

**PRIMARY-CARE-BASED EPISODES OF CARE AND THEIR
COSTS IN A THREE-MONTH FOLLOW-UP IN FINLAND**

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HEINONEN JOHANNA: PRIMARY-CARE-BASED EPISODES OF CARE AND THEIR COSTS IN A THREE-MONTH FOLLOW-UP IN FINLAND

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Tutkimuksen tavoitteena on tarkastella Suomessa terveyskeskusvastaanotolla käyneiden potilaiden ICPC-2 -luokiteltuja hoitokohtia, niihin liittyvää resurssien käyttöä ja niistä aiheutuvia terveydenhuollon suorita kustannuksia.

Tutkimus on prospektiivinen monitorointitutkimus liittyen Vaikuttava Terveysasema -hankkeeseen. 622 potilasta rekrytoitiin tutkimukseen kolmelta eri terveysasemalta Pirkanmaalta vastaanottokäynnin yhteydessä yhden viikon aikana vuonna 2011. Potilaille laadittiin kyselylomakkeet, joissa tiedusteltiin mm. sosioekonomisia tietoja, koettua terveydentilaa ja toimintakykyä, sekä arviota hoidon vaikuttavuudesta.

Tutkimuspotilaiden perusterveydenhuollon ja erikoissairaanhoidon resurssien käyttö selvitettiin kolmen kuukauden ajalta potilastietojärjestelmästä. Resurssien käyttö arvioitiin palvelun tuottajan vuoden 2012 kustannuksilla.

Keskimäärin yhdellä potilaalla oli kolmen kuukauden seuranta-ajalla 1,22 hoitokohtaa. Potilaiden ominaisuudet ja resurssien käyttö erosivat ryhmien välillä. Suurin episodiryhmä oli ICPC-2 -luku L eli 'Tuki- ja liikuntaelinsairaudet' (17 %). Tavallisin (8 %) yksittäinen episodi oli ylähengitystieinfektio. Keskimäärin hoitokohta maksoi kolmen kuukauden ajalla 389,56 euroa (keskivirhe 61,11) ja mediaani 165,00 euroa (kvartiilivälin pituus 118,46—288,56). Keskimäärin kalleimmat (909,85 euroa) hoitokohtat olivat ICPC-2 -luvussa K eli 'Verenkiertoelimet'. Samassa ryhmässä oli myös kallein yksittäinen episodi, jonka hinta oli 32 545,56 euroa. Kallein prosentti hoitokohteista kattoi yhteensä 36 % hoitokohtakustannuksista.

Potilaiden ominaisuudet, resurssien käyttö ja kustannukset erosivat ICPC-2 -lukujen välillä, mikä voitaisiin ottaa huomioon suunniteltaessa palveluiden tuottamista ja hinnoittelua. Tulevaisuuden tutkimuksiin tulisi saada tarkemmat diagnoosit, isompi aineisto ja pidemmät seuranta-ajat.

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Primary-Care-Based Episodes of Care and their Costs in a Three-Month Follow-Up in Finland

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Key points

Patient characteristics, resource use and costs related to different episodes of care based on the ICPC-2 classification have not been published.

The most common episodes were in the “Musculoskeletal” chapter, but the highest mean and single-episode costs were related to the “Circulatory” chapter.

The mean (median) cost of episodes that started in primary care was €390 (€165) during the three-month follow-up.

Patient characteristics, resource use and costs differed significantly between the ICPC-2 chapters. The most expensive one percent of the episodes covered 36% of the total costs of all the episodes.

Introduction

An episode of care (EOC) in primary health care (PHC) is defined as a health problem needing testing, diagnosis, care or follow-up from its first presentation by the patient to a family doctor, nurse or acute polyclinic until completion of the last health care (HC) contact related to it [1].

An EOC differs from an episode of disease—a health problem from its onset through its resolution—and also from an episode of illness, i.e. a period during which a person suffers from symptoms [2]. The cost of an episode (COE), disease, illness or care should be differentiated, because they apply to different populations and have different contents.

An EOC is the appropriate unit for assessing important attributes of PHC such as continuity, coordination, outcomes and satisfaction [3]. An EOC can be defined with an International Classification of Primary Care (ICPC) episode title code [1]. The ICPC was developed by the Wonca (World Organization of Family Doctors) International Classification Committee and designed to describe the three basic elements of an EOC in publicly funded HC: reason for encounter (RFE), diagnostic label, and diagnostic and therapeutic intervention [4][5][6]. The last diagnosis made (i.e. diagnostic label) during an EOC is the current episode title [1], which may vary over time. It should not be confused with the RFE, an agreed statement of the reason(s) why a person enters the HC system. [1][7][8][9]

Due to comorbidity, different episodes frequently exist at the same time [2]. Okkes and colleagues noticed that differences in the annual number of EOCs and encounters per patient were small between countries. However, there were large differences in resource consumption per EOC. The most prominent differences were related to prescriptions of antibiotics, oral contraceptives and cardiovascular medication, and treatment of gastrointestinal tract complaints. [12] These together with international price differences (unit costs) in HC services can cause large differences in the COEs between countries and demonstrate the importance of national COE evaluations.

There are no previous publications dealing with ICPC-2-based EOCs in Finland. COEs are relatively unknown in Finland and elsewhere. Due to limited resources, and for the purposes of health economic evaluation, the types of EOCs appearing in PHC and related resource consumption and costs are becoming important. The lack of published knowledge related to PHC resources has been noticed in Finnish studies [13][14][15][16][17][18][19][20][21][22]. However, just a few Finnish studies have assessed disease-based PHC costs based on relatively comprehensive data [13][23][22][24], and usually with a focus on a single patient group without EOCs.

The aim of this study was to explore patient characteristics, resource use and costs related to different ICPC-2-based EOCs in the Finnish PHC setting during a three-month time period.

Material and methods

The Effective Health Centre (EHC) study (funding from the Pirkanmaa Hospital District) was a prospective three-month follow-up study (sc. institutional study) carried out during 2011 in three different PHC practices in Pirkanmaa, Finland [25]. The study sought to recruit as many patients as possible during a one-week period in each practice. Patients with an appointment with a nurse or a doctor on the recruiting day were included, and patients visiting a specialized health guidance clinic for pregnant women, children and mothers were excluded. The recruitment date was the starting point (index day) for a three-month follow-up period of EOCs.

In total, 622 patients and 32 doctors participated in the EHC study. The study sample includes 41% (622/1520) of all the patients who had an appointment in the study practices during the recruitment phase. [25]

The patient- and HC-personnel-reported data were collected using tailored questionnaires. If they agreed to participate, the patients filled in a questionnaire given by a research assistant before or after their appointment. In addition, data were collected with patient consent from an electronic health record (EHR).

The EOCs were divided into main groups (A, B, D, etc.) based on the ICPC-2 chapter title codes. The episodes were labelled with the last diagnosis made during the three-month EOC, which was the EOC class used in the analysis. [1] Resource use (visits in PHC and secondary health care (SHC), examinations, laboratory tests, referrals, treatments and hospitalizations) (Table III) was collected from an EHR retrospectively by two researcher physicians who read the patient EHRs from the three-month follow-up period. The resources are presented as means together with their standard errors (SE), because the mean is the expected value of distribution [26].

Resource costing was done from the perspective of the HC payer, and the COEs include only direct HC costs. Unit costs were based on the official Pirkanmaa health district, Tampere health centre and Fimlab laboratory list prices (tariffs) from 2013 (Supplementary Appendix I available online). The data were checked for general consistency and any illogical results were checked and corrected. The

ICPC-2-based costs were bootstrapped [14] to establish robust confidence intervals for skewed distributions. SPSS V20 and Stata V10 statistical software were used in the data analysis.

Study permission was granted by the research committee of the City of Tampere and the chief physician of one clinic not located in Tampere. Due to the nature of this study, there was no need to apply for permission from the hospital district's ethics committee.

Results

EOCs were determined for 99% (618/622) of the study patients. The patients were typical Finnish HC patients regarding their age, occupational status and chronic diseases (table 1). The mean age was 49 years (median 55.0, interquartile range IQR 27.0–69.5). A long-term disease was the RFE for 31% (193) of the patients.

The 618 patients had 752 EOCs altogether. On average, the patients had 1.22 EOCs. The number of EOCs divided into ICPC-2 chapters is presented in Figure 1. The greatest number of EOCs (130) was in the “Musculoskeletal” chapter. The most common (63) single EOC was “upper respiratory infection”.

According to a doctor's or nurse's judgment, the phase of the primary EOC on the recruiting day was labelled as a “new episode” for 52% (326) of the patients that presented to HC for the first time for this new health problem, and the rest of the episodes were labelled as a “pre-existing episode” presenting with a problem that had required HC previously. Altogether 40% (304) of the EOCs continued after the follow-up period. Table II shows the patients' characteristics by EOC chapter.

Table III lists the resources used to calculate mean and total costs of the EOCs. The mean cost of the EOCs was €389.56 (SE 61.11) and the median was €165.00 (IQR €118.46–288.56) during the three-month follow-up. The mean costs and 95% confidence intervals by EOC chapter are presented in Figure 2. The most expensive group, on average, was “Circulatory”. The mean cost of PHC per episode was €237.21. The exact costs and arithmetic confidence intervals are available (Supplementary Appendix II available online).

The most expensive one percent of the EOCs covered 36% (€105,787.45 / €293,335.73) of the total costs in the data. The most expensive single episode was in the “Circulatory” chapter: €32,545.56.

Discussion

Considerable differences were found in patient characteristics, resource use and costs related to different EOCs. The most expensive one percent of the EOCs covered 36% of the total costs, which can be of interest to the Finnish municipal payer of HC services. The highest number of episodes was “Musculoskeletal”. However, the highest mean and single-episode costs were related to chapter K, “Circulatory”. The dual source of costs (PHC and SHC) is an important cause of variation.

The benefits of this study are the precise time during which the data were collected, the amount of exact information collected from the EHR together with the patient- and clinician-reported data and the use of valid unit cost data. By these methods it was possible to obtain accurate descriptive costs based on the ICPC-2 EOC titles. For example, some register studies ignore the exact data coverage time, i.e. some of the patients are lost during the follow-up.

However, this study had some limitations. First, the data collection period was limited to three months. An EOC is a longitudinal concept and this study may be regarded as cross-sectional when considering long-term EOCs. Since the time frame was relatively short, there was a residual risk that some EOC follow-ups were censored. However, this study was initially targeted to assess the short-term cost-effectiveness of different types of PHC service production systems. A longer follow-up period or a larger data set was not feasible due to the accurate and detailed data collection required and the lack of data collection resources and EHR data. Furthermore, a three-month follow-up can be suitable for capturing the costs of most acute short-term EOCs and also the acute phase of long-term EOCs.

Second, the data were collected in the beginning of the year when respiratory infections are overrepresented, which however should not bias the resource use or mean costs of the EOC chapter. The problem related to changes in the patient material can be corrected in the future by choosing a one-year follow-up period and follow-ups with a predefined patient entering-exiting timeline [22]. Third, all the episodes did not last the entire follow-up period. However, they did not restart, and most acute conditions resolve within three months. Thus, the resource and cost data are valid for the expected three-month timeline. This should be accounted for when the results are interpreted or when resource use is extrapolated.

Fourth, the recruiting method prevented full coverage of all available patients. Despite this, 41% of the patients participated, which is acceptable coverage for a study including patient- and clinician-reported data. Furthermore, due to patient-reported outcomes, written consent was needed. This

may have caused some selection bias, where some patient groups systematically dropped out. Unfortunately, ICPC-2 codes of the RFEs were not coded systematically into the EHR in the study health centres at the time of the study. However, in 2014 documenting of the RFEs had increased into 66 % in the study health stations at Tampere. The top 4 RFEs in 2014 were upper respiratory tract infection, high blood pressure, back pain and diabetes. There was no obvious bias in the study sample regarding the RFEs.

Fifth, the data were recorded manually, and local unit costs were collected from a few sources due to a lack of a single unit cost source. However, national unit costs can underestimate (local) costs; indexing to the present value does not seem to handle the problem very well, and local costs can be more precise for a particular resource [21][22]. For this reason, and also due to a lack of unit costs for many resources, a national unit cost list was not used as the key unit cost source.

Lastly, the targeted analytical perspective was HC payers. However, in practice the perspective was limited to the HC service provider's perspective, with most costs being the provider's tariffs. Drug costs (mostly paid by the social insurance institution) were excluded due to limitations in their reporting, a lack of reimbursement data and the probable small impact on total EOC costs. Furthermore, travel costs and production losses (presenteeism, absenteeism) would have been important for a societal perspective, but sick-leave data were not collected.

When considering the generalizability and applicability of the results, earlier studies were reviewed. Based on the current study, a patient is likely to visit his doctor around 4–5 times per year. Based on a UK study, a patient visits his doctor an average of 5.3 times per year [27] and is likely to present with three to four symptoms at the same encounter [28]. Soler and colleagues studied the prevalence and incidence of RFEs and EOCs in three countries. They discovered that RFEs seem to be more consistently distributed between populations than EOCs [1], i.e. symptoms are distributed equally but care is not. Furthermore, the relationship between RFE and diagnostic label is very similar regardless of the country [29], with some differences in the size ranges of the relationships [30]. Consequently, the results of this study may be applicable to a wider setting from the perspective of visit frequency/resource consumption.

The practical implication of the results for a clinician, a health economist or decision-makers is that they describe the spectrum of EOCs in PHC and show how resources and costs are distributed between different types of EOCs and what patient characteristics are in a particular ICPC-2 chapter.

Finally, based on the experience gained from this study, further studies should include more specific diagnoses, extended follow-up times and larger data sets. Automatic EHR data collection may solve these challenges.

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Declaration of interest

Tuomas Koskela has been granted financial support for this project from the Pirkanmaa Hospital District and is a shareholder of Pihlajalinna Ltd. The other authors have no relevant conflict of interest related directly to the scope of this work. The authors alone are responsible for the content and writing of the paper.

References

- [1] Soler JK, Okkes I, Oskam S, van Boven K, Zivotic P, Jevtic M, et al. An international comparative family medicine study of the Transition Project data from the Netherlands, Malta and Serbia. Is family medicine an international discipline? Comparing incidence and prevalence rates of reasons for encounter and diagnostic titles of episodes of care across populations. *Fam Pract* 2012;29:283–98.
- [2] Lamberts H, Hofmans-Okkes I. Episode of care: a core concept in family practice. *J Fam Pract* 1996;42:161–9.
- [3] Donaldson M, Yordy K, Vanselow N, eds. *Defining primary care: an interim report*. Washington, D.C.: Institute of Medicine, National Academy Press; 1994.
- [4] Lamberts H, Wood M editors. *ICPC, International Classification of Primary Care*. Oxford, England: Oxford University, Press; 1987.
- [5] Lamberts H, Wood M, Hofmans-Okkes I editors. *The International Classification of Primary Care in the European community*. Oxford, England: Oxford University, Press; 1993.
- [6] Klinkman MS, Green LA. Using ICPC in a computer-based primary care information system. *Fam Med* 1995;27:449–56.
- [7] Greenlick MR. Episodes of care classification. In: Grady ML, editor. *Primary care research: theory and methods*. Rockville: Agency for Health Care Policy and Research; 1991. p. 83.
- [8] Hornbrook MC, Hurtado RV, Johnson RE. Health care episodes. Definition, measurement and use. *Med Care Rev* 1985;42:163–218.
- [9] Solon JA, Feeney JJ, Jones SH, Rigg RD, Sheps CG. Delineating episodes of medical care. *Am J Public Health Nations Health* 1967;57:401–8.
- [10] Busse R, Geissler A, Aaviksoo A, Cots F, Häkkinen U, Kobel C, et al. Diagnosis related groups in Europe: moving towards transparency, efficiency, and quality in hospitals? *BMJ* 2013;346:f3197.
- [11] Moeller DJ, Evans J. Episode-of-care payment creates clinical advantages. *Manag Care* 2010;19:42–5.
- [12] Okkes IM, Polderman GO, Fryer GE, Yamada T, Bujak M, Oskam SK, et al. The role of family practice in different health care systems: a comparison of reasons for encounter, diagnoses, and interventions in primary care populations in the Netherlands, Japan, Poland, and the United States. *J Fam Pract* 2002;51:72–3.
- [13] Hallinen T, Martikainen JA, Soini EJ, Suominen L, Aronkyyö T. Direct costs of warfarin treatment among patients with atrial fibrillation in a Finnish health care setting. *Curr Med Res Opin* 2006;22:683–92.
- [14] Keränen J, Soini EJ, Ryyänänen OP, Hietaniemi K, Keränen U. Economic evaluation comparing From Home To Operation same day admission and preoperative admission one day prior to the

surgery process: a randomized, controlled trial of laparoscopic cholecystectomy. *Curr Med Res Opin* 2007;23:2775–84.

[15] Tamminen K, Laine J, Soini E, Martikainen J, Kankaanranta H. Cost-effectiveness analysis of budesonide/formoterol maintenance and reliever therapy versus fixed combination treatments for asthma in Finland*. *Curr Med Res Opin* 2008;24:3453–61.

[16] Hallinen TA, Soini EJ, Eklund K, Puolakka K. Cost-utility of different treatment strategies after the failure of tumour necrosis factor inhibitor in rheumatoid arthritis in the Finnish setting. *Rheumatology* 2010;49:767–77.

[17] Soini EJ, Davies G, Martikainen JA, Hu HX, Tunceli K, Niskanen L. Population-based health-economic evaluation of the secondary prevention of coronary heart disease in Finland. *Curr Med Res Opin* 2010;26:25–36.

[18] Soini EJ, Martikainen JA, Nousiainen T. Treatment of follicular non-Hodgkin's lymphoma with or without rituximab: cost-effectiveness and value of information based on a 5-year follow-up. *Ann Oncol* 2011;22:1189–97.

[19] Soini EJ, Hallinen TA, Puolakka K, Vihervaara V, Kauppi MJ. Cost-effectiveness of adalimumab, etanercept, and tocilizumab as first-line treatments for moderate-to-severe rheumatoid arthritis. *J Med Econ* 2012;15:340–51.

[20] Soini EJ, Martikainen JA, Vihervaara V, Mustonen K, Nousiainen T. Economic evaluation of sequential treatments for follicular non-Hodgkin lymphoma. *Clin Ther* 2012;34:915–25.

[21] Soini EJ, Leussu M, Hallinen T. Administration costs of intravenous biologic drugs for rheumatoid arthritis. *Springerplus* 2013;2:531.

[22] Hallinen T, Soini E, Asseburg C, Kuosmanen P, Laakkonen A. Warfarin treatment among Finnish patients with atrial fibrillation: retrospective registry study based on primary health care data. *BMJ Open* 2014;4:e004071.

[23] Paloneva J, Koskela S, Kautiainen H, Vanhala M, Kiviranta I. Consumption of medical resources and outcome of shoulder disorders in primary health care consulters. *BMC Musculoskeletal Disord* 2013;14:348.

[24] Honkasalo MT, Linna M, Sane T, Honkasalo A, Elonheimo O. A comparative study of two various models of organising diabetes follow-up in public primary health care - the model influences the use of services, their quality and costs. *BMC Health Serv Res* 2014;14:26.

[25] Kangaspunta V, Koskela T, Soini E, Rynänen OP. Potilaiden arvioon terveystieteiskäynnin hyödystä vaikuttavat tekijät. [Factors impacting the perceived usefulness of a patient's health centre visit] *Finn Med J* 2014;22:1654–9.

[26] Soini EJ. Cost-utility and expected value of perfect information related to trabectedin in the treatment of metastatic soft-tissue sarcoma: the publicly funded comments explored. *Ann Oncol* 2011;22:1465–6.

[27] Hippisley-Cox J, Fenty J, Heaps M. Trends in Consultation Rates in General Practice 1995 to 2006: Analysis of the QRESEARCH Database. The Information Centre for Health & Social Care, National Health Service 2007.

[28] Allander E. Distribution of doctor's consultations, operations, and symptoms with special relevance to social factors. Report on a Swedish nation-wide health survey. *Scand J Soc Med* 1974;2:37–46.

[29] Soler JK, Okkes I, Oskam S, van Boven K, Zivotic P, Jevtic M, et al. An international comparative family medicine study of the Transition Project data from the Netherlands, Malta, Japan and Serbia. An analysis of diagnostic odds ratios aggregated across age bands, years of observation and individual practices. *Fam Pract* 2012;29:315–331.

[30] Soler JK, Okkes I, Oskam S, van Boven K, Zivotic P, Jevtic M, et al. An international comparative family medicine study of the Transition Project data from the Netherlands, Malta and Serbia. Is family medicine an international discipline? Comparing diagnostic odds ratios across populations. *Fam Pract* 2012;29:299–314.

Supplementary material available online

Supplementary appendix I

Supplementary appendix II

Legends

Table I. Patient characteristics of the included patients (N 618: patients with an episode of care). Proportion is counted from the available data.

Table II. Episode characteristics. The episodes are represented through the patients they include. Notice that a patient may belong to several episodes (range 1–3). Thus, e.g. the mean age of the cases in the episodes does not match up to the mean age of the patients.

Table III. Means and standard errors (in parentheses) of the resources. The number of episodes in each chapter is shown in Table II.

*Includes visits to a physiotherapist, dietician, foot therapist and mental health worker.

** Includes radiography, ultrasonography and MRI.

*** Includes e.g. spirometry, tolerance test, Holter monitoring and scopies.

****Includes visits to the hospital emergency room, a dispensary outpatient clinic and a specialist.

Figure 1. The number of episodes of care divided into ICPC-2 chapters.

Figure 2. Mean costs and their 95% bootstrapped confidence intervals related to ICPC-2 chapters.

Bootstrapping is a resampling technique used to mimic the “true” distribution where the sample was collected.

Table I

| Characteristic | |
|---|----------|
| Gender, n (%): | 618 |
| Female | 381 (62) |
| Age (mean age 48.60 years, standard error 0.98), n (%): | 617 |
| < 30 | 162 (26) |
| 30–64 | 244 (39) |
| > 64 | 211 (34) |
| Housing, n (%): | 538 |
| With a partner | 247 (46) |
| With children | 25 (5) |
| With a partner and children | 66 (12) |
| With others | 32 (6) |
| Alone | 168 (31) |
| Employment, n (%): | 538 |
| Working full time or part-time | 153 (28) |
| Unemployed | 66 (12) |
| Retired | 262 (49) |
| Other, e.g. student, childcare at home | 56 (10) |
| Occupation, n (%): | 538 |
| Employee | 262 (49) |
| An entrepreneur | 61 (11) |
| An agricultural entrepreneur | 4 (1) |
| A lower-level clerical worker | 74 (14) |
| An upper-level clerical worker | 65 (12) |
| Other | 69 (13) |

| | |
|---|----------|
| Financial situation, n (%): | 538 |
| Good | 96 (18) |
| Fairly good | 119 (22) |
| Average | 215 (40) |
| Fairly poor | 78 (14) |
| Poor | 27 (5) |
| Chronic disease, n (%): | 608 |
| At least one | 362 (60) |
| Hypertension | 170 (28) |
| Osteoarthritis (hip or knee) | 91 (15) |
| Depression | 48 (8) |
| Diabetes | 70 (12) |
| Asthma or chronic obstructive pulmonary disease | 71 (12) |
| Heart disease | 88 (14) |
| Cancer | 20 (3) |

Table II

| ICPC-2 code (n) | Mean age (standard error) | Female (%) | At least one emergency or other urgent visit (%) | At least one chronic disease (%) | A pre- existing episode (%) |
|---|---------------------------------|------------|--|--|--------------------------------------|
| A: General and Unspecified (53) | 52.6 (3.4) | 36 (68) | 7 (13) | 30 (57) | 25 (47) |
| B: Blood, Blood Forming Organs and Immune Mechanism (10) | 60.1 (5.6) | 7 (70) | 0 (0) | 7 (70) | 5 (50) |
| D: Digestive (48) | 46.2 (3.6) | 32 (67) | 8 (17) | 30 (63) | 15 (31) |
| F: Eye (15) | 44.6 (6.8) | 8 (53) | 2 (13) | 7 (47) | 8 (53) |
| H: Ear (45) | 36.1 (4.6) | 26 (58) | 6 (13) | 14 (31) | 26 (58) |
| K: Cardiovascular (104) | 66.2 (1.4) | 65 (63) | 7 (7) | 80 (77) | 81 (78) |
| L: Musculoskeletal (130) | 52.3 (1.7) | 82 (63) | 18 (14) | 88 (68) | 82 (63) |
| N: Neurological (27) | 55.1 (4.6) | 18 (67) | 2 (7) | 19 (70) | 13 (48) |
| P: Psychological (38) | 48.0 (3.3) | 24 (63) | 0 (0) | 27 (71) | 25 (66) |
| R: Respiratory (111) | 33.4 (2.2) | 68 (61) | 23 (20) | 45 (41) | 36 (32) |
| S: Skin (61) | 51.4 (2.9) | 39 (64) | 6 (10) | 38 (62) | 23 (38) |

| | | | | | |
|---|-------------|----------|---------|----------|----------|
| T: | 62.2 (2.3) | 25 (50) | 0 (0) | 43 (86) | 43 (86) |
| Endocrine/Metabolic and Nutritional (50) | | | | | |
| U: Urological (15) | 59.5 (4.7) | 10 (67) | 3 (20) | 10 (67) | 6 (40) |
| W: Pregnancy, Childbearing, Family Planning (6) | 28.8 (3.4) | 6 (100) | 0 (0) | 3 (50) | 1 (17) |
| X: Female Genital (25) | 48.6 (3.9) | 25 (100) | 1 (4) | 14 (56) | 9 (36) |
| Y: Male Genital (9) | 50.9 (10.5) | 0 (0) | 0 (0) | 5 (56) | 5 (56) |
| Z: Social Problems (6) | 77.8 (5.4) | 4 (67) | 0 (0) | 6 (100) | 3 (50) |
| All episodes (753) | 50.5 (0.9) | 475 (63) | 83 (11) | 466 (62) | 406 (54) |

Table III

| Resource | Primary care visits | | | | Primary care calls | | Primary care ward | Examinations | | | Secondary care | | |
|----------|---------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| | Doctor | Nurse | On-call doctor | Other* | Doctor | Nurse | | Days | Laboratory tests | Imaging ** | Special *** | Visits **** | Ward days |
| A | 0.7925 (0.1122) | 0.8679 (0.2302) | 0.1698 (0.0645) | 0.0000 (0.0000) | 0.4151 (0.1125) | 0.1132 (0.0695) | 0.2453 (0.2453) | 3.1132 (0.6684) | 0.1509 (0.0681) | 0.0943 (0.0487) | 0.0377 (0.0264) | 0.3585 (0.3585) | 0.0189 (0.0189) |
| B | 0.9000 (0.1795) | 0.7000 (0.2603) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.4000 (0.1633) | 0.0000 (0.0000) | 0.0000 (0.0000) | 2.8000 (1.4283) | 0.3000 (0.2134) | 0.1000 (0.1000) | 0.1000 (0.1000) | 0.0000 (0.0000) | 0.0000 (0.0000) |
| D | 1.1042 (0.1124) | 0.1875 (0.0643) | 0.2083 (0.0727) | 0.0000 (0.0000) | 0.4375 (0.1070) | 0.2708 (0.0976) | 0.0000 (0.0000) | 4.0417 (0.7372) | 0.1250 (0.0567) | 0.1250 (0.0482) | 0.1042 (0.0536) | 0.0417 (0.0417) | 0.0417 (0.0292) |
| F | 1.1333 (0.13333) | 0.0667 (0.0667) | 0.1333 (0.0909) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.1333 (0.1333) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0667 (0.0667) | 0.2000 (0.1069) | 0.0000 (0.0000) | 0.0000 (0.0000) |
| H | 0.9778 (0.1167) | 0.4444 (0.1033) | 0.2000 (0.0985) | 0.0000 (0.0000) | 0.1556 (0.0546) | 0.0667 (0.0492) | 0.0000 (0.0000) | 0.0889 (0.0429) | 0.0000 (0.0000) | 0.0667 (0.0376) | 0.1111 (0.0571) | 0.0000 (0.0000) | 0.0222 (0.0222) |
| K | 1.2115 (0.0793) | 0.6154 (0.1025) | 0.0865 (0.0338) | 0.0000 (0.0000) | 0.3558 (0.0772) | 0.3269 (0.1698) | 0.1250 (0.0882) | 4.6538 (0.5134) | 0.0769 (0.0296) | 0.0865 (0.0309) | 0.0481 (0.0211) | 0.5385 (0.3811) | 0.0481 (0.0317) |
| L | 1.2769 (0.0927) | 0.2077 (0.0564) | 0.2154 (0.0608) | 0.3615 (0.1048) | 0.4077 (0.0662) | 0.0462 (0.0215) | 0.0000 (0.0000) | 1.1231 (0.3064) | 0.5154 (0.0759) | 0.0231 (0.0132) | 0.1846 (0.0359) | 0.0000 (0.0000) | 0.0154 (0.0108) |

| | | | | | | | | | | | | | |
|---|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| N | 1.1481 (0.1158) | 0.1111 (0.0616) | 0.1111 (0.0815) | 0.3333 (0.3333) | 0.3704 (0.2274) | 0.0741 (0.0741) | 0.0000 (0.0000) | 2.2593 (1.1076) | 0.2963 (0.1171) | 0.1481 (0.0697) | 0.2222 (0.1111) | 0.0000 (0.0000) | 0.0000 (0.0000) |
| P | 1.5000 (0.1799) | 1.3421 (0.6189) | 0.0000 (0.0000) | 0.5000 (0.2223) | 0.4211 (0.1443) | 0.1316 (0.0858) | 0.0000 (0.0000) | 1.7632 (0.5787) | 0.0000 (0.0000) | 0.0526 (0.0367) | 0.1053 (0.0505) | 0.0000 (0.0000) | 0.0000 (0.0000) |
| R | 1.1351 (0.1004) | 0.4234 (0.0608) | 0.2793 (0.0560) | 0.0090 (0.0090) | 0.1712 (0.0477) | 0.0991 (0.0338) | 0.0000 (0.0000) | 1.2162 (0.2989) | 0.1802 (0.0465) | 0.0180 (0.0127) | 0.0811 (0.0290) | 0.0631 (0.0547) | 0.0090 (0.0090) |
| S | 0.9672 (0.0809) | 1.3770 (0.5090) | 0.0984 (0.0385) | 0.0000 (0.0000) | 0.0984 (0.0385) | 0.0492 (0.0279) | 0.1311 (0.1312) | 0.6230 (0.3585) | 0.0164 (0.0164) | 0.0164 (0.0164) | 0.0656 (0.0396) | 0.4426 (0.3685) | 0.0164 (0.0164) |
| T | 1.0000 (0.0756) | 1.1400 (0.2374) | 0.0000 (0.0000) | 0.1000 (0.0429) | 0.3000 (0.0714) | 0.1400 (0.0640) | 0.0000 (0.0000) | 4.5600 (0.5556) | 0.0200 (0.0200) | 0.0200 (0.0200) | 0.0600 (0.0339) | 0.0000 (0.0000) | 0.0200 (0.0200) |
| U | 0.7333 (0.1817) | 0.5333 (0.1652) | 0.2000 (0.1069) | 0.0000 (0.0000) | 0.2667 (0.1182) | 0.7333 (0.5387) | 0.0000 (0.0000) | 2.4667 (0.5845) | 0.2000 (0.1069) | 0.1333 (0.0909) | 0.1333 (0.0909) | 0.0000 (0.0000) | 0.1333 (0.1333) |
| W | 1.1667 (0.1667) | 0.1667 (0.1667) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.1667 (0.1667) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.1667 (0.1667) | 0.0000 (0.0000) | 0.1667 (0.1667) |
| X | 1.0000 (0.1000) | 0.3200 (0.1800) | 0.0400 (0.0400) | 0.0000 (0.0000) | 0.2000 (0.1000) | 0.0000 (0.0000) | 0.0000 (0.0000) | 1.1200 (0.4333) | 0.6000 (0.1732) | 0.2000 (0.0817) | 0.2400 (0.1046) | 0.0000 (0.0000) | 0.0400 (0.0400) |
| Y | 1.2222 (0.1470) | 0.3333 (0.2357) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.1111 (0.1111) | 0.3333 (0.3333) | 0.0000 (0.0000) | 0.6667 (0.1667) | 0.1111 (0.1111) | 0.0000 (0.0000) | 0.1111 (0.1111) | 0.0000 (0.0000) | 0.0000 (0.0000) |
| Z | 1.0000 (0.2582) | 0.3333 (0.3333) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.1667 (0.1667) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.0000 (0.0000) | 0.1667 (0.1667) | 0.0000 (0.0000) | 0.0000 (0.0000) |

| | | | | | | | | | | | | | |
|-----|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| All | 1.1155 | 0.5817 | 0.1474 | 0.1076 | 0.2948 | 0.1408 | 0.0452 | 2.1527 | 0.1873 | 0.0598 | 0.1089 | 0.1474 | 0.0239 |
| | (0.0315) | (0.0620) | (0.0177) | (0.0252) | (0.0245) | (0.0292) | (0.0236) | (0.1503) | (0.0196) | (0.0090) | (0.0125) | (0.0662) | (0.0067) |

Figure 1.

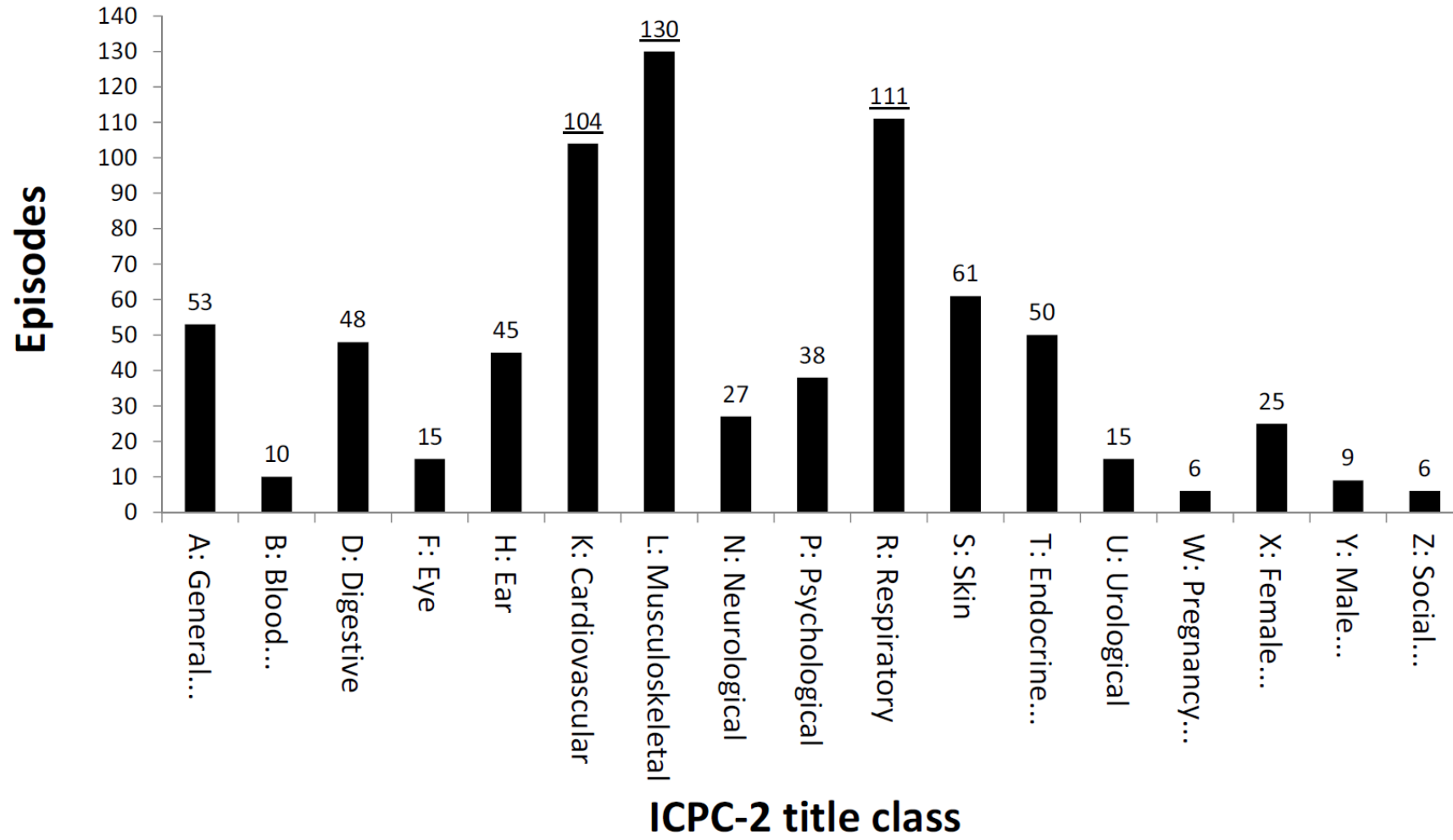
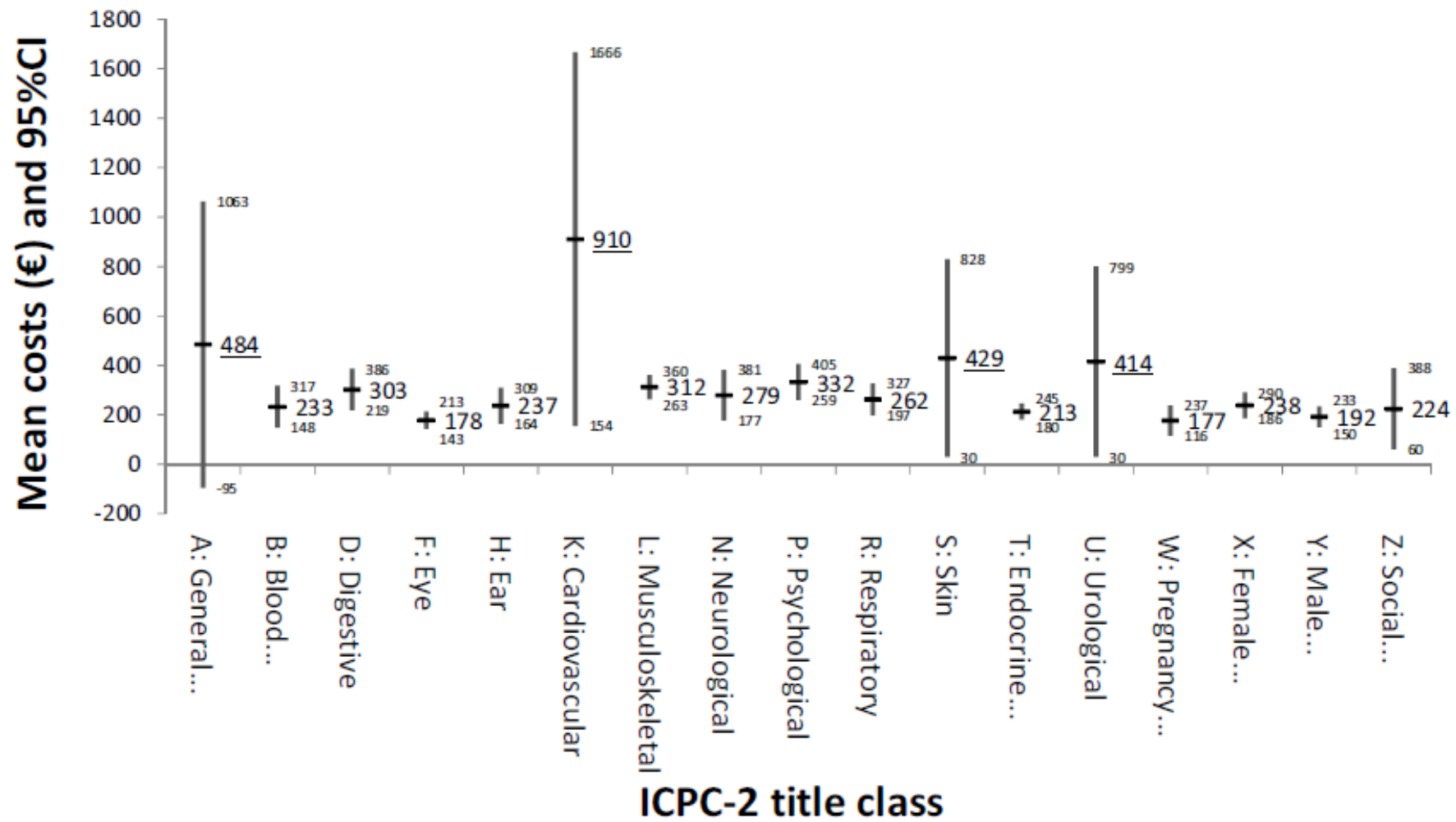


Figure 2.



Supplementary Appendix I. The unit costs were based on the official Finnish Pirkanmaa health district^a, Tampere health centre, Hatanpää hospital and Tampere Imaging^b, Fimlab laboratory^c list prices (tariffs) from year 2013, and “Unit costs of health care in Finland 2006” by Hujanen et al. (2008)^d which were transformed to 2013 real values using the official health care price index for public services obtained from Statistics Finland^e. If more than one unit cost was used in the resource valuation, range (lowest unit cost-highest unit cost), arithmetic mean, median {50th percentile}, and mode [unit costs that appeared most often in the data] were given.

| Resource | Unit costs (€ 2013). If several different unit costs were used, range, mean {median} [mode] were given |
|---|---|
| Visits | |
| Doctor | 118.46 ^b |
| Doctor on-call | 118.46 ^b |
| Nurse | 38.64 ^b |
| Physiotherapist | 88.42 ^b |
| Dietician | 108.36 ^b |
| Pedicure | 38.64 ^b |
| Mental nurse | 116.02 ^b |
| Calls | |
| Doctor | 20.69 ^{d, e} |
| Nurse | 9.14 ^{d, e} |
| One day at Ward in PHC | 262.30 ^b |
| Laboratory service charge | 11.90 ^c |
| Basic laboratory test | 1.55 ^c |
| Special laboratory test ¹ | 2.60-95.00 ^c , 28.05 {20.50} [18.50] |
| Imaging | |
| X-ray | 40.08 ^b |
| Ultrasound | 94.26-161.50 ^b , 101.41 {94.26} [94.26] |
| Magnetic resonance imaging | 277.65-277.80 ^b , 277.69 {277.69} [277.65] |
| Scopy | 195.00-280.67 ^{a, b} , 246.08 {280.67} [280.67] |
| Special examination | 45.00-280.00 ^a , 120.87 {111.97} [52.00] |
| SHC outpatient clinic ² | 67.00-1402.00 ^a , 291.58 {233.00} [89.00] |

| | |
|---|---|
| SHC outpatient clinic on-call ² | 189.00-1350.00 ^a , 472.08 {444.00} [450.00] |
| Specialized doctor visit ³ | 42.50-153.00 ^b , 70.82 {57.50} [57.50] |
| One day at Ward in SHC | 306.00-1330.00 ^a , 644.58 {593.60} [306.00, multiple modes exist, the smallest value is shown] |
| Procedure in SHC | 274.00-31,775.00 ^a , 888.67 {1133.00} [1133.00] |
| Special material in SHC ⁴ | 370.00 ^a |

PHC = primary health care. SHC = secondary (specialist) health care.

¹Exact prices were calculated for laboratory tests that differed much from the cost of basic blood count, which was used as a price estimate for a basic laboratory test. Classification was retrospectively done by two researcher physicians. Special laboratory tests include for example Pap smear, bacterial culture from wound, urine or sputum, urine drug screen, bone marrow aspiration, antibodies, glucose and lactose intolerance test and white blood cell count.

²Secondary health care outpatient clinic and clinic on-call refer to polyclinics of different specialties at the central hospital or at the city hospital at the public sector.

³Visit at a specialized doctor refer to visits at the private sector with payment commitment or voucher.

⁴In one SHC procedure special material was used which was added to the total cost of that episode of care.

Sources

^a Personal communication by Leila Matikka, Pirkanmaa Hospital District

^b Personal communications by chief physicians Kati Myllymäki, Erkki Lehtomäki and Pirkko Ranki

^c Personal communication by Maria Helenius, Fimlab Laboratories Ltd.

^d Hujanen T, Kapiainen S, Tuominen U, Pekurinen M. Terveystieteiden tutkimuskeskuksen yksikkökustannukset Suomessa vuonna 2006. Helsinki: Stakes.

^e Suomen virallinen tilasto (SVT): Julkisten menojen hintaindeksi [verkkójulkaisu]. ISSN=1798-4505. Helsinki: Tilastokeskus.

Supplementary Appendix II. The mean total and primary care costs and their 95% confidence intervals (CI = confidence interval, LL = lower limit, UL = upper limit, PC = primary care).

| ICPC-2 chapter | Mean cost (2013 euro) | 95%CI LL | 95%CI UL | Boostrapped CI LL | Bootstrapped CI UL | Mean PC cost (2013 euro) | 95%CI PC, LL | 95%CI PC, UL | n |
|---------------------------|----------------------------------|---------------------|---------------------|------------------------------|-------------------------------|-------------------------------------|-------------------------|-------------------------|----------|
| A | 484.10 | -106.86 | 1075.05 | -94.89 | 1063.08 | 261.91 | 94.86 | 428.97 | 53 |
| B | 232.80 | 141.60 | 232.99 | 148.24 | 317.35 | 214.20 | 117.74 | 310.66 | 10 |
| D | 302.58 | 218.30 | 386.85 | 219.22 | 385.94 | 249.93 | 196.77 | 303.09 | 48 |
| F | 177.98 | 142.56 | 213.41 | 143.46 | 212.51 | 162.38 | 131.47 | 193.30 | 15 |
| H | 236.57 | 162.65 | 310.48 | 163.81 | 309.33 | 174.87 | 133.16 | 216.58 | 45 |
| K | 909.85 | 142.60 | 1677.11 | 154.07 | 1665.64 | 257.12 | 195.24 | 319.00 | 104 |
| L | 311.85 | 260.92 | 362.78 | 263.43 | 360.26 | 271.08 | 230.15 | 312.01 | 130 |
| N | 278.75 | 174.71 | 382.80 | 176.74 | 380.77 | 258.20 | 164.00 | 352.40 | 27 |
| P | 332.31 | 259.15 | 405.48 | 259.44 | 405.19 | 306.05 | 238.24 | 373.87 | 38 |
| R | 262.08 | 197.03 | 327.12 | 196.79 | 327.36 | 217.11 | 186.41 | 247.80 | 111 |
| S | 429.18 | 37.48 | 820.87 | 29.97 | 828.39 | 230.87 | 126.08 | 335.65 | 61 |

| | | | | | | | | | |
|---|--------|--------|--------|--------|--------|--------|--------|--------|----|
| T | 212.76 | 179.95 | 245.58 | 180.12 | 245.41 | 198.84 | 172.70 | 225.00 | 50 |
| U | 414.32 | 15.48 | 813.16 | 29.58 | 799.06 | 209.99 | 145.75 | 274.23 | 15 |
| W | 176.59 | 110.43 | 242.75 | 115.96 | 237.22 | 148.09 | 81.99 | 214.20 | 6 |
| X | 237.66 | 184.12 | 291.21 | 185.63 | 289.70 | 203.80 | 164.53 | 243.08 | 25 |
| Y | 191.75 | 148.61 | 234.88 | 150.34 | 233.15 | 182.86 | 144.03 | 221.69 | 9 |
| Z | 223.62 | 42.29 | 404.95 | 59.57 | 387.67 | 134.79 | 78.16 | 191.41 | 6 |
