eSupplement

Effectiveness of two types of palliative homecare in cancer and non-cancer patients: a retrospective population-based study using claims data

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Content

eMethods

eTable1: Assignment of cancer or non-cancer

Disease	ICD-10 code
Cancer	C00*-C97*
Gastrointestinal cancer or corresponding metastases	C15*-C26*, C78.4-C78.8
Non-cancer	
Cardiovascular diseases	I0*-I6*
Heart failure	I50*
Cerebrovascular diseases	I60*-I69*
Kidney diseases	N17*-N18*, N28*, I12*-I13*
Liver diseases	K70*-K77*
Respiratory diseases	J09*-J18*, J20*-J22*, J40*-J47*, J96*
Neurodegenerative diseases	G10*, G20*, G35*, G122*, G231-G233*
Alzheimer's disease and dementia, senility	F00*-F03*, G30*, R54*
HIV disease	B20*-B24*

Identification of primary palliative care and specialized palliative homecare

Primary palliative care was identified via the fee schedule items (GOP) of the Uniform Value Scale (EBM): 03370/04370, 03371/04371, 03372/04372, 03373. Only general practitioners and pediatricians can bill these items. Fee schedule items for specialists such as oncologists or additional items by regional Associations of Statutory Health Insurance Physicians (KV) or selective-contracting were extensively researched and used to identify primary palliative care. Specialized palliative homecare was identified via the GOP: 01425, 01426. Items by regional Associations of Statutory Health Insurance Physicians (KV) or selective-contracting with billing of service were extensively researched to identify specialized palliative homecare. If both, specialized palliative homecare and primary palliative care, have been carried out, the assignment was made to specialized palliative homecare, since specialized palliative homecare compared to primary palliative care is the more comprehensive type of palliative homecare.

Linked items of claims data used

Access to the data was provided from October 2018. Via protected gateway the health insurance fund BARMER provided access to the scientific data warehouse to create the study population, to prepare and analyze the data. Plausibility checks were performed during data preparation. This revealed that services were billed after the date of death, which were included for the present analyses. For further information, we refer to the publication of Ditscheid and Storch et al[1]. The claims data used included demographic information (for example gender, age, date of death), outpatient and hospital diagnoses (10th revision of the International Statistical Classification of Diseases and Related Health Problems [ICD-10]), outpatient procedures (fee schedule items [GOP]) as well as hospital procedure codes (German version of the International Classification of Procedures in Medicine [OPS]) and outpatient drug prescriptions (Anatomical Therapeutic Chemical Code [ATC] or Central Pharmaceutical Number [PZN]). The different elements were linked using an individual but pseudonymous identifier.

30 day observation period

We added the observation period of 30 days to enhance the comparability to other studies[2–4]. To ensure that palliative care could have an impact on the indicators presented, palliative care had to be documented at least once before the observation period of 30 days before death. The chosen healthcare indicators were calculated for the observation periods of 30 days before death.

eResults & eDiscussion

30 day observation period

From a total of 95,962 individuals deceased in 2016, 14,685 patients were included in the analysis of the 30 day observation period (*eFigure 1*). That means in summary, 2,150 fewer patients within primary palliative care and 2,071 fewer patients within specialized palliative care compared to the observation period of 14 days. The lower number of patients in the observation period of 30 days is due to the fact that palliative care had to be documented at least once before the respective observation and palliative homecare in general as well as specialized palliative homecare in particular started late before death (in our population, specialized palliative homecare in median 21 days before death).

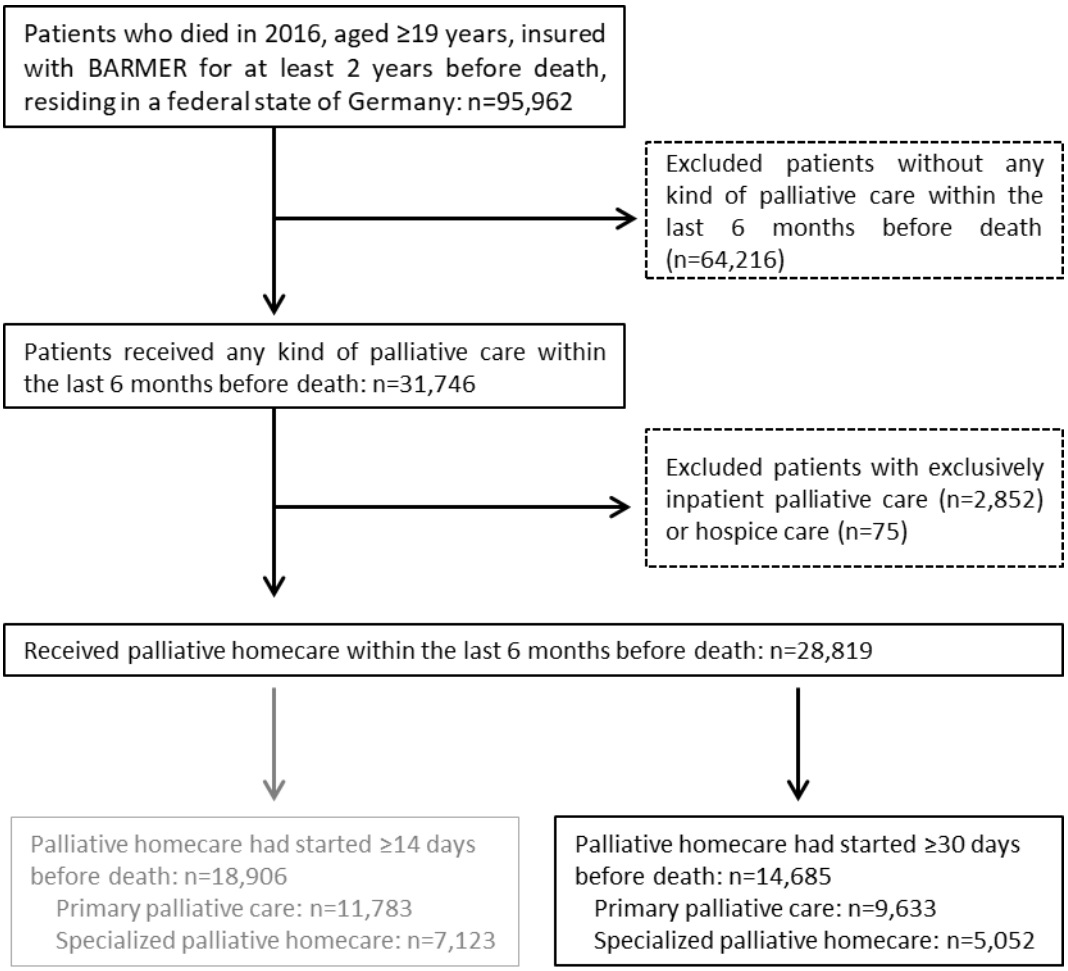
There were no relevant differences in patient characteristics between patients included for the observation periods of 14 and 30 days before death (*eTable 2*). Compared to the observation period of 14 days, similar results were observed within 30 days before death (*eTable 3*), except for insertion/change of PEG. Here, the analysis of the interaction was not feasible for the 30-day observation period due to the small number of patients within specialized palliative homecare.

In summary, the benefit of the more comprehensive specialized palliative homecare was evident in both observation periods, 30 and 14 days before death as well as in both subgroups of cancer and non-cancer patients.

Covariates and interactions

For results on covariates and interactions, see *eTable 4a* to *eTable 8b*: Older age, followed by living in a nursing home and the non-diagnosis of cancer seemed to be factors associated with a lower rate of potentially aggressive interventions at the end-of-life. In contrast, risk factors appeared to be high comorbidity, male gender and living in rural areas. For the latter, similar results were reported in other studies concerning the indicators chemotherapy[5] and artificial nutrition[6] at the end-of-life. The impact of the two types of palliative homecare as well as the presence or absence of cancer are main findings and therefore reported in the main paper.

84 *eFigure 1: Flow-Chart Study population, 30 days before death*



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eTable 2: Patients' characteristics, 30 days before death

	Primary palliative care			Specialized palliative homecare			Total			Primary palliative care vs. Specialized palliative homecare	
	All	Non-cancer	Cancer	**All**	Non-cancer	Cancer	**All**	Non-cancer	Cancer	MD or PP	p-Value
Patients receiving palliative homecare 30 days before death											
n	9,633	4,101	5,532	5,052	726	4,326	14,685	4,827	9,858		p<.0001
%	65.60	42.57	57.43	34.40	14.37	85.63	100.00	32.87	67.13		
Patients without gastrointestinal cancer or corresponding metastases											
n	7,018	4,101	2,917	2,656	726	1,930	9,674	4,827	4,847		p<.0001
% of All	72.85	58.44	41.56	52.57	27.33	72.67	100.00	49.90	50.10	20.28	
Age in years											
Mean (SD)	80.90 (11.40)	85.90 (9.27)	77.18 (11.41)	74.05 (12.45)	80.95 (13.33)	72.89 (11.92)	78.54 (12.21)	85.16 (10.14)	75.30 (11.83)	6.85	p<.0001
Female gender											
n	5,863	2,916	2,947	2,972	463	2,509	8,835	3,379	5,456		p=.0174
%	60.86	49.74	30.59	58.83	15.58	84.42	60.16	38.25	61.75	2.03	
Morbidity weight, CCI											
Mean (SD)	5.47 (3.80)	3.75 (2.61)	6.74 (4.03)	6.56 (4.03)	3.79 (2.72)	7.03 (4.03)	5.85 (3.91)	3.76 (2.63)	6.87 (4.03)	-1.09	p<.0001
Nursing home resident											
n	4,162	2,528	1,634	1,677	387	1,290	5,839	2,915	2,924		p<.0001
%	43.21	60.74	39.26	33.19	23.08	76.29	39.76	49.92	50.08	10.02	
Residency, urban											
(missing: Primary palliative care n=372, Specialized palliative homecare n=191) n	6,574	2,898	3,676	3,467	564	2,903	10,041	3,462	6,579		p=.6816
%	70.99	44.08	55.92	71.32	16.27	83.73	71.10	34.48	65.52	-0.33	

CCI Charlson Comorbidity Index; MD mean difference; PP percentage points difference; SD standard deviation

eTable 3: Healthcare indicators, 30 days before death

	Primary palliative care			Specialized palliative homecare			Total			Primary palliative care vs. Specialized palliative homecare	
	All	Non-cancer	Cancer	**All**	Non-cancer	Cancer	**All**	Non-cancer	Cancer	PP	p-Value
Patients receiving palliative homecare 30 days before death											
n	9,633	4,101	5,532	5,052	726	4,326	14,685	4,827	9,858		
%	65.60	42.57	57.43	34.40	14.37	85.63	100.00	32.87	67.13		
Place of death, hospital											
n	3,558	994	2,564	980	66	914	4,538	1,060	3,478		p<.0001
%	36.94	24.24	46.35	19.40	9.09	21.13	30.90	21.96	35.28	17.54	
Odds ratio primary palliative care vs. specialized palliative homecare [CI]			4.337 [3.943-4.771]								
Odds ratio non-cancer, primary palliative care vs. specialized palliative homecare [CI]		5.069 [3.820-6.725]			5.069 [3.820-6.725]						Interaction primary palliative care vs. specialized palliative homecare and non-cancer vs. cancer p=.2485
Odds ratio cancer, primary palliative care vs. specialized palliative homecare [CI]			4.255 [3.847-4.705]			4.255 [3.847-4.705]					
Hospital care											
n	4,006	1,210	2,796	1,356	101	1,255	5,362	1,311	4,051		p<.0001
%	41.59	29.50	50.54	26.84	13.91	29.01	36.51	27.16	41.09	14.75	
Odds ratio primary palliative care vs. specialized palliative homecare [CI]			3.025 [2.776-3.296]								
Odds ratio non-cancer, primary palliative care vs. specialized palliative homecare [CI]		3.403 [2.699-4.291]			3.403 [2.699-4.291]						Interaction primary palliative care vs. specialized palliative homecare and non-cancer vs. cancer p=.2806
Odds ratio cancer, primary palliative care vs. specialized palliative homecare [CI]			2.970 [2.710-3.256]			2.970 [2.710-3.256]					
Intensive care treatment											
n	571	212	359	77	15	62	648	227	421		p<.0001
%	5.93	5.17	6.49	1.52	2.07	1.43	4.41	4.70	4.27	4.41	
Odds ratio primary palliative care vs. specialized palliative homecare [CI]			4.899 [3.812-6.295]								
Odds ratio non-cancer, primary palliative care vs. specialized palliative homecare [CI]		3.416 [1.996-5.849]			3.416 [1.996-5.849]						Interaction primary palliative care vs. specialized palliative homecare and non-cancer vs. cancer p=.1515
Odds ratio cancer, primary palliative care vs. specialized palliative homecare [CI]			5.313 [4.015-7.030]			5.313 [4.015-7.030]					
Chemotherapy											
Cancer patients			5,532			4,326			9,858		
n			752			366			1,118		p<.0001
%			13.59			8.46			11.34	5.13	
Odds ratio primary palliative care vs. specialized palliative homecare [CI]			2.173 [1.883-2.507]								
Parenteral nutrition											
Patients without gastrointestinal cancer or corresponding metastases	7,018	4,101	2,917	2,656	726	1,930	9,674	4,827	4,847		
n	68	21	47	73	2	71	141	23	118		p<.0001
%	0.97	0.51	1.61	2.75	0.28	3.68	1.46	0.48	2.43	-1.78	
Odds ratio primary palliative care vs. specialized palliative homecare [CI]			0.668 [0.466-0.960]								
Odds ratio non-cancer, primary palliative care vs. specialized palliative homecare [CI]		3.131 [0.716-13.687]			3.131 [0.716-13.687]						Interaction primary palliative care vs. specialized palliative homecare and non-cancer vs. cancer p=.0264
Odds ratio cancer other than gastrointestinal or corresponding metastases, primary palliative care vs. specialized palliative homecare [CI]			0.561 [0.378-0.831]			0.561 [0.378-0.831]					
Insertion or change of a PEG											
Patients without gastrointestinal cancer or corresponding metastases	7,018	4,101	2,917	2,656	726	1,930	9,674	4,827	4,847		
n	50	27	23	7	0	7	57	27	30		p=.0100
%	0.71	0.66	0.79	0.26	0.00	0.36	0.59	0.56	0.62	0.45	
Odds ratio primary palliative care vs. specialized palliative homecare [CI]			3.702 [1.632-8.396]								
Odds ratio non-cancer, primary palliative care vs. specialized palliative homecare [CI]		not calculable			not calculable						Interaction primary palliative care vs. specialized palliative homecare and non-cancer vs. cancer p=.9463
Odds ratio cancer other than gastrointestinal or corresponding metastases, primary palliative care vs. specialized palliative homecare [CI]			2.610 [1.105-6.167]			2.610 [1.105-6.167]					

CI confidence interval; PEG Percutaneous Endoscopic Gastrostomy; PP percentage points difference; SD standard deviation

eTable 4a: Place of death, 14 days

Analysis: maximum likelihood estimators, 14 days				
Parameter	Estimator	Standard error	Wald Chi-square	Pr > ChiSq
Intercept	0.9363	0.1290	52.6461	<.0001
Age	-0.0307	0.00164	347.9092	<.0001
Male vs. female sex	0.00927	0.0372	0.0622	0.8030
Comorbidity index	0.0268	0.00488	30.1742	<.0001
Nursing home resident vs. non-nursing home resident	-1.6070	0.0454	1252.6846	<.0001
Rural vs. urban residency	-0.00564	0.0394	0.0205	0.8863
Cancer vs. non-cancer	-0.4999	0.1232	16.4677	<.0001
Primary palliative care vs. specialized palliative homecare	1.4895	0.0450	1096.1140	<.0001
Interaction cancer / non-cancer vs. primary palliative care / specialized palliative homecare	0.2053	0.1302	2.4848	0.1150

eTable 4b: Place of death, 30 days

Analysis: maximum likelihood estimators, 30 days				
Parameter	Estimator	Standard error	Wald Chi-square	Pr > ChiSq
Intercept	0.9357	0.1450	41.6543	<.0001
Age	-0.0301	0.00184	267.2770	<.0001
Male vs. female sex	0.00787	0.0418	0.0355	0.8506
Comorbidity index	0.0293	0.00552	28.1406	<.0001
Nursing home resident vs. non-nursing home resident	-1.6017	0.0502	1017.8512	<.0001
Rural vs. urban residency	-0.0207	0.0443	0.2174	0.6410
Cancer vs. non-Cancer	-0.4359	0.1445	9.0960	0.0026
Primary palliative care vs. specialized palliative homecare	1.4480	0.0513	795.6813	<.0001
Interaction cancer / non-cancer vs. primary palliative care / specialized palliative homecare	0.1751	0.1517	1.3319	0.2485

eTable 5a: Hospital care, 14 days

Analysis: maximum likelihood estimators, 14 days				
Parameter	Estimator	Standard error	Wald Chi-square	Pr > ChiSq
Intercept	-0.1309	0.1326	0.9753	0.3234
Age	-0.0204	0.00168	148.4301	<.0001
Male vs. female sex	0.0711	0.0386	3.4015	0.0651
Comorbidity index	0.0218	0.00506	18.6223	<.0001
Nursing home resident vs. non-nursing home resident	-1.1686	0.0472	612.0085	<.0001
Rural vs. urban residency	0.1361	0.0405	11.3118	0.0008
Cancer vs. non-cancer	-0.2848	0.1191	5.7185	0.0168
Primary palliative care vs. specialized palliative homecare	0.9831	0.0463	451.2910	<.0001
Interaction cancer / non-cancer vs. primary palliative care / specialized palliative homecare	0.1355	0.1268	1.1403	0.2856

eTable 5b: Hospital care, 30 days

Analysis: maximum likelihood estimators, 30 days				
Parameter	Estimator	Standard error	Wald Chi-square	Pr > ChiSq
Intercept	0.7989	0.1364	34.3016	<.0001
Age	-0.0236	0.00172	188.0113	<.0001
Male vs. female sex	0.0844	0.0389	4.7113	0.0300
Comorbidity index	0.0292	0.00516	31.9455	<.0001
Nursing home resident vs. non-nursing home resident	-1.1142	0.0433	663.3395	<.0001
Rural vs. urban residency	0.0892	0.0411	4.7094	0.0300
Cancer vs. non-cancer	-0.4276	0.1187	12.9723	0.0003
Primary palliative care vs. specialized palliative homecare	1.0887	0.0469	539.7866	<.0001
Interaction cancer / non-cancer vs. primary palliative care / specialized palliative homecare	0.1361	0.1262	1.1642	0.2806

eTable 6a: Intensive care treatment, 14 days

Analysis: maximum likelihood estimators, 14 days				
Parameter	Estimator	Standard error	Wald Chi-square	Pr > ChiSq
Intercept	-2.6275	0.3051	74.1593	<.0001
Age	-0.0304	0.00362	70.5685	<.0001
Male vs. female sex	0.3255	0.0886	13.5007	0.0002
Comorbidity index	0.00204	0.0119	0.0293	0.8641
Nursing home resident vs. non-nursing home resident	-0.9094	0.1129	64.8478	<.0001
Rural vs. urban residency	-0.0354	0.0949	0.1389	0.7094
Cancer vs. non-cancer	0.6661	0.3400	3.8386	0.0501
Primary palliative care vs. specialized palliative homecare	1.9727	0.1574	157.1647	<.0001
Interaction cancer / non-cancer vs. primary palliative care / specialized palliative homecare	-0.3623	0.3509	1.0660	0.3019

eTable 6b: Intensive care treatment, 30 days

Analysis: maximum likelihood estimators, 30 days				
Parameter	Estimator	Standard error	Wald Chi-square	Pr > ChiSq
Intercept	-2.3439	0.2915	64.6610	<.0001
Age	-0.0266	0.00350	57.9046	<.0001
Male vs. female sex	0.3476	0.0845	16.9418	<.0001
Comorbidity index	0.0101	0.0114	0.7839	0.3759
Nursing home resident vs. non-nursing home resident	-0.9165	0.1070	73.3432	<.0001
Rural vs. urban residency	-0.1503	0.0924	2.6451	0.1039
Cancer vs. non-cancer	0.8031	0.2969	7.3193	0.0068
Primary palliative care vs. specialized palliative homecare	1.6701	0.1429	136.6035	<.0001
Interaction cancer / non-cancer vs. primary palliative care / specialized palliative homecare	-0.4415	0.3079	2.0570	0.1515

10 *eTable 7a: Parenteral nutrition, 14 days*

Analysis: maximum likelihood estimators, 14 days				
Parameter	Estimator	Standard error	Wald Chi-square	Pr > ChiSq
Intercept	-0.4500	0.5101	0.7783	0.3777
Age	-0.0428	0.00682	39.3297	<.0001
Male vs. female sex	-0.2735	0.1910	2.0500	0.1522
Comorbidity index	0.0123	0.0245	0.2505	0.6167
Nursing home resident vs. non-nursing home resident	-1.1781	0.2648	19.7879	<.0001
Rural vs. urban residency	0.5424	0.1887	8.2619	0.0040
Cancer vs. non-cancer	-1.5633	0.5239	8.9038	0.0028
Primary palliative care vs. specialized palliative homecare	-0.9989	0.2330	18.3791	<.0001
Interaction cancer / non-cancer vs. primary palliative care / specialized palliative homecare	1.4389	0.5998	5.7558	0.0164

11 *eTable 7b: Parenteral nutrition, 30 days*

Analysis: maximum likelihood estimators, 30 days				
Parameter	Estimator	Standard error	Wald Chi-square	Pr > ChiSq
Intercept	0.4239	0.4734	0.8018	0.3705
Age	-0.0506	0.00642	62.2201	<.0001
Male vs. female sex	-0.2638	0.1807	2.1307	0.1444
Comorbidity index	0.00555	0.0232	0.0570	0.8114
Nursing home resident vs. non-nursing home resident	-0.7561	0.2227	11.5286	0.0007
Rural vs. urban residency	0.3718	0.1811	4.2161	0.0400
Cancer vs. non-cancer	-2.2779	0.7278	9.7958	0.0017
Primary palliative care vs. specialized palliative homecare	-0.5786	0.2006	8.3190	0.0039
Interaction cancer / non-cancer vs. primary palliative care / specialized palliative homecare	1.7200	0.7747	4.9291	0.0264

12 *eTable 8a: Insertion or change of a PEG, 14 days*

Analysis: maximum likelihood estimators, 14 days				
Parameter	Estimator	Standard error	Wald Chi-square	Pr > ChiSq
Intercept	-3.9993	1.0096	15.6902	<.0001
Age	-0.0392	0.0116	11.3335	0.0008
Male vs. female sex	0.5066	0.3084	2.6985	0.1004
Comorbidity index	0.0172	0.0436	0.1546	0.6942
Nursing home resident vs. non-nursing home resident	-0.2830	0.3247	0.7595	0.3835
Rural vs. urban residency	0.1051	0.3170	0.1099	0.7403
Cancer vs. non-cancer	-0.1331	1.1270	0.0139	0.9060
Primary palliative care vs. specialized palliative homecare	1.3126	0.5643	5.4107	0.0200
Interaction cancer / non-cancer vs. primary palliative care / specialized palliative homecare	0.6594	1.1655	0.3201	0.5715

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eTable 8b: Insertion or change of a PEG, 30 days

Analysis: maximum likelihood estimators, 30 days				
Parameter	Estimator	Standard error	Wald Chi-square	Pr > ChiSq
Intercept	-3.1892	0.8759	13.2565	0.0003
Age	-0.0370	0.0106	12.1877	0.0005
Male vs. female sex	0.6621	0.2796	5.6095	0.0179
Comorbidity index	-0.00153	0.0384	0.0016	0.9682
Nursing home resident vs. non-nursing home resident	-0.1911	0.2942	0.4217	0.5161
Rural vs. urban residency	-0.1824	0.3031	0.3622	0.5473
Cancer vs. non-cancer	-10.9434	166.0	0.0043	0.9474
Primary palliative care vs. specialized palliative homecare	0.9595	0.4386	4.7850	0.0287
Interaction cancer / non-cancer vs. primary palliative care / specialized palliative homecare	11.1859	166.0	0.0045	0.9463

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Abbreviations

ATC	Anatomical Therapeutic Chemical Code
CCI	Charlson Comorbidity Index
CI	Confidence interval
EBM	Uniform Value Scale
GOP	Fee schedule items
ICD	International Statistical Classification of Diseases and Related Health Problems
KV	Associations of Statutory Health Insurance Physicians
MD	Mean differences
OPS	German version of the international classification of procedures in medicine
OR	Odds ratio
PEG	Percutaneous endoscopic gastrostomy
PP	Change in percentage points
PZN	Central Pharmaceutical Number
RECORD	Reporting of studies conducted using observational routinely-collected health data
SAS	Software: Statistical Analysis System
SD	Standard deviation
STROSA	Consensus German reporting standard for secondary data analyses