Supplementary Online Content

Aghlmandi S, Halbeisen FS, Saccilotto R, et al. Effect of antibiotic prescription audit and feedback on antibiotic prescribing in primary care: a randomized clinical trial. *JAMA Intern Med.* Published online February 6, 2023. doi:10.1001/jamainternmed.2022.6529

eAppendix.

This supplementary material has been provided by the authors to give readers additional information about their work.

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eAppendix.

Process of the claims data

The claims data from three main insurances was formatted at the patient-level according to anonymized licenses number of physicians randomized in the trial and uploaded to a secure server of University Hospital Basel. The details for data preparation by insurances were provided to each insurance as a word document in German. The insurances provided the data in multiple tables (6 tables) as a CSV file. The data comprised baseline characteristics, Tarmed positions (Tarmed from French “tarif médical” is the official tariff system for reimbursement of ambulatory medical services in Switzerland), infection-related data, medications according to ATC group for pharmacy cost groups, and antibiotic medication. To calculate the prescription rates, we used Tarmed positions for a first or new in-person or phone consultation by a physician or a specialist as a denominator to count the number of consultations. Detail of the data process and aggregation of the data are provided in eFigure 1.

Further considerations for statistical analyses

Before fitting the models we further investigated the distribution of the outcomes and also the respective covariates. Due to the skewed nature of the rates as an outcome or at baseline (covariate) we used log-transformation and used the back transformation for log-log models (as both outcome and baseline rates were log-transformed) and present the result in the respective tables and figures. Also, the underlying assumptions for the models were further assessed to guarantee the reliability of the reported model results. For the ANCOVA model, we assessed the normality and homogeneity of variance of residuals, the

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linearity for quantitative predictors, and whether there was an interaction between treatment and other variables in the model.

The assumption of normality in the data was not held due to high outliers, and in particular due to the skewness created by the high outliers (high antibiotic consumption due to some specific underlying disease). Excluding these outliers showed the same results, and therefore we kept outliers in all models and report the coefficients for a full data set. For the Poisson model, we assessed whether the underlying assumptions of no overdispersion (extra-Poisson variation) and linearity for quantitative predictors were violated and then decided to use the logarithmic link function for the Poisson regression. Further details of the data management and the statistical analysis are predefined and can be found in the statistical analysis plan.

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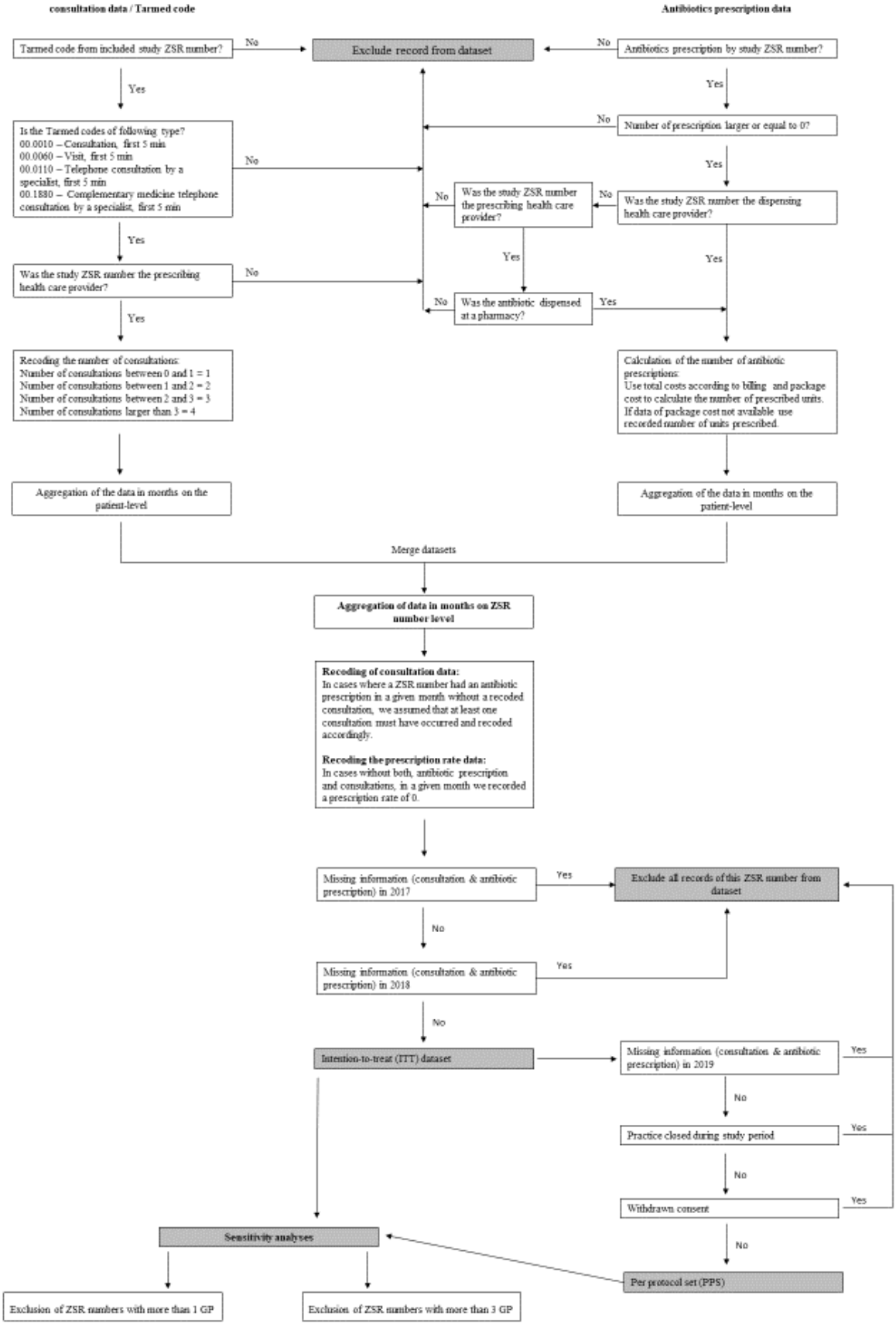
eFigure 1. Flow Diagram of the Data Processing Steps



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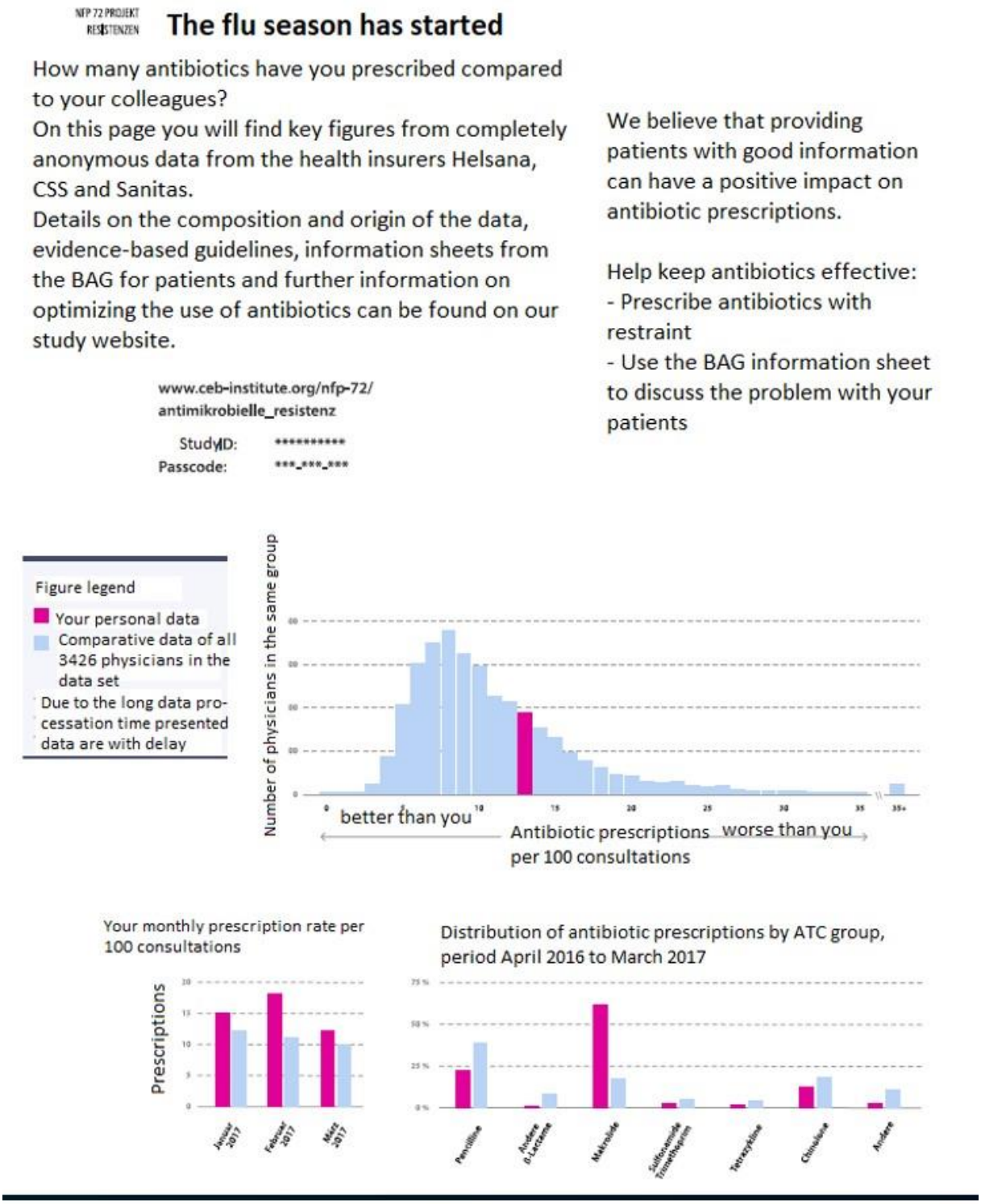
eFigure 2. English Translation of the Feedback Intervention



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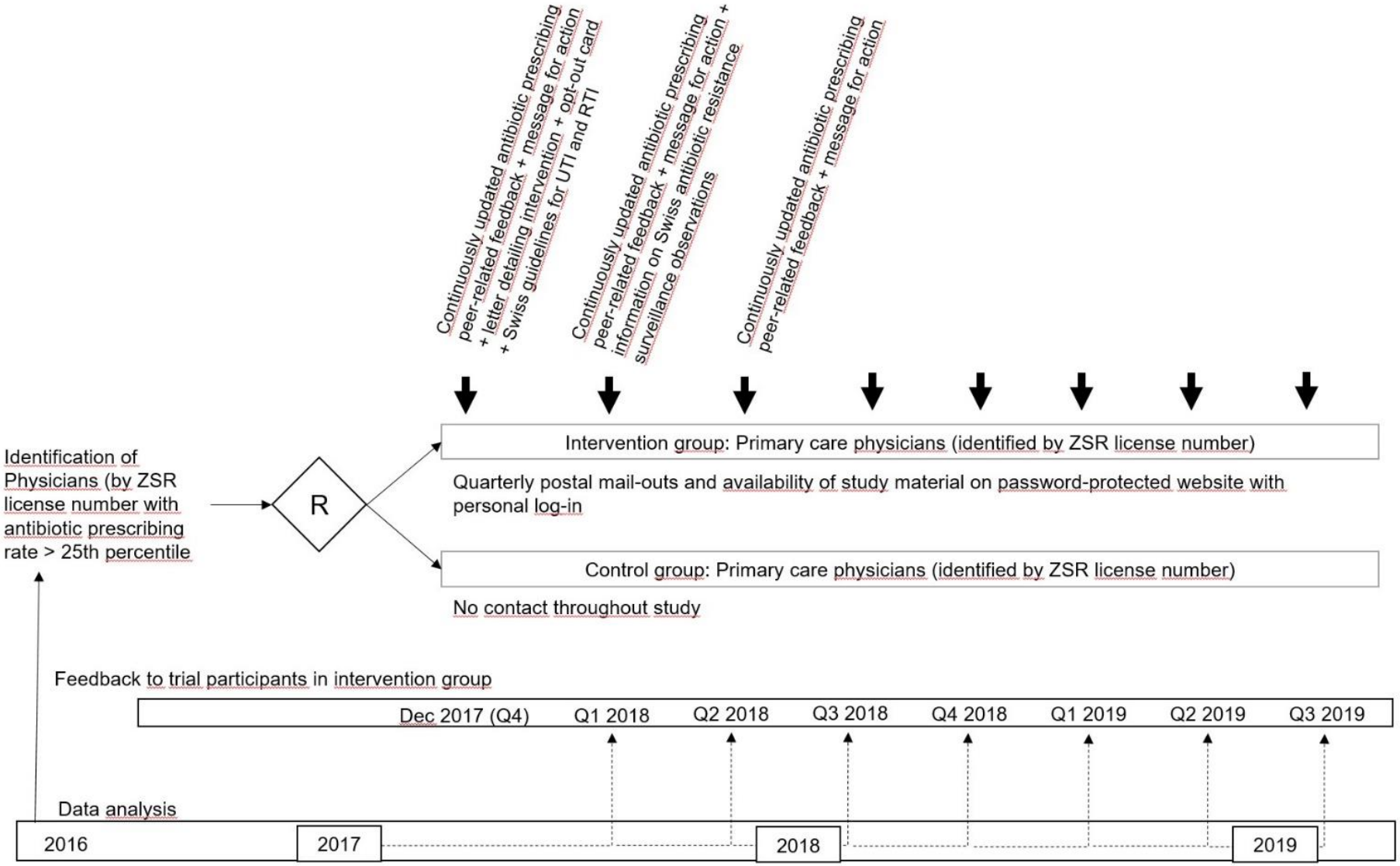
eFigure 3. Statistical Analysis Flow



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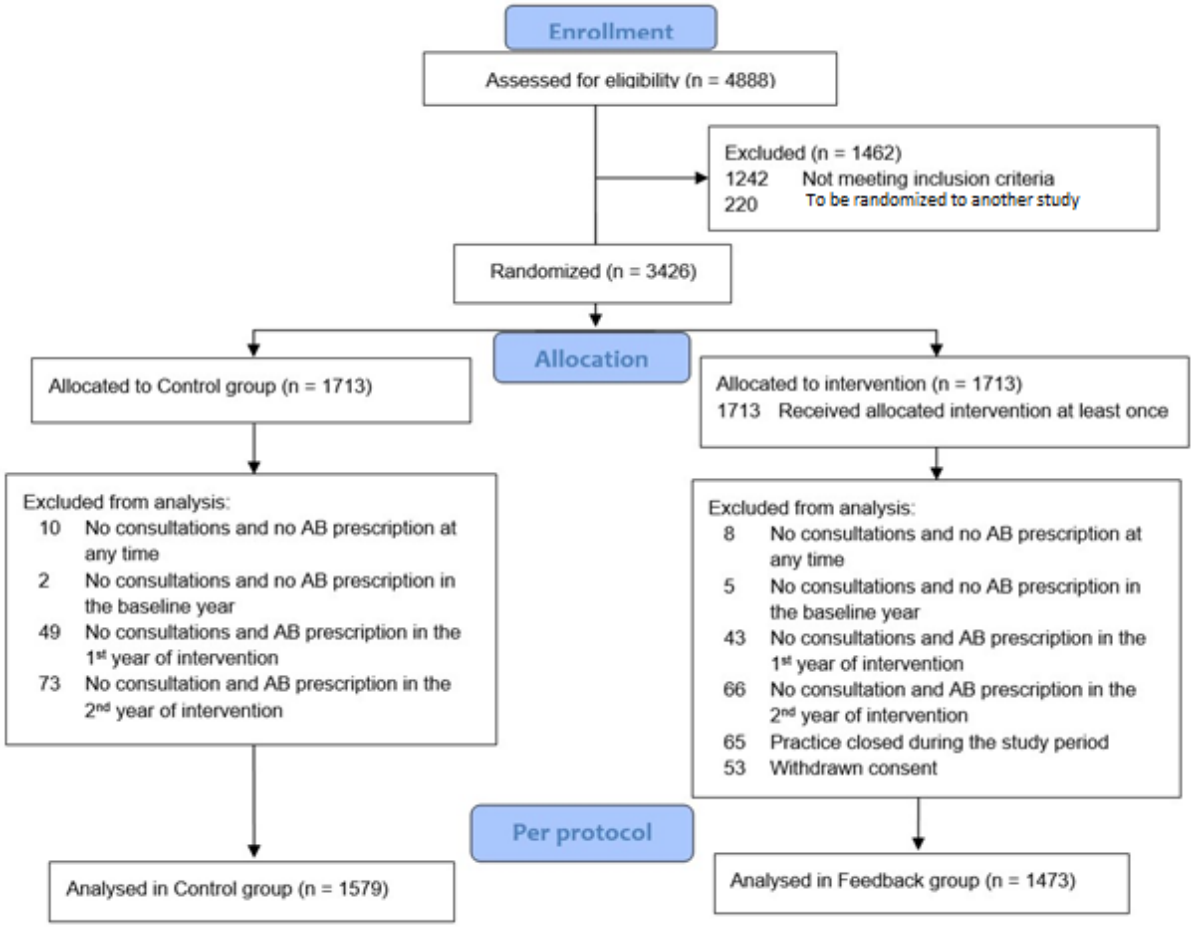
eFigure 4. Flow Diagram of Physician Disposition for Per-Protocol Analysis



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eTable 1. Summary of Yearly Prescription Rates per 100 Consultations

Year	Control			Feedback		
	Median	**Q1**	**Q3**	**Median**	**Q1**	**Q3**
2017	8.35	6.35	11.64	8.41	6.29	11.46
2018	8.51	6.27	11.99	8.32	6.17	11.69
2019	8.41	5.98	11.78	8.16	6.09	11.43

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eTable 2. Change of Antibiotic Prescription Rates per 100 Consultations in the Second Year of Intervention for all Patients and Different Antibiotic Groups

	% (95% CI)*	p-value
All patients		
Base model		
Assigned arm (feedback vs. control)	-0.11 (-1.17, 0.97)	0.84
Baseline prescription rate (2017)	4.22 (3.86, 4.58)	<0.001
Interaction (assigned*baseline)	-0.04 (-0.52, 0.45)	0.88
Multivariable model		
Assigned arm (feedback vs. control)	-0.14 (-1.20, 0.94)	0.80
Baseline prescription rate (2017)	4.22 (3.86, 4.58)	<0.001
Comorbidities (any vs. none)	0.53 (-0.20, 1.39)	0.20
Interaction (assigned*baseline)	-0.03 (-0.51, 0.46)	0.91
Macrolides		
Base model		
Assigned arm (feedback vs. control)	0.04 (-0.53, 0.60)	0.91
Baseline prescription rate (2017)	2.73 (2.45, 3.00)	<0.001
Interaction (assigned*baseline)	0.15 (-0.24, 0.53)	0.46
Multivariable model		
Assigned arm (feedback vs. control)	0.03 (-0.53, 0.59)	0.93
Baseline prescription rate (2017)	2.68 (2.41, 2.96)	<0.001
Comorbidities (any vs. none)	0.49 (-0.10, 1.2)	0.10
Interaction (assigned*baseline)	0.15 (-0.24, 0.53)	0.45
Other β-Lactams		
Base model		
Assigned arm (feedback vs. control)	-0.71 (-1.93, 0.53)	0.26
Baseline prescription rate (2017)	2.77 (2.53, 3.00)	<0.001
Interaction (assigned*baseline)	-0.42 (-0.73, -0.11)	0.01
Multivariable model		
Assigned arm (feedback vs. control)	-0.74 (-1.95, 0.50)	0.24
Baseline prescription rate (2017)	2.75 (2.52, 2.99)	<0.001
Comorbidities (any vs. none)	0.41 (-0.11, 1.31)	0.09
Interaction (assigned*baseline)	-0.42 (-0.74, -0.11)	0.01
Quinolones		
Base model		
Assigned arm (feedback vs. control)	-0.94 (-1.47, -0.41)	<0.001
Baseline prescription rate (2017)	4.24 (4.09, 4.40)	<0.001
Interaction (assigned*baseline)	-0.01 (-0.21, 0.20)	0.95
Multivariable model		
Assigned arm (feedback vs. control)	-1.04 (-1.57, -0.52)	<0.001
Baseline prescription rate (2017)	3.89 (3.73, 4.06)	<0.001
Comorbidities (any vs. none)	0.58 (-0.01, 1.2)	0.06
Interaction (assigned*baseline)	0.01 (-0.20, 0.21)	0.94
*Between group differences are reported in percentages Note: All the prescriptions are reported per 100 consultations		

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eTable 3. Change of Antibiotic Prescription Rates per 100 Consultations in the Second Year of Intervention for Different Age Groups

	% (95% CI)*	p-value
0-5 years		
Base model		
Assigned arm (feedback vs. control)	-0.75 (-1.98, 0.50)	0.24
Baseline prescription rate (2017)	1.51 (1.19, 1.82)	<0.001
Interaction (assigned*baseline)	0.14 (-0.30, 0.58)	0.53
Multivariable model		
Assigned arm (feedback vs. control)	-0.64 (-1.85, 0.59)	0.31
Baseline prescription rate (2017)	1.38 (1.07, 1.69)	<0.001
Respiratory infections	1.2 (-0.2, 2.4)	0.07
Interaction (assigned*baseline)	0.12 (-0.31, 0.56)	0.58
6-65 years		
Base model		
Assigned arm (feedback vs. control)	<0.01 (-1.01, 1.02)	0.996
Baseline prescription rate (2017)	3.69 (3.35, 4.02)	<0.001
Interaction (assigned*baseline)	-0.14 (-0.61, 0.32)	0.55
Multivariable model		
Assigned arm (feedback vs. control)	0.01 (-1.00, 1.03)	0.99
Baseline prescription rate (2017)	3.65 (3.31, 3.99)	<0.001
Comorbidities (any vs. none)	0.45 (-0.11, 1.21)	0.08
Interaction (assigned*baseline)	-0.15 (-0.61, 0.32)	0.53
>65 years		
Base model		
Assigned arm (feedback vs. control)	0.39 (-0.60, 1.40)	0.438
Baseline prescription rate (2017)	3.28 (2.95, 3.60)	<0.001
Interaction (assigned*baseline)	-0.17 (-0.64, 0.30)	0.468
Multivariable model		
Assigned arm (feedback vs. control)	0.46 (-0.53, 1.46)	0.37
Baseline prescription rate (2017)	3.28 (2.95, 3.61)	<0.001
Comorbidities (any vs. none)	0.49 (-0.09, 1.11)	0.18
Interaction (assigned*baseline)	-0.22 (-0.68, 0.25)	0.36
*Between-group differences are reported in percentages		

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eTable 4. Change of Antibiotic Prescription Rates per 100 Consultations in the First Year of Intervention for all Patients and Different Antibiotic Groups

	% (95% CI)*	p-value
All patients		
Base model		
Assigned arm (feedback vs. control)	0.54 (-0.12, 1.21)	0.11
Baseline prescription rate (2017)	4.55 (4.33, 4.77)	<0.001
Interaction (assigned*baseline)	-0.29 (-0.58, 0.01)	0.06
Multivariable model		
Assigned arm (feedback vs. control)	0.53 (-0.13, 1.20)	0.12
Baseline prescription rate (2017)	4.53 (4.31, 4.76)	<0.001
Comorbidities (any vs. none)	0.52 (0.29, 0.95)	0.04
Interaction (assigned*baseline)	-0.28 (-0.58, 0.02)	0.06
Macrolides		
Base model		
Assigned arm (feedback vs. control)	-0.12 (-0.61, 0.37)	0.62
Baseline prescription rate (2017)	2.54 (2.30, 2.77)	<0.001
Interaction (assigned*baseline)	0.31 (-0.02, 0.64)	0.07
Multivariable model		
Assigned arm (feedback vs. control)	-0.14 (-0.62, 0.35)	0.58
Baseline prescription rate (2017)	2.47(2.24, 2.71)	<0.001
Comorbidities (any vs. none)	0.51 (0.27, 0.93)	0.05
Interaction (assigned*baseline)	0.32 (-0.01, 0.65)	0.06
Other β-lactams		
Base model		
Assigned arm (feedback vs. control)	-0.56 (-1.73, 0.63)	0.35
Baseline prescription rate (2017)	2.88 (2.66, 3.10)	<0.001
Interaction (assigned*baseline)	-0.17 (-0.47, 0.13)	0.26
Multivariable model		
Assigned arm (feedback vs. control)	-0.62 (-1.79, 0.56)	0.30
Baseline prescription rate (2017)	2.88 (2.66, 3.10)	<0.001
Comorbidities (any vs. none)	0.50 (0.26, 0.93)	0.05
Interaction (assigned*baseline)	-0.19 (-0.49, 0.11)	0.22
Quinolones		
Base model		
Assigned arm (feedback vs. control)	0.04 (-0.43, 0.53)	0.86
Baseline prescription rate (2017)	4.38 (4.24, 4.52)	<0.001
Interaction (assigned*baseline)	-0.08 (-0.26, 0.11)	0.42
Multivariable model		
Assigned arm (feedback vs. control)	-0.03 (-0.50, 0.45)	0.92
Baseline prescription rate (2017)	4.10 (3.95, 4.26)	<0.001
Comorbidities (any vs. none)	0.52 (0.26, 0.93)	0.04
Interaction (assigned*baseline)	-0.07 (-0.25, 0.12)	0.50
* Between group differences are reported in percentages		

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eTable 5. Change of Antibiotic Prescription Rates per 100 Consultations in the First Year of Intervention for Different Age Groups

	% (95% CI)*	p-value
0-5 years		
Base model		
Assigned arm (feedback vs. control)	-0.30 (-1.47, 0.88)	0.62
Baseline prescription rate (2017)	1.78 (1.49, 2.08)	<0.001
Interaction (assigned*baseline)	-0.13 (-0.54, 0.29)	0.54
Multivariable model		
Assigned arm (feedback vs. control)	-0.22 (-1.38, 0.96)	0.71
Baseline prescription rate (2017)	1.69 (1.40, 1.99)	<0.001
Respiratory infections	0.50 (0.21, 0.91)	0.05
Interaction (assigned*baseline)	-0.15 (-0.56, 0.27)	0.49
6-65 years		
Base model		
Assigned arm (feedback vs. control)	-0.21 (-0.91, 0.50)	0.56
Baseline prescription rate (2017)	3.68 (3.44, 3.91)	<0.001
Interaction (assigned*baseline)	0.01 (-0.31, 0.33)	0.95
Multivariable model		
Assigned arm (feedback vs. control)	-0.21 (-0.90, 0.52)	0.57
Baseline prescription rate (2017)	3.65 (3.41, 3.89)	<0.001
Comorbidities (any vs. none)	0.49 (0.10, 0.91)	0.05
Interaction (assigned*baseline)	0.01 (-0.32, 0.33)	0.26
>65 years		
Base model		
Assigned arm (feedback vs. control)	-0.56 (-1.24, 0.13)	0.112
Baseline prescription rate (2017)	3.35 (3.12, 3.58)	<0.001
Interaction (assigned*baseline)	0.17 (-0.15, 0.50)	0.296
Multivariable model		
Assigned arm (feedback vs. control)	-0.53 (-1.22, 0.16)	0.13
Baseline prescription rate (2017)	3.34 (3.11, 3.57)	<0.001
Comorbidities (any vs. none)	0.51 (0.10, 0.91)	0.05
Interaction (assigned*baseline)	0.16 (-0.17, 0.48)	0.35
*Between group differences are reported in percentages		

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eTable 6. Change of Antibiotic Prescription Rates per 100 Consultations for 24 Months of Intervention

	% (95% CI)*
All patients	
Base model	
Assigned arm (feedback vs. control)	0.50 (-0.28, 1.29)
Baseline prescription rate (2017)	4.38 (4.11, 4.64)
Interaction (assigned*baseline)	-0.25 (-0.60, 0.10)
Multivariable model	
Assigned arm (feedback vs. control)	0.47 (-0.31, 1.26)
Baseline prescription rate (2017)	4.35 (4.08, 4.62)
Comorbidities (any vs. none)	0.51 (-0.03, 0.99)
Interaction (assigned*baseline)	-0.24 (-0.59, 0.11)
*Between-group differences are reported in percentages	

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eTable 7. All-Cause and Infection-Related Hospitalisations by Consultations

Outcome	Estimate (95% CI)	p-value
All cause hospitalisations by consultations in the second year of intervention		
Hospitalisations rate control group (Intercept)	0.02 (0.02, 0.03)	-
Assigned arm (feedback vs. control)	1.01 (1.00, 1.02)	0.25
All cause hospitalisations by consultations in the second year of intervention (Quasi-poisson)		
Hospitalisations rate control group (Intercept)	0.02 (0.02, 0.02)	-
Assigned arm (feedback vs. control)	1.01 (0.98, 1.04)	0.65
All cause hospitalisations by consultations in the first year of intervention		
Hospitalisations rate control group (Intercept)	0.02 (0.02, 0.03)	-
Assigned arm (feedback vs. control)	1.01 (0.98, 1.04)	0.57
All cause hospitalisations by consultations in the first year of intervention (Quasi-poisson)		
Hospitalisations rate control group (Intercept)	0.09 (0.09, 0.10)	-
Assigned arm (feedback vs. control)	1.02 (1.09, 1.03)	0.001
Infection-related hospitalisations by consultations in the second year of intervention		
Hospitalisations rate control group (Intercept)	0.01 (0.01, 0.02)	-
Assigned arm (feedback vs. control)	0.97 (0.93, 1.01)	0.11
Infection-related hospitalisations by consultations in the second year of intervention (Quasi-poisson)		
Hospitalisations rate control group (Intercept)	0.002 (0.0019, 0.0020)	-
Assigned arm (feedback vs. control)	0.97 (0.92, 1.02)	0.21
Infection-related hospitalisations by consultations in the first year of intervention		
Hospitalisations rate control group (Intercept)	0.002 (0.0020, 0.0021)	-
Assigned arm (feedback vs. control)	0.99 (0.96, 1.03)	0.70
Infection-related hospitalisations by consultations in the first year of intervention (Quasi-poisson)		
Hospitalisations rate control group (Intercept)	0.002 (0.0020, 0.0021)	-
Assigned arm (feedback vs. control)	0.99 (0.94, 1.05)	0.74

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eTable 8. Change of Antibiotic Prescription Rates per 100 Consultations for Different Outcomes Including Only Practice License Numbers With up to 3 General Practitioners (Sensitivity Analysis)

Outcome	% (95% CI)*	p-value
For ZSR numbers with ≤ 3 general practitioners		
Prescription rates in the second year of intervention		
Base Model		
Assigned arm (feedback vs. Control)	-0.05 (-1.13, 1.04)	0.93
Baseline prescription rate (2017)	4.24 (3.88, 4.61)	<0.001
Interaction (Assigned*Baseline)	-0.07 (-0.56, 0.42)	0.77
Multivariable model		
Assigned arm (feedback vs. Control)	-0.07 (-1.15, 1.03)	0.91
Baseline prescription rate (2017)	4.26 (3.89, 4.63)	<0.001
Comorbidities (any vs. none)	0.53 (0.20, 1.38)	0.19
Interaction (Assigned*Baseline)	-0.07 (-0.56, 0.42)	0.78
Prescription rates in the first year of intervention		
Base Model		
Assigned arm (feedback vs. Control)	0.57 (-0.04, 1.20)	0.07
Baseline prescription rate (2017)	4.54 (4.33, 4.75)	<0.001
Interaction (Assigned*Baseline)	-0.33 (-0.60, -0.05)	0.02
Multivariable model		
Assigned arm (feedback vs. Control)	0.56 (-0.06, 1.18)	0.08
Baseline prescription rate (2017)	4.53 (4.32, 4.74)	<0.001
Comorbidities (any vs. none)	0.52 (0.30, 0.89)	0.02
Interaction (Assigned*Baseline)	-0.32 (-0.60, -0.04)	0.03
Prescription rates in 24 months of intervention		
Base Model		
Assigned arm (feedback vs. Control)	0.52 (-0.27, 1.30)	-
Baseline prescription rate (2017)	4.39 (4.12, 4.65)	-
Interaction (Assigned*Baseline)	-0.29 (-0.64, 0.06)	-
Multivariable model		
Assigned arm (feedback vs. Control)	0.49 (-0.29, 1.27)	-
Baseline prescription rate (2017)	4.38 (4.11, 4.64)	-
Comorbidities (any vs. none)	0.50 (0.31, 0.89)	-
Interaction (Assigned*Baseline)	0.31 (-0.04, 0.66)	-
*Between group differences are reported in percentages		

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eTable 9. Change of Antibiotic Prescription Rates per 100 Consultations for Per Protocol Analysis

Outcome	% (95% CI)*	p-value
Prescription rates in the second year of intervention		
Base Model		
Assigned arm (feedback vs. control)	0.01 (0.00, 0.22)	0.95
Baseline prescription rate (2017)	4.22 (3.88, 4.55)	<0.001
Interaction (assigned*baseline)	-0.14 (-0.61, 0.34)	0.56
Multivariable model		
Assigned arm (feedback vs. control)	0.01(0.00, 0.22)	0.96
Baseline prescription rate (2017)	4.23 (3.89, 4.57)	<0.001
Comorbidities (any vs. none)	0.40 (-0.03, 0.89)	0.08
Interaction (assigned*baseline)	-0.14 (-0.62, 0.34)	0.56
Prescription rates in the first year of intervention		
Base Model		
Assigned arm (feedback vs. control)	0.10 (-0.04, 0.24)	0.17
Baseline prescription rate (2017)	4.55 (4.33, 4.77)	<0.001
Interaction (assigned*baseline)	-0.25 (-0.56, 0.06)	0.11
Multivariable model		
Assigned arm (feedback vs. control)	0.10 (-0.05, 0.24)	0.19
Baseline prescription rate (2017)	4.53 (4.31, 4.75)	<0.001
Comorbidities (any vs. none)	0.36 (0.03, 0.89)	0.04
Interaction (assigned*baseline)	-0.25 (-0.56, 0.06)	0.12
Prescription rates in 24 months of intervention		
Base model		
Assigned arm (feedback vs. control)	0.26 (-0.48, 0.99)	-
Baseline prescription rate (2017)	4.38 (4.15, 4.62)	-
Interaction (assigned*baseline)	-0.20 (-0.53, 0.14)	-
Multivariable model		
Assigned arm (feedback vs. control)	0.25 (-0.29, 0.79)	-
Baseline prescription rate (2017)	4.38 (3.62, 5.15)	-
Comorbidities (any vs. none)	0.38 (-0.03, 0.89)	-
Interaction (assigned*baseline)	-0.20 (-0.53, 0.14)	-
*Between group differences are reported in percentages		

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eTable 10. Number of General Practitioners Under One Practice License Number for the Included General Practitioners in the Study for the Intention to Treat Analysis

Number of the GPs*	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**10**	**11**
n (%)	1892 (57.2%)	864 (26%)	314 (9%)	126 (4%)	69 (2%)	22 (1%)	13 (0.4%)	5 (0.2%)	2 (0.1%)	2 (0.1%)
*The number of the GPs working under the same physician license number (ZSR) in one center or a policlinic										

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