How to measure disability, the disablement process and early signs of disability?

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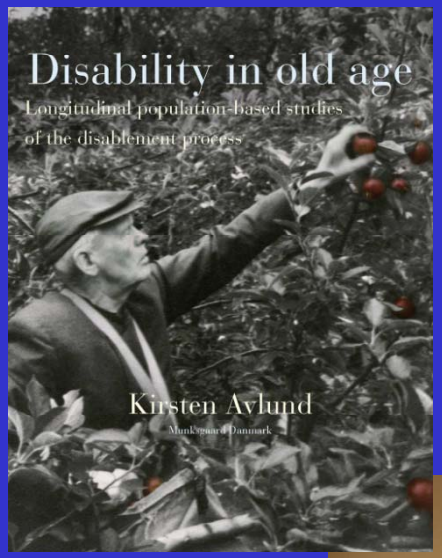

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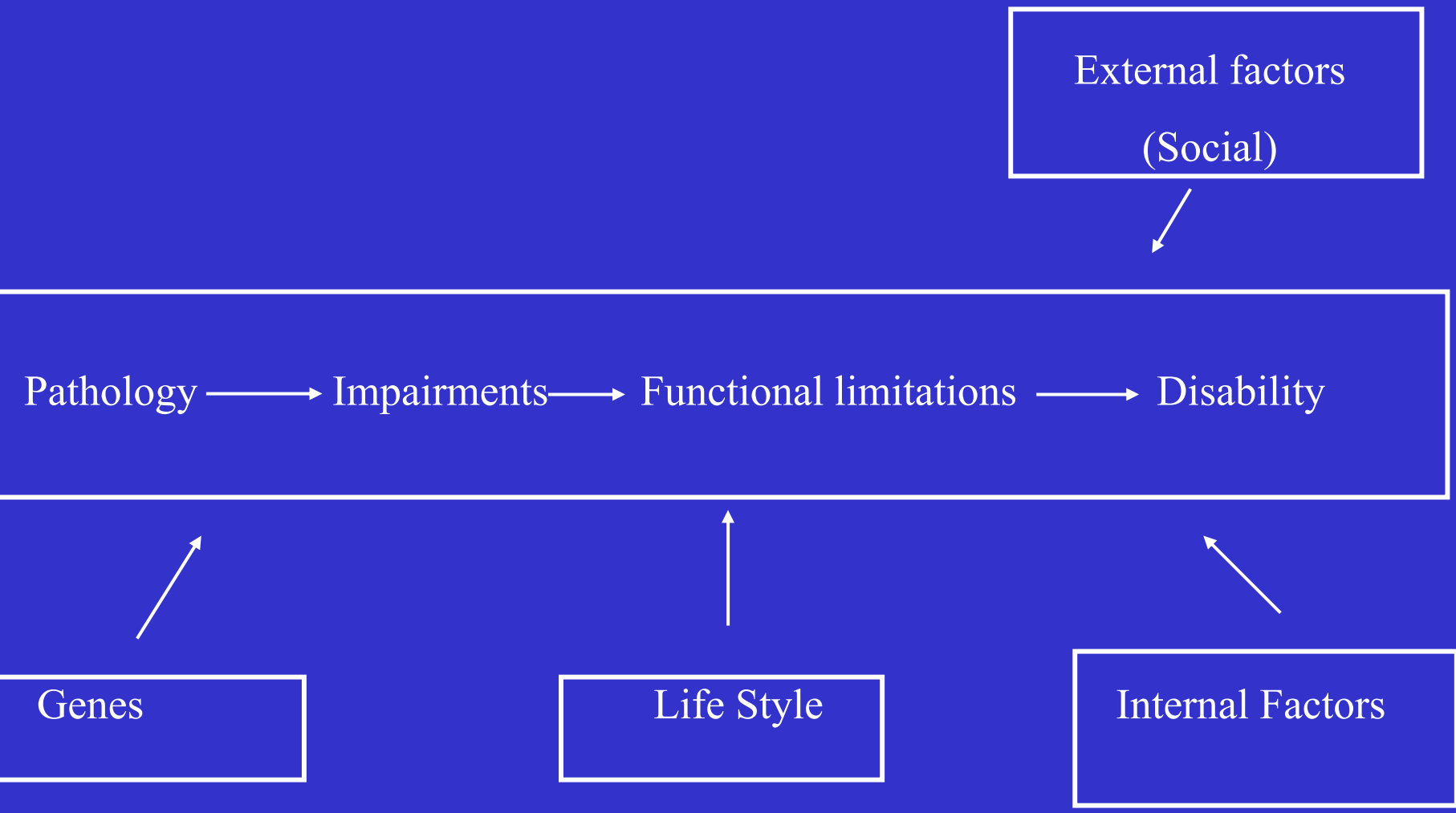
The disablement process



Verbrugge & Jette. Soc Sci Med, 1994.

The disablement process

- Pathology
  - Disease, injury, developmental conditions
- Impairment
  - Dysfunction and structural abnormalities in specific body systems
- Functional limitations
  - Restrictions in basic physical and mental actions
- Disability
  - Difficulties doing activities of daily life

Impairments, functional limitations and disability

Impairment	Func limitations	Disability
Anatomical, physiological, mental abnormality or loss	Limitation in performance at the level of the whole person	Difficulty in doing socially defined roles and tasks within a socio-cultural and physical environment
e.g. Gait assessment	Walking speed	Trouble walking on stairs

Pathology →	Impairment →	Functional Limitation →	Disabililty
Denervated muscle in arm due to trauma	Atrophy of muscle	Cannot pull with arm	Change of job; can no longer swim recreationally

Differentiating Functional Limitation and Disability
Nagi, IOM Report, 1991

Functional Limitation

Limitation in performance at the level of the whole organism or person

Disability

Limitation in performance of socially defined roles and tasks within a sociocultural and physical environment

Functional limitation refers to organismic performance; disability refers to social performance

Measuring Functional Limitations and Disability

- Functional limitations and physical disability refer to different behaviors not to different ways of measuring the same behavior.

- Thus, you can measure functional limitations and physical disabilities using either subjective or objective measures.

Examples of Objective Performance Tests Used to Evaluate Functional Limitations

- Pegboard test
- Picking up object
- Lifting 10 pounds
- Gait speed
- Chair rise – single and repeated
- Stair climb

Most measures of disability include

Mobility	e.g. walk on stairs, take long walks
ADL	Activities of Daily Living e.g. bathing, dressing
IADL	Instrumental Activities of Daily Living e.g. housework, shopping

Most measures of disability are based on questions about ability to perform on activity with or without

-need of help

-difficulties

-pain

-technical aids

-tiredness

-reduced speed

What do the 70-year-olds do? Examples in %

	Men	Women	p
(n)	(366)	(368)	
Mobility			
Walk outside in nice weather	100	100	
Walk on stairs	99	99	
ADL			
Wash upper body	100	100	
Shoes /Stockings on/off	100	100	
IADL			
Cook for guests	18	89	***
Garden work	71	54	***

P describes gender differences by Chi-Square test. *** $p<0.001$

Source: Avlund & Schultz-Larsen 1991

Reasons for not performing an IADL-activity

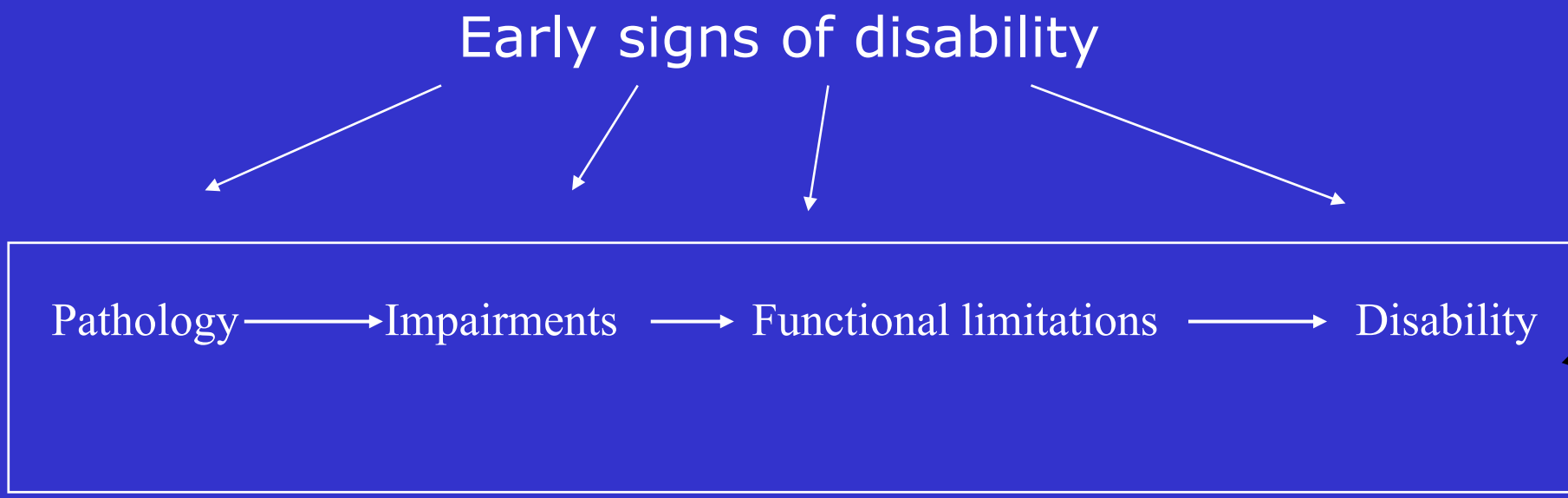
1) Irrelevant
2) No need, another person does it
3) Doesn´t know how to to it
4) Not motivated
5) Physical problems
6) Health problems
7) Fear of falling
8) Problems in the physical environment

Source: Myers. Med Care 1992;30:MS96-111.

Recommendations for measures of disablement process

- Be cautious about
  - Combining measures of different concepts in the disablement process
  - Combining measures of ADL and IADL

The disablement process



Indicators of later disability

Inflammation (Ferrucci et al. 1999; Penninx et al. 2004)

Inflammation in the periodontium (Holm-Pedersen 2006; Avlund et al. 2009)

Hand grip strength (Rantanen et al. 1999)

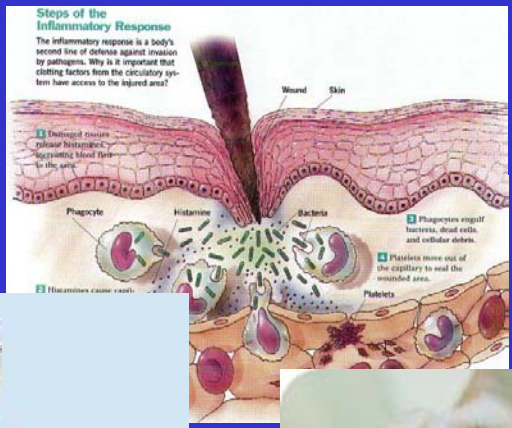
Physical performance (Guralnik et al. 1995; Gill et al. 1996; Ostir et al. 1998)

Difficulty with ADL (Sonn et al. 1996; Gill et al. 1998)

Task modification (Fried et al. 2001; Mänty et al. 2006)

Perceived security (Dahlin Ivanoff 2006)

Fatigue in daily activities (Avlund et al. 1995-2008)



Risk of incident disability in mobility after 18 months*

	Difficulty walking ½ mile	Difficulty climbing up
Task modification but no difficulty in tasks	3.77(1.91-7.47)	3.86(1.83-8.17)

*Adjusted by walking speed, stair climb speed, age, education, living alone, chronic diseases, depression, knee strength, balance

Source: Fried et al. J. Gerontol: Med Sci 2000; 55A: M43-M52

Task modification as indicator of early decline in perfomance and early disease

	Walking speed (sec)	Exercise tolerance (sec on tread mill)	Muske strength	Balance (sec)
Walking ½ mile				
igh function	Higher speed	Higher speed	Stronger	Higher speed
ask modification	↓	↓	↓	↓
ifficulty	Slower speed	Slower speed	Weaker	Slower speed
value - Trendtest	0.001	0.001	0.001	0.001

Source: Fried et al. J Clin Epidemiol 2001; 54: 889-901

Fatigue measured as Tiredness in daily activities

Mob-T*
Transfer
Get outdoors
Walk indoors
Walk outdoors in nice weather
Walk outdoors in poor weather
Walk on stairs

Lower Limb-T
Use toilet
Wash lower body
Dress lower body
Take shoes/stockings on/off*
Cut toenails

Sources: Avlund et al. 1995; 1996;1996; 1998

Odds ratios (95% CI) for onset of disability at five year follow-up by fatigue at age 75

	Mobility disability (n = 510)	**Disability in ADL** (n = 429)
Tired in 2-4 activities	3.2 (1.4-7.6)	2.1 (1.0-4.2)
Tired in 1 activity	1.7 (0.8-3.8)	2.0 (1.0-3.9)
Not tired	1.0	1.0

Adjusted by sex, chronic diseases, cognitive function, self-rated health, depressive symptoms, housing tenure, social relations, physical activity

Source: Avlund et al. J Clin Epidemiol 2002

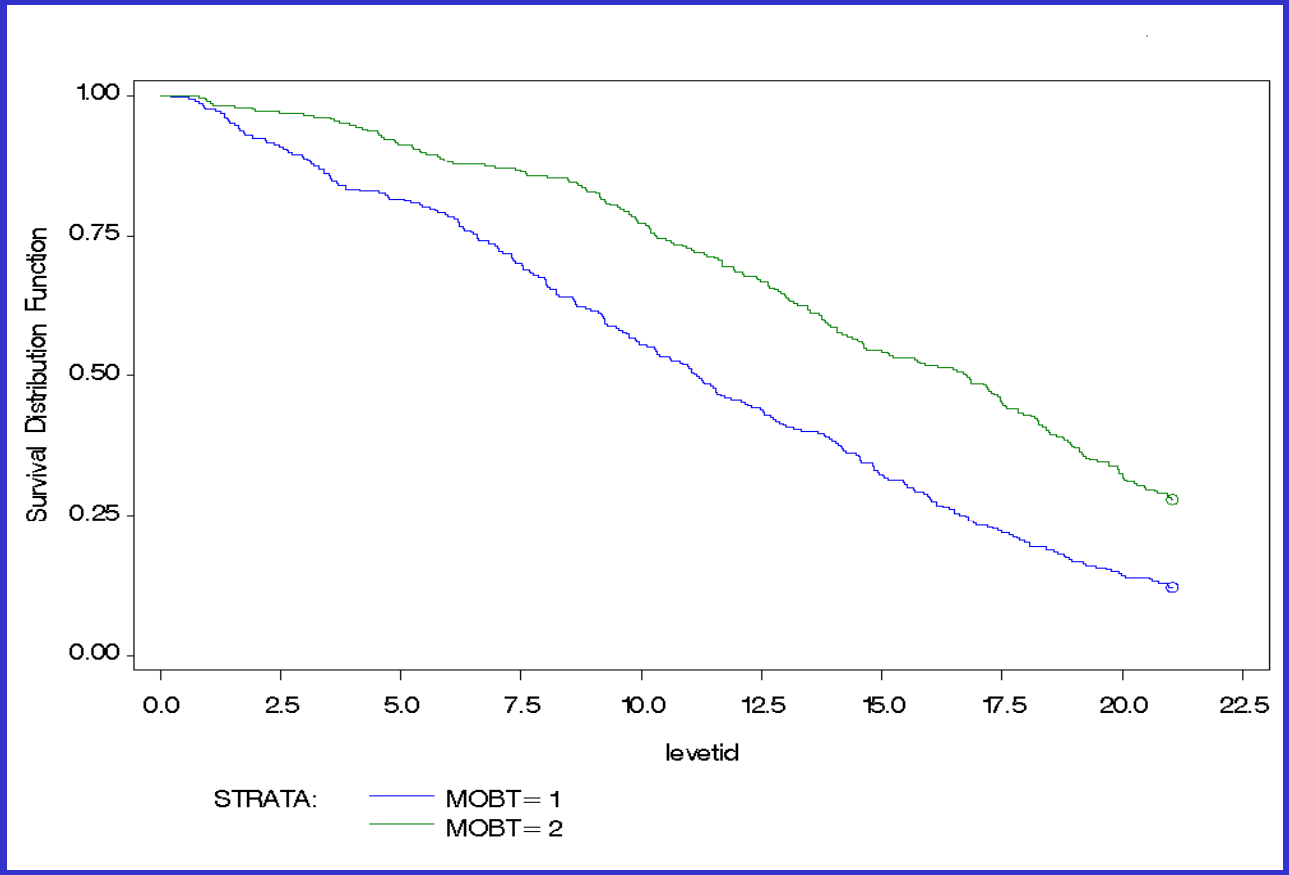
Odds ratios (95%) onset of disability and mortality at 5-, 10- and 15- year follow-up by fatigue at age 70

5-year follow-up	10-year follow-up	15-year follow-up
Onset of disability*		
(n = 564)	(n = 360)	(n = 181)
9.09(4.71-17.54)	**1.87 (1.17-2.99)**	1.84 (0.93-3.64)
Mortality*		
(n = 705)	(n = 705)	(n = 705)
1.83 (1.17-2.85)	**2.16 (1.52-3.05)**	**2.31 (1.64-3.24)**

Adjusted by sex, number of diseases, VO^2 max

Source: Schultz-Larsen and Avlund. Arch Gerontol Geriatr. 2007

Survival curves among 70-year-olds with and without fatigue during 21 year follow-up



Onset of walking limitation at 5-year follow-up

- Measured by a 10 meter laboratory test using a stop watch
- Onset of walking limitations was defined as onset into the slowest quartile of maximal walking speed: > 1.33 m / sec.

Odds ratios (95% CI) for onset of walking limitations at 5-year follow-up by fatigue (n = 319)

	Crude	Adjusted*
Tired	3.97(2.16-7.29)	2.78(1.43-5.41)
Not tired	1.0	1.0

* Adjusted by sex, walking speed and chronic diseases at baseline

Source: Avlund, Sakari-Rantala, Rantanen et al. J Am Geriatr Soc. 2004

Fatigue measured as Tiredness in daily activities is predictive of

- Onset of disability after
- 1 year (Avlund et al. 2008)
- 1½ years (Avlund et al. 2003)
- 5 years (Avlund et al. 2002; 2003; Schultz-Larsen et al. 2007)
- 10 years (Avlund et al. 2003; Schultz-Larsen et al. 2007)
- 15 years (Schultz-Larsen et al. 2007)

Fatigue measured as Tiredness in daily activities is predictive of

- Onset of disability
- Both in young, young-old and old-old populations
- In different geographic localities
-

Fatigue measured as Tiredness in daily activities is predictive of

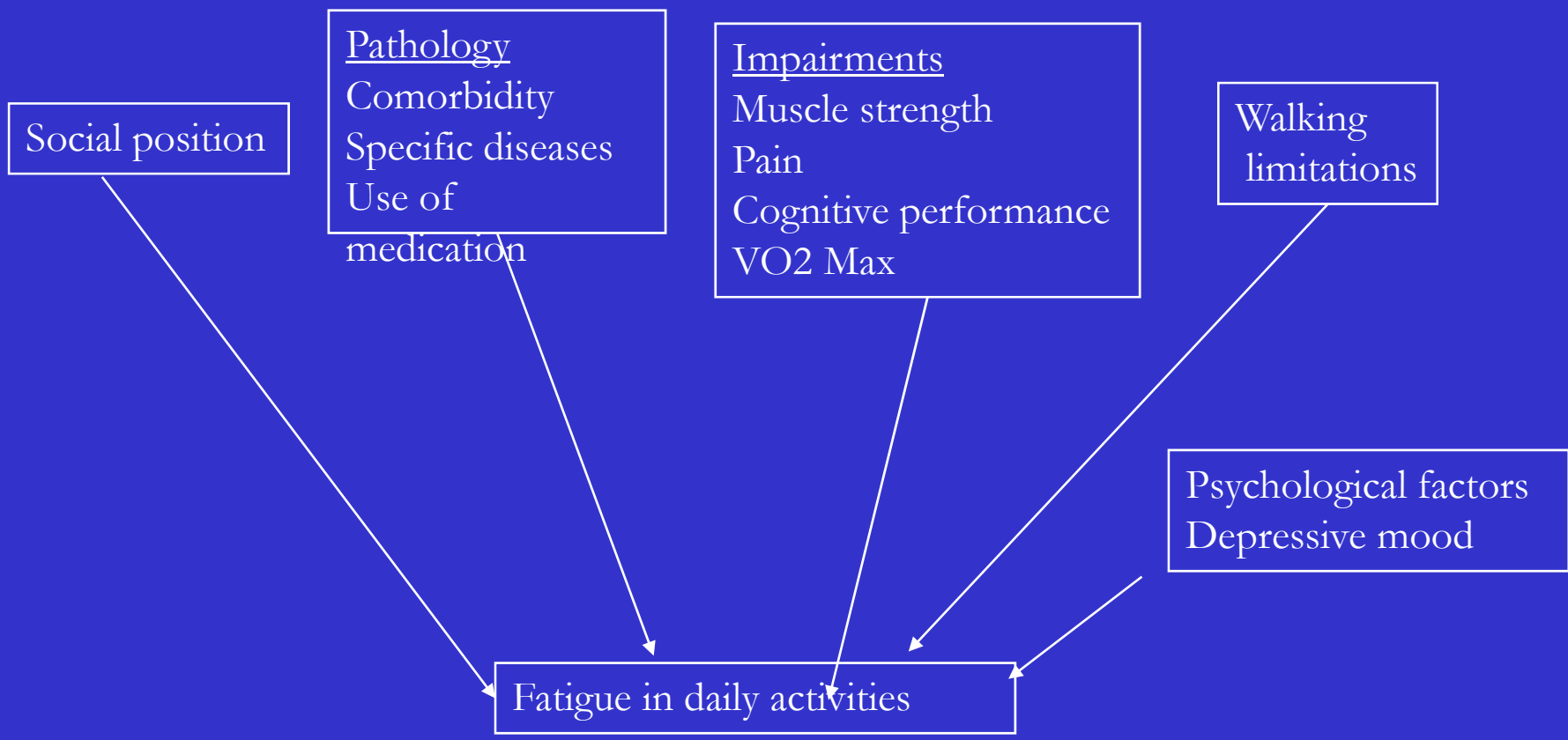
Onset of walking limitations
(Avlund et al. 2004)

Use of health and social services
(Avlund et al. 2001)

Decline in physical activity
(Elkjær et al. 2006)

Mortality
(Avlund et al. 1998; Avlund et al. 2003; Schultz-Larsen et al. 2007)

Factors related to fatigue in non-disabled older adults



Sources: Schultz-Larsen 1992; Avlund et al. 1994a; 1997; 2003c; 2006; 2007

Conclusions

- Fatigue is influenced by multiple potential modifiable factors
- None of these factors explain the associations between fatigue and the various outcomes
- Fatigue may be thus be regarded as a subjective measure of frailty
- Fatigue may be used to identify non-disabled individuals at high risk of functional decline

New research questions about early signs of disability will be followed during the next years at

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