaration of Interest

None.

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