

Definitions of ambulatory care sensitive conditions (supplement tables 1-5)

ICD list Purdy		
#	Diagnosis	ICD codes
1	Angina	I20, I24.0, I24.8, I24.9
2	Asthma	J45, J46
3	Cellulitis	L03, L04, L08.0, L08.8, L08.9, L88, L98.0
4	Congestive heart failure	I11.0, I50, J81
5	Convulsions and epilepsy	G40, G41, R56, O15
6	Chronic obstructive pulmonary disease	J20, J41, J42, J43, J47
7	Dehydration and gastroenteritis	E86, K52.2, K52.8, K52.9
8	Dental conditions	A69.0, K02, K03, K04, K05, K06, K08, K09.8, K09.9, K12, K13
9	Diabetes complications	E10.0–E10.8, E11.0–E11.8, E12.0–E12.8, E13.0–E13.8, E14.0–E14.8
10	Ear, nose and throat infections	H66, H67, J02, J03, J06, J31.2
11	Gangrene	R02
12	Hypertension	I10, I11.9
13	Influenza and pneumonia	J10, J11, J13, J14, J15.3, J15.4, J15.7, J15.9, J16.8, J18.1, J18
14	Iron-deficiency anaemia	D50.1, D50.8, D50.9
15	Nutritional deficiency	E40, E41, E42, E43, E55.0, E64.3
16	Other vaccine-preventable diseases	A35, A36, A37, A80, B05, B06, B16.1, B16.9, B18.0, B18.1, B26, G00.0, M01.4
17	Pelvic inflammatory disease	N70, N73, N74
18	Perforated/bleeding ulcer	K25.0–K25.2, K25.4–K25.6, K26.0–K26.2, K26.4–K26.6, K27.0–K27.2, K27.4–K27.6, K280–282, K284–K286
19	Pyelonephritis	N10, N11, N12, N13.6

Supplement table 1: ASCS definition by Purdy et al.¹

ICD list Freund		
#	Diagnosis	ICD codes
1	Angina	I20, I24.0, I24.8, I24.9
2	Asthma	J45, J46
3	Cellulitis	L03, L04, L08.0, L08.8, L08.9, L88, L98.0
4	Congestive heart failure	I11.0, I50, J81
5	Convulsion and epilepsy	G40, G41, R56, O15
6	Chronic obstructive pulmonary disease	J20, J41, J42, J43, J47
7	Dehydration and gastroenteritis	E86, K52.2, K52.8, K52.9
8	Dental conditions	A69.0, K02, K03, K04, K05, K06, K08, K09.8, K09.9, K12, K13
9	Diabetes complications	E10.0–E10.8, E11.0–E11.8, E12.0–E12.8, E13.0–E13.8, E14.0–E14.8
10	Ear, nose and throat infections	H66, H67, J02, J03, J06, J31.2
11	Gangrene	R02
12	Hypertension	I10, I11.9
13	Influenza and pneumonia	J10, J11, J13, J14, J15.3, J15.4, J15.7, J15.9, J16.8, J18.1, J18
14	Iron-deficiency anemia	D50.1, D50.8, D50.9
15	Nutritional deficiency	E40, E41, E42, E43, E55.0, E64.3
16	Other vaccine preventable diseases	A35, A36, A37, A80, B05, B06, B16.1, B16.9, B18.0, B18.1, B26, G00.0, M01.4
17	Pelvic inflammatory disease	N70, N73, N74
18	Perforated/bleeding ulcer	K25.0–K25.2, K25.4–K25.6, K26.0–K26.2, K26.4–K26.6, K27.0–K27.2, K27.4–K27.6, K280–282, K284–K286
19	Pyelonephritis	N10, N11, N12, N13.6
20	Alcohol-related diseases	F10
21	Atrial fibrillation and flutter	I47.1, I47.9, I49.5, I49.8, I49.9, R00.0, R002, R00.8
22	Constipation	K59.0
23	Fractured proximal femur	S72.0, S72.1, S72.2
24	Dyspepsia and other stomach function disorders	K30, K21
25	Hypokalemia	E87.6
26	Migraine/acute headache	G43, G44.0, G44.1, G44.3, G44.4, G44.8, R51

Supplement table 2: ASCS definition by Freund et al.²

ICD list Sundmacher		
#	Diagnosis	ICD codes
1	Ischaemic heart diseases	I20, I25.0, I25.1, I25.5, I25.6, I25.8, I25.9
2	Heart failure	I50
3	Other diseases of the circulatory system	I05, I06, I08.0, I49.8, I49.9, I67.2, I67.4, I70, I73, I78, I80.0, I80.80, I83, I86, I87, I95, R00.0, R00.2, R47.0
4	Bronchitis & COPD	J20, J21, J40-J44, J47
5	Mental and behavioural disorders due to use of alcohol or opioids	F10, F11
6	Back pain [dorsopathies]	M42, M47, M53, M54
7	Hypertension	I10-I15
8	Gastroenteritis and other diseases of intestines	K52.2, K52.8, K52.9, K57, K58b, K59.0
9	Intestinal infectious diseases	A01, A02, A04, A05, A07-A09
10	Influenza and pneumonia	J10, J11, J13, J14, J15.3, J15.4, J15.7, J15.8, J15.9, J16.8, J18.0, J18.1, J18.8, J18.9
11	Ear nose throat infections	H66, J01-J03, J06, J31, J32, J35
12	Depressive disordersc	F32, F33
13	Diabetes mellitus	E10.2-E10.6, E10.8, E10.9, E11, E13.6, E13.7, E13.9, E14, E16.2
14	Gonarthrosis [arthrosis of knee]	M17.0, M17.1, M17.4, M17.5, M17.9
15	Soft tissue disorders	G56.0, M67.4, M71.3, M75-M77, M79
16	Other avoidable mental and behavioural disorders	F40, F41, F43, F45, F50.0, F50.2, F60
17	Diseases of the eye	H25, H40
18	Diseases of urinary system	N30, N34, N39.0
19	Sleep disordersc	G47
20	Diseases of the skin and subcutaneous tissue	A46, L01, L02, L04, L08.0, L08.8, L08.9, L60.0, L72.1, L98.0
21	Malnutrition & nutritional deficiencie	D50, D51-D52, D53.1, D56, E40-64, R63.6
22	Dental diseases	K02, K04-K06, K08, K12, K13

Supplement table 3: ASCS definition by Sundmacher et al.³

ICD list Naumann		
#	Diagnosis	ICD codes
1	Angina	I20, I24.0 I24.8 I24.9
2	Asthma	J45, J46
3	Cellulitis	L03 L04 L08.0 L08.8 L08.9 L88 L98.0
4	Congestive heart failure	I11.0 I50 J81
5	Convulsions and epilepsy	G40 G41 R56 O15
6	Chronic obstructive pulmonary disease	J20, J41, J42, J43, J47
7	Dehydration and gastroenteritis	E86, K52.2, K52.8, K52.9
8	Dental conditions	A69.0, K02, K03, K04, K05, K06, K08, K09.8, K09.9, K12, K13
9	Diabetes complications	E10.0-E10.8, E11.0-E11.8, E12.0-E12.8, E13.0-E13.8, E14.0-E14.8
9a	Diabetes complications (typ 1)	E10.0-E10.8
9b	Diabetes complications (typ 2)	E11.0-E11.8
10	Ear, nose and throat infections	H66, H67, J02, J03, J06, J31.2
11	Gangrene	R02
12	Hypertension	I10, I11.9
13	Influenza and pneumonia	J10, J11, J13, J14, J15.3, J15.4, J15.7, J15.9, J16.8, J18.1
14	Iron-deficiency anaemia	D50.1, D50.8, D50.9
15	Nutritional deficiency	E40, E41, E42, E43, E55.0, E64.3
16	Other vaccine-preventable diseases	A35, A36, A37, A80, B05, B06, B16.1, B16.9, B18.0, B18.1, B26, G00.0, M01.4
17	Pelvic inflammatory disease	N70, N73, N74
18	Perforated/bleeding ulcer	K25.0-K25.2, K25.4-K25.6, K26.0-K26.2, K26.4-K26.6, K27.0-K27.2, K27.4-K27.6, K28.0-K28.2, K28.4, K28.6
19	Pyelonephritis	N10, N11, N12, N13.6
20	Alcohol-related diseases	F10
21	Atrial fibrillation and flutter	I47.1, I47.9, I49.5, I49.8, I49.9, R00.0, R00.2, R00.8
22	Constipation	K59.0
23	Fractured proximal femur	S72.0, S72.1, S72.2
24	Dyspepsia and other stomach function disorders	K30, K21
25	Migraine/acute headache	G43, G44.0, G44.1, G44.3, G44.4, G44.8, R51
26	Acute appendicitis	K35.0, K35.1
27	Tuberculosis	A15, A16, A17, A18, A19
28	Schizophrenia	F20, F21, F23.2, F25
29	Senility, alzheimers	F00-F03, R54
30	Stroke	I61-I64, I66, I67.2, I69.8, R47.0
31	Acute myocardial infarction	I21
32	Bronchial carcinoma	C34

Supplement table 4: ASCS definition by Naumann et al.⁴

ICD list Albrecht		
#	Diagnosis	ICD codes
1	Asthma	J45, J46
2	Hypertension	I10, I11.9
3	Congestive heart failure	I50, I11.0
4	Diabetes	E10.1-E10.8, E11.0-E11.8, E13.0-E13.8, E14.0-E14.8
5	Chronic obstructive pulmonary disease	J41-J44, J47
6	Angina	I20, I24.0, I24.8, I24.9
7	Dehydration	E86
8	Ear, nose and throat infections	H66, H67, J02, J03, J06, J31.2
9	Pneumonia	J12-18
10	Acute bronchitis	J20
11	Depressive disorders	F32
12	Chronic ischemic heart disease	I25
13	Dementia	F00, F01, F02, F03

Supplement table 5: ASCS definition by Albrecht et al.⁵

Prevalence of all ACSC diagnoses for the respective definitions

#	Purdy (NHS)	All inpatients n=13,536			Freund	All inpatients n=13,536			Sundmacher	All inpatients n=13,536			Naumann	All inpatients n=13,536			Albrecht	All inpatients n=13,536		
	Diagnosis	n	%	95% CI	Diagnosis	n	%	95% CI	Diagnosis	n	%	95% CI	Diagnosis	n	%	95% CI	Diagnosis	n	%	95% CI
	All ACSC	2,738	20.2	(19.6 - 20.9)	All ACSC	3,061	22.6	(21.9 - 23.3)	All ACSC	3,308	24.4	(23.7 - 25.2)	All ACSC	4,960	36.6	(35.8 - 37.5)	All ACSC	2,586	19.1	(18.4 - 19.8)
1	Angina	882	6.5	(6.1 - 6.9)	Angina	882	6.5	(6.1 - 6.9)	Ischaemic heart diseases	935	6.9	(6.5 - 7.3)	Stroke	1283	9.5	(9.0 - 10.0)	Angina	882	6.5	(6.1 - 6.9)
2	Convulsions and epilepsy	455	3.4	(3.1 - 3.7)	Convulsion and epilepsy	455	3.4	(3.1 - 3.7)	Heart failure	370	2.7	(2.5 - 3.0)	Angina	882	6.5	(6.1 - 6.9)	Pneumonia	402	3.0	(2.7 - 3.3)
3	Congestive heart failure	386	2.9	(2.6 - 3.1)	Congestive heart failure	386	2.9	(2.6 - 3.1)	Influenza and pneumonia	348	2.6	(2.3 - 2.9)	Acute myocardial infarction	624	4.6	(4.3 - 5.0)	Congestive heart failure	382	2.8	(2.5 - 3.1)
4	Influenza and pneumonia	308	2.3	(2.0 - 2.5)	Influenza and pneumonia	308	2.3	(2.0 - 2.5)	Bronchitis & COPD	337	2.5	(2.2 - 2.8)	Convulsions and epilepsy	455	3.4	(3.1 - 3.7)	COPD	317	2.3	(2.1 - 2.6)
5	Hypertension	266	2.0	(1.7 - 2.2)	Hypertension	266	2.0	(1.7 - 2.2)	Hypertension	296	2.2	(1.9 - 2.4)	Congestive heart failure	386	2.9	(2.6 - 3.1)	Hypertension	266	2.0	(1.7 - 2.2)
6	Perforated/bleeding ulcer	127	0.9	(0.8 - 1.1)	Atrial fibrillation and flutter	134	1.0	(0.8 - 1.2)	Diseases of urinary system	191	1.4	(1.2 - 1.6)	Hypertension	266	2.0	(1.7 - 2.2)	Chronic ischemic heart disease	146	1.1	(0.9 - 1.3)
7	Dehydration and gastroenteritis	105	0.8	(0.6 - 0.9)	Perforated/bleeding ulcer	127	0.9	(0.8 - 1.1)	Intestinal infectious diseases	183	1.4	(1.2 - 1.6)	Bronchial carcinoma	140	1.0	(0.9 - 1.2)	Diabetes	72	0.5	(0.4 - 0.7)
8	Diabetes complications	75	0.6	(0.4 - 0.7)	Dehydration and gastroenteritis	105	0.8	(0.6 - 0.9)	Gastroenteritis and other diseases of intestines	169	1.2	(1.1 - 1.5)	Atrial fibrillation and flutter	134	1.0	(0.8 - 1.2)	Dehydration	39	0.3	(0.2 - 0.4)
9	COPD	24	0.2	(0.1 - 0.3)	Migraine/acute headache	93	0.7	(0.6 - 0.8)	Diabetes mellitus	111	0.8	(0.7 - 1.0)	Influenza and pneumonia	129	1.0	(0.8 - 1.1)	Ear, nose and throat infections	23	0.2	(0.1 - 0.3)
10	Ear, nose and throat infections	23	0.2	(0.1 - 0.3)	Diabetes complications	75	0.6	(0.4 - 0.7)	Other diseases of the circulatory system	79	0.6	(0.5 - 0.7)	Perforated/bleeding ulcer	127	0.9	(0.8 - 1.1)	Depressive disorders	20	0.1	(0.1 - 0.2)
11	Iron-deficiency anaemia	23	0.2	(0.1 - 0.3)	Alcohol-related diseases	34	0.3	(0.2 - 0.4)	Other avoidable mental and behavioural disorders	50	0.4	(0.3 - 0.5)	Dehydration and gastroenteritis	105	0.8	(0.6 - 0.9)	Acute bronchitis	16	0.1	(0.1 - 0.2)
12	Cellulitis	14	0.1	(0.1 - 0.2)	Dyspepsia and other stomach function disorders	34	0.3	(0.2 - 0.4)	Diseases of the skin and subcutaneous tissue	50	0.4	(0.3 - 0.5)	Migraine/acute headache	93	0.7	(0.6 - 0.8)	Asthma	13	0.1	(0.1 - 0.2)
13	Pyelonephritis	14	0.1	(0.1 - 0.2)	COPD	24	0.2	(0.1 - 0.3)	Malnutrition & nutritional deficiency	46	0.3	(0.2 - 0.5)	Diabetes complications	75	0.6	(0.4 - 0.7)	Dementia	8	0.1	(0.0 - 0.1)
14	Asthma	13	0.1	(0.1 - 0.2)	Ear, nose and throat infections	23	0.2	(0.1 - 0.3)	Mental and behavioural disorders (alcohol or opioids)	36	0.3	(0.2 - 0.4)	Alcohol-related diseases	34	0.3	(0.2 - 0.4)				
15	Pelvic inflammatory disease	8	0.1	(0.0 - 0.1)	Iron-deficiency anemia	23	0.2	(0.1 - 0.3)	Ear nose throat infections	30	0.2	(0.1 - 0.3)	Dyspepsia and other stomach function disorders	34	0.3	(0.2 - 0.4)				

#	Purdy (NHS)	All inpatients n=13,536			Freund	All inpatients n=13,536			Sundmacher	All inpatients n=13,536			Naumann	All inpatients n=13,536			Albrecht	All inpatients n=13,536		
	Diagnosis	n	%	95% CI	Diagnosis	n	%	95% CI	Diagnosis	n	%	95% CI	Diagnosis	n	%	95% CI	Diagnosis	n	%	95% CI
16	Dental conditions	5	0.0	(0.0 - 0.1)	Cellulitis	14	0.1	(0.1 - 0.2)	Back pain [dorsopathies]	28	0.2	(0.1 - 0.3)	Chronic obstructive pulmonary disease	24	0.2	(0.1 - 0.3)				
17	Other vaccine-preventable diseases	5	0.0	(0.0 - 0.1)	Pyelonephritis	14	0.1	(0.1 - 0.2)	Depressive disordersc	22	0.2	(0.1 - 0.2)	Ear, nose and throat infections	23	0.2	(0.1 - 0.3)				
18	Nutritional deficiency	4	0.0	(0.0 - 0.1)	Asthma	13	0.1	(0.1 - 0.2)	Soft tissue disorders	16	0.1	(0.1 - 0.2)	Iron-deficiency anaemia	23	0.2	(0.1 - 0.3)				
19	Gangrene	1	0.0	(0.0 - 0.0)	Fractured proximal femur	11	0.1	(0.0 - 0.1)	Dental diseases	5	0.0	(0.0 - 0.1)	Cellulitis	14	0.1	(0.1 - 0.2)				
20					Hypokalemia	10	0.1	(0.0 - 0.1)	Diseases of the eye	4	0.0	(0.0 - 0.1)	Pyelonephritis	14	0.1	(0.1 - 0.2)				
21					Pelvic inflammatory disease	8	0.1	(0.0 - 0.1)	Sleep disordersc	2	0.0	(0.0 - 0.1)	Asthma	13	0.1	(0.1 - 0.2)				
22					Constipation	7	0.1	(0.0 - 0.1)	Gonarthrosis [arthrosis of knee]	0	0.0	(0.0 - 0.1)	Schizophrenia	13	0.1	(0.1 - 0.2)				
23					Dental conditions	5	0.0	(0.0 - 0.1)				Fractured proximal femur	11	0.1	(0.0 - 0.1)					
24					Other vaccine preventable diseases	5	0.0	(0.0 - 0.1)				Acute appendicitis	11	0.1	(0.0 - 0.1)					
25					Nutritional deficiency	4	0.0	(0.0 - 0.1)				Tuberculosis	9	0.1	(0.0 - 0.1)					
26					Gangrene	1	0.0	(0.0 - 0.0)				Pelvic inflammatory disease	8	0.1	(0.0 - 0.1)					
27												Senility, alzheimers	8	0.1	(0.0 - 0.1)					
28												Constipation	7	0.1	(0.0 - 0.1)					
29												Dental conditions	5	0.0	(0.0 - 0.1)					
30												Other vaccine-preventable diseases	5	0.0	(0.0 - 0.1)					
31												Nutritional deficiency	4	0.0	(0.0 - 0.1)					
32												Gangrene	1	0.0	(0.0 - 0.0)					

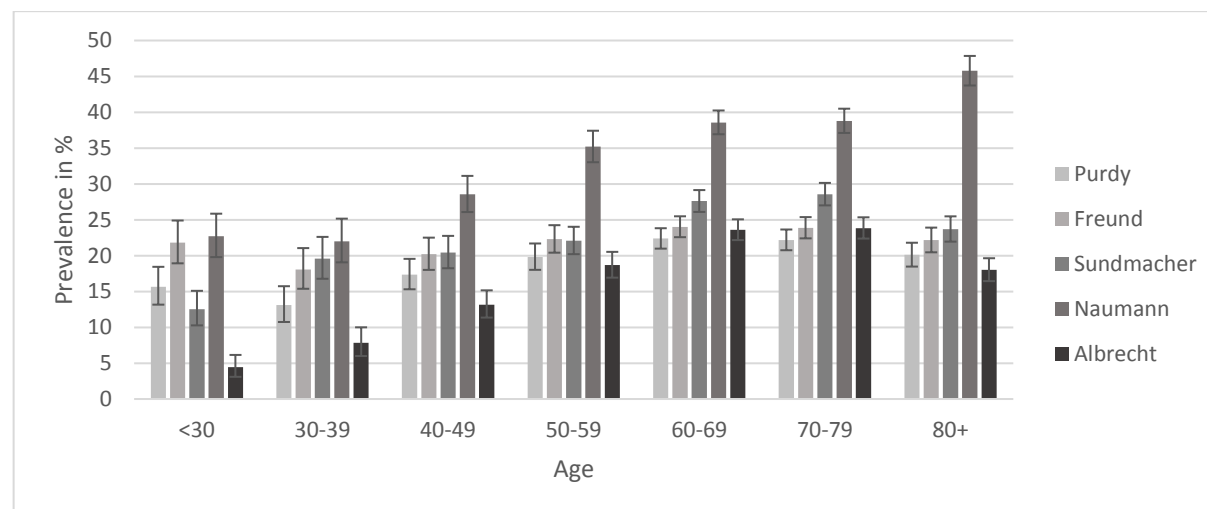
Supplement table 6: Frequencies of all ACSC-diagnoses for the respective definitions. Abbreviations: ACSC – ambulatory care sensitive conditions; COPD – chronic obstructive pulmonary disease

Prevalence of ACSC in age- and gender-subgroups

Even though prevalences for ACSC were consistently higher in men regardless of the applied definition, a significant difference of ACSC prevalence between men and women was evident for the definitions published by Purdy et al. ($p=0.007$), Freund et al. ($p=0.036$) Naumann et al. ($p=0.001$) and Albrecht et al. ($p<0.001$), but not for Sundmacher et al. ($p=0.136$). There was a consistently higher prevalence of ACSC in older patients as compared to younger patients regardless of the underlying definition ($p\leq 0.001$ for all comparisons listed in table 3, figure 1).

	Female sex			Male sex			Age ≤ 59			Age ≥ 60		
	n	%	95% CI	n	%	95% CI	n	%	95% CI	n	%	95% CI
All Inpatients	6,215	45.9	(45.0 - 46.8)	7,319	54.1	(53.2 - 54.9)	4,633	34.2	(33.4 - 35.0)	8,902	65.8	(65.0 - 66.6)
Any ACSC	2,891	46.5	(45.3 - 47.8)	3,612	49.4	(48.2 - 50.5)	1,785	38.5	(37.1 - 39.9)	4,719	53.0	(52.0 - 54.1)
Without ACSC	3,324	53.5	(52.2 - 54.7)	3,707	50.6	(49.5 - 51.8)	2,848	61.5	(60.1 - 62.9)	4,183	47.0	(45.9 - 48.0)
Purdy	1,194	19.2	(18.2 - 20.2)	1,542	21.1	(20.1 - 22.0)	805	17.4	(16.3 - 18.5)	1,933	21.7	(20.9 - 22.6)
Freund	1,354	21.8	(20.8 - 22.8)	1,705	23.3	(22.3 - 24.3)	971	21.0	(19.8 - 22.2)	2,090	23.5	(22.6 - 24.4)
Sundmacher	1,481	23.8	(22.8 - 24.9)	1,825	24.9	(23.9 - 25.9)	910	19.6	(18.5 - 20.8)	2,398	26.9	(26.0 - 27.9)
Naumann	2,184	35.1	(34.0 - 36.3)	2,774	37.9	(36.8 - 39.0)	1,353	29.2	(27.9 - 30.5)	3,606	40.5	(39.5 - 41.5)
Albrecht	1,055	17.0	(16.0 - 17.9)	1,529	20.9	(20.0 - 21.8)	606	13.1	(12.1 - 14.1)	1,980	22.2	(21.4 - 23.1)

Supplement table 7: Sex and age stratified prevalences of ACSC for patients with any ACSC when all definitions were combined, without any ACSC, and for the respective definitions. Abbreviations: ACSC – ambulatory care sensitive condition; IQR – inter quartile ranges; 95%-C - 95% confidence interval



Supplement figure 1: Age stratified prevalence and 95%-confidence intervals for inpatients

1. Purdy S, Griffin T, Salisbury C, et al. Ambulatory care sensitive conditions: terminology and disease coding need to be more specific to aid policy makers and clinicians. *Public Health* 2009;**123**(2):169-73.
2. Freund T, Campbell SM, Geissler S, et al. Strategies for reducing potentially avoidable hospitalizations for ambulatory care-sensitive conditions. *Ann Fam Med* 2013;**11**(4):363-70.
3. Sundmacher L, Fischbach D, Schuettig W, et al. Which hospitalisations are ambulatory care-sensitive, to what degree, and how could the rates be reduced? Results of a group consensus study in Germany. *Health policy* 2015;**119**(11):1415-23.
4. Naumann C, Augustin U, Sundmacher L. [Ambulatory care-sensitive conditions in Germany: a small area analysis (2006-2009)]. *Gesundheitswesen* 2015;**77**(4):e91-e105.
5. Albrecht M SM. Einsparpotenzial durch ambulant-sensitive Krankenhausfälle (ASK) - Regionale Auswertungen der fallpauschalen-bezogenen Krankenhausstatistik für das Jahr 2011. Zentralinstitut für die kassenärztliche Versorgung in Deutschland (Zi), Versorgungsatlas-Bericht 2015;**Nr. 15/08**.