Introduction

Dementia is one of the key challenges for aging societies all across the world. There is no doubt that research plays an important part in encountering the key question of early diagnosis, treatment, and appropriate care for the increasing number of patients as well as effective support for caregivers. Successful efforts in recent years have caused increased funding and establishment of new structures for coordinated research.

In Germany, the German Center for Neurodegenerative Diseases (DZNE) was founded in 2009 with the mission to coordinate existing expertise at 8 sites covering the entire spectrum from basic research to development of novel approaches for patient care. On the 5th and 6th of September of 2011, the DZNE had invited to an international workshop on 'Dementia care research – scientific evidence, current issues and future perspectives' in Greifswald, Germany. Experts from Germany, Europe and abroad met in the historic city of Greifswald. They spend two days presenting their work, discussing their ideas and developping visions for the near future. It was an exceptional experience to gather and to see that all participants were facing similar problems in their country, supported each other and created an atmosphere of effective exchange. Each country has advanced differently towards finding solutions, and it was apparent that there is no universal 'best way' to proceed. There is not THE typical person with dementia, nor THE typical treatment or care. There is neither THE research question nor THE health care system that we should look for. Innovative approaches need to consider demographic, legal and infrastructural contexts in various countries to be successful. However, they should be based on solid science.

This book summarizes the presentations given and the research questions discussed at the meeting. It should cover a variety and we have neither restricted the scope of the chapters nor edited the articles beyond the layout. We feel it is important to illustrate the diversity and complexity of dementia care research. There is one common goal of all the authors, and that is to pursue research for the improvement of the health and situation of the individual person with dementia. This includes targeting the relative, the caregiver, the social environment, the health care system and the social system as a whole.

The order of the chapters follows the structure the workshop was divided into. The first chapters deal with comprehensive approaches to translational research and dementia care research in or across different countries (chapter I-VI). The following chapters (VII-IX) describe studies in the health care system in Germany, while the last three chapters (X-XII) focus on different aspects and methods in dementia care research.

In chapter I Hoffmann et al. provide a framework for translational research in health care epidemiology and describe pertinent examples of evidence-based development of concepts and their impact on implementation and research. Boustani et al. (chapter II) take a look on the rising question of early detection and how the health care system can manage that. Alder et al. (chapter III) focus on the effectiveness and pitfalls of practical implementation of measures for relatives and caregivers in the real world. Fox et al. (chapter IV) describe the UK perspective on collaborative care and his colleagues Maidment et al. (chapter V) focus on the specific topic of medication. Meyer et al. (chapter VI) illustrate the international complexity and diversity of dementia care by pointing out results of a European wide study that clearly demonstrates existing demands and challenges to international research as well as limitations that all dementia care research must have on the national level. Thyrian et al. (chapter VII) and Vollmer et al. (chapter VIII) describe single German studies to improve health care for persons with dementia while Dreier et al. (chapter IX) address tasks and demands in the qualification of professional care providers. Bartholomeyczik et al. (chapter X) put a spotlight on new research structures in Germany. Von Kutzleben (chapter XI) presents results about research on self-reports of people with dementia and points out their relevance for a better understanding of dementia. Finally, Riesner (chapter XII) describes the adaptation of an international instrument to the German situation implying how national research can benefit from international evidence.

We would like to thank all contributors to this book. Due to its societal relevance and its dealing with an urgent matter, dementia care research is a sometimes stressfull and time consuming endeavour. Presenting a book of this scope therefore needs the help and time from many people. We would also like to thank all people who helped organising that workshop and made this book possible. Special thanks to Christiane Schnick, Kerstin Albuerne, Jana Hubert, Paula Winter, Katja Luebke and the staff at the DZNE in Bonn.

Greifswald, in February 2012

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Chapter I

Innovative models of medical care in rural areas – a case for translational research

Wolfgang Hoffmann, Jochen René Thyrian, Neeltje van den Berg

Summary

Demographic developments, especially the aging of the baby boomer generation and rising life expectancy, jointly contribute to an increase in the proportion of elderly in Germany's total population. One consequence of increasing age-related morbidity and decreasing mobility is an increasing demand for physician house calls. The AGnES concept (GP-supporting, community-based, e-health-assisted systemic intervention) described in this chapter is based on the delegation of GP-home visits to qualified GP practice assistants. It has been shown that specially qualified practice assistants can provide medical services of high quality. Furthermore, the example of the AGnES concept describes a successful translation of positively evaluated concepts into routine health care. Experience gained during the translation of the AGnES project confirm that the success of translation following a research study can be increased by considering translation while planning the research study. The process of translating evidence from basic research to regular health care is described and depicted in this chapter. Moreover, dementia is one focus area of morbidity that is affected by the demographic change in the population. The provision of appropriate medical and nursing care is a major challenge for the health care system in Germany, but epidemiological health care research has provided valuable results so far. However, population-based research targeting the complex situation through a comprehensive, integrated approach still needs to be conducted. Previous trials studying various collaborative care approaches for dementia in the primary care setting have demonstrated potential. However, these studies were all conducted in different health care systems outside of Germany, and it is unclear whether these results extend to the specific context of the German health system. Therefore, the DelpHi trial (Dementia: life- and person-centred help in MV) was one of the first trials in Germany to be initiated and is described in more detail in this chapter. Regarding the analysis of the effectiveness

and health economic efficiency of the DelpHi intervention, this comprehensive approach allows for an evaluation of the factors supporting and inhibiting the translation of successful innovative care models. The experiences of AGnES and DelpHi will be used to validate and further specify translational health services research and will hopefully add to the knowledge, evidence and experience needed for Germany's health care system to tackle the challenges of dementia.

Assessing the Need for Innovative Models

Demographic developments, especially aging of the baby boomer generations and rising life expectancy, jointly contribute to an increase in the proportion of elderly in Germany's total population. The proportion of persons aged 80 years or older will grow to 7.4% by 2020 (in 2005: 4.5% *(1)*). In the rural areas of the new German federal states, this trend is further enforced by the emigration of young persons. Based on current estimates for 2020, the proportion of persons aged 80 years or older will increase to 8.2% in Brandenburg *(2)*, 8.6% in Mecklenburg-Western Pomerania *(3)*, and 9.6% in Saxony *(4)*. This change in the age structure of the population has a considerable impact on the numbers of patients, especially with respect to age-associated chronic diseases and multimorbidity *(5, 6)*.

The age structure of general practitioners (GPs) in private practice shows a similar trend to that of the general population. In 2011, about one-third of private practice GPs entered retirement age *(7)*. For example, in Mecklenburg-Western Pomerania, approximately 40% of the primary practice positions will need to be replaced by 2020, even when assuming a retirement age of 68 rather than 65 years (own data). Regarding the increased demands for primary medical care as a consequence of the aging population as well as considerable problems finding successors for retired GPs in rural regions, relevant deficits in outpatient primary medical care are imminent. To maintain good quality medical care provision in such regions, the development of innovative concepts for the medical implementation of elaborated procedures to translate positively evaluated concepts into routine care are required. In the following sections, we will present an already translated project (AGnES) and discuss the experience gained with respect to a new concept (DelpHi), a specification and extension of the AGnES project.

Delegation of GP Home Visits: The AGnES Study

One consequence of increasing age-related morbidity and decreasing mobility is an increasing demand for physician house calls *(1)*. The AGnES concept (GP-supporting, community-based, e-health-assisted systemic intervention) is based on the delegation of GP home visits to qualified GP practice assistants. In regions with an imminent or already existing shortage of primary medical

care, AGnES-practice assistants can support individual GPs as well as small groups of GPs by providing care for a larger number of patients and/or a larger area *(8)*.

Patients included in the AGnES study were real-life patients selected by their attending GPs. A total of 11,228 home visits were conducted, mostly involving 1,430 multimorbid patients with a mean age of 78.6 years. Eighty-nine per cent of the patients had limited mobility or were immobile.

In a comprehensive evaluation, most participating GPs (38 of 42) reported that the AGnES concept had a positive effect on their workload. The GPs stated that the quality of care within the AGnES-concept was equal to the quality of his or her usual care for more than 92% of the participating patients. Thirty-seven of 42 GPs found that the AGnES-practice assistants had a positive influence on patients' compliance. The acceptance of the AGnES concept among the patients was very good, and 94.3% of the patients had a positive opinion about delegating home visits to a qualified AGnES-practice assistant *(2)*.

The AGnES model has shown that specially qualified practice assistants can, upon delegation by a GP, provide medical services of high quality. Furthermore, qualification as an AGnES-practice assistant is judged as an attractive professional perspective for nurses and medical assistants. Further details about the design, methods and results of the AGnES project are described elsewhere *(2-4)*.

Based on a legal amendment in March 2008, the AGnES model was introduced into the regular health care system on the federal level, effective from 1 April 2009. The comments on this amendment of the Act refer explicitly to the positive results of the AGnES concept as a model for the delegation of medical services (German Federal Council publication 718/1/07) to GPs in regions with an imminent shortage of medical care, with reimbursement from the statutory health insurances for their delegated home visits. A prerequisite for reimbursement is the sufficient qualification of the AGnES-practice assistant.

Several aspects of the translation process were of central relevance:

- The necessity of developing a concept of delegation was, after broad and sometimes controversial discussions between different health care professions and institutions, acknowledged by all relevant actors;
- Active involvement and support of health care politicians on different levels (communal, federal state, and national);
- The implementation of the projects in real-life settings similar to regular care;
- A comprehensive scientific evaluation, including patient-related, provider-related, and health economics aspects;
- The development of a defined modular curriculum for the qualification of AGnES-practice assistants;
- The support of the project by a lawyer specialising in medical liability law to check each delegated task for compatibility with current pertinent legislation;

– Continued information and involvement of the research staff as well as of the participating AGnES-practice assistants, GPs, patients, and larger public (including interviews with newspapers, radio, and television; documentary films and public talks);
– Active involvement and support of the research staff in the translation process through the provision of data and analyses (health policy, legislation, and negotiations of reimbursement conditions).

Translation of Health Care Concepts in Routine Health Care

Although the example of the AGnES concept describes a successful translation, the translation of positively evaluated concepts into routine health care is usually a challenge. One reason for this challenge is the limited communication between both medical professionals and health care providers and medical professionals and health care researchers *(5)*. As a result, evidence from research on innovations is often not accepted by practitioners and, consequently, not implemented ('translated') in routine medical practice.

Another possible limiting factor for translating research findings into health care practice in Germany is that all sectors of the health care system (e.g., outpatient care, hospital care, and rehabilitation care) have separate reimbursement structures, rendering development, implementation, and translation of cross-sectoral health care concepts almost impossible. Recent legislation allows for agreements between statutory health insurance funds and health care providers to introduce health care concepts into regular health care across different sectors of care (agreement on integrated care, Integrierte Versorgung: § 140 a-d SGB V). However, health insurance funds have no obligation to grant or continue an agreement and do not have to expand concepts to further regions or include other health care providers or patient groups, irrespective of the established success of a concept in terms of effectiveness and economic efficiency.

Despite the sectoral reimbursement system and its specific challenges, the German Advisory Council on the Assessment of Developments in the Health Care System (Sachverständigenrat zur Begutachtung der Entwicklung im Gesundheitswesen) emphasises the priority of cross-sectoral health care concepts and the operational integration of various professions in health care to meet the current challenges caused by demographic processes (Sachverständigenrat, 2009).

The experience gained during the translation of the AGnES project confirms that the success of translation following a research study can be increased by considering translation during the planning of the research study. To increase acceptance of the AgnES project, all representatives from all regular health care professions should be integrated into the process of developing relevant research questions and hypotheses and determining relevant patient groups and diseases. Other important aspects include the support of health care politicians

(conceptual and financial) and transparency towards the actors in the health care system, the media and the public.

The process of the translation of evidence from basic research to regular health care is depicted in Figure 1. According to this model, research starts as analytic research, driven by the results of clinical studies or an analysis of unmet needs. Translation may consist of several steps and ends with the successful implementation of a new concept in regular health care. After translation, the innovative health care concept should be monitored prospectively in routine practice, and both patient-related and economic factors should be evaluated. Ideally, both the experiences gained during the different steps of translation, as well as the results of monitoring the concept following its implementation in routine health care, should be used to define new research questions and inform future study designs, selection of settings, and concepts for translation.

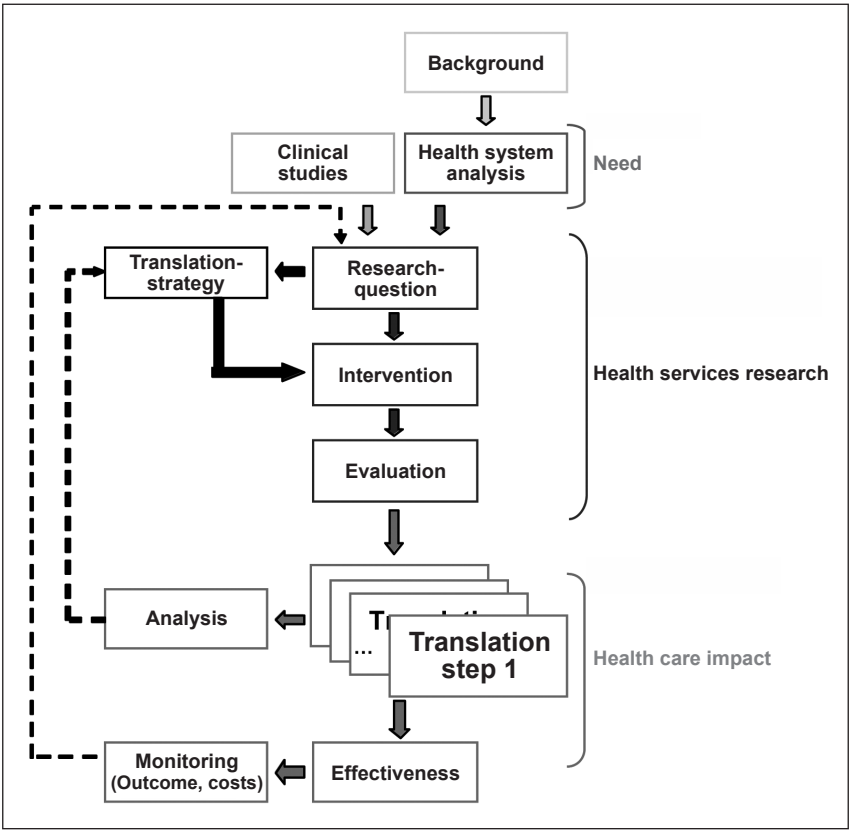

Figure 1: The process of translation

Focus on Dementia, Analysis of Needs

Dementia is one focus area of morbidity that is associated with the demographic change in the population. The provision of appropriate medical and nursing care is a major challenge for Germany's health care system. According to current estimates, the global prevalence of dementia in the older age group is estimated to be 24 million in 2001, and the number of patients is predicted to double every 20 years such that by 2040, more than 80 million people worldwide will be affected. The estimated annual incidence and prevalence of Alzheimer's disease, the most frequent cause of dementia in the elderly, rises dramatically with age. Incidence rates range from approximately 0.4% in people aged 65 to 69 years to nearly 10% in people over age 90. Corresponding prevalence rates range from approximately 2% in people aged 65 to 69 years to more than 25% in the 90 years or older age group *(6)*. In Germany, these estimates correspond to a total of approximately 1.1 million patients and 250,000 new cases each year *(7)*. Analyses and prognoses for the federal state of Mecklenburg Western Pomerania reveal that the number of people with dementia will increase by approximately 80-91% between 2005 and 2030 *(8)*.

A current review describes the research and care related to dementia in Germany *(9)*. The review emphasises an urgent need for population-based research to meet the challenge of early identification of dementia. Widespread availability of early diagnostic testing and early initiation of therapy requires qualified health care professionals. A further challenge is multimorbidity, which interferes with treatments for dementia because therapy for other diseases and concomitant diseases could potentially aggravate the clinical course of dementia. Multi-professional approaches need to be integrated into the existing health care system to create a comprehensive treatment and management approach for persons with dementia and, consequently, address the situation of the caregiver.

Epidemiological health care research has provided valuable results for each of these needs. However, population-based research targeting this complex situation in a comprehensive, integrated approach still needs to be conducted.

The Delphi-MV Trial, Research Hypothesis

Background and objective

Previous trials studying various collaborative care approaches for dementia in the primary care setting have demonstrated potential *(10-12)*. However, these studies were all conducted in different health care systems outside of Germany, and it is unclear whether these results extend to the specific context of the German health system.

The DelpHi trial (Dementia: life- and person-centred help in MV) is one of the first trials in Germany to examine this question.

The objective of this population-based intervention trial in the primary care setting is to test the efficacy and efficiency of a subsidiary support system for persons with dementia living at home on a population level. This subsidiary support system is initiated and coordinated by a Dementia Care Manager (DCM), a nurse with dementia-specific qualifications. The main goals are

1. to improve the quality of life of the patient and caregiver,
2. to reduce caregiver burden,
3. to reduce the behavioural and psychological symptoms of dementia and
4. to optimise pharmacotherapy, including anti-dementia drugs, to prevent drug related problems.

Designs and Methods

DelpHi is a general physician (GP) based cluster-randomised controlled prospective intervention trial of dementia patients 70 years of age or older, who live at home with their caregivers. The trial lasts for 48 months and is comprised of a 24-month baseline assessment, an overlapping 24-month intervention period and an annual follow-up assessment. All persons identified by a participating GP as eligible for the study will be screened for cognitive impairment. People meeting the inclusion criteria will be informed in detail about the DelpHi trial by the GP and will be asked to participate. Inclusion criteria include the following: Aged 70 years and older, living at home, screened positive for dementia (score of 8 or lower) in the DemTect *(13, 14)*, and absence of all exclusion criteria. Exclusion criteria include the following: Persons with insufficient command of the German language, and persons with medical conditions not allowing testing (e.g., hearing impairment, visual impairment).

Eligible persons are asked to provide written informed consent to be included in the DelpHi-trial. As cognitive decline is a core feature of dementia, the GP has to evaluate the ability of each patient to provide informed consent. If the screened person is unable to provide informed consent, his or her caregiver will be asked to provide consent.

Participants and their caregivers will be cluster-randomised on the GP-practice level into one of two groups:

1. Implementation of a Dementia Care Manager, who is specifically trained in dementia care management (DCM, intervention group) and
2. care as usual (control group).

All participants will be contacted by the study staff to arrange a baseline assessment, usually at the person's home.

In the intervention group, the DCM will maintain a minimum of monthly contact with the participant over a period of 12 months following the initial assessment. More frequent contact is possible within the first 6 months of the trial, depending on the individual participant's needs.

Participants randomised into the control group will receive no specific intervention. These participants will be visited at home for a comprehensive base-

line assessment but will otherwise continue to receive care as usual (usual care group).

Intervention

Participants randomised to the intervention group will receive integrative and collaborative care involving different professions where needed, coordinated by a DCM. Their GP receives comprehensive reports and is closely involved in the optimisation of the treatment.

The overall goal of the intervention is to optimise access to and provision of health care services for people with dementia and their caregiver. The DelpHi intervention is complex, multidimensional and multimodal and will be individually tailored to each participant and his or her ambient situation, social context and individual resources. The starting point is a detailed and systematic computer-assisted assessment of the person with dementia and the caregiver, conducted by the DCM. Based on this, pore-defined algorithms suggest specific actions and treatment. The intervention can be conceptualised as three tiers:

1. Treatment and care management,
2. medication management, and
3. caregiver support.

The DCM will address 8 action fields (medical diagnostics and treatment, nursing care and treatment, non-medical therapies, social inclusion/social support, legal counselling, technical assistance/telemedicine, pharmacological treatment and care, and caregiver support and education).

A more detailed description of the concept of a DCM, including the required qualifications and aspects of implementation, has been given elsewhere *(15)*.

Evaluation

The primary outcome in this complex intervention trial is optimisation of health care for patients with dementia and their caregivers. This is a multidimensional outcome with a focus on four dimensions:

1. quality of life,
2. caregiver burden,
3. behavioural and psychological symptoms of dementia and
4. pharmacotherapy with an anti-dementia drug and prevention/alleviation of potentially inappropriate medication.

We expect to find statistically significant differences between the intervention and control groups in all primary outcome measures. Specifically, we expect that persons with dementia and their caregivers in the intervention group will

have a higher quality of life than those in the control group. We also expect that there will be less caregiver burden and less behavioural and psychological symptoms of dementia in persons in the intervention group. The medical treatment with anti-dementia drugs will be more frequent, and potentially inappropriate medication will be less frequent in the intervention compared with the control group. It is likely that these effects will depend on various variables including age, marital status, co-morbidity, severity of dementia, cognitive status, and activities of daily living at baseline.

Translation

Already in the early stage of planning the study, we considered important aspects of translation in case of a positive evaluation. As early as possible, all actors in the field of dementia care within the study area were integrated and informed. A kick-off symposium was organised and physicians, nurses, social workers, inpatient services, outpatient services, health insurance representatives, politicians and other stakeholders were invited. Much effort was placed into achieving politicians' and stakeholders' support for the AGnES concept. Critical feedback from a variety of different professions was integrated into the intervention planning, and an internal scientific advisory board was established to provide feedback and advice on a qualitatively high level. The discussions are ongoing and inform the procedure of the study so that it more closely reflects reality.

The DelpHi researchers are part of several networks and advisory boards concerned with the development of good dementia care in the federal state of MV. This involvement ensures that the relevant stakeholders are informed and that all actors are up to date with the concept. In case of a positive evaluation, this will increase the likelihood that the intervention, or at least parts of it, will be implemented in routine care.

Resumé

Previous work and current efforts highlight the region in Mecklenburg-Western Pomerania as a model region for translational health services research. The experiences gained in the course of the successful translation of the AGnEs concept were condensed into a model of translation in health services research, covering the entire continuum of basic research to regular health care. The DelpHi-MV study concept includes the elements of the translation model on all levels. In terms of the analysis of the effectiveness and health economic efficiency of the DelpHi intervention, this comprehensive approach allows for an evaluation of the factors supporting and inhibiting the transfer of successful innovative care models. The experiences of AGnES and DelpHi will be used to validate and further specify translational health services research and will hope-

fully add to the knowledge, evidence and experience needed for Germany's health care system to tackle the challenges of dementia.

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Chapter II

Forecasting the Future Impact of Early Detection and Management Program for Alzheimer Disease

Malaz Boustani, Rabia Jermoumi

Summary

Alzheimer's disease (AD) is the most common cause of age-related dementia, an area of great unmet medical need that is also associated with an enormous socioeconomic healthcare burden. In this article, we will evaluate the costs and benefits of early detection and management for Alzheimer's disease in primary care practice over the period 2010-2050. Is cognitive screening to identify patients at early stages socially desirable? Do early diagnosis and treatment of AD offer substantial financial benefits to Medicaid and Medicare? Our analysis answers these questions by predicting the net benefits of early diagnosis and treatment relative to the usual care situation.

To demonstrate the economic viability of early screening and diagnosis for Alzheimer's disease in primary care setting we used decision analysis to compare the incremental costs and benefits of two alternative programs:

1. *situation without early detection,*
2. *collaborative care model, called PREVENT which includes screening, diagnosis, and management processes for dementia patients receiving care within a primary care practice.*

Conclusion

In conclusion implementing an early detection and management program (PREVENT) for AD in primary care is cost effective for the American Society, at varying rates of effectiveness and in constant dollars. This model estimates that direct annual savings are 4 billion dollars in 2010, 22 billion dollars in 2025, and 29 billion dollars in 2050.

The main key results of this study are:

– Early diagnosis and treatment of Alzheimer's may result in cost savings.
– Reducing behavioral and psychological issues are the primary reasons for cost savings.

Introduction

Alzheimer's disease (AD) is the most common cause of age-related dementia, an area of great unmet medical need that is also associated with an enormous socioeconomic healthcare burden. Currently, AD is affecting more than 4 million individuals in the United States and more than 16 million individuals worldwide *(1, 2)*. Increasing age is the greatest risk factor for AD, and the U.S. population is aging rapidly; as such, by 2050 the number of individuals with Alzheimer's disease is expected to increase to 14 million in the United States alone *(1, 2)*. The incidence of dementia doubles approximately every 5 years in individuals between the ages of 65 and 95 and by some estimates may reach nearly 50% by age 85 *(4)*. The fourth leading cause of death in the United States – after heart disease, cancer, and stroke – AD accounts for nearly 100,000 deaths annually and carries an annual cost of $ 110 billions.

Yet, despite the increasing prevalence of AD, the enormous emotional and financial costs, and the emerging treatments for the disease, AD continues to be under diagnosed. By some estimates, between 40-80% of persons with dementia are undiagnosed in primary care settings, and, as a result, are untreated *(3-8)*. Often within the primary care setting clinicians and caregivers fail to recognize and respond to dementia symptoms. This lack of response is exacerbated by limited resources such as time and cost, as well as clinicians' negative attitudes toward the value of detecting and managing dementia *(6, 7)*.

Clinicians are encouraged to be alert to the possibility that patients may have symptoms of dementia. Such awareness would be expected to reduce the time lag reported by many caregivers and families between the first notification of patient problems to clinicians and activation of diagnosis, treatment, and support services *(5)*. Routine screening is one strategy that has been proposed to help combat under diagnosis of AD.

In this article, we will evaluate the costs and benefits of early detection and management for Alzheimer's disease in primary care practice over the period 2010-2050. Is cognitive screening to identify patients at early stages socially desirable? Do early diagnosis and treatment of AD offer substantial financial benefits to Medicaid and Medicare? Our analysis answers these questions by predicting the net benefits of early detection and treatment relative to the usual care situation.

Methods and Materials

Modeling Strategy

To demonstrate the economic viability of early detection and management for Alzheimer's disease in primary care setting, we developed a model to evaluate the net benefits of early detection of AD compared to a situation without screening. The analyses proceed in three steps.

First, the direct costs of AD over the period 2010-2050 were estimated using a gross costing method in which we totaled utilization of important types of care and then multiply this utilization by a unit cost for each type of care. A detailed summary of the estimation of direct costs will be explained in detail in the next section and is summarized here.

Second, the cost of identifying an AD patient is estimated using the results of a screening and diagnostic regime reported by Boustani et al. *(3)*. This analysis incorporates the false-positive rate as well as empirical rates of voluntary participation at various stages of the diagnostic process. The predictions of the benefits of early intervention and the predicted costs of the diagnostic programs permit an estimate of the overall net benefits and financial savings that would result from the implementation of an early stage diagnostic and treatment program. This model characterizes costs and benefits based on: disease prevalence, expected test accuracies, and applies estimated costs associated with Alzheimer's diagnosis and treatment along with the benefits of biopsychosocial therapies.

Third, projections of potential net benefits over the period 2010-2050 are estimated. These projections contrast the costs of Alzheimer's care from 2010 through 2050 using the current disease detection methods versus the potential savings gained by beginning to increase the rate of implementing early detection tests in 2010 and expanding utilization through 2050.

We used decision analysis to compare the incremental costs and benefits of 2 alternative programs: 1) situation without screening, 2) collaborative care model, called PREVENT which includes screening, diagnosis, and management processes for dementia patients receiving care within a primary care practice. In this case, the screening method used includes the 6-item screener.

This instrument consists of 3-item query of temporal orientation and a 1-item recall of 3 words. Any patient who made at least 1 mistake was asked to complete the clinical diagnosis. Those who made no errors on this instrument were excluded from further evaluation.

Base Case Assumptions

Determination of Projected Prevalence

Demographic projections between 2010 and 2050 were obtained from the U.S. Census Bureau *(1)*. The prevalence of AD for patients over the age of 65 is 7.6% *(2)*. Based on this figure, if no scientific advances alter the incidence and progression of AD, around 7 million people in the United States will be suffering from the illness by the year 2050 *(2, 4)*.

A decision-analytic model was developed based on information from the literature. Without the implementation of screening, 80% of persons over age 65 visit their primary care physician. Between those who visit their PCP, only

27% patients with AD are recognized and 8% of them accept to undergo clinical treatment *(2, 3)*.

Unrecognized AD increases the cost and burden on society because of the delayed diagnosis in the mild stage when it is probably most treatable. This cost consists of the costs of diagnosis, functional impairment and accidents, poor control of medical comorbidities, and caregiver burden. Increasing medication costs through the use of cognitive enhancers, psychotropics, and antidepressants are another reason AD is a costly disease. In the later stages, the main costs are related to institutionalization and hospitalization.

An economic study of donepezil examined the medical costs of 70 AD patients for one year before and one year after starting this agent. Although medication costs increased significantly, overall costs decreased dramatically. In this study, the most cost effective use was in those patients who stayed on the medication for two years or more. Starting the medication early, when the patient has mild illness results in the biggest cost saving. Starting medications once patients have progressed to a moderate or severe stage usually does not have a significant impact. Two other economic studies have shown that persistent donepezil use results in reductions in overall costs *(9, 10)*.

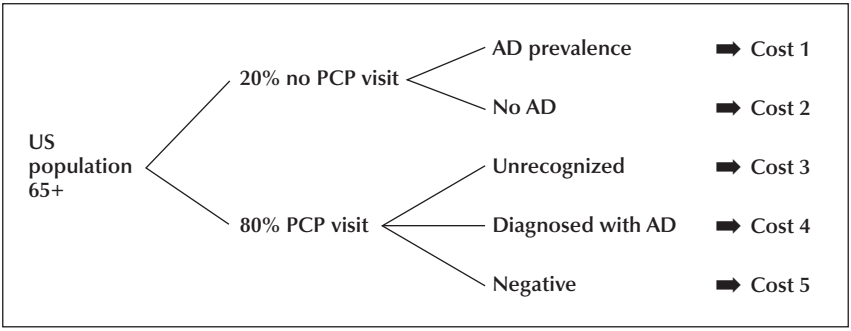

Figure 1: Usual care model for patients with Alzheimer Disease

A decision-analytic model was developed using the results of a screening and diagnostic regime reported by Boustani et al. The following key probabilities were used: 80% of total population over the age of 65 visit their primary care physician for dementia; only 40% are actually screened and 50% of patients who screened positive refuse to undergo the diagnostic assessment. Between patients who screened positive and accept full diagnosis, 47% are diagnosed with dementia, 33% have Cognitive Impairment – No Dementia (CIND) and 20% are normal. Only 7% of recognized patients with AD will accept to undergo clinical treatment. The above probabilities are illustrated in the decision-tree model in Figure 2.

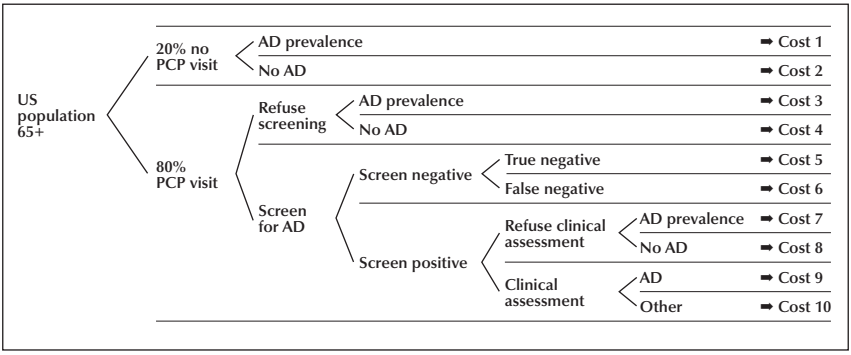

Figure 2: Screening and diagnosis model for patients with Alzheimer Disease

Determination of PREVENT Program Cost

The analyses incorporate the costs of screening test itself that ranges between $ 40 and $ 210. Those patients who show positive on the screening test and accept to undergo a clinical assessment would then be expected to be referred for a complete clinical workup for Alzheimer's disease. This workup includes medical procedures which are intended to exclude other causes of dementia as well as neuropsychological tests to confirm, or reject the disease. This cost amounts a total of $ 1,142 per diagnosis per patient.

Once patients are confirmed to have Alzheimer's disease, they will undergo treatment under a collaborative care model, called PREVENT which has successfully resulted in significant improvement in the quality of care and life of dementia patients and their caregivers within a primary care environment and resulted in reduction of NPI score by 5.6 points which may save costs. From a study by Murman and colleagues, prevention of a 1-point decline in the NPI score would save between $ 247 and $ 409 per year in total direct costs of care based upon year 2001 US dollars *(9, 13)*. In addition to both direct costs (e.g., physician visits, medications, hospital care, paid home care, and nursing home services) and indirect costs (unpaid care giving), PREVENT will cost an additional $ 1,000 per patient *(17)*.

A final component considered here is the cost associated with a false-positive test result. In the model we pay close attention to the often unexpected costs of false screening results and in particular the costs of unnecessary follow-up and treatment which might result from false positives. The potential for delayed identification and treatment of Alzheimer's disease resulting from false negatives is also evaluated. If patients screened false, a secondary assessment is made to confirm or refute the results of the screening. If the clinical follow-up shows a 'true negative' no other costs will be incurred. But other pathologic conditions may also be identified during clinical testing that otherwise might have gone undiagnosed.