Original Article

# Social Gradients in Myocardial Infarction and Stroke Diagnoses in Emergency Medicine

An Analysis of Socioeconomic Regional Disparities in a German City

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## Summary

Background: Persons of lower socio-economic status are at higher risk of disease, especially with respect to severe and chronic illnesses. To date, there have not been any studies with large case numbers regarding acute medical emergencies in this population.

Methods: In a retrospective study, data were obtained on all cases treated by emergency physicians in Bochum, Germany, in 2014/2015, including the diagnoses that were made by the emergency physicians. There were a total of 16 767 cases. The local unemployment rate was taken as an indicator of the socioeconomic situation of a neighborhood; it was defined as the percentage of registered unemployed persons among persons aged 15 to 64 with their domicile in the neighborhood. 12 168 cases were grouped by emergency medical diagnosis and analyzed with respect to the three most heavily represented diagnostic categories (cardiovascular, neurological, and pulmonary emergencies), which accounted for nearly two-thirds of all diagnoses.

Results: The overall rates of deployment involving emergency physicians were found to be positively correlated with the unemployment rate. After adjustment for age, sex, and possible confounders, this correlation was statistically significant ($p<0.01$). The indirectly standardized rate ratio (IRR) for the overall case-activity rate ranged from 0.841 (95% confidence interval: [0.808; 0.875]) with less than 5% unemployment to 1.212 [1.168; 1.256] with 9.5% unemployment or higher. The same finding was obtained with respect to diagnosis-specific case activity in each of the three main diagnostic categories (cardiovascular, neurological, and pulmonary emergencies), as well as for the respective commonest individual diagnoses (acute coronary syndrome/circulatory arrest [1498 cases], transient ischemic attack/ischemic stroke/intracerebral hemorrhage [1274 cases], and asthma/chronic obstructive pulmonary disease [663 cases]).

Conclusion: This study shows that the case-activity rate of the emergency medical services is significantly higher in socially disadvantaged neighborhoods, both with respect to total numbers and with respect to individual diseases. It demonstrates a problem affecting society as a whole, which should be taken into account in the organization of medical rescue services.

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The rescue services form the basis of emergency medical care for the German population and thus represent a cornerstone of health care in this country (1, 2). The system ensures that qualified and well-equipped medical personnel arrive at the accident site within a defined time (3). The number of calls answered by the German emergency rescue services has risen constantly in recent years. A total of 10 317 910 deployments were registered in the years 2000/2001, but by 2012/2013 the figure for the same period of time was 12 014 442 (4). The reasons for this increase are many and varied, and have been the subject of numerous analyses and discussions (5). Part of the growth can undoubtedly be explained by changes in disease incidence, accident patterns, and patient spectrum and requirements (6).

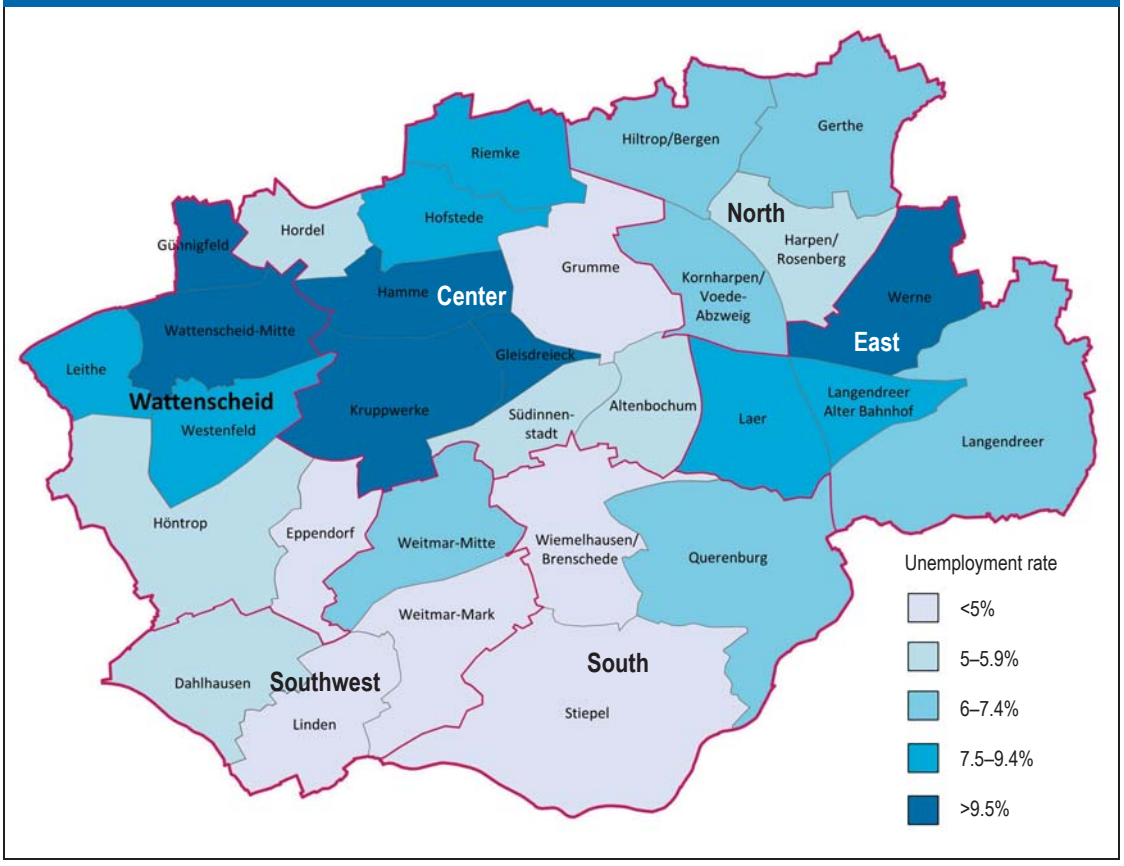
The number of people living in socially disadvantaged circumstances has risen sharply over the past 20 years. One of the markers for this trend is the proportion of the population who are poor or threatened by poverty, now up to 14%. The group of people that have no savings or are in debt has also grown in this period, as has the proportion of workers with short-term contracts and low pay (Federal Ministry of Labor and Social Affairs [7]). Furthermore, these disadvantages are clustered in particular population segments, regions, and urban districts.

The tendency for persons with low socioeconomic status to be at greater risk of illness applies particularly to serious diseases that often require long-term care, such as coronary heart disease, diabetes mellitus, chronic bronchitis, and many types of cancer (8, 9). The same is true for depression, anxiety disorders, and other mental illnesses, as well as for accidental injuries and functional limitations in performance of daily activities (10, 11).

Alongside an unhealthy lifestyle—typically little exercise, high calorie intake and imbalanced diet, smoking, and alcohol consumption—greater stresses and risks in the workplace, at home, in the family and among friends may well be responsible for the higher risk of sickness and early death (12, 13).

Ideally, composition effects and context effects are differentiated when explaining regional differences in health (14). Composition effects arise from

FIGURE




Distribution of unemployment in Bochum
(data © OpenStreetMap participants | cartography © grebemaps.de | artwork adapted by Alexander Haschemi)

differences among populations, e.g., in age structure, sex distribution, or socioeconomic status. Context effects are rooted in characteristics of the region itself that may act independently of the composition of the population. This may encompass factors such as the regional infrastructure with regard to transport, shops, and health care, the quality of available housing, and also stress caused by the environment, criminal activity, and so on. However, differentiation of the two types of effects tends to be theoretical, as in real life composition and context often interact. High-status members of the population move to better-appointed areas or bring about an improvement in the facilities and infrastructure of previously disadvantaged urban districts or regions (15).

Against this backdrop, we set out to investigate the socioeconomic regional variation in deployment of emergency physicians in Bochum, a city in the Ruhr Valley. All initial diagnoses by emergency physicians in Bochum in 2014 and 2015 were included, this being the most recent 2-year period for which complete data were available. The three groups of most commonly occurring principal diagnoses, namely cardiovascular, neurological, and pulmonary disease, were evaluated separately. Furthermore, the specific diagnoses acute coronary syndrome/cardiocirculatory arrest, transient ischemic attack (TIA)/insult/intracerebral bleeding (ICB), and asthma/exacerbated chronic obstructive pulmonary disease (COPD) were analyzed. Around two thirds of all deployments were accounted for by the three above-mentioned groups of principal diagnoses.

In order to be able to demonstrate socioeconomic regional variation, the data were analyzed by district and the 30 districts making up the city of Bochum were divided into five socioeconomic groups according to unemployment rate (percentage of population receiving unemployment benefit I).

## Method

### Data acquisition

This retrospective study embraces all emergency physician deployments in Bochum documented in emergency rescue service records between 1 January 2014 and 31 December 2015. Deployments of physicians from the out-of-hours service of the regional Association of Statutory Health Insurance Physicians were not included.

TABLE 1

**Emergency physician deployments in Bochum in 2014/2015: case numbers and characteristics of persons involved by socioeconomic status (unemployment rate in urban district of residence)**

| Deployments 2014/2015 | Unemployment rate in district | | | | | Overall |
|---|---|---|---|---|---|---|
| | Under 5% | 5 to <6% | 6 to <7.5% | 7.5 to <9.5% | 9.5% or more | |
| Total deployments n (%) | 2447 (100.0) | 2302 (100.0) | 2861 (100.0) | 1685 (100.0) | 2873 (100.0) | 12 168 (100.0) |
| Women n (%) | 1227 (50.1) | 1223 (53.1) | 1421 (49.7) | 869 (51.6) | 1458 (50.7) | 6198 (50.9) |
| Age, median (IQR) | 76 (64–84) | 75 (61–83) | 75 (58–83) | 73 (56–82) | 71 (54–82) | 74 (58–83) |
| Injury n (%) | 188 (7.7) | 187 (8.1) | 239 (8.4) | 112 (6.6) | 215 (7.5) | 941 (7.7) |
| Resuscitation n (%) | 102 (4.2) | 87 (3.8) | 104 (3.6) | 72 (4.3) | 90 (3.1) | 455 (3.7) |
| Transport n (%) | 2076 (84.8) | 1967 (85.4) | 2460 (86.0) | 1423 (84.5) | 2435 (84.8) | 10 361 (85.1) |
| Disease group | | | | | | |
| Cardiovascular disease n (%) | 805 (32.9) | 746 (32.4) | 896 (31.3) | 512 (30.4) | 863 (30.0) | 3822 (31.4) |
| Neurological disease n (%) | 465 (19.0) | 457 (19.9) | 543 (19.0) | 307 (18.2) | 574 (20.0) | 2346 (19.3) |
| Pulmonary disease n (%) | 274 (11.2) | 239 (10.4) | 327 (11.4) | 219 (13.0) | 329 (11.5) | 1388 (11.4) |
| Metabolic, hormonal, and nutritional disorders n (%) | 180 (7.4) | 202 (8.8) | 228 (8.0) | 133 (7.9) | 238 (8.3) | 981 (8.1) |
| Surgical disease n (%) | 179 (7.3) | 154 (6.7) | 216 (7.5) | 111 (6.6) | 188 (6.5) | 848 (7.0) |
| Psychiatric disease n (%) | 53 (2.2) | 38 (1.7) | 61 (2.1) | 36 (2.1) | 63 (2.2) | 251 (2.1) |
| (Pre-)final status n (%) | 228 (9.3) | 203 (8.8) | 230 (8.0) | 160 (9.5) | 259 (9.0) | 1080 (8.9) |
| Unspecified/other/unknown n (%) | 263 (10.7) | 263(11.4) | 360 (12.6) | 207 (12.3) | 359 (12.5) | 1452 (11.9) |
| Individual diagnoses (selected) | | | | | | |
| Acute coronary syndrome/ cardiocirculatory arrest n (%) | 328 (13.4) | 293(12.7) | 338 (11.8) | 202 (12.0) | 337 (11.7) | 1 498 (12.3) |
| TIA/insult/ICB n (%) | 280 (11.4) | 259(11.3) | 299 (10.5) | 169 (10.0) | 267 (9.3) | 1274 (10.5) |
| Asthma/COPD n (%) | 114 (4.7) | 104(4.5) | 157 (5.5) | 125 (7.4) | 163 (5.7) | 663 (5.4) |

COPD, chronic obstructive pulmonary disease; ICB, intracerebral bleeding; IQR, interquartile range; TIA, transitory ischemic attack

The documentation followed the stipulations of the German Interdisciplinary Association for Intensive Care and Emergency Medicine (*Deutsche Interdisziplinäre Vereinigung für Intensiv- und Notfallmedizin*, DIVI) and contained the following data:

- The patient's name, address, and date of birth
- Deployment number and call-out keyword
- Site of deployment and transport destination
- Times (call-out, transfer, and end of deployment)
- Employee number(s) of emergency service personnel for identification
- Initial findings (Glasgow Coma Scale [GCS], blood pressure, heart rate, blood sugar, respiratory rate, Oxygen saturation, ECG findings, information on breathing, mental state, and injuries)
- Reason for call-out/initial diagnosis
- Changes during the deployment
- Interventions, transfer, result.

Sex, date of birth, address, and suspected diagnoses, among other deployment-related data, were filtered out of the paper documentation and entered into an external, password-protected database in the form of an Excel spreadsheet (Microsoft Office 365, Excel 2013). The urban district could be assigned retrospectively on the basis of the address.

In each of the 30 districts of Bochum, the unemployment rate (proportion of population aged 15 to 64 years with principal residence in Bochum registered as unemployed), as published by Bochum City Council (16), was used as indicator of the socioeconomic situation.

Other available indicators showed high correlation (see "Limitations") and are therefore not reported here.

The study was approved by the ethics committee of the University of Bochum (registration number 16–5828-BR).

### Inclusion criteria

A total of 16 767 rescue service deployments involving an emergency physician took place in 2014 and 2015. We included only those deployments for which complete data were available, allowing identification of the site and thus the urban district. This was the case for 16 503 deployments (98.4% of the total).

**TABLE 2**

**Emergency physician deployments in Bochum in 2014/2015: deployment rates per year and 1000 inhabitants overall and by emergency physician's diagnosis (disease groups and most frequently assigned diagnoses)**

| Deployments 2014/2015 | Number of deployments (n) | Crude deployment rate per year and 1000 inhabitants | [95% CI] |
|---|---|---|---|
| Deployments (including excluded call-outs) | 16 767 | 22.94 | [22.46; 23.43] |
| Deployments overall | 12 168 | 16.65 | [16.24; 17.07] |
| Disease group | | | |
| Cardiovascular disease | 3822 | 5.23 | [5.00; 5.47] |
| Neurological disease | 2346 | 3.21 | [3.03; 3.40] |
| Pulmonary disease | 1388 | 1.90 | [1.76; 2.05] |
| Metabolic, hormonal, and nutritional disorders | 981 | 1.34 | [1.22; 1.47] |
| Surgical disease | 848 | 1.16 | [1.05; 1.28] |
| Psychiatric disease | 251 | 0.34 | [0.28; 0.41] |
| (Pre-)final status | 1080 | 1.48 | [1.36; 1.61] |
| Unspecified/other/unknown | 1452 | 1.99 | [1.85; 2.14] |
| Individual diagnoses (selected) | | | |
| Acute coronary syndrome/ cardiocirculatory arrest | 1498 | 2.05 | [1.91; 2.20] |
| TIA/insult/ICB | 1274 | 1.74 | [1.61; 1.88] |
| Asthma/COPD | 663 | 0.91 | [0.81; 1.01] |

CI, confidence interval; COPD, chronic obstructive pulmonary disease; ICB, intracerebral bleeding; TIA, transitory ischemic attack

Call-outs in which the deployment site did not correspond to the district of residence were excluded from analysis. Only for persons attended in their home district could a (indirect) conclusion regarding socioeconomic status be drawn, based on the district-level aggregation of data. This reduced the number of evaluable deployments to 12 198.

In another 30 deployments the age or sex of the person attended had not been documented. These cases too had to be excluded, as they would have hampered geographical comparability with regard to socioeconomic circumstances. Therefore, 12 168 deployments (72.6% of the total) remained for analysis *(eTable 1)*.

### Analysis and statistics

The 30 urban districts were pragmatically divided into quintiles according to unemployment rate (indicator for local socioeconomic circumstances), resulting in five classes each containing six districts. Altogether, the rate of unemployment ranged from 2.4 to 12.6% *(Figure)*. To describe the persons attended in the course of the emergency medical deployments, qualitative variables were expressed in terms of absolute frequencies (n) and percentages (%), quantitative variables by median and interquartile range (IQR). The chi-square and Kruskal–Wallis tests were used to uncover differences among the socioeconomic classes. Correlations were determined using Pearson's correlation coefficient. For each socioeconomic class we calculated crude deployment rates (per year and 1000 inhabitants) and exact 95% confidence intervals according to Clopper and Pearson.

The crude deployment rates were indirectly standardized by age and sex in order to obtain data that were independent of age and sex structure and therefore comparable (17). To this end, the expected number of deployments was calculated on the basis of the number of observed deployments in the socioeconomic classes, under the assumption that the age and sex distributions would correspond to those for the city of Bochum as a whole (standard population).

The ratio of expected to observed values was determined. This parameter is called the indirect rate ratio (IRR). Values under 1 are classified as below average and values over 1 as above average in comparison with the deployment rates in a population with the sex and age distribution of Bochum as a whole. Asymptotic 95% confidence intervals were also calculated (17).

A Cochran–Armitage test for trend was used to verify the hypothesis that lower socioeconomic status in a given urban district is associated with a higher deployment rate (18). The general level of significance was set at 5%.

The deployments were grouped according to initial diagnosis, and analyses of the three largest major groups (cardiovascular, neurological, and pulmonary diseases) *(Table 1)* were carried out.

Furthermore, the same calculations were performed for the most frequently recorded suspected

TABLE 3

**Emergency physician deployments and socioeconomic status (unemployment rate in urban district) overall and for cardiovascular, neurological, and pulmonary disease***

| Disease group | Unemployment rate | IRR [95% CI] |
|---|---|---|
| Overall | <5% | 0.841 [0.808; 0.875] |
| | 5 to <6% | 0.933 [0.895; 0.971] |
| | 6 to <7.5% | 0.996 [0.959; 1.032] |
| | 7.5 to <9.5% | 1.088 [1.036; 1.140] |
| | 9.5% or more | 1.212 [1.168; 1.256] |
| Cardiovascular disease | <5% | 0.864 [0.805; 0.924] |
| | 5 to <6% | 0.954 [0.885; 1.022] |
| | 6 to <7.5% | 0.997 [0.932; 1.063] |
| | 7.5 to <9.5% | 1.057 [0.966; 1.149] |
| | 9.5% or more | 1.189 [1.109; 1.268] |
| Neurological disease | <5% | 0.835 [0.759; 0.911] |
| | 5 to <6% | 0.964 [0.876; 1.053] |
| | 6 to <7.5% | 0.977 [0.895; 1.059] |
| | 7.5 to <9.5% | 1.026 [0.911; 1.141] |
| | 9.5% or more | 1.247 [1.145; 1.349] |
| Pulmonary disease | <5% | 0.819 [0.722; 0.916] |
| | 5 to <6% | 0.848 [0.740; 0.956] |
| | 6 to <7.5% | 0.998 [0.890; 1.107] |
| | 7.5 to <9.5% | 1.237 [1.073; 1.401] |
| | 9.5% or more | 1.231 [1.098; 1.364] |

* Age- and sex-standardized indirect rate ratio (IRR) and 95% confidence interval (CI)

diagnosis in each of these three major groups. For the cardiovascular, neurological, and pulmonary emergencies these were, respectively, acute coronary syndrome/cardiocirculatory arrest, TIA/insult/ICB, and asthma attack/exacerbated COPD.

The software package SAS (SAS Institute Inc., Cary, NC, USA; version 9.4) was used for all calculations.

## Results

A total of 12 168 deployments were included in our analyses. The patients' overall median age was 74 years (range 58 to 83). Altogether, approximately equal numbers of men and women were involved (49.1% versus 50.9%). The proportion of call-outs for women varied from 49.7% to 53.1% among the different socioeconomic classes, and the median age also showed a trend towards association with the socioeconomic status of the residential district.

Overall, 7.7% of deployments involved an injury, resuscitation was carried out in 3.7% of call-outs, and in 85.1% of cases the patient was transported to the hospital. Only the median age differed significantly between socioeconomic classes ($p<0.01$) *(Table 1)*.

The total of 16 767 emergency physician deployments corresponded to 22.94 [22.46; 23.43] per year and 1000 inhabitants. For the included cases, the deployment rate per year and 1000 inhabitants was 16.65 [16.24; 17.07]. For cardiovascular disease the rate was 5.23 [5.00; 5.47], for neurological disease 3.21 [3.03; 3.40], and for pulmonary disease 1.90 [1.76; 2.05] *(Table 2)*.

The IRR showed consistent findings *(Figure, Table 3)*: For all deployments, the IRR was 0.841 for an unemployment rate of under 5%, rising to 1.212 for an unemployment rate of 9.5% or more. For cardiovascular disease the rate increased from 0.864 to 1.189 (acute coronary syndrome and cardiocirculatory arrest: from 0.903 to 1.179). For neurological disease the IRR rose from 0.835 to 1.247 with increasing unemployment rate (TIA/insult/ICB: from 0.890 to 1.122). Finally, the same trend was seen for pulmonary disease, where the IRR rose from 0.819 to 1.231 (asthma attack and exacerbated COPD: from 0.708 to 1.299) *(Table 4)*.

Lower socioeconomic status in a given district thus goes together with more frequent call-out of the emergency services. This trend was consistently significant ($p<0.01$).

TABLE 4

**Emergency physician deployments and socioeconomic status (unemployment rate in urban district) for the diagnoses acute coronary syndrome/cardiocirculatory arrest, TIA/insult/ICB, and asthma attack/exacerbated COPD**

| Diagnosis | Unemployment rate | IRR [95% CI]* |
|---|---|---|
| Acute coronary syndrome/cardiocirculatory arrest | <5% | 0.903 [0.805; 1.001] |
| | 5 to <6% | 0.959 [0.850; 1.069] |
| | 6 to <7.5% | 0.961 [0.859; 1.064] |
| | 7.5 to <9.5% | 1.052 [0.907; 1.197] |
| | 9.5% or more | 1.179 [1.053; 1.305] |
| TIA/insult/ICB | <5% | 0.890 [0.786; 0.994] |
| | 5 to <6% | 0.988 [0.868; 1.108] |
| | 6 to <7.5% | 0.998 [0.885; 1.111] |
| | 7.5 to <9.5% | 1.059 [0.900; 1.219] |
| | 9.5% or more | 1.122 [0.987; 1.256] |
| Asthma attack/exacerbated COPD | <5% | 0.708 [0.578; 0.838] |
| | 5 to <6% | 0.768 [0.620; 0.915] |
| | 6 to <7.5% | 1.008 [0.850; 1.165] |
| | 7.5 to <9.5% | 1.466 [1.209; 1.723] |
| | 9.5% or more | 1.299 [1.100; 1.498] |

* Age- and sex-standardized indirect rate ratio (IRR) and 95% confidence interval (CI)
COPD, chronic obstructive pulmonary disease; ICB, intracerebral bleeding; TIA, transitory ischemic attack

## Discussion

Our aim in carrying out this study was to ascertain to what extent the number of emergency physician deployments is associated with the socioeconomic circumstances prevailing in the residential area involved.

We found that the number of deployments rises significantly with increasing unemployment rate. This observation supports the impressions reported by individual emergency physicians and rescue service personnel that they are more often called out to socially disadvantaged areas. The literature contains only a small number of studies on the association between consumption of emergency medical services and socioeconomic structures (19). Indeed, there are no data at all for the past 10 years in Germany. Moreover, the existing earlier studies mainly had low case numbers. To our knowledge, no social structure–related analysis of the link between social status and individual disease groups and diagnoses has yet been carried out.

A social structure atlas of Berlin (2003) shows that the overall number of deployments of emergency services (with or without involvement of an emergency physician) is higher in districts with unfavorable social circumstances. No detailed analysis of emergencies or areas of residence was carried out (20).

In a study published in 2002, Luiz et al. (21) analyzed 2576 deployments of emergency physicians in the German city of Kaiserslautern in 1997. They found a close correlation between call-outs in a given area and persons who were receiving assistance with living costs according to the Federal Social Assistance Act. Moreover, psychiatric emergencies occurred significantly more often in persons whose medical insurance contributions were paid by the social welfare office. Our study did not demonstrate a connection between psychiatric emergencies and social status *(Table 1)*.

In another German city, Münster, Engel et al. (22) analyzed the 2293 emergency physician deployments in the year 2006 to compare the four districts with the highest and the four districts with the lowest socioeconomic status, as determined by rates of unemployment and social assistance. The number of call-outs was significantly higher in the socially disadvantaged districts.

The comparability of our survey with the above-mentioned investigations is limited: the studies by both Luiz et al. (21) and Engel et al. (22) differ from the Bochum data with respect to number of inhabitants, population density, and structural characteristics.

At the time of investigation, Bochum had 365 406 inhabitants, compared with 272 000 in Münster and 108 866 in Kaiserslautern. The population density in Bochum, Münster, and Kaiserslautern was, respectively, 2504, 963, and 778 inhabitants per $km^2$. There were also differences in transport distances, hospital locations, and emergency service procedures, and some aspects of the emergency service system have seen fundamental changes in the past 10 to 20 years. Furthermore, the unemployment rates at the time of investigation differed widely: 10.1% in Bochum, 8.4% in Münster, and 17.7% in Kaiserslautern (23).

The annual rate of deployment of emergency physicians in the study period differed, sometimes considerably (22.9/1000 inhabitants in Bochum, 16.9/1000 inhabitants in Münster, wide variation from 12.9 to 33.7/1000 inhabitants in Kaiserslautern. Within Germany the rate of deployment involving an emergency physician varies according to settlement and regional structure (in rural areas 38.7/1000 inhabitants, in more densely populated areas 29.7/1000 inhabitants, recently increasing year on year (Federal Highway Research Institute). The national average rate of deployment involving an emergency physician in 2012 was 32.3/1000 inhabitants (4).

Despite the fundamental differences in study design, all three studies point to increased deployment of emergency physicians in socially disadvantaged areas.

### Limitations

In order to draw conclusions about social differences, we needed socioeconomic regional indicators. Information about the individual patients (education level, occupational status, or income) was not available, and the area of residence is not a reliable pointer to social circumstances at the individual level.

We therefore used the unemployment rate as an indicator of the socioeconomic structure of a given urban district. Luiz et al. (21) and Engel et al. (22) also included recipients of unemployment benefit II, social assistance (Social Code, Book II), or a basic provision (§§ 41 ff. Social Code, Book XII) on grounds of age or reduced earning capacity, but we chose not to consider these factors because of their very high correlation with the unemployment rate ($r = 0.982$ [$p<0.01$]). Indicators available at district level, such as proportion of immigrants or proportion of pupils who switch from a lower-level high school to a *Gymnasium* (a high school that educates its pupils to university entrance level) (16) also correlate closely with the unemployment rate ($r = 0.716$; $p<0.01$ and $r = –0.782$; $p<0.01$, respectively) and were therefore not considered.

The part that might be played by potentially socioeconomically driven variation in mobility of the patients could not be examined. However, the proportion of included cases is noticeably low in the class of districts with the highest unemployment rate (65.9% versus 72.6% overall). Strikingly, the highest deployment rates were nevertheless found here (not standardized) *(eTable 2)*.

This study was based on the suspected diagnoses as documented by emergency physicians. Unfortunately, no comparison with hospital admission and discharge diagnoses was possible. For this reason, we performed an additional subgroup analysis of the deployments in which the patient was transported to the hospital, for which the presence of medical emergencies requiring hospital diagnosis and treatment can be assumed. The results of this sensitivity analysis closely resembled those presented in this article *(eTable 3)*.

## Key messages

- Persons with low socioeconomic status are at greater risk of severe, chronic illness.
- For various reasons, the number of emergency service deployments in Germany has been increasing continuously for a number of years (2012/2013: circa 12 million call-outs).
- The rate of deployment of emergency physicians at urban district level rises statistically significantly with increasing unemployment rate.
- This increase was also seen on analysis of the most frequently occurring disease groups (cardiovascular, neurological, and pulmonary disease) and of the most commonly diagnosed diseases in each of these groups (acute coronary syndrome/cardiocirculatory arrest, TIA/insult/intracerebral bleeding [ICB], and asthma/chronic obstructive pulmonary disease [COPD]).

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**Conflict of interest statement**
The authors declare that no conflicts of interest exist.

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► **Supplementary material**
**eTables:**
**www.aerzteblatt-international.de/18m0041**

Supplementary material to:

# Social Gradients in Myocardial Infarction and Stroke Diagnoses in Emergency Medicine

An Analysis of Socioeconomic Regional Disparities in a German City

by Christoph Hanefeld, Alexander Haschemi, Thomas Lampert, Hans J. Trampisch, Andreas Mügge, Janine Miebach, Cordula Kloppe, and Renate Klaaßen-Mielke

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**eTABLE 1**

**Included and excluded emergency physician deployments by disease group**

| Deployments Bochum 2014/2015 | Inclusion | | | | | | Overall (included and excluded deployments) | |
|---|---|---|---|---|---|---|---|---|
| | No | | | Yes | | | | |
| Disease group | n | Proportion of disease group (%) | Proportion of nonincluded deployments (%) | n | Proportion of disease group (%) | Proportion of included deployments (%) | n | % |
| Cardiovascular disease | 1493 | 28.1 | 32.5 | 3822 | 71.9 | 31.4 | 5315 | 31.7 |
| Neurological disease | 912 | 28.0 | 19.8 | 2346 | 72.0 | 19.3 | 3258 | 19.4 |
| Pulmonary disease | 254 | 15.5 | 5.5 | 1388 | 84.5 | 11.4 | 1642 | 9.8 |
| Metabolic, hormonal, and other nutritional disorders | 403 | 29.1 | 8.8 | 981 | 70.9 | 8.1 | 1384 | 8.3 |
| Surgical emergencies | 784 | 48.0 | 17 | 848 | 52.0 | 7.0 | 1632 | 9.7 |
| Psychiatric emergencies | 110 | 30.5 | 2.4 | 251 | 69.5 | 2.1 | 361 | 2.2 |
| Unspecified emergencies | 44 | 20.3 | 1.0 | 173 | 79.7 | 1.4 | 217 | 1.3 |
| (Pre-)final deployments | 90 | 7.7 | 2.0 | 1080 | 92.3 | 8.9 | 1170 | 7 |
| Other | 65 | 18.3 | 1.4 | 290 | 81.7 | 2.4 | 355 | 2.1 |
| Missing | 444 | 31.0 | 9.7 | 989 | 69 | 8.1 | 1433 | 8.5 |
| Total | 4599 | 27.4 | 100 | 12 168 | 72.6 | 100 | 16 767 | 100 |

**eTABLE 2**

**Included and excluded emergency physician deployments by socioeconomic class (unemployment rate in urban district)**

| Deployments Bochum 2014/2015 | Inclusion | | | | | | Overall (included and excluded deployments) | |
|---|---|---|---|---|---|---|---|---|
| | No | | | Yes | | | | |
| District unemployment rate | n | Proportion of deployments in socio-economic class (%) | Proportion of nonincluded deployments (%) | n | Proportion of deployments in socio-economic class (%) | Proportion of included deployments (%) | n | % |
| Unclassifiable | 264 | 100 | 5.7 | 0 | 0 | 0 | 264 | 1.6 |
| Under 5% | 832 | 25.4 | 18.1 | 2447 | 74.6 | 20.1 | 3279 | 19.6 |
| 5 to < 6% | 713 | 23.6 | 15.5 | 2302 | 76.4 | 18.9 | 3015 | 18 |
| 6 to <7.5% | 845 | 22.8 | 18.4 | 2861 | 77.2 | 23.5 | 3706 | 22.1 |
| 7.5 to <9.5% | 456 | 21.3 | 9.9 | 1685 | 78.7 | 13.8 | 2141 | 12.8 |
| 9.5% or more | 1489 | 34.1 | 32.4 | 2873 | 65.9 | 23.6 | 4362 | 26 |
| Total | 4599 | 27.4 | 100 | 12 168 | 72.6 | 100 | 16 767 | 100 |

**eTABLE 3**

**Comparison of indirect rate ratios (IRR)***

| Emergency physician deployments Bochum 2014/2015 | Unemployment rate | IRR (overall) | IRR (with transport) |
|---|---|---|---|
| Total deployments | Under 5% | 0.841 | 0.839 |
| | 5 to <6% | 0.933 | 0.937 |
| | 6 to <7.5% | 0.996 | 1.005 |
| | 7.5 to <9.5% | 1.088 | 1.079 |
| | 9.5% or more | 1.212 | 1.206 |
| Cardiovascular disease | Under 5% | 0.864 | 0.860 |
| | 5 to <6% | 0.954 | 0.949 |
| | 6 to <7.5% | 0.997 | 1.001 |
| | 7.5 to <9.5% | 1.057 | 1.067 |
| | 9.5% or more | 1.189 | 1.189 |
| Neurological disease | Under 5% | 0.835 | 0.841 |
| | 5 to <6% | 0.964 | 0.965 |
| | 6 to <7.5% | 0.977 | 0.968 |
| | 7.5 to <9.5% | 1.026 | 1.017 |
| | 9.5% or more | 1.247 | 1.256 |
| Pulmonary disease | Under 5% | 0.819 | 0.815 |
| | 5 to <6% | 0.848 | 0.839 |
| | 6 to <7.5% | 0.998 | 1.024 |
| | 7.5 to <9.5% | 1.237 | 1.224 |
| | 9.5% or more | 1.231 | 1.225 |

*For the included deployments (n = 12 168) and for the included deployments with transport (n = 10 361), overall and for cardiovascular, neurological, and pulmonary disease