Supplementary appendix

Supplement to Erdmann S, Jahn R, Rohleder S, Bozorgmehr K. Overcoming denominator problems in refugee settings with fragmented electronic records for health and immigration data: a prediction-based approach.

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A1: More detailed description of the data used in this study

Table A1: Description of EHR data

Absolute and relative frequencies and mean, standard deviation, median and interquartile range (Q1 - Q3), minimum and maximum of the observed variables of the EHR data set stratified by the type of centre are given, respectively.

Variables	REC (N=345)	REG (N=100)	Total (N=445)
Centre			
1	22 (6%)	0 (0%)	22 (5%)
2	0 (0%)	6 (6%)	6 (1%)
4	37 (11%)	0 (0%)	37 (8%)
5	22 (6%)	0 (0%)	22 (5%)
6	32 (9%)	0 (0%)	32 (7%)
7	0 (0%)	38 (38%)	38 (9%)
8	7 (2%)	0 (0%)	7 (2%)
9	0 (0%)	23 (23%)	23 (5%)
10	19 (6%)	0 (0%)	19 (4%)
11	27 (8%)	0 (0%)	27 (6%)
12	16 (5%)	0 (0%)	16 (4%)
13	0 (0%)	27 (27%)	27 (6%)
14	16 (5%)	0 (0%)	16 (4%)
15	17 (5%)	0 (0%)	17 (4%)
17	25 (7%)	0 (0%)	25 (6%)
18	16 (5%)	0 (0%)	16 (4%)
19	22 (6%)	0 (0%)	22 (5%)
20	44 (13%)	0 (0%)	44 (10%)
21	0 (0%)	6 (6%)	6 (1%)
22	5 (1%)	0 (0%)	5 (1%)
23	18 (5%)	0 (0%)	18 (4%)
Month			
2017 11	1 (0%)	0 (0%)	1 (0%)
2017 12	1 (0%)	0 (0%)	1 (0%)
2018 01	1 (0%)	0 (0%)	1 (0%)
2018 02	1 (0%)	0 (0%)	1 (0%)
2018 03	1 (0%)	0 (0%)	1 (0%)
2018 04	3 (1%)	0 (0%)	3 (1%)
2018 05	3 (1%)	1 (1%)	4 (1%)
2018 06	4 (1%)	1 (1%)	5 (1%)
2018 07	5 (1%)	1 (1%)	6 (1%)
2018 08	6 (2%)	2 (2%)	8 (2%)
2018 09	6 (2%)	2 (2%)	8 (2%)
2018 10	6 (2%)	2 (2%)	8 (2%)
2018 11	6 (2%)	2 (2%)	8 (2%)
2018 12	7 (2%)	2 (2%)	9 (2%)
2019 01	7 (2%)	2 (2%)	9 (2%)
2019 02	7 (2%)	2 (2%)	9 (2%)
2019 03	7 (2%)	2 (2%)	9 (2%)
2019 04	7 (2%)	3 (3%)	10 (2%)
2019 05	7 (2%)	3 (3%)	10 (2%)
2019 06	8 (2%)	3 (3%)	11 (2%)
2019 07	9 (3%)	3 (3%)	12 (3%)
2019 08	8 (2%)	3 (3%)	11 (2%)
2019 09	11 (3%)	3 (3%)	14 (3%)
2019 10	12 (3%)	3 (3%)	15 (3%)
2019 11	11 (3%)	3 (3%)	14 (3%)
2019 12	11 (3%)	3 (3%)	14 (3%)
2020 01	11 (3%)	3 (3%)	14 (3%)
2020 02	11 (3%)	3 (3%)	14 (3%)
2020 03	12 (3%)	3 (3%)	15 (3%)
2020 04	10 (3%)	3 (3%)	13 (3%)
2020 05	11 (3%)	3 (3%)	14 (3%)
2020 06	11 (3%)	3 (3%)	14 (3%)

Variables	REC (N=345)	REG (N=100)	Total (N=445)
2020 07	10 (3%)	2 (2%)	12 (3%)
2020 08	9 (3%)	2 (2%)	11 (2%)
2020 09	9 (3%)	2 (2%)	11 (2%)
2020 10	9 (3%)	2 (2%)	11 (2%)
2020 11	9 (3%)	2 (2%)	11 (2%)
2020 12	10 (3%)	2 (2%)	12 (3%)
2021 01	10 (3%)	4 (4%)	14 (3%)
2021 02	11 (3%)	4 (4%)	15 (3%)
2021 03	11 (3%)	4 (4%)	15 (3%)
2021 04	11 (3%)	4 (4%)	15 (3%)
2021 05	11 (3%)	4 (4%)	15 (3%)
2021 06	11 (3%)	4 (4%)	15 (3%)
2021 07	2 (1%)	0 (0%)	2 (0%)
Male (patients)			
N	345	100	445
mean	60	60	60
sd	15	7.4	14
median	61	57	60
Q1 - Q3	54 -- 69	54 -- 64	54 -- 68
min - max	0 -- 100	47 -- 83	0 -- 100
Adult (patients)			
N	345	100	445
mean	79	83	80
sd	11	5.7	10
median	81	82	81
Q1 - Q3	73 -- 86	78 -- 87	74 -- 87
min - max	0 -- 100	70 -- 94	0 -- 100
Diseases of the digestive system			
N	345	100	445
mean	17	41	23
sd	21	23	23
median	8	36	12
Q1 - Q3	4 -- 22	22 -- 60	5 -- 35
min - max	0 -- 85	3 -- 89	0 -- 89
n_pat			
N	345	100	445
mean	182	396	230
sd	172	209	202
median	117	360	149
Q1 - Q3	80 -- 208	212 -- 588	93 -- 304
min - max	5 -- 934	29 -- 934	5 -- 934
Incidence of diseases of the digestive system with respect to patients			
N	345	100	445
mean	0.089	0.1	0.092
sd	0.065	0.028	0.059
median	0.084	0.1	0.092
Q1 - Q3	0.042 -- 0.13	0.088 -- 0.12	0.056 -- 0.12
min - max	0 -- 0.3	0.032 -- 0.21	0 -- 0.3

Table A2: Description of occupancy data

Absolute and relative frequencies and mean, standard deviation, median and interquartile range (Q1 - Q3), minimum and maximum of the observed variables of the occupancy data set stratified by the type of centre are given, respectively.

Variables	REC (N=137)	REG (N=78)	Total (N=215)
Centre			
1	5 (4%)	0 (0%)	5 (2%)
2	0 (0%)	8 (10%)	8 (4%)
3	1 (1%)	0 (0%)	1 (0%)
4	17 (12%)	0 (0%)	17 (8%)
5	13 (9%)	0 (0%)	13 (6%)
6	19 (14%)	0 (0%)	19 (9%)
7	0 (0%)	33 (42%)	33 (15%)
8	1 (1%)	0 (0%)	1 (0%)
9	0 (0%)	14 (18%)	14 (7%)
10	14 (10%)	0 (0%)	14 (7%)
11	14 (10%)	0 (0%)	14 (7%)
13	0 (0%)	14 (18%)	14 (7%)
14	17 (12%)	0 (0%)	17 (8%)
15	12 (9%)	0 (0%)	12 (6%)
16	0 (0%)	1 (1%)	1 (0%)
17	18 (13%)	0 (0%)	18 (8%)
18	4 (3%)	0 (0%)	4 (2%)
19	2 (1%)	0 (0%)	2 (1%)
21	0 (0%)	8 (10%)	8 (4%)
Month			
2018 10	2 (1%)	1 (1%)	3 (1%)
2018 11	1 (1%)	0 (0%)	1 (0%)
2018 12	4 (3%)	2 (3%)	6 (3%)
2019 01	5 (4%)	2 (3%)	7 (3%)
2019 02	3 (2%)	1 (1%)	4 (2%)
2019 03	6 (4%)	2 (3%)	8 (4%)
2019 04	2 (1%)	0 (0%)	2 (1%)
2019 05	4 (3%)	1 (1%)	5 (2%)
2019 06	5 (4%)	2 (3%)	7 (3%)
2019 07	4 (3%)	1 (1%)	5 (2%)
2019 08	5 (4%)	2 (3%)	7 (3%)
2019 09	5 (4%)	2 (3%)	7 (3%)
2019 10	7 (5%)	2 (3%)	9 (4%)
2019 11	7 (5%)	1 (1%)	8 (4%)
2019 12	7 (5%)	2 (3%)	9 (4%)
2020 01	7 (5%)	2 (3%)	9 (4%)
2020 02	7 (5%)	3 (4%)	10 (5%)
2020 03	3 (2%)	1 (1%)	4 (2%)
2020 04	5 (4%)	3 (4%)	8 (4%)
2020 05	5 (4%)	3 (4%)	8 (4%)
2020 06	5 (4%)	3 (4%)	8 (4%)
2020 07	6 (4%)	2 (3%)	8 (4%)
2020 08	0 (0%)	1 (1%)	1 (0%)
2020 09	3 (2%)	1 (1%)	4 (2%)
2020 10	1 (1%)	1 (1%)	2 (1%)
2020 11	4 (3%)	2 (3%)	6 (3%)
2020 12	0 (0%)	1 (1%)	1 (0%)
2021 01	3 (2%)	2 (3%)	5 (2%)
2021 02	0 (0%)	3 (4%)	3 (1%)
2021 03	4 (3%)	4 (5%)	8 (4%)
2021 04	2 (1%)	4 (5%)	6 (3%)
2021 05	3 (2%)	4 (5%)	7 (3%)
2021 06	2 (1%)	4 (5%)	6 (3%)
2021 07	3 (2%)	4 (5%)	7 (3%)
2021 08	4 (3%)	4 (5%)	8 (4%)
2021 09	3 (2%)	4 (5%)	7 (3%)

Variables	REC (N=137)	REG (N=78)	Total (N=215)
2021 10	0 (0%)	1 (1%)	1 (0%)
Male (occupancy)			
N	137	78	215
mean	67	65	66
sd	16	7	14
median	67	63	65
Q1 - Q3	53 -- 78	61 -- 70	59 -- 74
min - max	24 -- 98	49 -- 97	24 -- 98
Adult (occupancy)			
N	137	78	215
mean	79	75	77
sd	11	8.5	10
median	79	74	77
Q1 - Q3	69 -- 87	70 -- 79	70 -- 84
min - max	54 -- 100	55 -- 114	54 -- 114
n_occup			
N	137	78	215
mean	253	515	348
sd	138	389	287
median	226	362	244
Q1 - Q3	161 -- 289	190 -- 847	164 -- 449
min - max	32 -- 600	72 -- 1516	32 -- 1516

Table A3: Description of matched data

Absolute and relative frequencies and mean, standard deviation, median and interquartile range (Q1 - Q3), minimum and maximum of the observed variables of the matched data set stratified by the type of centre are given, respectively

Variables	REC (N=104)	REG (N=43)	Total (N=147)
Month			
2017 11	0 (0%)	0 (0%)	0 (0%)
2017 12	0 (0%)	0 (0%)	0 (0%)
2018 01	0 (0%)	0 (0%)	0 (0%)
2018 02	0 (0%)	0 (0%)	0 (0%)
2018 03	0 (0%)	0 (0%)	0 (0%)
2018 04	0 (0%)	0 (0%)	0 (0%)
2018 05	0 (0%)	0 (0%)	0 (0%)
2018 06	0 (0%)	0 (0%)	0 (0%)
2018 07	0 (0%)	0 (0%)	0 (0%)
2018 08	0 (0%)	0 (0%)	0 (0%)
2018 09	0 (0%)	0 (0%)	0 (0%)
2018 10	2 (2%)	1 (2%)	3 (2%)
2018 11	1 (1%)	0 (0%)	1 (1%)
2018 12	4 (4%)	1 (2%)	5 (3%)
2019 01	5 (5%)	1 (2%)	6 (4%)
2019 02	3 (3%)	0 (0%)	3 (2%)
2019 03	5 (5%)	1 (2%)	6 (4%)
2019 04	2 (2%)	0 (0%)	2 (1%)
2019 05	4 (4%)	1 (2%)	5 (3%)
2019 06	5 (5%)	2 (5%)	7 (5%)
2019 07	4 (4%)	1 (2%)	5 (3%)
2019 08	5 (5%)	1 (2%)	6 (4%)
2019 09	5 (5%)	2 (5%)	7 (5%)
2019 10	5 (5%)	1 (2%)	6 (4%)
2019 11	6 (6%)	1 (2%)	7 (5%)
2019 12	5 (5%)	2 (5%)	7 (5%)
2020 01	4 (4%)	1 (2%)	5 (3%)
2020 02	5 (5%)	1 (2%)	6 (4%)
2020 03	2 (2%)	1 (2%)	3 (2%)
2020 04	3 (3%)	2 (5%)	5 (3%)
2020 05	3 (3%)	3 (7%)	6 (4%)
2020 06	4 (4%)	3 (7%)	7 (5%)
2020 07	3 (3%)	1 (2%)	4 (3%)
2020 08	0 (0%)	1 (2%)	1 (1%)
2020 09	3 (3%)	0 (0%)	3 (2%)
2020 10	1 (1%)	0 (0%)	1 (1%)
2020 11	3 (3%)	2 (5%)	5 (3%)
2020 12	0 (0%)	1 (2%)	1 (1%)
2021 01	2 (2%)	2 (5%)	4 (3%)
2021 02	0 (0%)	2 (5%)	2 (1%)
2021 03	3 (3%)	2 (5%)	5 (3%)
2021 04	2 (2%)	2 (5%)	4 (3%)
2021 05	2 (2%)	2 (5%)	4 (3%)
2021 06	2 (2%)	2 (5%)	4 (3%)
2021 07	1 (1%)	0 (0%)	1 (1%)
Centre			
1	3 (3%)	0 (0%)	3 (2%)
2	0 (0%)	2 (5%)	2 (1%)
4	11 (11%)	0 (0%)	11 (7%)
5	13 (12%)	0 (0%)	13 (9%)
6	15 (14%)	0 (0%)	15 (10%)
7	0 (0%)	27 (63%)	27 (18%)
8	1 (1%)	0 (0%)	1 (1%)
9	0 (0%)	5 (12%)	5 (3%)
10	7 (7%)	0 (0%)	7 (5%)
11	13 (12%)	0 (0%)	13 (9%)

Variables	REC (N=104)	REG (N=43)	Total (N=147)
12	0 (0%)	0 (0%)	0 (0%)
13	0 (0%)	9 (21%)	9 (6%)
14	9 (9%)	0 (0%)	9 (6%)
15	11 (11%)	0 (0%)	11 (7%)
17	16 (15%)	0 (0%)	16 (11%)
18	4 (4%)	0 (0%)	4 (3%)
19	1 (1%)	0 (0%)	1 (1%)
20	0 (0%)	0 (0%)	0 (0%)
21	0 (0%)	0 (0%)	0 (0%)
22	0 (0%)	0 (0%)	0 (0%)
23	0 (0%)	0 (0%)	0 (0%)
Male (patients)			
N	104	43	147
mean	60	60	60
sd	14	7.4	13
median	59	57	58
Q1 - Q3	49 -- 70	55 -- 65	52 -- 69
min - max	23 -- 90	47 -- 79	23 -- 90
Adult (patients)			
N	104	43	147
mean	77	85	80
sd	11	4.8	10
median	77	85	81
Q1 - Q3	70 -- 86	82 -- 88	72 -- 87
min - max	48 -- 100	71 -- 94	48 -- 100
Diseases of the digestive system			
N	104	43	147
mean	10	47	21
sd	10	24	23
median	7	45	11
Q1 - Q3	4 -- 13	24 -- 68	5 -- 31
min - max	0 -- 45	5 -- 83	0 -- 83
n_pat			
N	104	43	147
mean	118	441	212
sd	55	223	195
median	105	463	127
Q1 - Q3	80 -- 140	204 -- 636	95 -- 227
min - max	29 -- 274	101 -- 934	29 -- 934
Incidence of diseases of the digestive system with respect to patients			
N	104	43	147
mean	0.08	0.11	0.088
sd	0.057	0.023	0.051
median	0.075	0.11	0.094
Q1 - Q3	0.037 -- 0.12	0.094 -- 0.12	0.054 -- 0.12
min - max	0 -- 0.23	0.05 -- 0.16	0 -- 0.23
Male (occupation)			
N	104	43	147
mean	65	66	65
sd	15	8.3	13
median	66	64	65
Q1 - Q3	50 -- 76	60 -- 72	57 -- 75
min - max	35 -- 94	49 -- 97	35 -- 97
Adult (occupation)			
N	104	43	147
mean	78	76	77
sd	10	9	10
median	78	75	77
Q1 - Q3	69 -- 85	71 -- 79	69 -- 84
min - max	54 -- 100	61 -- 114	54 -- 114

Variables	REC (N=104)	REG (N=43)	Total (N=147)
n_occup			
N	104	43	147
mean	270	695	394
sd	142	391	310
median	231	769	276
Q1 - Q3	168 -- 298	352 -- 1026	186 -- 503
min - max	32 -- 600	128 -- 1516	32 -- 1516
Incidence of diseases of the digestive system with respect to occupation			
N	104	43	147
mean	0.036	0.071	0.047
sd	0.031	0.019	0.032
median	0.031	0.069	0.043
Q1 - Q3	0.017 -- 0.049	0.055 -- 0.081	0.024 -- 0.068
min - max	0 -- 0.14	0.037 -- 0.12	0 -- 0.14
ratio			
N	104	43	147
mean	0.49	0.68	0.54
sd	0.18	0.16	0.2
median	0.43	0.67	0.49
Q1 - Q3	0.37 -- 0.57	0.53 -- 0.78	0.39 -- 0.69
min - max	0.13 -- 0.99	0.37 -- 0.99	0.13 -- 0.99

Table A4: Description of unmatched EHR data

Absolute and relative frequencies and mean, standard deviation, median and interquartile range (Q1 - Q3), minimum and maximum of the observed/predicted variables of the unmatched EHR data set are given, respectively. In case the predicted variables are described, boxes indicate the model and data set used (·····: predictions made on the basis of model of Section 2.3.3 modelling relationship 3 (patient-occupancy ratio when patient data is given)).

Variables	REC (N=234)	REG (N=36)	Total (N=270)
Centre			
1	19 (8%)	0 (0%)	19 (7%)
2	0 (0%)	1 (3%)	1 (0%)
4	21 (9%)	0 (0%)	21 (8%)
5	9 (4%)	0 (0%)	9 (3%)
6	15 (6%)	0 (0%)	15 (6%)
7	0 (0%)	8 (22%)	8 (3%)
8	6 (3%)	0 (0%)	6 (2%)
9	0 (0%)	10 (28%)	10 (4%)
10	12 (5%)	0 (0%)	12 (4%)
11	14 (6%)	0 (0%)	14 (5%)
12	16 (7%)	0 (0%)	16 (6%)
13	0 (0%)	16 (44%)	16 (6%)
14	7 (3%)	0 (0%)	7 (3%)
15	6 (3%)	0 (0%)	6 (2%)
17	9 (4%)	0 (0%)	9 (3%)
18	12 (5%)	0 (0%)	12 (4%)
19	21 (9%)	0 (0%)	21 (8%)
20	44 (19%)	0 (0%)	44 (16%)
21	0 (0%)	1 (3%)	1 (0%)
22	5 (2%)	0 (0%)	5 (2%)
23	18 (8%)	0 (0%)	18 (7%)
Month			
2017 11	1 (0%)	0 (0%)	1 (0%)
2017 12	1 (0%)	0 (0%)	1 (0%)
2018 01	1 (0%)	0 (0%)	1 (0%)
2018 02	1 (0%)	0 (0%)	1 (0%)
2018 03	1 (0%)	0 (0%)	1 (0%)
2018 04	3 (1%)	0 (0%)	3 (1%)
2018 05	3 (1%)	1 (3%)	4 (1%)
2018 06	4 (2%)	1 (3%)	5 (2%)
2018 07	5 (2%)	1 (3%)	6 (2%)
2018 08	6 (3%)	2 (6%)	8 (3%)
2018 09	6 (3%)	2 (6%)	8 (3%)
2018 10	4 (2%)	1 (3%)	5 (2%)
2018 11	5 (2%)	2 (6%)	7 (3%)
2018 12	3 (1%)	0 (0%)	3 (1%)
2019 01	2 (1%)	0 (0%)	2 (1%)
2019 02	4 (2%)	1 (3%)	5 (2%)
2019 03	1 (0%)	0 (0%)	1 (0%)
2019 04	5 (2%)	3 (8%)	8 (3%)
2019 05	3 (1%)	2 (6%)	5 (2%)
2019 06	3 (1%)	1 (3%)	4 (1%)
2019 07	5 (2%)	2 (6%)	7 (3%)
2019 08	3 (1%)	1 (3%)	4 (1%)
2019 09	6 (3%)	1 (3%)	7 (3%)
2019 10	6 (3%)	1 (3%)	7 (3%)
2019 11	5 (2%)	2 (6%)	7 (3%)
2019 12	6 (3%)	1 (3%)	7 (3%)
2020 01	7 (3%)	1 (3%)	8 (3%)
2020 02	6 (3%)	0 (0%)	6 (2%)
2020 03	10 (4%)	2 (6%)	12 (4%)
2020 04	7 (3%)	0 (0%)	7 (3%)
2020 05	8 (3%)	0 (0%)	8 (3%)
2020 06	7 (3%)	0 (0%)	7 (3%)

Variables	REC (N=234)	REG (N=36)	Total (N=270)
2020 07	6 (3%)	1 (3%)	7 (3%)
2020 08	9 (4%)	1 (3%)	10 (4%)
2020 09	6 (3%)	1 (3%)	7 (3%)
2020 10	8 (3%)	1 (3%)	9 (3%)
2020 11	5 (2%)	0 (0%)	5 (2%)
2020 12	10 (4%)	1 (3%)	11 (4%)
2021 01	7 (3%)	2 (6%)	9 (3%)
2021 02	11 (5%)	1 (3%)	12 (4%)
2021 03	7 (3%)	0 (0%)	7 (3%)
2021 04	9 (4%)	0 (0%)	9 (3%)
2021 05	8 (3%)	0 (0%)	8 (3%)
2021 06	9 (4%)	0 (0%)	9 (3%)
2021 07	1 (0%)	0 (0%)	1 (0%)
Male (patients)			
N	234	36	270
mean	60	58	59
sd	15	6.5	14
median	60	56	60
Q1 - Q3	54 -- 68	53 -- 61	54 -- 67
min - max	0 -- 100	51 -- 83	0 -- 100
Adults (patients)			
N	234	36	270
mean	80	82	80
sd	11	5.9	11
median	81	82	81
Q1 - Q3	74 -- 86	77 -- 87	75 -- 86
min - max	0 -- 100	70 -- 93	0 -- 100
Diseases of the digestive system			
N	234	36	270
mean	21	37	23
sd	23	23	24
median	11	30	12
Q1 - Q3	4 -- 34	21 -- 44	5 -- 37
min - max	0 -- 85	3 -- 89	0 -- 89
n_pat			
N	234	36	270
mean	211	373	233
sd	199	210	208
median	132	306	150
Q1 - Q3	80 -- 275	224 -- 470	85 -- 316
min - max	5 -- 934	29 -- 793	5 -- 934
Incidence of diseases of the digestive system with respect to patients			
N	234	36	270
mean	0.095	0.1	0.096
sd	0.068	0.032	0.064
median	0.09	0.1	0.092
Q1 - Q3	0.052 -- 0.13	0.083 -- 0.12	0.057 -- 0.13
min - max	0 -- 0.3	0.032 -- 0.21	0 -- 0.3
ratio			
N	234	36	270
mean	0.48	0.67	0.51
sd	0.05	0.028	0.081
median	0.49	0.67	0.49
Q1 - Q3	0.46 -- 0.51	0.65 -- 0.68	0.46 -- 0.52
min - max	0.25 -- 0.63	0.63 -- 0.78	0.25 -- 0.78
n_occup			
N	234	36	270
mean	437	566	454
sd	412	336	404
median	266	459	287
Q1 - Q3	165 -- 544	334 -- 714	182 -- 585

Variables	REC (N=234)	REG (N=36)	Total (N=270)
min - max	12 -- 1876	37 -- 1246	12 -- 1876
Incidence of diseases of the digestive system with respect to occupation			
N	234	36	270
mean	0.045	0.069	0.048
sd	0.033	0.023	0.033
median	0.042	0.068	0.045
Q1 - Q3	0.023 -- 0.062	0.056 -- 0.078	0.027 -- 0.068
min - max	0 -- 0.16	0.021 -- 0.16	0 -- 0.16

Table A5: Description of unmatched occupancy data

Absolute and relative frequencies and mean, standard deviation, median and interquartile range (Q1 - Q3), minimum and maximum of the observed/predicted variables of the unmatched occupancy data sets are given, respectively. In case the predicted variables are described, boxes indicate the model and data set used (– - – - –: predictions made on the basis of model of Section 2.3.2 and 2.3.1 modelling relationships 2 (patient-occupancy ratio when occupancy data is given) and 1 (disease incidence); - - - - -: predictions made on the basis of model of Section 2.3.2 modelling relationship 2 (patient-occupancy ratio when occupancy data is given)).

Variables	REC (N=26)	REG (N=14)	Total (N=40)
Centre			
1	2 (8%)	0 (0%)	2 (5%)
2	0 (0%)	3 (21%)	3 (8%)
3	1 (4%)	0 (0%)	1 (2%)
4	1 (4%)	0 (0%)	1 (2%)
5	0 (0%)	0 (0%)	0 (0%)
6	2 (8%)	0 (0%)	2 (5%)
7	0 (0%)	3 (21%)	3 (8%)
8	0 (0%)	0 (0%)	0 (0%)
9	0 (0%)	1 (7%)	1 (2%)
10	7 (27%)	0 (0%)	7 (18%)
11	1 (4%)	0 (0%)	1 (2%)
13	0 (0%)	3 (21%)	3 (8%)
14	8 (31%)	0 (0%)	8 (20%)
15	1 (4%)	0 (0%)	1 (2%)
16	0 (0%)	1 (7%)	1 (2%)
17	2 (8%)	0 (0%)	2 (5%)
Month			
2018 10	0 (0%)	0 (0%)	0 (0%)
2018 11	0 (0%)	0 (0%)	0 (0%)
2018 12	0 (0%)	0 (0%)	0 (0%)
2019 01	0 (0%)	0 (0%)	0 (0%)
2019 02	0 (0%)	0 (0%)	0 (0%)
2019 03	0 (0%)	0 (0%)	0 (0%)
2019 04	0 (0%)	0 (0%)	0 (0%)
2019 05	0 (0%)	0 (0%)	0 (0%)
2019 06	0 (0%)	0 (0%)	0 (0%)
2019 07	0 (0%)	0 (0%)	0 (0%)
2019 08	0 (0%)	0 (0%)	0 (0%)
2019 09	0 (0%)	0 (0%)	0 (0%)
2019 10	1 (4%)	0 (0%)	1 (2%)
2019 11	1 (4%)	0 (0%)	1 (2%)
2019 12	2 (8%)	0 (0%)	2 (5%)
2020 01	3 (12%)	0 (0%)	3 (8%)
2020 02	2 (8%)	0 (0%)	2 (5%)
2020 03	1 (4%)	0 (0%)	1 (2%)
2020 04	2 (8%)	0 (0%)	2 (5%)
2020 05	2 (8%)	0 (0%)	2 (5%)

Variables	REC (N=26)	REG (N=14)	Total (N=40)
2020 06	1 (4%)	0 (0%)	1 (2%)
2020 07	2 (8%)	1 (7%)	3 (8%)
2020 08	0 (0%)	0 (0%)	0 (0%)
2020 09	0 (0%)	0 (0%)	0 (0%)
2020 10	0 (0%)	0 (0%)	0 (0%)
2020 11	0 (0%)	0 (0%)	0 (0%)
2020 12	0 (0%)	0 (0%)	0 (0%)
2021 01	0 (0%)	0 (0%)	0 (0%)
2021 02	0 (0%)	0 (0%)	0 (0%)
2021 03	0 (0%)	0 (0%)	0 (0%)
2021 04	0 (0%)	0 (0%)	0 (0%)
2021 05	0 (0%)	0 (0%)	0 (0%)
2021 06	0 (0%)	0 (0%)	0 (0%)
2021 07	2 (8%)	4 (29%)	6 (15%)
2021 08	4 (15%)	4 (29%)	8 (20%)
2021 09	3 (12%)	4 (29%)	7 (18%)
2021 10	0 (0%)	1 (7%)	1 (2%)
Male (occupancy)			
N	26	14	40
mean	71	64	68
sd	21	4.4	17
median	69	63	65
Q1 - Q3	61 -- 95	62 -- 66	61 -- 72
min - max	24 -- 98	57 -- 72	24 -- 98
Adult (occupancy)			
N	26	14	40
mean	81	71	78
sd	13	7.4	13
median	78	71	75
Q1 - Q3	72 -- 97	67 -- 74	69 -- 85
min - max	59 -- 100	58 -- 86	58 -- 100
n_occup			
N	26	14	40
mean	225	331	262
sd	118	311	209
median	220	197	210
Q1 - Q3	154 -- 277	125 -- 311	130 -- 296
min - max	56 -- 583	87 -- 958	56 -- 958
ratio			
N	26	14	40
mean	0.52	0.74	0.6
sd	0.094	0.12	0.15
median	0.51	0.76	0.59
Q1 - Q3	0.44 -- 0.61	0.64 -- 0.81	0.49 -- 0.67
min - max	0.37 -- 0.66	0.57 -- 0.92	0.37 -- 0.92
n_pat			
N	26	14	40
mean	116	215	151
sd	65	165	119
median	115	158	118
Q1 - Q3	87 -- 133	93 -- 222	90 -- 170
min - max	25 -- 349	74 -- 544	25 -- 544
Diseases of the digestive system			
N	19	5	24
Nmiss	7 (27%)	9 (64%)	16 (40%)
mean	16	20	17
sd	5.8	12	7.2
median	15	15	15
Q1 - Q3	12 -- 19	13 -- 18	13 -- 19
min - max	6.6 -- 27	12 -- 40	6.6 -- 40
Incidence of diseases of the digestive system with respect to patients			

Variables	REC (N=26)	REG (N=14)	Total (N=40)
N	19	5	24
Nmiss	7 (27%)	9 (64%)	16 (40%)
mean	0.13	0.11	0.12
sd	0.03	0.026	0.029
median	0.13	0.12	0.12
Q1 - Q3	0.1 -- 0.14	0.088 -- 0.13	0.099 -- 0.14
min - max	0.078 -- 0.19	0.082 -- 0.14	0.078 -- 0.19
Incidence of diseases of the digestive system with respect to occupancy			
N	19	5	24
Nmiss	7 (27%)	9 (64%)	16 (40%)
mean	0.071	0.09	0.075
sd	0.025	0.035	0.028
median	0.066	0.094	0.074
Q1 - Q3	0.047 -- 0.087	0.059 -- 0.12	0.051 -- 0.092
min - max	0.037 -- 0.12	0.051 -- 0.13	0.037 -- 0.13

A.2 Original R Output of the fitted models and diagnostics

In all models, the KS test, the Dispersion test and the Outlier test were not conspicuous, except for the last model. Here, the KS test was significant, however the derivation from the expected distribution is marginal.

A.2.1 Negative binominal model fitted on the EHR data

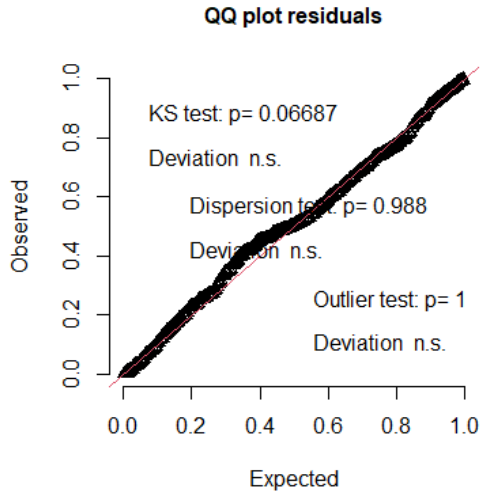
Function call:

```
library(glmmTMB)
m1 <-(glmmTMB(morb_gastro ~ adult + male + type_of_centre + n_pat10+
                ar1(timef + 0 | type_of_centre),
                disp = ~ type_of_centre,
                ziformula= ~ n_pat10,
                family = nbinom2,
                data = EHR_data))
library(DHARMa)
simulateResiduals(fittedModel = m1, plot = T, n=1000)
```

Output:

```
  Family: nbinom2  ( log )
 Formula:
 morb_gastro ~ adult + male + type_of_centre + n_pat10 +
     ar1(timef + 0 | type_of_centre)
 Zero inflation:               ~n_pat10
 Dispersion:                   ~type_of_centre
 Data: EHR_data

      AIC      BIC   logLik deviance df.resid
   3145.1   3190.2  -1561.6   3123.1      434

 Random effects:

 Conditional model:
  Groups  Name          Variance Std.Dev. Corr
  type_of_centre timef1 0.02659  0.1631   0.90 (ar1)
 Number of obs: 445, groups:  type_of_centre, 2

 Conditional model:
                   Estimate Std. Error z value Pr(>|z|)
 (Intercept)       1.209599   0.293872   4.116 3.85e-05 ***
 ErwachsenA10      0.030388   0.037343   0.814 0.415789
 MaennlichA10      0.117843   0.035065   3.361 0.000777 ***
 type_of_centreREG 0.142759   0.148626   0.961 0.336790
 n_pat10           0.030997   0.001451  21.361  < 2e-16 ***
 ---
 Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

 Zero-inflation model:
             Estimate Std. Error z value Pr(>|z|)
 (Intercept) -0.81494    0.27417  -2.972  0.00296 **
 n_pat10     -0.07586    0.01912  -3.967 7.28e-05 ***
 ---
```

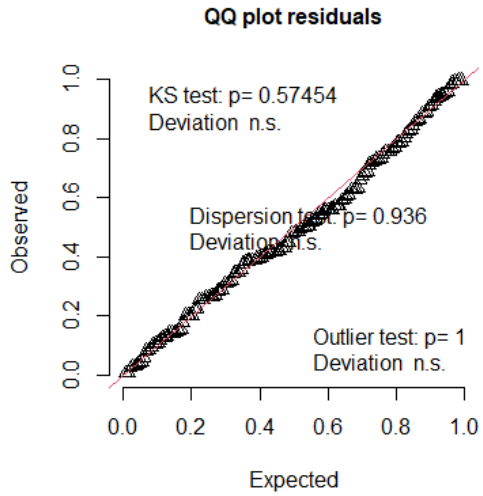
```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Dispersion model:
                  Estimate Std. Error z value Pr(>|z|)
(Intercept)       1.1283     0.1074  10.508  < 2e-16 ***
type_of_centreREG 1.9750     0.2980   6.628 3.39e-11 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



A.2.2 Generalized linear model fitted on the matched data (occup→pat)

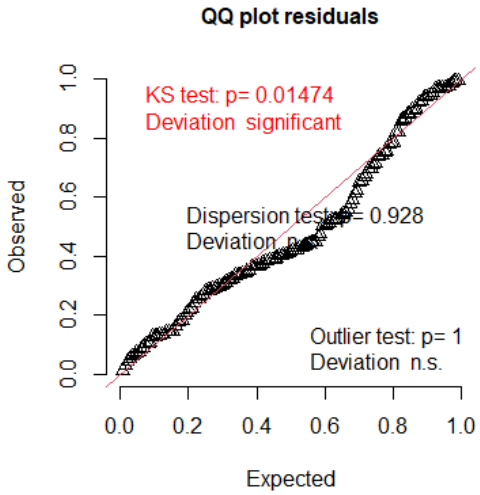
```
 Family: gaussian  ( identity )
Formula:
n_pat/n_occup ~ adult + male + type_of_centre + n_occup10
Dispersion:                   ~type_of_centre
Data: matched

     AIC      BIC   logLik deviance df.resid
  -139.9   -119.0     77.0   -153.9      140


Conditional model:
                  Estimate  Std. Error z value  Pr(>|z|)
(Intercept)      -0.0130257  0.1016618  -0.128    0.898
adult             0.0819681  0.0195188   4.199 2.68e-05 ***
male             -0.0093271  0.0144625  -0.645    0.519
type_of_centreREG 0.3295237  0.0371571   8.868  < 2e-16 ***
n_occup10        -0.0028899  0.0005849  -4.941 7.76e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Dispersion model:
                     Estimate Std. Error z value Pr(>|z|)
```

```
(Intercept)          -3.9532     0.1472  -26.85   <2e-16 ***
type_of_centreREG     0.2336     0.3072    0.76    0.447
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



A.2.3 Generalized linear model fitted on the matched data (pat→occup)

```
 Family: gaussian  ( identity )
Formula:
n_pat/n_occup ~ adult + male + type_of_centre + log(n_pat10)
Dispersion:                    ~type_of_centre
Data: matched

     AIC      BIC   logLik deviance df.resid
   -90.1    -69.2     52.1   -104.1      140


Conditional model:
                  Estimate Std. Error z value Pr(>|z|)
(Intercept)       0.395372   0.136763   2.891  0.00384 **
adult            -0.017429   0.020809  -0.838  0.40227
male              0.039569   0.015466   2.558  0.01051 *
type_of_centreREG 0.210239   0.047327   4.442  8.9e-06 ***
log(n_pat10)     -0.004705   0.026727  -0.176  0.86027
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Dispersion model:
                 Estimate Std. Error z value Pr(>|z|)
(Intercept)       -3.4391     0.1405  -24.48   <2e-16 ***
type_of_centreREG -0.3666     0.2675   -1.37    0.171
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



A.3 Results of sensitivity analysis

A.3.1 Sensitivity analysis not excluding $n_{occup} < n_{pat}$

Table A6 is a description of the full matched data, i.e., where records for which the occupancy number is smaller than the number of patients (i.e. $n_{occup} < n_{pat}$) were not excluded. It can be seen, that 175-147=28 observations have a ratio greater than one and that the interquartile range and the range of ratios in the full matched data set is given by 0.41 -- 0.81 and 0.13 -- 3.5, respectively. The individual values are given by:

1.02, 1.03, 1.05, 1.05, 1.06, 1.07, 1.08, 1.08, 1.12, 1.12, 1.13, 1.15, 1.17, 1.18, 1.19, 1.24, 1.27, 1.31, 1.33, 1.36, 1.43, 1.97, 2.20, 2.25, 2.36, 3.05, 3.27, 3.47.

Table A7 and A8 show the results of the models described in Sections 2.3.2 and 2.3.3 fitted on this data set. The results are similar with exception of the effect of type of centre. However, this could be explained by the fact, that the mean ratio in the group of REG facilities (=0.99) is biased upwards due to a few very high unrealistic ratios.

Table A6: Description of full matched data

Absolute and relative frequencies and mean, standard deviation, median and interquartile range (Q1 - Q3), minimum and maximum of the observed variables of the matched data set stratified by the type of centre are given, respectively. Records for which the occupancy number is smaller than the number of patients (i.e. $n_{occup} < n_{pat}$) were not excluded.

Variables	REC (N=111)	REG (N=64)	Total (N=175)
Month			
2017 11	0 (0%)	0 (0%)	0 (0%)
2017 12	0 (0%)	0 (0%)	0 (0%)
2018 01	0 (0%)	0 (0%)	0 (0%)
2018 02	0 (0%)	0 (0%)	0 (0%)
2018 03	0 (0%)	0 (0%)	0 (0%)
2018 04	0 (0%)	0 (0%)	0 (0%)
2018 05	0 (0%)	0 (0%)	0 (0%)
2018 06	0 (0%)	0 (0%)	0 (0%)
2018 07	0 (0%)	0 (0%)	0 (0%)
2018 08	0 (0%)	0 (0%)	0 (0%)
2018 09	0 (0%)	0 (0%)	0 (0%)
2018 10	2 (2%)	1 (2%)	3 (2%)
2018 11	1 (1%)	0 (0%)	1 (1%)
2018 12	4 (4%)	2 (3%)	6 (3%)
2019 01	5 (5%)	2 (3%)	7 (4%)
2019 02	3 (3%)	1 (2%)	4 (2%)
2019 03	6 (5%)	2 (3%)	8 (5%)
2019 04	2 (2%)	0 (0%)	2 (1%)
2019 05	4 (4%)	1 (2%)	5 (3%)
2019 06	5 (5%)	2 (3%)	7 (4%)
2019 07	4 (4%)	1 (2%)	5 (3%)
2019 08	5 (5%)	2 (3%)	7 (4%)
2019 09	5 (5%)	2 (3%)	7 (4%)
2019 10	6 (5%)	2 (3%)	8 (5%)
2019 11	6 (5%)	1 (2%)	7 (4%)
2019 12	5 (5%)	2 (3%)	7 (4%)
2020 01	4 (4%)	2 (3%)	6 (3%)
2020 02	5 (5%)	3 (5%)	8 (5%)
2020 03	2 (2%)	1 (2%)	3 (2%)
2020 04	3 (3%)	3 (5%)	6 (3%)
2020 05	3 (3%)	3 (5%)	6 (3%)
2020 06	4 (4%)	3 (5%)	7 (4%)
2020 07	4 (4%)	1 (2%)	5 (3%)
2020 08	0 (0%)	1 (2%)	1 (1%)
2020 09	3 (3%)	1 (2%)	4 (2%)
2020 10	1 (1%)	1 (2%)	2 (1%)
2020 11	4 (4%)	2 (3%)	6 (3%)
2020 12	0 (0%)	1 (2%)	1 (1%)
2021 01	3 (3%)	2 (3%)	5 (3%)
2021 02	0 (0%)	3 (5%)	3 (2%)
2021 03	4 (4%)	4 (6%)	8 (5%)
2021 04	2 (2%)	4 (6%)	6 (3%)
2021 05	3 (3%)	4 (6%)	7 (4%)
2021 06	2 (2%)	4 (6%)	6 (3%)
2021 07	1 (1%)	0 (0%)	1 (1%)
Centre			
1	3 (3%)	0 (0%)	3 (2%)
2	0 (0%)	5 (8%)	5 (3%)
4	16 (14%)	0 (0%)	16 (9%)
5	13 (12%)	0 (0%)	13 (7%)
6	17 (15%)	0 (0%)	17 (10%)
7	0 (0%)	30 (47%)	30 (17%)
8	1 (1%)	0 (0%)	1 (1%)
9	0 (0%)	13 (20%)	13 (7%)
10	7 (6%)	0 (0%)	7 (4%)

Variables	REC (N=111)	REG (N=64)	Total (N=175)
11	13 (12%)	0 (0%)	13 (7%)
12	0 (0%)	0 (0%)	0 (0%)
13	0 (0%)	11 (17%)	11 (6%)
14	9 (8%)	0 (0%)	9 (5%)
15	11 (10%)	0 (0%)	11 (6%)
17	16 (14%)	0 (0%)	16 (9%)
18	4 (4%)	0 (0%)	4 (2%)
19	1 (1%)	0 (0%)	1 (1%)
20	0 (0%)	0 (0%)	0 (0%)
21	0 (0%)	5 (8%)	5 (3%)
22	0 (0%)	0 (0%)	0 (0%)
23	0 (0%)	0 (0%)	0 (0%)
Male (patients)			
N	111	64	175
mean	61	61	61
sd	15	7.7	13
median	61	58	59
Q1 - Q3	50 -- 71	55 -- 67	54 -- 70
min - max	23 -- 90	47 -- 79	23 -- 90
Adult (patients)			
N	111	64	175
mean	78	83	80
sd	11	5.6	9.8
median	78	84	81
Q1 - Q3	70 -- 86	79 -- 87	73 -- 87
min - max	48 -- 100	71 -- 94	48 -- 100
Diseases of the digestive system			
N	111	64	175
mean	9.6	43	22
sd	10	22	22
median	6	44	12
Q1 - Q3	3 -- 13	24 -- 62	5 -- 33
min - max	0 -- 45	5 -- 83	0 -- 83
n_pat			
N	111	64	175
mean	121	409	226
sd	55	209	193
median	108	403	143
Q1 - Q3	81 -- 148	209 -- 590	100 -- 269
min - max	29 -- 274	101 -- 934	29 -- 934
Incidence of diseases of the digestive system with respect to patients			
N	111	64	175
mean	0.077	0.11	0.087
sd	0.058	0.026	0.05
median	0.073	0.11	0.091
Q1 - Q3	0.033 -- 0.12	0.091 -- 0.12	0.055 -- 0.12
min - max	0 -- 0.23	0.05 -- 0.17	0 -- 0.23
Male (occupancy)			
N	111	64	175
mean	66	65	66
sd	15	7.4	13
median	67	63	66
Q1 - Q3	51 -- 78	61 -- 70	59 -- 75
min - max	35 -- 94	49 -- 97	35 -- 97
Adult (occupancy)			
N	111	64	175
mean	78	75	77
sd	11	8.6	10
median	79	75	77
Q1 - Q3	69 -- 87	71 -- 79	70 -- 84
min - max	54 -- 100	55 -- 114	54 -- 114

Variables	REC (N=111)	REG (N=64)	Total (N=175)
n_occup			
N	111	64	175
mean	261	553	368
sd	142	392	297
median	229	417	259
Q1 - Q3	161 -- 290	236 -- 874	169 -- 475
min - max	32 -- 600	72 -- 1516	32 -- 1516
Incidence of diseases of the digestive system with respect to occupancy			
N	111	64	175
mean	0.036	0.11	0.062
sd	0.031	0.09	0.069
median	0.031	0.079	0.049
Q1 - Q3	0.016 -- 0.049	0.065 -- 0.1	0.026 -- 0.079
min - max	0 -- 0.14	0.037 -- 0.46	0 -- 0.46
ratio			
N	111	64	175
mean	0.54	0.99	0.7
sd	0.27	0.65	0.5
median	0.44	0.78	0.54
Q1 - Q3	0.38 -- 0.66	0.63 -- 1.1	0.41 -- 0.81
min - max	0.13 -- 2	0.37 -- 3.5	0.13 -- 3.5

Table A7: Results of the generalized linear model fitted on the full matched data (relationship 2: patient-occupancy ratio when occupancy data is given)

Estimates of the fixed effects of the conditional and dispersion model are given with associated 95% confidence intervals (CI). The number of observations is 175, the AIC is given by 79.

Model	Variable	Estimate	Lower 95% CI	Upper 95% CI
Conditional	Intercept	0	-0.31	0.3
	adult (10 %)	0.07	0.01	0.12
	male (10 %)	0.04	0	0.08
	Type of centre (ref = REC)	0.73	0.57	0.88
	$n_{occup}/10$	-0.01	-0.01	-0.01
Dispersion	Intercept	-3.22	-3.49	-2.96
	Type of centre (ref = REC)	2.07	1.63	2.51

Table A8: Results of the generalized linear model fitted on the full matched data (relationship 3: patient-occupancy ratio when patient data is given)

Estimates of the fixed effects of the conditional and dispersion model are given with associated 95% confidence intervals (CI). The number of observations is 175, the AIC is given by 147.9.

Model	Variable	Estimate	Lower 95% CI	Upper 95% CI
Conditional	Intercept	0.16	-0.26	0.57
	adult (10 %)	-0.02	-0.08	0.04
	male (10 %)	0.08	0.03	0.13
	Type of centre (ref = REC)	0.43	0.22	0.63
	$\log(n_{pat}/10)$	0.03	-0.07	0.13
Dispersion	Intercept	-2.73	-3	-2.47
	Type of centre (ref = REC)	1.8	1.35	2.25

A.3.2 Sensitivity analysis excluding observations with 0 cases of diseases of the digestive system

Due to the exclusion of observations with 0 cases of diseases of the digestive system, the number of observations in the EHR data reduced to 390 (i.e. 55 observations were excluded). Therefore, the number of observations in the matched data set is also reduced (from 147 to 130). Table A9, A10 and A11 show the results of the models of Section 2.3 fitted on the reduced data sets, where the zero-inflation part of the model of Section 2.3.1 was dropped.
In case of "significant" estimates, i.e., 95% confidence intervals of the estimates in the main paper do not contain the "no-effect value" (i.e. they do not contain 1 and 0 for the negative binominal model and for the generalized linear models, respectively), the results of the main analysis resemble that of the sensitivity analysis.

Table A9: Results of the negative binominal model fitted on the reduced EHR data (relationship1: disease incidence)
Estimates of the fixed effects of the conditional and dispersion model are given with associated 95% confidence intervals (CI). The number of observations is 390, the AIC is given by 2847.3 and the first-order autoregressive coefficient is given by 0.9.

Model	Variable	incident rate ratio	Lower 95% CI	Upper 95% CI
Conditional	Intercept	3.45	1.97	6.03
	adult (10 %)	1.03	0.96	1.11
	male (10 %)	1.12	1.05	1.2
	type of centre (ref = REC)	1.15	0.86	1.53
	$n_{pat}/10$	1.03	1.03	1.03
Dispersion	Intercept	3.23	2.65	3.94
	type of centre (ref = REC)	6.93	3.88	12.35

Table A10: Results of the generalized linear model fitted on the reduced matched data (relationship 2: patient-occupancy ratio when occupancy data is given)
Estimates of the fixed effects of the conditional and dispersion model are given with associated 95% confidence intervals (CI). The number of observations is 130, the AIC is given by -136.6.

Model	Variable	Estimate	Lower 95% CI	Upper 95% CI
Conditional	Intercept	0.09	-0.11	0.29
	adult (10 %)	0.08	0.04	0.12
	male (10 %)	-0.02	-0.05	0
	type of centre (ref = REC)	0.34	0.28	0.41
	$n_{occup}/10$	0	0	0
Dispersion	Intercept	-4.08	-4.4	-3.77
	type of centre (ref = REC)	0.26	-0.35	0.87

Table A11: Results of the generalized linear model fitted on the reduced matched data (relationship 3: patient-occupancy ratio when patient data is given)
Estimates of the fixed effects of the conditional and dispersion model are given with associated 95% confidence intervals (CI). The number of observations is 130, the AIC is given by -91.2.

Model	Variable	Estimate	Lower 95% CI	Upper 95% CI
Conditional	Intercept	0.61	0.32	0.89
	adult (10 %)	-0.03	-0.07	0.02
	male (10 %)	0.02	-0.01	0.06

	type of centre (ref = REC)	0.28	0.19	0.37
	$\log(n_{pat}/10)$	-0.04	-0.09	0.02
Dispersion	Intercept	-3.55	-3.85	-3.25
	type of centre (ref = REC)	-0.29	-0.83	0.25

A.4 Additional figures including 95% confidence intervals

Figure A1: Observations and predictions on relationship 2: patient-occupancy ratio when occupancy data is given

Observed (indicated by circles) and predicted (indicated by diamonds) ratio r and number of patients $n_{pat} = n_{pop} \cdot r$ on the basis of the matched data set and the model of Section 2.3.2 for the unmatched occupancy dataset, respectively. Observations/predictions of different facilities are indicated by the colours of the small dots inside the circles/diamonds, which are coloured with respect to the type of centre (REC: black, REG: blue). The associated 95% confidence intervals for the observed estimates/ predictions are indicated by error bars.

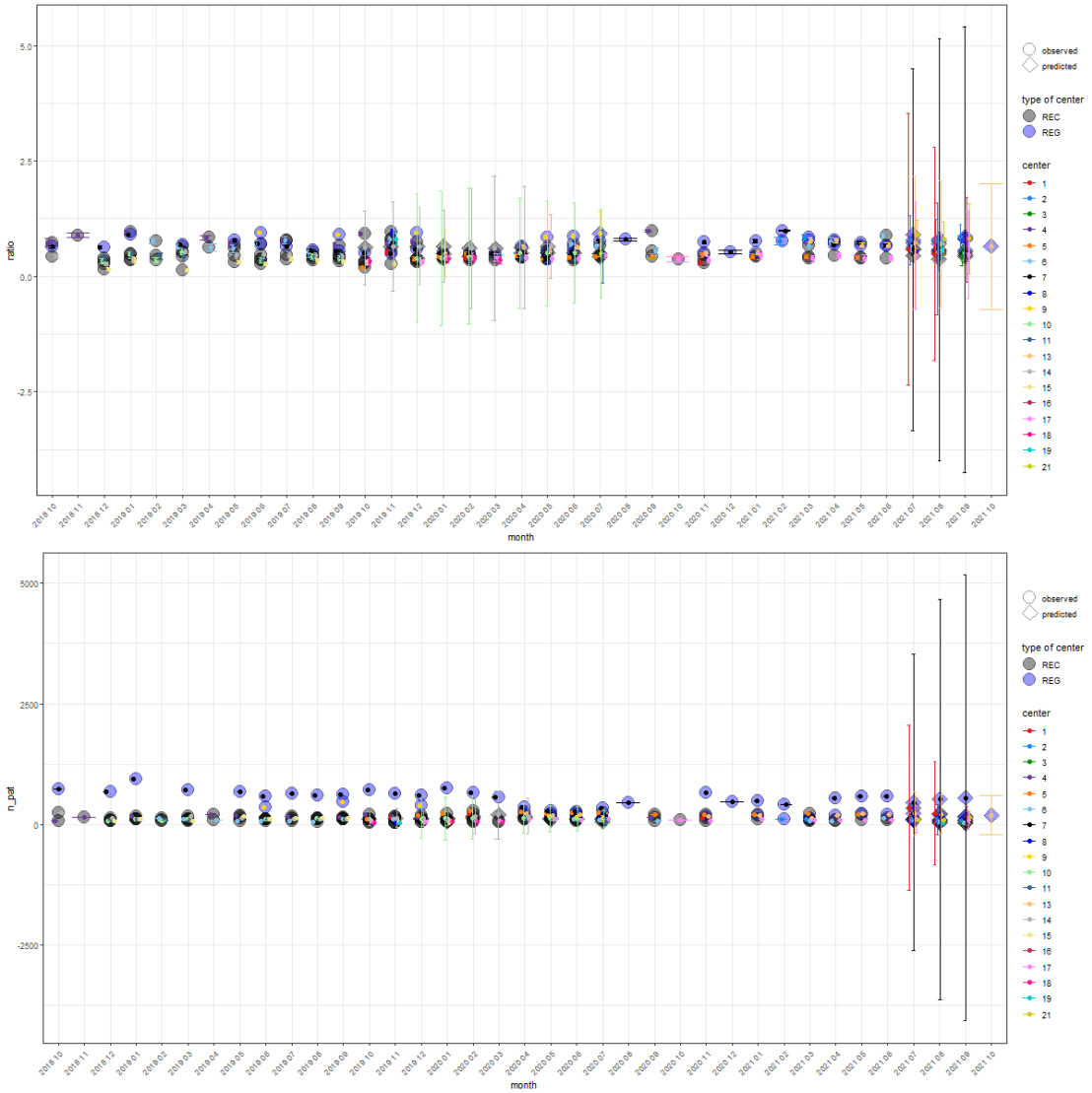


Figure A2: Observations and predictions on relationship 3: patient-occupancy ratio when patient data is given

Observed (indicated by circles) and predicted (indicated by diamonds) ratio r and number of persons $n_{occup} = n_{pat}/r$ on the basis of the matched data set and the model of Section 2.3.3 for the unmatched EHR dataset, respectively. Observations/predictions of different facilities are indicated by the colours of the small dots inside the circles/diamonds, which are colored with respect to the type of centre (REC: black, REG: blue). The associated 95% confidence intervals for the observed estimates/ predictions are indicated by error bars.

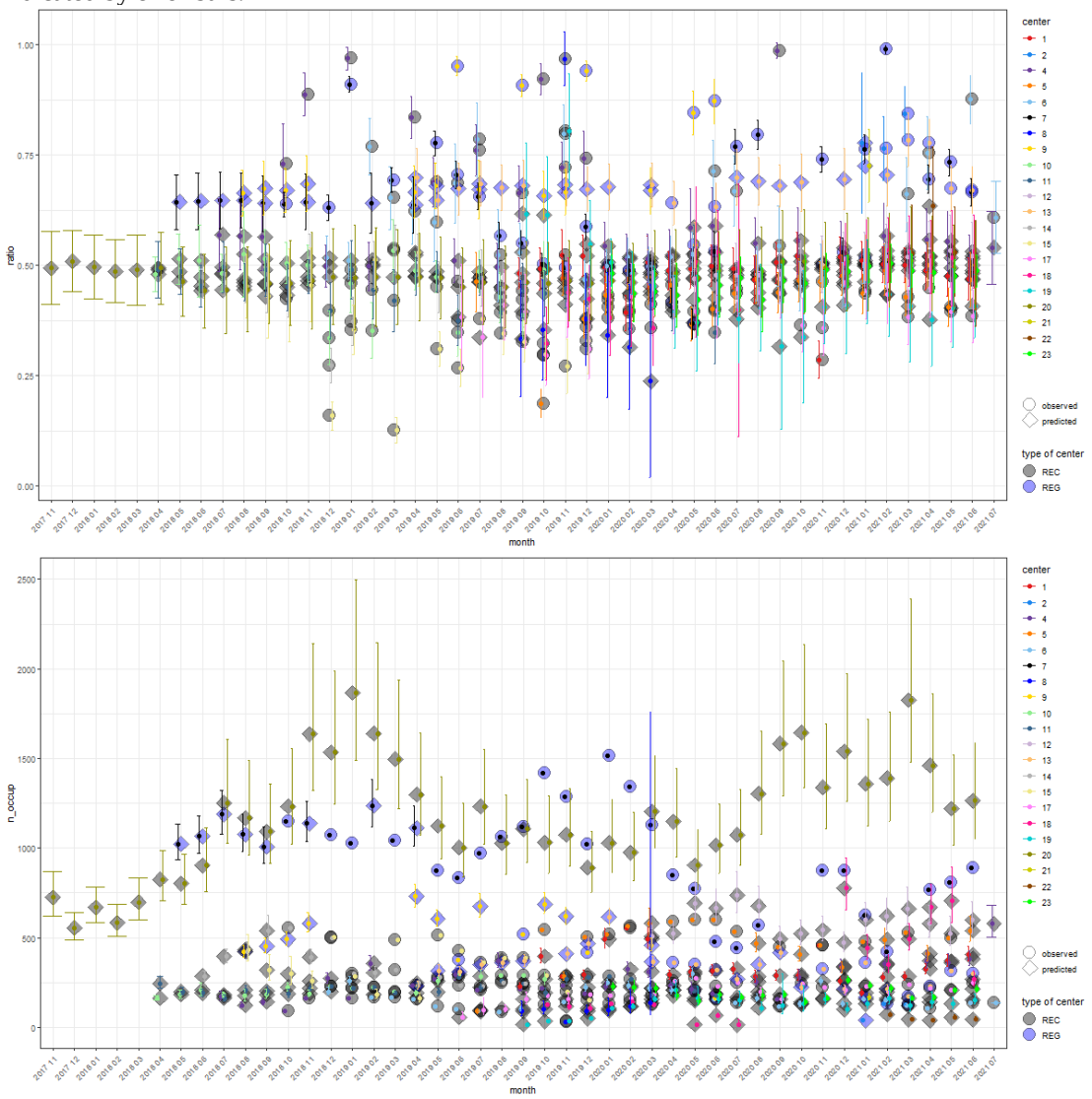


Figure A3: Observations and predictions on relationship 1 and 2: disease incidence depending on total population at risk (occupancy)

Observed (indicated by circles) and predicted (indicated by diamonds) disease incidence with respect to occupancy number (i.e., number of diseases of the digestive system divided by the occupancy number) on the basis of the EHR data set and the models of Section 2.3.2 (relationship 2: patient-occupancy ratio when occupancy data is given) and Section 2.3.1 (relationship 1: disease incidence) for the unmatched occupancy dataset, respectively. Observations/predictions of different facilities are indicated by the colours of the small dots inside the circles/diamonds, which are coloured with respect to the type of centre (REC: black, REG: blue). The associated 95% confidence intervals for the observed estimates/ predictions are indicated by error bars.