Public Health Questions on Physical Disabilities and Musculoskeletal Conditions

Studies using health surveys

Susan Picavet

Promotor: Prof dr. ir. D. Kromhout
Hoogleraar Volksgezondheidsonderzoek
Wageningen Universiteit

Copromotor: Dr. J.S.A.G. Schouten, arts
Universitair docent
Capaciteitsgroep Epidemiologie
Universiteit van Maastricht

Samenstelling promotiecommissie:

Prof dr. J.P. Mackenbach, Erasmus Universiteit Rotterdam

Prof dr. W. van Mechelen, Vrije Universiteit Amsterdam

Prof dr. E. G. Schouten, Wageningen Universiteit

Prof dr. P.R. Croft, Keele University, Staffordshire, UK

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Hendrika Susanna Johanna Picavet

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Abstract

Public Health Questions on Physical Disabilities and Musculoskeletal Conditions. Studies using health surveys

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H. Susan J. Picavet

For population-based information on physical disability and musculoskeletal conditions health surveys are the most important source of information. In this thesis studies are presented on the methods of the health survey and on public health questions concerning physical disabilities and musculoskeletal conditions. Data were used from a national health survey (the NetHIS, several years, n=±9,000 each year), a general epidemiological study (MORGEN-project 1993-1997, n=22,415) and a disease-specific health survey (DMC_3-study 1998, n=3,664).

First, two studies were carried out concerning the methodology of the health survey. It was shown that differences did not exist between respondents to a health mail survey or to a health interview survey, with one exception: persons with only primary school education were underrepresented in the mailed survey compared to the interview survey. In addition it was shown that differences in survey methodology had a substantial effect on prevalence estimates of disability. In particular the exact wording of the questions affected the results (up to differences of 16 percentage points), but also the method of data collection. Written questionnaires gave higher prevalences of disability than personal interviews, up to 11 percentage points. It can be concluded that it does not matter how potential participants are approached, the same persons participated (with the exception of the lowest educational groups), but it does matter how data collection takes place and how the questions are worded.

Second, the public health questions on physical disability and musculoskeletal conditions were focused on prevalences, trends, risk groups and determinants. The observed prevalences of self-reported physical disability (12.5% of population of 16 years and over) and musculoskeletal conditions (up to 75% of population aged 25 years and over) were high, which is the same in other western countries. In the period 1990-1998 the prevalence of physical disability did not change with the exception of the prevalence of disability of mobility which dropped slightly with 0.2 percentage points per year. Of the total prevalence of disability of mobility (20.5%) one-third could be attributed to the six following groups of chronic conditions: musculoskeletal diseases, lung diseases, neurological disorders, heart diseases, diabetes, and cancer. Musculoskeletal disorders account for the major part. Risk groups for physical disabilities were older age groups, women, persons living alone, persons who were divorced or widowed and persons with a low educational level. However, general socio-demographic characteristics could not be used to identify high risk groups for musculoskeletal pain, with the exception of persons who are work disabled and women. There were no differences between the working and the non-working population for the burden of low back problems. Activities characterised by an awkward posture, by the same posture for a long time or by often bending and rotating the trunk contributed significantly to low back pain in the population but physical inactivity did not.

Physical disabilities and musculoskeletal conditions make an important contribution to the burden of public health. These health problems need increasing attention of epidemiological research and public health policy, despite the fact that it concerns less than perfect defined health problems ('questionnaire diseases and conditions') based on less than perfect information sources (the health survey).

Stellingen behorend bij het proefschrift *'Health survey questions on physical disabilities and musculoskeletal conditions - studies using health surveys'* van Susan Picavet.

1. Dé prevalentie van lichamelijke beperkingen bestaat niet.

2. Schriftelijke surveys leveren hogere prevalenties van lichamelijke beperkingen op dan mondelinge surveys.

3. Nederlanders met alleen een lagere school opleiding doen relatief vaker mee aan surveys waarbij ze persoonlijk geïnterviewd worden dan aan surveys waarvoor ze een vragenlijst moeten invullen.

4. Voldoen aan de 'Nederlandse Norm Gezond Bewegen' vermindert niet het risico op lagerugklachten.

5. Onderzoekers gebruiken liever elkaars tandenborstel dan elkaars (onderzoeks) methoden en instrumenten.

6. Hoe hoger de respons, hoe hoger de kans op selectieve non-respons.

7. Roken verhoogt de kans op netwerken.

8. Privéhuishoudens ongevraagd benaderen voor commerciële doeleinden is een vorm van 'stalking' en moet strafbaar worden gesteld.

Wageningen, 20 april 2001

Contents

Chapter 1

Introduction

In the year 2000 Dutch men are expected to live about 75 years and Dutch women 80 years[1] whereas 100 years earlier these figures were 51 and 53.[2] These increasing life expectancies are a result of better health circumstances including fewer epidemics of infectious diseases, increasing prosperity, better food, better work circumstances, less heavy physical work, better housing, and better health care.[3]
However, there is also a reverse to this medal: growing numbers of elderly people and the oldest old lead to an increasing prevalence of 'old age'-problems, an increasing number of physically disabled, partially sighted, cognitively impaired and hard of hearing persons. In addition, the working population is confronted with health problems like burn-out, chronic low back pain and Repetitive Strain Injury (RSI) which could be associated with the new work circumstances (computer and other monotonous work), and a sedentary life style.
Nowadays the health of the Dutch population is, like other Western or developed countries, characterised by chronic health problems.[1] These health problems are for example cardiovascular diseases, chronic obstructive pulmonary diseases (COPD), cancer, musculoskeletal conditions, and long-term disabilities. These chronic health problems require long-term and expensive health care facilities. The major part of the costs for health care is consumed by the care for the chronically ill.[1,4] The future of the health of the Dutch is not expected to be too rosy either: chronic health problems will increase due to increasing life expectancies and increasing numbers of the elderly[1,5] and so will their impact on health care resources.

This thesis focuses on two major health problems: physical disabilities and musculoskeletal conditions. *Physical disabilities* refer to problems with routine daily functioning such as walking, carrying, hearing and seeing.[6] These are key health indicators for an ageing population because they are very prevalent in the growing elderly population and they reflect dependency on health care.[7] *Muscoloskeletal conditions* are an important source of physical disabilities[8] and are associated with a large societal burden because of their impact on sick leave and work disability.[9] The most common musculoskeletal conditions are: low back pain, pain of neck and shoulder and pain of hip and knee.
Both these indicators represent health problems that are mostly not univocally defined by diagnoses nor represented in health information sources like hospital and mortality statistics. These health problems are characterised by pain and limitations for which we often have to rely on self-reports of persons, such as used in a health

survey. A health survey supplies information on a population by structured questioning of a sample of that population. Sometimes a physical examination can also be part of the assessments. We used health surveys to answer some public health questions on physical disabilities and musculoskeletal conditions. Before studying these public health questions, the methodology of health surveys will be examined, focusing on non-response bias and the subjective nature of the self-reported information.

Questions on Health Survey methodology

A health survey is a type of population survey that includes measures of health characteristics, health related behaviour and a variety of demographic and socio-economic characteristics.[10] If the target population for such a health survey is all persons living in a certain country, the survey is usually referred to as a *national* health survey. If health survey data are collected by face to face interviews, the survey is commonly referred to as a *health interview survey* (HIS).
Compared to other information sources of health problems in the population, like health service registers and death registers, the advantages of health surveys include (i) the combination of data on socio-demographic and other background variables, lifestyle and many other possible determinants and health and morbidity characteristics, (ii) the possibility of assessing subjective data such as pain, complaints, perceived health, knowledge of health services, coping strategies, and opinions and (iii) the collection of data on many subgroups in the population including those who did not have contact with health services.
Disadvantages of health surveys include (i) failure of contacting everybody in the sample, and therefore introducing possible bias, (non-response bias) and (ii) reliance on self-reports that may not be valid. These disadvantages are further investigated in this thesis.

First, the effect of a mail or interview approach on the response (size of response and characteristics of respondents) is examined. Most health surveys in the Netherlands are carried out by mail or by home interview. Differences in response with regard to (socio)demographic, lifestyle and health characteristics are studied for two national health surveys, one using home interviews and one using mail questionnaires. (Chapter 2.1).
Second, a study on the effect of differences in survey methodology on the results is presented. The methodological differences were differences in the method of data collection (proxy questioning, yes/no; interview *versus* self administered questionnaire) and in construction of the questionnaire (wording of introductory text, of activities, and of response categories). The effect of these differences on prevalences in three domains of physical disability - activities of daily living, mobility, and communication (hearing and seeing) - were studied (Chapter 2.2).

Public Health Questions on physical disability and musculoskeletal conditions

Central public health questions are: What are the prevalences and incidences of diseases? How do these figures change over time? Are there any groups in the population at higher risk of developing diseases and health problems? What are the risk factors? How do these factors change over time?
In this study the focus is on prevalences, risk groups and determinants. General sociodemographic characteristics were used to identify high risk groups. These characteristics were: age, sex, marital status, household situation (living alone or with others), region of living, work status and educational level. Identification of high risk groups in the population is for instance necessary to generate hypotheses or explanations of health differences and for the estimation of the potential health impact of prevention programs. The existence of differences in health between subgroups in the population also suggest that there is room for improvements in health.

For *physical disability* a study was carried out to estimate prevalences, identify risk groups and analyse time trends (chapter 3.1). In addition it was studied which chronic conditions are responsible for the burden of physical disability in the population (chapter 3.2).
Chapter 4 presents studies on *musculoskeletal conditions,* starting with a study on prevalences and risk groups of musculoskeletal pain of different anatomical sites (chapter 4.1.1). The next parts of chapter 4 focuses on the most common pain site: low back pain. The differences in the burden of low back problems between the working and non-working population are described in chapter 4.1.2. In addition two studies are presented on determinants of low back pain: one focusing on physical load in daily life (chapter 4.2.1) and one focusing on physical inactivity (chapter 4.2.2).

Health surveys analysed in this thesis

Several health surveys were used for the studies presented in this thesis. The main surveys were the NetHIS, the MORGEN-project and the DMC_3-study, all based on random samples of men and women living in the Netherlands.
NetHIS[11] stands for the Netherlands Health Interview Survey. It is carried out on a continuous basis since 1981 by Statistics Netherlands. Approximately 9000 persons are yearly interviewed at home and are also requested to fill in a questionnaire. Several years of data of the NetHIS are used for analyses in this thesis.
The MORGEN-project[12] is the Monitoring Project on Risk Factors for Chronic Diseases carried out by the National Institute of Public Health and the Environment in the period 1993-1997. More than 22 thousand persons aged 20-59 years and living in 3 towns in the Netherlands (Amsterdam, Doetinchem and Maastricht) participated. The measurements consisted of several self-administered questionnaires and

a physical examination. The MORGEN project formed also the basis of follow-up studies in Doetinchem and Maastricht.
The DMC_3-study[13] is a national health survey on musculoskeletal conditions using mailed questionnaires. The DMC_3-study was carried out in 1998-1999 by the National Institute of Public Health and the Environment in co-operation with Statistics Netherlands. DMC_3 stands for Dutch population-based Musculoskeletal Complaints and Consequences Cohort. An age-sex stratified sample of the Dutch population aged 25 years and over was approached for this study and 3,664 persons returned the questionnaire.
Table 1.1 presents an overview of the health surveys analysed by chapter.

Table 1.1 Overview of health surveys used in different chapters of this thesis

Chapter	Title	Age group (yr.)	Health survey			
			NetHIS	MORGEN-study	DMC_3-study	Other surveys
2.1	National health surveys by mail or home interview: effects on response	25+	NetHIS 1998, n=6,061	-	Baseline Measurement, n=3,664	
2.2	Comparing survey data on functional disability: the impact of some methodological differences	55+	5 data years of NetHIS (1983, 1984, 1985, 1989, 1990) n=9,814	-	-	4 other surveys, see chapter 2.2, n=10,254
3.1	Physical disability in the Netherlands: prevalences, risk groups and time trends	19+	NetHIS 1990-1998, n=62,352	-	-	
3.2	Contribution of six chronic conditions to the burden of mobility disability in the Dutch population	20+	NetHIS 1989-1994, n=26,288	-	-	
4.1.1	Musculoskeletal pain in the Netherlands: prevalences, consequences and risk groups, the DMC_3-study	25+	-	-	Baseline Measurement, n=3664	
4.1.2	Prevalences and consequences of low back problems in the Netherlands, working vs. non-working population, the MORGEN-study	20-59	-	MORGEN 1993-1995, n=13,822	-	
4.2.1	Physical load in daily activities and low back problems, the MORGEN-study	20-59	-	MORGEN 1993-1997, n=22,415	-	
4.2.2	Physical inactivity: a risk factor for low back problems in the general population?	20-59	-	Maastricht cohort of MORGEN-study 1994-1997 with follow-up in 1998, n=3,759	-	

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Chapter 2.1

National health surveys by mail or home interview: effects on response*

Abstract

Study objective - To study the effect of using a mail questionnaire or home interviews on the size and the selectivity of response to national health surveys.
Design- The interview survey and the mail survey were both carried out in the same country (the Netherlands) using the same sample frame, the same study period (1998) and collected partly the same data on demographic, socio-economic and health characteristics.
Setting – The Netherlands.
Participants – Dutch non-institutionalized inhabitants aged 25 years and over.
Main results - Response to the mail survey was lower (46.9%, n=3,664) than to the interview survey (58.4%, n=6,061). The mail survey gave higher response rates for women and lower response rates for persons with lower levels of education. Respondents to the mail survey reported lower rates of smoking but a slightly worse health status and higher figures on the use of health care services. No differences by method of data collection were found for age, marital status, region, household composition, work status and categories of body mass index.
Conclusion - Although the response of the mail survey was lower than the home interview survey, respondents showed generally small differences, with exception of level of education.

* Picavet, HSJ. National health surveys by mail or home interview: effects on response (submitted).
Part of data also published in: Picavet, HSJ, HWV van Gils, JSAG Schouten. Klachten van het bewegingsapparaat in de Nederlandse bevolking, prevalenties, consequenties en risicogroepen. CBS/RIVM (RIVM rapportnummer 266807002) Bilthoven, 2000.

Introduction

National health surveys are the main sources for data on many (public) health indicators. Data collection can be carried out by face-to-face interviews, telephone interviews, mail questionnaires or a combination of methods. In the Netherlands we often use face-to-face interviews carried out at home or mail questionnaires. The choice of the mode of data collection is determined by several factors, including available resources and response expectations. Face-to-face interviews surveys are much more expensive than mail surveys.[1] Several effects of mode of data collection on response are known.

First it is generally thought that response rates are better for interview surveys than mail surveys[2], some evidence for elderly is available.[3] Second, those who respond to interview surveys can be different from those who respond to mail surveys. There is some evidence that lower socio-economic classes are under-represented in mail surveys compared to interview surveys.[4] Third, people can respond differently to questions on paper than to questions asked by an interviewer. For instance, for some disability indicators it is known that systematically higher prevalences are found using self-administered questionnaires compared to interviews.[5] The same is found for other health indicators.[6-8] In addition, questions that can be affected by social desirability, e.g. alcohol consumption, using of car belts, are suspected to do better in self-administered questionnaires than in face-to-face interviews. However, information on height, household composition, work status is considered not to be affected by mode of data collection.[9]

For this paper we were able to study the response to a health mail survey and to a health interview survey, both using the same sample frame (population register), the same target population (the Dutch non-institutionalised population) and mainly the same topics and questions. The question of our study is: does using a mailed survey or an interview survey lead to different respons groups,? According to the (limited) data in the literature we expect (a) the response on the mail survey to be lower than on the interview survey, (b) that respondents to the mail survey with lower educational levels are underrepresented and (c) that population estimates on non-mode-dependent questions such as work status, number of persons in the household, height and weight, are not affected by mode of data collection. (d) Our last hypothesis is that population-based estimates of health indicators based on mail survey will represent a less favourable health status compared to the interview survey.

Methods

Two health surveys carried out in the Netherlands were analysed (1) the Netherlands Health Interview Survey (NetHIS) of 1998 which uses face-to-face interviews at home carried out by trained interviewers combined with a paper ques-

tionnaire, and (2) the baseline of the Dutch Musculoskeletal Complaints and Consequences Cohort study (DMC_3-study) which uses mail questionnaires. General characteristics of the two studies are presented in table 1. The NetHIS is a continuous survey started in 1981 and carried out by Statistics Netherlands. From 1997 the NetHIS is one module of the integrated system of face-to-face interviews of Statistics Netherlands. The DMC_3-study is carried out by the National Institute of Public Health and the Environment in collaboration with Statistics Netherlands. For the two surveys the same sample frame (population register) and sample method were used, although for the DMC_3-study this was a stratified sample. The sample frame provides us with data on date of birth, sex, marital status and address details of the persons in the sample. The surveys collected identical information for sociodemographic characteristics, health indicators, risk indicators and the use of health services. We have, however two exceptions: the questions on houshold composition and on educational level were much more detailed in the NetHIS than in the DMC_3-study.

The net response was calculated by dividing the number of respondents by the number of those actually approached excluding those who were known to be deceased or those whose address was unknown. These figures are presented for both surveys: for the total group and by sample frame characteristics, i.e. age group, sex, marital status and region. For NetHIS two response figures are given: one for the interview and one for questionnaire. After the interview, which is carried out by trained interviewers with laptop computers the interviewees were handed the paper questionnaire and asked to fill it in and send it back by free post return envelope.

In order to compare the results of the surveys, both surveys were weighted. Weighting factors were constructed in such a way that the distribution of both surveys by age, sex, region and marital status was equal to that of the Dutch population of 1998. The surveys were then compared for (1) sociodemographic characteristics (household composition, education, work status), (2) health indicators (perceived health, limitations in daily life, chronic conditions), (3) risk factors (smoking, body mass index) and (4) the use of health care services.

Household composition presents the number of persons living in the household. Level of education was measured as the highest level reached and then summarised in 4 groups: primary school, junior (vocational) education, secondary (vocational) education, vocational colleges/university. Work status is defined according to 4 categories: have paid work for more than 12 hours a week, does not have paid work for more than 12 hours per week but wants to have work for more than 12 hours a week, does not have nor wants work for more than 12 hours a week, and those who are work disabled or have a pension (at least everybody above 65 years of age). Perceived health was measured with the question, 'How do you rate your health using a mark for a school-report?' In the Netherlands these marks are between 1 and 10 with 10 as the best mark. The following groups were made according to other descriptions of health[10]: mark 1 to 5 (bad health), 6 to 7 (average health), 7.5 to 8.5 (good health) and higher than 8.5 (excellent health). Limitations in daily life was measured by a simple question 'Do you have any limitation in your daily activi-

ties due to a health problem?' For the assessment of chronic conditions a list of chronic health problems was used. The majority of the descriptions of chronic conditions were identical for the DMC_3-study and the NetHIS. These were: COPD (Chronic Obstructive Pulmonary Disease), sinusitis , coronary heart disease or other severe heart disease, hypertension, (consequences of) stroke, peptic ulcer, severe intestinal disorder, diabetes, thyroid disorders, epilepsy, dizziness and falling, migraine, severe skin disease and cancer.
For smoking 5 fixed response categories were used: every day smokers, occasional smokers, former every day smokers, former occasional smokers and never smokers. 'Occasional' smokers are those who smoke less than one cigarette a day. Body Mass Index (BMI) is calculated by dividing weight (in kilogram) by squared length (in meters) and was categorised as < 18.5 (underweight), 18.5-25 (normal weight), 25-30 (moderate overweight) and > 30 (severe overweight).[11] The use of health care services was measured identically in both surveys for contact with general practitioner (GP), medical specialist and physiotherapist. For the GP and the medical specialist two indicators were calculated: contact in the past 2 months and contact in the past year. For the physiotherapist only contact in the past year was measured.

Differences in results between the surveys were calculated using the weighted percentages and the 99% confidence limits were calculated using the standard errors of the unweighted prevalences.

Table 1 Overview of survey characteristics

	DMC_3-study	NetHIS
Period of research	September 1998- January 1999	January-December 1998
Sample	Two phase sample from population register, persons of 25 years and older, stratified by age (10 years groups) and sex	Two phase sample from population register
First contacts	Mail questionnaire with letter signed by hand	Advance letter and after a week visit of trained interviewer with structured questionnaire programmed in laptop computer
Extra contacts	1e reminder after 3 weeks (letter), 2e reminder after 6 weeks (response card, telephone or questionnaire)	A maximum of 3 home visits on different times, one reminder (letter) for the questionnaire
Duration	30-60 minutes for completion of questionnaire	Interview duration of 45 minutes on the average and 15 minutes for the questionnaire
Data collection	Questionnaire of 28 pages with routing indicated by colors and free post return envelope	Interview and questionnaire of 12 pages (which was left behind and could be sent by free post return envelope)
Contents	General characteristics (20%) Health characteristics (80%)	General characteristics (50%) Health characteristics (50%)

Table 2 Response for DMC_3-study (mail survey) and NetHIS (interview survey) by demographic characteristics available from the sample frame

	DMC_3-study			NetHIS				
	Sample	Response		Sample	Response interview		Response questionnaire†	
	Number	Number	%	Number	Number	%	Number	%
Total	*7818*	*3665*	*46.9*	*10378*	*6061*	*58.4*	*4970*	*47.9*
Men	3942	1641	41.6	4969	2907	58.5	2395	48.2
Women	3876	2024	52.2	5410	3154	58.3	2575	47.6
Age group								
25-44 yr	2552	1178	46.2	4760	2799	58.8	2288	48.1
45-64 yr	2741	1348	49.2	3629	2130	58.7	1795	49.5
65+ yr	2613	1139	43.6	1989	1132	56.9	887	44.6
Marital status								
Not married	1338	475	35.5	2076	1005	48.4	817	39.4
Married	5172	2626	50.8	6780	4278	63.1	3573	52.7
Widow	760	327	43.0	765	408	53.3	284	37.1
Divorced	548	237	43.2	737	370	50.2	296	40.2
Region of living*								
North	872	405	46.4	1130	697	61.7	572	50.6
West	3179	1453	45.7	4641	2432	52.4	2000	43.1
East	1770	831	46.9	2192	1414	64.5	1165	53.1
South	1997	976	48.9	2410	1518	63.0	1233	51.2

†These are the numbers of the persons who participated in the interview and also returned the supplement paper questionnaire.
*The Netherlands is divided into 12 provinces. Three provinces are combined to one region.

Results

The response to the interview of the NetHIS was higher (58.4%) than the response of the mail questionnaire of the DMC_3-study (46.9%) (table 2). Using a questionnaire as a second step after the interview survey gave some additional non-response, resulting in a net response to the NetHIS questionnaire of 47.9%. The mail survey gave higher response rates for women than for men whereas the NetHIS shows no differences by sex. The response patterns of the two surveys for age, marital status and region were similar. The response of persons of 65 years and over was slightly lower than of the other age groups. Those who were married show the highest response and those who were not married the lowest. By region of living we found a slightly lower response in the West, which is the most urbanised region of the Netherlands, including Amsterdam, Rotterdam and The Hague.

Table 3 Estimations of socio-demographic and health and health-related characteristics according to DMC_3-study and NetHIS, both surveys weighted for the Dutch population of 1998, and the differences between the surveys, incl. 99% Confidence limits.

	DMC_3-study	NetHIS	Difference†	99% CL	
	%				
Socio-demographic characteristics					
Household composition					
One person	16.7	17.4	0.7	(-1.3	2.7)
Two persons	40.6	39.5	1.1	(-1.6	3.8)
More than two	42.7	43.2	0.5	(-2.2	3.2)
Education (highest level reached)					
Primary school	14.5	21.1	6.6	(4.4	8.8)
Junior (vocational) education	34.7	26.0	8.7	(6.2	11.2)
Secondary (vocational) education	28.3	32.0	3.7	(1.3	6.1)
Vocational colleges, university	22.6	20.8	1.8	(-0.4	4.0)
Work status					
Have paid work > 12 hours /week	55.5	56.0	0.5	(-2.2	3.2)
Wants paid work > 12 hours /week	6.4	6.6	0.2	(-1.1	1.5)
Does not want paid work > 12 hours /week	14.9	15.0	0.1	(-1.9	2.1)
Pension, work disabled	23.2	22.4	0.8	(-1.7	3.3)
Health indicators					
Perceived health (by mark)*					
1-5 (bad)	6.2	6.3	0.1	(-1.3	1.5)
6-7 (average)	30.1	24.7	5.4	(2.8	8.0)
7,5-8,5 (good)	40.6	44.1	3.5	(0.7	6.3)
>8,5 (excellent)	23.2	24.2	1.0	(-1.4	3.4)
Limitations in daily life	12.7	16.6	3.9	(1.9	5.9)
Chronic conditions*					
COPD	8.1	7.8	0.3	(-1.2	1.8)
Sinusitis	11.8	9.6	2.2	(0.5	3.9)
Coronary heart disease or other severe heart disease	2.9	3.7	0.8	(-0.3	1.9)
Hypertension	11.9	11.1	0.8	(-1.1	2.7)
(consequences of) Stroke	0.8	0.9	0.1	(-0.5	0.7)
Peptic ulcer	1.9	1.5	0.4	(-0.4	1.2)
Severe intestinal disorder	4.0	2.2	1.8	(0.8	2.8)
Diabetes	3.1	3.0	0.1	(-1.0	1.2)
Thyroid disorders	2.6	1.8	0.8	(-0.1	1.7)
Epilepsy	0.6	0.5	0.1	(-0.3	0.5)
Dizziness and falling	2.9	1.8	1.1	(0.2	2.0)
Migraine	10.0	7.5	2.5	(0.9	4.1)
Severe skin disease	2.0	1.9	0.1	(-0.7	0.9)
Cancer	1.6	1.3	0.3	(-0.4	1.0)
Risk indicators					
Smoking*					
Every day	24.2	29.4	5.2	(2.8	7.6)
Occasionally	5.5	5.4	0.1	(-1.1	1.3)
Former every day	22.2	24.2	2.0	(-0.5	4.5)
Former occasionally	13.6	10.1	3.5	(1.6	5.4)
Never	34.5	31.0	3.5	(0.9	6.1)

(Table 3 cond.)

	DMC_3-study	NetHIS	Difference†	99% CL	
	%				
Body Mass Index					
< 18.5	1.5	1.7	0.2	(-0.5	0.9)
18.5-25	57.0	55.9	1.1	(-1.6	3.8)
25-30	33.1	33.7	0.6	(-2.0	3.2)
>30	8.4	8.8	0.4	(-1.2	2.0)
Use of health care services					
Contact with GP, past 2 months	46.2	36.6	9.6	(6.9	12.3)
Contact with GP, past year	76.9	77.3	0.4	(-1.8	2.6)
Contact with medical specialist, past 2 months	20.3	16.1	4.2	(2.1	6.3)
Contact with medical specialist, past year	35.3	40.8	5.5	(2.8	8.2)
Contact with physiotherapist, past year	22.7	18.9	3.8	(1.6	6.0)

*In NethHIS assessed by paper questionnaire

†Absolute difference of the prevalences of the two surveys.

Table 3 presents the estimations of different characteristics of the Dutch population aged 25 years and over according to the two surveys. These estimations were almost identical for household composition and work status, but for level of education we found that those with only primary school were underrepresented in the DMC_3-study with 14.5% compared to 21.1% in the NetHIS. If this figure is estimated on the basis of those who participated in the NetHIS and also returned the questionnaire, we get a percentage of those with only primary school of 19.5%. Of the NetHIS respondents who did not return the questionnaire 28.4% ($p<.01$) had only primary school. For the other characteristics there was no difference between the respondents of NetHIS who did and who did not return the questionnaire (not shown).

For the health indicators we see that estimated proportions of the extreme values of subjective/perceived health (bad and excellent) were the same for both surveys but that there was a small shift to better health in the NetHIS. In contrast with that the NetHIS reported a higher prevalence of persons with limitations in daily life (16.6% versus 12.7%), suggesting a worse health for the respondents of NetHIS. The estimated prevalences of 14 chronic conditions were the same in both surveys or slightly higher in the DMC_3-study. The latter was true for: sinusitis, severe intestinal disorder, dizziness with falling, and migraine.

The DMC_3-study gave a lower figure for every day smokers than the NetHIS, 24.2% versus 29.4% but the estimations of BMI-categories were the same for both surveys. The use of health care services (GP or specialist) during the past 2 months and contact with the physiotherapist during the past year was more often reported by the respondents of the DMC_3-study. The percentage persons with contact with GP during the past year was the same for both studies and the percentage with contact with medical specialist during the past year was relative lower in the DMC_3-study.

Discussion

In this study we found that a health *mail* survey had a lower response rate than a health *interview* survey but that the differences in the respondents by mode of data collection were small with exception of educational level.

Other studies also reported higher response rates for interview surveys than mail surveys.[3] However it is very difficult to make absolute statements about this because many other factors could have affected response such as study design differences. In our study one important drawback of the mail survey was the length of the questionnaire. The questionnaire was rather long, with 28 pages. However, the questionnaire was divided in a few parts indicated by coloured paper and if a screening question was negative many pages could be skipped. There is some evidence that long questionnaires affects response negatively[12,13], although one study did not found a difference in response by using a 4 page or 16 page questionnaire.[14] We think that the response of the mail survey would have been higher if we had used a much shorter questionnaire but then the amount of information gathered would have been much less.

In both surveys analysed in this paper, high risk groups for low response were: higher age groups (65 years and over), and those who were not married (anymore), and this was found before.[13-17] Usually men were also underrepresented but we did not found this in the NetHIS. We found no differences between the mail survey and the interview survey with regard to age, marital status and region of living. Other studies also reported no difference by region[18] although rural areas had a slightly higher response than urbanised areas.[13] For the demographic characteristics, we conclude that our national mail and interview surveys with respect to health-related topics have similar, slightly selective, response.

An under-representation of lower socio-economic groups in the mail survey has been found before, regardless the indicator being income levels[17,19] or level of education.[14,20] However, also examples exist with no differences in response by income groups.[21] Because level of education is in general such an important determinant of health[22] and health-related behavior[23] it was important to look for response bias due to educational level. Unfortunately there is no other source than population surveys for the information on the distribution by level of education in the Netherlands. So it is impossible to say whether or not the estimations of the surveys represent an under- or overestimation. This study indicates that those with only primary school were less likely to respond to a mail questionnaire than to an interview survey.

For a health survey it was also important to identify response bias due to health. What are the health characteristics of respondents and non-respondents? In general it is suggested that respondents to health surveys are the 'worried well'[24]: healthy individuals who see their doctor regularly and follow healthy life-style practices. Our study showed that the mail survey gave higher rates of health care utilisation and a lower prevalence of smoking compared to the health interview

survey. The overestimation of the utilisation of health services by mail surveys was found before[25,26] and the same was true for the underestimation of smokers.[20,27] The mail survey gave a slightly more unhealthy picture of the population than the interview survey, based on subjective health and a few chronic conditions. However, in contrast to what we expected[5] the prevalence of limitations in daily life was higher in the interview survey than in the mail survey. Examples of studies on non-response bias with respect to health characteristics are mail surveys among the very elderly and non-response bias was often found[9] due to bad health and diminished cognitive functioning[28], affecting health-related estimations more than factual information.[9] Elderly non-responders also had higher death rates.[9,24] In general we can expect that health surveys miss the very unhealthy part of the population and that respondents of mail surveys can be described as the 'worried well'. It was important to note however that although some of the differences between the NetHIS and the DMC_3-study are statistically significant the differences in terms of percentage points are small. A lack of differential non-response in comparing mail surveys and interview surveys was also found in other studies.[21,29]

A limitation of this study is that both surveys have a rather low response. Surveys in the Netherlands are in general confronted with lower response rates than health surveys elsewhere in Europe[30], or compared to mail surveys published in medical journals[31] despite intensive efforts to reduce non-response. General guidelines to increase motivation for participation[32] were used where possible, including an interesting topic (health), confidentiality, a good reputation of the two organisations responsible for the surveys, approval by official institutions, use of advance letters in the home interview survey, repeated contacts (with a maximum of three), use of trained interviewers and attractive questionnaires. Systematic differences in health and health-related topics between those participating and not participating in health surveys – whether or not by mail or interview - are possible. If such extreme groups exist we are never able to investigate them but they do not differ in terms of sociodemographic characteristics and they do hardly differ between a mail or interview survey.

An additional limitation is the difference in time period of data collection between the NetHIS (all year in 1998) and DMC_3-study (september-december 1998). In 1998 the response to the NetHIS per month varied from 55.7% (June) to 64.1% (october). Response figures of the NetHIS does not differ per trimester, except that the response to the NetHIS is somwhat lower in the summer months due to holidays. There is also no systematic variation in health prevalences by month or season.[10]

Differences in sponsorship or themes of the surveys can also contribute to the response. Statistics Netherlands was involved in both studies and in the DMC_3-study also the National Institute of Public Health. Both organisations are national government-associated non-profit organisations. We do not think that differences in the perception exist or should have affected response rates. Because the focus of the DMC_3-study was on musculoskeletal health problems, and the NetHIS was a general health survey, the response could have been higher for those with muscu-

loskeletal health problems than for those without musculoskeletal health problems. Because musculoskeletal health problems are very common this would not have affected the response rate but an overrepresentation of musculoskeletal health problems can be expected. For limitations in daily life, however, we found a higher prevalence in the NetHIS than in the DMC_3-study.

Our comparisons showed that the response was lower on the mail survey than the interview survey, that responders with lower educational levels are underrepresented in the mail survey, and that estimates of questions such as work status, number of persons in the household, height and weight, are not affected by mode of data collection. Our fourth hypothesis, stating that population-based estimates of health indicators based on mail survey will represent a less favourable health status compared to the interview survey, is not confirmed for all health indicators. In general, we can conclude that the differences in respondents between interview surveys or mail surveys are no reason for great concern.

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Chapter 2.2

Comparing survey data on functional disability: the impact of some methodological differences*

Abstract

Study objective - To examine the impact of some differences in survey methodology on the prevalences of functional disability in population based surveys of the elderly.
Design and methods - Nine surveys of Dutch people aged 55 years and older were compared to investigate differences in the method of data collection (proxy questioning, yes/no; interview versus self administered questionnaire) and construction of the questionnaire (wording of introductory text, activities, and response categories). The effect of these differences on prevalences in three domains of functional disability - activities of daily living, mobility, and communication - were studied. Both univariate analyses and multivariate logistic regression were used to quantify the methodological influences.
Results - No effect of proxy questioning could be shown. Self administered questionnaires yielded higher prevalences of disability than interviewer administered questionnaires - in particular for mobility (odds ratio 1.4, 95% confidence interval 1.3, 1.6) and communication (OR=1.7, 95%CI 1.5, 1.9), resulting in prevalence differences of 9 and 11 percentage points respectively. Seemingly minor differences in the structure and wording of the questionnaires resulted in major differences (up to 15.6 percentage points) in prevalence estimates of functional disability. These differences were associated with the severity level of the disability indicated by the wording of the questions.
Conclusions - Differences in survey methodology have a substantial effect on prevalence estimates of disability in the elderly. These differences should be taken into account when making international comparisons and studying time trends based on survey data.

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Introduction

Information on disability is used increasingly to monitor and evaluate public health because disability figures reflect the burden of health problems in relation to chronic diseases and the ageing of the population. The main source of disability data is still the population survey (household survey, health interview survey),[1] by means of which information on a target population is obtained by structured questioning of a sample. Nowadays, many countries have experience with population based surveys[2] and questions on disability are included in most of the health interview surveys in the European region, USA, Canada, Australia, and Japan.[3] Survey data on disability are used to describe the health of a population both as prevalences of disability and as "disability free life expectancy", a public health measure that combines disability prevalences and mortality figures.[4]
The availability of these data tempts researchers and policy makers to make comparisons - are there any differences in the prevalences of disability between regions, between countries, or over time?[5,6] To be able to attribute differences in disability prevalences and/or disability free life expectancy between countries and in time to *real* health differences, however, it is necessary to understand the comparability of survey data on disability prevalences.[7] Surveys that provide the figures on disability may differ considerably in their methodological procedures, and these differences probably affect the interpretation of differences in the prevalences of disability. Little is known about the size of these methodological effects. Furthermore, where systematic methodological effects can be identified these findings can be used to make different surveys more comparable.

Over the past years a number of population surveys have been carried out in The Netherlands, each providing data on functional disability in the Dutch population aged 55 years and more. These surveys differ in their methodology and we wished to determine whether or not differences in the estimated prevalences of disability were due to these methodological differences and what size these differences are.

Differences in methodology that can affect the comparability of data from population based surveys are to be found in:

- Sampling methods,
- Methods of data collection; and
- Instruments used

A sample that represents (a part of) the population of a country can be drawn by a variety of methods such as address or postal files, electoral registers, population registers, or telephone directories. In many cases at least two sampling stages can be distinguished. The sample design can have a major impact on the prevalence of disability as a result of unequal probabilities in selecting the sample unit.[8] When these unequal probabilities are known, the results of the survey can be weighted in order to obtain a data set that is representative for the target population. These weighting procedures are analogous to the procedures that are used to adjust for

age differences. Most sample frames for health surveys exclude people living in institutions such as nursing homes, which implies the exclusion of a group of probably severely disabled elderly. This should be taken into account when data from a survey which excludes institutionalised people is compared with a survey that includes people in institutions. The same is true when comparing surveys that provide data on target populations for which very different criteria for nursing home admission are present, particularly when data from different countries are compared.
The method of data collection refers to the choice of using either interviewer administered techniques, self completion, or both, and whether to use proxies. The validity of proxy responses has been investigated before.[9-12] For the assessment of functional disability a proxy effect for minor disabilities (under-reporting by proxy) might be expected but not for obvious and long standing disabilities. There is some evidence that self administered (written) questionnaires show systematically higher prevalences of disability than interviewer administered questionnaires.[13,14]
It is indisputable that different instruments may yield different results. Often, however, there is a high similarity between instruments designed to measure the same concept of "functional disability" with only slightly different wordings of the actual questions or a different number of activities, or both. It is important to know the extent to which these seemingly unimportant differences between instruments affect the estimation of prevalences of functional disability, even more so because it has already been shown that activities of daily living (ADL) prevalences differ substantially between surveys in the USA.[15]

In this paper, we will describe the impact of some differences in the construction of the instruments and differences in the method of data collection on the prevalences of functional disability.

Methods

The material
Nine different surveys concerning elderly Dutch people provide unique material with which to study the effect of methodological differences. The data consist of a number of years of the continuous Netherlands health interview survey (HIS: 1983, 1984, 1985, 1989, 1990) and three multipurpose surveys: the continuous Netherlands quality of life survey (QLS: 1989, 1990), the quality of life survey of the elderly of 1982 (QLE82), and the public service survey of 1987 (PSS87). Like the HIS, these multipurpose studies collect information on health characteristics.

The general characteristics of the surveys are summarised in table 1. All the surveys provided data on a probability sample of the non-institutionalised population aged 55 years and older. The exclusion of people living in institutions - mainly homes for the elderly and nursing homes, but also prisons - is a common procedure in health interview surveys. Because the prevalence of functional disability among the institution-

alised population will be relatively large, the prevalences based on these surveys will be an underestimation of the total absolute prevalences in the population. Because all the surveys excluded the institutionalised population of the same target population, however, it will not distort the comparisons.

Table 1 Characteristics of the surveys

General	
Names/years	Netherlands health interview survey 1983-1990 (HIS) Quality of life survey of the elderly 1982 (QLE) Public services survey 1987 (PSS) Qality of life survey 1989-1990 (QLS)
Population	Non-institutionalised Dutch population: the analysis relates to the elderly, i.e. those aged 55 years and older
Sample method	Two stage sample of households or two stage sample of individuals
Response	±60%
Respondents 55+	numbers between 1040 and 4283, total more than 25000 elderly
Measurement of functional disability	
ADL	<Difficulty or needing help with> eating and drinking, getting in/out of a chair, getting in/out of bed, (un)dressing, transferring from one room to another on the same level, walking stairs, entering/leaving the house, transferring outdoors, washing hands and face, washing entirely
Mobility	Carrying an object of 5 kg - for instance a shopping bag – for 10 m, bending down and picking something from the floor, walking 400 m without standing still
Communication	Hearing what is said in a normal conversation with 3 or more other persons/with one person, eyesight good enough to read ordinary newspaper print/to see the face of someone from 4 m

Different levels of disability are represented in different response categories

All surveys were carried out by trained interviewers/pollsters who visited people at home, and used questionnaires, part of which, in some cases, was left behind and collected later. Thus, part of the data collection was oral and some written. None of the surveys used telephone interviews or self-administered postal questionnaires.

Functional disability

Using a list of activities (or functions), functional disability was measured by asking the respondents to state whether they had difficulty carrying out the acitivity, needed help, or were unable to carry out the activity. The list of activities was adapted from the OECD indicator for long term disability[16,17] to which some ADL items had been added. The original OECD indicator as well as the ICIDH[18] had been constructed on the basis of the concepts described by Wood.[19] Questions on mobility, eg walking, communication, eg hearing and seeing, and ADL activities are part of the most essential questions on disability to be used in survey research.[20] The number of activities differed per survey (see table 2).

Methodological differences

In general, the survey designs were very similar so we had the unique possibility of quantifying the effects of the seemingly minor differences in survey characteristics. The methodological differences that could be studied were: differences in the methods of data collection and in the construction of the questionnaires.

Data collection - Two aspects of the method of data collection could be studied: allowing a proxy to be interviewed and the use of interviewer administered *versus* self administered questionnaires. In some data years of the HIS, the use of proxies for people who were not at home or were unable to respond was a standard procedure for the interview administered questionnaire. In 1989 and 1990 a self administered questionnaire was used as well as the interview, and this was left behind by the interviewer and collected later. Because the ADL questions were part of the interview in those years (and therefore possibly answered by proxies) and the mobility questions were part of the written questionnaire (and thus answered by the respondent) it was possible to compare the prevalence of disability reported by proxies with that reported by the people themselves.

Questionnaire construction - With regard to the construction of the instruments, three aspects were studied. The first concerns the possible effect of using an introductory text to the questions on disability. Some surveys included an introductory text to the questions on mobility and communication which emphasised that the questions referred to *longstanding* disability. Although the original OECD instrument aimed to assess long term disability, temporary problems were not necessarily excluded. The introductory text aimed therefore to prevent the reporting of *temporary* activity limitations. Comparison of the estimated prevalences in the surveys concerned should give an indication of the effect of the introductory text. If temporary disability is reported, the prevalence is likely to be higher.

The second aspect concerns the effect of the wording of the activites, how they are described. Within all domains of disability some items are phrased slightly differently across the surveys. These differences in wording will be described in detail in the results section. The original questions were, of course, phrased in Dutch. The translations used in this article are as literal as possible and do not necessary represent normal phrasings in the English language or should give the same results when used in these translations. The results should be seen as an illustration of the potential effect of differences in wording of the activities.

The third aspect of questionnaire construction concerns the response categories. All surveys used questions on disability with response categories which included levels of severity - for example, "with difficulty", "needing help", or "unable to carry out the activity" (the D variant (of Difficulty)). The effects of differences within this D variant were studied. The response categories for the disability for hearing and seeing are either phrased as a D variant or in terms of the *evaluation* of the ability to hear or see: <can see/hear>, well, moderately, badly, not at all (the E variant (of Evaluation)).

Table 2 Methodological characteristics and adjusted prevalences by domain of disability, per survey. All surveys are conducted in the Netherlands among the non-institutional population of 55 years and older. Prevalences include the least severe severity level that was assessed in the survey.

	Survey								
	HIS83	HIS84	HIS85	HIS89	HIS90	QLE82	QLE89	QLS90	PSS87
No. of respondents aged 55+	2060	2119	2017	1924	1694	4283	8448	1283	3840
Activities of daily living (ADL)									
Methodological differences:									
Method of datacollection (i=interview, s=self administered)	i*	s	s	i*	i*	i	i	i	s
Contruction of response categories									
Distinction between minor and major difficulty	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Including "not able to"	Yes	Yes	Yes	No	No	No	Yes	Yes	No
Including "only with help"	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Prevalences (55+)									
Eating and drinking				2.4	2.3	0.5	2.3	2.1	1.4
Getting in/out of a chair				15.7	16.3	6.8	18.6	16.5	11.2
Getting in/out of bed	3.8	4.6	4.9	11.4	12.7	5.2	9.8	9.7	10.0
(Un)dressing†	4.8	7.0	6.0	7.5	9.7	6.1	9.1	8.6	9.5
Transferring one level	3.5	4.7	3.8	6.0	6.2	2.4	5.8	6.8	5.5
Walking stairs†	26.2	29.4	29.3	22.3	24.4	17.4	27.8	29.6	20.7
Entering/leaving the house				7.9	9.4	4.6	8.5	8.8	7.8
Transferring outdoors				15.2	17.0	11.4	21.7	20.8	15.5
Washing face and hands				2.4	2.8	1.0	3.8	3.1	2.1
Washing entirely				6.8	8.5	4.0	8.4	7.6	6.9
One ADL or more‡	26.7	30.2	29.9	28.3	32.0	21.9	34.3	34.5	24.7

cont.

Mobility									
Methodological differences:									
Method of datacollection (i=interview, s=self administered)	i*	s	s	s	s	i			s
Emphasis on long duration of disability in introduction	No	No	No	Yes	Yes	No			No
Prevalences (55+):									
Carrying 5 kg for 10 m	30.9	34.3	33.0	33.1	32.1				
Bending and picking up	24.2	32.0	29.8	26.4	25.2				
Walking 400 m†	27.1	34.4	33.4	23.4	22.5	18.2			18.2
Disability in Mobility‡	44.7	54.8	52.8	41.4	38.4				
Communication									
Methodological differences:									
Method of datacollection (i=interview, s=self administered)	i*	s	s	s	s	i	i	i	i
Emphasis on long duration of disability in introduction	No	No	No	Yes	Yes	No	No	No	No
Construction of response categories (D=descriptive, E=evaluative):§	D	D	D	D	D	E	E	E	E
Prevalences (55+):									
Conversation 3 or 4 persons†	16.7	21.9	21.1	20.3	20.2	19.5	12.2	10.8	24.8
Conversation 1 person	5.2	6.6	7.2	6.2	6.2				
Reading normal letters	11.6	23.2	24.3	21.3	22.5	15.5	15.3	14.9	16.3
Seeing on a distance†	6.9	11.2	10.0	10.6	10.7	13.2	14.7	13.2	7.7
Communication disability‡	26.4	36.6	38.3	35.1	34.1	31.3	21.3	18.9	34.0

* Proxyquestioning allowed; † wording of function can differ per survey; ‡ the aggregated prevalence rates are based on all available items per survey; § Descriptive = <Can do activity> without difficulty, with minor difficulty, not able to; evaluative = <Can do activity> good, moderate, bad, not at all.
HIS = Netherlands health interview survey; QLE = quality of life survey of the elderly; QLS = quality of life survey; PSS = public services survey.

Analysis
Univariate and multivariate statistical analyses were performed as was visual inspection of the data. For each survey, the estimated prevalences of functional disability, per item as well as aggregated per domain of disability, are presented in table 2. These prevalences were adjusted for differences in the age-sex composition of the respondents and for differences in sample design. In such a table it is not feasible to present the statistical differences between every two surveys. In all cases a difference of 5 percentage points was statistically significant ($p<0.01$). In most cases a lesser difference approaches statistical significance. Differences between prevalences were described as the absolute difference in percentage points (prevalence difference) and as the ratio between the two prevalences. Multiple logistic regression was used to calculate the relative effects of some of the methodological differences.

Results

The methodological differences and prevalences per disability item and aggregated per domain of disability are presented in table 2. For the three different domains of disability, the aggregated prevalences differed significantly per survey. The percentage of people of 55 years and older who reported at least minor difficulty with at least one ADL item ranged from 21.9% to 34.5%. These figures were 38.4% and 54.8% for disability in terms of mobility, and 18.9% and 38.3% for problems with hearing and/or seeing.

When surveys used identical methods, however, the estimated prevalences were very similar. This is true for the survey pairs HIS84 and HIS85, HIS89 and HIS90, QLS89 and QLS90, and for all domains of disability.

The great variations in disability prevalences across surveys that used different methods and similar prevalences for surveys with identical methodology reflected the impact of methodological differences.

Proxy questioning
Interviews involving proxies are a common feature of the Netherlands health interview survey. For the elderly population, the percentage of proxies is about 21% for men and 5% for women, which is much lower than the percentage for the entire population, which is 30%. The main reasons for proxy interviews were "not at home" (because of work, shopping, hobbies, or other activities) (more than 70%) and "unable to" because of illness (at home or in hospital). Because the proxy group consisted of apparently healthy persons on the one hand and severely disabled on the other, it is not known what the expected mean health status of this group is compared with the non-proxy group. Table 3 presents the prevalences of disability in

terms of ADL and mobility for all persons for whom a proxy was interviewed and for all persons who were interviewed themselves. The average health status seemed to be better in the proxy than in the non-proxy group. This held true for disability in ADL, which can represent a proxy effect, and it also held true for disability in mobility, which cannot represent a proxy effect. At an aggregated level, there was no indication of under-reporting or over-reporting of disabilities by the use of proxies.

Table 3 Reporting of disability in activities of daily living (ADL) and in mobility by proxy and non-proxy group (which only counts for ADL)

	HIS89/90 respondentes for ADL	
	Non-proxy	Proxy
No of people	3156	462
ADL (interview)	31.1%	22.7%
Mobility (self administered)	42.9%	27.1%

HIS=Netherlands health interview survey

Interviewer versus self administered questionnaires

To measure the effect of interviewer versus self administrated questionnaires, HIS83 and HIS84/85, and QLE82 and PSS87 were compared. Separate comparisons were necessary because HIS83-85 and QLE82/PSS87 used different response categories. The differences are summarised in table 4. For all domains of disability, self administered questionnaires showed systematically higher prevalences, with disability in mobility and communcation showing higher differences than disability in ADL. In most cases the prevalence difference of the aggregated prevalences was higher than the mean prevalence difference of the single items. The effect of the method of data collection seemed to accumulate in the aggregated prevalences. Using self administered questionnaires increased the measured aggregated prevalence of disability in communication by an absolute difference of 11.0 percentage points (that is, a relative increase of 42%) and for the prevalence of disability in mobility by an absolute difference of 9.0 percentage points (that is, a relative increase of 20%). For disability in ADL these figures were 3.4 (13%) and 2.6 (12%) respectively for the two methods (HIS83 *versus* HIS84/85 and QLE82 *versus* PSS87 respectively).

Emphasis on long duration of disability in an introductory text

The effect of mentioning *explicitly* a long duration of disability on prevalences was studied for disability in mobility and in communication by comparing HIS89/90 (duration emphasised) with HIS84/85 (not emphasised) (see table 5). Because of the five year gap between the two surveys, real changes in prevalences can not be ruled out. Since very large changes in prevalences are unlikely over such a period, however, the dramatic decrease in prevalence was mainly due to the difference in methodology, in particular for disability in mobility.

Table 4 Differences of prevalences of functional disability between self administered and interview surveys

Surveys compared	Domain of disability	Differences across single items		Difference for aggregated prevalence	
		Prevalence difference	Prevalence ratio	Prevalence difference (+95%CI)	Prevalence ratio
		mean (range)	Mean (range)		
HIS83 vs HIS84/85	ADL	1.6 (0.3-3.2)	1.24 (1.09-1.46)	3.4 (1.0, 5.7)	1.13
	Mobility	5.4 (2.1-7.8)	1.21 (1.07-1.32)	9.0 (6.4, 11.6)	1.20
	Communication	5.6 (1.4-12.7)	1.55 (1.26-2.10)	11.0 (8.6, 13.4)	1.42
QLE82 vs PSS87	ADL	3.1 (0.9-4.8)	1.83 (1.36-2.80)	2.6 (0.8, 4.4)	1.12

HIS = Netherlands health interview survey; QLE = quality of life survey of the elderly; PSS = public services survey

Table 5 Differences in the prevalences of functional disability of surveys that used or did not use an introductory text that emphasised the long duration of the disability

Domain of disability	Differences across single items		Difference for aggregated prevalence	
	Prevalence difference	Prevalence ratio	Prevalence difference (+95%CI)	Prevalence ratio
	mean (range)	Mean (range)		
Mobility	-5.7 (-10.1-1.0)	0.83 (0.68-0.97)	-13.7 (-15.9, -11.5)	0.74
Communication	-0.9 (-1.9-0.0)	0.94 (0.9-1.00)	-2.8 (-4.9, -0.07)	0.93

The use of the introduction lowered the estimated prevalence of disability in mobility by 13.7 percentage points. Where there was no emphasis on the long duration of disability, up to 26% of the reported disability in mobility could be attributed to temporary disability. This finding held true for the separate mobility items, although the comparison for the item "walking" was hampered by differences in wording of the function (see below). When the duration of the disability is not emphasised, temporary problems with mobility can also be reported. The lack of effect on the prevalences of problems in hearing and eyesight of emphasising the long duration of disability, indicated that these problems are of a permanent nature when they are reported.

Differences in wording of the functions

The effect of differences in the wording of the function was studied for five items - walking stairs, dressing, seeing, hearing, and walking a certain distance. For the item "walking stairs" the wording in HIS83 and HISS4/85 was: "Can you walk up and down a staircase of 15 steps without standing still?". In the other surveys; "walking stairs" was part of the ADL list, which is more generally phrased. HIS83 and HISS9/90 were comparable because they both assessed this disability by self administered questionnaire. The phrasing in HIS83 resulted in a slightly higher estimation of disabilities than the general wording. This was true, in particular, for severe disabilities: the percentage of the elderly who reported inability to climb the stairs was 7.3% in HIS83, while in HIS89/90 the mean percentage of elderly who reported that they were able to climb stairs only with help was 3.4% (prevalence difference: 3.9, 95% CI 2.6, 5.2). The addition of the phrase "without standing still" in HIS83 probably made the function more difficult to perform.

Unlike all other surveys, QLE and PSS incuded the phrase "putting on shoes" in the item "(un) dressing" which might have made it a more difficult activity to perform. For these surveys the mean prevalence of disability with dressing was 7.7%, for all other surveys it was 7.2%. The main problem in this comparison was that QLE and PSS also used different response categories which probably resulted in lower prevalences (see next paragraph), indicating that the extended phrasing of the item resulted in (relative) higher prevalences.

To investigate problems with eyesight, the two questions most commonly used were: "Is your eyesight good enough to read ordinary newspapers print?" and "Is your eyesight good enough to recognise a face at a certain distance?". For the recognition of a face at a certain distance there were two main ways of asking - seeing at a specific distance (4 metres, on the other side of the room) and just "seeing on the street". The mean prevalences for these two variants were 9.2% (HIS and PSS) and 13.4% (QLE and QLS) respectively (prevalence difference 4.2, 95% CL 3.2, 5.2). Within the elderly, in particular, problems with eyesight are very diverse. This diversity can lead to serious problems when disability in seeing is to be assessed

with such global questions. The observed differences in prevalences when questions have different wording illustrate this.

Three methods were used to assess problems with hearing. PSS and QLS simply asked whether the hearing of a person was good, moderate, or bad, on the basis of which a mean of 22% of the respondents reported problems. The HIS questionnaires included two questions on the degree of difficulty, that is, "Can you hear what is said in a normal conversation with three or four other persons?" and the same question with one other person (both despite hearing aid, if usually worn). Of the elderly, 19.9% reported problems with one or both of these hearing functions. Whether or not the wording of the function or the construction of the response categories had any effect on prevalence is unknown because both differed and could have had an (adverse) effect.

The greatest variation in the phrasing of questions on functional disability between the surveys concerned the function of walking. Differences included the wording of the time of walking, the distance (400 metres or one block), the use of an aid such as a cane, and the level of difficulty. Comparing these was quite problematic because apart from these differences the method of data collection and the duration of the disability also played a part. As an illustration, the five versions of the question on walking disability and the prevalences are presented in table 6. The absolute difference can be as big as 15.3 percentage points when two self administered surveys are compared: HIS85 *versus* PSS87 (95% CI 12.9,17.7). Even for the estimation of the elderly population with the most severe disability in mobility ("not able to walk") the prevalences varied from 4.2% to 15.9%.

Differences in response categories

In the response categories, the level of difficulty with an activity may be indicated (the D variant) or the activity can be evaluated in terms of "good, moderate, bad" (E variant). With regard to the D variant, which is used with the ADL questions in all surveys, two differences are studied: the distinction between minor and major difficulty and the distinction between "unable to" and "needing help" as the most severe level of disability.

In the HIS (all years) and the QLS, a distinction between minor and major difficulty was made, whereas no such distinction existed in QLE82 and PSS87. Where this distinction was made, higher prevalences were found for almost all ADL items, comparing the percentage reporting at least "minor difficulty" with the precentage reporting at least "difficulty". Furthermore, it can be shown that the percentage who reported "major difficulty" was systematically lower (see figure 1). This indicates that the response category "with difficulty" does not cover "minor and major" difficulty but represents something in between. As a consequence these absolute prevalences have become incomparable.

Table 6 Prevalences of walking disability for five variants in wording of the question and/or differences in method of data collection, non-institutional population 55+, the Netherlands

QLE82, interview	
How long can you walk without help?	
> 40 minutes	71.0
30-39 min	5.5
20-29 min	5.3
10-19 min	7.4
< 10 minutes	6.6
Not able	4.2
PSS87, self administered	
Walking for ten minutes without standing still	
Without difficulty	81.9
With difficulty	14.0
Only with help	4.1
HIS83, interview	
Can you walk 400 metres without standing still?	
Without difficulty	72.9
With minor difficulty	9.2
With major difficulty	5.1
Not able	12.8
HIS85, self administered	
Can you walk 400 mtres without standing still?	
Without difficulty	66.6
With minor difficulty	12.4
With major difficulty	5.1
Not able	15.9
HIS89, self administered	
<Emphasising long duration of disability>	
Can you walk 400 metres without standing still (using a cane if necessary)?	
Without difficulty	76.6
With minor difficulty	10.2
With major difficulty	3.5
Not able	9.7

HIS = Netherlands health interview survey; QLE = quality of life survey of the elderly; PSS = public services survey

The other difference in the response categories for the ADL could be found in the wording of the most severe response category. HIS83-85 used "unable to", HIS89/90, QLE82, and PSS87 used "only with help", and QLS89/90 used both.

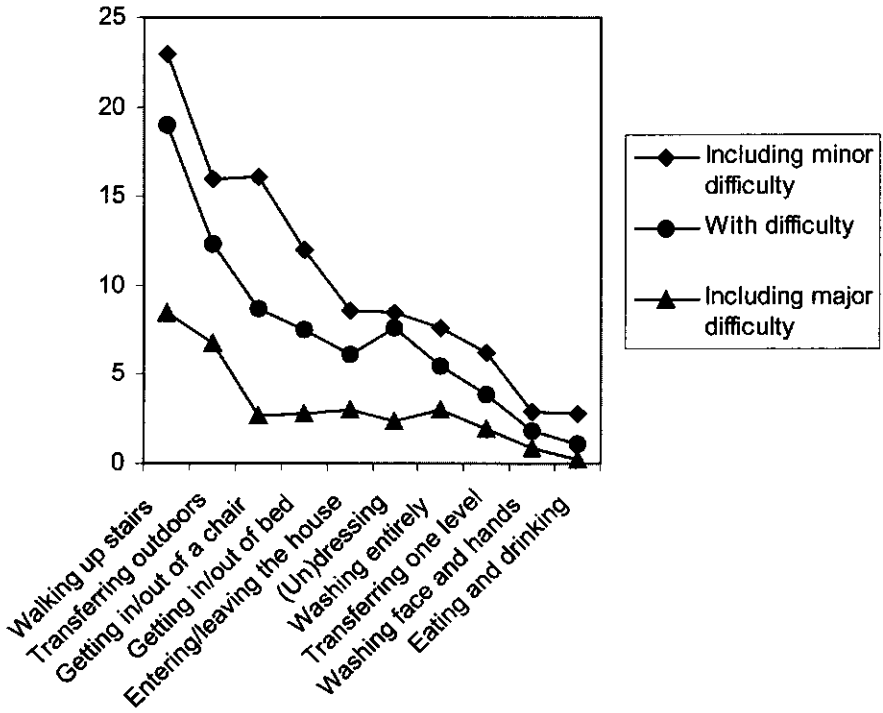

Figure 1 Prevalences of activities in daily living (ADL) disability in relation to different response categories for each ADL item. The prevalences for the disability levels "including minor difficulty" and "including major difficulty" were based on the Netherlands health interview survey 1989/1990; data for the disability level "with difficulty" were derived from the quality of life survey of the elderly of 1982 and the public services survey of 1987.

There was considerable variation in the estimates of the size of the group of elderly suffering from the most severe ADL disabilities (not shown). These different phrases used to describe the most severe ADL disabilities were not interchangeable, which was also illustrated by the observation in QLS89/90 that both categories were "filled". Exclusion of one of these responses might have hampered the classification of severity and it might also have affected the interpretation of the other response categories.

The D variant and E variant can be compared for the questions on disability in seeing. QLE82, QLS89/90 and PSS87 used response categories in evaluative terms. A comparison of the prevalences on the basis of PSS87 and HISS9/90 (both self administered questionnaires) showed that the E variant lead to lower prevalences than the D variant. This is particularly true for the most severe category: the estimated prevalence among those whose eyesight was too bad to read ordinary newspaper print (despite glasses) was 5.1% for HIS89 and 1.4% for PSS87 ($p<0.01$). The figures for recognising a face were 2.9% and 0.4% respectively ($p<0.01$). These different response categories yielded different, and therefore incomparable, prevalences.

Table 7 Multivariate logistic regression: the effects of the main methodological differences on the aggregated prevalences of disability*

	Odds ratio (95% CI)
Model for ADL disability	
Method of data collection	1.17 (1.09, 1.27)
Response categories	
Differences in difficulty	1.53 (1.39, 1.69)
Including category "not able to"	1.22 (1.09, 1.37)
Including category "only with help"	1.44 (1.28, 1.62)
Model for disability in mobility	
Method of data collection	1.44 (1.29, 1.60)
Introductory text	1.74 (1.59, 1.91)
Model for disability in communication	
Method of data collection	1.67 (1.49, 1.87)
Introductory text	1.13 (1.03, 1.24)
Response categories	1.19 (1.07, 1.32)

*The methodological characteristics were included in the models as follows: for method of data collection: 1 = selfadministered, 0 = interview administered, for response categories in the disability in communication model: 1 = D variant, 0 = E variant, for the other models: 1 = characteristic presnt, 0 = characterisic absent.

Multivariate analyses

The results of the multivariate logistic regression are presented in table 7. The main methodological differences were included in the model as dummy variables. The methodological effects that were identified by the univariate analyses were still present in the multivariate analyses. The results can be summarised as follows: written self administered surveys provided consistently higher aggregated disability prevalences than interviewer administered surveys and differences in the actual instrument (introductory text and response categories) had significant effects on the estimated prevalences.

In addition to this we observe that for disability in ADL and disability in mobility, the effects of differences in the construction of the instrument were more important than those related to the method of data collection. For disability in communication, the effect of differences in the method of data collection was more pronounced.

Discussion

The finding that different surveys yield different estimates of the size of the (elderly) population with disabilities had already been reported for ADL disabilities on the basis of surveys carried out in the USA.[15] Our study shows that the prevalences of disability in mobility and communication can be added to the list of disability prevalences that differ across surveys, although this held true only for surveys that differ in methodology. Identical surveys yielded the same prevalences for functional disability, both for the aggregated prevalences and the prevalences per item. All methodological differences studied in this study were shown to affect appreciably the

prevalences of disability, with exception of the proxy effect. At the aggregated level we could not show that the use of proxies yielded higher disability prevalences, a finding which had previously been reported.[9-12]

The finding that self administered questionnaires yielded higher prevalences than interview questionnaires is consistent with published reports.[13-14] Prevalences for disability in ADL, mobility, and communication based on self administered surveys are 13%, 20%, and 42% respectively higher than those in interview based surveys, resulting in prevalence differences of up to 11 percentage points. Self administered instruments and interviewer instruments are therefore not equivalent, although more research is needed to determine which of these is the most valid.

The use of an introductory text which emphasised the long duration of the disability reduced the prevalences of some of the disabilities, as would be expected if temporary disability were reported when the introductory text was omitted. More than 25% of the estimated elderly population with disability in mobility can be due to reporting of temporary disability.

The most striking result of this study was the major difference in estimated prevalences due to seemingly minor differences in instruments (wording of activities and of response categories). This was mainly due to the assessment of the degree of difficulty in performing the activity, which was defined by the exact wording of the activity and the wording of the response categories. The actual wordings of the disability questions define the threshold for the disability that will be identified. When there are differences in the wording of these questions, even seemingly minor ones, different prevalences of disability result.

These results were based on comparing data that were already available and were not collected for the purpose of investigating methodological differences. The design is not therefore ideal for the study of methodological influences on the outcome of surveys. Alternative factors that could have contributed to the differences between the surveys are differences in the *selectivity* of the relative high non-response and/or large shifts in the real prevalences of disability per year. However, the systematic similarity of the results of surveys that used identical methodology makes these hypotheses very unlikely.

To quantify health differences between groups, we need comparable data of the prevalences of health problems. For the quantification and monitoring of health problems in an ageing population, data on functional disability and chronic conditions based on population surveys are increasingly used. Our study illustrates the size of the influences that methodological differences in surveys can have on the estimated absolute prevalences of functional disability in the elderly, which we consider as alarmingly large. No true disability prevalence exists: the prevalence is very sensitive to characteristics of the survey and depends, in particular, on the severity of disabil-

ity as is indicated by the actual wording of the questions and response categories. For international comparisons, agreement on instruments in population surveys such as health interview surveys are a prerequisite. Our findings also imply that consistency in methodology is necessary if the assessment of time trends on the basis of series of surveys is required. These requirements seem to conflict with one another because adaptation of survey methodology to meet international agreements implies interruption of time trend assessment in those countries which already have series of surveys. For the interpretation of the results from regional surveys or surveys within a specific patient population it may be necessary to compare these with reference values from other surveys, surveys concerning other regions, or other patient categories or even national population based surveys. Such comparisons are only possible when surveys use the same methodological procedures as the "comparison standard". The design and execution of a population survey or the assessment of health characteristics require many decisions on instruments and methodological procedures. The potential effects of methodological characteristics on the outcome of surveys and the implication of these for comparisons with other surveys should be taken into account during this decision phase.

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Chapter 3.1

Physical disability in the Netherlands: prevalence, risk groups and timetrends[†]

Abstract

Background – Physical disability is an important health indicator of Western populations. In this paper an overview of the prevalence of physical disabilities in the Netherlands is given with a focus on risk groups and time trends.
Methods – Cross-sectional national health survey data (NetHIS) of nine years 1990-1998 presenting data on 62,352 persons of 16 years or over were used. Visual, hearing, mobility and ADL disability were analysed.
Results - About one-eighth of the research population had a physical disability, i.e. had at least major difficulty with one or more functions such as walking, seeing, hearing and washing. This figure increased from 1.7% in the age group of 16-24 yr. to 44.1% in the age group of 75 yr. or older. Risk groups were women, those living alone, those who were divorced or widowed and those with a low educational level. In the period 1990-1998 the prevalence did not change with the exception of the prevalence of mobility disability which dropped slightly with 0.2 percentage points per year due to decreasing prevalences among men.
Conclusion – Prevalence of disability is high and stable, and expected to increase in the future due to the ageing of the population.

[†] Picavet HSJ, and N Hoeymans. Physical disability in the Netherlands: prevalence, risk groups and trends (submitted)

Introduction

Data on physical disability are increasingly used to describe the health of the population[1-12] sometimes in combination with mortality figures to produce disability free life expectancies.[13] It is a generic health indicator: it informs us about the meaning of health problems for daily functioning and is usually based on disabilities in walking, lifting, bending, hearing and seeing, and personal care activities such as washing and (un)dressing, the so-called disabilities in Activities of Daily Living (ADL).[2]
The attention for physical disability is growing because of several developments. First, it is increasingly recognised that health problems should not only be viewed in terms of diseases and clinical parameters but also in terms of its consequences for daily life.[2] Physical disabilities, sick leave, work disability, and the need for health services are important consequences. Especially for chronic diseases for which full recovery is often not possible, such consequences should be kept to an minimum. Chronic conditions are also the main causes of physical disability.[14] Second, physical disabilities can express the combined effect of several diseases, which is important since comorbidity is very common[15] especially among the elderly[15,16] and numbers of elderly are growing in Western societies both in size and proportion. In the year 2000 the Netherlands consist of almost 16 million persons of whom 13.5% is 65 years or older.[17] In the year 2025 the population is expected to grow to 17 million persons with 19% elderly.
In this paper we present data on physical disabilities in the Dutch population based on the national Health Interview Survey of the Netherlands. We focus on risk groups as identified by general socio-demographic characteristics and on time trends.

Methods

Material
In this paper we used the Netherlands Health Interview Survey (NetHIS), which presents data on the non-institutionalised population of the Netherlands. The NetHIS is a continuous survey that started in 1981 and is carried out by Statistics Netherlands. From 1997 the NetHIS is one module of an integrated system of face-to-face interviews of Statistics Netherlands. Home interviews are carried out by trained interviewers with laptop computers. During the interview a paper questionnaire was left behind with a free post return envelop. Until 1996 the sample frame of NetHIS was a list of all addresses in the Netherlands, from 1997 the population register which gives a sample of individuals. Addresses belonging to an institution, homes for the elderly, homes for the (severe) disabled or mentally ill and jails, were excluded. The response to the NetHIS is around 60% each year.

Measurement of disability

Several indicators for physical disability were analysed. Measurement of physical disability was based on the OECD disability indicator[18] and measured among persons of 16 years or over in the paper questionnaire. Visual disability was defined as major difficulty or not able to read normal letters of ordinary newspaper print and/or to recognise a face on a distance of 4 meters. Hearing disability was defined as major difficulty or not able to have a conversation within a group of 3 or more persons and/or to have a conversation with one person.

Mobility disability was defined as major difficulty or not able to carry 5 kg for 10 meters and/or bending and picking something from the floor and/or walking 400 meters.

ADL-disability was defined as major difficulty or not able to do one of the following 10 activities of daily life: eating and drinking, getting in/out of a chair, getting in/out of bed, (un)dressing, transferring on one level, walking stairs, entering/leaving the house, transferring outdoors, washing face and hands and washing entirely. These ADL-problems were only measured for persons of 55 years or older and were part of the face to face interview. In presenting the data for persons of 16 years or over we assigned zero prevalence to those below the age of 55.

Physical disability was defined as major difficulty or not able to carry out one or more of all the activities mentioned above.

Measurement of back ground variables

Data on disability were analysed by age, sex, marital status, household composition and level of education.

Household composition presents the number of persons living in the household. Level of education was measured as the highest level reached and then summarised in 4 groups: primary school, junior and secondary (vocational) education, higher vocational education and university.

Statistical analysis

For the disability prevalence and risk groups we used NetHIS data from 1997 and 1998. Two data years were combined to increase power, n=15,425. In order to present estimations for the Dutch population, weighting factors were used to make the distribution by age, sex, region and marital status equal to the average of the Netherlands of 1997 and 1998. Multivariate logistic regression was used to identify risk groups. Trend analyses were carried out using nine years of NetHIS data on disability, from 1990 to 1998. Age-sex specific rates per year were applied to the age-sex distribution of the Dutch population of 1995. Statistical significance of trends was tested for the total population and for subgroups, using regression analyses adjusted for age and sex.

All analyses of data were performed using SAS version 6.12.

Results

Prevalence and risk groups of physical disability

About one-eighth of the Dutch population (12.6%) aged 16 years or over was estimated to have a physical disability of vision, hearing, mobility or ADL (table 1).

Mobility disability was most prevalent with 7.4% followed by visual disability (4.0%), ADL-disability (3.6%) and hearing disability (2.5%).

With the exception of hearing disability, physical disability was more common among women than among men. More than twice as much women than men reported disability in mobility or ADL. The prevalence of physical disability increased with age from 1.7% in the age group of 16-24 yr to 44.1% in the age group of 75 yr or over. The increase by age was evident for all disability types.

Table 1 Prevalence of physical disability, percentage and 95% confidence limits, the Netherlands, standardised by the population of 1997/1998 (Source: NetHIS 1997/1998).

	Visual disability (n=12,453)		Hearing disability (n=12,378)		Mobility disability (n=12,449)		ADL disability (n=15,425)		Total physical disability	
Total	4.0	(±0.3)	2.5	(±0.3)	7.4	(±0.5)	3.6	(±0.3)	12.6	(±0.6)
Sex										
Men	3.1	(±0.4)	2.7	(±0.4)	4.1	(±0.5)	2.2	(±0.4)	8.9	(±0.7)
Women	5.0	(±0.5)	2.2	(±0.4)	10.6	(±0.8)	5.1	(±0.5)	16.0	(±0.9)
Age group										
16-24	0.9	(±0.5)	0.3	(±0.3)	0.6	(±0.4)	-		1.7	(±0.6)
25-44	1.0	(±0.3)	1.2	(±0.3)	2.5	(±0.4)	-		4.2	(±0.5)
45-64	6.7	(±0.8)	2.6	(±0.5)	8.5	(±0.9)	2.3	(±0.5)	15.0	(±1.1)
65-74	7.5	(±1.5)	6.0	(±1.3)	17.8	(±2.1)	12.0	(±1.8)	25.6	(±2.5)
75+	18.9	(±3.0)	10.4	(±2.3)	36.7	(±3.7)	28.6	(±3.5)	44.1	(±3.8)
Marital Status										
Married	4.1	(±0.4)	2.6	(±0.4)	7.2	(±0.6)	2.7	(±0.4)	12.1	(±0.7)
Divorced	7.0	(±2.0)	2.1	(±1.1)	10.2	(±2.4)	4.2	(±1.6)	17.3	(±3.0)
Widowed	12.8	(±2.6)	8.1	(±2.1)	31.9	(±3.6)	25.0	(±3.4)	41.1	(±3.8)
Never married	1.5	(±0.4)	1.2	(±0.4)	2.6	(±0.5)	0.7	(±0.3)	4.9	(±0.7)
Household composition										
One person	7.0	(±1.2)	4.6	(±1.0)	15.8	(±1.7)	11.4	(±1.5)	24.0	(±2.0)
Two persons	4.8	(±0.6)	3.2	(±0.5)	9.5	(±0.8)	4.2	(±0.6)	14.9	(±1.0)
More than 2	2.5	(±0.4)	1.3	(±0.3)	3.1	(±0.4)	0.4	(±0.2)	6.3	(±0.6)
Educational level										
Primary school	9.5	(±1.2)	6.5	(±1.0)	19.0	(±1.6)	10.4	(±1.3)	28.8	(±1.9)
Junior and secondary (vocational)	3.9	(±0.6)	2.1	(±0.5)	7.9	(±0.9)	2.9	(±0.6)	12.4	(±1.1)
Vocational	2.4	(±0.5)	1.6	(±0.4)	4.0	(±0.6)	1.6	(±0.4)	7.4	(±0.8)
University	2.3	(±0.6)	1.1	(±0.4)	2.5	(±0.6)	0.9	(±0.4)	5.3	(±0.9)

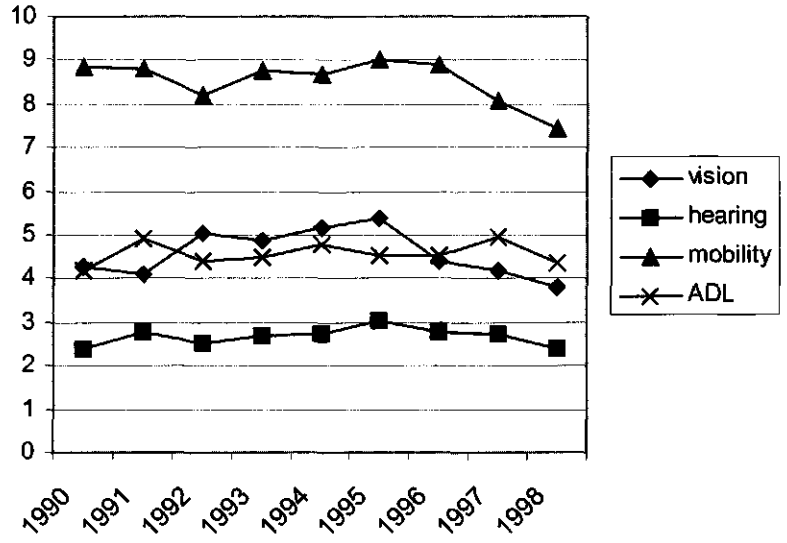

Figure 1 The prevalence of physical disability in the period 1990-1998: standardised to the population of 1/1/1995, NetHIS.

Table 2 Odds ratios (95% confidence interval) for physical disability by socio-demographic characterisitics adjusted for age and sex (Source: NetHIS 1997/1998).

	Visual disability	Hearing disability	Mobility disability	ADL disability	Total physical disability
Marital Status					
Married	1	1	1	1	1
Divorced	1.6 (1.1-2.3)	0.6 (0.3-1.2)	1.0 (0.7-1.4)	1.4 (0.8-2.3)	1.2 (0.9-1.5)
Widowed	1.0 (0.7-1.5)	0.8 (0.5-1.3)	1.0 (0.8-1.4)	1.4 (0.9-2.1)	1.1 (0.9-1.4)
Never married	0.6 * (0.4-0.9)	0.7 (0.5-1.1)	0.6 * (0.5-0.8)	0.9 (0.7-2.0)	0.7 (0.6-0.9)
Houshold Composition					
One person	1.2 (0.9-1.8)	1.8 * (1.1-2.9)	1.4 (1.1-1.9)	1.5 * (1.0-2.3)	1.3 * (1.1-1.7)
Two persons	1	1	1	1	1
More than 2	0.9 (0.7-1.2)	0.8 (0.6-1.1)	0.7 * (0.6-0.8)	1.0 (0.7-1.5)	0.8 * (0.7-0.9)
Educational Level					
Primary school	2.3 * (1.7-3.1)	3.8 * (2.5-5.9)	4.2 * (3.2-5.6)	3.0 * (2.0-4.5)	3.4 * (2.7-4.1)
Junior/secondary (vocational)	1.2 (0.9-1.8)	1.9 * (1.2-3.0)	2.5 * (1.9-3.4)	1.7 * (1.1-2.6)	2.0 * (1.6-2.4)
Vocational	1.0 (0.7-1.4)	1.5 (1.0-2.3)	1.8 * (1.3-2.4)	1.7 * (1.1-2.7)	1.5 * (1.6-2.4)
University	1	1	1	1	1

Those who were widowed had the highest disability prevalences followed by the divorced, those who were married and those who were never married. Adjustments for differences by age and sex gave only a significant lower prevalence in visual and mobility disability for those who were never married compared to those who were married (table 2). Visual disability is relatively often found among the divorced.
For household composition the highest prevalences of physical disability were found for those living alone, which persisted for hearing and ADL disability after adjustment for age and sex differences.
For all types of disability clear differences by level of education were found, with those with lower educational levels having the most unfavourable disability status.

Time trends of physical disability
Standardised to the 1995 Dutch population we found fairly stable disability prevalences during the last decade (figure 1). A slight decrease is seen during the latest years. The decrease in physical disability prevalence is statistically significant with 0.2 percentage points, mostly due to the decrease in the prevalence of mobility disability (table 3).

Table 3 Trends in physical disability in period 1990-1998 by socio-demographic characterisitics in percentage points increase or decrease per year and 95% confidence limits, adjusted for age and sex,* p<0.05, (Source: NetHIS 1990-1998).

	Visual disability		Hearing disability		Mobility disability		ADL disability		Total Physical disability	
Total	0.0	(±0.1)	0.0	(±0.1)	-0.2 *	(±0.1)	0.0	(±0.1)	-0.2 *	(±0.1)
Sex										
Men	-0.1	(±0.1)	0.0	(±0.1)	-0.2 *	(±0.1)	0.0	(±0.1)	-0.2 *	(±0.1)
Women	0.0	(±0.1)	0.0	(±0.1)	-0.1	(±0.1)	0.0	(±0.1)	-0.1	(±0.2)
Age group										
16-24	0.0	(±0.1)	0.0	(±0.1)	0.0	(±0.1)			0.0	(±0.1)
25-44	0.0	(±0.1)	0.0	(±0.1)	0.0	(±0.1)			0.0	(±0.1)
45-64	-0.1	(±0.2)	0.1	(±0.1)	-0.2 *	(±0.2)	0.0	(±0.1)	-0.3 *	(±0.2)
65-74	0.0	(±0.3)	0.2	(±0.2)	-0.2	(±0.4)	0.3 *	(±0.3)	-0.1	(±0.5)
75+	0.0	(±0.5)	-0.3	(±0.4)	0.1	(±0.6)	0.1	(±0.6)	-0.7 *	(±0.7)
Marital status										
Married	-0.1	(±0.1)	0.0	(±0.1)	-0.2 *	(±0.1)	0.0	(±0.1)	-0.2 *	(±0.1)
Divorced	-0.1	(±0.4)	-0.1	(±0.2)	-0.5 *	(±0.5)	-0.1	(±0.3)	-0.5	(±0.6)
Widowed	0.3	(±0.4)	-0.1	(±0.4)	0.4	(±0.6)	0.7 *	(±0.5)	0.2	(±0.6)
Never married	0.0	(±0.1)	0.0	(±0.1)	-0.1	(±0.1)	-0.1 *	(±0.1)	-0.1	(±0.1)
Household composition										
One person	0.2	(±0.2)	0.0	(±0.2)	-0.1	(±0.3)	0.3 *	(±0.2)	-0.2	(±0.3)
Two persons	-0.1 *	(±0.1)	0.0	(±0.1)	-0.1	(±0.2)	-0.1	(±0.1)	-0.3 *	(±0.2)
More than 2	0.0	(±0.1)	0.0	(±0.1)	-0.1 *	(±0.1)	0.0	(±0.0)	-0.1	(±0.1)
Educational level										
Primary school	0.1	(±0.2)	0.1	(±0.2)	0.0	(±0.3)	0.3 *	(±0.2)	0.0	(±0.3)
Junior and secondary (vocational)	-0.2 *	(±0.1)	0.0	(±0.1)	-0.1	(±0.2)	0.0	(±0.1)	-0.1	(±0.2)
Vocational	0.0	(±0.1)	0.0	(±0.1)	-0.2 *	(±0.1)	0.0	(±0.1)	-0.1	(±0.1)
University	0.1	(±0.1)	0.0	(±0.1)	0.0	(±0.1)	-0.1	(±0.1)	0.0	(±0.2)

The prevalence of hearing disability is most stable over the last decade with no differences in any subgroup. For visual disability a statistical significant decrease was found for those who are living with two persons in the household and those with junior and secondary (vocational) education. For ADL-disability an increase was found for those aged 65-75 yr, those who were widowed, those who were living alone and those with only primary school. A significant decrease in ADL-disability was only found for those who were never married.
The prevalence of mobility disability was statistical significantly decreased for men, those aged 45-64 yr, those who were married or divorced, those living with more than 2 persons in the household and those having had vocational educational training.
Taking all disability types together we found a decrease in the prevalence and mainly for men and two age groups: 45-64 yr and 75 yr or over.

Discussion

This paper shows that disability is common among the Dutch population. About one-eighth of the population of 16 years or over had a physical disability, i.e. had at least major difficulty with mobility, hearing, seeing or ADL, and for those older than 75 yr this was even 44%.
Some population-based disability prevalences of other countries are presented to illustrate that physical disability is a common problem in many western countries. One of the few studies presenting the different disability types at the same time is a study among Canadian elderly, which also showed that mobility disability is the most common type of disability.[5] In contrast to what we found their results showed higher prevalences for hearing disability than for visual disability. The same was true for a study among the US elderly of 70 years or over.[6] An Italian study on elderly reported a self-reported prevalence of hearing impairment of around 9%[7], a population-based study in Sweden among the non-institutionalised population of 16-85 yr reported a prevalence of hearing problems of 10.7%, varying from 2.4% in the youngest age group to 30% on the oldest age group.[8] Based on US national survey data a prevalence of hearing impairment of 33% among elderly of 70 years or over was reported.[6] We found somewhat lower prevalences, with 2.5% for the total population of 16 years or over, which increased from 0.3% in the youngest age group to 10.4 % in the oldest age group. It is commonly found that the prevalence of hearing disability is higher among men than women in contrast to other disability types. We found only a slight and non-significantly higher prevalence among men compared to women.
For visual disability we found a prevalence of 4.0% that increased from 0.9% in the youngest age group to 18.9% in the oldest age group. Some published data on self-reported visual impairment refer to the US elderly with 18.1% among those of 70 years or over[6] and around 13% for those aged 50 years or over.[9] The last figure was

based on a similar definition of visual disability as ours using the question 'difficulty seeing words and letters in ordinary newspaper print'.

For 43 year old men and women of the UK a prevalence of disability concerning physical movement of 7% was reported[10], 25% of British men aged 52-73 yr reported locomotor problems[11] and a similar figure was found for difficulty walking among persons aged 50 years or over in the US.[9] We found a prevalence of 7.4 % for the population aged 16 years or over which varied from 0.6% in the youngest age group to 36.7% in the oldest age group.

In our study ADL-disability prevalence was estimated as 12.0% and 28.6% for the age groups 65-74 yr and 75+ respectively. A study among non-institutionalised Italian elderly found similar figures for ADL disability with 9% and 31% for the same age groups respectively.[12]

Absolute prevalences of disability are hard to compare between studies and countries due to methodological differences becauseeven minor differences in methods can affect the results severely.[19] Based on a European panel study it was shown that the Netherlands has the highest prevalences of physical disability, together with Portugal and Germany.[20]

We have presented the disability prevalences by subgroups in the population both with and without adjustments for age and sex differences. Adjusted results give an idea of potential causal mechanisms and are therefore popular. However, from a public health point of view it is also important to know which subgroups in the population have most health problems, independent from its causes. We used some simple socio-demographic characteristics to define subgroups in the population.

The higher age groups, women, those living alone, and the lower SES groups are high risk groups in our study, also after adjustment for age and sex differences and these risk groups are commonly found for physical disability.[5,9-12] The increasing prevalences of physical disability with increasing age is of extra concern because the continuing ageing of the population[17] will lead to increasing numbers of persons with physical disability. The higher prevalences of health problems among women compared to men are often described as: 'men are more likely to die than women and women suffer from higher levels of morbidity than men'. [21] Identifying those living alone as a high risk group for physical disability is important, because they are probably more likely to use professional care services in absence of potential help from a housemate. Socio-economic differences in health are commonly found for all health indicators and in most European countries[22] and this is confirmed for physical disability with our data. For marital status it is usually found that those who are married are healthier than those who are never married, divorced or widowed.[23] However, adjusted for age we found hardly any differences in disability prevalences by marital status, except that the lowest prevalences of hearing- and mobility disability were found for those who were never married.

Interpreting our data we should take into account the limitation of our data due to the high non-response, around 40%, also relatively high compared to other countries in Europe.[24] Strength of the NetHIS data, however, is the availability of

many years of data gathered with the same methods which gives us the possibility to calculate time trends. We found fairly stable age-sex specific prevalences during a 9 year period and if there was a change it was a decline in disability prevalence mainly due to declines in mobility disability among men. Most published time trend data refer to the US population. Based on the US National Health Interview Survey (NHIS) a slight increase in disability prevalence was found between 1966-1976.[1] More recent US NHIS data showed disability declines during the 1980s.[3] On the basis of the US National Long Term Care Surveys, presenting data on US elderly of 65 years or over, also a decline in (ADL) disability prevalence between 1982-1994 was found:[4] a decline of 9.8% to 8.4% in the age group 65-74 yr, of 24.7% to 21.4% in the age group 75-84 yr and of 57.3% to 52.7% in the age group of 85 yr or over. Analysis of data of the Canadian Health and Activity Limitation Survey (HALS) showed an increase in disability prevalence between 1986 and 1991.[5]

Several developments could have had an effect on the prevalence of disability over the years including (i) methodological changes, (ii) changes in self-perception of disability, and (ii) real changes in the health of the population.

(i) Statistics Netherlands has standardised their survey methodology but several changes could have affected the data on time trends. First, during the 1990s there was a change in sample methodology due to the fact that the NetHIS became a part of an integrated system of surveys. It is not likely that the transition from a sample from addresses to a sample of individuals changed the response group because the content of the NetHIS and response figures are the same in the different years. Changes in the size and characteristics of the institutional population could have had a greater impact because the policy of the 1980s and 1990s was to stimulate the independent living of the elderly despite severe disability. This could have resulted in higher disability prevalences in the non-institutionalised population, especially among the older age groups. We did not find an increase in disability but this development could have masked a (greater) decrease in disability prevalence. During 1990 to 1999 the institutionalised population showed a decrease in the absolute size from 278 thousand (1.9% of the total population) to 231 thousand (1.4%). This change is in particular substantial for the age group 75 years or over because around 60% of those in institutions is 75 years or over. In this age group the percentage of institutionalisation has decreased from 17% to 14% in the period 1995-1999; for the period 1990-1994 these data were not available. If this development in the second half of the 1990s was the same in the first half of the 1990s this could have masked a greater decline in disability prevalences than we already found for the persons of 75 years or older. However, to give a definite answer of time trends in this age group is not possible because the non-response to the NetHIS due to severe health problems, will also be high in this age group.

(ii) Self-report of physical disability can be affected by individuals expectations about their ability and functioning.[9] Colvez & Blanchet[1] mentioned this to explain the increase in disability prevalence during the 1980s in the USA. We also think that social and economic developments can affect self-evaluations of health. It is possible that the economic prosperity during the 1990s in the Netherlands with

improved financial and material circumstances for most Dutch inhabitants could have led to lower prevalences of self-reported disability.
(iii) Real trends in disability prevalences can be due to changes in biological ageing, due to healthier cohorts, better health care or other circumstances affecting health status. In the 1990s, the age-sex specific disability prevalences seemed to have been quite stable. The increasing life expectancies were not accompanied by a more unhealthy population. However, due to the increase of the population, especially of the elderly, a continuation of stable disability prevalences will result in increasing numbers of persons with disabilities.

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Chapter 3.2

The contribution of chronic conditions to the total burden of mobility disability in the Dutch population*

Abstract

Objectives. To assess the proportions of the burden of mobility disability in the Dutch population that are attributable to six common chronic conditions.
Methods. National survey data were analysed using an elimination technique which combines the results of logistic regression analysis and the disease prevalence.
Results. Of the total prevalence of disability (20.5%) 33.7% can be attributed to the six chronic conditions. Musculoskeletal disorders account for the major part, whereas the contribution of cancer is very small.
Conclusions. The potential benefits of effective curative and/or preventive treatments of chronic conditions, in terms of reduction of the disability burden in the population, are limited.

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Introduction

The burden of disability represents an important public health problem because of the aging of the population[1] and because of the associations between burden of disability and increasing health care demand,[2-6] ensuing costs,[7] and increasing mortality.[8] The most important determinants of disability are chronic conditions, which are highly prevalent in today's Western societies, especially in old age.[1] Many studies have shown the high association between specific chronic conditions and disability, using both cross-sectional[9-17] and longitudinal[18-21] designs. Only a few studies have analyzed the impact of individual chronic conditions on the total burden of disability, which is determined not only by the strength of the association of each chronic condition with disability but also by the prevalence of the condition.[6,12,16] These few studies have shown that musculoskeletal diseases (including arthritis) are the leading cause of disability for both men and women, for both the total population[6] and the elderly.[12,16] In this study we assessed the proportion of the total burden of disability in the Dutch population that can be attributed to six main groups of chronic conditions.

Methods

Data were derived from the continuous Netherlands Health Interview Survey,[22] which provides information on a two-stage probability sample of Dutch households. For the present study we used data on persons aged 16 years and older, because no data on disability are collected for younger persons. Data from 4 years (1989 through 1992) were aggregated to provide a substantial recent database (n = 26.288). In those years the nonresponse rate was about 40%, mainly because people refused to participate, were not at home (in spite of revisits), or were "unable to participate." In spite of this nonresponse rate, the sample appears to be a fairly accurate representation of the Dutch population on the basis of figures on age, sex, marital status, and region.[22]

Mobility disability was defined as the presence of at least minor difficulty with walking, carrying, and bending, based on questions derived from the Organization for Economic Cooperation and Development (OECD) long-term disability indicator.[23]

Respondents were asked whether they had had each of 24 conditions in the 12 months prior to interview. For this report we selected six major clusters of chronic conditions: musculoskeletal diseases, lung diseases, neurological disorders, heart diseases, diabetes, and cancer. These conditions have been given priority in research by the Dutch Advisory Council on Health Research.[24]

Multiple logistic regression was used to assess the association of the separate chronic conditions and age with disability. Age was included as a continuous variable representing seven (almost equal) age groups. The coefficients of the logistic model and the actual presence of the individual conditions among respondents

were then used to recalculate the prevalence of disability by averaging the predicted probability of having a disability for all respondents, by the formula

$$p_{tot} = \frac{1}{n_{tot}} \sum_{i=1}^{i=n} \frac{1}{(1 - e^{-z_i})}$$

with $z_i = c + \beta_1 d_{1,i} + \beta_2 d_{2,i} + \beta_3 d_{3,i} + \beta_4 d_{4,i} + \beta_5 d_{5,i} + \beta_6 d_{6,i} + \beta_{age,j}$

where

P_{tot} = proportion of the population age 16 years and over with disability
n_{tot} = total number of respondents (=24,191)
i = age group (1 to 7)
n_i = number of respondents in age group i
e = 2.71828.....
C = Constant of the logistic model
$ß_1..ß_6$ = The estimated logistic coefficients for disease 1 to disease 6
$d_{1,i}..d_{6,i}$ = Prevalences of disease 1 to 6 in age group i.

(Note: If the coefficients of the logistic model are estimated by the method of maximum likelihood, there is no need to actually calculate P_{tot} as indicated, because in that case P_{tot} is simply the observed proportion of disability. Thus P_{tot} = .205 from Table 1. The formula must be used for eliminated-condition estimates, or for P_{tot} when other methods of parameter estimation are used.)

This procedure was repeated after eliminating one disease at a time by setting the presence of the disease to 0 among all respondents. The difference between the resulting prevalence and the calculated total prevalence is a measure of the contribution of the individual chronic condition to the total prevalence of disability. The method we used is very similar to the method of calculating the attributable fraction or population attributable risk.[25] We were reluctant to follow Guccione et al.[12] in using the odds ratio to estimate the relative risk (RR) in the formula p_c(RR - 1)/RR, because our data violate the rare-disease assumption in the outcome variable, that is, disability, the prevalence of which is over 20%. Assuming a relative risk of 2 and a prevalence of 20% gives an odds ratio of 2.7. Using this odds ratio as an estimation of the relative risk results in an overestimation of the population attributable risk.

Results

Reflecting the Dutch noninstitutionalized population aged 16 years and older, our sample shows a slightly higher proportion of women than men and decreasing numbers of respondents with increasing age (Table 1). Almost 80% of the population had intact mobile function. Of the selected chronic conditions the musculoskeletal disorders were most frequent, reported by 17.5% of all persons aged 16 years and older. Lung diseases were second at almost 6%.

All chronic conditions show significant association with disability (see odds ratios in Table 2), with musculoskeletal disorders and neurological disorders the most important ones (with odds ratios of 5.8 and 3.5, respectively). When both the association with disability and the prevalence of the chronic condition are taken into account, the most important disease group is musculoskeletal diseases. Almost 26% of the disability in the population can be attributed to musculoskeletal diseases, 4% to neurological disorders, 2.4% to lung diseases, 1.6% to heart diseases, 1.1 % to diabetes, and 0.2% to cancer. Although heart diseases are more strongly associated with disability than lung diseases, the contribution of lung diseases to the total burden of disability - which takes both odds ratios and the disease prevalence into account - is higher. The six selected chronic conditions account for 33.7% of the total prevalence of disability.

TABLE 1 – Age and sex distribution of the sample (n=24.191)[a] and prevalence of disability and chronic conditions: Netherlands Health Interview Surevy, 1989 trough 1992

	no.	(%)
Total	24191	(100)
Men	11856	(49)
Women	12335	(51)
Age, years		
16-35	10199	(40.8)
35-54	8088	(32.4)
55-74	5118	(20.5)
75+	1575	(6.3)
DISABILITY IN MOBILITY[b]		
no disability	19231	(79.5)
disability	4959	(20.5)
CHRONIC CONDITIONS[c]		
Musculoskeletal	4233	(17.5)
Lung diseases	1427	(5.9)
Neurological disorders	798	(3.3)
Heart diseases	556	(2.3)
Diabetes	556	(2.3)
Cancer	193	(0.8)
One or more conditions	6798	(26.1)
Comorbidity (two or more)	1185	(4.9)

[a]This n represents those whom all data on disability and chronic conditions are available; it is smaller than the total survey n (26.288) because of item nonresponse.

[b]Disability is defined as the presence of at least minor difficulty with walking, acrrying, or bending.

[c]Musculoskeletal diseases are defined as "severe back problems, longer than three months or slipped disc"; "*osteoarthritis of knees, hips or hands*"; "*arthritis, rheumatoid arthritis of hands or feet*"; and "*other chronic arthritis* of joints." Lung diseases are defined as "asthma, chronic bronchitis or chronic obstructive pulmonary disease (COPD)". Neurological diseases are difined as "epilepsy"; "dizziness with falling"; and "stroke." Heart diseases are defined as "severe heart problem" and "myocardial infarction."

TABLE 2 - The proportions of disability attributable to chronic conditions in the Dutch population, Netherlands Health Interview Survey 1989-1992.

	Adjusted OR[a] (95% CL) for mobility disability	Prevalence of disability given elimination of specified disease[b]	Population 'Attributable' Risk Percentage[c]
CHRONIC CONDITIONS			
Musculoskeletal	5.8 (5.4-6.3)	14.5	25.6%
Lung diseases	1.7 (1.5-2.0)	19.1	2.4%
Neurological disorders	3.5 (3.0-4.2)	18.8	3.9%
Heart diseases	1.9 (1.5-2.3)	19.2	1.6%
Diabetes	1.6 (1.3-1.9)	19.3	1.1%
Cancer	1.3 (1.1-1.6)	19.5	0.2%
All chronic conditions		12.9	33.7%

[a] Multiple logistic regression results cotrolling for age as a continuous variable representing seven age groups (16-24, 25-34, 35-44, 45-54, 65-74 and 75+ years)

[b] See Methods for formula used. The original calculated prevalence of mobility disability is 19.5%.

[c] Represents the percent reduction in the prevalence of mobility disability due to the elimination of the specified chronic conditions.

Discussion

The proportion of disability in the population that can be attributed to a chronic condition is a function of both the prevalence and the strength of its association with disability. A substantial proportion of disability in mobility was found to be associated with the selected chronic conditions, musculoskeletal diseases being the most important.

Several studies have investigated the contribution of chronic conditions to the total burden of disability in the population. The comparability of our results with those of other studies is, however, limited, owing to differences in population, in the kind, number, and measurement of chronic conditions and disability, and in analytical strategies.

Our results are limited to disability in mobility, including a rather mild severity level. Further research could take different disability cutoff points into account. The contribution of chronic conditions to other forms of disability-disability in activities of daily living, social disability, mental disability-will also be different and needs further study.

One limitation of our study is that the data on chronic conditions were based on self- report. We do not know whether the reported condition was diagnosed by a physician or whether undiagnosed or latent diseases were present. The association of a chronic condition with disability is also dependent on duration and severity of the condition, for which no information was available in our sample. Another limitation of our study is the exclusion of the institutionalized population. This implies, at least, an underestimation of the total prevalence of disability and chronic conditions, especially within the older age groups for whom institutionalization is relatively high (in the Dutch population the percentage of institutionalization among those aged 55

years and older is around 7%; for those aged 80 years and older, around 33%). Whether the associations found between chronic conditions and disability are affected by this selection bias is not known.

The analyses described here provide insight into the potential health benefits of eliminating chronic conditions. The highest reduction in the disability burden in the population could be achieved if effective curative or preventive treatments or both for musculoskeletal diseases could be developed. However, even if we could eliminate the consequences of all the selected disease groups, the total burden of disability in the population would be only moderately reduced. Two thirds of the burden of disability in mobility is due to other diseases or medical conditions or to old age. However, we should keep in mind the effect on life expectancy, because when we are really able to eliminate certain chronic conditions, postponement of death is likely to occur. However, this has no implications for our findings with regard to nonfatal diseases (e.g., musculoskeletal diseases), because these diseases do not affect life expectancy.[26] Eliminating fatal diseases such as cancer is even less promising with regard to the burden of disability, because the elimination of such diseases would lead to an increase in life expectancy with disability.[26]

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Chapter 4.1.1

Musculoskeletal pain in the Netherlands: prevalences, consequences and risk groups, the DMC_3-study*

Abstract

Objective - To present estimates on the prevalence of musculoskeletal pain of five different anatomical areas and ten anatomical sites, and their consequences and risk groups in the general Dutch population.
Methods - Cross-sectional data from a population-based study of a sex-age stratified sample of Dutch inhabitants of 25 years and older were used. With a postal questionaire data was assessed on musculoskeletal pain, additional pain characteristics (location, duration, course), its consequences (utilisation of health care, sick leave and limitation in daily life) and general socio-demographic characteristics.
Results - The top three of self-reported musculoskeletal pain (point prevalence (P_p) with 95% confidence interval (CI)) was: 1. low back pain, P_p =26.9% (95%CI 25.5-28.3), 2. shoulder pain, P_p=20.9% (95%CI 19.6-22.2) and 3. neck pain, P_p=20.6% (95%CI 19.3-21.9). In most cases the pain was described as continuous or recurrent and mild. In every 3 out of 10 cases the complaints about pain were accompanied by limitations in daily living. Between 33% and 42% of those with complaints consulted their general practitioner about their pain. With the exception of persons who are work disabled, general sociodemographic characteristics cannot be used to identify high risk groups.
Conclusions - Musculoskeletal pain is common in all subgroups of the population and has far-reaching consequences for health, work and the use of health care.

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Introduction

Musculoskeletal disorders and complaints comprise an important public health problem due to high impact on disability,[1,2] sickness absence and work disability,[3,4] and health care costs [5]. Population-based data on these health problems are scarce as mentioned in the framework for the Bone and Joint Decade 2000-2010.[6] Most available data refer to the working population,[7] specific professions such as nurses[8] or refer only to complaints of specific anatomical sites such as lower back[9], shoulder[10] and neck.[11] For some countries population-based data on not further specified musculoskeletal pain are available [12-14] but national data on musculoskeletal pain on different anatomical sites are scarse. Some data are available on the USA with data from the HANES of 1971-1975[15,16] for Norway for three anatomical areas.[17] More examples of studies focussing on more than one pain site are available but only limited to a specific region within one country.[18-25]
In order to provide insight in the prevalence of musculoskeletal health problems of different anatomical sites we have carried out a population-based survey on musculoskeletal pain in the Netherlands. In this paper figures on prevalences, consequences (utilization of health care, sick leave and limitation in daily life) and risk groups (on the basis of general socio-demographic characteristics) are presented for five different anatomical areas and ten anatomical sites.

Methods

Baseline data of the Dutch population-based Musculoskeletal Complaints and Consequences Cohort study (DMC_3-study) were analysed.

Study population

The Dutch population of 1998 consists of over 15 million inhabitants of whom over 10 million are 25 years and older. A random sample stratified by 10 years age group and sex of 8,000 persons aged 25 years and over (numbers of equal size per age-sex band) was taken from the population register of 1998, identical to general surveys of Statistics Netherlands.[25] Data on sex, age, address, and marital status were available on the basis of the population register. The data on the 12 provinces based on address were also used to construct four regions of living: north, west, east and south.

Questionnaire

We used a 28-pages full-colour questionnaire that consisted of general questions and health questions. Pages of 5 different colors corresponded with one of the following five anatomical areas 1. neck, shoulder or higher part of the back, 2. elbow or

wrist/hand, 3. lower part of the back, 4. hip or knee, 5. ankle and foot. Every coloured area started with a screening question: Did you have had pain in <anatomical area> during the past 12 months? Screenpositives were asked to answer all the questions of the relevant color focussing on: the anatomical site, whether or not the pain still exists, the duration and severity of the pain, the course of the pain, self-reported causes, specific complaints (such as radiation to the legs for back pain), and some consequences of the pain for health care utilization, work and health during the 12 months before the survey: contact with general practitioner, medical specialist or physiotherapist, use of medicines, work leave, limitations in daily life and work disability.

Per anatomical area seven different descriptions were used to assess the course of the pain. The description included 'single complaint'and every combination of recurrency (continous, frequently recurrent or occasionally recurrent) and severity of pain (severe or mild).

Sociodemographic characteristics that were used to identify high risk groups were: sex, age, marital status, region of living, household composition, educational level and work status. Self-reported information on current marital status was used. Household composition presents the number of persons living in the household. Level of education was measured as the highest level reached and then summarized in 4 groups: primary school, junior (vocational) education, secondary (vocational) education, vocational colleges/university. Work status is classified in 4 categories:[25] have paid work for more than 12 hours a week, does not have but wants to have work for more than 12 hours a week, does not have nor wants work for more than 12 hours a week, and those who are work disabled or have a pension (at least everybody above 65 years of age).

Mailing procedure

The questionnaire was sent by post with a hand signed cover letter and free post return envelop. After 3 weeks a first reminder (a letter) was sent and after 6 weeks a second reminder: either a letter with response card or a complete questionnaire, or a telephone interview. With the response card or telephone interview persons could indicate whether or not they wanted to receive another questionnaire in case of a lost questionnaire. Persons who did not want to participate were asked to return the response card with information on the reason for non-participation and whether or not they had musculoskeletal pain complaints for the 10 pain sites (both 12-months period and point prevalence were assessed).

Statistical analysis

The net response was calculated by dividing the number of respondents by the number of those actual approached excluding those who were known to be deceased or those whose address was unknown. All data were entered twice and discrepancies corrected followed by an additional range check. In order to present estimations for the Dutch population, weighting factors were used to make the distri-

bution by age, sex, region and martial status equal to that of the Netherlands of 1998.
For the five anatomical areas the 1 year-period prevalence was calculated and for the 10 pain sites also the point prevalence and the prevalence of chronic pain (=current pain lasting more than 3 months).
Multivariate logistic regression was used to identify risk groups. All analyses of data were performed using SAS version 6.12.

Results

Response

Of the original sample of 8,000, one hunderd and eighty-two were identified as not living at the address to which the questionnaire was send or were died. These were excluded from the sample. The net response of the DMC_3-study was 46.9%, n=3664. The response was slightly higher for women, for those in the middle age groups (45-64 yr) and for those who were married (table 1). The small number of missing values for the pain questions were recoded as not having pain.

Table 1 Description of the sample and respondents of DMC_3-study (%)

		Sample (n=7,818)	Response (n=3,664)	
			Unweighted	Weighted*
Sex	Men	50.4	44.8	49.1
	Women	49.6	55.2	50.9
Age group	25-44	32.3	32.1	47.0
	45-64	34.7	36.8	34.6
	65+	33.1	31.1	18.4
Marital status	Unmarried	17.1	13.0	20.1
	Married	66.2	71.7	65.3
	Widow	9.7	8.9	6.9
	Divorced	7.0	6.5	7.7
Region of living	North	11.2	11.1	10.6
	West	40.7	39.6	44.0
	East	22.6	22.7	20.6
	South	25.5	26.7	24.7

*Respondents are weighted to present a distribution of sex, age, marital status and region of living equal to that of the Netherlands in 1998.

Table 2 Prevalences of musculoskeletal pain (%) in the Dutch population, by anatomical area and site, including 95% confidence range, DMC_3-study

Pain of	Period prevalence (12-months) Screening		Period prevalence (12-months)		Point prevalence		Prevalence of chronic pain	
Neck			31.4	(±1.5)	20.6	(±1.3)	14.3	(±1.1)
Shoulders	44.5	(±1.6)	30.3	(±1.5)	20.9	(±1.3)	15.1	(±1.2)
Higher back			18.8	(±1.3)	9.1	(±0.9)	6.2	(±0.8)
Elbow	23.2	(±1.4)	11.2	(±1.0)	7.5	(±0.9)	5.3	(±0.7)
Wrist/hand			17.5	(±1.2)	12.5	(±1.1)	9.3	(±0.9)
Lower back	43.9	(±1.6)	43.9	(±1.6)	26.9	(±1.4)	21.2	(±1.3)
Hip	28.0	(±1.5)	12.8	(±1.1)	9.1	(±0.9)	7.4	(±0.8)
Knee			21.9	(±1.3)	15.2	(±1.2)	11.7	(±1.0)
Ankle	14.9	(±1.2)	9.2	(±0.9)	4.9	(±0.7)	3.5	(±0.6)
Food			9.4	(±0.9)	6.5	(±0.8)	5.0	(±0.7)
No pain			25.5	(±1.4)	46.1	(±1.6)	55.6	(±1.6)
One site			24.5	(±1.4)	24.1	(±1.4)	21.6	(±1.3)
2-3 sites			29.4	(±1.5)	20.3	(±1.3)	15.6	(±1.2)
4 or more			20.6	(±1.3)	9.5	(±0.9)	7.2	(±0.8)

Prevalence of pain complaints

Almost three-quarter (74.5%) of the Dutch population aged 25 years and over reported any musculoskeletal pain during the past 12 months, 53.9% reported musculoskeletal pain during the survey (point prevalence) and 44.4% reported musculoskeletal pain lasting longer than 3 months (table 2). The ranking of most frequently reported pain sites (based on the point prevalence) was: 1. lower back, 2. shoulder 3. neck, 4. knee, 5. wrist/hand, 6. higher back, 7. hip, 8. elbow, 9. ankle and 10. foot. The majority of those reporting pain, reported pain at more than one site, roughly two-third for the period prevalence and more than half of the point prevalence and the prevalence of chronic pain (table 2). Within one anatomical area often more than one pain site was mentioned. Between the anatomical areas the overlap was also considerable and there was also clustering: the prevalence of the combination of pain complaints was always higher than expected on the basis of independence (not shown).

Prevalences by age group are presented in figure 1. For pain in neck, shoulders or higher back, of elbow or wrist/hand and of ankle or foot the prevalences were stable over the different age groups. For low back pain we see a slight decline with increasing age, and for pain of hip or knee a slight increase.

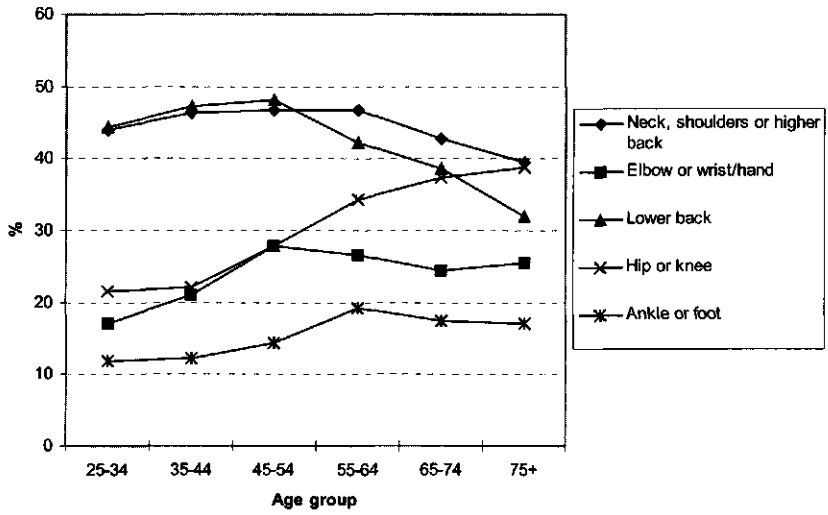

Figure 1 Period prevalence of musculoskeletal pain by age group and area of pain.

Course of pain

A very small proportion of those reporting musculoskeletal pain indicated their pain as a non-recurrent/single complaint, the proportion varied from 4.8% to 11.6% depending on the pain area (table 3). For recurrency we see that roughly 30% of the complaints were described as continuous pain and 55% as recurrent pain. For severity, we see that roughly 15% reported severe pain and 70% mild pain. Differences between the pain areas were not large. Between 5.3% and 9.7% of the pain sufferers indicated a more than one category, which was in most cases a combination of continuous mild pain and recurrent severe pain.

Consequences of pain

About half of those reporting musculoskeletal pain reported also contact with an health professional because of their specific musculoskeletal pain during the last year (table 4). Roughly between 30% and 40% reported contact with the general practitioner, between 20% en 30% contact with a medical specialist and between 20% and 30% a contact with the physiotherapist. The use of medicines during the last year was reported by 17.6% of those with pain of elbow or wrist/hand and by 27.4% of those with pain of neck, shoulder or higher back. For the other areas the use of medicines was reported by a proportion between those extremes.

Roughly 30% reported limitation in daily life due to their musculoskeletal pain. For those who had paid work, the majority with pain did not report work leave because

of their pain complaint. The highest percentage with work leave was found for low back pain: almost a quarter (24.4%) of those with low back pain reported sick leave in the past year. For pain of ankle or foot and neck, shoulder or higher back work leave was also relatively common but for pain of elbow or wrist/hand and pain of hip or knee sick leave was less frequent.

Table 3 Course of musculoskeletal pain (%), by anatomical area, DMC_3-study

	Among persons with pain of				
	Neck, shoulder or higher back	Elbow or wrist/hand	Lower back	Hip or knee	Ankle or foot
Continuous severe pain	3.1	4.0	3.5	5.2	6.1
Continuous mild pain	25.9	29.2	20.2	27.8	29.8
Recurrent severe pain*	8.3	11.0	15.4	10.1	12.4
Recurrent mild pain*	46.7	43.3	47.7	46.0	34.8
Non-recurrent	6.3	7.5	4.8	4.8	11.6
Complaint varies**	9.7	5.0	8.3	6.2	5.3

* for the 'recurrent'-category 'frequently recurrent' and 'occasionally recurrent' were combined
** for a number of respondents more than one of the seven course descriptions were ticked, this was often a combination of continuous mild pain and recurrent severe pain.

Table 4 Consequences of musculoskeletal pain (%) during 12 months before survey, by anatomical area, DMC_3-study

	Among persons with pain of				
	Neck, shoulder or higher back	Elbow or wrist/hand	Lower back	Hip or knee	Ankle or foot
Contact with:					
General Practitioner	40.8	33.8	31.6	32.6	39.7
Medical Specialist	29.9	27.4	19.8	25.0	30.1
Physiotherapist	32.8	21.6	26.3	20.9	18.2
One of the above	53.4	47.0	42.2	43.7	50.7
Use of medication	27.4	17.6	24.5	22.1	22.7
Limitation in daily life	29.4	32.1	32.6	29.9	*
Work leave (among those with paid work)					
Never	72.4	77.5	69.3	79.3	70.9
Less than one week	7.7	4.8	8.4	4.6	8.1
1-4 weeks	7.7	5.9	9.9	4.2	6.8
More than 4 weeks	5.9	5.3	6.1	4.0	7.5
Not applicable	6.2	6.4	6.3	8.0	6.7

* Not available

Risk groups

In a multivariate logistic regression model including all general sociodemographic characteristics there were two variables consistently associated with musculoskeletal pain: for all anatomical areas we found that women had the highest prevalences of pain, with ORs between 1.3 and 1.8 compared to men, and that those who were work disabled more often had pain, with ORs between 2.2 and 2.8, compared to those who were not work disabled.

Corrected for the other variables the middle age group of 45 to 64 year is a high risk group for elbow or wrist/hand, hip or knee and ankle or foot. Marital status and geographic region are not relevant indicators to define high risk groups for musculoskeletal pain. Educational level and work status played only a role for low back pain and pain of hip and knee but for educational status in an opposite direction: those with secondary (vocational) or vocational education reported relatively high prevalences of low back pain and relatively low prevalences of hip or knee pain. Household composition showed that those living alone are at high risk for complaints of the upper extremities and that living with more than two is protective for the lower extremities.

Non-response bias

With respect to the general data from the population register respondents and non-respondents hardly differ. For a small proportion of the non-respondents (n=729, 17,6%) we collected data on the prevalence of musculoskeletal pain for the 10 pain sites, by means of the response card. The period prevalence is consistently lower among the non-respondents, between 2 and 8 percentage points lower (not shown). The point prevalence is similar for respondents and non-respondents (not shown).

Discussion

This paper shows that musculoskeletal pain and its consequences are very common in the Dutch population of 25 years and over and that we can not clearly identify high risk groups on the basis of general sociodemographic characteristics, with exception of those who are work disabled and women.

While interpreting the results of the DMC_3-study some limitations should be taken into account, including the possibility of selective non-response and limitations concerning the measurement of musculoskeletal pain. Like other population-based studies in the Netherlands this study also had a relative high non-response.[27] However, based on the general characteristics from the population register respondents and non-respondents did not differ.

Table 5. Odds ratios (+ 95% confidence interval) for musculoskeletal pain in the Dutch population by socio-demographic characterisitics, by anatomical area, DMC_3-study (statistical significant ORs are printed bold)

	Pain of									
	Neck, shoulder or higher back		Elbow or wrist/hand		Lower back		Hip or knee		Ankle or foot	
Sex										
Men	1		1		1		1		1	
Women	**1.8**	**(1.5-2.1)**	**1.8**	**(1.5-2.1)**	**1.3**	**(1.1-1.5)**	**1.5**	**(1.3-1.8)**	**1.4**	**(1.1-1.7)**
Age group										
25-44	1		1		1		1		1	
45-64	1.0	(0.9-1.2)	**1.5**	**(1.2-1.8)**	1.0	(0.8-1.2)	**1.4**	**(1.2-1.8)**	**1.5**	**(1.1-1.9)**
65+	0.9	(0.6-1.4)	1.2	(0.8-2.0)	1.0	(0.6-1.4)	**1.5**	**(1.0-2.3)**	1.6	(0.9-2.8)
Marital status										
Unmarried	1.0	(0.8-1.2)	1.0	(0.7-1.3)	0.8	(0.6-1.0)	0.8	(0.6-1.3)	**1.4**	**(1.0-1.9)**
Married	1		1		1		1		1	
Widow	**0.7**	**(0.5-0.9)**	0.7	(0.5-1.0)	0.9	(0.7-1.3)	0.9	(0.7-1.3)	0.8	(0.5-1.2)
Divorced	1.0	(0.7-1.3)	1.2	(0.8-1.6)	1.1	(0.8-1.4)	1.0	(0.7-1.4)	1.0	(0.7-1.6)
Region of living										
North	0.8	(0.7-1.1)	0.9	(0.7-1.2)	1.0	(0.8-1.3)	0.9	(0.7-1.2)	0.8	(0.6-1.2)
West	1		1		1		1		1	
East	1.0	(0.8-1.2)	1.0	(0.8-1.2)	1.0	(0.9-1.2)	0.9	(0.8-1.1)	1.0	(0.7-1.2)
South	0.9	(0.7-1.0)	1.0	(0.8-1.2)	1.1	(0.9-1.3)	0.9	(0.8-1.2)	0.9	(0.7-1.2)
Household composition										
One person	1.6	(1.2-2.0)	**1.4**	**(1.-1.9)**	**1.1**	(0.9-1.4)	1.2	(0.9-1.5)	1.3	(0.9-1.7)
Two persons	1		1		1		1		1	
More than 2	1.0	(0.8-1.2)	0.9	(0.7-1.2)	0.9	(0.8-1.2)	**0.8**	**(0.6-1.0)**	**0.7**	**(0.5-1.0)**
Educational level										
Primary school	1.2	(0.8-1.7)	1.0	(0.7-1.6)	1.2	(0.8-1.7)	**0.7**	**(0.5-1.0)**	1.0	(0.6-1.6)
Junior (vocational)	1.2	(0.9-1.7)	1.1	(0.8-1.7)	1.2	(0.9-1.8)	0.7	(0.5-1.0)	1.1	(0.7-1.7)
Secondary (vocational)	1.1	(0.8-1.6)	1.1	(0.7-1.6)	**1.5**	**(1.0-2.1)**	**0.6**	**(0.4-0.9)**	1.1	(0.6-1.7)
Vocational	1.0	(0.8-1.5)	1.3	(0.8-2.0)	**1.5**	**(1.0-2.1)**	**0.6**	**(0.4-0.9)**	1.5	(0.9-2.4)
University	1		1		1		1		1	
Work status -1										
Without work	1.6	(1.0-2.5)	1.6	(1.0-2.6)	1.1	(0.7-1.8)	1.4	(0.9-2.4)	1.3	(0.7-2.3)
Work disabled	**2.4**	**(1.8-3.1)**	**2.2**	**(1.7-2.9)**	**2.6**	**(2.0-3.5)**	**2.8**	**(2.1-3.7)**	**2.4**	**(1.8-3.3)**
Not one of these	1		1		1		1		1	
Work status -2										
Have paid work > 12 hours	1		1		1		1		1	
Wants paid work > 12 hours	1.2	(0.8-1.6)	1.1	(0.7-1.5)	1.0	(0.7-1.3)	0.8	(0.6-1.2)	1.4	(0.9-2.1)
Does not want paid work > 12 hours	0.8	(0.7-1.0)	1.0	(0.7-1.2)	**0.8**	**(0.6-1.0)**	**0.8**	**(0.6-1.0)**	1.1	(0.8-1.5)
Pension. work disabled	0.9	(0.6-1.3)	1.2	(0.8-1.8)	**0.7**	**(0.5-1.0)**	1.3	(0.9-1.8)	1.1	(0.7-1.8)

More important the comparison of the pain prevalences of our respondents with those of the group of non-respondents based on the response card, suggests that the DMC_3-study gives a slight *over*estimation of the pain prevalences of the period prevalence. For low back pain it was found before that prevalence figures in survey responders may overestimate the true population prevalence.[9] In addition we have made a comparison between the response of the DMC_3-study and the response of

the Netherlands Health Interview Survey (NethHIS), using socio-economic, health, health care and lifestyle data as described in a separate paper.[28] We concluded that although the response to the mail survey (DMC_3-study) was lower than to the Neth-HIS respondents hardly differed with exception of a lower partcipation among persons with only primary school as educational level.

The prevalence of health problems based on population-based surveys, are highly determined by the methods used and the exact definition of pain and the exact wording of the questions in the questionnaire.[10,29,30] However, especially for pain assessment, self-reports are unavoidable.

High prevalences of musculoskeletal pain are commonly found in many countries. In the Ontario Health Survey of Canada the prevalence of a musculoskeletal health problem was 29% among those aged 16 years and over.[12] According to the US Health and Retirement survey 62% of those age 51 to 61 years reported at least one musculoskeletal health problem.[13] Also in the German population musculoskeletal pain was the most reported pain complaint.[14] An overview of prevalences of musculoskeletal pain based on population-based surveys focussing several anatomical sites is presented in table 6.

Table 6 Overview of prevalences of musculoskeletal pain based on population-based surveys focussing on several anatomical sites

Country, study	Age group (yr.)	Number studied	Description of pain	Prevalence	%
US HANES, National, 1971-1975, interview, (Cunningham et al 1984)[15]	25-74	6,913	pain on most days during at least a month	Back	17.2
				Knee	13.3
				Hip	8.2
				Fingers	6.8
				Shoulder	6.7
				Elbow	4.2
				Ankle	4.3
				Foot	3.2
				Wrist	3.1
				Any	32.6
(Miles et al 1993)[16]	55-74	1,126	pain on most days during at least a month	Neck or back	45.6
				Knee	33.1
				Hip	22.4
				Other	35.7
UK, North England, 1986, postal survey (Badley et al 1992)[20]	16+	21 889 house-holds repr. 42,826 people	suffer from any pain, swelling or stiffness	Knee	10.1
				Back	10.0
				Shoulder	6.9
				Hand	6.6
				Neck	5.9
				Hip	5.2
				Foot	4.8
				Ankle	4.1
				Wrist	3.3
				Elbow	3.1
				Any	24

Table 6 cond.

Country, study	Age group (yr.)	Number studied	Description of pain	Prevalence		%
UK, urban area, Postal survey (Urwin 1998)[18]	16-75	3,999	pain for more than one week during the past month	Back		23
				Knee		19
				Shoulder		16
				Neck		14
				Hand		12
				Hip		9
				Elbow		6
				Any		47
UK, North-east Scotland, postal survey (Elliott et al 1999)[19]	25 +	3,605	chronic pain of at least 3 months	Back		16.0
				Arthritis		15.8
				Any chronic pain		50.4
					M	V
Sweden, southern district,1988, postal survey (Andersson et al 1993)[21]	25-74	1,609	pain of more than 3 months	Low back	23.8	22.8
				Shoulder, upper arm	17.7	22.3
				Neck, back of head	14.5	19.1
				Knee	14.2	12.7
				Hand, wrist	8.6	16.8
				Shank, foot	9.6	11.9
				Elbow, forearm	8.3	11.9
Sweden, middle Sweden, postal survey (Linton et al 1998)[22]	35-45	2,305	spinal pain during past 12 months	Low back		56
				Neck		44
				Upper back		15
				Total spinal pain		66
					(a)	(b)
Sweden, a county, postal survey (Brattberg et al 1989)[23]	18-84	827	pain or discomfort (a), longer than 6 months (b)	Lower back	31.3	20.3
				Shoulders, arms	30.7	23.2
				Neck	26.2	19.3
				Legs	25.2	20.1
				Hips	14.4	10.4
				Upper back	13.4	10.2
				Any pain or disc	65.9	
Norway, national, Interview survey 1995 (Brage & Bjerkedal 1996)[17]	16-66	6,681	Pain during the last 14 days and at least a lot troubled	Cervical/upper limb		12.5
				Back		9.9
				Lower limb		7.7
Norway, 2 counties, postal survey (Hagen et al 1997)[24]	20-79	11,780	pain during previous month	Back		21.6
				Neck/shoulder		15.4
				Both		17.0
					M	V
Netherlands, one village 1975-1979, self-administered questionnaire (Valkenburg 1979)[25]	20+	6,584	Pain at moment of investigation	Back	23.6	32.5
				Neck	9.8	18.2
				Knee, right/left	6.7/6.1	11.8/11.1
				Shoulder, right/left	6.0/6.2	11.7/9.9
				Hand or wrist, right/left	4.0/3.3	9.1/8.9
				Hip, right/left	3.1/2.9	5.2/5.6
				Elbow, right/left	3.4/2.9	5.3/4.8
				Ankle or foot, right/left	3.0/3.0	5.0/5.1

In presents one study of the USA, 3 of the UK, 3 of Sweden, 2 of Norway and one from the Netherlands. Two of the studies were based on interviews and the rest on postal or self-administered questionnaires. The assessment and definition of the anatomical locations and pain varied and also the results in terms of the absolute prevalences. The prevalences are high and in particular for the back, neck, shoulders or knee.

Most available population-based studies focussed on one anatomical site. There are many studies on low back pain[31,32] and the range of prevalence of low back pain is between 8% and 82%. As an illustration we can present some data for other anatomical sites. A chronic neck disorder was reported by 9% of the men and 12.5% of the women in a Finish study.[11] More than half of the population in an English study among persons of 18 to 78 years of age reported shoulder pain according to at least one defintion of shoulder pain.[19] One of the few population-based studies on knee pain found a prevalence of 28.7%.[33] This was a study in England in the age group of 40-79 years and no differences by sex were found, which is the same in our study. The last illustration is a study of foot pain in the USA among women of 65 years and older.[34] Chronic and severe pain of at least one foot was reported by 14% of the women.

This overview of the literature shows that musculoskeletal pain is highly prevalent in all Western countries but at this point in time we are unable to evaluate the prevalence of musculoskeletal pain in the Netherlands as relative high or low compared to other countries. Our observation that low back pain, neck pain and shoulder pain are the most prevalent complaints is in agreement with results of other studies. The considerable overlap between pain experienced at different sites, as was reported by more than half of the respondents reporting pain, has also been found previously.[18] This was also put aptly by Croft in 'the epidemiology of pain: the more you have, the more you get'.[35] Future research on musculoskeletal conditions should consider to include all pain areas and should not focus on one pain site, because multiple site pain can have implications for etiology and consequences of pain.

The comparison of different studies is limited due to differences in questions and definitions. In the DMC_3-study we have measured many additional characteristics to get a broad picture of musculoskeletal pain. International consensus on instruments or definitions for measuring these health problems does not yet exists but should contribute to better international comparisons in the future. The results of the DMC_3-study suggest that measuring the self-reported course of pain should be considered for such international consensus. Seven descriptions were used to describe 'course'. Only a small part of the pain complaints was described as a single complaint. Most pain complaints were continuous or recurrent. Additional analyses are needed to identify which characteristics of the self-reported course of pain are associated with the use of health services, limitations of daily life, work leave and work disability.

Per anatomical area we have asked in our study some global consequences of the specific pain in terms of contact with health care professionals, use of medicines, disability and work leave. The presented figures represent the year before the survey. Our figures on consults with health care professionals seem rather low: only a minority of 50% or less reported a consult. Data of the Ontario Health survey showed a yearly consultation rate among those with any musculoskeletal disorder – which was 30% of the population - of more than 70%.[2] This implies that more than 20% of the population yearly consult a health professional for a musculoskeletal health problem. Our study gives even a higher percentage because the last year more than 40% of those with musculoskeletal pain, which was more than 70% of the population, consulted a health professional. This means that on a yearly basis 28% of the population consults a health care professional because of musculoskeletal pain, which can be considered as very high.

However, a considerable proportion of those with musculoskeletal pain does *not* consult a health professional and this was already shown for chronic low back pain patients in the UK.[36] This implies at least two things: (changes in) treatments of musculoskeletal pain do not reach those persons and registers within the health care will not be adequate to get a complete picture of musculoskeletal health problems in the population.

Musculoskeletal pain is not necessarily a problem of the older age groups. In contrast to many health problems, musculoskeletal pain is also very prevalent among the younger age groups. Women reporting higher rates of musculoskeletal pain than men is also commonly found. In contrast to most health problems and also to other findings on musculoskeletal pain[18] we found no effect of socio-economic status (as measured by educational level) on the pain prevalence. On the basis of the general sociodemographic characteristics only those who are work disabled were found to be a high risk group for musculoskeletal pain. This is not unexpected because musculoskeletal health problems are an important reason for work disability. For the Dutch population it was calculated that more than one-third of those who were work disabled were so because of low back problems.[37] Identification of high risk groups in the population is necessary to generate hypotheses or explanations of health differences and for the design of prevention programs. The existence of differences in health between subgroups in the population also suggest that there is room for improvements in health.

In conclusion, the results of this study show that musculoskeletal pain is very common among every subgroup in the population. It supports the effort within the framework of the Bone and Joint Decade 2000-2010, that asks for more attention for research, treatment and prevention of musculoskeletal conditions and for the care for those who suffer from them.

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Chapter 4.1.2

Prevalence and consequences of low back problems in the Netherlands, working versus non-working population, the MORGEN-study*

Abstract

Objective - To study the burden of illness of low back problems - prevalence and consequences - in the working and the non-working population.
Methods - Data from the Monitoring Project on Risk factors for Chronic Diseases, the MORGEN-study, were used. This project provided data on a probability sample of the general population aged 20-59 years in the Netherlands. Cross-sectional questionnaire data on 6317 men (24% non-working) and 7505 women (47% non-working) gathered in the period 1993 to 1995 were analysed.
Results - The 12 month period prevalence of low back problems for the working and non-working population was 44.4% and 45.8% for men, and 48.2% and 55.0% for women. Larger differences were found for chronic low back problems, and activity limitation and use of health services due to low back problems. More than one-third of those who were disabled were so because of low back problems. Excluding the work disabled, the prevalence and consequences of low back pain were still higher in the non-working group in comparison with the working population. Most of the non-working women were housewives and this group was both large in size and had a high prevalence of low back problems.
Conclusions - Among men studied, more than a quarter of the total burden of low back problems in those aged 20-59 years was found in the non-working population, among women this was 50%. Both research on causes and determinants of low back pain and the development of preventive actions - now being extensively focused on the working population - should also be translated to the non-working population.

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Introduction

Research on high risk groups for low back pain has mainly been focused on subgroups of the working population.[1-4] Evidently, low back pain is a key research topic among the working population because the suspected work-related determinants of low back pain and because the increasing responsibilities of employers for the health of their employees. However, to assess the total public health impact of low back problems, those belonging to the non-working population have also to be taken into account. The role of subgroups, that is, working and non-working population for the total burden of low back problems in the population is determined by (i) the size of the subgroup and (ii) the subgroups' prevalence of low back problems.

The size of the non-working population is substantial in many western countries, also among those belonging to the working-age group, that is those between around 15 and 64 yr. of age. According to the definition of the International Labor force, the unemployed for instance comprise figures as 8% (The Netherlands), 13% (France) or even 24% (Spain).[5] Besides the unemployed, housewives, students and those who are work disabled belong to the non-participants of the work force in the working-age group. In addition, it is well-known that subgroups of the non-working population have more health problems than those of the working population,[6,7] and this is also true for low back pain problems.[8,9]

In this paper we quantify the role of the working and non-working population for the burden of illness of low back problems (LBP) using population-based health survey data. In addition to the prevalence of LBP, we analyse the consequences of LBP which is described in terms of activity limitation, use of health services and some (former) work-related consequences.

Methods

For this study we used data from the Monitoring Project on Risk Factors for Chronic Diseases (the MORGEN-study), a cross-sectional study of age stratified probability samples of men and women aged 20-59 yr. who are living in three towns located in different regions in the Netherlands. The municipal population registers were used as the sampling frames. Data collection has started in 1993 and continued until 1997. It comprises questionnaires and medical examination at the regional Public Health Service (PHS) in each town. In this paper we will present analyses of data collected in the years 1993-1995.

Persons in the sample received a signed invitation letter, a flyer introducing the study and a response card. To stimulate participation the results of physical examination data (blood pressure, cholesterol, blood glucose values and quetelet index) were reported to the participants by letter. The response card was sent back by 70%, and 50% completed the full assessment (several questionnaires and physical examination). The total number of respondents in 1993-1995 was 13,927.

Data on sociodemographic variables, such as employement situation, lifestyle and the presence of chronic conditions were assessed by questionnaire. For low back problems a screening question was used: 'Have you had trouble, discomfort or pain with the lower part of the back during the last 12 months?' The region of interest was illustrated by a drawing of a complete human figure indicating the area between L1 and the gluteal folds (painted black) as the area of interest. The answers to the questions were checked by a research assistant during the PHS-visit and those with low back problems were given a supplementary questionnaire. This supplementary questionnaire comprised questions on low back pain characteristics (duration of LBP, with/without radiation to extremities, frequency), its consequences unrelated to work (limitation of normal activities, use of health care) and its consequences related to (former) work (work absenteeism, work disability, changes in work due to LBP). This questionnaire was designed from experiences of other studies using questionnaires to assess low back pain characteristics.[10,11]

The low back pain parameters under study were: (1) having or have had low back problems during the past year, (2) having chronic low back problems (longer than 3 months), (3) having or have had low back problems with radiation to the leg(s).

The working population is defined as those who have wage-earnings and those who own a business. Other studies use the term labour force participation or employement status. The non-working population consists of housewives, unemployed, the early retired, those having a disability pension and 'other'. The 'other' group subjects such as students.

For men and women the weighted estimates of prevalence and consequences of LBP will be presented by working status, including 95% confidence estimates. Data were weighted so the age-sex distribution is equal to that of the Netherlands population aged 20-59 years of 1994: presented prevalences can be interpreted as estimates for the population prevalences. Confidence estimates are calculated on the original respondent distribution. The effects of differences in residence, marital status, age and education on these prevalence are studied using logistic regression analysis. To assess the relative importance of subgroups for the total burden of low back problems in the population we calculated a combination score including the subgroup prevalence and the size of the subgroup. The combination score is calculated by multiplying the size of the subgroup (in %) and its LBP-prevalence and dividing it by the total LBP-prevalence.

Table 1 Description of the population by work-status, MORGEN-population aged 20-59 years, unweighted and weighted for the age-sex distribution of the Dutch population aged 20-59 in 1994.

	Unweighted		Weighted	
	Working population	Non-working population	Working population	Non-working population
Number (abs)*	8482	5340		
%				
Sex (% male)	56.2	43.8	60.0	34.4
Age				
20-29 years	18.2	16.1	27.6	27.8
30-39 years	27.6	16.9	32.0	21.4
40-49 years	32.4	26.2	27.1	23.6
50-59 years	21.9	40.9	13.3	27.3
Place of residence				
Amsterdam	32.6	33.6	32.1	34.7
Doetichem	30.3	27.3	30.0	25.8
Maastricht	37.2	39.1	37.9	39.5
Marital status				
unmarried	29.7	23.4	36.8	33.9
married	62.7	64.1	56.9	56.0
widow	0.9	2.8	0.6	1.9
divorced	6.2	9.4	5.1	7.9
Level of education				
primary school	7.2	20.1	6.0	16.5
junior (vocational) education	35.2	42.8	33.8	38.8
Secondary (vocational) education	30.1	22.6	33.0	28.8
Vocational colleges, university	27.5	14.4	27.2	15.9

* The total number (n=13,822) is slightly lower than the total number of repondents of the MORGEN-study (n=13,927) due to missing values for work status (0.8%).

Results

Of the MORGEN population almost 60% belonged to the working population. The non-working population consisted of more women, more persons in the highest age group, that is 50-59 y, and more persons with lower education (Table 1). Weighting by age and sex changed the distribution by age and marital status as expected. However the distribution by place of residence and level of education did not change.

Higher prevalence of LBP and its consequences were found in the non-working population than in the working population, which held true for both men and women (Table 2) and also when adjustments were made for differences in age, marital status, educational level and residence (not shown). The largest differences were found for the more severe low back problems, that is chronic low back prob-

lems and LBP with radiating pain to the leg(s). Chronic LBP was reported by 16.0% and 23.1% of the working and non-working men respectively and 17.9% and 27.4% of the working and non-working women.

Consequences of low back pain were also reported more frequently by those belonging to the non-working population than by those belonging to the working population. Activity limitation due to low back pain was reported by 11.8% and 18.6% of the working and non-working men and 11.6% and 18.2% for the working and non-working women. For the use of health services due to low back pain these figures were 18.1% and 22.6% (men), and 19.4% and 25.0% (women). A small proportion of the working population was (partially) work disabled, whereas 13.1% of the non-working men and 6.2% of the non-working women was (partially) work disabled due to low back problems. Adaptation of the workplace or change of job in the past *due to low back problems* was reported more frequently by those belonging to the non-working population than by those belonging to the working population.

Among the non-workers those who were work disabled reported, not surprisingly, the highest proportion of low back problems. Furthermore, more than one-third of those who were work-disabled *and* non-working were work disabled *because of their low back problems. The unemployed and the women who were* housewives had also substantially more low back problems than those who were working.

Translating our findings to the total population in the age group 20-59 yr. we see that almost a quarter of the burden of low back problems among men was found in the non-working population. For women this proportion was 50% (Table 3). Between 7 and 15% of the burden of low back problems in the population was attributed to the population which was work disabled and between 3 and 7% to the unemployed. Among women the major burden was found in the group of housewives (between 28 and 34%).

Discussion

The results of this study indicate that LBP is a major health problem in both the non-working as well as the working population, and 30% (men) and 50% (women) of the total burden of the low back problems is found in the non-working population. This held true for both the prevalence and consequences of LBP. Besides those who were work disabled, groups of concern are the unemployed and housewives.

For analyses in this paper it is essential to have information on the general population, which is available in the MORGEN-study. The MORGEN-study has also some limitations including the LBP measurement, problems in the classification of non-working subgroups and the possibility of non-response bias.

Table 2 Prevalence of low back problems (LBP) and consequences (and 95% Confidence Intervals) among working and non-working population and the non-working subgroups, MORGEN93-95, weighted for the Dutch population 20-59 years. The 'n'-values are the unweighted numbers.

	Working population (n=8482)	Non-working population n=5340	By non-working subgroup				
			Housewives	Un-employed	On early retirement	Work disabled	Other
Men (n=6317)							
Size of population (in % of total men)	76.3	23.7	0.4	5.7	1.2	6.0	10.3
LBP-prevalences							
12 months period prevalence	44.4 (43.0 45.8)	45.8 (43.3 48.2)	-	46.0	40.1	58.7	39.0
chronic	16.0 (14.9 17.0)	23.1 (21.0 25.2)	-	20.8	13.5	45.5	13.0
radiation	12.7 (11.8 13.7)	18.3 (16.4 20.2)	-	16.0	16.7	35.7	9.8
LBP-consequences							
activity limitation	11.8 (10.9 12.7)	18.6 (16.6 20.5)	-	17.3	5.0	34.7	11.9
use of health services	18.1 (17.0 19.2)	22.6 (20.5 24.7)	-	22.1	10.8	40.4	14.6
(partially) work disabled	1.8 (1.4 2.2)	13.1 (11.4 14.8)	-	3.3	-	36.7	6.6
work adaptation or change of job	3.1 (2.6 3.6)	4.3(3.3 5.3)	-	3.5	-	7.1	3.5
Women (n=7505)							
Size of population (in % of total women)	53.1	46.9	27.2	4.4	0.2	4.5	10.6
Low back problems							
12 months period prevalence	48.2 (46.5 49.9)	55.0 (53.4 56.6)	53.7	53.0	-	73.9	51.2
chronic	17.9 (16.6 19.2)	27.4 (26.0 28.8	28.0	19.2	-	53.8	18.6
radiation	14.8 (13.6 16.1)	23.9 (22.6 25.3)	23.7	22.1	-	48.3	15.7
LBP-consequences							
activity limitation	11.6 (10.5 12.7)	18.2 (17.0 19.4)	16.2	13.7	-	45.9	14.1
use of health services	19.4 (18.1 20.8)	25.0 (23.7 26.4)	24.3	19.7	-	52.0	17.8
(partially) work disabled	0.7 (0.4 1.0)	6.2 (5.4 7.0)	2.3	2.5	-	37.4	3.6
work adaptation or change of job	2.5 (2.0 3.0)	3.7 (3.1 4.3)	2.7	4.4	-	8.8	3.6

- = not appicable

Table 3 The burden of low back problems due to working and non-working population and the non-working subgroups, MORGEN93-95.

	Total prevalence	Due to:		Due to non-working subgroup				
		Working population	Non-working population	Housewives	Unemployed	On early retirement	Work disabled	Other
		% of total prevalence						
Men								
LBP-prevalences								
12 months period prevalence	44.7	75.8	24.2	-	5.9	1.1	7.8	8.9
chronic	17.7	69.1	30.9	-	6.7	1.0	15.4	7.5
radiation	14.0	69.2	30.8	-	6.5	1.5	15.2	7.2
LBP-consequences								
activity limitation	13.4	67.2	32.8	-	7.4	-	15.5	9.1
use of health services	19.2	72.1	27.9	-	6.6	-	12.6	7.8
Women								
Low back problems								
12 months period prevalence	51.4	49.8	50.2	28.4	4.6	0.2	6.5	10.6
chronic	22.4	42.5	57.5	34.0	3.8	-	10.8	8.8
radiation	19.1	41.2	58.8	33.7	5.1	-	11.4	8.8
LBP-consequences								
activity limitation	14.7	41.9	58.1	30.0	4.1	-	14.1	10.2
use of health services	22.0	46.7	53.3	30.0	4.0	-	10.6	8.6

- = not appicable

The data on LBP were based on self-reports using a screening question with a very low severity level. Self-report is the only source to assess information on health problems like LBP, but under- or overreporting may be introduced. For instance, awareness of occupational hazards may result in overreporting among workers who have increased awareness of such hazards.[12] Such response tendencies seem relevant for comparisons between subgroups in the working population but are not likely to differ between the working and non-working population, so being of less relevance in this analyses. The low severity level of the screening question, using also terms such as 'trouble' and 'discomfort' is responsible for the high (in absolute terms) 12 month period prevalence of LBP, although even the chronic LBP prevalence can be regarded as high. Other questions and other instruments will give different absolute figures but the observed differences between the working and non-working population were consistent for different severity levels of LBP as characterised by radiation, duration, and its consequences. Unfortunately the MORGEN study lacks data on the severity of pain among those with LBP and on *current* LBP (other than those with chronic LBP), so these figures could not be analysed.

The question on employement status in the MORGEN study has resulted in a relatively high group (8.7%) of people not specified in a subgroup, in this paper referred to as 'other'. This group consists mainly of students (full-time education was not a separate category) and those who regard themselves belonging to more than one category (3.1% of the total MORGEN population). Because this 'other' category is an unknown mix of apparently relatively healthy subjects (students) and probably relatively less healthy subjects, such as persons who are partly work disabled, we can not adequately interpret the prevalence figures in this group.

The relative high non-response of the MORGEN-study is equivalent to the non-response of other populations surveys in the Netherlands. This is in general lower than observed in other countries.[13] This low response was partly introduced by using different phases in the study. In the first phase persons were asked to indicate their agreement to participate in the study by sending back a response card. Agreement led to completion of a postal questionnaire (the second phase) and then invitation and a visit to the Public Health Service (third phase). In addition, high demands were put on the respondents. Participants had to come to the regional Public Health Service on weekdays between nine and five for their examinations including the collection of blood. For those who did not want to participate in the study and gave their reasons on the response card, these reasons were mainly 'no time' (39%), 'no interest' (25%) and 'already having a medical check-up on a regular basis' (18%).

Selection bias with respect to LBP is unlikely because the MORGEN study is a general health study not presented as a specific LBP-study. If reasons for non-participation differs between the working and (subgroups of) the non-working population more severe selection bias is introduced. Although this bias cannot be measured directly some indication can be given by comparing our figures of working and non-working population by those of other sources. In the MORGEN-population

76% of the men and 53% of the women belonged to the working population. Figures reported by Statistics Netherlands are 71% and 42% for men and women respectively and concern the population of 15 to 64 y.[5] Our figures are slightly higher which is at least partly due to differences in age range. These findings indicate no reason to suspect selection bias for employement status.

The prevalence of LBP being higher in the non-working population than in the working population has been indicated by other studies, although those studies did not account for the size of the non-working population. Data from the NHANES-II (USA)[8] show low back pain prevalence of the working and the non-working population of 14.7% and 21.4% (prevalence odds ratio (OR) =1.6) respectively. Low back pain figures from the Ontario Health Survey (Canada)[9] for the working and non-working population were 7.3% and 10.8% respectively (OR=1.5).

Explanations for these findings include the 'healthy worker' selection process and both groups being exposed to risk factors of low back problems. The healthy worker selection process, also called the healthy worker effect, refers to the process that those who remain employed tend to be healthier than those who leave employment.[14] The causes of the low back problems of those belonging to the non-working population can be found in the former working situation. This will be true for a substantial part of those who are work-disabled but possibly also for those who are unemployed. This phenomenon can, however, not explain the high prevalence of low back pain among housewives because most of them have no long employement history. In particular in this subgroup etiologic factors of LBP should be investigated.

Although in most cases the causes of low back pain are unknown, rather undisputed risk factors for low back problems are physically strenuous activities such as heavy lifting, twisting, working in an awkward position, frequent lifting in non-neutral postures, static postures, especially prolonged sitting, and motor-vehicle driving.[15-18] Such activities are, of course, also not unknown in leisure time and household activities. Further research is needed to identify differences and correspondences of the aetiology of low back problems in the working and the non-working population.

The identification of subgroups in the population that have high risks for low back pain is necessary to identify risk factors for low back pain and to identify target groups for (cost-effective) preventive actions. The importance of subgroups in the population for public health lies in the focus of intervention and prevention. If these actions are only focused on the working population, the largest part of the burden of low back problems is not eligible, because these are found in the non-working population. At this moment substantial effort is put into interventions to reduce the problem of low back problems in the workplace. These interventions include specific exercise, ergonomic adaptation of the work place, and education (back

school).[19-22] Knowledge on these issues should also be translated to the non-working population.

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Chapter 4.2.1

Physical load in daily life and low back problems in the general population - the MORGEN-study*

Abstract

Background. We studied the contribution of physical load in daily activities, including activities in work, house keeping and leisure time, to the burden of low back problems (LBP) in the population.

Methods. Logistic regression models were used to calculate the association between physical load and several LBP-parameters as assessed by questionnaire in a cross-sectional study on 22,415 randomly selected men and women in The Netherlands controlling for well-known LBP determinants. The population attributable risk percentage (PAR) was estimated with the elimination-method using the logistic model.

Results. Half of the population reported LBP during the past year and 19% chronic LBP. Activities characterised by an awkward posture, by the same posture for a long time or by often bending and rotating the trunk, increased the risk for LBP, with ORs between 1.1 and 1.6. More than 13% of the 1-year period prevalence of LBP could be contributed to these activities. This PAR was higher for those belonging to the working population, for women and for the more severe LBP-parameters.

Conclusion. Because LBP present such a large public health problem, the estimated potential impact of eliminating (the unhealthy effect of) physical load is substantial. To assess the real health gain, more insight is necessary in the causality of the relationship and in effective preventive measures.

* Picavet, HSJ, JSAG Schouten. Physical load in daily life and low back problems in the general population - the MORGEN-study. Preventive Medicine 2000;31:506-512.

Introduction

Low back problems (LBP) represent a major public health problem in Western countries due to its high prevalence and due to its major consequences for the individual and society including disabilities and work leave.[1] Although the etiology of most LBP is poorly understood, some specific physical activities are well-known risk indicators for LBP.[1-8] Lifting, twisting, lifting while twisting, pulling, pushing, carrying and lowering, bending, and bent or twist posture are identified as LBP risk factors in the work situation of the general working population[2,3] and within specific working areas or specific professions, e.g. nurses,[4-6] salespeople[7] and construction workers[8]. These physical exposures are usually referred to as occupational activities, work load, physical work exposures, which all emphasize the work environment. These exposures of physical load also occur outside the work situation but have not been studied in the general population.

To assess the contribution of physical load to the total burden of LBP in the population we need adequate estimates of the prevalence of exposure to physical load, and the exposure dependent risk of LBP. Such a population attributable risk (PAR) provides insight into the proportion of LBP that, in theory, would be preventable if the unhealthy effect of physical load can be eliminated.

The basic elements for calculating the PAR for the total population are not easily derived from literature. First, figures on the exposure to physical load (and the LBP-risks) are only available for the working population and in most cases only for specific occupations. But many persons do not belong to the working population and exposure to physical load can also take place outside the workplace. Secondly, comparison of the available studies on physical load exposure and related LBP risk, is highly limited due to differences in the instruments and methods used and due to differences in the study population characteristics (e.g., differences by age group, sex, socioeconomic status, type of industry, and country). In particular there is no internationally accepted instrument for the measurement of LBP. In general it is important to distinguish divers LBP parameters, including a time dimension (duration and recurrence) and severity (severity of pain, sign of root compression, disability). Thirdly, most relative risk (RR) estimations are based on odds ratios (OR) calculated using cross-sectional designs. The OR is a poor estimator of the RR when the rare disease assumption is not met. In most populations low back pain - with one year prevalences up to 75%[9]- is not a rare disease.

The objective of the current study is to estimate the contribution of physical load in daily activities to the burden of LBP in the population. We analyzed cross-sectional population-based questionnaire data on physical load in daily activities including work, leisure and household activities in both the working and the non-working population, in relation to LBP.

Methods

Material

For this study we used data from the Monitoring Project on Risk Factors for Chronic Diseases (the MORGEN study): a cross-sectional study of probability samples of men and women aged 20-59 years, stratified by 10-year age groups (samples of equal size), living in three towns (Maastricht, Amsterdam, Doetinchem) located in different regions in The Netherlands. The data collection years were 1993 to 1997. The municipal population registers were used as sampling frames. After an agreement to participate on the basis of a postal invitation, respondents received various questionnaires and made an appointment for a medical examination at the Public Health Service (PHS) of each town. Of those approached 75% responded: 50% completed the total survey including questionnaires and a medical examination, 20% refused to participate and 5% agreed to participate but could not make an appointment for investigation at the PHS. Of the "passive" non-responders, who amounted to 25%, it is estimated that 30% is due to errors in the address registers (address does not exist, addressee is unknown, moved or died). Data were available for 22,415 persons.

Data on sociodemographic variables, on physical load in daily activities and the presence of chronic conditions were assessed by self-administered questionnaire. The questionnaire on physical load consisted of 9 items of specific physical activities and postures. The questions were preceded by a title "Strain in daily activities" and a text explaining that "daily activities" refer to activities during paid work, housekeeping, school, leisure time and voluntary work. The form of the questions was: In daily life, do you often do activities in an awkward posture? (yes/no). It was designed as a screening questionnaire for physical load in different professions. The validity study showed that the physical load ranking of different professions on the basis of the questionnaire was similar to the ranking based on observation techniques.

For LBP a screening question was used: Have you had trouble, discomfort or pain with/in the lower part of the back during the last 12 months? The region of interest was illustrated by a drawing of a complete human figure indicating the area of interest in black.

The answers to the questions were checked by a research assistant during the PHS-visit and those with LBP were given a supplementary questionnaire. This supplementary questionnaire comprised questions on low back pain characteristics such as duration of LBP, radiation to extremities, contact with physician because of the LBP and activity limitation. This questionnaire was designed using experiences of other studies using questionnaires to assess low back pain characteristics.[10,11] Several low back pain parameters were analyzed:

(1) 1 year period prevalence of LBP - those who reported having had low back problems during the past 12 months.

(2) LBP with radiation - those who reported having had low back problems during the past 12 months *with radiation to the leg(s).* This parameter indicates the possibility of root compression, and presents therefor a measure of a specific subtype of LBP sufferers and severity.
(3) Chronic LBP - those who reported having had low back problems during the past 12 months *longer than 3 months.*

Data were also analyzed for working men and women and nonworking men and women. The working population was defined as those who are wag-earners and those who own a business. The nonworking population consists of housewives, the unemployed, the early retired, those having a disability pension, students etc.

Analyses

Multiple logistic regression was used to estimate the association between physical load parameters and LBP. Adjustment was made for some well-known risk factors for LBP,[12] i.e. age, sex, height, smoking, socioeconomic status, obesity and marital status. ORs were calculated two ways: per individual activity including all other risk factors (model 1) and also including all other physical load parameters (model 2).

The PAR presents the proportion of the prevalence of LBP that can be attributed to a risk factor. In its most basic form the formula is PAR = $(p-p_e)/p$, with p representing the prevalence of LBP and p_e the prevalence of LBP when the specific risk factor is not present in the population or not a risk factor. The PAR is usually calculated using the formula PAR = $p_r(RR-1)/(p_r(RR-1)+1)$ with RR representing the relative risk on LBP of the exposed versus the non-exposed and p_r representing the proportion exposed in the population.[13] Although the odds ratio (OR) is often used as estimation of the RR, this was not possible in this study due to the high prevalence of LBP, which violates the rare disease assumption. An alternative method was estimating p_e by calculating the average probability of having LBP in our population with the original estimates found using the logistic model and by eliminating the risk factor.[14] This is the same as setting the exposure to its target value, i.e., non-exposure.[15] The coefficients of the logistic model and the actual exposures among the respondents were used to recalculate the prevalence of LBP by averaging the predicted probablity of having LBP for all respondents, by formula:

$$p = \frac{1}{n}\sum_{i=1}^{n}\frac{1}{(1-e^{-z_i})} \text{ with } z_i = c + \sum_{j=1}^{l}\beta_j g_{j,i} ,$$

where p is the predicted proportion of the population in the agegroup 20-59 years with LBP, n is the total number of respondents, e is the basis of the natural logarithm (approximately 2.71828), c is the constant of the results of the logistic regression, β_j is the coefficient belonging to exposure or confounder j, $g_{j,i}$ is the value of

exposure or confounder *j* for respondent *i*, and *I* is the total number of exposures or confounders in the model.

Repeating this calculation and setting the coefficient of exposure *j* to 0 gives the predicted proportion of the population with LBP when exposure j is eliminated. This calculation method also takes into account the effects of other risk factors if one risk factor is eliminated. A PAR was only calculated for the physical load parameters that were statistically significant associated with LBP independently of the other physical load parameters. Analyses are performed using SAS, version 612.

Table 1 Description of the population, MORGEN project 1993-1997

	N	22,415
	%	
Sex (% male)		45.2
Age	20-29 years	17.5
	30-39 years	23.9
	40-49 years	30.7
	50-59 years	28.0
Place of residence	Amsterdam	33.5
	Doetichem	29.5
	Maastricht	37.0
Marital status	Unmarried	28.6
	Married	61.7
	Widow	1.6
	Divorced	8.0
Education (highest Level achieved)	primary school	11.7
	junior (vocational) education	36.6
	secondary (vocational) education	27.8
	vocational colleges, university	23.9
Work status	paid job	62.6
	no paid job	37.4
Smoking	Current	35.6
Obesity	Body Mass Index ≥ 30 kg/m^2	10.4
Low back problems	12 months period	50.3
	with radiation	16.6
	Chronic	19.1

Results

General characteristics of the study population are summarized in Table 1. LBP during the 12 months before interview were reported by 50.3%. LBP that were accompanied with radiation to the legs were present among 16.6% of the population. Chronic LBP were observed in almost one-fifth of all respondents.

Physical load was reported frequently, especially "often bending and twisting the trunk" (40.6%), "often keeping the same posture for a long time" (32.6%), "often making regular short movements" (30.2%) and "often lifting, carrying, pushing and pulling" (30,4%) (Table 2). Without controlling for the other physical load parameters, all physical load parameters were associated with LBP with ORs ranging from 1.29 to 2.01 (model 1). These ORs were almost the same as the univariate ORs. The ORs were also in the same order of magnitude for the different LBP-parameters (not shown). Including all parameters in the model (model 2) yielded only a few activities being statistically significantly associated with LBP. "Often awkward postures" was most strongly associated with the period prevalence of LBP (OR= 1.64, 95% Confidence limits (CL) 1.50 1.79). Other independent negative effects on LBP were found for "often keeping the same posture for a long time", "often bending and twisting the trunk", "often and for a long time keeping a twisted trunk" and "often lifting, carrying, pushing and pulling".

Of the 12 months period prevalence of LBP 13.3% is attributed to the 5 statistically significant associated physical load parameters (Table 3). The total PARs for the more severe LBP parameters are higher, 18.3 and 15.6% of LBP with radiation and chronic LBP respectively. "Often awkward postures" has the largest contribution of the physical load parameters.

Table 2 Prevalence of physical load and association with low back problems, 12 month period prevalence of LBP, Odds Ratio (OR) and 95% Confidence Limits (CL), MORGEN project 1993-1997

	Prevalence (%)	Association with low back problems OR* (95%CL)		
		Univariate	Model 1	Model 2
Mechanical vibration	6.8	1.25 (1.12 1.39)	1.32 (1.18 1.48)	-
Often awkward postures	18.7	1.93 (1.80 2.07)	2.01 (1.87 2.16)	1.64 (1.50 1.79)
Often keeping the same posture for a long time	32.6	1.14 (1.07 1.20)	1.30 (1.23 1.38)	1.17 (1.10 1.25)
Often making regular short movements	30.2	1.39 (1.31 1.47)	1.43 (1.34 1.52)	-
Often bending and twisting trunk	40.6	1.48 (1.41 1.57)	1.52 (1.44 1.61)	1.18 (1.10 1.27)
Often and for a long time keeping a twisted trunk	23.9	1.38 (1.29 1.47)	1.45 (1.36 1.55)	1.10 (1.02 1.19)
Often have yours arms elevated	16.8	1.26 (1.18 1.36)	1.29 (1.19 1.39)	-
Often working kneeled or squatted	8.9	1.56 (1.42 1.72)	1.55 (1.41 1.71)	-
Often lifting, carrying, pushing, pulling	30.4	1.45 (1.37 1.54)	1.48 (1.40 1.58)	1.16 (1.08 1.25)

*Model 1: including age, sex, work status, marital status, education, smoking and obesity, Model 2 : same as model 1 including all other physical load variables

Table 3 Estimated Population Attributable Risk (PAR) for physical load expressed as the percentage of the prevalence of LBP, MORGEN-project 1993-1997

	LBP parameter [PAR (%)]*		
	Period prevalence	LBP with radiation	Chronic LBP
Mechanical vibration	-	-	-
Often awkward postures	4.3	8.6	9.5
Often keeping the same posture for a long time	2.4	3.2	-
Often making regular short movements	-	2.7	-
Often bending and twisting trunk	3.2	5.6	5.3
Often and for a long time keeping a twisted trunk	1.0	-	1.9
Often have yours arms elevated	-	-	-
Often working kneeled or squatted	-	-	-
Often lifting, carrying, pushing, pulling	2.3	-	-
Total PARt	13.3	18.3	15.6

Results of elimination model based on logistic model including all other physical load variables and age, sex, work status, marital status, education, smoking and obesity

†*Only based on the statistical significant load parameters*

Exposure to physical load was more often reported by the working population than by the nonworking population (figure 1). Among the working population only mechanical vibration is more often reported by man than by women. Among the nonworking population there were some more differences between men and women. Only the physical load parameter "often awkward postures" is, for all groups, systematically associated with increased risk for low back problems (Table 4). "Often bending and twisting the trunk" is only a risk factor for women and "often lifting, carrying , pushing and pulling" only for the working population (especially among working women). The PARs differ by substantially by subgroup: higher among women than among men and the PARs were higher among the working than among the nonworking population.

Discussion

This study showed that eliminating the (health consequences of) physical load can theoretically reduce the burden of low back pain by 13-18%. This PAR can be regarded as substantial because LBP is a prevalent public health problem, strongly associated with work disability, health care utilization and high costs. Our analysis showed that we should focus on the prevention of regular exposure to activities characterized by awkward postures, bending and twisting and the prevention of keeping the same posture for a long time. Physical load can be either part of the work situation or of leisure time expenditures.

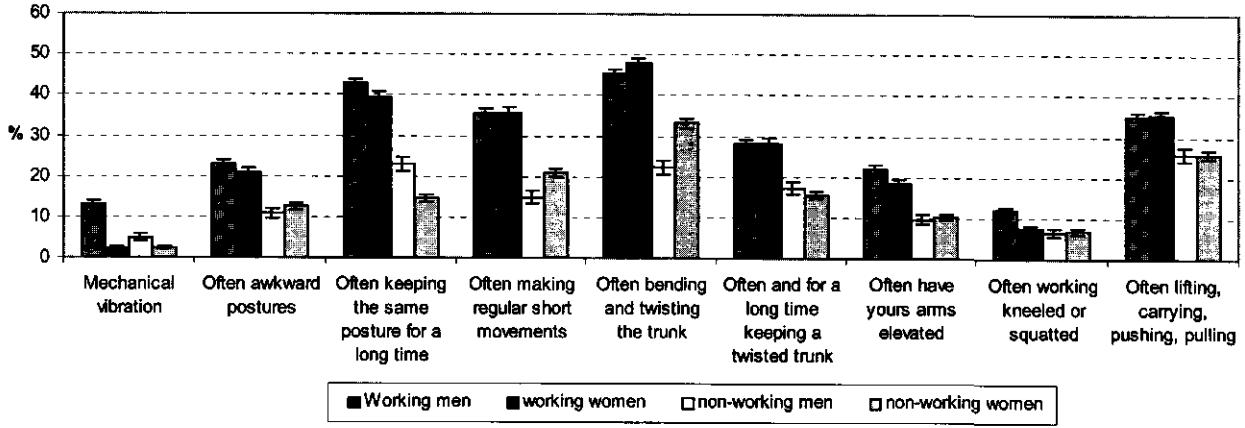

Figure 1 The prevalence of physical load among working men and women and nonworking men and women

Table 4 Estimation of Population Attributable Risk (PAR) of low back problems (LBP) for physical load, by working men and women and nonworking men and women, expressed as the percentage of the prevalence of LBP, MORGEN project 1993-1997

	PAR[f]			PAR[f]		
	Period prevalence	LBP with radiation	Chronic LBP	Period prevalence	LBP with radiation	Chronic LBP
	Working men (n = 7,655)			Nonworking men (n = 2,405)		
Mechanical vibration	-	-	-	-	-	-
Often awkward postures	4.5%	10.9%	7.9%	2.2%	4.4%	6.6%
Often keeping the same posture for a long time	5.4%	11.3%	5.9%	3.2%	-	-
Often making regular short movements	-	-	-	-	-	-
Often bending and twisting the trunk	-	-	-	-	-	-
Often and for a long time keeping a twisted trunk	2.3%	-	8.4%	-	-	-
Often have yours arms elevated	-	-	-	-	-	-
Often working kneeled or squatted	-	4.4%	-	-	-	-
Often lifting, carrying, pushing, pulling	3.2%	-	-	-	-	*
Total PAR[+]	15.5%	24.1%	20.3%	6.0%	4.4%	6.6%
	Working women (n = 6,262)			Nonworking women (n = 5,893)		
Mechanical vibration	-	1.4%	-	0.6%	1.8%	21.6%
Often awkward postures	5.1%	9.3%	11.8%	3.4%	7.0%	7.6%
Often keeping the same posture for a long time	2.2%	-	5.2%	-	-	-
Often making regular short movements	-	-	-	1.7%	5.9%	3.5%
Often bending and twisting the trunk	5.2%	10.1%	15.1%	3.1%	5.8%	-
Often and for a long time keeping a twisted trunk	-	-	-	-	-	-
Often have yours arms elevated	-	-	-	-	-	-
Often working kneeled or squatted	-	-	-	-	-	-
Often lifting, carrying, pushing, pulling	4.8%	10.3%	6.2%	-	-	-
Total PAR[+]	17.6%	27.5%	32.9%	9.3%	18.8%	12.3%

[f]Results of elimination model based on logistic model including all other physical load variables and age, sex, work status, marital status, education, smoking and obesity

*This item was inversly associated met LBP, so no PAR could be estimated

[+]Only based on the statistically significant physical load parameters

In a recent review study "frequent bending and twisting" and "manual materials handling" (similar to "lifting, carrying, pulling, pushing") were regarded as established risk factors (in the work situation) with ORs ranging between 1.29-8.09 and 1.12-3.07 respectively.[16] Our ORs were in the lower range compared to those found in other studies. In contrast to our study the review revealed "static work posture" (similar to "same posture for a long time") as no being a risk factor for low back problems, and "whole-body vibration" (OR range 1.47-9.00) as being one.

In order to calculate a PAR estimate, information on the prevalence of the risk factor is needed, but most papers do not present these figures. Some data are available: The Ontario Health Survey 1990 showed for different occupational groups a range of 7-31% reporting "working with back in awkward position" (similar to awkward posture) and 2-33% reporting "operating vibrating vehicles and equipment".[2] Of a Danish working population 40% reported "frequent bending and twisting" and 6% "mechanical vibration",[17] which was very similar to our data (40.6% and 6.8% respectively). This study is the only one also presenting an estimation of the PAR for the 12 month prevalence of low back pain with "mechanical vibration" contributing 0.4% and "frequent bending and twisting" 6.5%.

While interpreting the PAR estimations we should take some limitations into account: measurement issues, the cross-sectional nature of the data and the possibility of non-response bias. In general, poor reproducibility and validity figures are reported for self-reported physical activities related to postural load compared to measures requiring more effort, measures using log books and measures using systematic observation.[18,19] Such detailed assessments are necessary to study postural load as etiologic factors for LBP, including the quantification of the exposure-effect relationship.[20] However, for large-scale population surveys like the MORGEN study we are limited to questionnaire gathered information for which only broad/gross postural activities can be assessed. For analyses as presented we are limited to broad categories of activities, which introduces less specificity and therefore lower associations between the measured physical load and low back pain. The measurement of LBP can only be carried out by self-reports. Reporting bias cannot be excluded and is unknown. The prevalences we found are high and are due to the low severity level of the screening question, using also terms as "trouble" and "discomfort". More severe LBP subgroups were analyzed using additional severity characteristics. These more severe LBP parameters gave the same results.

The MORGEN project was also used to estimate the sizes of specific risks on LBP because (prospective) epidemiological studies on LBP risks related to the exposure levels in daily life are not available. The causality of the found association cannot be proven although physical load represents well-known risk factors for LBP on the basis of both cross-sectional and longitudinal studies on physical load in the work situation.[2-8,21,22] Because the associations are based on cross-sectional data the calculated PARs are more likely to be an underestimation than an overestimation, so the "true" PARs will be even higher.

The relative high non-response is equivalent with the non-response of other populations surveys in the Netherlands which is in general higher than observed in other countries.[23] Because the MORGEN study is a general health survey and not presented as a study into the relationship between physical load and LBP no response bias towards this relationship is suspected.

Apart from these limitations the MORGEN study had some advantages for this analyses. First, we could analyze the impact of physical load for low back problems among the nonworking population. Our study showed both the prevalence of physical load and its association with low back problems being different for working men and women and nonworking men and women. The largest health benefits can be found if the unhealthy effects of the physical load parameters among the working population can be prevented, but the effect among the nonworking women (mainly housewives) should not be neglected. Second, we could take into account different LBP parameters. A larger part of the more severe LBP parameters could be attributed to the physical load parameters. Third, PARs were estimated using a method that was not affected by the fact that we are dealing with a common disease.[14] Using the OR as an estimate of the RR, in order calculate the PAR with the usual method, is not valid because the rare disease assumption is not met.

Identifying physical load as a risk factor for LBP provides opportunities for preventive possibilities, which can include the application of ergonomics principles[24] and exercise programs.[25-27] Also, employee education programs that teach safe lifting and handling are well-known, although the effect is recently questioned.[28] Our analyses show a substantial potential impact of reducing the burden of LBP when effective preventive actions regarding physical load can be developed and implemented in daily activities. In further research into the causality of the relationship and into effective preventive measures, attention should also be paid to the exposure to risk activities outside the work place, e.g. household activities, do-it-yourself activities. Other research should focus on the background of the more than 80% of the burden of LBP which cannot be explained by physical load.

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Chapter 4.2.2

Physical inactivity: a risk factor for low back problems in the general population?*

Abstract

Objectives. To determine whether physical inactivity predicts low back problems 1 to 4 years later in the general population.
Methods. We analyzed prospective questionnaire data of a population-based survey of persons aged 20-59 years in the Netherlands, n=3759.
Results. Of the population 50% spent on the average less than ½ hour/day on moderate intensity physical activities and 23% was physical inactive (< ½ hour/week). Half of the population had low back problems the previous year and 20% reported chronic low back problems. Having low back problems is predicted by low back problems 1 to 4 years before ($OR_{1\text{-year}}$ =5.7, 95%CI 4.9-6.7, $OR_{chronic}$ =8.6, 95%CI 7.0-10.6) but not by physical inactivity.
Conclusion. Being physically active according to health promotion guidelines is not associated with a lower risk of low back problems.

* Picavet HSJ, J Schuit. Physical inactivity: a risk factor for low back problems in the general population? (submitted)

Introduction

Low back conditions present a large public health problem in all Western countries due to its high prevalence and its responsibility for (work) disability[1] and the use and costs of health care services.[2] One of the often studied determinants is physical activity. Both extremes of the physical activity continuum are suspected to be associated with low back conditions. On the one hand, heavy physical work load, frequent lifting, frequent bending and twisting and extreme sports activities are established risk factors for low back problems.[3-5] Lack of physical activity, on the other hand, is also often seen as a risk factor, especially for the development of chronic low back conditions.[5-9] However, intervention studies often fail to demonstrate a positive effect of regular exercise on new episodes of low back pain.[9]

Evidence of the effect of physical inactivity is based on occupational populations, cross-sectional community-based studies[3,5] and randomized controlled trials investigating exercise therapy for low back sufferers.[9] Prospective community-based studies investigating the relationship between regular exercise and low back conditions are lacking. In addition it is unknown if physical activity according to the health promotion guidelines[10] has an impact on low back pain. For adults the guideline is: at least ½ hour of moderate activity per day for at least 5 days a week, preferably all days[10], which is also adapted by the prevention organisations in the Netherlands.[11] From a public health point of view it is important to get insight in the potential health effect of health promotion campaigns for physical activity on the burden of low back conditions.

In this paper we used prospective population-based data to investigate the relationship between physical activity, defined according to the guidelines, and low back pain.

Methods

For this study we used data from the cohort of the Monitoring Project on Risk Factors for Chronic Diseases (the MORGEN-study), living in Maastricht, a town in the south of the Netherlands. The baseline study consisted of data collected in 1993 to 1997 using age-sex stratified probability samples in the age group of 20-59 years, drawn from the municipal population register every year. Measurement consisted of several questionnaires and a physical examination in the Municipal Health Service (n=8291, respons=50%). All those who participated in the baseline study were send a short follow-up questionnaire in 1998, under the condition that they were still alive or had no objections against another approach, n=7611. Of those 66% responded, complete follow-up data is available for n=5007. For the analyses in this paper we excluded the respondents in year 1993 because the measurement of physical activity changed after the first year, leaving n=3759.

Measurement of physical activity During baseline measurement an extented version of a validated questionnaire on physical activity was used.[12] For several activities it was measured how much time persons spent doing the activity. The activities were: work (sitting, standing, hand labor, heavy labor), walking, biking, gardening, do-it-yourself, house work and sports. The kind of sports was also specified. Respondents had to indicate the average hours per week in an average week spent in an activity. Two parameters were calculated using this data: (i) on the average less than ½ hours per day doing activities of at least moderate intensity, which is most close to being not active enough according to the guidelines[10] and (ii) on the average less than ½ hours per week doing activities of at least moderate intensity, which is defined as being totally inactive. Information on the intensity of the activities were derived from Ainsworth et al[13] and only activities with an intensity of at least 4 metabolic equivalents (MET) were defined as at least moderate intensity. MET is calculated as the ratio of the metabolic rate for an activity divided by the resting metabolic rate, equal to about 3.5 ml $O_2 \cdot kg^{-1} \cdot min^{-1}$ for a person weighting 60 kilo. The intensity of 4 MET is equivalent to brisk walking. Ordinary walking was not considered to be of moderate intensity. Times spent on biking, sports and heavy work determined 98% of reaching the level of the guidelines in this population. In the baseline measurement we did not have information whether the activities are carried out every day, or preferably all days of the week, as described in the definition of the guidelines. Therefor we did not use the cutoff point of 2.5 hours per week spent on activities of moderate intensity but 3.5 hours per week, which is equal to an average of 0.5 hours per day.

Measurement of low back pain The 1-year prevalence of low back pain was measured with the question 'Have you had trouble, discomfort or pain in the lower part of the back during the last 12 months?' that was based on the Nordic questionnaire.[14] Additional data on duration was used to calculate chronic low back pain, i.e. low back pain lasting more than 3 months.

Analyses are performed using SAS612.

Results

The study population consisted of slightly more women than men and the response for the older two age groups was higher than for the two younger age groups (table 1). The 1 year prevalence of low back problems during baseline was 53.7% and of chronic low back problems 19.3%. During follow-up these figures were slightly lower with 41.2% and 13.9% respectively. Although the association between baseline and follow-up was high, still considerable numbers recovered from their low back problems and vice versa (table 1).

Not reaching the guideline levels for physical activity was estimated for almost half of the population (49.1%) and the percentage persons that were totally physical inactive was 22.4%.

Table 1 Description of the study population, MORGEN-Maastricht cohort 1994-1998.

Number (abs)		3759
		%
Men		45.0
Age (baseline)	20-29 years	14.4
	30-39 years	22.2
	40-49 years	31.5
	50-59 years	32.0
Baseline measurement year	1994	22.0
	1995	29.7
	1996	25.8
	1997	22.5
Working		62.1
Level of education	primary school	10.9
	junior (vocational) education	35.2
	secondary (vocational) education	28.4
	vocational colleges, university	25.5
Low back problems (1 year prevalence)	Baseline and follow-up	31.7
	Baseline but not follow-up	22.0
	Not baseline but follow-up	9.5
	Not baseline nor follow-up	36.8
Chronic low back problems	Baseline and follow-up	8.0
	Baseline but not follow-up	11.3
	Not baseline but follow-up	5.9
	Not baseline nor follow-up	74.8
Physical inactive	According to guidelines (< ½ hour/day)	49.1
	Total (< ½ hour/week)	22.4

Low back pain after 1-4 years was highly determined by low back pain at baseline but not by physical inactivity during baseline, independent from the definition used (table 2). Cross-sectional there was also no association between physical inactivity and low back problems (not shown). If we analyze the different types of activities that contribute to the guidelines then we see that biking and sport activities at baseline were not associated with low back pain after 1-4 years. Heavy work at baseline was associated with increased chronic low back pain after 1-4 years (OR=1.47, 95%CI 1.05-2.05).

The results did not differ by numbers of years of follow-up, nor by different subgroups, i.e. men/women, different age groups, working/non-working or educational level (not shown).

Table 2 Baseline determinants of low back pain after 1-4 year, OR + 95% confidence interval*

	Low back pain after 1-4 year	
	Period prevalence	Chronic LBP
Age (per 10 years)	0.86 (0.80-0.92)	1.11 (1.61-2.49)
Sex (women vs men)	1.77 (1.53-2.04)	2.00 (1.61-2.49)
Low back pain (period prevalence)	5.74 (4.95-6.67)	-
Chronic low back pain	-	8.66 (7.04-10.6)
Physical inactive according to guidelines	0.99 (0.86-1.14)	1.07 (0.87-1.32)
Totally physical inactive	0.88 (0.74-1.05)	1.09 (0.86-1.39)
Type of physical activity contributing to guidelines		
Biking	0.99 (0.85-1.17)	0.98 (0.79-1.22)
Sports	0.95 (0.80-1.14)	0.96 (0.74-1.23)
Heavy work	1.22 (0.95-1.58)	1.47 (1.05-2.05)

*All logistic regression models included age, sex, low back pain at baseline and the specific physical inactivity parameter

Discussion

In our study physical inactivity is not a risk factor for low back pain. Being physical active according to the guidelines does not give a lower risk on low back problems one year or a few years later. No health effects in terms of a reduction in the burden of low back conditions in the general population can be expected if we could successfully stimulate physical activity to guidelines levels. Furthermore, even complete inactivity is not associated with increased low back pain prevalences, neither cross-sectional nor longitudinal. This lack of association is remarkably consistent among subgroups in the population. In addition, reaching the guidelines including heavy work activities is associated with increased risk on chronic low back pain 1 to 4 years later.

Low levels of physical activity are often found not to be associated with new or recurrent episodes of low back pain[3,5,6,8] and we confirm this finding using prospective population-based data and definitions of physical activity based on the health promotion guidelines. In contrast to what others reported[5,7,8] we did not found a preventive effect of physical activity for those who had experienced low back pain at baseline.

Of course, the comparability of studies is limited due to differences in design, in measurement of low back pain and in measurement of physical activity.

The measurement of LBP is always carried out by self-reports but questions do often differ and this will affect the results. The observed prevalences were high and this is due to the low severity level of the screening question, using also terms as 'trouble' and 'discomfort'. For our results with respect to the association with physical activity we found no differences for the two LBP parameters, although chronic LBP was better predicted by chronic LBP 1 to 4 years ago.

The measurement of physical activity is also based on self-report. Around half of our population of 20 to 59 years of age met physical activity levels according to the guidelines.[10] This is a somewhat more favorable figure than those for the US adults of 18 years or over for whom the estimates were between 32% and 38%.[15] However, these physical activity estimates are also affected by the methods used.[16] We analyzed only a global measure of physical activity.

An additional limitation of our data is the relative high non-response which is equivalent with the non-response of other populations surveys in the Netherlands which is in general higher than observed in other countries.[17] Because the MORGEN-study is a general health survey and not presented as a study into the relationship between physical activity and LBP no response bias towards this relationship is suspected. However, respondents of health surveys can be described as the worried well[18] and if this is also the case in our study we expect the inactive group to be a selective one. It is possible that the non-active responders have more health problems, and in particular more low back conditions that make them worry. But we did not find an association.

In conclusion, in this study we found no proof that prevention programs based on guidelines for physical activity could be effective in reducing LBP. This does, however, not give us a reason to stop facilitating an increase in (leisure-time) physical activity levels within the population because there are enough other reasons to do so.[19]

Low back pain - being a major public health problem- needs attention from preventive research and practise. First, there could be a focus on preventive possibilities of specific physical activities and this asks for more research. Second, a major change in the management of an acute episode of low back pain is the promotion of continuing normal activities and to avoid bed rest (to prevent chronic low back pain).[20] This is now a standard in General Practitioner (GP) guidelines.[21] Maybe this is not only a task for GP's but also for public health services because it is also known that many persons with low back problems does not (again) consult their GP despite continuation of low back problems.[22] Public health prevention programs could focus on patients beliefs about physical activity and low back pain which has been proven to affect recovery and improvement.[23]

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Chapter 5

General discussion

This thesis focused on public health questions on physical disabilities and musculoskeletal conditions. Both physical disabilities and (most) musculoskeletal conditions represent health problems characterised by pain and limitations and often without a clear diagnosis. Although people seldom die from these health problems, they have a high impact on quality of life, society and health care. For information on physical disabilities and musculoskeletal disorders we have to rely on self-reports. The health survey is therefore the main source for population-based data.
In this thesis, studies were presented on the quality of health surveys and on public health questions concerning physical disabilities and musculoskeletal conditions. The public health questions focused on prevalences, time trends, risk groups and determinants.
In the general discussion of this thesis first the main findings will be summarised. Thereafter the following themes are discussed: health survey questions, standardisation of survey methods, non-response bias, the public health impact of musculoskeletal conditions, prevention of physical disability, prevention of musculoskeletal conditions and ending with some remarks on the future of health monitoring.

Main findings

With respect to the methodology of health surveys, we found no differences between respondents to a health mail survey or to a health interview survey, with one exception: persons with only primary school were underrepresented in a mailed survey compared to an interview survey. In addition it was shown that differences in survey methodology had a substantial effect on prevalence estimates of disability. In particular the exact wording of the questions affected the results, but also the data collection method. Written questionnaires gave higher prevalences of disability than personal interviews.
It can be concluded that it makes no difference whether persons are approached for an interview or with a mail questionnaire, the same type of persons participate (with exception of the lowest educational groups). However, it does make a difference how the data collection takes place and how the questions are constructed.

The observed prevalences of the self-reported physical disability and musculoskeletal conditions are high. In table 1 estimations are given of the numbers in the Dutch population affected by physical disability or musculoskeletal pain using specific definitions and research methods. According to these estimations for 1998, more than 900 thousand non-institutionalised persons suffered from disability of mobility in the Netherlands and 4.7 million suffered from chronic musculoskeletal pain. These prevalences are also high in other Western countries.

Table 1. Estimated number of persons in the general population with physical disability or with musculoskeletal pain*

	Dutch population (x 1,000) 1998		Disability of mobility (NetHIS 97/98)[‡]		Chronic musculoskeletal pain (DMC$_3$-study)[ʃ]	
	Total	Institutionalised[†]	%	Number in the Dutch population (x 1,000)	%	Number in the Dutch population (x 1,000)
0-16 yr.	2,861.4	17.7	na		na	
16-24 yr.	1,953.4	12.1	0.6	11.6	na	
25-44 yr.	5,032.0	31.2	2.5	125.0	38.9	1,945.3
45-64 yr.	3,636.5	22.5	8.5	307.2	51.6	1,864.8
65-74 yr.	1,183.3	19.8	17.8	207.1	48.8	567.8
75+ yr.	900.5	133.6	36.7	281.5	43.7	335.1
total	15,567.1	237.0		932.4		4,713.0

* Calculated as the product of estimated prevalence (in %) using health surveys and the numbers in the population in the specific age group excluding the institutionalised population.

[†] For the age groups below 65 yr. we only had the total number of those who were institutionalised: equal percentages per age group were used to estimate the numbers per age group.

[‡] Mobility disability was defined as major difficulty or not able to carry 5 kg for 10 meters and/or bending and picking something from the floor and/or walking 400 meters and was measured by self-administered questionnaire.

[ʃ] Pain during at least 3 months of neck, shoulders, higher back, elbow, wrist/hand, lower back, hip, knee or ankle/foot measured by self-administered questionnaire.

na = not available, NetHIS = Netherlands Health Interview Survey, DMC$_3$-study = Dutch population-based Musculoskeletal Complaints and Consequences Cohort.

In the period 1990-1998 the prevalence of physical disability did not change with the exception of a slight drop in the prevalence of mobility disability.

One-third of the total prevalence of disability in mobility could be attributed to the following six groups of chronic conditions: musculoskeletal diseases, lung diseases, neurological disorders, heart diseases, diabetes, and cancer. Musculoskeletal disorders accounted for the major part.

Risk groups for physical disabilities were older age groups, women, persons living alone, persons who were divorced or widowed and persons with a low educational level. General socio-demographic characteristics could not be used to identify high risk groups for musculoskeletal pain, with the exception of being work disabled or women. Among both the working and the non-working population, the burden of low back problems is high.

Activities characterised by an awkward posture, by the same posture for a long time or by often bending and rotating the trunk contributed significantly to low back pain in the population, but physical inactivity did not.

Health survey questions

For physical disability it was shown that the observed prevalences based on the health surveys are highly dependent on the implicit or explicit severity levels as worded in the questions and response categories. Therefore the exact prevalence of disability is unknown. Physical disability refers to a continuous spectrum of health problems from very mild disability to very severe and the cut-off points depend on the wording of the survey questions.
For musculoskeletal pain the prevalence is also affected by the wording of the questions.[1,2] In the MORGEN study and in the DMC_3-study we therefore tried to assess as much as possible of the continuous spectrum of musculoskeletal pain by including many additional characteristics and consequences, see table 2. This additional information is needed to fully characterise the burden of complaints.

Table 2. Overview of characteristics of musculoskeletal pain as assessed in the MORGEN-study and DMC_3-study

	The MORGEN-study	The DMC_3-study
Anatomical location	2 areas	10 sites
Complaint characteristics		
current pain		x
frequency	x	
duration	x	x
severity of pain		x
course of pain		x
radiating pain (where applicable)	x	x
self-reported causes	x	x
time of day with most pain	x	
age of onset of first pain	x	
Complaint-specific consequences		
limitations in daily functioning	x	x
work leave	x	x
work-disability	x	x
change or adaptation of work	x	x
medical treatment	x	
contact general physician		x
contact medical specialist		x
contact physiotherapist		x
use of medicines		x
location-specific disability		x

MORGEN-study = Monitoring Project on Risk Factors for Chronic Diseases
DMC_3-study = Dutch population-based Musculoskeletal Complaints and Consequences Cohort.

In the DMC_3-study we used pain as the central concept to assess musculoskeletal health problems. In Canada and USA the term arthritis is commonly used for musculoskeletal disorders, often focusing on rheumatoid arthritis and osteoarthritis and thus excluding back and neck/shoulder conditions.[3,4] To establish the prevalence of

arthritis in the population, the consensus of a working group of experts was that 'symptomatic arthritis rather than radiographic evidence of arthritis should be used to measure prevalence. Symptomatic includes both self-reported arthritis as well as reported pain in the joints.'[5]

The often used clinical classification of low back pain is based on the duration of pain: acute low back pain (less than 6 weeks), subacute low back pain (between 6 weeks and 3 months) , and chronic low back pain (more than 3 months).[6,7] However, in our study, most cases of low back pain were described as recurrent, and this was not only true for low back pain but also for the other musculoskeletal pain complaints. A classification on duration alone is probably not enough to fully assess the burden of health problems. It should be further studied how the course of low back pain can better be incorporated in public health surveys, epidemiological study classifications and clinical classifications.[8]

Many persons report pain on different sites. The typical overlap of site specific pains (for example back pain) with pain at other sites indicates that strictly "local" concepts may be misleading.[9] Future research on musculoskeletal conditions should consider to include all pain areas and should not focus on one pain site, because multiple site pain can have implications for aetiology and consequences of pain.

Standardisation of survey methods

We have shown that differences in methodology of surveys can highly affect the results of these surveys. Standardisation of survey methods and questionnaires is therefore a prerequisite for the analyses of time trends and (inter)national comparisons of prevalences of health problems on the basis of health survey data. During a part of the 1980s and the 1990s Statistics Netherlands standardised most of their survey methods. Therefore the analysis of time trends of physical disability was possible over that period, as illustrated in chapter 3.1. However, changes over time other than survey methods can affect the interpretation of time trends, such as changes in the policy regarding institutionalisation or cultural and economical developments.

Standardisation is also needed for comparisons between regions in one country. Standardisation of health surveys carried out by regional Public Health Services (PHS) is already for several years a topic of debate in a special PHS working group.

Although standardisation is also a prerequisite for valid international comparisons, it is even more complicated because differences in languages will have an impact on the results of health surveys. In the Seven Countries Study among elderly men, for instance, it was shown that the category 'less than moderately good health' was much more prevalent in Finland than in other countries[10] and there was no other explanation than differences in meaning of the wordings.

For physical disabilities one of the first attempts of standardisation was the scale for Activities of Daily Living (ADL)[11] and for health interview surveys in Europe it was the OECD-indicator.[12] Nowadays, physical disability is often measured by the SF36,[13] which was used in the MORGEN-study (in the last three study years: 1995-1997) and in the DMC_3-study. A short form of the SF36, which consists of 12 items[14] is recommended to become part of the NetHIS, starting in 2001 or 2002.
For musculoskeletal complaints no international agreements exist on the most relevant definitions and additional severity characteristics. International agreements should lead to better international comparisons. However, "standardisation" can also have drawbacks. The often used Nordic-questionnaire on musculoskeletal complaints[15] restrained research progress because some important complaint characteristics were not a part of the Nordic-questionnaire.[16]

Comparison of prevalences is not possible without standardisation of health survey methods. However, the analyses of risk groups, risk factors and other studies of the relation between variables measured by health surveys is often thought to be less affected by differences in survey methods.

Non-response bias

For every study it is important to evaluate the generalisability of the results. The question is whether or not the research findings can be translated to other populations than the respondents. The surveys used in this thesis were designed to produce estimates for the non-institutionalised Dutch population.
For all these surveys random samples of the population were drawn, most of the time using population registers. The major drawbacks of all these surveys are the low participation rates, with ±60% (HIS) and ±50% (MORGEN and DMC_3-study), despite many response improving strategies including advance contact (where applicable), hand signed and carefully constructed letters and approval by medical ethical committees. National surveys in the Netherlands are, unfortunately, confronted with relatively high non-response rates in comparison with other countries[17], and in comparison with studies published in medical journals.[18]
The rather low response rate in the MORGEN-study could be due to the several stages in approaching people and the high respondent burden. The low response rate in the DMC_3-study could be due to the long length of the baseline questionnaire. Of the respondents who returned the reply card in the DMC_3-study 10% mentioned 'to many questions' as a reason for non-participation. Probably a better strategy would have been to use a short screening questionnaire followed by additional questionnaires for those with specific health problems and those who wanted to participate again. This strategy was, for example, used in a survey on musculoskeletal complaints in England,[19] resulting in a response rate of 78.5% in the screening

stage. Using this strategy and a follow-up after a period (e.g. 6 months), would lead to at least 3 times of approaching people, and the rule of Statistics Netherlands is that persons should not be approached for more than two times in order to reduce respondent burden. This rule was also used for the DMC_3-study, resulting in the large questionnaire that probably reduced the response rate.

However, every survey based on samples has non-response and the possibilities of non-response bias should be evaluated for every survey. The reason is that the potential non-response bias could be large, even for surveys with an accepted high[20] response rate of 80%. Some subgroups in the population can be described as hard-to-reach segments of the population[21] and are generally underrepresented. For instance, ethnic subgroups are usually underrepresented in the general health surveys and specific surveys are necessary.[22]

There are several ways to identify non-response bias: (i) comparison of respondents and non-respondents using data known from the sampling frame (ii) analyses of reasons of non-participation, (iii) intensified data collection among non-respondents and (iv) comparison with data of other registers. Some examples of these analyses are given below.
(i) For the surveys analysed in this thesis only minor differences were usually found between respondents and non-respondents using characteristics as age, sex, region of living and marital status. This is reassuring but no guarantee for the absence of non-response bias.
(ii) If persons do not participate because of health problems this is a major problem. For those who did not want to participate in the MORGEN-study and gave their reasons on the response card or participated in the non-response study, the main reasons for non-participation were: 'no time or interest' (50%), 'I am healthy there is no reason to participate' (16%), and 'already having a medical check-up on a regular basis' (25%).[23] For the DMC_3-study the main reasons were: no specific reason in relation to health (no interest or time, no reason, privacy, too many questions) (52%) and 'not healthy enough' (10%).[24] On the reply card of the DMC_3-study almost nobody gave 'a good health' as reason for non-participation. However, the results of both studies cannot be compared because the age range differed and the MORGEN-study used precoded response categories and in the DMC_3-study an open-ended question was used. But the analyses of reasons for non-participation illustrates that in most cases non-health related factors are the main reasons for non-participation, although this probably does not held for the elderly in which health problems will be more important.
(iii) Another way to obtain information about non-response bias is to take a random sample of the respondents and to use every effort to get the relevant information from them. This strategy has not been explored in the MORGEN or DMC_3-study. During the HIS of 1984 a specific non-response study was carried out using telephone interviews and additional home visits. These efforts resulted in the meas-

urement of 25% of the non-respondents. This group did not differ from the original respondents on health related indicators.[25]
(iv) Some examples exist where data from other registers were used to check for non-response bias. In chapter 4.1.1 it was shown that 76% of the men and 53% of the women belonged to the working population in the age group 20-59 yr. according to the MORGEN-study (of 1993 to 1995). Figures reported by Statistics Netherlands are 71% and 42% for men and women respectively and refer to the population aged 15 to 64 yr.[26] The MORGEN figures are slightly higher which is at least partly due to the difference in age range because the percentage working in the age groups 15-19 yr. and 60-64 yr. will be lower than in the 20-59 yr. age group. These findings indicate no reason to suspect selection bias for employment status.
A study comparing survey data with health insurance registers showed that health care utilisation of respondents was slightly higher than among non-respondents (e.g. utilisation of specialist medical care 37.2% versus 32.2%), whereas general socio-demographic characteristics did not differ.[27]

In this thesis we presented an analysis of the response group of a mailed and an interview survey. The observed difference in participation by educational level between mailed and interview surveys needs also further study because educational level is an important indicator for socio-economic status and this is an important determinant of health including disability and musculoskeletal diseases.[28,29] Although it is suspected that the mailed survey gave an underrepresentation of the lower SES group it is also possible that the interview survey gave a relative overrepresentation of the lower SES group.

Until now, there is no proof of large differences between respondents and non-respondents. However, 'the absence of proof of bias is not proof of its absence'.[30] More research should be carried out on non-response bias and it should be explored whether or not some minimum standard procedures should be used in order to make a judgement about the quality of the survey response. This is also needed for studies with 'acceptable' response rates. It is possible that if non-respondents are a selective group, increasing efforts to improve response rate can even lead to a more selective non-response group, and leading to more biased estimates.

The public health impact of musculoskeletal chronic conditions

The importance of diseases and conditions for public health can be evaluated in different ways. Rankings can for instance be based on incidence and prevalence, potential years of life lost, the impact on disability, health care utilisation and expected future developments. These are also the criteria used in the Dutch Public Health Status and Forecasts (PHSF) on the health, prevention and health care in the Netherlands until 2015,[31] which is summarised in table 3.

Table 3. Global ranking of diseases on the basis of annual incidence (range 1-7), prevalence (range 1-7), potential years of life lost (range 1-6), disease-year equivalents (range 1-6), costs of health care (range 1-5) and future developments (range 1-7) in the Netherlands in 1994, excluding perinatal conditions/congenital anomalies, injuries due to accidents and poisoning, or dental disorders.[31] Low number implies a relative high public health burden.

	Disease/disorder	Annual incidence*	Prevalence*†	Prevalence*‡	Potential years of life lost#	Years lived with disability#	Costs of health care$	Future development+
Infectious and parasitic diseases	infectious intestinal diseases	2	-	-	6	4	5	6
	tuberculosis	7	-	-	5	6	-	5
	meningitis	7	-	-	4	5	5	7
	septicaemia	6	-	-	4	-	5	3
	AIDS	7	7	-	3	6	5	7
	sexually transmitted diseases	4	-	-	-	-	-	-
Neoplasms	oesophagus cancer	7	7	-	3	6	5	1
	stomach cancer	7	6	-	3	5	5	1
	colon and rectal cancer	6	4	-	2	3	4	2
	lung cancer	6	5	-	1	4	4	1
	skin cancer	5	5	-	3	5	-	2
	breast cancer	5	4	-	2	3	4	3
	prostate cancer	6	5	-	3	4	4	1
	non-Hodgkin lymphomas	7	6	-	3	5	5	2
Endocrine, nutritional and metabolic diseases	diabetes	4	3	2	2	2	3	2
Mental disorders	dementia	5	4	3	3	2	1	2
	schizophrenia	7	5	-	-	3	3	5
	depression	4	4	2	-	1	3	4
	anxiety disorders	5	4	1	-	1	3	4
	substance dependence	5	4	2	-	1	3	-
	intellectual disability	-	4	3	-	2	1	-
Nervous system and sense organs	Parkinson's disease	6	5	4	4	3	4	2
	multiple sclerosis	7	5	-	4	4	4	4

	epilepsy	6	4	-	4	3	3	5
	visual impairments	4	2	4	-	1	3	2
	hearing impairments	4	2	1	-	1	3	2
Diseases of the circulatory system	ischemic heart disease	5	3	3	1	2	2	2
	heart failure	4	4	3	2	3	3	2
	stroke	5	4	3	1	2	2	2
	aneurysm of the abdomial aorta	6	-	4	3	-	-	1
Diseases of respiratory system	upper respiratory infections	1	-	-	-	4	4	6
	influenza	2	-	-	6	3	-	5
	Chronic Non-Specifc Lung Disease	4	2	-	2	1	2	3
Diseases of digestive system	ulcers of stomach and duodenum	5	4	-	4	6	3	3
	inflammatory bowel disease	7	5	-	6	4	4	5
Diseases of genitoury system	acute infections of the urinary system	2	-	-	5	3	4	4
Diseases of the skin and subcutaneous tissue	atopic eczema	4	3	-	-	3	}4	6
	contact eczema	2	3	2	-	2		5
Diseases of musculoskeletal system and connective tissue	rheumatoid arthritis	5	4	3	5	2	3	3
	osteoarthritis	3	2	2	-	2	3	2
	neck and back conditions	1	3	1	6	3	2	2
	osteoporosis	5	5	2	-	-	5	2
	hip fracture	5	-	-	-	5	3	2

* 1 = >1,000,000 cases; 2 = 300,000-1,000,000 cases; 3 = 100,000-300,000 cases; 4 = 30,000-100,000 cases; 5 = 10,000-30,000 cases; 6 = 3,000-10,000 cases; 7<3,000.
† point prevalence based on health care records.
‡ point prevalence based on data from epidemiological studies.
# using Dutch 'disability weights', 1 = 100,000 years; 2 = 30,000-100,000 years; 3 = 10,000-30,000 years; 4 = 3,000-10,000 years; 5 = 1,000-3,000 years; 6 = 1,000.
$ 1 = 3,000 million; 2 = 1,000-3,000 million; 3 = 300-1,000 million; 4 = 100-300 million; 5 = <100 million (Dutch guilders).
+ changes in number of cases in the period 1994-2015 because of changes in the population size and structure 1 = +45 to 60%, 2 = +35 to 45%, 3 =+ 25 to 35%, 4 = +15 to 25%, 5 = +5 to 15%, 6 = 0 to 5%, 7 = -5 to 0%.

Neck and back conditions belong to the conditions with the highest annual incidence and prevalence. Osteoarthritis belongs to the second highest group of most prevalent conditions. Musculoskeletal conditions are not a cause of death, so its contribution to the numbers of death and years of life lost is small, which is also shown by the low rankings for potential years of life lost in table 3.
Musculoskeletal conditions are, however, the leading cause of disability in the Western populations as observed in the studies presented in this thesis and by other population-based surveys.[3,4,32] In addition, musculoskeletal conditions are one of the leading causes for a poor quality of life.[33] According to the PHSF rheumatoid arthritis and osteoarthritis rank second in the disability top six, which is based on Years Lived with Disability (YLDs). The highest ranking number disability is given to mental disorders, chronic non-specific lung diseases and visual and hearing impairments. In the Burden of Disease study of the World Bank[34] musculoskeletal conditions ranked second for its contribution to the YLDs in the developed countries, after neuro-psychiatric conditions.
The absolute prevalences of physical disability and musculoskeletal conditions depend highly on the definition used. The proportion of disability attributed to musculoskeletal conditions will also depend on the domains and severity of disability and the musculoskeletal diseases and complaints that are taken into account.

As a group, musculoskeletal conditions are the second leading group of conditions for the costs spent on health services in the Netherlands.[35] Per disease category neck and back conditions belong to rank 2, whereas dementia and intellectual disability were given rank 1.[31] However, the societal costs for musculoskeletal conditions including losses of productive years due to sickness absence[36,37] are much higher. Sickness absence due to musculoskeletal conditions is high in western countries, such as illustrated for Sweden,[38] and the increase in sick leave between the mid 1980s to the mid 1990s in the UK is in particularly due to 'diseases of musculo-skeletal system'.[39]
Based on the expected growth of the population the prevalence of almost all diseases will increase, see the last column of table 3. The musculoskeletal conditions belong to the diseases with the highest expected increase in prevalence in the coming 15 years. Other changes can however also affect prevalences, such as demographic changes (the number of the unemployed, the educational level, living conditions)[40] and health (care) changes (new epidemics, changes in preventive and/or curative possibilities).
During the 1990s the sex-age adjusted prevalences for physical disability prevalence seem to have been stable. Analyses of time trends of musculoskeletal conditions and related consequences in the Netherlands are not yet available. In contrast to physical disability, the prevalence of low back problems seemed to have risen in the period 1980-2000 in the UK.[41] These UK researchers thought that the most probable reason was that '(...) cultural changes have led to a greater awareness of minor back

symptoms and willingness to report them. This shift may also have rendered back pain more acceptable as a reason for absence attributed to sickness.'[41]
Because of its high impact on disability, sick leave and use of health care musculoskeletal complaints cannot be dismissed as minor or trivial health problems.[42] Research and funding of these areas have been neglected for many years but are nowadays much more recognised. The importance of research on musculoskeletal conditions is also recognised internationally as illustrated by the Bone and Joint Decade 2000-2010[43,44] initiative.

Prevention of physical disabilities

Prevalences of physical disability are high and age-sex specific prevalences were stable during the last decade. Expected demographic changes will therefore lead to an increasing prevalence of disability. An important question is: what is the best way to prevent and postpone disability, to maintain independence, mobility and societal participation of an ageing population?[45]
All factors that can be of importance in the development of disease - hereditary factors, lifestyle habits, living conditions and environmental factors - may also play a role in the onset of disability, even in the presence of a chronic disease.
For prevention, more studies are needed to evaluate the possible impact of possible modifiable life style habits on disability. A recent review on risk factors for functional decline in non-institutionalised elderly people revealed besides diseases, factors such as low level of physical activity, smoking, low frequency of social contacts, low and high body mass index and no alcohol use versus moderate alcohol.[46] Often these effects are extremely difficult to study because 'some of these problems may be due to a progressive loss of musculoskeletal function caused by decades of sedentary living habits.'[47]
The relative contribution of each of these factors is not well-known. In this thesis the relative contribution of chronic conditions to the burden of disability in the population was studied. It was shown that the group of musculoskeletal conditions, including osteoarthritis and back and neck/shoulder problems, made the largest contribution. For the maximum prevention of physical disability in the population we therefore should focus on musculoskeletal conditions.
However, still a large part of disabilities cannot be attributed to chronic conditions or injuries. Many physical disabilities are by people themselves viewed as inevitable infirmities of old age,[48] but prevention may be possible. The importance of research on the prevention of disability is mentioned many times[49] but it is still poorly funded. One of the reasons according to a Lancet editorial is because 'research into disability and rehabilitation has no good track record'.[50] It is, however, a challenging research field.

Prevention of musculoskeletal conditions

Musculoskeletal conditions are a real public health challenge and preventive actions should be considered.
The focus of research of potential risk factors is often on physical load and physical activity[51] and these factors were explored in this thesis in relation to low back problems. Activities characterised by an awkward posture, by the same posture for a long time or by often bending and rotating the trunk, are well-established risk factors and we have estimated that 17% of chronic low back pain can be attributed to these physical load activities. This is much lower than previous estimations of up to 50%.[52] Effective preventive activities on physical load will be useful in reducing low back problems although its maximum impact on the burden of low back pain is probably only moderate.

Prevention programmes using the ACSM/CDC† quidelines[53] on physical activity (at least ½ hours a day activities of a moderate activity level on at least 5 days of the week) will have no impact on the burden of low back pain. In the USA the growing attention for musculoskeletal conditions has resulted in a National Arthritis Action Plan[54] and chronic back conditions for the first time mentioned in *Healthy People 2010*.[55] In the draft for public comments of the *Health People 2010 Objectives* it was said that the prevention of chronic low back pain 'for the overall population, the emphasis should be on physical activity (..)' [56] but this was removed from the final text.[55] According to our results this removal seems appropriate. This implies that the prevention of low back pain cannot coincide with the current prevention programmes for cardiovascular conditions focusing on physical activity.
However, it is still possible that physical activity could be a part of a complex of preventive measures for low back pain. More research is needed on what activities (specific sport activities, walking, biking) with what frequency and intensity will be beneficial. Maybe persons who are active for ½ hour per day but have a sedentary life style for the rest of the day (sitting at work, in the car from work to home, watching television all evening) may be at risk. One of the factors that can play a role is a continuous active lifestyle starting in early childhood. The effects of such lifelong exposures are, however, extremely difficult to investigate.
Besides physical load and physical activity often studied potential modifiable risk factors for musculoskeletal pain are: smoking[57] and obesity.[58] The contribution of these factors seems, however, modest.[57,58]

For preventive research in musculoskeletal conditions not only the role of risk factors for the occurrence of pain or disease should be investigated but also the factors associated with other characteristics of health problems like recurrence, intensity of

† ACSM=American College of Sports Medicine, CDC=Centre for Disease Control

pain or duration. Moreover research could also focus more on determinants of consequences like sick leave, disability and the use of health care.
In addition, we should search for new possibilities of preventive actions including the search for new risk factors. In the search for new factors that are associated with the development of chronic low back pain or other musculoskeletal pain, and related disability, a new promising concept is 'fear-avoidance'.[59] This concept refers to an unhealthy coping strategy. Certain persons have such a high level of fear of pain, that in case of a pain period, avoidance behaviour (in particular avoidance of movements and physical activity) is generated that will lead to continuation of the pain and disability. This results in a vicious circle leading to chronic pain. In rehabilitation, successful treatments have been developed based on this model and trials in primary care are underway. If it can be shown that the concept of 'fear-avoidance' is also a relevant factor for chronic pain syndromes in the general population, this will give an idea of promising prevention perspectives. For low back pain these prevention initiatives should target on beliefs about low back pain, in particular coping strategies.[60]

Future health monitoring

'By the year 2000 it is possible to describe the health status of the Dutch population in more than only mortality figures' was written in de 1986 public health policy report of the Dutch ministry of public health.[61] Other health indicators are morbidity and disability. In this thesis a study was made of public health questions on physical disabilities and musculoskeletal conditions, using data from a national health survey (the NetHIS), a general epidemiological study (MORGEN-project) and a disease-specific health survey (DMC_3-study).
Physical disabilities and musculoskeletal conditions provide a large contribution to the burden of public health. These health problems need therefore continuous attention of public health and epidemiological research, despite the fact that it concerns less than perfect defined health problems ('questionnaire diseases and conditions') and less than perfect instruments (the health survey) to assess the information needed. The art of epidemiology is perhaps not in undertaking the (impossible) 'perfect' study but in understanding the imperfections in studies, both self-conducted and reported by others, and hence achieving a reasonable interpretation of the available data.[62]

The future developments in research on the prevention of physical disability and musculoskeletal conditions, with increasing attention due to The Bone and Joint Decade, should be accompanied by appropriate monitoring initiatives.
Mail surveys with good short, well designed, questionnaires may be for monitoring purposes a cheaper and equally good alternative for the expensive home interview surveys. There should be less attention for precise estimations of prevalences and

more attention for those factors for which developments can or will be expected, for instance for severity characteristics and consequences of health problems. If preventive measures are carried out focusing on the chronicity of low back pain, monitoring systems should not only focus on the incidence or prevalence of low back pain but on the duration of low back pain. In addition health surveys should incorporate the information for which the health survey is the only source of information such as behavioural factors that are increasingly proofed to be of importance in chronic health problems.

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Summary

Many changes during the past century in life circumstances, work, food, prosperity and health care have resulted in great changes in the health of the Dutch population. Life expectancy is high and still increasing but has also resulted in increasing 'old-age' problems such as mobility disabilities and problems with hearing or seeing. In addition, nowadays prevalent and sometimes 'new' health problems like burnout, Repetitive Strain Injury (RSI) and chronic low back pain are associated with the new work circumstances (computer and other monotonous work), and life style.
In this thesis several studies were presented on public health questions concerning physical disability and musculoskeletal conditions and on the methodology of the health survey, the most important source of information for these health indicators. Central public health questions are: What is the prevalence of health problems? How do these prevalences change over time? What are the high risk groups? What are the determinants or risk factors of health problems?

In the introduction (chapter 1) it was described that physical disability and musculoskeletal conditions represent problems that are mostly not univocally defined by diagnoses nor represented in health information sources like hospital and mortality statistics. These health problems are characterised by pain and limitations for which we often have to rely on self-reports of persons, such as used in a health survey. *Physical disability* is key health indicator for an ageing population. *Muscoloskeletal conditions* are an important source of physical disabilities and are associated with an enormous societal burden because of its impact on sick leave and work disability. The introduction was ended with a description of the research questions of this thesis and a summary of the health surveys that were analysed. The most important surveys were: the national health interview survey (the NetHIS, n=±9000 each year), a general epidemiological study (MORGEN-project, n=22 415) and a disease-specific health survey using mail questionnaires (DMC_3-study, n=3664). All these surveys provide data on random samples of men and women from the non-institutionalised Dutch population.

In chapter 2 studies on the methodology of health surveys were presented. To examine the effect of using a mail questionnaire or home interviews on the size and the selectivity of response to national health surveys, the NetHIS and DMC_3-study were compared (chapter 2.1). Both surveys were carried out in the same country (the Netherlands), using the same sampling frame, the same study period (1998) and collected partly the same data on demographic, socio-economic and health characteristics. Response to the mail survey was lower (46.9%, n=3665) than to the interview survey (58.4%, n=6061). The mail survey gave higher response rates

for women and lower response rates for persons with low levels of education. Respondents to the mail survey reported lower rates of smoking but a slightly worse health status and more use of health care services. No differences between the two methods were found for age, marital status, region, household composition, work status and categories of body mass index. The conclusion was that, although the response of the mail survey was lower than the home interview survey, respondents showed generally small differences, with exception of level of education.

In chapter 2.2 the impact of some differences in survey methodology on the prevalences of functional disability in population based surveys of the elderly were investigated. Nine different surveys of Dutch people aged 55 years and older were compared to investigate differences in the method of data collection (proxy questioning, yes/no; interview versus self administered questionnaire) and construction of the questionnaire (wording of introductory text, activities, and response categories). The effect of these differences on prevalences in three domains of functional disability - activities of daily living, mobility, and communication - were studied. No effect of proxy questioning could be shown. Self administered questionnaires yielded higher prevalences of disability than interviewer administered questionnaires - in particular for mobility (Odds Ratio (OR) = 1.4, 95% Confidence interval (CI) 1.3-1.6) and communication (OR = 1.7, 95%CI 1.5-1.9). Seemingly minor differences in the structure and wording of the questionnaires resulted in major differences in prevalence estimates of functional disability, up to differences of 16 percentage points. These differences were associated with the severity level of the disability indicated by the wording of the questions and response categories. The effect of methodological differences on prevalence estimates of disability differences should be taken into account when making international comparisons and studying time trends based on survey data.

Public health questions on physical disability were the topics of chapter 3. In chapter 3.1 an overview of the prevalence of physical disabilities in the Netherlands was given with a focus on risk groups and time trends. Cross-sectional national health survey data (NetHIS) of nine years 1990-1998 presenting data on 62 352 persons of 16 years or over were used. Visual, hearing, mobility and ADL disability were analysed. About one-eighth of the research population had a physical disability, i.e. had at least major difficulty with one or more functions such as walking, seeing, hearing and washing. This figure increased from 1.7% in the age group of 16-24 yr. to 44.1% in the age group of 75 yr. or older. Risk groups were women, persons living alone, persons who were divorced or widowed and persons with a low educational level. In the period 1990-1998 the age-sex adjusted prevalence did not change with the exception of the prevalence of mobility disability which dropped slightly with 0.2 percentage points per year due to decreasing prevalences among men. The prevalence of disability was high and stable, and is expected to increase in the future due to increasing life expectancy and the ageing of the population.

In chapter 3.2 a study was presented to assess the proportions of the burden of mobility disability that are attributable to six common chronic conditions. The population attributable risk percentage (PAR) was calculated using the NetHIS (1989-1992) concerning 21 191 respondents of 16 years and over. About one-fifth of the population reported disability of mobility, that is at least minor difficulty with walking, bending and picking something from the floor and carrying. Of the total prevalence of disability 33.7% could be attributed to the six chronic conditions. Musculoskeletal disorders account for the major part, whereas the contribution of cancer was very small. The potential benefits of effective curative and/or preventive treatments of chronic conditions on disability in the population are limited.

In chapter 4 some public health questions on musculoskeletal conditions were addressed. First a presentation was given on the prevalence of musculoskeletal pain of five different anatomical areas and ten anatomical sites, and their consequences and risk groups in the general Dutch population (chapter 4.1.1). Cross-sectional data from a population-based study of a sex-age stratified sample of Dutch inhabitants of 25 years and older were used, the baseline measurement of the DMC_3-study (n=3664). Musculoskeletal pain, additional pain characteristics (location, duration, course), its consequences (utilisation of health care, sick leave and limitation in daily life) and general socio-demographic characteristics were assessed by a postal questionnaire. The top three of self-reported musculoskeletal pain sites (point prevalence (P_p) was: 1. low back pain (26.9%), 2. shoulder pain (20.9%) and 3. neck pain, P_p=20.6%. In most cases the pain was described as continuous or recurrent and mild. In every 3 out of 10 cases the complaints about pain were accompanied by limitations in daily living. Between 33% and 42% of those with complaints consulted their general practitioner about their pain. With the exception of persons who are work disabled, general sociodemographic characteristics cannot be used to identify high risk groups. Musculoskeletal pain is common in all subgroups of the population and has far-reaching consequences for health, work and the use of health care.

Information on risk factors, prevalences and consequences is often based on studies concerning the working population. In chapter 4.1.2 a study was presented on the burden of illness of low back problems in the working and the non-working population. Data from the Monitoring Project on Risk factors for Chronic Diseases, the MORGEN-study (1993 to 1995) on 6317 men (24% non-working) and 7505 women (47% non-working) were analysed. The prevalence of low back problems was higher in the non-working than in the working population, especially for the more severe low back pain parameters (chronic low back problems, and activity limitation or use of health services due to low back problems). Excluding the work disabled, the prevalence and consequences of low back pain were still higher in the non-working group in comparison with the working population. Most of the non-working women were housewives and this group was both large in size and had a high prevalence of low back problems. Among men, more than a quarter of the to-

tal burden of low back problems in those aged 20-59 years was found in the non-working population, among women this was 50%. Both research on causes and determinants of low back pain and the development of preventive actions - now being extensively focused on the working population - should also be translated to the non-working population.

Activities that can be described as physical load, such as lifting heavy objects and working in an awkward posture, are established risk factors for low back problems. In chapter 4.2.1 a study is described on the contribution of physical load in daily activities, including activities in work, house keeping and leisure time, to the burden of low back problems (LBP) in the population. The PARs were calculated using the MORGEN-study (1993-1997), n=22 415, controlling for well-known LBP determinants. Activities characterised by an awkward posture, by the same posture for a long time or by often bending and rotating the trunk, increased the risk for LBP, with ORs between 1.1 and 1.6. More than 13% of the 1-year period prevalence of LBP could be contributed to these activities. This PAR was higher for those belonging to the working population, for women and for the more severe LBP-parameters. Because LBP present such a large public health problem, the estimated potential impact of eliminating (the unhealthy effect of) physical load is substantial. To assess the real health gain, more insight is necessary in the causality of the relationship and in effective preventive measures.

It is suspected that an adequate amount of physical activity is one of the few possibilities to prevent (chronic) low back problems. In chapter 4.2.2 it was determined whether physical inactivity predicts low back problems 1 to 4 years later in the general population. This was studied using the 3759 men and women of the Maastricht cohort of the MORGEN-study who were measured two times with an interval of 1-4 years. Of this population 50% spent on the average less than ½ hour/day on moderate intensity physical activities and 23% was physical inactive (< ½ hour/week). Half of the population had low back problems the previous year and 20% reported chronic low back problems. Having low back problems is predicted by low back problems 1 to 4 years before, with odds ratios higher that 5, but not by physical inactivity. Being physically active according to health promotion guidelines is not associated with a lower risk of low back problems, so the prevention of low back problems does not coincide with cardiovascular preventive measures.

In the general discussion (chapter 5) of this thesis the results of all the studies are summarised and discussed.
For the Dutch population of 1998 we estimated that more than 900 thousand non-institutionalised persons suffered from mobility disability and 4.7 million suffered from chronic musculoskeletal pain. These health indicators represent huge public health problems and deserve systematic attention from research, prevention and health politics. In order to monitor the developments of the prevalence and consequences of physical disability and musculoskeletal conditions adequate

information systems should be developed. In the design of such information systems increasing attention should be paid to the relevance of characteristics measured and to the procedures to exclude or quantify non-response bias.

Samenvatting

De afgelopen 100 jaar hebben veranderingen in leefomgeving, arbeid, welvaart en gezondheidszorg tot enorme veranderingen in de gezondheid van de Nederlandse bevolking geleid. We leven steeds langer maar daardoor worden we ook meer met 'ouderdoms' gezondheidsproblemen geconfronteerd dan vroeger. Voorbeelden hiervan zijn lichamelijke beperkingen, verminderd gezichtsvermogen en slechter gehoor. Andere 'nieuwe' en/of veelvuldig voorkomende gezondheidsproblemen zoals burn-out, RSI en lagerugklachten worden in verband gebracht met de veranderingen in het werk (computers, hoge werkdruk) en leefstijl.

In dit proefschrift werd verslag gedaan van enkele studies waarin volksgezondheidsvraagstukken zijn onderzocht op het gebied van lichamelijke beperkingen en klachten van het bewegingsapparaat en van enkele studies naar de gezondheidsenquête die de belangrijkste gegevensbron is voor deze gezondheidsindicatoren. Centrale volksgezondheidsvraagstukken zijn: hoe vaak komt een gezondheidsprobleem voor (prevalentie)? Wat zijn de veranderingen in de tijd (tijdtrends)? Bij wie komen die gezondheidsproblemen vooral voor (risicogroepen)? Zijn er factoren te identificeren die van invloed zijn op het voorkomen van de gezondheidsproblemen (determinanten)?

In het inleidend hoofdstuk werd aangegeven dat lichamelijke beperkingen en klachten van het bewegingsapparaat belangrijke gezondheidsproblemen zijn die vaak niet eenduidig via diagnostisch onderzoek zijn vast te stellen noch in veel gegevensbronnen eenduidig worden vastgelegd. Ze worden gekenmerkt door pijn en beïnvloeding van het dagelijks leven van mensen en dit is vooral vast te stellen door de zelf-rapportage van personen zoals met behulp van een gezondheidsenquête.
Lichamelijke beperkingen vormen een goede indicator voor de beschrijving van de gezondheid van een vergrijzende samenleving. *Klachten van het bewegingsapparaat* verwijzen naar gezondheidsproblemen die weliswaar ook bij het oudere deel van de bevolking van belang zijn, maar tevens bij de jongere leeftijdsgroepen omdat ze voor een groot deel verantwoordelijk zijn voor ziekteverzuim, arbeidsongeschiktheid en het gebruik van zorgvoorzieningen.
Tot slot werd in hoofdstuk 1 een opsomming gegeven van de vraagstellingen van dit proefschrift en een overzicht van de belangrijkste gezondheidsenquêtes die in dit proefschrift zijn geanalyseerd. Deze enquêtes zijn: de gezondheidsenquête van het Centraal Bureau voor de Statistiek (CBS) die vanaf 1981 continu wordt gehouden bij circa 9000 personen per jaar, de MORGEN-studie (MOnitoring Risicofactoren en GEzondheid in Nederland) die van 1993-1997 is verricht door het Rijks Instituut voor Volksgezondheid en Milieu (RIVM) bij ruim 22 duizend personen van 20-59 jaar, en de eerste ronde van de landelijke studie naar Klachten en Aandoeningen van het

Bewegingsapparaat (n=3665 personen van 25 jaar en ouder) – kortweg de KAB-studie - die in 1998 is uitgevoerd door het RIVM in samenwerking met het CBS. Al deze onderzoeken betreffen aselecte steekproeven van mannen en vrouwen uit de Nederlandse niet-institutionele bevolking.

In hoofdstuk 2 werd de methode van de gezondheidsenquête onder de loep genomen. Ten eerste werd onderzocht of de methode van dataverzameling - postenquête of een persoonlijk interview - van invloed is op kenmerken van de respondenten (hoofdstuk 2.1). Resultaten van de KAB-studie (postenquête, n=3664) en de CBS gezondheidsenquête (persoonlijk interview, n=6061 en een schriftelijke vragenlijst, n=4970) werden vergeleken. Deze beide enquêtes verstrekken gegevens over dezelfde bevolking (Nederlandse niet-institutionele bevolking), hanteren dezelfde gegevensbron voor het nemen van de steekproef (het bevolkingsregister vastgelegd in de Gemeentelijke Basis Administratie (GBA)) en verzamelen voor een belangrijk deel dezelfde demografische, sociaal-economische en gezondheidsgegevens. De respons op de interview enquête bleek hoger (58,4%) dan die op de postenquête (46,9%), alhoewel een aanvullende schriftelijke vragenlijst bij de interview enquête de respons verlaagde tot 47,9%. Er werden verrassend weinig verschillen tussen de enquêtes gevonden voor: demografische gegevens op basis van de GBA en sociaal-demografische en gezondheids-gerelateerde gegevens op basis van de enquêtes. De enige uitzondering vormden de personen met alleen een lagere school opleiding. Deze namen relatief minder vaak deel aan de postenquête. De conclusie was dat het uitvoeren van een gezondheidsenquête per post of interview niet leidt tot een verschillende samenstelling van de responsgroep, behalve dat personen met alleen een lagere school ondervertegenwoordigd zijn in de postenquête.

In hoofdstuk 2.2 werd nagegaan of aspecten van de methode van dataverzameling (zoals interview versus schriftelijke vragenlijst) en de constructie van de vragenlijst (zoals formulering van de vragen) van invloed zijn op de schattingen van de omvang van lichamelijke beperkingen op basis van enquêtes. Hiertoe werden de resultaten van negen verschillende enquêtes vergeleken die allen de Nederlandse bevolking van 55 jaar en ouder betroffen. Deze enquêtes verschaften in totaal over meer dan 25 duizend personen gegevens. Het effect op de prevalentie schattingen van beperkingen in Algemeen Dagelijkse Levensverrichtingen (ADL), mobiliteit, horen of zien werd onderzocht. Het hanteren van een schriftelijke vragenlijst leverde systematische hogere prevalenties van beperkingen op dan het hanteren van mondelinge interviews. Dit gold met name voor beperkingen in mobiliteit (Odds Ratio (OR)=1,4, 95% betrouwbaarheidsinterval (BI) 1,3–1,6) en in beperkingen van horen of zien (OR=1,7, 95%BI 1,5-1,9). Ogenschijnlijk kleine verschillen in formulering van de enquêtevragen en antwoordmogelijkheden hadden grote invloed op de prevalentie schattingen, die resulteerde in prevalentieverschillen tot 16 percentage punten. De richting van de prevalentie verschillen hield verband met het impliciete of expliciete ernstniveau van de beperkingen zoals geformuleerd in de vraag of antwoordcategorieën. Er werd geconcludeerd dat de absolute prevalentie van gezondheidsproble-

men op basis van een gezondheidsenquête voor een groot deel bepaald wordt door de formulering van de vragen in de enquête en de gehanteerde waarnemingsmethode.

In hoofdstuk 3 werden enkele volksgezondheidsvraagstukken uitgewerkt voor lichamelijke beperkingen. In de eerste plaats werd een overzicht gegeven van de prevalentie van lichamelijke beperkingen (beperkingen in de ADL, de mobiliteit, het gezichtsvermogen en het horen), de risicogroepen op basis van algemeen sociaaldemografische kenmerken en van de trend in de tijd (hoofstuk 3.1). Voor deze analyses werd gebruik gemaakt van CBS gezondheidsenquête in de periode 1990-1998, n=62 352 personen. Circa éénachtste van de personen van 16 jaar en ouder bleek een lichamelijke beperking te rapporteren, d.w.z. tenminste grote moeite met functies zoals lopen, zichzelf wassen, zien of horen. De prevalentie nam toe van 1,7% in de leeftijdsgroep van 16-24 jaar tot 44,1% in de leeftijdsgroep van 75 jaar en ouder. Risicogroepen voor lichamelijke beperkingen zijn vrouwen, alleenwonenden, ongehuwden, personen uit lage sociale klassen en personen uit de niet-werkende bevolking. De voor leeftijd- en geslachtverschillen gecorrigeerde prevalentie van lichamelijke beperkingen bleek over de periode 1990-1998 nauwelijks te veranderen. Dit bleek evenmin het geval voor de verschillende subgroepen in de bevolking, met uitzondering van de prevalentie van beperkingen in de mobiliteit bij mannen, die met een gemiddelde van 0,2 percentage punten per jaar daalde. De conclusie was dat lichamelijke beperkingen veel voorkomen en dat de prevalentie in de jaren '90 weinig veranderde. Bij een toenemende levensverwachting en vergrijzing van de bevolking zal het absolute aantal personen met lichamelijke beperkingen sterk toenemen.

In hoofdstuk 3.2 werd verslag gedaan van een studie naar de vraag welke chronische aandoeningen 'verantwoordelijk' zijn voor de omvang van beperkingen in mobiliteit in de bevolking. Het populatie attributieve risico (PAR) werd berekend voor zes (groepen van) chronische aandoeningen: aandoeningen van het bewegingsapparaat, longaandoeningen, neurologische aandoeningen, hartaandoeningen, diabetes en kanker. Gegevens waren afkomstig van de CBS gezondheidsenquête van de jaren 1989-1992 betreffende 21 191 personen van 16 jaar en ouder. Circa éénvijfde van de bevolking rapporteerde beperkingen in de mobiliteit, d.w.z. tenminste enige moeite met lopen, bukken en iets van de grond pakken of iets dragen. Ongeveer éénderde (33,7%) van deze beperkingen kon worden 'toegeschreven' aan de genoemde chronische aandoeningen en met name aan aandoeningen van het bewegingsapparaat. De conclusie was dat indien er effectieve behandelingen van chronische aandoeningen zouden worden ontwikkeld dat dan de potentiële gezondheidswinst in termen van vermindering van lichamelijke beperkingen beperkt is.

In hoofdstuk 4 kwamen enkele volksgezondheidsvraagstukken met betrekking tot klachten en aandoeningen van het bewegingsapparaat aan de orde. Gestart werd met een overzicht van de prevalentie en risicogroepen van pijnklachten van het be-

wegingsapparaat (hoofdstuk 4.1.1). Hiervoor werd gebruik gemaakt van de KAB-studie die gegevens verschaft over de Nederlandse bevolking van 25 jaar en ouder, n=3664. De meest gerapporteerde klacht is die van de lage rug (26,9%), gevolgd door schouderpijn (20,9%) en nekpijn (20,6%). In de meeste gevallen werd de pijn beschreven als een milde maar wel chronische of vaak terugkerende klacht. Circa 40% van de personen met klachten consulteerde voor hun pijnklacht de huisarts. Verder bleek dat klachten van het bewegingsapparaat in alle lagen van de bevolking veel voorkwamen en dat m.u.v. vrouwen en arbeidsongeschikten er geen duidelijke risicogroepen op basis van sociaal-demografische kenmerken te onderscheiden waren.

Kennis over risicofactoren, prevalenties en consequenties van lagerugklachten zijn met name verkregen in onderzoek bij (subgroepen van) de werkende bevolking. Op basis van de grootte van de groep en wellicht de omvang van de lagerugproblematiek is het niet-werkende deel van de bevolking vanuit volksgezondheidsoogpunt niet te verwaarlozen. Dit werd verder uitgezocht in hoofdstuk 4.1.2. Hiervoor werden gegevens van het MORGEN-project geanalyseerd uit de jaren 1993-1995, die 6317 mannen en 7505 vrouwen in de leeftijd van 20-59 jaar betreffen. Van deze onderzoekspopulatie behoorde respectievelijk 24% en 47% tot de niet-werkende bevolking: huisvrouwen, werkelozen, arbeidsongeschikten, vutters, en anderen (o.m. studenten). Zowel de prevalenties als de consequenties van lagerugklachten kwamen vaker voor bij de niet-werkende dan bij de werkende bevolking. Verschillen bleven bestaan na correctie voor verschillen in leeftijd, burgerlijke staat, opleidingsniveau en woonplaats. Van de niet-werkende bevolking namen de arbeidsongeschikten weliswaar de hoogste prevalenties en consequenties voor hun rekening, maar werkelozen en huisvrouwen waren eveneens groepen waarbij lagerugklachten veel voorkwamen. Onderzoek naar oorzaken van lagerugklachten en de ontwikkeling van preventieve strategieën zullen niet alleen gericht moeten zijn op het werkende deel van de bevolking, maar dienen vanuit volksgezondheidsoogpunt ook gericht te worden op subgroepen uit de niet-werkende bevolking.

Een aantal fysiek belastende activiteiten, zoals vaak tillen, worden doorgaans aangemerkt als risicofactoren voor lagerugklachten. Om een indruk te krijgen van de bijdrage van deze risicofactoren aan de problematiek van lagerugklachten in de Nederlandse bevolking werd in hoofdstuk 4.2.1 een schatting gemaakt van het populatie attributieve risico (PAR). Deze PARs werden berekend op basis van gegevens uit de MORGEN-studie (1993-1997), n=22 415 personen (20-59 jaar). Activiteiten die gekenmerkt worden door een ongemakkelijke houding, langdurig dezelfde houding en het vaak buigen of draaien van het bovenlichaam waren geassocieerd met een verhoogd risico op lagerugklachten. Meer dan 13% van de 1-jaar periode prevalentie van lagerugklachten kon worden 'toegeschreven' aan deze activiteiten. De PAR was hoger voor het werkende deel van de bevolking, voor vrouwen en voor de ernstigere vormen van lagerugklachten. De PARs lijken laag maar omdat de lagerugklachten een groot volksgezondheidsprobleem vormen, zullen effectieve preventieve maat-

regelen gericht op fysiek belastende activiteiten tot substantiële gezondheidswinst kunnen leiden.

Er wordt verondersteld dat voldoende lichamelijke activiteit één van de weinig mogelijkheden is voor de preventie van (chronisch) lagerugklachten. De vraagstelling van de studie in hoofdstuk 4.2.2 was: is het niet voldoen aan de norm voor gezond bewegen (tenminste ½ uur matig-intensieve activiteiten op tenminste 5 dagen per week) een risicofactor voor (chronische) lagerugklachten? Dit is onderzocht bij 3759 mannen en vrouwen (20-59 jaar) van het Maastricht-cohort van het MORGEN-project, die twee maal met een interval van 1 tot 4 jaar zijn ondervraagd. Bijna de helft (49%) van de onderzoekspopulatie voldeed niet aan de richtlijn voor gezond bewegen en 22% was als inactief te omschrijven. Het hebben van lagerugklachten werd goed voorspeld door het hebben van lagerugklachten 1 tot 4 jaar eerder, met een odds ratio van meer dan 5, maar niet door lichamelijke inactiviteit. Geconcludeerd werd dat niet voldoen aan de richtlijn voor gezond bewegen geen risicofactor is voor lagerugklachten. Om de rol van lichamelijke (in)activiteit voor preventieprogramma's voor lagerugklachten verder te onderzoeken zal gekeken moeten worden naar specifieke lichamelijke activiteiten.

In een afsluitend hoofdstuk (hoofdstuk 5) werden de bevindingen uit dit proefschrift samengevat en kritisch besproken.
Voor de Nederlandse bevolking in het jaar 1998 werd geschat dat 900 duizend personen lichamelijke beperkingen hadden en 4,7 miljoen personen chronische klachten van het bewegingsapparaat. Deze gezondheidsindicatoren vertegenwoordigen omvangrijke volksgezondheidsproblemen en verdienen dan ook systematische aandacht vanuit onderzoek, preventie en gezondheidsbeleid. Voor het monitoren van ontwikkelingen in de prevalentie en consequenties van lichamelijke beperkingen en klachten van het bewegingsapparaat moeten goede informatiesystemen worden ontworpen. Daarbij zal de aandacht onder meer moeten worden gericht op de relevantie van de gemeten factoren en op procedures voor het uitsluiten, dan wel kwantificeren van non-response bias.

About the author

Susan Picavet was born in Amsterdam (17/5/1964), grew up in the south of the Netherlands (Noord Brabant) and returned to Amsterdam where she finished college. In 1982 she started the study Human Movement Sciences at the Free University in Amsterdam with special topics on health science in relation to human movement, psychology of human movement and public health.
She worked at the Institute of Social Medicine at the Academic Medical Centre (AMC) in Amsterdam and Statistics Netherlands in Voorburg before starting in 1996 at the Department of Chronic Diseases Epidemiology of the National Institute of Public Health and the Environment in Bilthoven.
Besides her colleagues and work, she loves Amsterdam, soccer, Wartburgia D3, tennis, biking, skiing, dancing, going to the theater or cinema or sauna, wine, beer, tea, fresh orange juice, playing cards, scrabble, laughing, cooking, etc, and her friends & family.

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