

COGNITIVE AGEING

Lecture 2

Cognitive ageing



Research on cognitive aging is concerned with the basic processes of learning and memory as well as with the complex higher order processes of language and intellectual competence or executive functioning.
Research - longitudinal follow-up of samples that were first assessed in childhood or adolescence or carefully stratified samples from defined populations, first assessed at a particular life stage, whether in early adulthood, or in early old age.
Two major methodological issues in cognitive aging research are whether one should employ age-comparative (between participants) or age-change (within participants) designs and how investigators should address the role of response speed.

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Age-comparative vs age-change designs

Age-comparative studies - contrast a group of young adults (typically college students) with convenience samples of community-dwelling older adults in their sixties and seventies.

However, it is often unreasonable to assume that the two age groups can be adequately matched for other status variables that might provide rival explanations for any observed age difference on the dependent variable of interest.

This internal validity threat creates particular problems for identifying the mechanisms that may be implicated in age-related decline from young adulthood into old age.

Age-comparative designs are also inadequate in explaining individual differences in intra-individual age changes.

The latter can only be investigated by means of longitudinal paradigms (Schaie, 1996). The internal validity of longitudinal studies can also be impaired by failure to attend to issues such as participant attrition, impact of history, and reactivity (practice) effects.

The role of response speed

Changes in the central nervous system are the primary common cause for the observed age-related declines in cognitive performance.

An unbiased marker of such change might be simple reaction time.

If some measure/s of reaction time or perceptual speed is partialled out of the relation between measures of a cognitive process and chronological age (Madden, 2001; Salthouse, 1999) = reduction in age differences .

The average increase in many measures of reaction time increases by a factor of approximately 1.6 from the early twenties to the late sixties (Cerella, 1990).

However, it is not clear whether the observed average increase in reaction time is of significance in many or most tasks of daily living.

It is critical therefore in cognitive aging studies to disaggregate changes in speed of response from changes in accuracy of performance (Willis, 1996; Willis & Schaie, 1986).

The role of individual differences

Although findings on age differences or age changes suggest virtually linear declines for many cognitive functions, it is difficult to reproduce linear decline patterns at the individual level.

More common are stair-step patterns that reflect decline occurring in response to an unfavorable event (perhaps the loss of a spouse) followed by a period of stability at a lower level, with further decline upon the occurrence of other unfavorable events (cf. Schaie, 1989).

Sensory -perceptual limitations

Vision



An important meta-issue is the question to what extent decline can be attributed to changes in peripheral sensory functions.

Anatomical changes

Pupil size declines (senile miosis), and the lens becomes more opaque.

This loss of transparency - pronounced at short wavelength (e.g. for blue light) = less retinal illumination (half of 65yr-olds – cataract).

Age-related photoreceptor and ganglion cell loss.

Macular degeneration and glaucoma also impair vision in significant numbers of older persons.

Indicator of how well fine spatial detail can be recognized (near and far acuity).

Visual acuity

By age 40 difficulty focusing upon printed text that is closer than a foot and by age 60 it becomes difficult to focus upon objects located within 3 feet.

Decreases in both near and far acuity until around age 70 are usually due to refractive errors that can be corrected using glasses or contact lenses.

However, visual difficulties that remain increase sharply in the late seventies and eighties - attributable to greater prevalence of diseases of the retina.

Age-related deficits in visual acuity become more severe when there is low luminance or low contrast stimuli.

Sensory -perceptual limitations

Dark adaptation and glare

Changing level of illumination results in a significant reduction in visual sensitivity.

There is some age-related slowing in the rate of dark adaptation. The rate of loss is greater for short wavelength light (i.e., blue, green) due to the age-related "yellowing" of the lens.

Colour Vision

Difficulties in colour vision are greater under low light conditions and age differences in blue-green colour discrimination can be reduced at high levels of illumination.

Colour constancy mechanisms remain relatively intact in the elderly possibly minimizing performance decrements on real-world tasks.

Age-related decrements in motion sensitivity and accuracy of speed perception. These age-related losses may be mediated by neural rather than optical mechanisms. There are also age differences in thresholds for the detection of motion in the ability to judge the apparent speed of automobiles

Motion perception

Memory

Older persons are currently thought to be at a disadvantage in retrieving information from memory when the information to be retrieved is complex and when there are few cues or other environmental support.

Age differences are far greater

- in recall than in recognition of information
- when a task involves effortful processing than when automatic processing is involved
- for explicit than implicit memory.

Reduction in Working memory

Memory deficits - nonverbal tasks such as memory for spatial location, memory for faces, and for actions and activities.

Greater difficulty in integrating the context of information they are trying to remember.

Studies of prospective memory suggest that older people do well in remembering simple and event-based tasks, but are at a disadvantage when tasks become complex or are time-based.

Attentional processes are implicated whenever individuals engage in multi-tasking or time-sharing activities.

Attention

Deficits in inhibition, reading comprehension and the ability to attend simultaneously to multiple tasks (e.g., Schieber, 2003; West, 1999;).

Differences in executive functioning (Kramer, Larish, Weber, & Bardell, 1999).

Attention deficits have not been found in episodic memory (Nyberg, Nilsson, Olofson, & Bäckman, 1997).

Language

Age related differences in language behaviour are closely related to the processes of encoding and retrieving verbal materials

Greater age differences in textual tasks that involve recent connections than in those that involve recollection of older connections.

Language production is adversely affected in older persons under intense time pressure.

Word-finding difficulty (tip-of-the-tongue) - more likely with infrequently used words.

Deficits in story recall - in connection formation rather than in specific communication ability.

Older persons tend to benefit from textual material that provides priming of associations because it contains learned semantically linked information (McKay & Abrams, 1996).

Age differences - planning what one intends to say and how to say it during language production (hesitate, false starts, repetitions).

Age Changes in Intellectual Competence

Longitudinal studies - the adult life course of mental abilities is not uniform.

The fluid abilities (thought to be innate) tend to peak in early midlife and begin to decline by the early sixties.

Crystallized abilities (abilities acquired in a given cultural context -particularly verbal abilities) do not usually peak until the fifties and begin to decline in the seventies and often show minimal decline in the eighties (Schaie, 1996a).

But in advanced old age increasing convergence and steeper decline for both aspects of intellectual competence may occur, probably caused by the increasing decline of sensory and central nervous system functions (Baltes & Lindenberger, 1997; Baltes & Mayer, 1999).

Cross-sectional snap-shots - may yield different ability profiles. For example, there has been a positive linear cohort trend for inductive reasoning, the basic component of most problem solving tasks, while there has been a negative trend in numeric skills.

Because most tasks of daily living represent complex combinations of basic cognitive processes, many individuals can maintain their abilities above the minimally necessary threshold level for independent functioning by engaging in compensatory processes that may often be quite complex (Baltes, Staudinger, & Lindenberger, 1999).

Individual differences - depend on complex patterns of individual life experience.

Most healthy community-dwelling persons are able to maintain a high level of function until advanced old age.

Decision-Making and Problem Solving

Antecedents of successful decision-making in the elderly have been identified as good physical health, adequate levels of functioning on basic intellectual skills, tolerance for ambiguity, as well as beliefs about ways of knowing.

Decision making may also be affected by age-related processing styles.

Youthful styles - involves intensive data gathering to the presence of integrated knowledge bases that compensate for a lack of experience.

Make critical decisions with less information than young or middle-aged adults.

Task novelty = negative influence on effective problem solutions, as does task complexity and lack of task structure.

Importance - availability of declarative knowledge that is relevant to a particular decision.

Lessened tolerance of ambiguity in the elderly has been noted to affect medical decision making in that older persons act more quickly to reduce ambiguous situations (Leventhal, Leventhal, Schaefer & Easterling 1993)

The mature middle-aged style balances data gathering with the integration of accumulated experience.

The style of the old is to use acquired knowledge sometimes indiscriminately and inappropriately using heuristics that have worked well in the past (Sinnott. 1989)



Recap...



A video in collaboration between the Association of
American Medical Colleges and Khan Academy

Can Cognitive Aging be Slowed or Reversed?

A brief five-hour training program for persons over age 65 resulted in average training gains of about 1/2 SD on the abilities of Spatial Orientation and Inductive Reasoning.

Of those for whom significant decrement could be documented over a 14-year period, roughly 40% were returned to the level at which they had functioned when first studied.

The analyses of structural relationships among the ability measures prior to and after training, further allow the conclusion that training does not result in qualitative changes in ability structures, and is thus highly specific to the targeted abilities.

A seven-year follow-up further demonstrated that those subjects who showed significant decline at initial training do remain at substantial advantage over untrained comparison groups (Willis & Schaie, 1994).

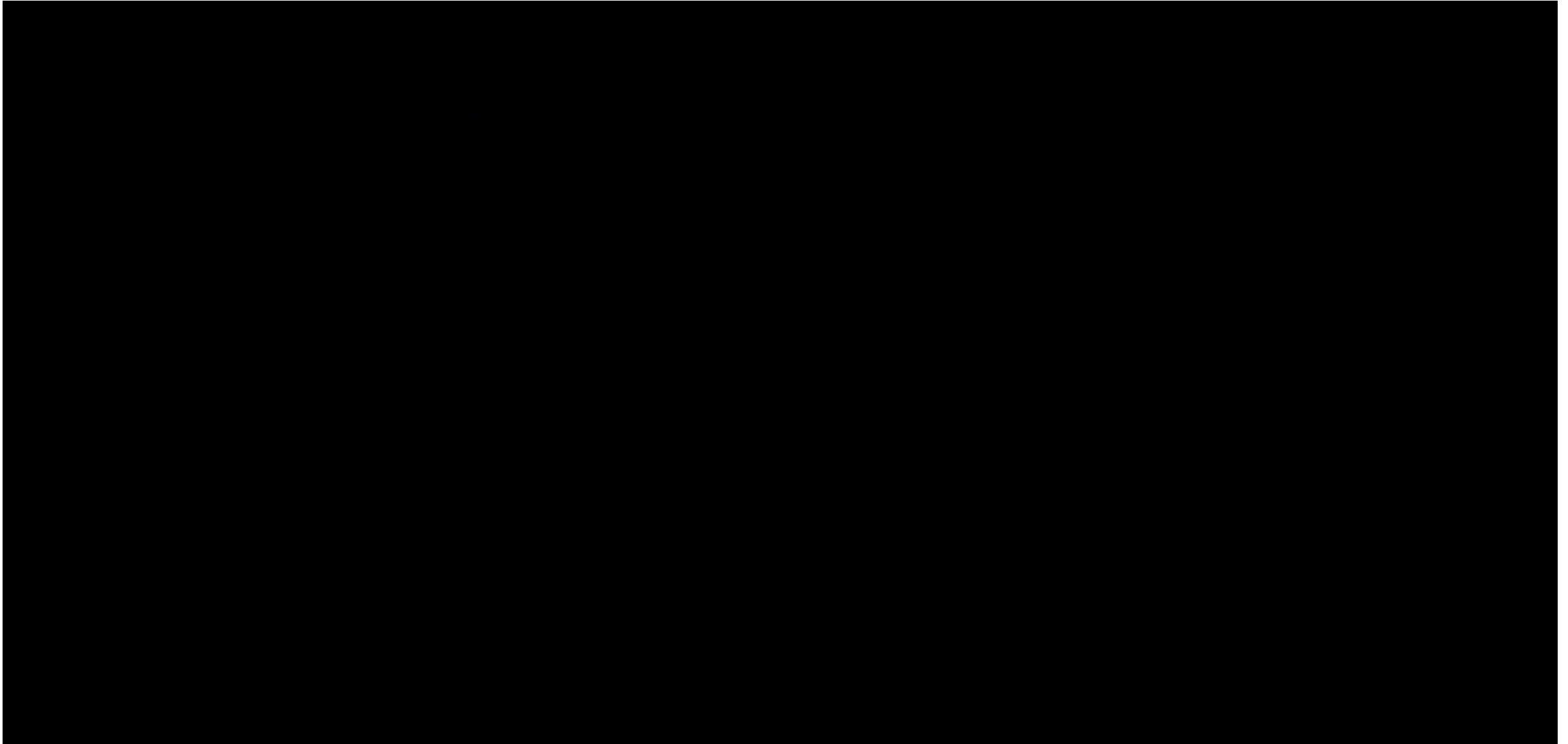
It should be noted, however, that while cognitive training may improve performance in the elderly and may function to reduce effects of age decrement, such training will also be effective in enhancing the performance of young adults such that age differences tend to remain robust (Baltes & Kliegl, 1992)

Findings from cognitive intervention studies suggest that cognitive decline in old age might be attributed to disuse rather than the deterioration of the physiological or neural substrates of cognitive behaviour.

Ageing research



Homework: please watch the video



BREAK

lecture 1.pdf

Dementia

Dementia defined (Cummings, 2004)

- A syndrome of acquired persistent intellectual impairments – deterioration in at least 3 of the following...
 - Memory
 - Language
 - Visuospatial skills
 - Personality or behaviour
 - Manipulation of acquired knowledge (executive function)



- No universally accepted definition...

symptoms



Forgetfulness



Language deterioration



Mood changes



Impaired judgement loss of initiative

- But routinely include memory impairment, decline in social or occupational function
progressive deterioration, incurability (APA, 2000)

What is Dementia?

850,000

people are estimated to be living with dementia in the UK.

1 in 3

people born in the UK this year will develop dementia in their lifetime.



24% of men and 35% of women born in 2015 will develop dementia in their lifetime.

24.6 million

people in the UK – 38% of the population – know a family member or close friend living with dementia.

5.2%

of people over the age of 60 are living with dementia globally.

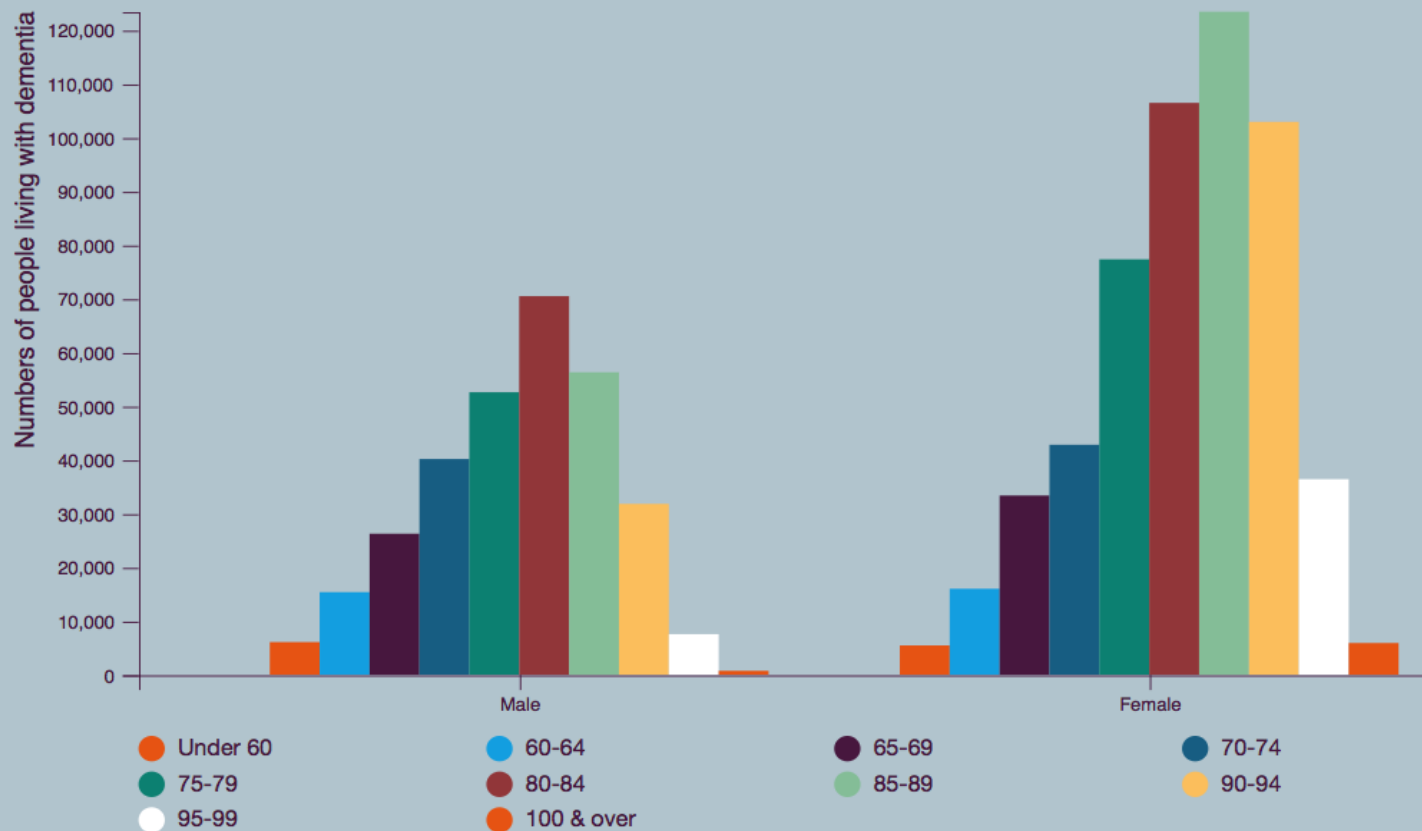
209,600

The number of new cases of dementia a year in the UK.

One in 14

people over 65 have dementia in the UK and one in 79 of the whole population.





The majority of dementia costs per year are due to **informal care at £11.6bn (44.2%)**, with social care costing £10.3bn (39.0%) and healthcare costs £4.3bn (16.4%). **The total cost is over £26bn.**

1/4

of hospital beds are occupied by people living with dementia who are over 65.



Lifestyle changes to improve cardiovascular health can reduce the risk of dementia.



Around a third of a person's risk of developing Alzheimer's disease may be due to **modifiable lifestyle factors.**

Attitudes to dementia



39% of people under 60 years and **52%** of people 60 years and above said that **Alzheimer's is the disease they are most concerned about**. It is the most feared disease for people 60 years and above.

49%

of people are worried that they would be seen as mad after a diagnosis of dementia and **56% of people put off seeking a diagnosis** for up to a year or more.

24.6 million

people in the UK – **38% of the population** – know a family member or close friend living with dementia.

1.5 million people

in the UK, including **both people living with dementia and their carers**, would benefit from new dementia treatments.

3/4

of people are unaware that they can affect their risk of developing dementia.



46% of people think dementia mostly affects older people, 15% think dementia affects only old people and 9% of people think dementia can also affect younger people.



23% of people identified dementia as caused by brain disease or degeneration and 46% identified it as loss of memory.



40% of people would adopt a healthier lifestyle to reduce their risk of developing dementia.

3/4

of people didn't think that giving up smoking could reduce your risk of developing dementia.



85% of people want to stay at home as long as possible after a diagnosis of dementia, 47% think they would be able to.

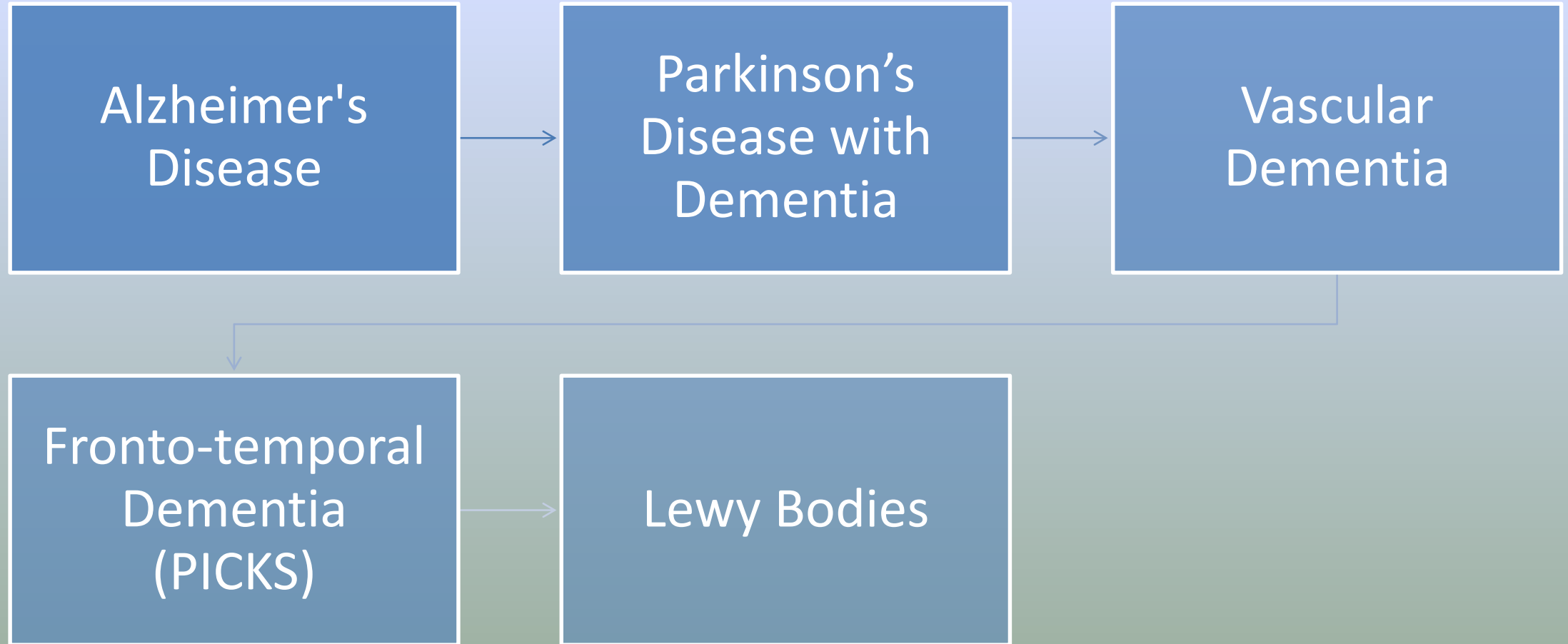
42%

of people believe that once a person living with dementia stops recognising loved ones, they don't benefit from spending time with them.



68% of people feel isolated following a diagnosis of dementia.

Some Common types of dementia



Alzheimer's Disease



Alzheimer's is probably the best-known cause of dementia, accounting for about two-thirds of cases in the elderly.



Changes the brain's structure, which leads to the death of brain cells, this disrupts the brain's usual activity.



Shortage of chemicals involved with the transmission of messages with the brain

Develops slowly over several years. It is not always obvious to begin with and symptoms can overlap with other illnesses.

Early signs -difficulties forming new memories, but people may also experience language or spatial awareness difficulties.

Vascular Dementia

Some people have both vascular dementia and Alzheimer's disease – often called 'mixed dementia'.

Memory loss, disorientation and problems with communication.

Triggered by blockages to the blood vessels (Vascular system) in the brain.

Not enough blood and oxygen reach the nerve cells so they die.

Areas of the brain tissue that have died in this way are called infarcts, so vascular dementia is also called multi-infarct dementia.

RISK FACTORS - smoking, high blood pressure (known as hypertension), high cholesterol, type 2 diabetes, obesity and heart problems.

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- Thinking skills – taking more time to process information and having problems with attention, planning and reasoning.
 - Personality changes – these may include depression and apathy (becoming less interested in things). People may also become more emotional.
 - Movement problems – difficulty walking or changes in the way a person walks.
 - Bladder problems – frequent urge to urinate or other bladder symptoms. This can be common in older age, but can be a feature of vascular dementia when seen with other symptoms.

Fronto-temporal Dementia & PICKS

Damage is usually focused in the front part of the brain.

Personality and behaviour are initially more effected than memory.

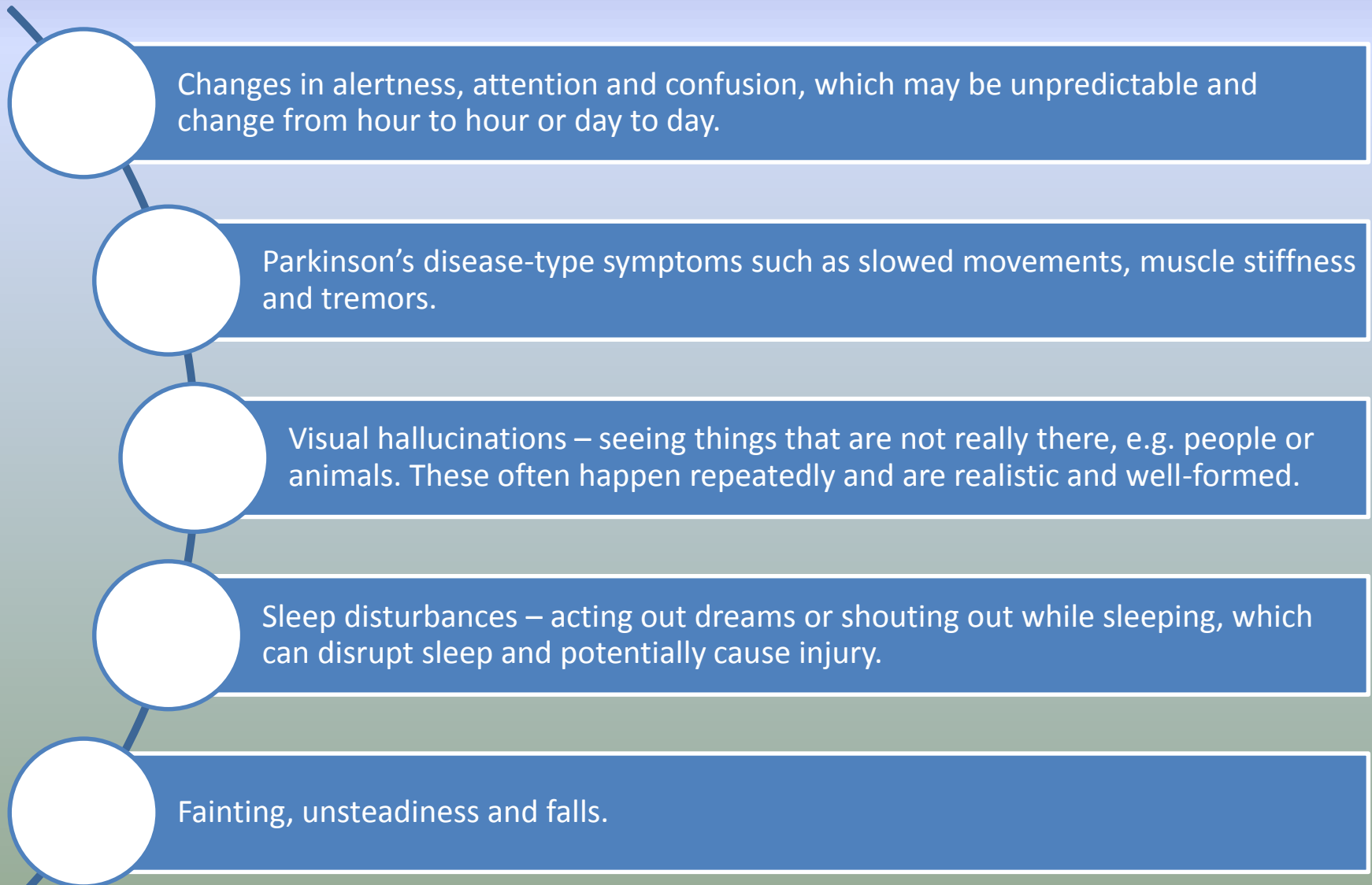
Pick's Disease is the older name for what is now known as a variant of Fronto-temporal Dementia.

Typically the onset occurs between the ages of 40 and 70.

- **Behavioural changes** such as, impulsivity, obsession i.e. over eating or eating one type of food, rudeness/impatience, inability to function, lack of attention to hygiene, poor judgement , sexual exhibitionism or promiscuity, withdrawal or seclusion.
- **Emotional changes** such as: mood changes, easily distracted, unaware of changes in behaviour
- **Language changes** such as: loss of speech, decreased ability to read or write, repeating words others say
- **Physical changes** such as: increased muscle rigidity or stiffness, difficulty moving about, lack of coordination, memory loss can also be affected

Dementia with Lewy Bodies

<https://www.youtube.com/watch?v=CxxwvRCE7G4>



Changes in alertness, attention and confusion, which may be unpredictable and change from hour to hour or day to day.

Parkinson's disease-type symptoms such as slowed movements, muscle stiffness and tremors.

Visual hallucinations – seeing things that are not really there, e.g. people or animals. These often happen repeatedly and are realistic and well-formed.

Sleep disturbances – acting out dreams or shouting out while sleeping, which can disrupt sleep and potentially cause injury.

Fainting, unsteadiness and falls.

The protein is called alpha-synuclein and the clumps it forms are called Lewy bodies. The protein clumps damage the way nerve cells work and communicate.

The nerve cells affected are in areas of the brain that control thinking, memory and movement.

Lewy bodies are also responsible for the damage that causes movement problems in Parkinson's disease.

Impact of dementia in UK

850,000 people in the UK, with numbers set to rise to over 1 million by 2025. This will soar to 2 million by 2051.

225,000 will develop dementia this year, that's one every three minutes.

1 in 6 people over the age of 80 have dementia.

70 per cent of people in care homes have dementia or severe memory problems.

There are over 40,000 people under 65 with dementia in the UK.

Two thirds of the cost of dementia is paid by people with dementia and their families.

Dementia is one of the main causes of disability later in life, ahead of cancer, cardiovascular disease and stroke.

Unpaid carers supporting someone with dementia save the economy £11 billion a year.

There are an estimated 46.8 million people living with dementia and the numbers affected will double every 20 years, rising to 115.4 million in 2050.

Another 7.7 million people will develop dementia around the world every year.

diagnosis

Association between dementia and memory loss

- Although significant, not a salient feature of every dementing disease

Functional decline

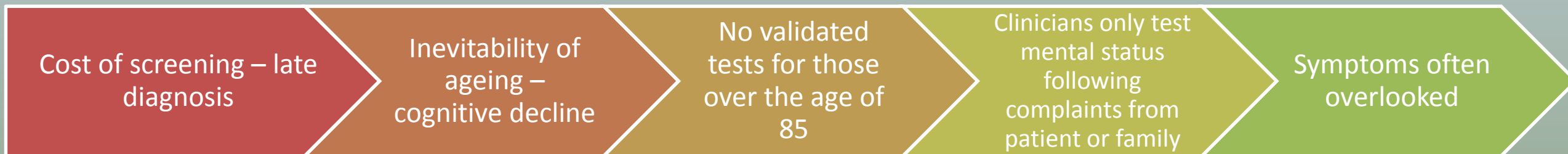
- Personal hygiene, bill paying, housecleaning, personality

Clinical marker separating “possible dementia” and “normal aging” from “dementia”

diagnosis



DIFFICULTIES WITH DIAGNOSIS



Advantages of diagnosis

Provide a diagnostic answer and education for the patient/family

Relieve the fear of an irreversible or progressive disease (depression or stroke)

Treat the underlying disease

Initiate prevention/rehabilitation strategies

Treat cognitive and behavioural symptoms

Plan legal and financial future while patient is still competent

Initiate management strategies that will postpone dependence and institutionalisation

Alzheimer's disease

The Alzheimer's Gene- Controlling ApoE



Risk Factors

- Obesity
- High blood pressure
- Head trauma
- High cholesterol
- Being American!
 - Higher rates in
 - Japanese-Americans than Japanese
 - African-Americans than Africans
- Depression
- Lower rates in highly educated
 - Beneficial consequences of learning and memory



Possible Protective Factors

- **Education**

The ability of the brain to change suggests to some that staying mentally active as you age may help to maintain healthy brain synapses. A 2002 study reported an association between frequent participation in cognitively stimulating activities (such as reading, doing crossword puzzles, visiting museums) and a reduced risk for Alzheimer's.

- **Exercise**

Lowers risk of high blood pressure and other risk factors associated with Alzheimer's

- **Alcohol Consumption**

Men who consume one to three drinks of alcohol per day cut their risk of developing the disease by nearly half. Among women, however, the risk was reduced by only 4%. The type of alcohol had no effect on the results. But further study is needed. In the meantime, experts do not recommend drinking alcohol to fend off Alzheimer's disease.

Impact on family members

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3181916/>



Family caregivers provide the majority of care for people with dementia (Baumgarten et al, 1997) and experience significantly **higher levels of psychological morbidity**, depression, stress and burden than their counterparts who are not caregivers or who are caring for the physically ill (Brodaty et al, 1990)

Impact on family members

The words 'burden', 'strain' and 'stress' are used interchangeably in research about caregivers (Donaldson, Tarrier and Burns (1997))

'Caregiver burden'

- Physical
- Psychological
- social
- Financial



Factors associated with burden and stress

being female

having a poor relationship with the care recipient

lack of social support

(Pinquart & Sörensen ,2003)

Mougias, Politis, Mougias, Kotrotsou, Skapinakis, Damigos, and Mavreas (2015)

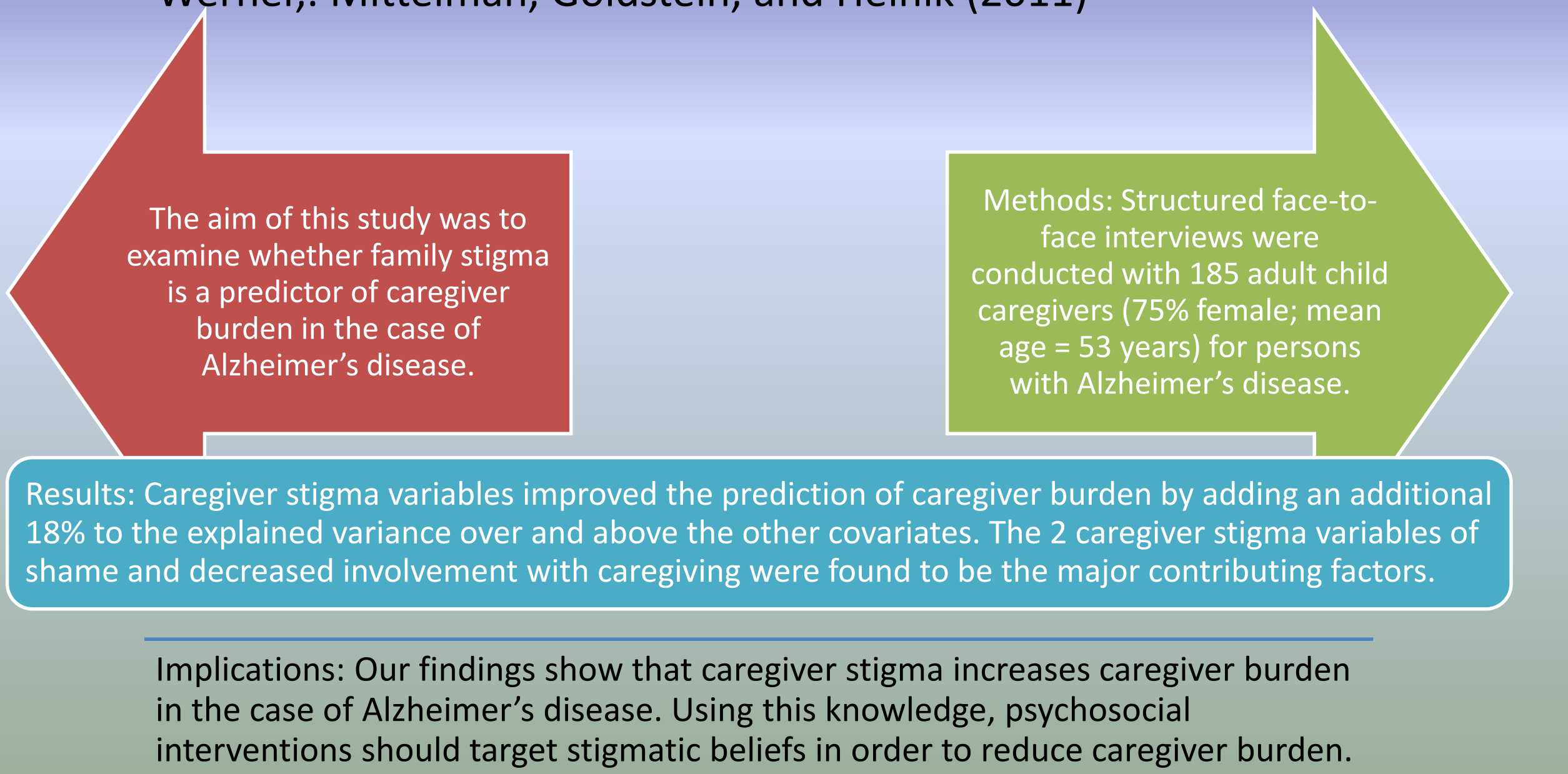
The aim of the present study was to examine the level of burden in Greek caregivers who live in Athens, and its association with patient and caregiver factors. This was a cross-sectional study of 161 primary caregivers of dementia patients living in the community and attending a secondary clinic.

Most patients were suffering from Alzheimer's Dementia (n=101; 62.73%) and had moderate and severe dementia according to the MMSE score (mean MMSE=11.50), with patients being unable to perform 2 basic activities of daily living on average.

Caregivers were involved in their role for 3.6 years on average and the mean weekly caregiving time was more than 70 hours.

Nearly half of the 161 caregiver were highly burden and almost one fourth were depressed. Lower caregiver's age, behavioral symptoms of dementia patients and caregivers' depression were found to be independently associated with caregiver's burden.

Werner,. Mittelman, Goldstein, and Heinik (2011)



The aim of this study was to examine whether family stigma is a predictor of caregiver burden in the case of Alzheimer's disease.

Methods: Structured face-to-face interviews were conducted with 185 adult child caregivers (75% female; mean age = 53 years) for persons with Alzheimer's disease.

Results: Caregiver stigma variables improved the prediction of caregiver burden by adding an additional 18% to the explained variance over and above the other covariates. The 2 caregiver stigma variables of shame and decreased involvement with caregiving were found to be the major contributing factors.

Implications: Our findings show that caregiver stigma increases caregiver burden in the case of Alzheimer's disease. Using this knowledge, psychosocial interventions should target stigmatic beliefs in order to reduce caregiver burden.

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