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LIVESTOCK ODOURS AND QUALITY OF LIFE OF NEIGHBOURING RESIDENTS

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Abstract: Neighbours of intensive livestock production facilities frequently complain of odour annoyance. They are also concerned about potential negative health effects of environmental exposures to livestock emissions. Quality of life (QoL) was assessed in residents of a rural community neighbouring an area with high concentration of animal farms. A postal cross-sectional survey was carried out among the 4,537 residents, aged 18–44 years. Of these, 3,112 (69%) responded to questions on annoyance by livestock odours (4-point scale), on QoL (assessed by the short form 12, SF-12), and on potential confounders (age, gender, respiratory symptoms, smoking, living on or close to a farm, and employment status). SF-12 scores were available for 2745 (88%) subjects. Sixty-one percent of the respondents complained about unpleasant odours, 91% of these accused livestock as source of these odours. Physical and emotional SF-12 scores were inversely related to annoyance scores. Better risk communication might improve QoL in concerned neighbours of intensive livestock production facilities.

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INTRODUCTION

It is well known that animal farmers are at high risk for chronic airway diseases, in particular chronic bronchitis [10, 13]. Inside the animal buildings, airborne dust, endotoxin, bacteria and fungi are among the most important agents responsible for such types of respiratory symptoms [6, 11, 13].

However, these agents are also emitted into the environment. Due to the characteristic of livestock odour emissions, such exposures can easily be identified by the neighbours of animal facilities. As a result, people living in areas with a high density of livestock are often worried about possible negative health effects of environmental exposures to animal house emissions [19]. In this context, Schiffman [17] presented four ways by which odours could affect human health:

1. the volatile organic compounds (VOC) could produce toxicological effects;
2. odours could cause sensory irritations in eyes, throat and nose. Nevertheless, such irritations can also happen when no odours are present;
3. VOC could stimulate sensory nerves and induce neurochemical changes;
4. health effects caused by agricultural odours could be due to cognitive and emotional factors (e.g. attitudes toward unpleasant odours or stored mental experience with similar odours).

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Schiffman *et al.* [18] showed that odour annoyance can adversely effect the mood of residents bothered by livestock odours in their living environment. Subjects living close to industrial swine confinement buildings reported more anger, less vigour, more tension and depression, as well as more fatigue and confusion, compared to subjects not neighbouring such facilities [18]. In this context, neighbours of industrial swine operations reported a reduced quality of life (QoL) [24]. The data of both studies have been based on ecological comparisons of residents of different communities therefore, exposure to livestock production facilities has not been estimated on an individual base [18, 24]. Moreover, these investigations have been based on small numbers without taking into account potential confounding factors, and no standard instruments for the assessment of QoL have been used.

The aim of this study was to analyse the association between exposure to livestock odours and QoL on a large population living in close proximity to intensive livestock production facilities. Exposure was assessed using self-estimates of odour intensity.

METHODS

Study population. The study region is a part of Northern Germany were intensive animal production, especially swine and poultry production, is carried out. All 4,537 inhabitants, age 18–44 years, living in a rural town received a mail-in questionnaire. Up to 2 postal reminders were sent. Subjects not responding within 6 weeks after the first mailing were contacted by phone. Overall, 3,112 (68.6%) subjects returned the completed questionnaires. Their mean age (SD) was 33.0 (7.8) years as compared to 32.3 (7.7) years in the eligible population. The proportion of women among the participants was slightly higher than in the source population (51.2% *vs.* 48.2%, respectively). The study was approved by the local ethics committee.

Questionnaire. In order to assess QoL, a 77-item questionnaire was used that included the Short Form 12 Health Survey (SF-12). This 12-item instrument is a short form of the most widely used SF-36 Health Survey [7]. By this means, QoL was measured and transferred into a comparable scale with reference values for the general population.

For socio-demographic characteristics and respiratory health, the selected items were taken from the ECRHS questionnaire [5, 21]. Exposure to livestock odours in the living environment was assessed on a 4 point scale ranging from “not at all“ to “extremely“.

All questions were taken from pre-existing validated questionnaire instruments. Additionally, the reliability of the questionnaire was tested on a group of 52 inhabitants from a small town in the studied region. All questions used for this analysis were shown to have “good” to “very good” reliability [3].

Table 1. Descriptive data.

N = 2745[1]	Mean	Range
Age (years)	32.7	18–44
Physical SF-12 score	52.4	14–67
Emotional SF-12 score	49.8	10–64
Time at home (hours/week)	101.0	1–168
	n	%
Male gender	1,346	49.0
12+ years of schooling	643	23.8
Current smokers	911	33.5
Living on a farm	432	15.8
Nasal allergies	366	13.5
Odour annoyance		
• Not at all	1,057	39.0
• A little	1,267	46.8
• Very much	270	10.0
• Extremely	115	4.2

[1]Due to missing data in some of the predictors the numbers do not necessarily add up to 2,745.

Statistical analysis. Crude means and 95% confidence intervals of the physical and emotional SF-12 scores were calculated for each level of odour annoyance. Additionally, multiple linear regression models were carried out using the most parsimonious model. The models utilized the following parameters as predictor variables: age, gender, smoking habits, level of education, current living on a farm, nasal allergies, time spent per week in the home environment, and level of odour annoyance. Statistical analyses were carried out using SPSS statistical package.

RESULTS

Descriptive data are given in Table 1. SF-12 scores were available for 2,745 of the 3,112 participants (88.2%). Forty-nine percent of them were male, the mean age was 33 years. About 16% of the participants were currently living on a farm. Sixty-one percent of the respondents complained about unpleasant odours and 91% of these accused livestock as source of these odours. The mean physical (52.4) and emotional (49.8) SF-12 scores were within the range for the general population. Living on a farm was weakly associated with a lower level of odour annoyance (not at all annoyed: 43.5% *vs.* 38.2%, respectively).

As shown in Figure 1, the mean physical and emotional SF-12 scores decreased significantly with increasing self-reported level of odour annoyance in the home environment. These results were confirmed in the multiple linear regression model (Tab. 2). Level of odour annoyance was the strongest predictor of physical SF-12 scores. Additionally, physical SF-12 scores were significantly decreased for participants with higher age, nasal allergies, and longer

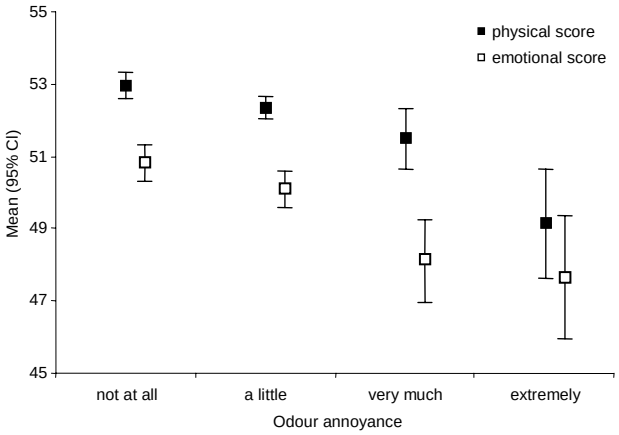

Figure 1. Mean (95% CI) SF-12 scores by level of odour annoyance (N = 2,709).

stay in the home environment during the week. Physical SF-12 scores were significantly higher for subjects currently living on a farm and with a higher level of education.

With respect to emotional QoL scores, higher level of annoyance and female gender were the most important predictors of lower SF-12 scores. Additionally, current smoking, higher level of education, and self-reported nasal allergies were significantly associated with reduced emotional SF-12 scores. Those living on a farm reported significantly higher scores.

DISCUSSION

The results of our study indicated that self-assessed level of odour annoyance is a strong negative predictor of QoL assessed by SF-12.

The main advantages of our study are the reasonable response rate, the large number of subjects included, as well as the use of a validated, standardised means to assess QoL. Using this instrument, we could confirm most of the known factors associated with QoL, such as age, gender, respiratory symptoms, smoking [7]. However, only 6% of the variance were explained by the models.

Livestock odours might vary from day to day, and by time of the year. Besides the current level of exposure to livestock odours, the level of annoyance reported by the participants might depend on past levels of exposure to livestock odours, on the time spent in the home environment, as well as on the personal attitude of the respondents towards these odours [17]. The latter, e.g. can be seen by the fact that farmers and farm workers reported significantly more often to be not at all annoyed by livestock odours (52.4% *vs.* 38.3%, respectively). Therefore, the level of odour annoyance might actually reflect the level of concern more than the actual level of exposure.

With respect to QoL, the self-assessed level of odour annoyance was the most significant predictor. Similar results on unspecific symptoms and QoL have been shown in some earlier studies [17, 18, 24]. However, within these cross-sectional epidemiological studies no causal relationship can be proved.

Table 2. Predictors of physical and emotional SF-12 scores. Results of the multiple linear regression models.

N = 2468	Physical SF-12 score β (95% β)	Emotional SF-12 score β (95% β)
R^2	0.06	0.06
Age (years)	-0.08	0.05
	-0.11; -0.04	0.002; 0.09
Female gender	0.43	-3.05
	-0.06; 0.93	-3.75; -2.35
Current smokers	-0.32	-1.59
	-0.86; 0.21	-2.34; -0.83
Ex-smokers	0.06	-1.07
	-0.59; 0.71	-1.99; -0.15
12+ years of schooling	0.73	-1.51
	0.18; 1.28	-2.30; -0.73
Living on a farm	0.80	1.44
	0.16; 1.43	0.54; 2.35
Nasal allergies	-2.67	-1.44
	-3.34; -1.99	-2.40; -0.48
Time at home (hours/week)	-0.02	-0.002
	-0.02; -0.01	-0.01; 0.01
Odour annoyance:		
A little	-0.66	-1.12
	-1.16; -0.16	-1.83; -0.40
Very much	-1.35	-2.27
	-2.16; -0.53	-3.43; -1.11
Extremely	-3.47	-2.56
	-4.66; -2.28	-4.25; -0.87

While the level of odour annoyance was inversely related to QoL, the prevalence of chronic respiratory diseases was reduced in the studied population, e.g. the prevalence of nasal allergies was only 13.5% as compared to 22.9% in the European Community Respiratory Health Survey in Hamburg [8]. In particular, those with regular contact to farming environments during childhood were at reduced risk for nasal allergies [12]. These results are in accordance with current findings that exposure to animal confinement houses might protect from atopic diseases [1, 4, 9, 14, 16, 22]. Among the factors discussed are endotoxins and infectious agents common in the farming environment [2, 15, 23]. Thus, with respect to respiratory symptoms, the population in question might be healthier than other populations. Nevertheless, some of the respondents were concerned about negative health effects of exposure to the agents derived from livestock. As described by Smith, emotional well-being has a larger impact on QoL than physical health [20]. Therefore, a better risk communication might decrease the level of concern among the neighbouring residents of intensive livestock production facilities and therefore improve QoL.

CONCLUSIONS

Subjects who are annoyed by livestock odours might have a decreased QoL as measured by SF-12. Therefore, a better risk communication might improve the physical and emotional well-being of the concerned sections of the population living in close proximity to intensive livestock production facilities.

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