Under-estimation of obesity, hypertension and high cholesterol by self-reported data

Comparison of self-reported information and objective measures from health examination surveys

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Abstract

Background. Non-communicable diseases (NCDs) cause 63% of deaths worldwide. The leading NCD risk factor is raised blood pressure, contributing to 13% of deaths. A large proportion of NCDs are preventable by modifying risk factor levels. Effective prevention programmes and health policy decisions need to be evidence based. Currently, self-reported information in general populations or data from patients receiving healthcare provides the best available information on the prevalence of obesity, hypertension, diabetes etc. in most countries.

Methods. In the European Health Examination Survey Pilot Project, 12 countries conducted a pilot survey among the working age population. Information was collected using standardized questionnaires, physical measurement and blood sampling protocols. This allowed comparison of self-reported and measured data on prevalence of overweight, obesity, hypertension, high blood cholesterol and diabetes.

Results. Self-reported data under-estimated population means and prevalence for health indicators assessed. The self-reported data provided prevalence of obesity four percentage points lower for both men and women. For hypertension, the self-reported prevalence was ten percentage points lower, only in men. For elevated total cholesterol, the difference was 50 percentage point among men and 44 percentage points among women. For diabetes, again only in men, the self-reported prevalence was one percentage point lower than measured. With self-reported data only, almost 70% of population at risk of elevated total cholesterol is missed compared with data from objective measurements.

Conclusions. Health indicators based on measurements in the general population include undiagnosed cases, therefore providing more accurate surveillance data than reliance on self-reported or healthcare-based information only.

Key words: health examination survey, hypertension, obesity, diabetes, high cholesterol

Introduction

Representative and accurate health information is needed for planning and evaluation of health policies and prevention activities. Information on the health, health behaviours and lifestyle of the general population can be obtained from administrative registers, or through health interview or health examination surveys. The availability and coverage of administrative registers on health issues vary between countries. The availability of health interview and health examination surveys, their coverage, the questions and measurements included, and the population groups covered also vary considerably between countries [1].

Administrative registers such as medical records include people who have been diagnosed and treated by a physician. These registers represent the part of the population which has been seeking medical attention for their health conditions. In health interview and health examination surveys, a random sample of the population is taken. When a sample is selected from a sampling frame which covers the entire population, the selected sample should represent the entire population. In health interview surveys, the information obtained is based on self-reporting of the survey participants while in health examination surveys, objective measurements are also conducted.

Several studies have compared the prevalence of health outcomes from these three different data sources: administrative registers, self-reported information from health interview surveys, and clinical measurements from health examination surveys and cohort studies. When self-reported information was compared with medical records or clinical measurements from health examination surveys, self-reported information under-estimated the prevalence of hypertension [2-12] and high cholesterol [6,10,12]. Some studies provided relatively close estimates for the prevalence of diabetes [2,5,11,12], while other studies slightly under-estimated the prevalence of diabetes [3,4,6,8,10]. For height and weight, required for estimating the prevalence of overweight and obesity, data are not systematically available from administrative registers. Self-reported information under-estimates the prevalence of overweight and obesity in comparison with clinical examinations [13-15]. Prevalence of hypertension and high cholesterol have been under-estimated by medical records when compared with clinical examinations. However, for diabetes, the prevalence estimates have been relatively close between these two data sources. [2]

We compare self-reported information and objective measurements from the same individuals to examine whether population-level means and prevalences differ between these two data sources. We also assess the extent of any discrepancies, and how it varies between countries across Europe.

Material and methods

The European Health Examination Survey (EHES) Pilot Project (http://www.ehes.info) was conducted in 2009-2011. In 12 countries (Czech Republic, Finland, Germany, Greece, Italy, Malta, Netherlands, Norway, Poland, Portugal, Slovakia and UK/England) a pilot health examination survey of adults aged 25-64 years in the general population was conducted [16]. Random samples of the population were selected from the best available sampling frames in each country. Examinations and interviews were conducted by specially trained fieldwork personnel. [17] The total number of participants in these surveys was 4127 (44% men). Samples were not representative for the countries, limiting country level comparisons. The surveys included questionnaire(s), physical measurements and collection of blood samples. [16] Each survey received ethical approval from the appropriate ethical committee(s) and the survey participants gave informed consent before the measurements were taken.

Measurement data

The measurements were conducted using standardized protocols. [18] Height (cm) and weight (kg) were measured without shoes and heavy outer garments. Blood pressure (mmHg) was measured three times, on the right arm, in a sitting posture. The mean of the second and third measurements were used in analysis. Total cholesterol (mmol/l) was determined from serum samples, glucose (mmol/l) from fasting (at least 8 hours) plasma samples and/or glycated haemoglobin (HbA_{1c}) from EDTA blood samples.

The availability of data on weight, height, and blood pressure was high in all surveys. For serum cholesterol, data was available only for 51% of the survey participants in survey E. In the other surveys, data was available for at least 90% of survey participants. Fasting blood samples were available for determination of plasma glucose in ten surveys (all except surveys C and E). For practical reasons, fasting blood samples were often collected only from those who came to the examination in the morning, i.e. had fasted overnight. Therefore, relatively low availability of data for fasting glucose (50% or less) was observed in surveys C, G and I. Glycated haemoglobin (HbA_{1c}) was available in half the surveys (A, C E, F, H, I and K) and for almost all participants within these surveys. However, in survey E, only 51% of survey participants had HbA_{1c}.

Self-reported data

Self-reported information is based on data collected from questionnaires as part of the EHES surveys [18]. Survey participants were asked, before they were measured, “How tall are you without shoes? (in cm)” and “How much do you weight without clothes and shoes? (in kg)”. In countries, where Imperial units are commonly used, participants were allowed to provide information either in metric units or Imperial units. Imperial units were then transferred to metric units by the survey organizer. Self-reported height and weight were not asked in four surveys (I, J, K, L).

The information on self-reported hypertension, high total cholesterol and diabetes was based on the question: “Do you have or have you ever had any of the following diseases or conditions, diagnosed by a medical doctor? (Yes/No) Myocardial infarction, Coronary heart disease or angina pectoris, High blood pressure (hypertension), Elevated blood cholesterol, Stroke (cerebral haemorrhage, cerebral thrombosis), Diabetes”. Diagnosed hypertension and diabetes were not asked in survey I, and diagnosed high blood cholesterol was not asked in two surveys (I and E).

The use of medication is based on self-reporting from the questions "During the past two weeks, have you used any medicines that were prescribed for you by a doctor?" and if yes, "Were the medicines for …? (Yes/No) High blood pressure, Lowering the blood cholesterol level, Diabetes". Data on the use of medication for high blood pressure was not available in survey I; in three surveys (E, F and L), availability of data was less than 80%. For use of medications to lower blood cholesterol levels, data was not available in two surveys (I and E), and in two surveys (F and L) the data availability was less than 80%. Data on use of medications for diabetes was missing from survey I and in three surveys (E, F and L) the availability of data was less than 80%.

Definition of indicators

The definitions of the indicators for measured and self-reported overweight, obesity, hypertension, elevated blood cholesterol and diabetes are given in Table 1.

In the calculation of the indicators, only persons for whom both the measured and self-reported data for that indicator were available were used. The age standardized means and prevalences were calculated separately for men and women aged 25-64 years. Each 10-year age group was weighted equally.

Table 1. Definition of indicators

Data source	Indicator	Definition
Objective measurements	BMI	Measured weight (kg) / measured height $(m)^2$
	Overweight	BMI, based on measured data ≥ 25 kg/m^2
	Obesity	BMI, based on measured data ≥ 30 kg/m^2
	Hypertension	Systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg or being on drug treatment for hypertension (self-reported)
	Elevated total cholesterol	Serum total cholesterol ≥ 5.0 mmol/l or being on drug treatment to lower blood cholesterol level (self-reported)
	Diabetes	Fasting plasma glucose ≥ 7.0 mmol/l or HbA_{1c} (NGSP) ≥ 6.5% (IFFC HbA_{1c} ≥ 48 mmol/mol) or being on drug treatment for diabetes (self-reported)
Self-reported	BMI	Self-reported weight (kg) / self-reported height $(m)^2$
	Overweight	BMI, based on self-reported data ≥ 25 kg/m^2
	Obesity	BMI, based on self-reported data ≥ 30 kg/m^2
	Hypertension	Has answered 'Yes' to question 'Do you have or have you ever had any of the following diseases or conditions, diagnosed by a medical doctor?' – 'High blood pressure (hypertension)'
	Elevated total cholesterol	Has answered 'Yes' to question 'Do you have or have you ever had any of the following diseases or conditions, diagnosed by a medical doctor?' – 'Elevated blood cholesterol'
	Diabetes	Has answered 'Yes' to question 'Do you have or have you ever had any of the following diseases or conditions, diagnosed by a medical doctor?' – 'Diabetes'

Analytical methods

To test whether the observed differences between self-reported information and objective measurements between the populations were uniform, one-way variance analysis and log liner model were used.

The sensitivity, specificity, positive predictive value (PPV) and negative predictive values (NPV) were calculated for the indicators. Additionally, the percentage at risk that was missed by reliance solely on self-report, was calculated as:

$$\frac{\text{\# of persons classified as not at risk by self-report but at risk by measurement data}}{\text{\# of persons classified as at risk by measurement data}}$$

to estimate the proportion of the population at risk for specific conditions (obesity, hypertension, high cholesterol and diabetes) which would be missed using only self-reported information.

Results

Anthropometry, overweight and obesity

Mean measured height, over all populations, was 178.2 cm for men and 164.9 cm for women. These were 0.7 cm and 0.6 cm, respectively, less than mean self-reported height. The difference between measured and self-reported height varied significantly between populations but in general, self-reported height was higher than measured height. (Table 2)

Mean measured weight, over all populations, was 85.4 kg for men and 70.0 kg for women. The self-reported weight was lower than the measured weight for men and women, by 1.3 kg and 1.4 kg respectively. The difference between measured and self-reported weight also varied significantly between populations but in all populations for women and in all except one for men, self-reported weight under-estimated measured weight. (Table 2)

Table 2. Population mean of height, weight and BMI, and prevalence of overweight and obesity among 25-64 year old. Age standardized. Absolute difference between measured and self-reported indicators

Survey	Height cm				Weight kg				BMI kg/m^2				Overweight %			Obesity %		
	N	Measured	Self-reported	Difference	N	Measured	Self-reported	Difference	N	Measured	Self-reported	Difference	Measured	Self-reported	Difference	Measured	Self-reported	Difference
MEN																		
A	582	182.3	182.2	0.1	580	87.5	85.9	1.6	527	26.4	25.9	0.5	61.7	55.4	6.3	15.1	11.7	3.4
B	68	179.8	180.4	-0.6	67	88.5	87.0	1.5	67	27.4	26.7	0.7	71.1	68.4	2.7	23.6	18.1	5.5
C	78	176.5	177.5	-1.0	77	85.6	85.4	0.2	77	27.5	27.1	04.	64.6	64.5	0.1	27.5	25.4	2.1
D	50	177.6	177.9	-0.3	49	84.3	83.4	0.9	49	26.7	26.4	0.3	62.0	59.5	2.5	19.4	14.0	5.4
E	344	176.0	177.3	-1.3	323	85.1	83.3	1.8	323	27.4	26.5	0.9	70.2	63.8	8.9	21.6	15.6	6.0
F	188	174.6	176.0	-1.4	188	80.5	80.7	-0.2	188	26.4	26.0	0.4	54.1	54.6	-0.5	19.0	14.8	4.2
G	53	174.2	175.3	-1.1	52	85.6	84.8	0.8	52	28.2	27.6	0.6	83.2	85.3	-2.1	28.9	19.8	9.1
H	58	171.8	172.6	-0.8	71	83.4	81.3	2.1	56	27.9	27.0	0.9	72.7	69.6	3.1	24.5	17.1	7.4
All surveys	*1420*	*178.2*	*178.9*	*-0.7*	*1407*	*85.4*	*84.1*	*1.3*	*1384*	*26.9*	*26.2*	*0.7*	*64.9*	*60.5*	*4.4*	*18.6*	*14.2*	*4.4*
p-value for differences over all surveys	*0.0486*				*0.012*				*<0.0001*				*0.0083*			*0.001*		
p-value for variation in differences between surveys	*< 0.0001*				*<0.0001*				*<0.0001*				*<0.0001*			*<0.0001*		

WOMEN																		
A	687	168.1	168.1	0.0	676	72.0	70.3	1.7	670	25.4	24.8	0.6	45.7	39.6	6.1	15.1	12.9	2.2
B	95	164.4	164.8	-0.4	95	67.1	65.6	1.5	95	24.8	24.1	0.7	41.3	37.5	3.8	13.5	8.2	5.3
C	110	165.3	166.3	-1.0	109	70.1	69.6	0.5	108	25.7	25.2	0.5	40.6	39.6	1.0	19.2	13.9	5.3
D	81	164.3	164.2	0.1	80	64.8	64.4	0.4	80	24.0	23.9	0.1	35.1	33.7	1.4	5.1	5.1	0.0
E	440	162.9	163.7	-0.8	399	72.7	70.5	2.2	398	27.4	26.3	1.1	62.5	52.1	10.4	28.0	20.3	7.7
F	205	162.4	164.4	-2.0	205	63.7	63.4	0.3	205	24.2	23.4	0.8	36.5	29.2	7.3	11.6	7.2	4.4
G	56	158.8	161.5	-2.7	57	70.7	70.2	0.5	55	28.6	27.2	1.4	56.3	57.1	-0.8	35.3	26.5	8.8
H	61	158.1	159.4	-1.3	77	67.7	66.4	1.3	61	27.0	25.9	1.1	54.7	50.0	4.7	30.5	24.7	5.8
All surveys	*1735*	*164.9*	*165.5*	*-0.6*	*1698*	*70.0*	*68.6*	*1.4*	*1672*	*25.8*	*25.0*	*0.8*	*47.7*	*41.6*	*6.1*	*18.1*	*13.9*	*4.2*
p-value for differences over all surveys	*0.004*				*0.0024*				*<0.0001*				*0.0002*			*0.0004*		
p-value for variation in differences between surveys	*<0.0001*				*<0.0001*				*<0.0001*				*<0.0001*			*<0.0001*		

The measured BMI over all populations was 0.7 kg/m^2 higher than the self-reported BMI among men. For women, the difference was 0.8 kg/m^2. Variation in the difference between measured and self-reported BMI between populations was significant and larger among women than men. (Table 2)

Over all populations, the prevalence of overweight, based on measurements, was 64.9 % for men and 47.7 % for women. These were 4.4 percentage points and 6.1 percentage points higher than the prevalence of overweight based on self-reported information. The variation in the difference between measured and self-reported prevalence of overweight was significant between populations. (Table 2)

The prevalence of obesity, over all populations, from measurements was 18.6 % for men and 18.1 % for women. The prevalence of obesity from self-reported information was lower for men and women, by 4.4 percentage point and 4.2 percentage points respectively. Similar to the prevalence of overweight, the differences between countries in under-estimation of prevalence of obesity by self-reported data varied considerably between populations; this variation was statistically significant. (Table 2)

Hypertension

The prevalence of hypertension, over all populations, from measurements was 32.7 % among men and 21.9% among women. For men, the self-reported prevalence of hypertension was 10.1 percentage points lower than prevalence based on measurements, while for women the self-reported prevalence was 3.5 percentage points higher than that based on measurement of blood pressure. There was significant variation in this between populations for both men and women. (Table 3)

Elevated total cholesterol

In both men and women, the prevalence of elevated total cholesterol based on measurements was higher than the self-reported prevalence of elevated total cholesterol. The measured prevalence of elevated total cholesterol, all populations combined, was 71.1% for men and 62.6% for women.

Table 3. Prevalence of hypertension, high cholesterol and diabetes among 25-64 year old. Age standardization. Absolute difference between measured and self-reported indicators.

Survey	Prevalence of hypertension (%)				Prevalence of high cholesterol (%)				Prevalence of diabetes (%)			
	N	**Measured**	**Self-reported**	**Difference**	**N**	**Measured**	**Self-reported**	**Difference**	**N**	**Measured**	**Self-reported**	**Difference**
MEN												
A	575	36.0	18.9	17.1	540	73.2	17.5	55.7	468	6.5	6.1	0.4
B	69	31.5	16.4	15.1	69	69.4	22.0	47.4	67	4.0	4.3	-0.3
C	48	25.8	24.6	1.2	48	72.5	28.3	44.2	n.a	n.a	n.a	n.a
D	70	29.7	31.1	-1.4	66	67.6	27.1	40.5	70	12.4	11.2	1.2
E	187	32.2	33.0	-0.8	n.a	n.a	n.a	n.a	123	8.1	8.1	0.0
F	186	31.3	25.0	6.3	84	58.8	31.6	27.2	87	5.7	5.6	0.1
G	53	19.4	13.2	6.2	49	70.6	23.8	46.8	16	0.0	4.2	-4.2
H	80	38.3	19.0	19.3	81	75.6	15.4	60.2	82	9.8	9.4	0.4
J	81	32.3	24.2	8.1	80	70.7	29.4	41.3	80	5.1	4.1	1.0
K	39	40.3	30.4	9.9	32	73.1	35.4	37.7	31	0.0	0.0	0.0
L	52	13.0	11.2	1.8	52	56.4	5.9	50.5	51	8.1	4.7	3.4
All surveys	*1440*	*32.7*	*22.6*	*10.1*	*1101*	*71.1*	*21.5*	*49.6*	*1075*	*6.6*	*5.8*	*0.8*
p-value for differences over all surveys	*<0.0001*				*<0.0001*				*0.2101*			

p-value for variation in differences between surveys	*<0.0001*				*<0.0001*				*<0.0001*			
WOMEN												
A	630	25.1	28.5	-3.4	556	62.6	14.9	47.7	486	4.6	4.9	-0.3
B	96	25.2	12.5	12.7	94	69.2	22.6	46.6	93	0.8	0.8	0.0
C	80	12.8	13.7	-0.9	80	72.5	22.0	50.5	n.a	n.a	n.a	n.a
D	101	19.1	18.8	0.3	96	60.0	19.5	40.5	102	3.3	5.4	-2.1
E	218	27.0	42.1	-15.1	n.a	n.a	n.a	n.a	128	9.5	9.5	0.0
F	202	14.0	19.3	-5.3	104	62.9	28.6	34.3	107	2.1	4.8	-2.7
G	58	12.2	11.8	0.4	50	64.4	21.4	43.0	15	0.0	6.3	-6.3
H	80	27.4	16.3	11.1	74	18.4	19.7	-1.3	74	5.9	7.0	-1.1
J	86	30.7	26.6	4.1	86	59.1	16.6	42.5	84	5.3	4.8	0.5
K	57	36.5	42.4	-5.9	48	58.6	42.6	16.0	46	3.2	6.0	-2.8
L	53	10.8	16.0	-5.2	52	45.0	8.5	36.5	53	0.0	0.0	0.0
All surveys	*1661*	*21.9*	*25.4*	*-3.5*	*1240*	*62.6*	*19.0*	*43.6*	*1188*	*3.9*	*4.8*	*-0.9*
p-value for differences over all surveys	*0.0089*				*<0.0001*				*0.1339*			
p-value for variation in differences between surveys	*<0.0001*				*<0.0001*				*<0.0001*			

n.a.: data not available

Among men, the measured prevalence of elevated total cholesterol was 49.6 percentage points and among women 43.6 percentage points higher than self-reported prevalence. There was significant variation between populations. (Table 3)

Diabetes

The prevalence of diabetes based on measurements was 6.6% among men and 3.9% among women, all populations combined. Among men, the measured prevalence of diabetes was 0.8 percentage points higher than self-reported, while in women, the measured prevalence was 0.9 percentage points lower than self-reported. The pattern was mixed between populations but variation was statistically significant (Table 3).

Proportion at risk missed by self-reported information

Assuming that results from the objective measurements during the survey represent the true situation in the population, we estimated the proportion of the population at risk which would be missed by estimates based on self-reported data. For obesity, 30% of obese men and 26% of obese women would be missed by self-reported data. Similarly 41% of hypertensive men and 28% of hypertensive women; 68% of men and 70% of women with elevated total cholesterol; and 22% of diabetic men and 14% of diabetic women would be missed by self-reported data (Table 4).

Table 4. Proportion at risk that was missed by reliance solely on self-report, and sensitivity and specificity of the self-reported information

		Data based on objective measurements															
		Obesity				Hypertension				High cholesterol				Diabetes			
		Men		Women		Men		Women		Men		Women		Men		Women	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Self-reported data	Yes	185	18	232	7	304	60	304	154	250	15	237	27	62	9	43	17
	No	81	1100	81	1352	214	830	120	1068	534	259	557	367	17	986	7	1121
	% at risk missed	30%		26%		41%		28%		68%		70%		22%		14%	
	Sensitivity	70%		74%		59%		72%		32%		30%		78%		86%	
	Specificity	98%		99%		93%		87%		95%		93%		99%		99%	
	PPV	91%		97%		84%		66%		94%		90%		87%		72%	
	NPV	93%		94%		80%		90%		33%		40%		98%		99%	

Discussion

Observed bias of self-reported information

Our results show that there is clear under-estimation of the population prevalence of overweight, obesity and elevated total cholesterol for both men and women when compared with objective measurements. For the prevalence of hypertension and diabetes, under-estimation of self-reported information was observed in men but not as clearly in women. These results are in line with the results from previous studies [8,14].

Previous studies have shown that self-reported height is up to 2.2 cm greater than measured height in the general population among both men and women. For weight, self-reported values have been consistently lower than measured values, by up to 1.6 kg in men and women. The reporting bias has been larger among overweight and obese people. [14] These results are similar to our findings, supporting the general impression that people tend to report that they are taller and leaner than they really are. For over-reporting of height, it also may be that people have had their height measured over a decade(s) ago, and with increasing age, people tend to become shorter [19].

The observed over-reporting of height and under-reporting of weight has a direct impact on BMI levels and thus to the prevalence of overweight and obesity. Our results showed under-estimation of BMI similar to results from USA and Ireland [13,20]. Results from the National Health and Nutrition Examination Survey (NHANES) in the USA show that error in self-reported BMI increases with age [20] and there are differences between ethnic groups in the reporting bias [21]. Irish results have demonstrated that miss-reporting of height and weight, and thus under-estimation of BMI has increased over time; particularly among overweight and obese individuals [13].

In previous studies, prevalence of self-reported hypertension has been one to 39 percentage points lower than prevalence based on measured data. Our results showed slightly smaller difference. This reduced difference may be explained by increased awareness of hypertension over time, which has been reported from several countries [22-25]. Regardless of this positive development, the difference between self-reported and measured hypertension prevalence remains large.

For elevated total cholesterol, the self-reported prevalence has been around 30 percentage points lower than prevalence based on measurement in previous studies [7,10,12]. In our study, differences between prevalence of self-reported and measured elevated total cholesterol were significantly larger. This difference may be explained by different definitions of measured elevated total cholesterol. In some of the previous studies, the definition has been based on observed total cholesterol level (≥ 5.0 mmol/l) only. In our definition of measured elevated total cholesterol, people who reported that they were using medicines to lower their blood cholesterol levels were also considered as having elevated total cholesterol. It could also be that people under medical treatment for high cholesterol who have their cholesterol levels under control (< 5.0 mmol/l), do not report having high cholesterol for self-reported question.

For diabetes, our results showed rather small differences which were not systematic between populations or sexes. In previous studies, the difference between self-reported and measured prevalence of diabetes has been 1-2 percentage points [7,10]. In our study, we had a very small numbers of cases, which may have affected the outcome. There is also some evidence that HbA_{1c} would diagnose less diabetes than an oral glucose tolerance test but would work as well as a fasting glucose test[26].

For self-reported information, people have to know their condition before they can report it. Awareness of a specific health condition requires an examination and diagnosis by a medical doctor. Since most health conditions included in this study are asymptomatic for a long time, people do not have a reason to seek medical treatment for them. This is often a reason for under-reporting of self-reported health conditions.

Strengths and limitation of our study

In the EHES Pilot Project, the data on self-reported medical conditions can be compared with objective measurements taken during the health examination surveys. The strengths of our study are the use of standardized survey methods (sampling, questions, and measurement protocols) across the countries and external quality control. [18] The standardized protocols ensure that observed deviations in the results between populations are not due to differences in measurement techniques. This was supported with external quality control actions. We have both self-reported and measured data from the same individuals, who were working age men and women from several countries.

The sample sizes for these pilot surveys were relatively small and represented only small areas within the various countries. Therefore, survey specific results cannot be generalized to any specific country but analysis show variation in extend of under-recording between different survey populations.

In health examination surveys with physical examinations and collection of blood samples, a definition of health conditions is based on measurements taken on a single occasion during the survey. A medical diagnosis of hypertension, hypercholesterolaemia or diabetes is generally based on several subsequent measurements. Therefore health examination surveys can over- or under-estimate the true prevalence of specific health conditions in the population.

Implications for health policy planning

In 2008, 63% of deaths in the world were due to non-communicable diseases (NCD), primarily cardiovascular diseases, diabetes, cancer and chronic respiratory disease. Most of the NCDs are strongly associated with raised blood pressure, overweight and obesity, hyperglycaemia and hyperlipidaemia. The leading NCD risk factor globally is raised blood pressure, contributing to 13% of NCD deaths. Tobacco use, hyperglycaemia, physical inactivity, overweight and obesity, and high cholesterol are also very important. [27]

A large proportion of NCDs could be prevented through changes in these risk factors: even a 2 mmHg lower systolic blood pressure would result in about a 10% reduction in stroke mortality and about 7% lower mortality from ischemic heart disease or other vascular causes in the middle age. [28] Similarly, 1 mmol/l lower total cholesterol leads to about one-third lower ischemic heart disease mortality [29] and one unit lower BMI means a 4% and 3% lower fatal and non-fatal cardiovascular risk in men and women respectively [30].

Geoffrey Rose proposed that small, population wide-changes in risk factor profiles would be more effective than large changes in smaller, high risk sub-groups of the population [31]. Thus information required for identifying the extent of a problem in the population, developing and implementing a policy, targeting it to appropriate sub-groups of the population, and monitoring and evaluation of the progress needs to cover the whole population, not only patients in the health care system. Such information is not available from administrative registers. Although health examination surveys are more expensive than interview surveys, they provide more accurate information on the health and health risks of the population. Policy makers use the additional information extensively and are very appreciative of its usefulness [32].

Conclusions

Our results have confirmed that self-reported information tends to under-estimate population prevalence of overweight, obesity, hypertension, high total cholesterol and diabetes. Using standardized protocols, we have demonstrated that under-estimation is not uniform between populations or population sub-groups. Objective measurements taken during health examination surveys provide more accurate information about the health of the population for supporting evidence based health policies.

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Declaration of conflicting interests

None declared.

Key points

- Self-reported information on health indicators under-estimated population means and prevalences.
- Under-estimation of population level health indicators by self-reported information is not uniform between populations.
- A large proportion of people at risk are missed if only self-reported information is used.
- Reliance on self-reported information alone for health policy is likely to lead to under-estimation of the health problems in the population.

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