

Appendix A

Construction of chronic, single-entities conditions from data in the HUNT3 Survey, by questionnaires and measurements.

ORIGINAL QUESTIONNAIRE, ENGLISH VERSION

Main questionnaire

https://www.ntnu.edu/c/document_library/get_file?uuid=129b68c3-520c-457f-8b98-02c49219b2ee&groupId=140075

Sex- and age-specific questionnaire

https://www.ntnu.edu/c/document_library/get_file?uuid=35ae2816-4155-4b64-a259-770946fa46d4&groupId=140075

GENERAL COMMENTS

Chronicity

Chronicity was defined by either 1: duration (3 months or longer), 2: causing functional limitation (physical, mental, social) or 3: requiring health care management (pharmacological or not, primary or specialist care),¹ or 4: chronicity was assumed based on medical knowledge and clinical experience.

Missing

In variables with index questions and cluster text, missing was in general corrected for affirmed index question and regarded as “no” if replied to any alternative to any of the other questions in the block. Information on missing is also collected from the HUNT Databank.

References

References hold information on construction or accuracy of self-report of, or comparison of prevalence of the conditions to primary care and/or non-participant data. In general, self-report is considered to give reliable estimates of multimorbidity in studies of large samples.²

MAIN QUESTIONNAIRE

Hearing impairment³

Index question: "Do you suffer from longstanding (at least 1 year) illness or injury of a physical or psychological nature that impairs your functioning in your daily life?" Yes, no. Options on follow-up question combined condition type (motor, vision, hearing, somatic, and psychiatric) and severity (slight, moderate, and severe).

Included with hearing impairment were those who reported chronic disease and moderate to severe hearing impairment.

"20 Diseases": Myocardial infarction, angina pectoris, heart failure, other heart disease, stroke or brain haemorrhage, kidney disease, asthma, chronic bronchitis, emphysema or chronic obstructive pulmonary disease, diabetes, psoriasis, eczema on hands, cancer, epilepsy, rheumatoid arthritis, ankylosing spondylitis, sarcoidosis, osteoporosis, fibromyalgia and osteoarthritis

Cluster text: "Have you had or do you have any of the following;

Myocardial infarction;^{4,5} angina pectoris;^{5,6} heart failure;⁴ other heart disease; stroke^{4,5} or brain haemorrhage; kidney disease;⁵ asthma;⁵ chronic bronchitis, emphysema or chronic obstructive pulmonary disease; diabetes;^{4,5} psoriasis;⁷ eczema on hands;^{8,9} cancer;^{5,10} epilepsy;¹¹ rheumatoid arthritis;^{5,12} ankylosing spondylitis;^{5,12} sarcoidosis; osteoporosis;^{5,13} fibromyalgia⁵ and osteoarthritis⁵?"

Separate tick boxes for each diagnosis: Yes, no.

For each diagnosis, included were those who affirmed to have or have had the diagnosis.

Chronicity is assumed based on medical knowledge and clinical experience.

SEX- AND AGE-DIFFERENTIATED QUESTIONNAIRE

Headache⁵

Seven questions in one block. Question 1: "Have you had headaches in the last year?"

Yes/no.

Migraine without aura¹⁴

Of those who affirmed headache last year, migraine without aura was constructed from three of seven questions:

1. "What is the average strength of your headaches?" 1=Mild, 2=Moderate, 3=Strong.
Recoded to dichotomous variable, where 1=Moderate/Strong.
2. "How long does the headache usually last?" 1=Less than 4 hours, 2=4 hours - 1 day, 3=1 - 3 days, 4= More than 3 days.
Recoded to dichotomous variable, where 1= Less than 4 hours – 3 days.
3. Cluster text: "Are the headaches usually characterized or accompanied by
 - Throbbing/thumping pain?" Yes, no.
 - Pain on one side of the head?" Yes, no.
 - Worsening with physical activity?" Yes, no.
 - Nausea and/or vomiting?" Yes, no.
 - Hypersensitivity to light and/or noise?" Yes, no.

Included with migraine: were those who affirmed to headache lasting 0 to 72 hours and at least two of four characteristics (pulsating quality, unilateral location, moderate/severe pain intensity, or aggravation by physical activity) and during headache having at least one of two accompanying symptoms (nausea and/or vomiting or increased sensitivity to light and/or noise).¹⁴

Chronicity is assumed based on medical knowledge and clinical experience.

Chronic headache¹⁴

Of those who affirmed headache last year, chronic headache was constructed from two of seven questions:

1. "If yes (headache in the last year): What type of headache? Migraine, other."

The HUNT Databank created two variables with range 1: 1) migraine and 2) other headache.

2. "Average number of days a month with headaches:"

1=Less than 1 day, 2=1-6 days, 3=7-14 days, 4=More than 14 days.

Recoded to dichotomous variable, where 1= More than 14 days.

Included as case with chronic headache were those reporting "other" type of headache and an average frequency of more than 14 days per month.

Chronicity is assumed based on medical knowledge and clinical experience.

Pain⁵

Index question: "In the last year, have you had pain or stiffness in muscles or joints that has lasted at least 3 consecutive months?" Yes, no.

The follow-up question "If yes: Where have you had this pain or stiffness?" was combined with a figure with arrows and tick boxes at nine locations (neck, upper back, lower back, shoulder, elbow, hand, hip, knee and ankle/foot).

Chronic widespread pain¹⁵

Dichotomous variables were made for each major body area: 1) Trunk (neck, upper and lower back),

2) Upper limb (shoulder, elbow, hand), and 3) Lower limb (hip, knee, foot/ankle), where 1=At least one painful location. A sum (row total) score variable was made for the major body areas and dichotomized, where 1=3, that is one pain in each major body area.

Of those who affirmed to pain or stiffness that has lasted more than three consecutive months, chronic widespread pain was defined as pain at more than three sites in all major body areas (trunk, upper and lower limbs) for more than three months in the last year.

Chronic, local pain

Of those who affirmed to pain or stiffness that has lasted more than three consecutive months,

chronic, local pain was defined as pain in the neck or upper back or lower back or shoulder or elbow or hand or hip or knee or ankle/foot, excluding presence of chronic widespread pain, generating nine dichotomous variables.

Thyroidal disease⁵

Cluster text: "Has it ever been verified that you have/have had hypothyroidism or hyperthyroidism?" Separate tick boxes for each condition (yes, no), generating two dichotomous variables, 1=Yes.

For each diagnosis, included were those who affirmed to have or have had the diagnosis. Chronicity is assumed based on medical knowledge and clinical experience.

Irritable bowel syndrome^{16 17}

Index question: "Have you had stomach pain or discomfort in the last 12 months?" Answers: Yes, much; yes, a little; no. Irritable bowel syndrome was further constructed from four of six follow-up questions: "If yes:

"In the last 3 months, have you had this as often as 1 day a week for at least 3 weeks?" Yes, no.

"Is the pain/discomfort relieved by having a bowel movement?" Yes, no.

"Is the pain/discomfort related to more frequent or less frequent bowel movements than normal?" Yes, no.

"Is the pain/discomfort related to the stool being softer or harder than usual?" Yes, no.

Included with irritable bowel syndrome were those who affirmed little or much stomach pain or discomfort in the last year, who for as often as 1 day a week for at least 3 weeks in the last 3 months have had at least two of the following: pain/discomfort relieved by having a bowel movement, related to altered frequency of bowel movements, or related to altered stool appearance, resembling a modified version of the Rome criteria.^{16 17}

Gastro-oesophageal reflux disease^{5 18}

Cluster text: "To what degree have you had the following problems in the last 12 months?"

Options combined type (nausea, heartburn/acid regurgitation, diarrhea, constipation, alternating constipation and diarrhea, and bloating) and frequency (never, a little, or much). Generated one dichotomous variable, heartburn, where 1=Much.

Gastro-oesophageal reflux disease is defined as much heartburn/acid regurgitation in the last 12 months.¹⁸

Anxiety^{5 19}

Instrument variable: Hospital Anxiety and Depression Scale.¹⁹ Every other statement of 14 statements covers symptoms on anxiety and depression and is scored 0-3. The HUNT Databank constructed a total score for anxiety (HADS-A), if all 7 anxiety items were answered.

Anxiety was defined as HADS-A score $\geq 8/21$, indicating mild or possible anxiety.²⁰⁻²²

Chronicity is assumed based on medical knowledge and clinical experience.

Depression^{5 19}

Instrument variable: Hospital Anxiety and Depression Scale.¹⁹ Every other statement of 14 statements covers symptoms on anxiety and depression and is scored 0-3. The HUNT Databank constructed total score depression (HADS-D), if all 7 depression items were answered.

Depression was defined as HADS-D score $\geq 8/21$, indicating mild or possible depression.²⁰⁻²²

Chronicity is assumed based on medical knowledge and clinical experience.

Chronic insomnia^{5 23}

There were nine questions on sleeping pattern in one cluster, including three concerning insomnia. Initial text: "How often in the last 3 months have you

"Had difficulty falling asleep at night?" Never/seldom, sometimes, several times a week.

"Woken up repeatedly during the night?" Never/seldom, sometimes, several times a week.

"Woken too early and couldn't get back to sleep?" Never/seldom, sometimes, several times a week.

Chronic insomnia was defined as in the last 3 months, several times a week, having difficulty falling asleep at night and waking up repeatedly during the night, and waking up too early. A modified version of the diagnostic criteria for insomnia in the International Classification of Sleep Disorders.²³

Alcohol use disorder²⁴

Instrument variable: Cut down/Annoyed/Guilty/Eye-opener, also known as the CAGE questionnaire.²⁴ The CAGE questionnaire is a 4-item scale with scores of 0-1. A summary variable was created and dichotomized in which a score of 1 indicates ≥ 2 positive answers. Alcohol use disorder was defined as CAGE score greater than 2.²⁵

Chronicity is assumed based on medical knowledge and clinical experience.

Dental health problem

"How would you say your dental health is?" Very, bad, ok, good, very good.

Dental health problems were defined as self-reported bad or very bad dental health.²⁶

Chronicity is assumed based on medical knowledge and clinical experience.

Menopausal hot flashes

Asked to women older than 30 years only.

Two questions were used to define menopausal illness:

"Do you have/have you had hot flashes due to menopause?" During the day, during the night, day and night, haven't had any.

"If you have had hot flashes, how would you describe them?" Very intense, moderately intense, hardly noticeable.

Included with menopausal hot flashes were those who reported hot flashes occurring daily and/or nightly and of at least moderate severity.

Chronicity is assumed based on medical knowledge²⁷ and clinical experience.

Nocturia²⁸

Age group 20-29 years were excluded.

One question on nocturia, identical to that of the International Prostate Symptom Scale (IPSS), was asked to men and women older than 30 years.

"How many times do you get up during the night to urinate?" None, 1 time, 2 times, 3 times, 4 times, 5 times or more.

Nocturia was defined as two or more voids per night.²⁸

Chronicity is assumed based on medical knowledge and clinical experience.

Urine incontinence^{5 29}

Men 20-29 years were excluded.

Instrument variable: The Epidemiology of Incontinence in the County of Nord-Trøndelag (EPINCONT) questionnaire.²⁹

Index question: Do you have involuntary loss of urine? Yes, no.

Urine incontinence was constructed from two of six follow up questions. "If yes":

"How often do you have involuntary loss of urine?" Less than once a month, once or more per month, once or more per week, every day and/or night

"How much urine do you leak each time?" Drops or little, small amount, large amounts.

Self-reported frequency and volume of leakage were multiplied to obtain the validated 4-level Sandvik Severity Index, categorizing incontinence as slight, moderate, severe, and very severe.²⁹

Urine incontinence were included if severe to very severe.

Chronicity is assumed based on medical knowledge and clinical experience.

Prostate symptoms^{30 31}

Asked of men older than 30 years only.

Instrument variable: The International Prostate Symptom Scale³⁰ was slightly modified in HUNT3,³¹ becoming a 7-item scale with scores of 0-5 per question.

Included were prostate symptoms of at least moderate severity, i.e. summary score ≥ 8 points.³⁰

Chronicity is assumed based on medical knowledge and clinical experience.

Eye diseases³²

The age group 20-29 years were excluded.

Cluster text: "Do you have any of the following eye conditions?" Cataract, glaucoma, and macula degeneration. Separate tick boxes, yes, no.

For each diagnosis, included were those who affirmed to have or have had the diagnosis.

Chronicity is assumed based on medical knowledge and clinical experience.

MEASUREMENTS

Obesity^{33 34}

HUNT Databank constructed the BMI variable, defined as (weight in kg)/(height in m²).

Obesity was defined as either BMI ≥ 35 or a BMI 25-34.9 and an increased waist circumference (≥ 88 cm for females; ≥ 102 cm for males).^{33 34}

Chronicity is assumed based on medical knowledge and clinical experience.

Hypertension^{5 26}

Blood pressure in HUNT3 is measured three times at one consultation. The mean of measurement 2 and 3 is calculated by HUNT Databank.

Hypertension was defined as measured mean systolic BP \geq 180 mmHg or diastolic BP \geq 110 mmHg or reporting use of antihypertensive medications, excluding self-reported cardiovascular disease, diabetes, or kidney disease, and excluding extreme measures. Chronicity is assumed based on medical knowledge and clinical experience.

Hypercholesterolemia³⁵

Hypercholesterolemia was defined as total-cholesterol \geq 8 mmol/L.³⁵

Chronicity is assumed based on medical knowledge and clinical experience.

REFERENCES

1. Goodman RA, Posner SF, Huang ES, et al. Defining and measuring chronic conditions: imperatives for research, policy, program, and practice. *Prev Chronic Dis* 2013;10:E66. doi: 10.5888/pcd10.120239 [published Online First: 2013/04/27]
2. Fortin M, Stewart M, Poitras ME, et al. A systematic review of prevalence studies on multimorbidity: toward a more uniform methodology. *Ann Fam Med* 2012;10(2):142-51. doi: 10.1370/afm.1337 [published Online First: 2012/03/14]
3. Valete-Rosalino CM, Rozenfeld S. Auditory screening in the elderly: comparison between self-report and audiometry. *Braz J Otorhinolaryngol* 2005;71(2):193-200. doi: /S0034-72992005000200013 [published Online First: 2006/02/01]
4. Okura Y, Urban LH, Mahoney DW, et al. Agreement between self-report questionnaires and medical record data was substantial for diabetes, hypertension, myocardial infarction and stroke but not for heart failure. *J Clin Epidemiol* 2004;57(10):1096-103.
5. Langhammer A, Krokstad S, Romundstad P, et al. The HUNT study: participation is associated with survival and depends on socioeconomic status, diseases and symptoms. *BMC Med Res Methodol* 2012;12:143. doi: 10.1186/1471-2288-12-143 [published Online First: 2012/09/18]
6. Merzenich H, Blettner M, Niehoff D, et al. Cardiac late events in German breast cancer patients: a validation study on the agreement between patient self-reports and information from physicians. *BMC Cardiovasc Disord* 2018;18(1):218. doi: 10.1186/s12872-018-0961-7 [published Online First: 2018/12/01]
7. Modalsli EH, Snekvik I, Asvold BO, et al. Validity of Self-Reported Psoriasis in a General Population: The HUNT Study, Norway. *J Invest Dermatol* 2016;136(1):323-5. doi: 10.1038/jid.2015.386 [published Online First: 2016/01/15]
8. Svensson Å, Lindberg M, Meding B, et al. Self-reported hand eczema: symptom-based reports do not increase the validity of diagnosis. *Br J Dermatol* 2002;147(2):281-84.
9. Meding B, Barregård L. Validity of self-reports of hand eczema. *Contact Dermatitis* 2001;45(2):99-103.
10. Navarro C, Chirlaque MD, Tormo MJ, et al. Validity of self reported diagnoses of cancer in a major Spanish prospective cohort study. *J Epidemiol Community Health* 2006;60(7):593-9. doi: 10.1136/jech.2005.039131 [published Online First: 2006/06/23]
11. Keezer MR, Bouma HK, Wolfson C. The diagnostic accuracy of screening questionnaires for the identification of adults with epilepsy: A systematic review. *Epilepsia* 2014;55(11):1772-80. doi: 10.1111/epi.12811
12. Videm V, Thomas R, Brown MA, et al. Self-reported Diagnosis of Rheumatoid Arthritis or Ankylosing Spondylitis Has Low Accuracy: Data from the Nord-Trøndelag Health Study. *J Rheumatol* 2017;44(8):1134-41. doi: 10.3899/jrheum.161396 [published Online First: 2017/04/17]
13. Cunningham TD, DeShields SC. Factors associated with the accuracy of self-reported osteoporosis in the community. *Rheumatol Int* 2016;36(12):1633-40. doi: 10.1007/s00296-016-3573-5 [published Online First: 2016/10/08]

14. Hagen K, Zwart JA, Aamodt AH, et al. The validity of questionnaire-based diagnoses: the third Nord-Trondelag Health Study 2006-2008. *J Headache Pain* 2010;11(1):67-73. doi: 10.1007/s10194-009-0174-7 [published Online First: 2009/12/01]
15. Mundal I, Grawe RW, Bjorngaard JH, et al. Prevalence and long-term predictors of persistent chronic widespread pain in the general population in an 11-year prospective study: the HUNT study. *BMC Musculoskelet Disord* 2014;15:213. doi: 10.1186/1471-2474-15-213 [published Online First: 2014/06/22]
16. Hammer J, Talley NJ. Diagnostic criteria for the irritable bowel syndrome. *Am J Med* 1999;107(5A):5S-11S. doi: 10.1016/s0002-9343(99)00276-4 [published Online First: 1999/12/10]
17. Longstreth GF, Thompson WG, Chey WD, et al. Functional bowel disorders. *Gastroenterology* 2006;130(5):1480-91. doi: 10.1053/j.gastro.2005.11.061 [published Online First: 2006/05/09]
18. Ness-Jensen E, Lindam A, Lagergren J, et al. Changes in prevalence, incidence and spontaneous loss of gastro-oesophageal reflux symptoms: a prospective population-based cohort study, the HUNT study. *Gut* 2012;61(10):1390-7. doi: 10.1136/gutjnl-2011-300715 [published Online First: 2011/12/23]
19. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983;67(6):361-70. doi: 10.1111/j.1600-0447.1983.tb09716.x [published Online First: 1983/06/01]
20. Mykletun A, Stordal E, Dahl AA. Hospital Anxiety and Depression (HAD) scale: factor structure, item analyses and internal consistency in a large population. *Br J Psychiatry* 2001;179:540-4. doi: 10.1192/bjp.179.6.540 [published Online First: 2001/12/04]
21. Bjelland I, Dahl AA, Haug TT, et al. The validity of the Hospital Anxiety and Depression Scale. An updated literature review. *J Psychosom Res* 2002;52(2):69-77. doi: 10.1016/s0022-3999(01)00296-3 [published Online First: 2002/02/08]
22. Herrmann C. International experiences with the Hospital Anxiety and Depression Scale--a review of validation data and clinical results. *J Psychosom Res* 1997;42(1):17-41. doi: 10.1016/s0022-3999(96)00216-4 [published Online First: 1997/01/01]
23. Medicine AAOs. The international classification of sleep disorders: diagnostic and coding manual: American Acad. of Sleep Medicine 2005.
24. Ewing JA. Detecting alcoholism. The CAGE questionnaire. *JAMA* 1984;252(14):1905-7. doi: 10.1001/jama.252.14.1905 [published Online First: 1984/10/12]
25. Skogen JC, Overland S, Knudsen AK, et al. Concurrent validity of the CAGE questionnaire. The Nord-Trondelag Health Study. *Addict Behav* 2011;36(4):302-7. doi: 10.1016/j.addbeh.2010.11.010 [published Online First: 2010/12/21]
26. Tomasdottir MO, Getz L, Sigurdsson JA, et al. Co-and multimorbidity patterns in an unselected Norwegian population: Cross-sectional analysis based on the HUNT Study and theoretical reflections concerning basic medical models. *European Journal for Person Centered Healthcare* 2014;2(3):335-45.
27. Avis NE, Crawford SL, Greendale G, et al. Duration of menopausal vasomotor symptoms over the menopause transition. *JAMA Intern Med* 2015;175(4):531-9. doi: 10.1001/jamainternmed.2014.8063 [published Online First: 2015/02/17]
28. Tikkinen KA, Johnson TM, 2nd, Tammela TL, et al. Nocturia frequency, bother, and quality of life: how often is too often? A population-based study in Finland. *Eur Urol* 2010;57(3):488-96. doi: 10.1016/j.eururo.2009.03.080 [published Online First: 2009/04/14]
29. Sandvik H, Seim A, Vanvik A, et al. A severity index for epidemiological surveys of female urinary incontinence: comparison with 48-hour pad-weighting tests. *Neurourol Urodyn* 2000;19(2):137-45. doi: 10.1002/(sici)1520-6777(2000)19:2<137::aid-nau4>3.0.co;2-g [published Online First: 2000/02/19]

30. Barry MJ, Fowler FJ, Jr., O'Leary MP, et al. The American Urological Association symptom index for benign prostatic hyperplasia. The Measurement Committee of the American Urological Association. *J Urol* 1992;148(5):1549-57; discussion 64. doi: 10.1016/s0022-5347(17)36966-5 [published Online First: 1992/11/11]
31. HUNT Databank. International Prostate Symptom Scale in HUNT3 Questionnaire 2 [Webpage]. Levanger: HUNT Databank; 2019 [cited 2019 05.20.]. Available from: https://hunt-db.medisin.ntnu.no/hunt-db/#/instrumentpart/45_11 2019.
32. MacLennan PA, McGwin G, Jr., Searcey K, et al. Medical record validation of self-reported eye diseases and eye care utilization among older adults. *Curr Eye Res* 2013;38(1):1-8. doi: 10.3109/02713683.2012.733054 [published Online First: 2012/10/20]
33. Janssen I, Katzmarzyk PT, Ross R. Waist circumference and not body mass index explains obesity-related health risk. *Am J Clin Nutr* 2004;79(3):379-84. doi: 10.1093/ajcn/79.3.379 [published Online First: 2004/02/27]
34. Perreault L. Obesity in adults: Prevalence, screening, and evaluation. Waltham, MA: UpToDate 2018.
35. Helsedirektoratet. Nasjonal faglig retningslinje for individuell primærforebygging av hjerte-og karsykdommer, kortversjon, IS-1675. In: Helsedirektoratet, ed., 2009.