

# Trends, disparities and geographical variation in outpatient antibiotic consumption – A population-based study

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## Background

- Antimicrobial overuse and misuse of broad-spectrum antibiotics increases the risk of antimicrobial resistance.
- Investigating unwarranted variation in antibiotic prescription has therefore gained global priority.

## Methods

- Complete individual-level data on all redeemed out-of hospital prescriptions for antibiotics in the entire adult population of Central Denmark (1.3 million inhabitants) during 2006-2015.
- Narrow spectrum antibiotics were defined as beta-lactamase sensitive penicillins (ATC-group J01CE), beta-lactamase resistant penicillins (J01CF), first-generation cephalosporins (J01DB) and macrolides (J01FA01).
- Broad-spectrum antibiotics included combinations of penicillins including beta-lactamase inhibitors (J01CR), penicillins with extended spectrum (J01CA), second-generation cephalosporins (J01DC), third-generation cephalosporins (J01DD), macrolides, lincosamides and streptogramins (J01F).
- Annual prescription rate of antibiotics was calculated as the number of inhabitants who filled at least one antibiotic prescription divided by the total cumulated person time in the observation year.

## Aim

- To examine trends in overall antibiotic use in the Central Denmark Region between 2006-2015.
- To examine time trends in the utilization of narrow- and broad-spectrum antibiotics as well as the variation in antibiotic use by sex, age, and municipality of residence.

## Results

- Following an initial increase of 2% between 2006 and 2011, the overall rate of redeemed prescriptions for antibiotics per 1,000 person years declined by 17% between 2011 and 2015, with a clear decrease among both sexes (FIGURE 1).
- The decrease since 2011 was mainly due to a decrease in narrow-spectrum antibiotic use (FIGURE 2). In 2015, broad-spectrum antibiotic use for the first time surpassed the use of narrow-spectrum antibiotics in Denmark, mainly related to increased use of combination penicillins with beta-lactamase inhibitors.
- A continuous increasing trend in broad-spectrum antibiotic use was observed among females aged  $\geq 65$  years and males aged  $\geq 85$  years (FIGURE 3). Overall antibiotic use increased with age and was clearly higher in women than men.
- A clear decline over time in overall antibiotic use was found in all municipalities with decreasing geographical variation (FIGURE 4). However, striking differences with two- to four-fold variation in the use of tetracycline, macrolides, and fluoroquinolones remained in 2015.

FIGURE 1. Prescribing rates of antibiotics per 1,000 person-years 2006 to 2015, overall (green) and stratified by sex (red = female; blue = male)

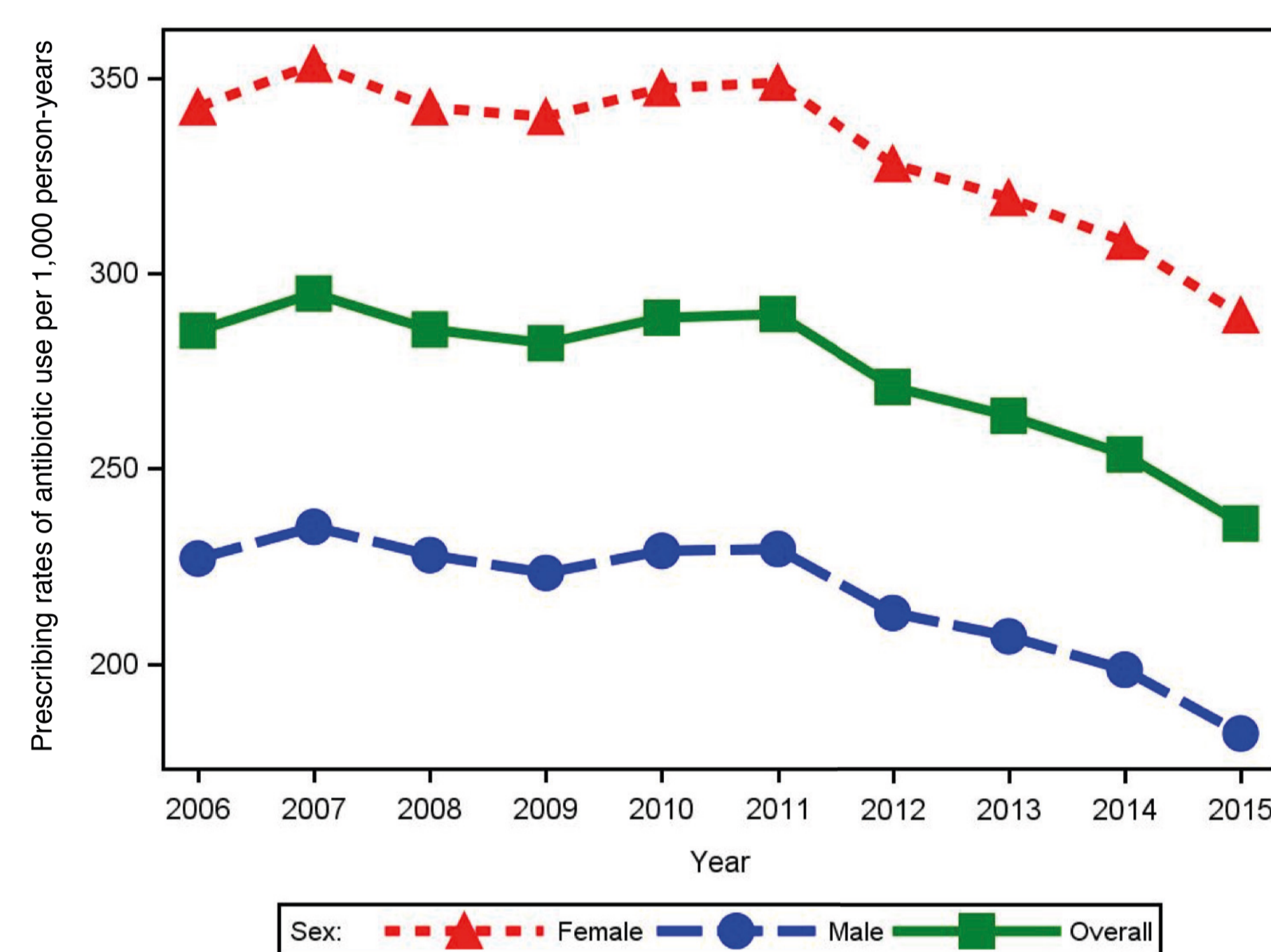


FIGURE 2. Prescribing rates of broad- and narrow-spectrum antibiotics per 1,000 person-years 2006 to 2015

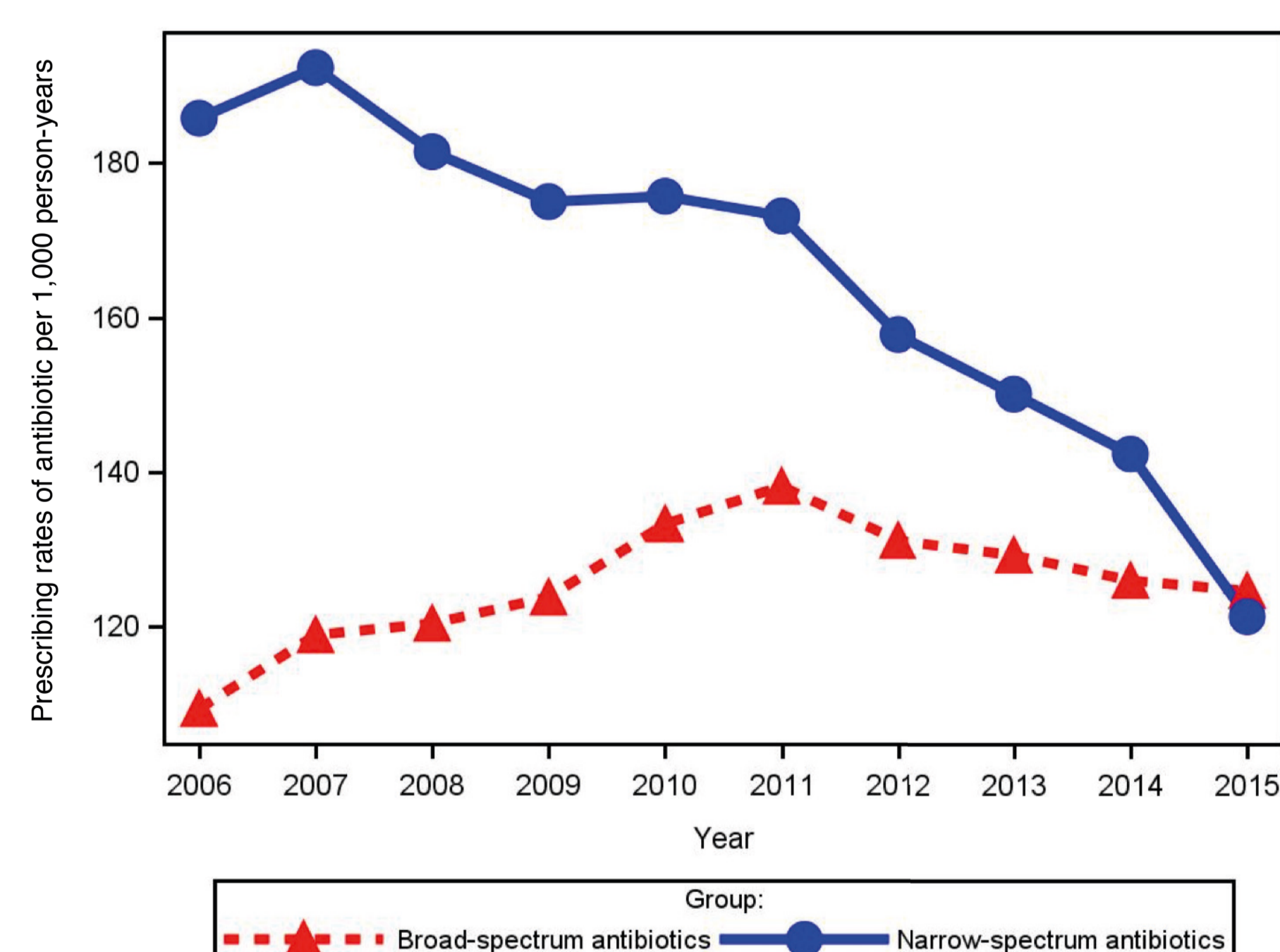


FIGURE 3. Prescribing rates of broad- and narrow-spectrum antibiotics per 1,000 person-years by sex and age group

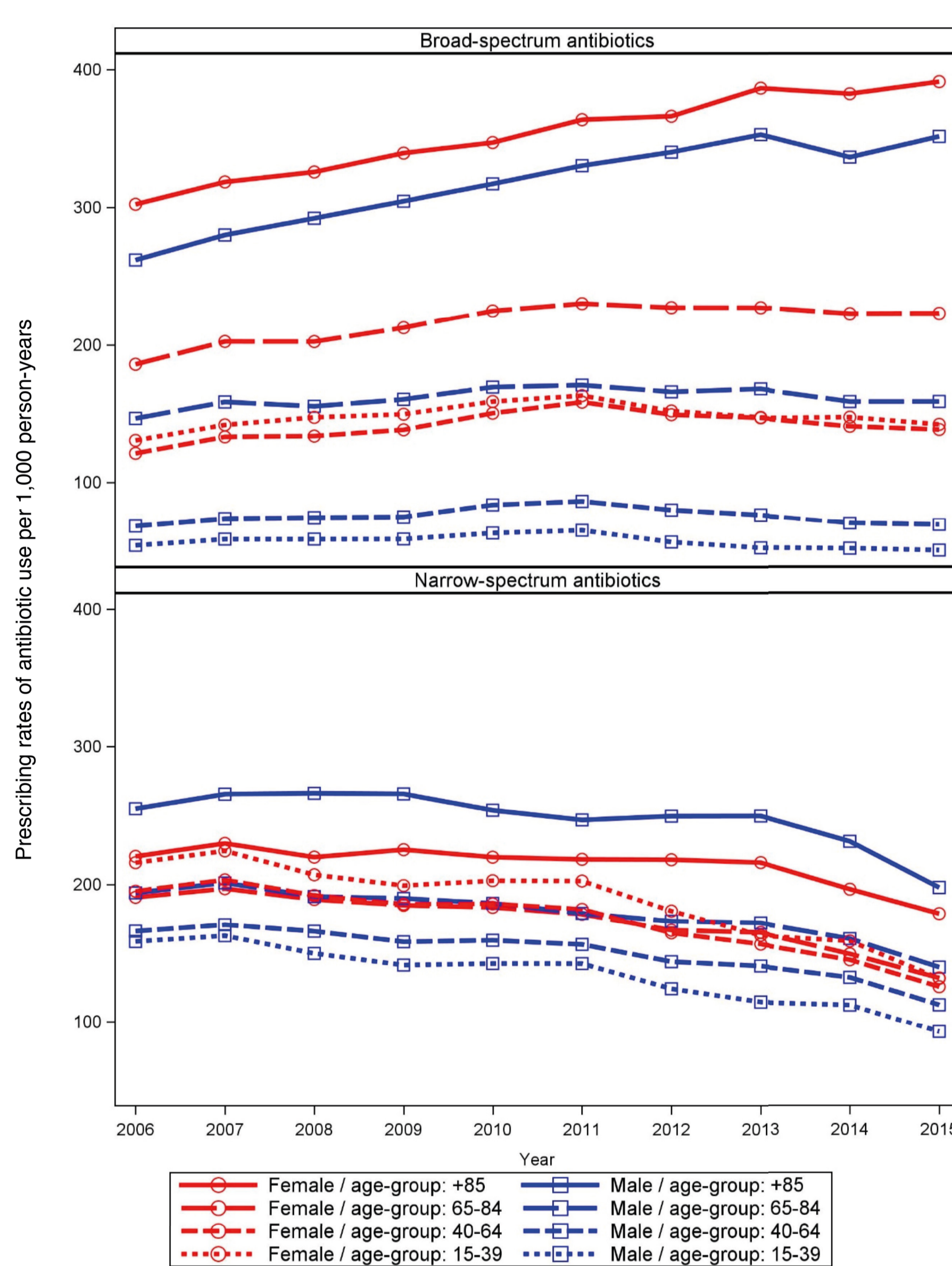
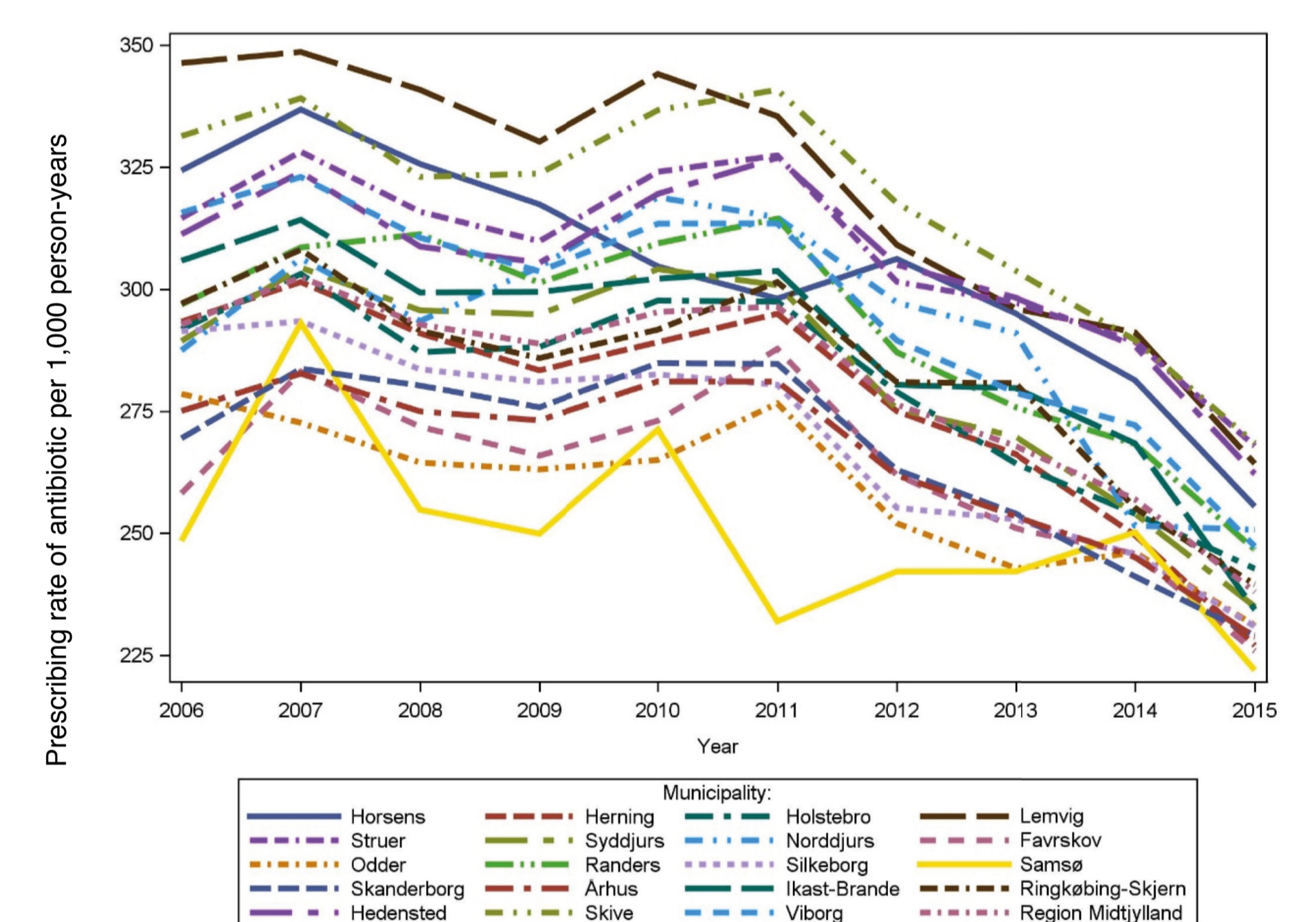


FIGURE 4. Age and sex standardized prescribing rate of antibiotics per 1,000 person-years by municipalities in Central Denmark Region



## CONCLUSION

Antibiotic use has decreased by 17% in Central Denmark after 2011. However, substantial geographical variation in antibiotic prescription remains and the use of broad-spectrum antibiotics has increased in adults of older age. There seems to be a continuous need for a more consistent and appropriate clinical practice and sustained attention in relation to the use of broad spectrum antibiotics, especially in adults of older age.

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