

A cross-sectional study of ambulatory care services use by multimorbid patients in primary care in the light of the Andersen model

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Abstract

Background: Multimorbidity is frequently encountered in primary care and is associated with an increasing use of healthcare services. The Andersen Behavioral Model of Health Services Use is a multilevel framework classifying societal, contextual, and individual characteristics about the use of healthcare services into three categories: 1. predisposing factors, 2. enabling factors, and 3. need factors. The present study aimed to explore multimorbid patients' use of ambulatory healthcare in terms of homecare and other allied health services, visits to GPs, and number of specialists involved. A secondary aim was to apply Andersen's model to explore factors associated with this use. **Method:** In a cross-sectional study, 100 Swiss GPs enrolled up to 10 multimorbid patients each. After descriptive analyses, we tested the associations of each determinant and outcome variable of healthcare use, according to the Andersen model's three categories: predisposing factors (patient's age, sex, marital status, educational level), enabling factors (health literacy (HLS EU 6), deprivation (DipCare)), and need factors (patient's quality of life (EQ-5D-3L), treatment burden (TBQ), severity index (CIRS), number of chronic conditions and number of medications). Logistic regressions (for dichotomous variables) and negative binomial regressions (for count variables) were calculated to identify predictors of multimorbid patients' healthcare use. **Results:** Analyses included 843 multimorbid patients; mean age 73.0 (SD 12.0); 48.3% men; 15.1% (127/843) used homecare; 34.9% (294/843) used other health services; median patient-GP contacts (previous year), 11 (IQR 7-16); mean number of specialist's involved 1.9 (SD 1.4). In the complete Andersen model, not having an informal caregiver (OR 0.50, 95%CI 0.28-0.88), using more medications (OR 1.13, 95%CI 1.05-1.21), and being less independent (OR 2.47, 95%CI 1.36-4.51) were all factors positively associated with homecare services use. Social deprivation was related with a decrease in homecare services use (OR 0.75, 95%CI 0.62-0.89)." **Conclusion:** Multimorbid patients in primary care reported a high use of ambulatory healthcare services variably associated with the Andersen model's factors: Healthcare use was associated with objective medical needs, but also on contextual or individual predisposing or enabling factors. These findings emphasize the importance of adapting care coordination to individual patients' profile

Background

Multimorbidity is defined as the co-occurrence of two or more chronic medical conditions within one person (1-5). Multimorbidity is well-known in primary care settings and is associated with increased healthcare use and costs (6). This effect increases with the number of co-occurring chronic conditions (7-9). Multimorbidity is associated with greater numbers of visits to general practitioners (GPs), specialist consultations, hospitalizations, and drug prescriptions (6, 7, 10-12). In Germany, for example, multimorbid patients had more than twice as many contacts per year with physicians, and the number of consultations and the number of different physicians contacted increased steadily with each additional chronic condition (13).

The use of healthcare services use is influenced by a complex system of societal, contextual, and individual factors. To explore these factors, researchers have developed explanatory models to help

identify the most important predictors of healthcare services use (14). Andersen's Behavioral Model of Health Services Use provides a multilevel framework assigning those factors according to three categories: 1. predisposing factors, defined as demographic data and socioeconomic status 2. enabling factors, defined by financial and organizational aspects and 3. need factors defined as perceived needs by a patient and evaluated needs by the GP (see also Methods section). (14) Since the Andersen model was developed 50 years ago, it has evolved and integrated new variables (15, 16). The model has been widely used by different disciplines, exploring different aspects of health care service use as societal, economic, philosophic, anthropologic, structural or medical point of views in different populations. Variables used in the model depend on the chosen perspective and although they are not identical in each publication, they always refer to the three factors described above. A recent literature review showed that Andersen's model is still commonly used as a theoretical framework for studies on a broad range of diseases and health service domains (17-19).

Little is known about the level of healthcare service use by multimorbid patients in primary care in Switzerland. The present study therefore aimed to explore multimorbid patients' use of ambulatory healthcare service including homecare and other allied health services, numbers of visits to GPs, and number of specialists consulted. with specialists. A secondary aim was to apply Andersen's model to explore factors associated with the use of healthcare services use in the studied population.

Methods

Study design and setting

Data for this study were extracted from the cross-sectional MultiMorbidity Study in Family Medicine (MMFM), conducted in Switzerland between January and September 2015. The study's detailed protocol and its first results have been described elsewhere (20, 21). In summary, a convenience sample of 100 GPs randomly enrolled 888 patients, aged 18 years and over, with at least three chronic conditions identified from a pre-established list of 75 conditions (22). Missing values were deleted listwise, resulting in a final sample of 843 participants (94.9% of the initial sample). A minimum of three chronic conditions was preferred to enable an exploration of more complex situations. The profiles of participating GPs were similar in terms of age, gender, and practice location to those of Switzerland's population of GPs as described in the Swiss Health Observatory report 55 in 2016. (23) Patients gave their written informed consent to participate.

GPs enrolled eligible patients using a personal preestablished random calendar. If an eligible patient refused to participate, then the GP documented their date of birth, sex and reason for refusing. (20) GPs completed a written form for each patient enrolled, collecting the following variables to understand their healthcare services use in the 12 months preceding the index consultation: number of GP-patient contacts (including consultations, home visits, and telephone calls), number of medical specialists involved in the treatment (defined as other physicians seen by the patient), formal homecare services use, and use of other allied health services such as physiotherapy or occupational therapy. Patients also

responded to a standardized telephone interview conducted by a trained research collaborator and including questions about the presence of an informal caregiver and measures of self-perceived treatment burden (TBQ score) (24), quality of life (EQ-5D-3L index) (25, 26), health literacy (HLS EU 6 score) (27, 28), and level of material, social and health deprivation (DipCare) (29).

The variables from patients and GPs' questionnaire responses, which were potentially associated with the use of ambulatory healthcare services use, were divided into three categories (see Additional File 1) according to Andersen's model (14, 30), as reviewed by de Boer (31) and Babtisch (17).

- **Predisposing factors** were defined as demographic data and socioeconomic status (e.g., age, sex, marital status).
- **Enabling factors** were defined as financial and organizational factors (e.g., deprivation score assessed using the DipCare Index (29), containing 16 questions about material, social, and health deprivation).
- **Need factors** included patients' perceived health (self-evaluation of their own health status and needs according to the EQ-5D-3L index and the TBQ score) and health as evaluated by the GP (e.g., number of chronic conditions, number of medications, Cumulative Index Rating Scale (CIRS) score (32, 33), Severity Index (SI), and treatment burden (TBQ)).

One significant enabling factor usually considered is the health insurance coverage status. However, health insurance is mandatory for everyone living in Switzerland, and everybody has basic health and accident insurance which covers the costs of medical treatment and hospitalization (34). All the study participants were considered to have basic coverage, at the very least, so this was not included as an enabling factor

Statistical analyses

After a descriptive analysis of the participants' characteristics, we considered four different dependent variables: two binary (use of homecare services and use of other allied health services) and two count variables (number of contacts with a GP in the last 12 months and number of specialists involved). We tested associations between each determinant and outcome variable using one-way ANOVAs, two-tailed *t*-tests, and Pearson's chi-square tests to compare differences in means and proportions, respectively. The level of significance was set to $p < 0.05$. Variables that were associated ($p < 0.20$) were subsequently included in multivariate analyses. Logistic regressions (for dichotomous variables) and negative binomial regressions (for count variables) were calculated to identify the determinants of ambulatory healthcare use among multimorbid patients. We added the predisposing factors, enabling factors, and need factors into the regression model in a stepwise manner as independent variables, creating three models (see Additional File 1). Model 1 uses predisposing factors alone, Model 2 integrated predisposing and enabling factors, and Model 3 was the complete model combining predisposing, enabling, and need factors (Table 2).

All analyses were performed using Stata software, version 14 (StataCorp LP, College Station, TX, USA). Missing values were deleted listwise, resulting in a final sample of 843 participants (94.9% of the initial sample).

Ethical approval: The present study was approved by the Human Research Ethics Committee of the Canton of Vaud (Protocol 314/15).

Results

Descriptive analyses

Analyses included 843 patients, with a mean age of 73.0 (SD 12.0) years old, and of whom 48.3% were men. Their characteristics are reported in Table 1. The most frequent chronic conditions were hypertension, cardiovascular disease risk factors, diabetes, obesity and ischemic heart disease, but 74 /75 chronic conditions of the list were mentioned at least once.

Details of the bivariate analyses involving the four dependent outcome variables (use of homecare services, use of other allied health services, number of contacts with GPs, and number of specialists involved) and the comparisons between the users and non-users of homecare and other allied health services can be found in the Supplementary Material. Analyses of the intermediate Andersen models considering predisposing factors alone (Model 1) and predisposing and enabling factors together (Model 2) are in the Additional File 2.

Results from the multivariate analyses of the complete Andersen model (Model 3), integrating the predisposing, enabling, and need factors for our four outcomes are shown in Table 2. The final models revealed that the four outcomes were not equally associated with either the factors or the categories. Although the use of homecare services and the number of specialists consulted were associated with factors all three categories (predisposing, enabling, and need), GP–patient contacts were associated with the predisposing and need factors, and the use of other allied health services was only associated with need factors.

Homecare services

Homecare services were used by 15.1% (127/843) of the patient sample and use increased with age. In the complete model (Model 3), not having an informal caregiver, using a higher number of medications, and being less independent were all factors positively associated with the use of homecare services. It was noteworthy that social deprivation, however, was related to a decrease in homecare services use.

Other allied health services

Other allied health care services (e.g, physiotherapy or occupational therapy) had been used by 34.9% (294/843) of patients during the preceding year, with use also increasing with age. After adjusting for all factors (Model 3), only reporting pain or discomfort in the EQ-5D-3L questionnaire (OR 2.84; $p < 0.001$) remained associated with the use of other allied health services.

Contact with GPs

In the preceding 12 months, participants had a median of 11 contacts with their GP (IQR 7–16). Multivariate analysis showed that the predisposing factors of age and the absence of an informal caregiver were significantly associated with a higher number of GP–patient contacts. Among need factors, higher numbers of medications, a higher CIRS, a higher severity index score, a higher treatment burden (as evaluated by the GP), and problems performing usual activities of daily life were associated with more GP–patient contacts.

Number of specialists involved

Most patients, 84% (708/843), had consulted one or more specialists in the preceding 12 months, with a mean (SD) of 1.9 (1.4) specialists seen. This number increased until patients were 70 years old and then decreased. The fully adjusted model confirmed associations between a greater number of specialists consulted and certain predisposing factors such as a higher educational level and linguistic region (higher in the French than the German-speaking region) and enabling factors such as social deprivation. Need factors, such as the number of chronic conditions, the number of medications prescribed, and the treatment burden were also associated with the number of specialists consulted.

Discussion

The present study analyzed the use of ambulatory healthcare services by multimorbid patients in primary care settings. Within the framework of Andersen Behavioral Model of Health Services Use, it explored the individual, contextual, and societal factors for four outcomes: the use of homecare services, the use of other allied health services, the numbers of GP–patient contacts and the number of specialists involved. The factors associated with these four outcomes differed (e.g., use of other allied health services were associated with pain, whereas the number of GP–patient contacts was essentially associated with factors pertaining to medical severity), and only the age factor was associated with all of them. Interestingly, only 15% of the sample's patients used homecare services, and although the number of specialists consulted increased with age up to 70 years old, surprisingly, it decreased after that. Andersen's model revealed that need factors were associated with all four outcomes, predisposing factors with three (homecare, GP–patient contacts, and specialist consulted), and enabling factors with only two (homecare and specialists consulted). This shows that the use of ambulatory healthcare services depended, logically, on objective medical needs, but also on contextual or individual factors.

As expected, multimorbid patients used more homecare services than the general population (7) (35), and greater age was significantly associated with higher use (36). Despite a lack of social support usually

being considered a predictor of healthcare services use (37), the present study found that social support seemed instead to be a promoter of its use. Indeed, patients with an informal caregiver or who were less socially deprived were more likely to use homecare services. These results are in line with those of a Canadian study by Lai L. *et al.* on Chinese immigrants (38).

Reporting pain or discomfort was the only factor associated with the use of other allied health services, which was the only outcome solely associated with need factors. This suggests that the use of other allied health services may be influenced solely by necessity. We found no previous study that specifically analyzed the use of other allied health services by multimorbid patients. Bähler *et al.* studied the costs linked using other allied health services, laboratory tests, and medical devices (“other outpatient costs”), whereas Heins *et al.* recorded that 46% of multimorbid patients without cancer used physical therapy and 7% used occupational therapy, which was in line with the present results (39).

Multimorbid patients in the present study frequently consulted their GPs: this increased with age and the number and severity of their chronic conditions—a result in line with other European studies (40, 41). However, Schellhorn *et al.* found that age did not play a significant role in predicting the frequency of visits to physicians by older Swiss adults (42). GPs’ evaluations of need factors with regard to the number of GP–patient contacts showed an associations with the health status and the clinical severity of multimorbidity, confirming the results of previous studies (16, 43-45).

Interestingly, the present study revealed that although the number of specialists consulted initially increased with age, it decreased after 70 years old, in contrast to other studies (12, 46). We could hypothesize that even though the oldest patients have increasing numbers of chronic conditions, they may have more difficulty attending specialist consultations or may set different priorities. Restriction of access and discrimination are other factors potentially influencing the number of specialists consulted. Furthermore, the decreasing number of specialists consulted at older ages may be compensated by increasing contacts with GPs. This could suggest that their care tends towards a more holistic focus on the patients whole-person rather than on their specific diseases: Close GP–patient relationships and the continuity of care prevent the overuse of specialist consultations (47). Higher educational level has been described previously as a predictor of higher number of specialist consultations (46).

Our study found no association between healthcare service use and disease or treatment burden, which might have been thought of as obvious predictors of use. The concept of treatment burden is recent and there are only few publications on this topic with none describes the specific relationship between treatment burden and healthcare services uses. (48, 49)

The number of medications used was positively associated with three outcomes (homecare services, GP–patient contacts, and specialists consulted). Unsurprisingly, the number of medications used increased with the number of chronic conditions (8, 16, 44, 50).

As described above, Andersen’s model enabled us to analyze and classify individual, societal, and contextual characteristics according to the three categories of factors of ambulatory healthcare use:

predisposing factors, enabling factors, and need factors. This model was initially designed as a tool to analyze inequalities in healthcare services use (17, 30, 31). In the present study, predisposing and need factors contributed most to explain ambulatory healthcare services use. However, each ambulatory healthcare use outcome was associated with a different combination of factors, illustrating the complexity of caring for multimorbid patients where all three factors of the Andersen model can influence patient's health care services use. We suggest that this indicates the importance for GPs to develop more patient-centered care rather than disease-oriented care as proposed by most guidelines. Indeed, May propose to start with "treatments for patients and not for diseases". (51) This is in line with other authors' suggestions of giving less importance to disease-centered care and starting to care for patients holistically. (52, 53) In reality, demographic and socioeconomic status or individual perceived health may have more influences on the health care service use than a given chronic condition. As multimorbidity grows with aging populations, caregivers and political decision-makers should be aware of the need to integrate all three factors from the Anderson model into planning health care access and thus reducing inequalities. Future research about the health care service use for multimorbid patients in primary care should integrate variables and the reflection of the Andersen model.

Strengths And Limitations

The present study's strengths include its large population of multimorbid patients from primary care settings across the country, and its inclusion of all adults over 18 years old instead of focusing on older adults, as do most studies on multimorbidity. Furthermore, multimorbidity was defined as three or more of 75 chronic conditions on a pre-established list, thus giving a broader picture of multimorbidity's complexity. Finally, the study assessed a significant range of social and medical variables and factors with potential associations to multimorbid patients' medical and homecare use in primary care settings, thus helping to provide a more global picture of the situation in Switzerland.

Nevertheless, the present results should be considered in light of certain limitations. First, the cross-sectional design merely demonstrated associations, and causal relationships could not be inferred. Second, Andersen's model is quite an old framework, developed fifty years ago even if several researchers still used it recently (17-19, 30, 31). The model has evolved over the years and do not use exactly the same variables in all publications depending on the discipline using it. The present study includes most of the variables of Andersen's three factors, but some variables have not been included in our concept (i.e. as cultural believes or organizational factors). However, we found no other framework enabling to explore economic, sociodemographic or societal aspects of the healthcare service use by multimorbid patients and we think in reality that the model added some very important information to our analyzes. Combining multiple measures into a single multivariate model, especially of underlying "need factors", may have over-adjusted the model and diluted the effects of specific measures. It is thus difficult to draw conclusions from a multivariate model containing every variable, as this creates a major risk of collinearity. The sometimes-divergent results showed the complexity of the relationships between predisposing, enabling, and need factors, as well as the limitations of a theoretical model. Third, one important characteristic of the Swiss healthcare system is that GPs do not fulfil the function of

gatekeepers: patients are free to consult specialists directly without informing their GP, implying that the number of those consultations may have been underestimated.

Conclusion

The present study described the use of ambulatory healthcare services by multimorbid patients in a primary care setting in Switzerland. It revealed that their use was variably associated with the predisposing factors, enabling factors, and need factors described within the framework of the Andersen model. The care of multimorbid patients is therefore complex, and the population is far from heterogenous. Our findings emphasized the importance of adapting care coordination to individual patients' individual profile and highlighted that GPs should increase their efforts to provide patient-centered style of care, rather than more traditional disease-oriented care.

Abbreviations

GPs: general practitioners

MMFM: MultiMorbidity in Family Medicine

Declarations

Ethical approval and consent to participate:

The study protocol was approved by the Human Research Ethics Committee of the Canton Vaud, acting as the lead ethics committee for Switzerland (Protocol 315/14). Each patient included gave their written informed consent to participate.

Consent to publish:

Not applicable.

Availability of data:

Data are available at the Department of Family Medicine, Center for Primary Care and Public Health (Unisanté), University of Lausanne, Switzerland.

Competing interests:

Dagmar M Haller is a member of the Editorial Board (Associate Editor) of BMC Family Practice. The authors declare no other conflicts of interest.

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Authors' contributions: LH, BB, DHH, and AZ developed the protocol for the MMFM study. LH, AZ, and DHH recruited the GPs. MM, YM, and LH planned the analysis and drafted the manuscript. MM did the statistical analyses. MM, YM, BB, LH, DHH, SS, SNJ, and AZ contributed to interpreting the findings and the final manuscript's content. All authors read and approved the final manuscript.

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References

1. van den Akker M, Buntinx F, Knottnerus JA. Comorbidity or multimorbidity. *European Journal of General Practice*. 1996;2(2):65-70.
2. Marengoni A, Angleman S, Melis R, Mangialasche F, Karp A, Garmen A, et al. Aging with multimorbidity: a systematic review of the literature. *Ageing Res Rev*. 2011;10(4):430-9.
3. Valderas JM, Starfield B, Sibbald B, Salisbury C, Roland M. Defining comorbidity: implications for understanding health and health services. *Annals of family medicine*. 2009;7(4):357-63.
4. Fortin M, Bravo G, Hudon C, Vanasse A, Lapointe L. Prevalence of multimorbidity among adults seen in family practice. *Annals of family medicine*. 2005;3(3):223-8.
5. Excoffier S, Herzig L, N'Goran AA, Deruaz-Luyet A, Haller DM. Prevalence of multimorbidity in general practice: a cross-sectional study within the Swiss Sentinel Surveillance System (Sentinella). *BMJ open*. 2018;8(3):e019616.
6. Lehnert T, König HH. [Effects of multimorbidity on health care utilization and costs]. *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz*. 2012;55(5):685-92.
7. Bahler C, Huber CA, Brungger B, Reich O. Multimorbidity, health care utilization and costs in an elderly community-dwelling population: a claims data based observational study. *BMC Health Serv Res*. 2015;15:23.
8. Vegda K, Nie JX, Wang L, Tracy CS, Moineddin R, Upshur RE. Trends in health services utilization, medication use, and health conditions among older adults: a 2-year retrospective chart review in a primary care practice. *BMC health services research*. 2009;9:217.
9. Zulman DM, Pal Chee C, Wagner TH, Yoon J, Cohen DM, Holmes TH, et al. Multimorbidity and healthcare utilisation among high-cost patients in the US Veterans Affairs Health Care System. *BMJ*

- open. 2015;5(4):e007771.
10. Glynn LG, Valderas JM, Healy P, Burke E, Newell J, Gillespie P, et al. The prevalence of multimorbidity in primary care and its effect on health care utilization and cost. *Family practice*. 2011;28(5):516-23.
 11. van Oostrom SH, Picavet HSJ, de Bruin SR, Stirbu I, Korevaar JC, Schellevis FG, et al. Multimorbidity of chronic diseases and health care utilization in general practice. *BMC Family Practice*. 2014.
 12. Starfield B, Lemke KW, Herbert R, Pavlovich WD, Anderson G. Comorbidity and the use of primary care and specialist care in the elderly. *Annals of family medicine*. 2005;3(3):215-22.
 13. van den Bussche H, Schön G, Kolonko T, Hansen H, Wegscheider K, Glaeske G, et al. Patterns of ambulatory medical care utilization in elderly patients with special reference to chronic diseases and multimorbidity—results from a claims data based observational study in Germany. *BMC geriatrics*. 2011;11:54.
 14. Andersen RM. Families' use of health services: a behavioral model of predisposing, enabling and need components [dissertation]. West Lafayette, IN: Prudue University. 1968: Available from: <http://docs.lib.purdue.edu/dissertations/AAI6902884/>.
 15. Andersen RM. National health surveys and the behavioral model of health services use. *Med Care*. 2008;46(7):647-53.
 16. Linden M, Horgas AL, Gilberg R, Steinhagen-Thiessen E. Predicting Health Care Utilization in the Very Old: The Role of Physical Health, Mental Health, Attitudinal and Social Factors. *Journal of Aging and Health*. 1997;9(1):3-27.
 17. Babitsch B, Gohl D, Lengerke Tv. Re-revisiting Andersen's Behavioral Model of Health Services Use: a systematic review of studies from 1998–2011. *GMS Psycho-Social-Medicine*. 2012.
 18. Liu Z, Tan Y, Liang H, Gu Y, Wang X, Hao Y, et al. Factors Influencing Residents' Willingness to Contract With General Practitioners in Guangzhou, China, During the GP Policy Trial Phase: A Cross-Sectional Study Based on Andersen's Behavioral Model of Health Services Use. *Inquiry*. 2019;56:46958019845484.
 19. Fortin M, Bamvita JM, Fleury MJ. Patient satisfaction with mental health services based on Andersen's Behavioral Model. *Can J Psychiatry*. 2018;63(2):103-14.
 20. Deruaz-Luyet A, N'Goran AA, Tandjung R, Frey P, Zeller A, Haller DM, et al. Multimorbidity in primary care: protocol of a national cross-sectional study in Switzerland. *BMJ open*. 2015;5(10):e009165.
 21. Deruaz-Luyet A, N'Goran AA, Senn N, Bodenmann P, Pasquier J, Widmer D, et al. Multimorbidity and patterns of chronic conditions in a primary care population in Switzerland: a cross-sectional study. *BMJ open*. 2017;7(6):e013664.
 22. N'Goran AA, Blaser J, Deruaz-Luyet A, Senn N, Frey P, Haller DM, et al. From chronic conditions to relevance in multimorbidity: a four-step study in family medicine. *Family practice*. 2016.
 23. Senn N ES, Cohidon C. La médecine de famille en Suisse. *OSwiss Health Observatory*. 2016/11;Obsan dossier 55.

24. Tran VT, Montori VM, Eton DT, Baruch D, Falissard B, Ravaud P. Development and description of measurement properties of an instrument to assess treatment burden among patients with multiple chronic conditions. *BMC medicine*. 2012;10:68.
25. Brooks R. EuroQol: the current state of play. *Health policy (Amsterdam, Netherlands)*. 1996;37(1):53-72.
26. Perneger TV, Combescure C, Courvoisier DS. General population reference values for the French version of the EuroQol EQ-5D health utility instrument. *Value Health*. 2010;13(5):631-5.
27. van der Heide I, Uiters E, Sorensen K, Rothlin F, Pelikan J, Rademakers J, et al. Health literacy in Europe: the development and validation of health literacy prediction models. *European journal of public health*. 2016;26(6):906-11.
28. Sorensen K, Pelikan JM, Rothlin F, Ganahl K, Slonska Z, Doyle G, et al. Health literacy in Europe: comparative results of the European health literacy survey (HLS-EU). *European journal of public health*. 2015;25(6):1053-8.
29. Vaucher P, Bischoff T, Diserens EA, Herzig L, Meystre-Agustoni G, Panese F, et al. Detecting and measuring deprivation in primary care: development, reliability and validity of a self-reported questionnaire: the DiPCare-Q. *BMJ open*. 2012;2(1):e000692.
30. Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? *J Health Soc Behav*. 1995;36(1):1-10.
31. de Boer AH, W. W, C. dHH. Predictors of health care utilization in the chronically ill: a review of the literature. *Health policy (Amsterdam, Netherlands)*. 1997(42):101-15.
32. Linn BS, Linn MW, Gurel L. Cumulative illness rating scale. *J Am Geriatr Soc*. 1968;16(5):622-6.
33. Hudon C, Fortin M, Vanasse A. Cumulative Illness Rating Scale was a reliable and valid index in a family practice context. *Journal of Clinical Epidemiology*. 2005;58(6):603-8.
34. De Pietro C, Camenzind P, Sturny I, Crivelli L, Edwards-Garavoglia S, Spranger A, et al. Switzerland: Health System Review. *Health Syst Transit*. 2015;17(4):1-288, xix.
35. statistique OOfdl. *Statistique de l'aide et des soins à domicile*. 2015.
36. Kadushin G. Home health care utilization: a review of the research for social work. *Health & social work*. 2004;29(3):219-44.
37. Chappell NL. Social support and the receipt of home care services. *Gerontologist*. 1985;25(1):47-54.
38. Lai DW. Use of home care services by elderly Chinese immigrants. *Home health care services quarterly*. 2004;23(3):41-56.
39. Heins MJ, Korevaar JC, Hopman PE, Donker GA, Schellevis FG, Rijken MP. Health-related quality of life and health care use in cancer survivors compared with patients with chronic diseases. *Cancer*. 2016;122(6):962-70.
40. van den Bussche H, Schön G, Kolonko T, Hansen H, Wegscheider K, Glaeske G, et al. Patterns of ambulatory medical care utilization in elderly patients with special reference to chronic diseases and

- multimorbidity—results from a claims data based observational study in Germany. *BMC Geriatr.* 2011;11:54.
41. Salisbury C, Johnson L, Purdy S, Valderas JM, Montgomery AA. Epidemiology and impact of multimorbidity in primary care: a retrospective cohort study. *Br J Gen Pract.* 2011;61(582):e12-21.
 42. Schnellhorn M, Stuck AE, Minder CE, Beck JC. Health Services Utilization Of Elderly Swiss: Evidence From Panel Data. *Health economics.* 2000.
 43. Rapoport J, Jacobs P, Bell NR, Klarenbach S. Refining the measurement of the economic burden of chronic diseases in Canada. *Chronic diseases in Canada.* 2004;25(1):13-21.
 44. Hessel A, Gunzelmann T, Geyer M, Brähler E. Inanspruchnahme medizinischer Leistungen und Medikamenteneinnahme bei über 60jährigen in Deutschland – gesundheitliche, sozialstrukturelle, sozio-demographische und subjektive Faktoren. *Zeitschrift für Gerontologie und Geriatrie.* 2000;33(4):289-99.
 45. Martin MY, Powell MP, Peel C, Zhu S, Allman R. Leisure-time physical activity and health-care utilization in older adults. *Journal of aging and physical activity.* 2006;14(4):392-410.
 46. Xakellis GC. Are Patients Who Use a Generalist Physician Healthier Than Those Who Seek Specialty Care Directly? *Family Medicine.* 2005;37(10):719-26.
 47. Romano MJ, Segal JB, Pollack CE. The Association Between Continuity of Care and the Overuse of Medical Procedures. *JAMA internal medicine.* 2015;175(7):1148-54.
 48. Sheehan OC, Leff B, Ritchie CS, Garrigues SK, Li L, Saliba D, et al. A systematic literature review of the assessment of treatment burden experienced by patients and their caregivers. *BMC geriatrics.* 2019;19(1):262.
 49. Herzig L, Zeller A, Pasquier J, Streit S, Neuner-Jehle S, Excoffier S, et al. Factors associated with patients' and GPs' assessment of the burden of treatment in multimorbid patients: a cross-sectional study in primary care. *BMC family practice.* 2019;20(1):88.
 50. Ramage-Morin PL. Medication use among senior Canadians. *Health reports.* 2009;20(1):37-44.
 51. May CR, Eton DT, Boehmer K, Gallacher K, Hunt K, MacDonald S, et al. Rethinking the patient: using Burden of Treatment Theory to understand the changing dynamics of illness. *BMC health services research.* 2014;14:281.
 52. Tinetti ME, Fried T. The end of the disease era. *The American journal of medicine.* 2004;116(3):179-85.
 53. Gabbay J, le May A. Mindlines: making sense of evidence in practice. *Br J Gen Pract.* 2016;66(649):402-3.

Table 1

Table 1.

Sample description, N = 843

	All	Women	Men	<i>p</i> -value	
Participants					
N (%)	843 (100)	436 (51.7)	407 (48.3)	-	
Age					
Mean (SD)	73.0 (12.0)	72.9 (13.4)	73.1 (10.3)	0.848	
< 65 years, n (%)	187 (22.2)	107 (24.5)	80 (19.7)	0.002	
65–74 years, n (%)	240 (28.5)	104 (23.8)	136 (33.4)	-	
75–84 years, n (%)	278 (33.0)	140 (32.1)	138 (33.9)	-	
≥ 85 years, n (%)	138 (16.4)	85 (19.5)	53 (13.0)	-	
Marital status⁺					
Single, n (%)	80 (9.5)	50 (11.5)	30 (7.4)	< 0.001	
Married, n (%)	418 (49.6)	155 (35.5)	263 (64.6)	-	
Separated/Divorced, n (%)	143 (17.0)	75 (17.2)	68 (16.7)	-	
Widowed, n (%)	202 (24.0)	156 (35.8)	46 (11.3)	-	
Mean number of adults in household⁺ (SD)					
	1.7 (0.6)	1.5 (0.6)	1.8 (0.6)	< 0.001	
Presence of an informal caregiver⁺, n (%)					
	572 (67.8)	292 (67.0)	280 (68.8)	0.571	
Educational level⁺					
Primary, n (%)	186 (22.1)	124 (28.4)	62 (15.2)	< 0.001	
Secondary, n (%)	319 (37.8)	181 (41.5)	138 (33.9)	-	
Tertiary, n (%)	338 (40.1)	131 (30.0)	207 (50.9)	-	
Linguistic region					
French-speaking, n (%)	325 (38.5)	173 (39.7)	152 (37.3)	0.487	
German-speaking, n (%)	518 (61.4)	263 (60.3)	255 (62.6)	-	
Location of GP's practice					
Urban, n (%)	367 (43.5)	204 (46.8)	163 (40.0)	0.129	
Semi-urban, n (%)	339 (40.2)	163 (37.4)	176 (43.2)	-	
Rural, n (%)	137 (16.3)	69 (15.8)	68 (16.7)	-	
Mean number of chronic conditions (SD)					
	5.4 (2.2)	5.4 (2.1)	5.5 (2.2)	0.519	
Mean number of medications (SD)					
	7.7 (3.5)	7.9 (3.6)	7.5 (3.3)	0.067	
Mean CIRS score* (SD)					
	10.2 (4.3)	10.0 (4.3)	10.5 (4.3)	0.068	
Mean treatment burden (evaluated by GP; SD)					
	4.5 (1.7)	4.6 (1.7)	4.4 (1.7)	0.109	
Mean TBQ score**⁺ (SD)					
	26.8 (18.8)	26.6 (18.6)	26.9 (19.0)	0.850	
DipCare Index					
Mean material deprivation score (SD)	0.5 (1.3)	0.6 (1.4)	0.4 (1.1)	0.014	
Mean social deprivation score (SD)	3.1 (1.4)	3.0 (1.4)	3.1 (1.4)	0.119	
Mean healthcare deprivation score (SD)	0.5 (0.7)	0.5 (0.7)	0.4 (0.7)	0.034	
Quality of life (EQ-5D-3L)⁺					
Mobility	Problematic, n (%)	372 (44.1)	210 (48.2)	162 (39.8)	0.015
Self-care	Problematic, n (%)	98 (11.6)	53 (12.2)	45 (11.1)	0.619
Usual activities	Problematic, n (%)	327 (38.8)	198 (45.4)	129 (31.7)	< 0.001
Pain/Discomfort	Problematic, n (%)	643 (76.3)	356 (81.6)	287 (70.5)	< 0.001
Anxiety/Depression	Problematic, n (%)	355 (42.1)	228 (52.3)	127 (31.2)	< 0.001
Visual Analog Scale (VAS), Mean (SD)		63.1 (19.4)	60.4 (19.4)	65.9 (19.0)	< 0.001

Results are expressed as the number of participants (percentage) or as an average ± standard deviation. *p*-values express differences between men and women. *CIRS = Cumulative illness rating scale. **TBQ = Treatment burden questionnaire. ⁺Self-perceived

Table 2

Table 2. Multivariate analysis of factors associated with the outcome variables of ambulatory healthcare services use (homecare, allied health services, number of GP-patient contacts and number of specialists consulted), considering Andersen's model, controlled for predisposing factors + enabling factors + need factors; N = 843

		Homecare services	Allied health services	Contacts with GP in last 12 months	Number of specialists
		Odds ratio (95% CI)	Odds ratio (95% CI)	IRR (95% CI)	IRR (95% CI)
Predisposing factors					
Sex	Men	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
	Women	1.48 (0.88-2.49)	1.24 (0.91-1.69)	1.00 (0.92-1.08)	0.93 (0.84-1.04)
Age	< 65 years	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
	65-74 years	1.03 (0.43-2.50)	1.11 (0.69-1.77)	1.11 (0.99-1.25)	1.17 (1.00-1.37)
	75-84 years	1.82 (0.77-4.29)	0.78 (0.48-1.27)	1.21 (1.07-1.36)	1.19 (1.01-1.41)
	85+ years	4.22 (1.62-10.99)	0.87 (0.49-1.53)	1.26 (1.08-1.46)	0.96 (0.77-1.20)
Marital status	Single	1 (ref.)	-	1 (ref.)	1 (ref.)
	Married	1.10 (0.38-3.18)	-	1.57 (1.35-1.82)	0.95 (0.77-1.17)
	Separated/Divorced	2.02 (0.88-4.65)	-	1.12 (0.99-1.26)	1.03 (0.87-1.21)
	Widow ^{ed}	1.60 (0.73-3.54)	-	1.08 (0.95-1.23)	0.88 (0.74-1.05)
Number of adults in household		0.69 (0.38-1.25)	-	1.04 (0.96-1.12)	1.08 (0.97-1.20)
Presence of an informal caregiver	Presence	1 (ref.)	-	1 (ref.)	-
	Absence	0.50 (0.28-0.88)	-	0.90 (0.83-0.98)	-
Educational level	Primary	-	-	1 (ref.)	1 (ref.)
	Secondary	-	-	0.94 (0.85-1.04)	1.07 (0.93-1.24)
	Tertiary	-	-	0.86 (0.78-0.96)	1.21 (1.05-1.40)
Linguistic region	German-speaking	-	1 (ref.)	1 (ref.)	1 (ref.)
	French-speaking	-	0.80 (0.58-1.11)	0.80 (0.73-0.86)	1.23 (1.10-1.37)
Location of GP's practice	Urban	-	-	-	1 (ref.)
	Semi-urban	-	-	-	0.88 (0.79-0.98)
	Rural	-	-	-	0.83 (0.72-0.97)
Enabling factors					
Material deprivation		0.85 (0.67-1.06)	1.07 (0.94-1.23)	-	1.00 (0.96-1.05)
Social deprivation		0.75 (0.62-0.89)	-	1.01 (0.98-1.04)	1.07 (1.03-1.12)
Healthcare deprivation		1.06 (0.70-1.61)	1.20 (0.91-1.57)	1.00 (0.93-1.07)	1.02 (0.93-1.11)
Need factors					
Number of chronic conditions		1.04 (0.93-1.15)	1.06 (0.98-1.15)	0.99 (0.97-1.01)	1.02 (1.00-1.05)

			1.16)				
	Number of medications		1.13 (1.05- 1.21)	1.01 (0.96- 1.06)	1.03 (1.02- 1.04)		1.04 (1.02-1.06)
	CIRS score[°]		1.00 (0.94- 1.07)	1.01 (0.97- 1.06)	1.01 (1.00- 1.03)		1.01 (1.00-1.03)
	Treatment burden		1.15 (0.98- 1.33)	1.10 (0.99- 1.22)	1.08 (1.05- 1.10)		1.06 (1.02-1.10)
	TBQ score^{°°}		1.00 (0.99- 1.01)	1.00 (0.99- 1.01)	1.00 (1.00- 1.00)		1.00 (1.00-1.00)
	Perceived health state (EQ-5D-3L)	Mobility	Non-problematic	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Problematic			1.26 (0.74- 2.14)	1.27 (0.90- 1.80)	0.99 (0.91- 1.08)	1.01 (0.90-1.13)	
	Self-care	Non-problematic	1 (ref.)	1 (ref.)	1 (ref.)		1 (ref.)
		Problematic	2.47 (1.36- 4.51)	0.86 (0.52- 1.42)	0.87 (0.77- 0.99)		0.95 (0.80-1.12)
	Usual activities	Non-problematic	1(ref.)	1(ref.)	1(ref.)		1(ref.)
		Problematic	1.45 (0.84- 2.49)	1.35 (0.93- 1.94)	1.09 (1.00- 1.20)		1.05 (0.92-1.18)
	Pain/Discomfort	Non-problematic	1 (ref.)	1 (ref.)	-		1 (ref.)
		Problematic	0.86 (0.45- 1.66)	2.49 (1.59- 3.90)	-		1.12 (0.98-1.28)
	Anxiety/Depression	Non-problematic	1 (ref.)	-	1 (ref.)		-
		Problematic	1.18 (0.71- 1.94)	-	1.04 (0.95- 1.13)		-
	Health scale (VAS)		1.00 (0.98- 1.01)	1.00 (0.99- 1.01)	1.00 (1.00- 1.00)		1.00 (1.00-1.00)
	Pseudo R²		0.27	0.09	0.04		0.07

Statistical analyses conducted using logistic regressions for homecare services use and allied health services use and using negative binomial regressions for number of GP-patient contacts in the last 12 months and the number of specialist's consulted, adjusting for all the variables indicated. °CIRS = Cumulative illness rating scale. °°TBQ = Treatment burden questionnaire.

Supplementary Files

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