

# IMPROVING ANTIBIOTIC PRESCRIBING: INTRODUCTION OF PERIOPERATIVE ANTIBACTERIAL PROPHYLAXIS

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## Abstract

**Keywords:** interventions, policy, antibiotic use, perioperative antibacterial prophylaxis

**Country of focus** Russia

In the global surgical practice the issue of the need for a perioperative antibacterial prophylaxis (PABP) has been positively resolved in the late 1970s. PABP reduces the frequency of surgical infections and allows for reduction of antibiotic consumption, which is important for implementation of policies of containment of antimicrobial resistance in a hospital setting.

**The objective:** to evaluate effects of interventions introducing PABP at surgical departments

**Study design:** in 2007-2009 the following interventions were implemented: (1) PABP clinical protocols developed for various surgical departments and training workshops for physicians carried out (12/2007); (2) official order on implementation of PABP issued (10/2008) to address the organizational implications of the need to involve multidisciplinary team (surgeon, anesthesiologist and nursing staff); (3) changes in the list of drug prescriptions for registration of the first pre-operative antibiotic dose introduced (10/2008); (4) audit and feedback implemented since 07/2008. Evaluation of changes in antibiotic use was carried out on quarterly basis by analysing changes in antibiotic consumption (hospital pharmacy data) using ATC/DDD methodology. Antibiotic consumption was measured as the number of defined daily doses per 100 bed-days (DDD/100 bed-days). Two surgical departments were chosen for detailed monitoring: vascular surgery and traumatology.

**Results and lessons learned:** In 2009 as compared with 2007 antibiotic consumption at the department of vascular surgery decreased by 13 DDD/100 bed-days and became 14 DDD/100 bed-days, at the department of traumatology – decreased by 8 DDD/100 bed-days and became 11 DDD/100 bed-days. The range of prescribed antibiotics changed. Consumption of cephalosporins I-II, proven drugs of choice for PABP, increased at the department of vascular surgery from 7% to 57% ( $P<0.05$ ) of total antibiotic consumption, at the department of traumatology – from 27% to 64% ( $P<0.05$ ). Consumption of cephalosporins III largely decreased. Despite the use of more expensive cefuroxime, total antibiotic expenditures did not change.

**Policy relevance or importance to public health or clinical medicine:** active implementation of PABP policies, involving various interventions, allowed to improve antibiotic use in surgical practice.

## Introduction

It is well recognized that perioperative antibacterial prophylaxis (PABP) is an important part of surgical care. PABP reduces the frequency of surgical infections<sup>1</sup> and allows for reduction of antibiotic consumption.

Despite the existence of a large number of recommendations, the principles of PABP are not always used in surgical practice in hospitals Russia<sup>2,3</sup>. Irrational use of antibiotics (including non-compliance with PABP) in surgical practice may contribute to the development of antimicrobial resistance.

Introduction of new approaches to treatment in clinical practice is a challenge. Usually there are several factors determining the inconsistency of real practice and modern approaches to therapy<sup>4,5</sup>. Strategies including different types of interventions are the most effective because they allow to overcome various types of barriers<sup>6,7</sup>.

## Problem Addressed

The aim was to evaluate effects of interventions introducing PABP at surgical departments

## Methods

In 2007-2009 the following interventions were implemented:

1. PABP clinical protocols developed for various surgical departments and training workshops for physicians carried out (12/2007)
2. official order on implementation of PABP issued (10/2008) to address the organizational implications of the need to involve multidisciplinary team (surgeon, anesthesiologist and nursing staff)
3. changes in the list of drug prescriptions for registration of the first pre-operative antibiotic dose introduced (10/2008)
4. audit and feedback implemented since 07/2008.

Evaluation of changes in antibiotic use was carried out on quarterly basis by analysing changes in antibiotic consumption (hospital pharmacy data) using ATC/DDD methodology. Antibiotic consumption was measured as the number of defined daily doses per 100 bed-days (DDD/100 bed-days). Two surgical departments were chosen for detailed monitoring: vascular surgery and traumatology.

Statistical analysis was performed using the method segmented linear regression analysis and Z-test for two independent proportions.

## Results

Before the interventions (2007) the total amount of antibiotic drugs used for systemic treatment was 27 DDD/100 bed-days at the department of vascular surgery and 14 DDD/100 bed-days at the department of traumatology. In 2009 (after carrying out the interventions) antibiotic consumption at the department of vascular surgery decreased by 13 DDD/100 bed-days (48%) and became 14 DDD/100 bed-days, at the department of traumatology – decreased by 8 DDD/100 bed-days (42%) and became 11 DDD/100 bed-days.

The second and third interventions were associated with a large stepwise reduction of antibiotic consumption at both departments (figure 1 and 2).

Fig. 1. Change of use of systemic antibiotics (DDD/100 bed-days) at the department of vascular surgery under the influence of interventions, 2007-2009

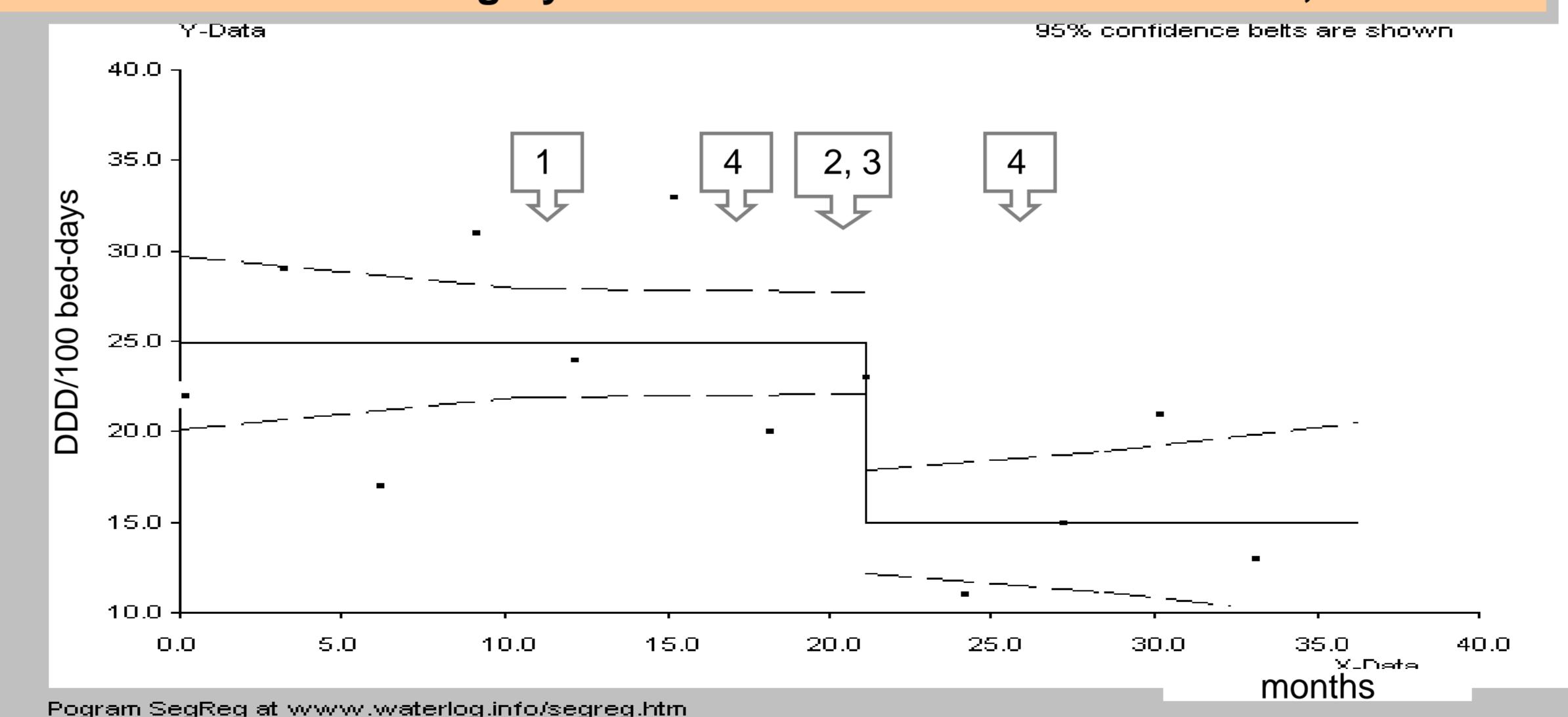
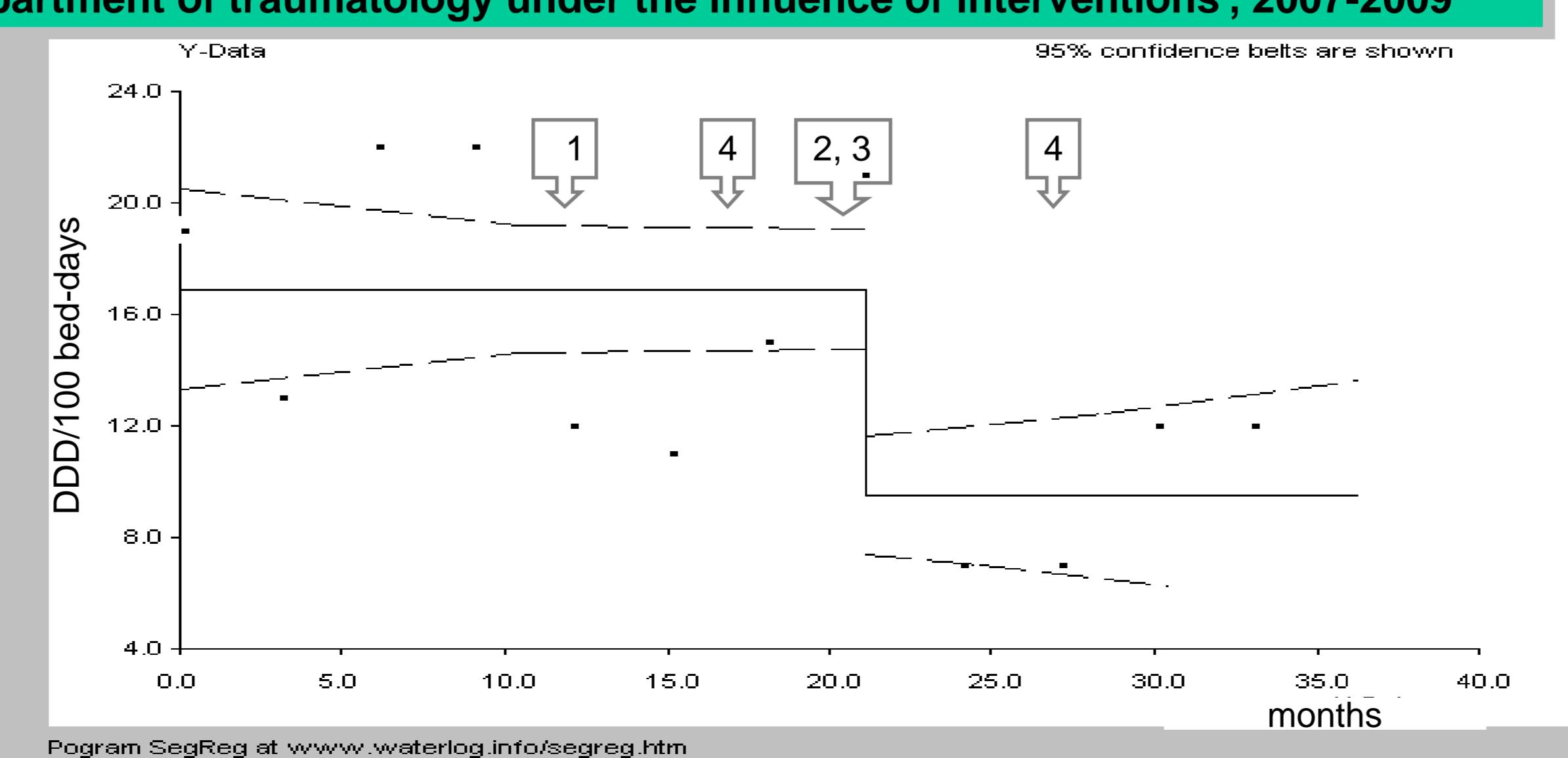


Fig. 2. Change of use of systemic antibiotics (DDD/100 bed-days) at the department of traumatology under the influence of interventions, 2007-2009



In 2007 cephalosporins III (ceftriaxone) were used most frequently. They were about 40% of the total amount of antibiotics in the trauma department and half of the total amount antibiotics in the department of vascular surgery. Widespread use of the 3<sup>rd</sup> generation cephalosporins promotes microorganisms beta-lactamase-producing extended-spectrum (ESBL). These microorganisms are a major problem in hospitals in Russia.

Introduction of the principles of PABP led to a two-fold reduction in the use of cephalosporins of the III generation at the department of vascular surgery (from 53% to 26% of total antibiotic consumption,  $p<0.05$ ) and a three-fold reduction at the trauma department (from 41% to 12% of total antibiotic consumption,  $p<0.05$ ). There was an increase in consumption of cephalosporins I and II at both departments (table 1)

Tab. 1. Antibiotic consumption at departments of vascular surgery and traumatology, 2007-2009

	vascular surgery, percentage of total antibiotic consumption		traumatology, percentage of total antibiotic consumption	
	2007 year	2009 year	2007 year	2009 year
Ceftriaxone	50.1	22.5	37.6	7.5
Cefoperazone	2.2	0.6	2.9	5.0
Ceftazidime	0.3	2.8	0.3	0
Cefazolin	6.4	29.4	15.0	32.3
Cefuroxime	0.7	27.6	11.7	31.9
Penicillins combined with beta-lactamase inhibitors	6.0	1.1	0.0	3.5
Ciprofloxacin	4.0	2.1	13.7	5.1
Norfloxacin	3.3	2.6	0.0	0.0
Amikacin	1.7	0.8	4.2	1.2
Gentamicin	2.1	0.8	0.9	0.0
Vancomycin	0.3	3.8	2.3	1.5
Ampicillin	11.5	0.6	0.0	0.0
Others	11.3	5.2	11.5	12.2
In total	100.0 (n=3593 DDD)	100.0 (n=1567 DDD)	100.0 (n=2620 DDD)	100.0 (n=1715 DDD)
Cephalosporins I-II	7.1	57.0*	26.7	64.2*
Cephalosporins III	52.7	25.9*	40.8	12.4*

\*  $P<0.05$  compared with the data in 2007

## Conclusion

- Measures on implementation of PABP have been shown to be effective. This was evidenced by a decrease in total antibiotic consumption and reduction of use of 3<sup>rd</sup> generation cephalosporins
- Support of the hospital administration in relation to this policy (as expressed in official documents, etc.) and solving organizational problems with implementation of PABP was of great importance for the effectiveness of interventions

## Policy relevance

This study showed that antibiotic use in hospital can be significantly improved by active implementation of PABP policy consisting of multiple interventions.

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