BMJ Open

Needs-based provision of medical care to nursing home residents: protocol for a mixed-methods study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-025614
Article Type:	Protocol
Date Submitted by the Author:	24-Jul-2018

Complete List of Authors:	Czwikla, Jonas; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences Schulz, M; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences Heinze, Franziska; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences Kalwitzki, Thomas; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences Gand, Daniel; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Services Research; University of Bremen, High-Profile Area Health Sciences Schmidt, Annika; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Care Research; University of Bremen, High-Profile Area Health Sciences Tsiasioti, Chrysanthi; Research Institute of the Local Health Care Funds (WIdO) Schwinger, Antje; Research Institute of the Local Health Care Funds (WIdO) Kloep, Stephan; University of Bremen, Competence Center for Clinical Trials (KKSB); University of Bremen, High-Profile Area Health Sciences Schmiemann, Guido; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Services Research; Hannover Medical School, Institute for General Practice Wolf-Ostermann, Karin; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Care Research; University of Bremen, High-Profile Area Health Sciences Gerhardus, Ansgar; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Services Research; University of Bremen, High-Profile Area Health Sciences Rothgang, Heinz; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences, Bremen
Keywords:	Medical care, Nursing homes, Needs assessment, Administrative claims, Health services research

Needs-based provision of medical care to nursing home residents: protocol for a mixed-methods study

Jonas Czwikla[1,7], Maike Schulz[1,7], Franziska Heinze[1,7], Thomas Kalwitzki[1,7], Daniel Gand[2,7], Annika Schmidt[3,7], Chrysanthi Tsiasioti[4], Antje Schwinger[4], Stephan Kloep[5,7], Guido Schmiemann[2,6,7], Karin Wolf-Ostermann[3,7], Ansgar Gerhardus[2,7], Heinz Rothgang[1,7]

[1] University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions, Mary-Somerville-Straße 5, 28359 Bremen, Germany

[2] University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Services Research, Grazer Straße 4, 28359 Bremen, Germany

[3] University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Care Research, Grazer Straße 4, 28359 Bremen, Germany

[4] Research Institute of the Local Health Care Funds (WIdO), Rosenthaler Str. 31, 10178 Berlin, Germany

[5] University of Bremen, Competence Center for Clinical Trials (KKSB), Linzer Straße 4, 28359 Bremen, Germany

[6] Hannover Medical School, Institute for General Practice, Carl-Neuberg-Str. 1, 30625 Hannover, Germany

[7] University of Bremen, High-Profile Area Health Sciences, Bremen, Germany

Corresponding author:

Jonas Czwikla, M.A. (czwikla@uni-bremen.de)

University of Bremen, SOCIUM Research Center on Inequality and Social Policy

Mary-Somerville-Straße 5, 28359 Bremen, Germany

Phone: +49 (0)421 218 58633

Co-authors:

Dr. Maike Schulz (maike.schulz@uni-bremen.de)

Franziska Heinze, M.Sc. (fheinze@uni-bremen.de)

Dipl.-Geront. Thomas Kalwitzki (thomas.kalwitzki@uni-bremen.de)

Daniel Gand, M.A. (daniel.gand@uni-bremen.de)

Annika Schmidt, M.Sc. (schmidt.annika@uni-bremen.de)

Chrysanthi Tsiasioti (Chrysanthi.Tsiasioti@wido.bv.aok.de)

Dr. Antje Schwinger (antje.schwinger@wido.bv.aok.de)

Dr. Stephan Kloep (kloep@math.uni-bremen.de)

PD Dr. Guido Schmiemann (schmiema@uni-bremen.de)

Prof. Dr. Karin Wolf-Ostermann (wolf-ostermann@uni-bremen.de)

Prof. Dr. Ansgar Gerhardus (ansgar.gerhardus@uni-bremen.de)

Prof. Dr. Heinz Rothgang (rothgang@uni-bremen.de)

Word count: 2.032

Abstract

Introduction Nursing home residents typically have greater needs for medical care than community-dwelling elderly. However, restricted cognitive abilities and limited mobility may impede their access to GPs and medical specialists. The provision of medical care in nursing homes may therefore be inappropriate in some areas of medical care. The purpose of this mixed-methods study is to systematically assess, evaluate and explain met and unmet medical care needs in German nursing homes and to develop solutions where medical care is found to be inappropriate.

Methods and analysis First, Statutory Health Insurance claims data are analyzed to identify differences in the utilization of medical care between nursing home residents and community-dwelling elderly with and without need for long-term care. Second, the health status and medical care of 500 nursing home residents are assessed and evaluated to quantify met and unmet medical care needs. Third, qualitative expert interviews and case conferences and, fourth, quantitative analyses of linked data are used to provide structural, case-specific and generalizable explanations of inappropriate medical care among nursing home residents. Fifth, a modified Delphi study is employed to develop pilot projects aiming to improve medical care in nursing homes.

Ethics and dissemination This study was approved by the Ethics Committee of the University of Bremen. Research findings are disseminated through presentations at national and international conferences and publications in peer-reviewed scientific journals.

Trial registration number DRKS00012383

Article Summary

Strengths and limitations of this study

- Based on longitudinal Statutory Health Insurance claims data, cross-sectional data collected in nursing homes, expert interviews and case conferences the provision of medical care is analyzed for the first time in relation to individual medical care needs among nursing home residents in Germany.
- The mixed-methods designs allows a comprehensive assessment, evaluation and explanation of met and unmet medical care needs in nursing homes.
- Participatory approaches involving GPs, medical specialists, nursing home staff, Statutory Health Insurance employees, nursing home residents and relatives are used to increase the acceptance and effectiveness of pilot projects to be developed to improve medical care where it is found to be inappropriate.
- Differences in the willingness to participate among nursing homes and nursing home residents may result in a selective study population.
- Focusing on nursing homes located in the federal state of Bremen and members of one local Statutory Health Insurance fund may limit the generalizability of the study results.

Introduction

Nursing home residents may not receive appropriate medical care since restricted cognitive abilities and limited mobility may impede their access to GPs and medical specialists [1-3]. Moreover, nursing home residents typically suffer from multimorbidity, frailty, cognitive impairments and polypharmacy, resulting in diverse medical care needs that compound the challenge of providing appropriate medical care [4-7].

Empirical studies support this view, indicating inappropriate medical care provision in nursing homes for the treatment of visual and hearing impairments [8-10], oral health care [1 2 11 12], pain treatment [13] and drug prescriptions [2 14-17]. Atramont et al., furthermore, found nursing home admission to be negatively associated with some forms of outpatient care [18] and positively associated with psychotropic and antibacterial drug use [19].

There is, however, hardly any empirical evidence on explanations of inappropriate medical care provision in nursing homes. In this regard, a health technology assessment report concluded that there is not sufficient data available to allow recommendations to be drawn on how medical care provision in German nursing homes can be improved [2].

Given this lack of evidence, the proposed research project aims to systematically assess, evaluate and explain met and unmet medical care needs in German nursing homes and to develop solutions where medical care is found to be inappropriate. The specific aims are: (1) to identify differences in the utilization of medical care between a) nursing home residents, b) community-dwelling elderly in need for long-term care and c) community-dwelling elderly without need for long-term care; (2) to quantify met and unmet medical care needs of nursing home residents; (3) to provide structural and case-specific explanations of inappropriate medical care provision in nursing homes; (4) to provide explanations of inappropriate medical care provision that are generalizable to the total population of nursing home residents; and (5) to develop pilot projects aiming to improve medical care provision in nursing homes.

Methods and analysis

This mixed-methods study is running from April 1, 2017 to March 31, 2020. It is structured into five steps (figure 1). In step 1, Statutory Health Insurance (SHI) claims data are analyzed in order to identify differences in the utilization of medical care between nursing home residents and community-dwelling elderly with and without the need for long-term care. Such differences in the utilization of medical care may indicate, but not prove, inappropriate medical care provision in nursing homes. Thus, in step 2, nursing home residents' health status and utilization of medical care are assessed and evaluated to quantify met and unmet medical care needs with respect to vision, hearing, oral health and Parkinson's disease. In steps 3 and 4, qualitative expert interviews and case conferences as well as quantitative methods are used to provide structural, case-specific and generalizable explanations of inappropriate medical care in nursing homes. In step 5, a modified Delphi study is used to generate ideas on how to improve the provision of medical care in nursing homes. Consequently, at least two pilot projects are developed and implemented in one nursing home to test for practicability. In the following sections, each step is described in detail.

Step 1: Analysis of SHI claims data

SHI claims data from AOK Bremen/Bremerhaven, a local SHI fund, are analyzed to identify differences in the utilization of medical care that indicate inappropriate medical care provision in German nursing homes. The available data comprise information on sex, age, in- and outpatient care as well as on long-term care use. All diagnoses are coded according to the German Modification of the International Classification of Diseases, 10th Revision (ICD-10-GM) and can be differentiated according to GPs and medical specialties in the outpatient setting.

From 245,000 insured persons, a subsample of 68,718 insured persons aged 60 years and over is drawn. For this subsample, the morbidity status of each insured person is defined by 31 disease categories related to at least one of 13 examined medical specialties (table 1).

Table 1 Disease categories and related medical specialties used to define the individual morbidity status of insured persons examined in step 1

No.	Disease categories	ICD-10-GM 2015 codes	Related medical specialties*
01	Hypertensive diseases	I10-I15	Internal medicine, cardiology
02	Ischemic heart diseases	I20-I52	Internal medicine, cardiology
03	Metabolic disorders	E70-E90	Internal medicine
04	Arthropathies	M00-M25	Internal medicine, orthopedics
05	Diabetes mellitus	E10-E14	Internal medicine
06	Dorsopathies	M40-M54	Orthopedics
07	Disorders of thyroid gland	E00-E07	Internal medicine
08	Vascular diseases	I70-I89	Internal medicine, cardiology
09	Organic, including symptomatic, mental disorders; other degenerative diseases of the nervous system	F00-F09; G30-G32	Neurology/psychiatry
10	Diseases of esophagus, stomach and duodenum; hernia; other diseases of intestines	K20-K31; K40-K46; K55-K64	Internal medicine
11	Chronic lower respiratory diseases	J40-J47	Internal medicine, pulmonology
12	Mood (affective) disorders	F30-F39	Neurology/psychiatry
13	Cerebrovascular diseases	I60-I69	Internal medicine, neurology/psychiatry
14	Neurotic, stress-related and somatoform disorders	F40-F48	Neurology/psychiatry
15	Symptoms and signs involving the urinary system; other diseases of urinary system	R30-R39; N30-N39	Gynecology, urology
16	Diseases of the eye and adnexa	H00-H59	Ophthalmology
17	Renal failure	N17-N19	Internal medicine, nephrology
18	Osteopathies and chondropathies	M80-M94	Orthopedics
19	Diseases of the ear and mastoid process	H60-H95	Otorhinolaryngology
20	Mononeuropathies; polyneuropathies and other disorders of the peripheral nervous system	G56; G57; G58; G59; G60-G64	Internal medicine, neurology/psychiatry
21	Diseases of male genital organs	N40-N51	Urology
22	Dermatitis, eczema; melanoma and other malignant neoplasms of skin	L20-L30; C43-C44	Dermatology, surgery
23	Noninflammatory disorders of female genital tract	N80-N98	Gynecology
24	Other disorders of the skin and subcutaneous tissue	L80-L99	Dermatology
25	Extrapyramidal and movement disorders	G20-G26	Internal medicine, neurology/psychiatry
26	Mental and behavioral disorders due to psychoactive substance use	F10-F19	Neurology/psychiatry
27	Cerebral palsy and other paralytic syndromes	G80-G83	Internal medicine, neurology/psychiatry
28	Obesity and other hyperalimentation; Malnutrition	E65-E68; E40-E46	Internal medicine
29	Schizophrenia, schizotypal and delusional disorders; disorders of adult personality and behavior	F20-F29; F60-F69	Neurology/psychiatry
30	Functional impairments	U50-U52	Internal medicine, Orthopedics

31	Injuries	S00-S09; S10-S19; S20-S29; S30-S39; S40-S49; S50-S59; S60-S69; S70-S79; S80-S89; S90-S99; T08-T14	Orthopedics, surgery

*Due to the availability of data, dentistry had to be analyzed separately and is therefore not presented.

Zero-inflated poisson regression analyses as well as linear and logistic regression analyses are conducted to investigate the resulting 45 combinations of disease categories and related medical specialties separately. Each regression model includes only those insured persons who are diagnosed in the examined disease category. The dependent variable is the number of outpatient visits in the related medical specialty in 2015. Independent variables are the remaining 30 disease categories, age, sex, region, death, care setting and dummy variables as a combination of the obtained level of care and the care setting.

Step 2: Assessment of nursing home residents

The standardized assessment focuses on vision, hearing, oral health and Parkinson's disease. It consists of two parts: First, the individual health status and medical care provision of 500 nursing home residents are assessed. Second, the provision of medical care is evaluated for each resident to determine met and unmet medical care needs.

Residents are eligible for assessment if a) they are in need for long-term care, b) are aged 60 and over, c) have been residing in a nursing home located in the federal state of Bremen for at least 12 months and d) are a member of the AOK Bremen/Bremerhaven. Eligible residents (or their legal guardians) are recruited by the participating nursing homes and approached for informed consent.

The standardized assessment is carried out by trained study nurses and includes: (1) examinations of residents, (2) self-assessments by residents, (3) proxy-assessments by residents' care nurses and (4) reviews of medical charts (table 2).

Table 2 Instruments used to assess cross-sectional data in step 2

Category	Instrument	Source*			
		E	S	P	R
Area of medical care					
Vision	Visual test [25]	X			
	Questionnaire for individual rating of vision and use of visual aids		X	X	
	Chart review for vision-related diagnoses (e.g. age-related macular degeneration, cataract) and relevant comorbidities (e.g. diabetes mellitus)				X
Hearing	Whispered voice test [26]	X			
	Questionnaire for individual rating of hearing and use of hearing devices		X	X	
	Chart review for hearing-related diagnoses (e.g. presbycusis)				X
Oral health	Oral Health Assessment Tool (OHAT) [27] and Oral Health Impact Profile (OHIP) [28]	X			
	Questionnaire for individual rating of dental problems as well as availability and use of dentures		X	X	
	Chart review for oral health-related diagnoses (e.g. gingivitis)				X
Parkinson's disease	Chart review for diagnosis of Parkinson's disease, prescribed medications and contacts to medical specialists (e.g. neurologists) and/or therapists (e.g. physiotherapists)				X
General health status					
Health-related quality of life	Short-Form Health Survey (SF-12) [29]		X	X	
Depression	Geriatric Depression Scale (GDS) [30 31]		X		
	Cornell Scale for Depression in Dementia (CSDD) [32]			X	
Functional and cognitive status	Mini-Mental State Examination [33]		X		
	Extended Barthel-Index [34]			X	
Nutrition	Mini-Nutritional Assessment Short Form (MNA-SF) [35-38]			X	
Vital signs	Chart review for vital signs and falls				X
Level of care	Chart review for level of care				X
Additional data					
Utilization of medical care	Questionnaire and chart review for diagnoses, prescriptions of medication and aids, contacts to and organization of general and specialized care, hospitalization, contacts to duty doctors and emergency calls			X	X
Sociodemographic data	Questionnaire and chart review for age, sex, education, marital status, migrant status and relatives			X	X
Nursing home characteristics	Questionnaire** for size, number of employees and residents, location-related information			X	

*E = examinations of residents; S = self-assessed by residents; P = proxy-assessed by residents' care nurses; R = reviewed in medical charts
** This questionnaire is completed by administrative employees of the respective nursing home.

Additionally, health-related aspects (e.g. quality of life and depression) are assessed as well as structural factors relating to the participating nursing homes (e.g. numbers of employees and residents) that may act as explanatory variables of medical care.

Based on these data, a geriatrician, a GP and where necessary a medical specialist of the corresponding field (i.e. an ophthalmologist, an ENT specialist, a dentist or a neurologist) determine case by case whether or not medical care needs are met.

Step 3: Expert interviews and case conferences

Semi-structured expert interviews and case conferences are used to identify structural and case-specific explanations of inappropriate medical care provision in nursing homes. Expert interviews are conducted with nursing home staff, physicians, people in need for long-term care and informal caregivers who provide informed consent. The number of interviews is determined by the principal of theoretical saturation. All interviews are recorded on tape, transcribed and analyzed using content analysis [20]. The results provide a framework for the subsequent case conferences, which are conducted for a selected subsample of nursing home residents assessed in step 2.

The case conferences are held with the consenting nurses and, where necessary, the consenting physicians and other health professionals involved in the provision of nursing and medical care of the respective resident. Twenty residents with appropriate medical care and twenty residents with inappropriate medical care are randomly selected for each field of medical care (i.e. vision, hearing, oral health and Parkinson's disease). The case conferences are based on a summarized presentation of the health status and medical care provision of the respective resident. Using problem-centered group interviews [21], the conference members then discuss, case by case, factors that foster or inhibit the provision of needs-based medical care.

Step 4: Analysis of linked data, non-response analysis and extrapolation

In step 4, primary data assessed in step 2 and SHI claims data covering the years 2014-2018 are linked at the individual level. The linked data are analyzed to identify generalizable factors that impact the provision of medical care:

First, retrospective and prospective regression analyses are conducted. Retrospective analyses are used to identify factors in the utilization of medical care that impact the quantified met and unmet medical care needs of nursing home residents. Prospective analyses are used to investigate the impact of the standardized assessment conducted in step 2 on the utilization of medical care.

Next, a non-response analysis is conducted. SHI claims data of 1,500 residents are analyzed to identify systematic differences between responders and non-responders (e.g. in the distribution of age, sex, morbidity and long-term care level as well as in the duration of stay in long-term care and nursing homes).

Third, prevalence of met and unmet medical care needs is extrapolated. Findings are projected to a) all nursing home residents insured by the AOK Bremen/Bremerhaven, b) all nursing home residents of the federal state of Bremen and c) all nursing home residents of Germany.

Step 5: Modified Delphi study and pilot projects

Based on the factors identified that may explain inappropriate medical care in steps 3 and 4, a modified Delphi study is then carried out. The technique is used with stakeholders from the fields of nursing and medical care and comprises three rounds. The first round is based on face-to-face focus group discussions, while the second and third rounds each consist of semi-structured online surveys. Each survey takes about 20 minutes to complete and is online for up to 2 weeks.

In the first round, a convenience sample of homogeneous and heterogeneous focus groups of consenting stakeholders (i.e., nursing home staff, GPs, medical specialist, SHI employees,

nursing home residents and relatives) generate ideas on how medical care provision to nursing home residents can be improved. The focus groups are led by experienced project researchers, who feed the results of steps 3 and 4 into the discussions. Based on the ideas generated, the project researchers draft at least two pilot projects.

In the second round, the experts are given descriptions of these potential pilot projects and rate them with respect to their feasibility and effectiveness for improving medical care of nursing home residents. These ratings are summarized and distributed back to all experts.

In the third round, the experts re-rate the projects based on the rating results from the previous round. This is expected to result in a more consensual decision. Taking the results of this last round into account, the concept of the pilot projects is revised and implemented in one nursing home to test for practicability. A systematic evaluation of the pilot projects is planned in a follow-up study.

Discussion

This mixed-methods study broadens the limited evidence on the needs-based provision of medical care in nursing homes. It systematically assesses, evaluates and explains met and unmet medical care needs in nursing homes and takes first steps toward improvement.

Up to now, several studies have described differences in the utilization of medical care between nursing home residents and community-dwelling elderly with and without need for long-term care [2 22-24]. None of these, however, has evaluated whether such differences reflect unmet medical care needs at the individual. Neither have differences in the utilization of medical care been explained by prevailing structures that may be changed.

The present mixed-methods study addresses this evidence gap: Based on longitudinal SHI claims data, cross-sectional data collected in nursing homes as well as transcripts of expert interviews and case conferences, differences in the utilization of medical care are identified, met and unmet medical care needs are quantified, explanations of inappropriate provision of

medical care are provided and pilot projects are developed aiming to improve the provision of medical care where it is found to be inappropriate. Participatory approaches involve GPs, medical specialists, nursing home staff, SHI employees, nursing home residents and relatives. This is expected to result in strong acceptance and effective pilot projects which will be systematically evaluated in a follow-up study.

There are, however, some limitations to consider. First, in the present study, all nursing homes in the federal state of Bremen are invited to participate and to recruit nursing home residents for study participation. Differences in the willingness to participate among nursing homes and nursing home residents may result in a selective study population. The claims-based non-response analysis, however, permits the identification of structural differences between participants and non-participants. Second, the study focuses on nursing homes located in the federal state of Bremen and members of one local SHI fund. Therefore, the generalizability of research findings may be limited.

In conclusion, the findings from this study enhance our knowledge of met and unmet medical care needs in nursing homes. The pilot projects provide a first step towards a sustainable improvement of medical care in German nursing homes. Therefore, it is expected that the findings are highly relevant for many stakeholders from the fields of nursing and medical care.

Ethics and dissemination

The Ethics Committee of the University of Bremen approved this study on November 23, 2017. All eligible nursing home residents and all nursing home staff are informed in detail about the study. Informed consent is obtained from all included nursing home residents (or their legal guardians where applicable). Informed consent is also obtained from all persons included in the expert interviews, case conferences and Delphi study. Dissemination strategies

include presentations at national and international conferences and publications in peer-reviewed scientific journals.

Acknowledgements

We are grateful to the AOK Bremen/Bremerhaven for the provision of longitudinal SHI claims data and to Vicki May for proofreading this protocol.

Footnotes

Contributors: JC, TK, ASchw, GS, KW-O, AG and HR designed the study. MS, TK, CT, ASchw and HR specified the analysis of longitudinal SHI claims data. MS, FH, DK, ASchm, SK, GS, KW-O, AG and HR specified the collection of cross-sectional primary data. JC, MS, FH, DG, ASchm, CT, ASchw and SK wrote the first draft of the protocol which was critically revised by TK, GS, KW-O, AG and HR. All authors approved the final version of the protocol.

Funding: This work was supported by the Innovation Committee at the Federal Joint Committee (grant number 01VSF16039).

Competing interests: None declared.

Figures

See separate file (Figure_1.TIF)

Figure 1 Conceptual framework of the mixed-methods study

References

1. Iliffe S, Davies SL, Gordon AL, et al. Provision of NHS generalist and specialist services to care homes in England: review of surveys. *Prim Health Care Res Dev* 2016;17(2):122-37.
2. Balzer K, Butz S, Bentzel J, et al. Medical specialist attendance in nursing homes. *GMS Health Technol Assess* 2013;9:Doc02.
3. Burns E, Nair S. New horizons in care home medicine. *Age Ageing* 2014;43(1):2-7.
4. Briggs R, Holmerová I, Martin FC, et al. Towards standards of medical care for physicians in nursing homes. *Eur Geriatr Med* 2015;6(4):401-3.
5. Gordon AL, Franklin M, Bradshaw L, et al. Health status of UK care home residents: a cohort study. *Age Ageing* 2014; 43(1):97-103.
6. Bjork S, Juthberg C, Lindkvist M, et al. Exploring the prevalence and variance of cognitive impairment, pain, neuropsychiatric symptoms and ADL dependency among persons living in nursing homes; a cross-sectional study. *BMC geriatr* 2016; 16:154.
7. Tolson D, Rolland Y, Andrieu S, et al. International Association of Gerontology and Geriatrics: a global agenda for clinical research and quality of care in nursing homes. *J Am Med Dir Assoc* 2011;12(3):184-9.
8. Thibault L, Kergoat H. Eye care services for older institutionalised individuals affected by cognitive and visual deficits: a systematic review. *Ophthalmic Physiol Opt* 2016;36(5):566-83.
9. Yamada Y, Vlachova M, Richter T, et al.. Prevalence and correlates of hearing and visual impairments in European nursing homes: results from the SHELTER study. *J Am Med Dir Assoc* 2014;15(10):738-43.
10. Cohen-Mansfield J, Infeld DL. Hearing aids for nursing home residents: current policy and future needs. *Health Policy* 2006;79(1):49-56.

11. Zenthofer A, Rammelsberg P, Cabrera T, et al.. Increasing dependency of older people in nursing homes is associated with need for dental treatments. *Neuropsychiatr Dis Treat* 2014;10:2285-90.

12. Muller F, Naharro M, Carlsson GE. What are the prevalence and incidence of tooth loss in the adult and elderly population in Europe? *Clin Oral Impl Res* 2007;18 Suppl 3:2-14.

13. Lukas A, Mayer B, Onder G, et al. [Pain therapy in German long-term care facilities in a European comparison. Results of the SHELTER study]. *Schmerz* 2015;29(4):411-21.

14. Storms H, Marquet K, Aertgeerts B, et al. Prevalence of inappropriate medication use in residential long-term care facilities for the elderly: a systematic review. *Eur J Gen Pract* 2017;23(1):69-77.

15. Dörks M, Allers K, Schmiemann G, et al. Inappropriate medication in non-hospitalized patients with renal insufficiency: a systematic review. *J Am Geriatr Soc* 2017;65(4):853-62.

16. Morin L, Laroche ML, Texier G, et al. Prevalence of potentially inappropriate medication use in older adults living in nursing homes: a systematic review. *J Am Med Dir Assoc* 2016;17(9):862.e1-9.

17. Johnell K. Inappropriate drug use in people with cognitive impairment and dementia: a systematic review. *Curr Clin Pharmacol* 2015;10(3):178-84.

18. Atramont A, Bourdel-Marchasson I, Bonnet-Zamponi D, et al. Impact of nursing home admission on health care use and disease status elderly dependent people one year before and one year after skilled nursing home admission based on 2012-2013 SNIIRAM data. *BMC Health Serv Res* 2017;17(1):667.

19. Atramont A, Bonnet-Zamponi D, Bourdel-Marchasson I, et al. Health status and drug use 1 year before and 1 year after skilled nursing home admission during the first quarter of 2013 in France: a study based on the French National Health Insurance Information System. *Eur J Clin Pharmacol. 2018;74(1):109-18*.

20. Kohlbacher F. The use of qualitative content analysis in case study research. *Forum: Qual Soc Res* 2006; doi:10.17169/fqs-7.1.75.

21. Witzel A. The problem-centered interview. *Forum: Qual Soc Res* 2000; doi:10.17169/fqs-1.1.1132.

22. Kleina T, Horn A, Suhr R, et al. [Current status of medical care for nursing home residents in Germany - results of an empirical study]. *Gesundheitswesen* 2017;79(5):382-87.

23. Schmiemann G, Herget-Rosenthal S, Hoffmann F. [Medical services for nursing home residents : results of the study on inappropriate medication in patients with renal insufficiency in nursing homes]. *Z Gerontol Geriatr* 2016;49(8):727-33.

24. Pittrow D, Krappweis J, Rentsch A, et al. Pattern of prescriptions issued by nursing home-based physicians versus office-based physicians for frail elderly patients in German nursing homes. *Pharmacoepidemiol Drug Saf* 2003;12(7):595-9.

25. Bailey IL, Lovie JE. New design principles for visual acuity letter charts. *Am J Optom Physiol Opt* 1976;53(11):740-5.

26. Macphee GJ, Crowther JA, McAlpine CH. A simple screening test for hearing impairment in elderly patients. *Age Ageing* 1988;17(5):347-51.

27. Chalmers JM, King PL, Spencer AJ, et al. The Oral Health Assessment Tool--validity and reliability. *Aust Dent J* 2005;50(3):191-9.

28. John MT, Miglioretti DL, LeResche L, et al. German short forms of the Oral Health Impact Profile. *Community Dent Oral Epidemiol* 2006;34(4):277-88.

29. Morfeld M, Kirchberger I, Bullinger M. SF-36. Fragebogen zum Gesundheitszustand: Deutsche Version des Short Form - 36 Health Survey. Göttingen: Hogrefe; 2011.

30. Yesavage JA, Brink TL, Rose TL, et al.. Development and validation of a geriatric depression screening scale: a preliminary report. *J Psychiatr Res* 1982;17(1):37-49.

31. Allgaier AK, Kramer D, Mergl R, et al. [Validity of the geriatric depression scale in nursing home residents: comparison of GDS-15, GDS-8, and GDS-4]. *Psychiatrische Praxis* 2011;38(6):280-6.

32. Alexopoulos GS, Abrams RC, Young RC, et al. Cornell Scale for Depression in Dementia. *Biol Psychiatry* 1988;23(3):271-84.

33. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975;12(3):189-98.

34. Prosiegel M, Böttger S, Schenk T, et al. Der Erweiterte Barthel-Index (EBI) - eine neue Skala zur Erfassung von Fähigkeitsstörungen bei neurologischen Patienten. *Neurol Rehabil* 1996;2:7-13.

35. Rubenstein LZ, Harker JO, Salva A, et al. Screening for undernutrition in geriatric practice: developing the short-form mini-nutritional assessment (MNA-SF). *J Gerontol A Biol Sci Med Sci* 2001;56(6):M366-72.

36. Vellas B, Villars H, Abellan G, et al. Overview of the MNA--Its history and challenges. *J Nutr Health Aging* 2006;10(6):456-63; discussion 463-5.

37. Guigoz Y. The Mini Nutritional Assessment (MNA) review of the literature--What does it tell us? *J Nutr Health Aging* 2006;10(6):466-85; discussion 485-7.

38. Kaiser MJ, Bauer JM, Ramsch C, et al. Validation of the Mini Nutritional Assessment short-form (MNA-SF): a practical tool for identification of nutritional status. *J Nutr Health Aging* 2009;13(9):782-8.

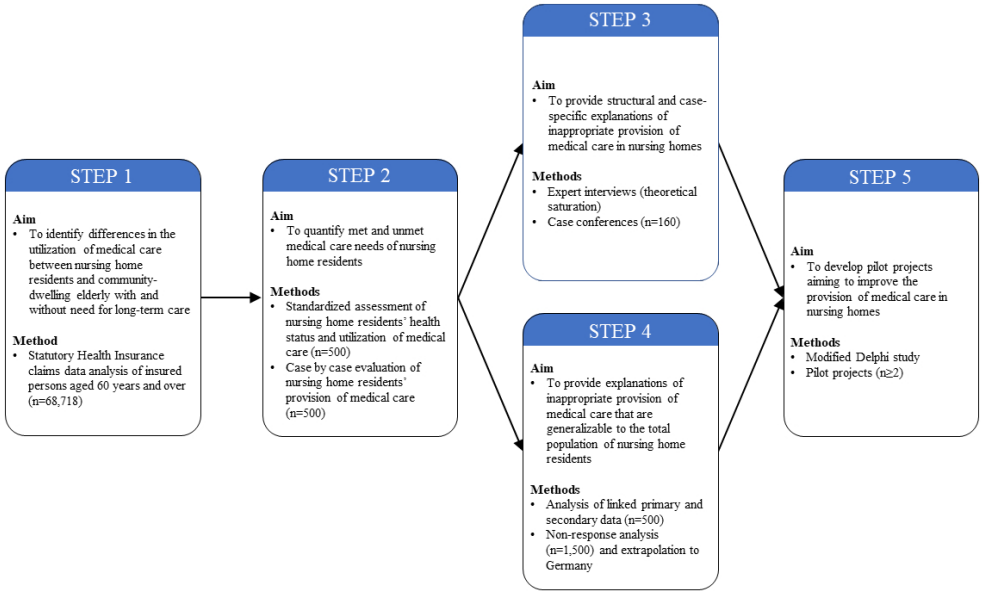

Figure 1 Conceptual framework of the mixed-methods study

307x188mm (96 x 96 DPI)

BMJ Open

Needs-based provision of medical care to nursing home residents: protocol for a mixed-methods study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-025614.R1
Article Type:	Protocol
Date Submitted by the Author:	21-Dec-2018
Complete List of Authors:	Czwikla, Jonas; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences Schulz, M; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences Heinze, Franziska; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences Kalwitzki, Thomas; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences Gand, Daniel; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Services Research; University of Bremen, High-Profile Area Health Sciences Schmidt, Annika; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Care Research; University of Bremen, High-Profile Area Health Sciences Tsiasioti, Chrysanthi; Research Institute of the Local Health Care Funds (WIdO) Schwinger, Antje; Research Institute of the Local Health Care Funds (WIdO) Kloep, Stephan; University of Bremen, Competence Center for Clinical Trials (KKSB); University of Bremen, High-Profile Area Health Sciences Schmiemann, Guido; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Services Research; Hannover Medical School, Institute for General Practice Wolf-Ostermann, Karin; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Care Research; University of Bremen, High-Profile Area Health Sciences Gerhardus, Ansgar; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Services Research; University of Bremen, High-Profile Area Health Sciences Rothgang, Heinz; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences, Bremen
Primary Subject Heading:	Health services research

Secondary Subject Heading:	Geriatric medicine, Ophthalmology, Ear, nose and throat/otolaryngology, Dentistry and oral medicine, Neurology
Keywords:	Medical care, Nursing homes, Needs assessment, Administrative claims, Health services research

Needs-based provision of medical care to nursing home residents: protocol for a mixed-methods study

Jonas Czwikla[1,7], Maike Schulz[1,7], Franziska Heinze[1,7], Thomas Kalwitzki[1,7], Daniel Gand[2,7], Annika Schmidt[3,7], Chrysanthi Tsiasioti[4], Antje Schwinger[4], Stephan Kloep[5,7], Guido Schmiemann[2,6,7], Karin Wolf-Ostermann[3,7], Ansgar Gerhardus[2,7], Heinz Rothgang[1,7]

[1] University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions, Mary-Somerville-Straße 5, 28359 Bremen, Germany

[2] University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Services Research, Grazer Straße 4, 28359 Bremen, Germany

[3] University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Care Research, Grazer Straße 4, 28359 Bremen, Germany

[4] Research Institute of the Local Health Care Funds (WIdO), Rosenthaler Str. 31, 10178 Berlin, Germany

[5] University of Bremen, Competence Center for Clinical Trials (KKSB), Linzer Straße 4, 28359 Bremen, Germany

[6] Hannover Medical School, Institute for General Practice, Carl-Neuberg-Straße 1, 30625 Hannover, Germany

[7] University of Bremen, High-Profile Area Health Sciences, Bremen, Germany

Corresponding author:

Jonas Czwikla, M.A. (czwikla@uni-bremen.de)

University of Bremen, SOCIUM Research Center on Inequality and Social Policy

Mary-Somerville-Straße 5, 28359 Bremen, Germany

Phone: +49 (0)421 218 58633

Co-authors:

Dr. Maike Schulz (maike.schulz@uni-bremen.de)

Franziska Heinze, M.Sc. (fheinze@uni-bremen.de)

Dipl.-Geront. Thomas Kalwitzki (thomas.kalwitzki@uni-bremen.de)

Daniel Gand, M.A. (daniel.gand@uni-bremen.de)

Annika Schmidt, M.Sc. (schmidt.annika@uni-bremen.de)

Chrysanthi Tsiasioti (Chrysanthi.Tsiasioti@wido.bv.aok.de)

Dr. Antje Schwinger (antje.schwinger@wido.bv.aok.de)

Dr. Stephan Kloep (kloep@math.uni-bremen.de)

PD Dr. Guido Schmiemann (schmiema@uni-bremen.de)

Prof. Dr. Karin Wolf-Ostermann (wolf-ostermann@uni-bremen.de)

Prof. Dr. Ansgar Gerhardus (ansgar.gerhardus@uni-bremen.de)

Prof. Dr. Heinz Rothgang (rothgang@uni-bremen.de)

Word count: 2.539

Abstract

Introduction Nursing home residents typically have greater needs for medical care than community-dwelling elderly. However, restricted cognitive abilities and limited mobility may impede their access to general practitioners and medical specialists. The provision of medical care in nursing homes may therefore be inappropriate in some areas of medical care. The purpose of this mixed-methods study is to systematically assess, evaluate and explain met and unmet medical care needs in German nursing homes and to develop solutions where medical care is found to be inappropriate.

Methods and analysis First, Statutory Health Insurance claims data are analyzed to identify differences in the utilization of medical care between nursing home residents and community-dwelling elderly with and without need for long-term care. Second, the health status and medical care of 500 nursing home residents are assessed and evaluated to quantify met and unmet medical care needs. Third, qualitative expert interviews and case conferences and, fourth, quantitative analyses of linked data are used to provide structural, case-specific and generalizable explanations of inappropriate medical care among nursing home residents. Fifth, a modified Delphi study is employed to develop pilot projects aiming to improve medical care in nursing homes.

Ethics and dissemination This study was approved by the Ethics Committee of the University of Bremen. Research findings are disseminated through presentations at national and international conferences and publications in peer-reviewed scientific journals.

Trial registration number DRKS00012383

Article Summary

Strengths and limitations of this study

- Based on longitudinal Statutory Health Insurance claims data, cross-sectional data collected in nursing homes, expert interviews and case conferences the provision of medical care is analyzed for the first time in relation to individual medical care needs among nursing home residents in Germany.
- The mixed-methods designs allows a comprehensive assessment, evaluation and explanation of met and unmet medical care needs in nursing homes.
- Participatory approaches involving general practitioners, medical specialists, nursing home staff, Statutory Health Insurance employees, nursing home residents and relatives are used to increase the acceptance and effectiveness of pilot projects to be developed to improve medical care where it is found to be inappropriate.
- Differences in the willingness to participate among nursing homes and nursing home residents may result in a selective study population.
- Focusing on nursing homes located in the federal state of Bremen and members of one local Statutory Health Insurance fund may limit the generalizability of the study results.

Introduction

Nursing home residents may not receive appropriate medical care since restricted cognitive abilities and limited mobility may impede their access to general practitioners (GPs) and medical specialists.[1-3] Moreover, nursing home residents typically suffer from multimorbidity, frailty, cognitive impairments and polypharmacy, resulting in diverse medical care needs that compound the challenge of providing appropriate medical care.[4-7] Empirical studies support this view, indicating inappropriate medical care provision in nursing homes for the treatment of visual and hearing impairments,[8-10] oral health care,[1,2,11,12] pain treatment[13] and drug prescriptions.[2,14-17] Atramont et al., furthermore, found nursing home admission to be negatively associated with some forms of outpatient care[18] and positively associated with psychotropic and antibacterial drug use.[19] There is, however, hardly any empirical evidence on explanations of inappropriate medical care provision in nursing homes. In this regard, a health technology assessment report concluded that there is not sufficient data available to allow recommendations to be drawn on how medical care provision in German nursing homes can be improved.[2]

Given this lack of evidence, the proposed research project aims to systematically assess, evaluate and explain met and unmet medical care needs in German nursing homes and to develop solutions where medical care is found to be inappropriate. The specific aims are: (1) to identify differences in the utilization of medical care between a) nursing home residents, b) community-dwelling elderly in need for long-term care and c) community-dwelling elderly without need for long-term care; (2) to quantify met and unmet medical care needs of nursing home residents; (3) to provide structural and case-specific explanations of inappropriate medical care provision in nursing homes; (4) to provide explanations of inappropriate medical care provision that are generalizable to the total population of nursing home residents; and (5) to develop pilot projects aiming to improve medical care provision in nursing homes.

Methods and analysis

This mixed-methods study is running from April 1, 2017 to March 31, 2020. It is structured into five steps (figure 1). In step 1, Statutory Health Insurance (SHI) claims data are analyzed in order to identify differences in the utilization of medical care between nursing home residents and community-dwelling elderly with and without the need for long-term care. Such differences in the utilization of medical care may indicate, but not prove, inappropriate medical care provision in nursing homes. Thus, in step 2, nursing home residents' health status and utilization of medical care are assessed and evaluated to quantify met and unmet medical care needs with respect to vision, hearing, oral health and Parkinson's disease. In steps 3 and 4, qualitative expert interviews and case conferences as well as quantitative methods are used to provide structural, case-specific and generalizable explanations of inappropriate medical care in nursing homes. In step 5, a modified Delphi study is used to generate ideas on how to improve the provision of medical care in nursing homes. Consequently, at least two pilot projects are developed and implemented in one nursing home to test for practicability. In the following sections, each step is described in detail.

Step 1: Analysis of SHI claims data

SHI claims data from AOK Bremen/Bremerhaven, a local SHI fund, are analyzed to identify differences in the utilization of medical care that indicate inappropriate medical care provision in German nursing homes. The available data comprise information on sex, age, in- and outpatient care as well as on long-term care use. All diagnoses are coded according to the German Modification of the International Classification of Diseases, 10th Revision (ICD-10-GM) and can be differentiated according to GPs and medical specialties in the outpatient setting.

From 245,000 insured persons, a subsample of 68,718 insured persons aged 60 years and over is drawn. Insured persons with missing or invalid information on demographic characteristics

(n = 124) are not considered. For this subsample, the morbidity status of each insured person is defined by 31 disease categories related to at least one of 13 examined medical specialties (table 1).

Table 1 Disease categories and related medical specialties used to define the individual morbidity status of insured persons examined in step 1

No.	Disease categories	ICD-10-GM 2015 codes	Related medical specialties*
01	Hypertensive diseases	I10-I15	Internal medicine, cardiology
02	Ischemic heart diseases	I20-I52	Internal medicine, cardiology
03	Metabolic disorders	E70-E90	Internal medicine
04	Arthropathies	M00-M25	Internal medicine, orthopedics
05	Diabetes mellitus	E10-E14	Internal medicine
06	Dorsopathies	M40-M54	Orthopedics
07	Disorders of thyroid gland	E00-E07	Internal medicine
08	Vascular diseases	I70-I89	Internal medicine, cardiology
09	Organic, including symptomatic, mental disorders; other degenerative diseases of the nervous system	F00-F09; G30-G32	Neurology/psychiatry
10	Diseases of esophagus, stomach and duodenum; hernia; other diseases of intestines	K20-K31; K40-K46; K55-K64	Internal medicine
11	Chronic lower respiratory diseases	J40-J47	Internal medicine, pulmonology
12	Mood (affective) disorders	F30-F39	Neurology/psychiatry
13	Cerebrovascular diseases	I60-I69	Internal medicine, neurology/psychiatry
14	Neurotic, stress-related and somatoform disorders	F40-F48	Neurology/psychiatry
15	Symptoms and signs involving the urinary system; other diseases of urinary system	R30-R39; N30-N39	Gynecology, urology
16	Diseases of the eye and adnexa	H00-H59	Ophthalmology
17	Renal failure	N17-N19	Internal medicine, nephrology
18	Osteopathies and chondropathies	M80-M94	Orthopedics
19	Diseases of the ear and mastoid process	H60-H95	Otorhinolaryngology
20	Mononeuropathies; polyneuropathies and other disorders of the peripheral nervous system	G56; G57; G58; G59; G60-G64	Internal medicine, neurology/psychiatry
21	Diseases of male genital organs	N40-N51	Urology
22	Dermatitis, eczema; melanoma and other malignant neoplasms of skin	L20-L30; C43-C44	Dermatology, surgery
23	Noninflammatory disorders of female genital tract	N80-N98	Gynecology
24	Other disorders of the skin and subcutaneous tissue	L80-L99	Dermatology
25	Extrapyramidal and movement disorders	G20-G26	Internal medicine, neurology/psychiatry
26	Mental and behavioral disorders due to psychoactive substance use	F10-F19	Neurology/psychiatry
27	Cerebral palsy and other paralytic syndromes	G80-G83	Internal medicine, neurology/psychiatry
28	Obesity and other hyperalimentation; Malnutrition	E65-E68; E40-E46	Internal medicine
29	Schizophrenia, schizotypal and delusional disorders; disorders of adult personality and behavior	F20-F29; F60-F69	Neurology/psychiatry
30	Functional impairments	U50-U52	Internal medicine, Orthopedics

31	Injuries	S00-S09; S10-S19; S20-S29; S30-S39; S40-S49; S50-S59; S60-S69; S70-S79; S80-S89; S90-S99; T08-T14	Orthopedics, surgery

*Due to the availability of data, dentistry had to be analyzed separately and is therefore not presented.

Zero-inflated Poisson regression analyses are conducted to investigate the probability (component I) and intensity (component II) of medical care for the resulting 45 combinations of disease categories and related medical specialties separately. Each regression model includes only those insured persons who are diagnosed in the examined disease category and have valid information on all variables included in the model. The dependent variable is the number of outpatient visits in the related medical specialty in 2015. Independent variables are the remaining 30 disease categories, age, sex, region, death, care setting and dummy variables as a combination of the obtained level of care and the care setting. In a sensitivity analysis, the probability and intensity of medical care is investigated using logistic and linear regression analyses, respectively.

Step 2: Assessment of nursing home residents

The standardized assessment focuses on vision, hearing, oral health and Parkinson's disease. It consists of two parts: First, the individual health status and medical care provision of 500 nursing home residents are assessed. Second, the provision of medical care is evaluated for each resident to determine met and unmet medical care needs.

Residents are eligible for assessment if a) they are in need for long-term care, b) are aged 60 years and over, c) have been residing in a nursing home located in the federal state of Bremen for at least 12 months and d) are a member of the AOK Bremen/Bremerhaven. The total number of eligible nursing home residents is approximately 1,800. Assuming a realistic response rate of 25-30% results in approximately 500 study participants. The recruitment strategy comprises two stages: At stage one, the total number of nursing homes located in the

federal state of Bremen is approached for participation. At stage two, eligible residents (or their legal guardians) are recruited by the nursing homes agreeing to participate and approached for informed consent. In case of reaching considerably less than 500 participants, the recruitment strategy may be extended to the federal state of Lower Saxony to ensure that enough nursing home residents with met and unmet medical care needs are included in the explanation of inappropriate medical care provision (steps 3 and 4).

The standardized assessment is carried out by trained study nurses and includes: (1) examinations of residents, (2) self-assessments by residents, (3) proxy-assessments by residents' care nurses and (4) reviews of medical charts (table 2).

Table 2 Instruments used to assess cross-sectional data in step 2

Category	Instrument	Source*			
		E	S	P	R
Area of medical care					
Vision	Visual test[20]	X			
	Questionnaire for individual rating of vision and use of visual aids		X	X	
	Chart review for vision-related diagnoses (e.g. age-related macular degeneration, cataract) and relevant comorbidities (e.g. diabetes mellitus)				X
Hearing	Whispered voice test[21]	X			
	Questionnaire for individual rating of hearing and use of hearing devices		X	X	
	Chart review for hearing-related diagnoses (e.g. presbycusis)				X
Oral health	Oral Health Assessment Tool (OHAT)[22] and Oral Health Impact Profile (OHIP)[23]	X			
	Questionnaire for individual rating of dental problems as well as availability and use of dentures		X	X	
	Chart review for oral health-related diagnoses (e.g. gingivitis)				X
Parkinson's disease	Chart review for diagnosis of Parkinson's disease, prescribed medications and contacts to medical specialists (e.g. neurologists) and/or therapists (e.g. physiotherapists)				X
General health status					
Health-related quality of life	Short-Form Health Survey (SF-12)[24]		X	X	
Depression	Geriatric Depression Scale (GDS)[25,26]		X		
	Cornell Scale for Depression in Dementia (CSDD)[27]			X	
Functional and cognitive status	Mini-Mental State Examination[28]		X		
	Extended Barthel-Index[29]			X	
Nutrition	Mini-Nutritional Assessment Short Form (MNA-SF)[30-33]			X	
Vital signs	Chart review for vital signs and falls				X
Level of care	Chart review for level of care				X
Additional data					
Utilization of medical care	Questionnaire and chart review for diagnoses, prescriptions of medication and aids, contacts to and organization of general and specialized care, hospitalization, contacts to duty doctors and emergency calls			X	X
Sociodemographic data	Questionnaire and chart review for age, sex, education, marital status, migrant status and relatives			X	X
Nursing home characteristics	Questionnaire** for size, number of employees and residents, location-related information			X	

*E = examinations of residents; S = self-assessed by residents; P = proxy-assessed by residents' care nurses; R = reviewed in medical charts

** This questionnaire is completed by administrative employees of the respective nursing home.

Additionally, health-related aspects (e.g. quality of life and depression) are assessed as well as structural factors relating to the participating nursing homes (e.g. numbers of employees and residents) that may act as explanatory variables of medical care.

Based on these data, a geriatrician and a GP jointly determine case by case whether or not medical care needs in the areas of vision, hearing, oral health and Parkinson's disease are met. In cases of uncertainties or discrepancies, geriatricians and GPs may decide to consult a medical specialist of the corresponding field (i.e. an ophthalmologist, an ear, nose and throat (ENT) specialist, a dentist or a neurologist) who independently determines whether or not medical care needs in the respective area are met. The process of evaluating met and unmet medical care needs is based on standardized guidelines and is tested and adjusted before final application. All physicians are trained on how to evaluate met and unmet medical care needs. Intercoder reliability is assessed for a subsample of 50 nursing home residents.

Step 3: Expert interviews and case conferences

Semi-structured expert interviews and case conferences are used to identify structural and case-specific explanations of inappropriate medical care provision in nursing homes. Expert interviews are conducted with nursing home staff, physicians, people in need for long-term care and informal caregivers who provide informed consent. The number of interviews is determined by the principal of theoretical saturation. All interviews are recorded on tape, transcribed and analyzed using content analysis.[34] The results provide a framework for the subsequent case conferences, which are conducted for a selected subsample of nursing home residents assessed in step 2.

The case conferences are held with the consenting nurses and, where necessary, the consenting physicians and other health professionals involved in the provision of nursing and medical care of the respective resident. Twenty residents with appropriate medical care and twenty residents with inappropriate medical care are randomly selected for each field of

medical care (i.e. vision, hearing, oral health and Parkinson's disease). The case conferences are based on a summarized presentation of the health status and medical care provision of the respective resident. Using problem-centered group interviews,[35] the conference members then discuss, case by case, factors that foster or inhibit the provision of needs-based medical care.

Step 4: Analysis of linked data, non-response analysis and extrapolation

In step 4, primary data assessed in step 2 and SHI claims data covering the years 2014-2018 are linked at the individual level. The linked data are analyzed to identify generalizable factors that impact the provision of medical care:

First, retrospective and prospective regression analyses are conducted. Retrospective analyses are used to identify factors in the utilization of medical care that impact the quantified met and unmet medical care needs of nursing home residents. Prospective analyses are used to investigate the impact of the standardized assessment conducted in step 2 on the utilization of medical care.

Next, a non-response analysis is conducted. SHI claims data of 1,800 residents are analyzed to identify systematic differences between responders and non-responders. Chi-square tests are used to identify differences in the distribution of age groups, sex, morbidity and long-term care levels. Differences in the mean duration of stays in long-term care and nursing homes are identified using t-tests.

Third, prevalence of met and unmet medical care needs is extrapolated. Controlling for systematic differences between responders and non-responders identified in the non-response analysis, prevalence of met and unmet medical care needs is projected to all nursing home residents insured by the AOK Bremen/Bremerhaven. Using official statistics, systematic differences in the distribution of age groups, sex and long-term care levels between nursing home residents insured by the AOK Bremen/Bremerhaven and the total population of nursing

home residents in the federal state of Bremen are identified. Taking into account identified differences, the prevalence of met and unmet medical care needs is then projected to all nursing home residents of Bremen. Finally, the prevalence is projected to all nursing home residents of Germany controlling for identifiable differences in the distribution of age groups, sex and long-term care levels between nursing home residents in Bremen and Germany.

Step 5: Modified Delphi study and pilot projects

Based on the factors identified that may explain inappropriate medical care in steps 3 and 4, a modified Delphi study is then carried out. The technique is used with stakeholders from the fields of nursing and medical care and comprises three rounds. The first round is based on face-to-face focus group discussions, while the second and third rounds each consist of semi-structured online surveys. Each survey takes about 20 minutes to complete and is online for up to 2 weeks.

In the first round, a convenience sample of homogeneous and heterogeneous focus groups of consenting stakeholders (i.e., nursing home staff, GPs, medical specialist, SHI employees, nursing home residents and relatives) generate ideas on how medical care provision to nursing home residents can be improved. The focus groups are led by experienced project researchers, who feed the results of steps 3 and 4 into the discussions. Based on the ideas generated, the project researchers draft at least two pilot projects.

In the second round, the experts are given descriptions of these potential pilot projects and rate them with respect to their feasibility and effectiveness for improving medical care of nursing home residents. These ratings are summarized and distributed back to all experts.

In the third round, the experts re-rate the projects based on the rating results from the previous round. This is expected to result in a more consensual decision. Taking the results of this last round into account, the concept of the pilot projects is revised and at least two pilot projects are implemented simultaneously in one nursing home to test for practicability. To minimize

the risk of contamination effects, the pilot projects are implemented in different areas of the nursing home. A systematic evaluation of the pilot projects is planned in a follow-up study.

Patient and public involvement

Nursing home residents and the public were not involved in the development of the research question and outcome measures as well as in the design of and the recruitment to the study. Nursing home residents are involved in the standardized assessments of vision, hearing, oral health, health-related quality of life, depression as well as functional and cognitive status (self-assessments). Furthermore, nursing home residents and relatives are involved in the expert interviews, the modified Delphi study and the development of pilot projects. The results of the standardized assessment are summarized and disseminated to the participating nursing homes (i.e. the results are not directly disseminated to the participating residents). The results of the expert interviews, the modified Delphi study and the development of pilot projects are disseminated to the participating nursing home residents and relatives.

Discussion

This mixed-methods study broadens the limited evidence on the needs-based provision of medical care in nursing homes. It systematically assesses, evaluates and explains met and unmet medical care needs in nursing homes and takes first steps toward improvement.

Up to now, several studies have described differences in the utilization of medical care between nursing home residents and community-dwelling elderly with and without need for long-term care.[2,36-38] None of these, however, has evaluated whether such differences reflect unmet medical care needs at the individual level. Neither have differences in the utilization of medical care been explained by prevailing structures that may be changed.

The present mixed-methods study addresses this evidence gap: Based on longitudinal SHI claims data, cross-sectional data collected in nursing homes as well as transcripts of expert

interviews and case conferences, differences in the utilization of medical care are identified, met and unmet medical care needs are quantified, explanations of inappropriate provision of medical care are provided and pilot projects are developed aiming to improve the provision of medical care where it is found to be inappropriate. Participatory approaches involve GPs, medical specialists, nursing home staff, SHI employees, nursing home residents and relatives. This is expected to result in strong acceptance and effective pilot projects which will be systematically evaluated in a follow-up study.

There are, however, some limitations to consider. First, in the present study, all nursing homes in the federal state of Bremen are invited to participate and to recruit nursing home residents for study participation. Differences in the willingness to participate among nursing homes and nursing home residents may result in a selective study population. The claims-based non-response analysis, however, permits the identification of structural differences between participants and non-participants. Second, the study focuses on nursing homes located in the federal state of Bremen and members of one local SHI fund. Therefore, the generalizability of research findings may be limited.

In conclusion, the findings from this study enhance our knowledge of met and unmet medical care needs in nursing homes. The pilot projects provide a first step towards a sustainable improvement of medical care in German nursing homes. Therefore, it is expected that the findings are highly relevant for many stakeholders from the fields of nursing and medical care.

Ethics and dissemination

The Ethics Committee of the University of Bremen approved this study on November 23, 2017. All eligible nursing home residents and all nursing home staff are informed in detail about the study. Informed consent is obtained from all included nursing home residents (or their legal guardians where applicable). Informed consent is also obtained from all persons

included in the expert interviews, case conferences and Delphi study. Dissemination strategies include presentations at national and international conferences and publications in peer-reviewed scientific journals.

Acknowledgements

We are grateful to the AOK Bremen/Bremerhaven for the provision of longitudinal SHI claims data as well as to the Bremer Heimstiftung, the Bundesverband privater Anbieter sozialer Dienste e.V., the LandesArbeitsGemeinschaft der Freien Wohlfahrtspflege Bremen e.V. and the Hausärzteverband Bremen for their cooperation. Furthermore, we are grateful to the participating nursing homes, nursing home residents, physicians, relatives, study nurses, student assistants and Statutory Health Insurance employees as well as to Vicki May for proofreading this protocol.

Footnotes

Contributors: JC, TK, ASchw, GS, KW-O, AG and HR designed the study. MS, TK, CT, ASchw and HR specified the analysis of longitudinal SHI claims data. MS, FH, DK, ASchm, SK, GS, KW-O, AG and HR specified the collection of cross-sectional primary data. JC, MS, FH, DG, ASchm, CT, ASchw and SK wrote the first draft of the protocol which was critically revised by TK, GS, KW-O, AG and HR. All authors approved the final version of the protocol.

Funding: This work was supported by the Innovation Committee at the Federal Joint Committee (grant number 01VSF16039).

Competing interests: None declared.

Figures

See separate file (Figure_1.jpg)

Figure 1 Conceptual framework of the mixed-methods study

References

1 Iliffe S, Davies SL, Gordon AL, et al. Provision of NHS generalist and specialist services to care homes in England: review of surveys. *Prim Health Care Res Dev* 2016;17(2):122-37.

2 Balzer K, Butz S, Bentzel J, et al. Medical specialist attendance in nursing homes. *GMS Health Technol Assess* 2013;9:Doc02.

3 Burns E, Nair S. New horizons in care home medicine. *Age Ageing* 2014;43(1):2-7.

4 Briggs R, Holmerová I, Martin FC, et al. Towards standards of medical care for physicians in nursing homes. *Eur Geriatr Med* 2015;6(4):401-3.

5 Gordon AL, Franklin M, Bradshaw L, et al. Health status of UK care home residents: a cohort study. *Age Ageing* 2014;43(1):97-103.

6 Björk S, Juthberg C, Lindkvist M, et al. Exploring the prevalence and variance of cognitive impairment, pain, neuropsychiatric symptoms and ADL dependency among persons living in nursing homes; a cross-sectional study. *BMC Geriatr* 2016;16:154.

7 Tolson D, Rolland Y, Andrieu S, et al. International Association of Gerontology and Geriatrics: a global agenda for clinical research and quality of care in nursing homes. *J Am Med Dir Assoc* 2011;12(3):184-9.

8 Thibault L, Kergoat H. Eye care services for older institutionalised individuals affected by cognitive and visual deficits: a systematic review. *Ophthalmic Physiol Opt* 2016;36(5):566-83.

9 Yamada Y, Vlachova M, Richter T, et al. Prevalence and correlates of hearing and visual impairments in European nursing homes: results from the SHELTER study. *J Am Med Dir Assoc* 2014;15(10):738-43.

10 Cohen-Mansfield J, Infeld DL. Hearing aids for nursing home residents: current policy and future needs. *Health Policy* 2006;79(1):49-56.

11 Zenthöfer A, Rammelsberg P, Cabrera T, et al. Increasing dependency of older people in nursing homes is associated with need for dental treatments. *Neuropsychiatr Dis Treat* 2014;10:2285-90.

12 Müller F, Naharro M, Carlsson GE. What are the prevalence and incidence of tooth loss in the adult and elderly population in Europe? *Clin Oral Impl Res* 2007;18 Suppl 3:2-14.

13 Lukas A, Mayer B, Onder G, et al. [Pain therapy in German long-term care facilities in a European comparison. Results of the SHELTER study]. *Schmerz* 2015;29(4):411-21.

14 Storms H, Marquet K, Aertgeerts B, et al. Prevalence of inappropriate medication use in residential long-term care facilities for the elderly: a systematic review. *Eur J Gen Pract* 2017;23(1):69-77.

15 Dörks M, Allers K, Schmiemann G, et al. Inappropriate medication in non-hospitalized patients with renal insufficiency: a systematic review. *J Am Geriatr Soc* 2017;65(4):853-62.

16 Morin L, Laroche ML, Texier G, et al. Prevalence of potentially inappropriate medication use in older adults living in nursing homes: a systematic review. *J Am Med Dir Assoc* 2016;17(9):862.e1-9.

17 Johnell K. Inappropriate drug use in people with cognitive impairment and dementia: a systematic review. *Curr Clin Pharmacol* 2015;10(3):178-84.

18 Atramont A, Bourdel-Marchasson I, Bonnet-Zamponi D, et al. Impact of nursing home admission on health care use and disease status elderly dependent people one year before and one year after skilled nursing home admission based on 2012-2013 SNIIRAM data. *BMC Health Serv Res* 2017;17(1):667.

19 Atramont A, Bonnet-Zamponi D, Bourdel-Marchasson I, et al. Health status and drug use 1 year before and 1 year after skilled nursing home admission during the first quarter of 2013 in France: a study based on the French National Health Insurance Information System. *Eur J Clin Pharmacol. 2018;74(1):109-18*.

20 Bailey IL, Lovie JE. New design principles for visual acuity letter charts. *Am J Optom Physiol Opt* 1976;53(11):740-5.

21 Macphee GJ, Crowther JA, McAlpine CH. A simple screening test for hearing impairment in elderly patients. *Age Ageing* 1988;17(5):347-51.

22 Chalmers JM, King PL, Spencer AJ, et al. The Oral Health Assessment Tool--validity and reliability. *Aust Dent J* 2005;50(3):191-9.

23 John MT, Miglioretti DL, LeResche L, et al. German short forms of the Oral Health Impact Profile. *Community Dent Oral Epidemiol* 2006;34(4):277-88.

24 Morfeld M, Kirchberger I, Bullinger M. SF-36. Fragebogen zum Gesundheitszustand: Deutsche Version des Short Form - 36 Health Survey. Göttingen: Hogrefe; 2011.

25 Yesavage JA, Brink TL, Rose TL, et al. Development and validation of a geriatric depression screening scale: a preliminary report. *J Psychiatr Res* 1982;17(1):37-49.

26 Allgaier AK, Kramer D, Mergl R, et al. [Validity of the geriatric depression scale in nursing home residents: comparison of GDS-15, GDS-8, and GDS-4]. *Psychiatrische Praxis* 2011;38(6):280-6.

27 Alexopoulos GS, Abrams RC, Young RC, et al. Cornell Scale for Depression in Dementia. *Biol Psychiatry* 1988;23(3):271-84.

28 Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975;12(3):189-98.

29 Prosiegel M, Böttger S, Schenk T, et al. Der Erweiterte Barthel-Index (EBI) - eine neue Skala zur Erfassung von Fähigkeitsstörungen bei neurologischen Patienten. *Neurol Rehabil* 1996;2:7-13.

30 Rubenstein LZ, Harker JO, Salvà A, et al. Screening for undernutrition in geriatric practice: developing the short-form mini-nutritional assessment (MNA-SF). *J Gerontol A Biol Sci Med Sci* 2001;56(6):M366-72.

31 Vellas B, Villars H, Abellan G, et al. Overview of the MNA--Its history and challenges. *J Nutr Health Aging* 2006;10(6):456-63; discussion 463-5.

32 Guigoz Y. The Mini Nutritional Assessment (MNA) review of the literature--What does it tell us? *J Nutr Health Aging* 2006;10(6):466-85; discussion 485-7.

33 Kaiser MJ, Bauer JM, Ramsch C, et al. Validation of the Mini Nutritional Assessment short-form (MNA-SF): a practical tool for identification of nutritional status. *J Nutr Health Aging* 2009;13(9):782-8.

34 Kohlbacher F. The use of qualitative content analysis in case study research. *Forum: Qual Soc Res* 2006; doi:10.17169/fqs-7.1.75.

35 Witzel A. The problem-centered interview. *Forum: Qual Soc Res* 2000; doi:10.17169/fqs-1.1.1132.

36 Kleina T, Horn A, Suhr R, et al. [Current status of medical care for nursing home residents in Germany - results of an empirical study]. *Gesundheitswesen* 2017;79(5):382-87.

37 Schmiemann G, Herget-Rosenthal S, Hoffmann F. [Medical services for nursing home residents : results of the study on inappropriate medication in patients with renal insufficiency in nursing homes]. *Z Gerontol Geriatr* 2016;49(8):727-33.

38 Pittrow D, Krappweis J, Rentsch A, et al. Pattern of prescriptions issued by nursing home-based physicians versus office-based physicians for frail elderly patients in German nursing homes. *Pharmacoepidemiol Drug Saf* 2003;12(7):595-9.

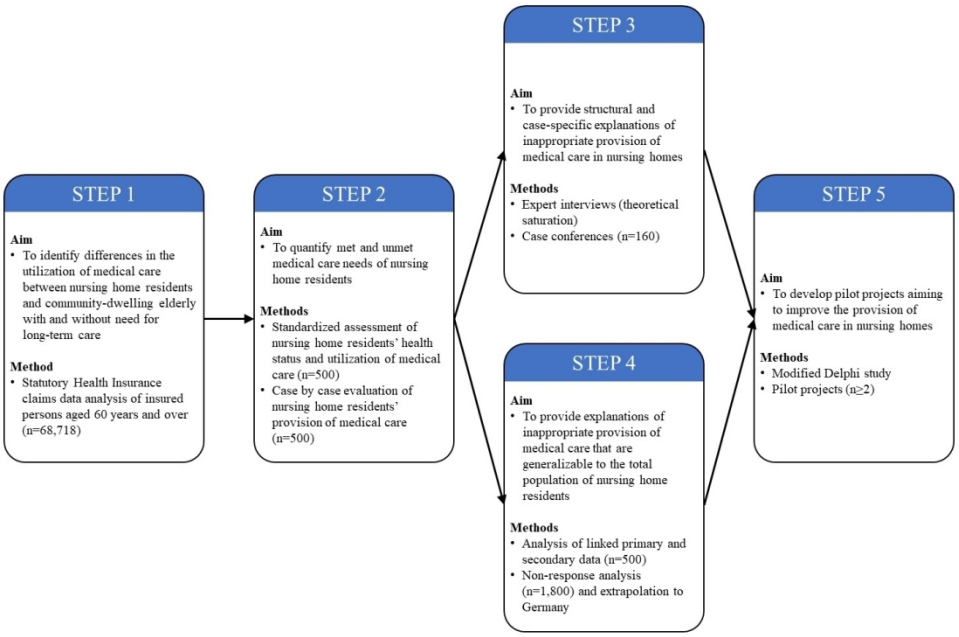

Figure 1 Conceptual framework of the mixed-methods study

128x96mm (300 x 300 DPI)

BMJ Open

Needs-based provision of medical care to nursing home residents: protocol for a mixed-methods study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2018-025614.R2
Article Type:	Protocol
Date Submitted by the Author:	11-May-2019
Complete List of Authors:	Czwikla, Jonas; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences Schulz, M; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences Heinze, Franziska; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences Kalwitzki, Thomas; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences Gand, Daniel; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Services Research; University of Bremen, High-Profile Area Health Sciences Schmidt, Annika; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Care Research; University of Bremen, High-Profile Area Health Sciences Tsiasioti, Chrysanthi; WIdO-AOK Research Institute Schwinger, Antje; WIdO-AOK Research Institute Kloep, Stephan; University of Bremen, Competence Center for Clinical Trials (KKSB); University of Bremen, High-Profile Area Health Sciences Schmiemann, Guido; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Services Research; Hannover Medical School, Institute for General Practice Wolf-Ostermann, Karin; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Care Research; University of Bremen, High-Profile Area Health Sciences Gerhardus, Ansgar; University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Services Research; University of Bremen, High-Profile Area Health Sciences Rothgang, Heinz; University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions; University of Bremen, High-Profile Area Health Sciences, Bremen
Primary Subject Heading:	Health services research
Secondary Subject Heading:	Geriatric medicine, Ophthalmology, Ear, nose and throat/otolaryngology, Dentistry and oral medicine, Neurology

Keywords:	Medical care, Nursing homes, Needs assessment, Administrative claims, Health services research

Needs-based provision of medical care to nursing home residents: protocol for a mixed-methods study

Jonas Czwikla[1,7], Maike Schulz[1,7], Franziska Heinze[1,7], Thomas Kalwitzki[1,7], Daniel Gand[2,7], Annika Schmidt[3,7], Chrysanthi Tsiasioti[4], Antje Schwinger[4], Stephan Kloep[5,7], Guido Schmiemann[2,6,7], Karin Wolf-Ostermann[3,7], Ansgar Gerhardus[2,7], Heinz Rothgang[1,7]

[1] University of Bremen, SOCIUM Research Center on Inequality and Social Policy, Department of Health, Long-term Care and Pensions, Mary-Somerville-Straße 5, 28359 Bremen, Germany

[2] University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Services Research, Grazer Straße 4, 28359 Bremen, Germany

[3] University of Bremen, Institute of Public Health and Nursing Research (IPP), Department for Health Care Research, Grazer Straße 4, 28359 Bremen, Germany

[4] WIdO-AOK Research Institute, Rosenthaler Str. 31, 10178 Berlin, Germany

[5] University of Bremen, Competence Center for Clinical Trials (KKSB), Linzer Straße 4, 28359 Bremen, Germany

[6] Hannover Medical School, Institute for General Practice, Carl-Neuberg-Straße 1, 30625 Hannover, Germany

[7] University of Bremen, High-Profile Area Health Sciences, Bremen, Germany

Corresponding author:

Jonas Czwikla, M.A. (czwikla@uni-bremen.de)

University of Bremen, SOCIUM Research Center on Inequality and Social Policy

Mary-Somerville-Straße 5, 28359 Bremen, Germany

Phone: +49 (0)421 218 58633

Co-authors:

Dr. Maike Schulz (maike.schulz@uni-bremen.de)

Franziska Heinze, M.Sc. (fheinze@uni-bremen.de)

Dipl.-Geront. Thomas Kalwitzki (thomas.kalwitzki@uni-bremen.de)

Daniel Gand, M.A. (daniel.gand@uni-bremen.de)

Annika Schmidt, M.Sc. (schmidt.annika@uni-bremen.de)

Chrysanthi Tsiasioti (Chrysanthi.Tsiasioti@wido.bv.aok.de)

Dr. Antje Schwinger (antje.schwinger@wido.bv.aok.de)

Dr. Stephan Kloep (kloep@math.uni-bremen.de)

PD Dr. Guido Schmiemann (schmiema@uni-bremen.de)

Prof. Dr. Karin Wolf-Ostermann (wolf-ostermann@uni-bremen.de)

Prof. Dr. Ansgar Gerhardus (ansgar.gerhardus@uni-bremen.de)

Prof. Dr. Heinz Rothgang (rothgang@uni-bremen.de)

Word count: 3,181

Abstract

Introduction Nursing home residents typically have greater needs for medical care than community-dwelling elderly. However, restricted cognitive abilities and limited mobility may impede their access to general practitioners and medical specialists. The provision of medical care in nursing homes may therefore be inappropriate in some areas of medical care. The purpose of this mixed-methods study is to systematically assess, evaluate and explain met and unmet medical care needs in German nursing homes and to develop solutions where medical care is found to be inappropriate.

Methods and analysis First, Statutory Health Insurance claims data are analyzed to identify differences in the utilization of medical care between nursing home residents and community-dwelling elderly with and without need for long-term care. Second, the health status and medical care of 500 nursing home residents are assessed and evaluated to quantify met and unmet medical care needs. Third, qualitative expert interviews and case conferences and, fourth, quantitative analyses of linked data are used to provide structural, case-specific and generalizable explanations of inappropriate medical care among nursing home residents. Fifth, a modified Delphi study is employed to develop pilot projects aiming to improve medical care in nursing homes.

Ethics and dissemination This study was approved by the Ethics Committee of the University of Bremen. Research findings are disseminated through presentations at national and international conferences and publications in peer-reviewed scientific journals.

Trial registration number DRKS00012383

Article Summary

Strengths and limitations of this study

- Based on longitudinal Statutory Health Insurance claims data, cross-sectional data collected in nursing homes, expert interviews and case conferences the provision of medical care is analyzed for the first time in relation to individual medical care needs among nursing home residents in Germany.
- The mixed-methods designs allows a comprehensive assessment, evaluation and explanation of met and unmet medical care needs in nursing homes.
- Participatory approaches involving general practitioners, medical specialists, nursing home staff, Statutory Health Insurance employees, nursing home residents and relatives are used to increase the acceptance and effectiveness of pilot projects to be developed to improve medical care where it is found to be inappropriate.
- Differences in the willingness to participate among nursing homes and nursing home residents may result in a selective study population.
- Focusing on nursing homes located in the federal state of Bremen and members of one local Statutory Health Insurance fund may limit the generalizability of the study results.

Introduction

Nursing home residents may not receive appropriate medical care since restricted cognitive abilities and limited mobility may impede their access to general practitioners (GPs) and medical specialists.[1-3] Moreover, nursing home residents typically suffer from multimorbidity, frailty, cognitive impairments and polypharmacy, resulting in diverse medical care needs that compound the challenge of providing appropriate medical care.[4-7] Empirical studies support this view, indicating inappropriate medical care provision in nursing homes for the treatment of visual and hearing impairments,[8-10] oral health care,[1,2,11,12] pain treatment[13] and drug prescriptions.[2,14-17] Atramont et al., furthermore, found nursing home admission to be negatively associated with some forms of outpatient care[18] and positively associated with psychotropic and antibacterial drug use.[19] There is, however, hardly any empirical evidence on explanations of inappropriate medical care provision in nursing homes. In this regard, a health technology assessment report concluded that there is not sufficient data available to allow recommendations to be drawn on how medical care provision in German nursing homes can be improved.[2]

Given this lack of evidence, the proposed research project aims to systematically assess, evaluate and explain met and unmet medical care needs in German nursing homes and to develop solutions where medical care is found to be inappropriate. The specific aims are: (1) to identify differences in the utilization of medical care between a) nursing home residents, b) community-dwelling elderly in need for long-term care and c) community-dwelling elderly without need for long-term care; (2) to quantify met and unmet medical care needs of nursing home residents; (3) to provide structural and case-specific explanations of inappropriate medical care provision in nursing homes; (4) to provide explanations of inappropriate medical care provision that are generalizable to the total population of nursing home residents; and (5) to develop pilot projects aiming to improve medical care provision in nursing homes.

Methods and analysis

This mixed-methods study is running from April 1, 2017 to March 31, 2020. It is structured into five steps (figure 1). In step 1, Statutory Health Insurance (SHI) claims data are analyzed in order to identify differences in the utilization of medical care between nursing home residents and community-dwelling elderly with and without the need for long-term care. Such differences in the utilization of medical care may indicate, but not prove, inappropriate medical care provision in nursing homes. Thus, in step 2, nursing home residents' health status and utilization of medical care are assessed and evaluated to quantify met and unmet medical care needs with respect to vision, hearing, oral health and Parkinson's disease. In steps 3 and 4, qualitative expert interviews and case conferences as well as quantitative methods are used to provide structural, case-specific and generalizable explanations of inappropriate medical care in nursing homes. In step 5, a modified Delphi study is used to generate ideas on how to improve the provision of medical care in nursing homes. Consequently, at least two pilot projects are developed and implemented in one nursing home to test for practicability. In the following sections, each step is described in detail.

Step 1: Analysis of SHI claims data

SHI claims data from AOK Bremen/Bremerhaven, a local SHI fund, are analyzed to identify differences in the utilization of medical care that indicate inappropriate medical care provision in German nursing homes. The available data comprise information on sex, age, in- and outpatient care as well as on long-term care use of 245,000 insured persons (i.e. 34.7% of the total population in the federal state of Bremen). The data represent 51.8% of the population of community-dwelling individuals with need for long-term care and 54.9% of the population of nursing home residents in Bremen. All diagnoses are coded according to the German Modification of the International Classification of Diseases, 10th Revision (ICD-10-GM) and can be differentiated according to GPs and medical specialties in the outpatient setting. In

Germany, the Federal Joint Committee defines which services are reimbursed by the SHI ensuring that all SHI insured persons are treated according to the current standard of care.[20] SHI claims data comprise all diagnoses coded by physicians for reimbursement purposes of services with clear benefits. Services with unclear benefits, which have to be paid out of pocket, are not included.

From the 245,000 insured persons, a subsample of 68,718 insured persons aged 60 years and over is drawn. Insured persons with missing or invalid information on demographic characteristics (n = 124) are not considered. For this subsample, the morbidity status of each insured person is defined by 31 disease categories related to at least one of 13 examined medical specialties (table 1).

Table 1 Disease categories and related medical specialties used to define the individual morbidity status of insured persons examined in step 1

No.	Disease categories	ICD-10-GM 2015 codes	Related medical specialties*
01	Hypertensive diseases	I10-I15	Internal medicine, cardiology
02	Ischemic heart diseases	I20-I52	Internal medicine, cardiology
03	Metabolic disorders	E70-E90	Internal medicine
04	Arthropathies	M00-M25	Internal medicine, orthopedics
05	Diabetes mellitus	E10-E14	Internal medicine
06	Dorsopathies	M40-M54	Orthopedics
07	Disorders of thyroid gland	E00-E07	Internal medicine
08	Vascular diseases	I70-I89	Internal medicine, cardiology
09	Organic, including symptomatic, mental disorders; other degenerative diseases of the nervous system	F00-F09; G30-G32	Neurology/psychiatry
10	Diseases of esophagus, stomach and duodenum; hernia; other diseases of intestines	K20-K31; K40-K46; K55-K64	Internal medicine
11	Chronic lower respiratory diseases	J40-J47	Internal medicine, pulmonology
12	Mood (affective) disorders	F30-F39	Neurology/psychiatry
13	Cerebrovascular diseases	I60-I69	Internal medicine, neurology/psychiatry
14	Neurotic, stress-related and somatoform disorders	F40-F48	Neurology/psychiatry
15	Symptoms and signs involving the urinary system; other diseases of urinary system	R30-R39; N30-N39	Gynecology, urology
16	Diseases of the eye and adnexa	H00-H59	Ophthalmology
17	Renal failure	N17-N19	Internal medicine, nephrology
18	Osteopathies and chondropathies	M80-M94	Orthopedics
19	Diseases of the ear and mastoid process	H60-H95	Otorhinolaryngology
20	Mononeuropathies; polyneuropathies and other disorders of the peripheral nervous system	G56; G57; G58; G59; G60-G64	Internal medicine, neurology/psychiatry
21	Diseases of male genital organs	N40-N51	Urology

22	Dermatitis, eczema; melanoma and other malignant neoplasms of skin	L20-L30; C43-C44	Dermatology, surgery
23	Noninflammatory disorders of female genital tract	N80-N98	Gynecology
24	Other disorders of the skin and subcutaneous tissue	L80-L99	Dermatology
25	Extrapyramidal and movement disorders	G20-G26	Internal medicine, neurology/psychiatry
26	Mental and behavioral disorders due to psychoactive substance use	F10-F19	Neurology/psychiatry
27	Cerebral palsy and other paralytic syndromes	G80-G83	Internal medicine, neurology/psychiatry
28	Obesity and other hyperalimentation; Malnutrition	E65-E68; E40-E46	Internal medicine
29	Schizophrenia, schizotypal and delusional disorders; disorders of adult personality and behavior	F20-F29; F60-F69	Neurology/psychiatry
30	Functional impairments	U50-U52	Internal medicine, Orthopedics
31	Injuries	S00-S09; S10-S19; S20-S29; S30-S39; S40-S49; S50-S59; S60-S69; S70-S79; S80-S89; S90-S99; T08-T14	Orthopedics, surgery

*Due to the availability of data, dentistry had to be analyzed separately and is therefore not presented.

Descriptive analyses are conducted in two steps. First, the prevalence of each single disease category in 2015 is determined among the groups of nursing home residents, community-dwelling elderly in need for long-term care and community-dwelling elderly without need for long-term care. Second, for the 45 combinations of disease categories and related medical specialties, the proportion of prevalent cases with an outpatient visit in the related medical specialty in 2015 is calculated among the three groups (i.e. nursing home residents as well as community-dwelling elderly with and without need for long-term care). Lower proportions of prevalent cases with an outpatient visit in the related medical specialty may indicate, but not prove, unmet medical care needs.

Poisson regression analyses are conducted to investigate the intensity of medical care for the 45 combinations of disease categories and related medical specialties separately. In cases of overdispersion, negative binomial regression and in cases of excess zeros, zero-inflated Poisson regression or zero-inflated negative binomial regression analyses are conducted. Each regression model includes only those insured persons who are diagnosed in the examined disease category and have valid information on all variables included in the model. The

dependent variable is the number of outpatient visits in the related medical specialty in 2015. Independent variables are age (in five-year groups), sex and dummy variables as a combination of the obtained level of care (no long-term care dependency, level 1, level 2, level 3 of long-term care dependency) and the care setting (community, nursing home). To take account of differences in morbidity and mortality that likely impact the number of outpatient visits, the remaining 30 disease categories and death are included as control variables. Multicollinearity between variables is evaluated on the basis of the variance inflation factor.

Step 2: Assessment of nursing home residents

The standardized assessment focuses on vision, hearing, oral health and Parkinson's disease. It consists of two parts: First, the individual health status and medical care provision of 500 nursing home residents are assessed. Second, the provision of medical care is evaluated for each resident to determine met and unmet medical care needs.

Residents are eligible for assessment if a) they are in need for long-term care, b) are aged 60 years and over, c) have been residing in a nursing home located in the federal state of Bremen for at least 12 months and d) are a member of the AOK Bremen/Bremerhaven. The total number of eligible nursing home residents is approximately 1,800. The recruitment strategy comprises two stages: At stage one, the total number of nursing homes located in the federal state of Bremen is approached for participation by the research team (i.e. no sampling strategy is applied). At stage two, all eligible residents (or their legal guardians) are invited for participation and approached for informed consent by the nursing homes agreeing to participate (i.e. also no sampling strategy is applied). We expect that not all nursing homes and not all nursing home residents agree to participate and assume to reach 25-30% of the approximately 1,800 eligible nursing home residents, resulting in a study population of 500

nursing home residents. In case of reaching considerably less than 500 participants, the recruitment strategy may be extended to the federal state of Lower Saxony.

The standardized assessment is carried out by trained study nurses and includes: (1) examinations of residents, (2) self-assessments by residents, (3) proxy-assessments by residents' care nurses and (4) reviews of nursing records (table 2). The examination of residents comprises the application of a visual test,[21] a whispered voice test[22] and the Oral Health Assessment Tool (OHAT).[23] During the self-assessments, nursing home residents are asked, inter alia, to rate their vision, hearing and oral health as well as whether they use a visual aid, a hearing device or dentures. Further questions relate to their general health status. The residents' self-assessments are complemented by the proxy-assessments in which the residents' care nurses are asked the same or comparable questions. Information regarding the utilization of medical care (e.g. contacts to general and specialized care), sociodemographic data and nursing home characteristics are obtained from the residents' care nurses and nursing records.

Table 2 Instruments used to assess cross-sectional data in step 2

Category	Instrument	Source*			
		E	S	P	R
Area of medical care					
Vision	Visual test[21]	X			
	Questionnaire for individual rating of vision and use of visual aids		X	X	
	Review of nursing records in terms of vision-related diagnoses (e.g. age-related macular degeneration, cataract) and relevant comorbidities (e.g. diabetes mellitus)				X
Hearing	Whispered voice test[22]	X			
	Questionnaire for individual rating of hearing and use of hearing devices		X	X	
	Review of nursing records in terms of hearing-related diagnoses (e.g. presbycusis)				X
Oral health	Oral Health Assessment Tool (OHAT)[23]	X			
	Oral Health Impact Profile (OHIP)[24]		X		
	Questionnaire for individual rating of dental problems as well as availability and use of dentures		X	X	
	Review of nursing records in terms of oral health-related diagnoses (e.g. gingivitis)				X
Parkinson's disease	Review of nursing records in terms of diagnosis of Parkinson's disease, prescribed medications and contacts to medical specialists (e.g. neurologists) and/or therapists (e.g. physiotherapists)				X
General health status					
Health-related quality of life	Short-Form Health Survey (SF-12)[25]		X	X	
Depression	Geriatric Depression Scale (GDS)[26,27]		X		
	Cornell Scale for Depression in Dementia (CSDD)[28]			X	
Functional and cognitive status	Mini-Mental State Examination[29]		X		
	Extended Barthel-Index[30]			X	
Nutrition	Mini-Nutritional Assessment Short Form (MNA-SF)[31-34]			X	
Vital signs	Review of nursing records in terms of vital signs and falls				X
Level of care	Review of nursing records in terms of level of care				X
Additional data					
Utilization of medical care	Questionnaire for and review of nursing records in terms of diagnoses, prescriptions of medication and aids, contacts to and organization of general and specialized care, hospitalization, contacts to duty doctors and emergency calls			X	X
Sociodemographic data	Questionnaire for and review of nursing records in terms of age, sex, education, marital status, migrant status and relatives			X	X
Nursing home characteristics	Questionnaire** for size, number of employees and residents, location-related information			X	

*E = examinations of residents; S = self-assessed by residents; P = proxy-assessed by residents' care nurses; R = reviewed in nursing records
** This questionnaire is completed by administrative employees of the respective nursing home.

Additionally, health-related aspects (e.g. quality of life and depression) are assessed as well as structural factors relating to the participating nursing homes (e.g. numbers of employees and residents) that may act as explanatory variables of medical care.

The assessed data are summarized in individual case reports. These case reports comprise information on age, sex, level of care, date of nursing home admission, in- and outpatient medical care, diagnoses, medication, aids, vital signs, falls, the result of the visual test and self-reported use of visual aids, the result of the whispered voice test and self-reported use of hearing devices, all data of the OHAT, the self- and proxy-assessed oral health, the proxy-assessed availability and use of dentures as well as the result of the Oral Health Impact Profile (OHIP).[24] Moreover, the case reports include the results of the instruments applied for assessing the health-related quality of life,[25] depression,[26-28] functional and cognitive status,[29,30] nutrition,[31-34] as well as all comments made by the trained study nurses during the assessment. Based on the case reports (in printed form), a geriatrician and a GP jointly determine case by case whether or not medical care needs in the areas of vision, hearing, oral health and Parkinson's disease are met, i.e. whether or not the provision of medical care is appropriate. In cases of uncertainties or discrepancies, geriatricians and GPs may access all assessed data (in digital form) and decide to consult a medical specialist of the corresponding field (i.e. an ophthalmologist, an ear, nose and throat (ENT) specialist, a dentist or a neurologist) who independently determines whether or not medical care needs in the respective area are met. Based on these data, the prevalence of met and unmet medical care needs is quantified for each area. The process of evaluating met and unmet medical care needs is based on standardized guidelines and is tested and adjusted before final application. All physicians are trained on how to evaluate met and unmet medical care needs. Intercoder reliability is assessed for a subsample of 50 nursing home residents.

Step 3: Expert interviews and case conferences

Semi-structured expert interviews and case conferences are used to identify structural and case-specific explanations of inappropriate medical care provision in nursing homes. Expert interviews are conducted with nursing home staff, physicians, people in need for long-term care and informal caregivers who provide informed consent. The number of interviews is determined by the principal of theoretical saturation. All interviews are recorded on tape, transcribed and analyzed using content analysis.[35] The results provide a framework for the subsequent case conferences, which are conducted for a selected subsample of nursing home residents assessed in step 2.

The case conferences are held with the consenting nurses and, where necessary, the consenting physicians and other health professionals involved in the provision of nursing and medical care of the respective resident. Twenty residents with appropriate medical care and twenty residents with inappropriate medical care are randomly selected for each field of medical care (i.e. vision, hearing, oral health and Parkinson's disease). The case conferences are based on a summarized presentation of the health status and medical care provision of the respective resident. Using problem-centered group interviews,[36] the conference members then discuss, case by case, factors that foster or inhibit the provision of needs-based medical care.

Step 4: Analysis of linked data, non-response analysis and extrapolation

In step 4, primary data of the 500 nursing home residents assessed in step 2 and SHI claims data covering the years 2014-2018 are linked at the individual level. The linked data are analyzed to identify generalizable factors that impact the provision of medical care:

First, retrospective and prospective regression analyses are conducted. Retrospective analyses are used to identify factors in the utilization of medical care that impact the quantified met and unmet medical care needs of nursing home residents. Prospective analyses are used to

investigate the impact of the standardized assessment conducted in step 2 on the utilization of medical care.

Next, a non-response analysis is conducted. SHI claims data of 500 responders and 1,300 non-responders are analyzed to identify systematic differences between responders and non-responders. Chi-square tests are used to identify differences in the distribution of age groups, sex, morbidity and long-term care levels. Differences in the mean duration of stays in long-term care and nursing homes are identified using t-tests for normally distributed variables and Wilcoxon-Mann-Whitney tests for non-normal distributions.

Third, prevalence of met and unmet medical care needs determined in step 2 is extrapolated. Controlling for systematic differences between responders and non-responders identified in the non-response analysis, prevalence of met and unmet medical care needs in the areas of vision, hearing, oral health and Parkinson's disease is projected to all nursing home residents insured by the AOK Bremen/Bremerhaven. Using official statistics, systematic differences in the distribution of age groups, sex and long-term care levels between nursing home residents insured by the AOK Bremen/Bremerhaven and the total population of nursing home residents in the federal state of Bremen are identified. Taking into account identified differences, the prevalence of met and unmet medical care needs is then projected to all nursing home residents of Bremen. Finally, the prevalence is projected to all nursing home residents of Germany controlling for identifiable differences in the distribution of age groups, sex and long-term care levels between nursing home residents in Bremen and Germany.

Step 5: Modified Delphi study and pilot projects

Based on the factors identified that may explain inappropriate medical care in steps 3 and 4, a modified Delphi study is then carried out. The technique is used with stakeholders from the fields of nursing and medical care and comprises three rounds. The first round is based on face-to-face focus group discussions, while the second and third rounds each consist of a

semi-structured online survey. Each survey takes about 20 minutes to complete and is online for up to 2 weeks.

In the first round, a convenience sample of at least two homogeneous and two heterogeneous focus groups of four to six participating stakeholders (i.e., nursing home staff, GPs, medical specialist, SHI employees, nursing home residents and relatives) generate ideas on how medical care provision to nursing home residents can be improved. The focus groups are led by two experienced project researchers, who feed the results of steps 3 and 4 into the discussions. All focus group discussions are recorded, summarized and discussed within the research team. Based on the results, the project researchers draft at least two potential pilot projects.

In round two, the experts of the first round are given descriptions of the potential pilot projects. They rate and comment on the proposed pilot projects with respect to their feasibility and effectiveness for improving medical care of nursing home residents. These ratings are narratively and visually summarized.

In the third round, the same experts re-rate the projects based on the summarized ratings from the previous round. The re-ratings are summarized using the same method as in round two. Taking the results of this last round into account, the concept of the pilot projects is revised. This is expected to result in a more consensual decision. At least two pilot projects are implemented simultaneously in one nursing home to test for practicability. To minimize the risk of contamination effects, the pilot projects are implemented in different areas of the nursing home. A systematic evaluation of the pilot projects is planned in a follow-up study.

Patient and public involvement

Nursing home residents and the public were not involved in the development of the research questions and outcome measures as well as in the design of and the recruitment to the study. Nursing home residents are involved in the standardized assessments of vision, hearing, oral

health, health-related quality of life, depression as well as functional and cognitive status (self-assessments). Furthermore, nursing home residents and relatives are involved in the expert interviews, the modified Delphi study and the development of pilot projects. The results of the standardized assessment are summarized and disseminated to the participating nursing homes (i.e. the results are not directly disseminated to the participating residents). The results of the expert interviews, the modified Delphi study and the development of pilot projects are disseminated to the participating nursing home residents and relatives.

Discussion

This mixed-methods study broadens the limited evidence on the needs-based provision of medical care in nursing homes. It systematically assesses, evaluates and explains met and unmet medical care needs in nursing homes and takes first steps toward improvement.

Up to now, several studies have described differences in the utilization of medical care between nursing home residents and community-dwelling elderly with and without need for long-term care.[2,37-39] None of these, however, has evaluated whether such differences reflect unmet medical care needs at the individual level. Neither have differences in the utilization of medical care been explained by prevailing structures that may be changed.

The present mixed-methods study addresses this evidence gap: Based on longitudinal SHI claims data, cross-sectional data collected in nursing homes as well as transcripts of expert interviews and case conferences, differences in the utilization of medical care are identified, met and unmet medical care needs are quantified, explanations of inappropriate provision of medical care are provided and pilot projects are developed aiming to improve the provision of medical care where it is found to be inappropriate. Participatory approaches involve GPs, medical specialists, nursing home staff, SHI employees, nursing home residents and relatives. This is expected to result in strong acceptance and effective pilot projects which will be systematically evaluated in a follow-up study.

There are, however, some limitations to consider. First, in the present study, all nursing homes in the federal state of Bremen are invited to participate and to recruit nursing home residents for study participation. Differences in the willingness to participate among nursing homes and nursing home residents may result in a selective study population. The claims-based non-response analysis, however, permits the identification of structural differences between participants and non-participants. Second, the study focuses on nursing homes located in the federal state of Bremen and members of one local SHI fund. Therefore, the generalizability of research findings may be limited.

In conclusion, the findings from this study enhance our knowledge of met and unmet medical care needs in nursing homes. The pilot projects provide a first step towards a sustainable improvement of medical care in German nursing homes. Therefore, it is expected that the findings are highly relevant for many stakeholders from the fields of nursing and medical care.

Ethics and dissemination

The Ethics Committee of the University of Bremen approved this study on November 23, 2017. All eligible nursing home residents and all nursing home staff are informed in detail about the study. Informed consent is obtained from all included nursing home residents (or their legal guardians where applicable). Informed consent is also obtained from all persons included in the expert interviews, case conferences and Delphi study. Dissemination strategies include presentations at national and international conferences and publications in peer-reviewed scientific journals.

Acknowledgements

We are grateful to the AOK Bremen/Bremerhaven for the provision of longitudinal SHI claims data as well as to the Bremer Heimstiftung, the Bundesverband privater Anbieter sozialer Dienste e.V., the LandesArbeitsGemeinschaft der Freien Wohlfahrtspflege Bremen e.V. and the Hausärzteverband Bremen for their cooperation. Furthermore, we are grateful to the participating nursing homes, nursing home residents, physicians, relatives, study nurses, student assistants and Statutory Health Insurance employees as well as to Vicki May for proofreading this protocol.

Footnotes

Contributors: JC, TK, ASchw, GS, KW-O, AG and HR designed the study. MS, TK, CT, ASchw and HR specified the analysis of longitudinal SHI claims data. MS, FH, DG, ASchm, SK, GS, KW-O, AG and HR specified the collection of cross-sectional primary data. JC, MS, FH, DG, ASchm, CT, ASchw and SK wrote the first draft of the protocol which was critically revised by TK, GS, KW-O, AG and HR. All authors approved the final version of the protocol.

Funding: This work was supported by the Innovation Committee at the Federal Joint Committee (grant number 01VSF16039).

Competing interests: None declared.

Figures

See separate file (Figure_1.jpg)

Figure 1 Conceptual framework of the mixed-methods study

References

1 Iliffe S, Davies SL, Gordon AL, et al. Provision of NHS generalist and specialist services to care homes in England: review of surveys. *Prim Health Care Res Dev* 2016;17(2):122-37.

2 Balzer K, Butz S, Bentzel J, et al. Medical specialist attendance in nursing homes. *GMS Health Technol Assess* 2013;9:Doc02.

3 Burns E, Nair S. New horizons in care home medicine. *Age Ageing* 2014;43(1):2-7.

4 Briggs R, Holmerová I, Martin FC, et al. Towards standards of medical care for physicians in nursing homes. *Eur Geriatr Med* 2015;6(4):401-3.

5 Gordon AL, Franklin M, Bradshaw L, et al. Health status of UK care home residents: a cohort study. *Age Ageing* 2014;43(1):97-103.

6 Björk S, Juthberg C, Lindkvist M, et al. Exploring the prevalence and variance of cognitive impairment, pain, neuropsychiatric symptoms and ADL dependency among persons living in nursing homes; a cross-sectional study. *BMC Geriatr* 2016;16:154.

7 Tolson D, Rolland Y, Andrieu S, et al. International Association of Gerontology and Geriatrics: a global agenda for clinical research and quality of care in nursing homes. *J Am Med Dir Assoc* 2011;12(3):184-9.

8 Thibault L, Kergoat H. Eye care services for older institutionalised individuals affected by cognitive and visual deficits: a systematic review. *Ophthalmic Physiol Opt* 2016;36(5):566-83.

9 Yamada Y, Vlachova M, Richter T, et al. Prevalence and correlates of hearing and visual impairments in European nursing homes: results from the SHELTER study. *J Am Med Dir Assoc* 2014;15(10):738-43.

10 Cohen-Mansfield J, Infeld DL. Hearing aids for nursing home residents: current policy and future needs. *Health Policy* 2006;79(1):49-56.

11 Zenthöfer A, Rammelsberg P, Cabrera T, et al. Increasing dependency of older people in nursing homes is associated with need for dental treatments. *Neuropsychiatr Dis Treat* 2014;10:2285-90.

12 Müller F, Naharro M, Carlsson GE. What are the prevalence and incidence of tooth loss in the adult and elderly population in Europe? *Clin Oral Impl Res* 2007;18 Suppl 3:2-14.

13 Lukas A, Mayer B, Onder G, et al. [Pain therapy in German long-term care facilities in a European comparison. Results of the SHELTER study]. *Schmerz* 2015;29(4):411-21.

14 Storms H, Marquet K, Aertgeerts B, et al. Prevalence of inappropriate medication use in residential long-term care facilities for the elderly: a systematic review. *Eur J Gen Pract* 2017;23(1):69-77.

15 Dörks M, Allers K, Schmiemann G, et al. Inappropriate medication in non-hospitalized patients with renal insufficiency: a systematic review. *J Am Geriatr Soc* 2017;65(4):853-62.

16 Morin L, Laroche ML, Texier G, et al. Prevalence of potentially inappropriate medication use in older adults living in nursing homes: a systematic review. *J Am Med Dir Assoc* 2016;17(9):862.e1-9.

17 Johnell K. Inappropriate drug use in people with cognitive impairment and dementia: a systematic review. *Curr Clin Pharmacol* 2015;10(3):178-84.

18 Atramont A, Bourdel-Marchasson I, Bonnet-Zamponi D, et al. Impact of nursing home admission on health care use and disease status elderly dependent people one year before and one year after skilled nursing home admission based on 2012-2013 SNIIRAM data. *BMC Health Serv Res* 2017;17(1):667.

19 Atramont A, Bonnet-Zamponi D, Bourdel-Marchasson I, et al. Health status and drug use 1 year before and 1 year after skilled nursing home admission during the first quarter of 2013 in France: a study based on the French National Health Insurance Information System. *Eur J Clin Pharmacol. 2018;74(1):109-18*.

20 Gemeinsamer Bundesausschuss. The Federal Joint Committee. https://www.g-ba.de/downloads/17-98-2804/2018-12-04_G-BA_Flyer_Der_Gemeinsame_Bundesausschuss_EN_bf.pdf (accessed April 22, 2019).

21 Bailey IL, Lovie JE. New design principles for visual acuity letter charts. *Am J Optom Physiol Opt* 1976;53(11):740-5.

22 Macphee GJ, Crowther JA, McAlpine CH. A simple screening test for hearing impairment in elderly patients. *Age Ageing* 1988;17(5):347-51.

23 Chalmers JM, King PL, Spencer AJ, et al. The Oral Health Assessment Tool--validity and reliability. *Aust Dent J* 2005;50(3):191-9.

24 John MT, Miglioretti DL, LeResche L, et al. German short forms of the Oral Health Impact Profile. *Community Dent Oral Epidemiol* 2006;34(4):277-88.

25 Morfeld M, Kirchberger I, Bullinger M. SF-36. Fragebogen zum Gesundheitszustand: Deutsche Version des Short Form - 36 Health Survey. Göttingen: Hogrefe; 2011.

26 Yesavage JA, Brink TL, Rose TL, et al. Development and validation of a geriatric depression screening scale: a preliminary report. *J Psychiatr Res* 1982;17(1):37-49.

27 Allgaier AK, Kramer D, Mergl R, et al. [Validity of the geriatric depression scale in nursing home residents: comparison of GDS-15, GDS-8, and GDS-4]. *Psychiatrische Praxis* 2011;38(6):280-6.

28 Alexopoulos GS, Abrams RC, Young RC, et al. Cornell Scale for Depression in Dementia. *Biol Psychiatry* 1988;23(3):271-84.

29 Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975;12(3):189-98.

30 Prosiegel M, Böttger S, Schenk T, et al. Der Erweiterte Barthel-Index (EBI) - eine neue Skala zur Erfassung von Fähigkeitsstörungen bei neurologischen Patienten. *Neurol Rehabil* 1996;2:7-13.

31 Rubenstein LZ, Harker JO, Salvà A, et al. Screening for undernutrition in geriatric practice: developing the short-form mini-nutritional assessment (MNA-SF). *J Gerontol A Biol Sci Med Sci* 2001;56(6):M366-72.

32 Vellas B, Villars H, Abellan G, et al. Overview of the MNA--Its history and challenges. *J Nutr Health Aging* 2006;10(6):456-63; discussion 463-5.

33 Guigoz Y. The Mini Nutritional Assessment (MNA) review of the literature--What does it tell us? *J Nutr Health Aging* 2006;10(6):466-85; discussion 485-7.

34 Kaiser MJ, Bauer JM, Ramsch C, et al. Validation of the Mini Nutritional Assessment short-form (MNA-SF): a practical tool for identification of nutritional status. *J Nutr Health Aging* 2009;13(9):782-8.

35 Kohlbacher F. The use of qualitative content analysis in case study research. *Forum: Qual Soc Res* 2006; doi:10.17169/fqs-7.1.75.

36 Witzel A. The problem-centered interview. *Forum: Qual Soc Res* 2000; doi:10.17169/fqs-1.1.1132.

37 Kleina T, Horn A, Suhr R, et al. [Current status of medical care for nursing home residents in Germany - results of an empirical study]. *Gesundheitswesen* 2017;79(5):382-87.

38 Schmiemann G, Herget-Rosenthal S, Hoffmann F. [Medical services for nursing home residents : results of the study on inappropriate medication in patients with renal insufficiency in nursing homes]. *Z Gerontol Geriatr* 2016;49(8):727-33.

39 Pittrow D, Krappweis J, Rentsch A, et al. Pattern of prescriptions issued by nursing home-based physicians versus office-based physicians for frail elderly patients in German nursing homes. *Pharmacoepidemiol Drug Saf* 2003;12(7):595-9.

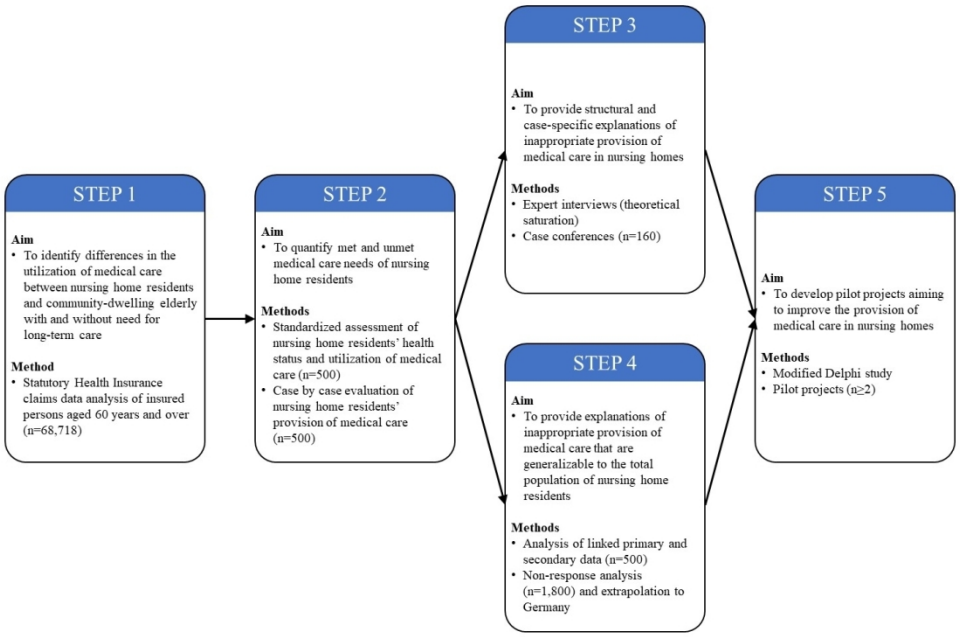

Figure 1 Conceptual framework of the mixed-methods study

128x96mm (300 x 300 DPI)