Older persons are more frail after an emergency care visit to the out-of-hours General Practitioner Cooperative in the Netherlands: a cross sectional descriptive TOPICS-MDS study

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Abstract
Background In the Netherlands community dwelling older people with primary care emergency problems contact the General Practitioner Cooperative (GPC) after hours. However, frailty remains often unobserved with the hazard of adverse health outcomes. The aim of this study was to provide insight in differences between older persons with or without GPC emergency care visits (reference group) regarding frailty and healthcare use.

Methods A cross-sectional descriptive study design was based on data from the public data repository: The Older Persons and Informal Caregivers Survey Minimum Dataset (TOPICS-MDS). Frailty in older persons (65+ years, n=32,149) was measured by co-morbidity, functional and psychosocial aspects, quality of life and a frailty index. Furthermore, home care use and hospital admissions of older persons were identified. We performed multilevel logistic and linear regression analysis. A random intercept model was utilized to test differences between groups, and adjustment factors (confounders) were used in the multilevel analysis.

Results Older persons with GPC contact were, compared to the reference group, more frail on the domain of co-morbidity (mean difference 0.52 ; 95% CI 0.47-0.57, p <0.0001), functional limitations (mean difference 0.53 ; 95% CI 0.46-0.60, p <0.0001), reported less emotional wellbeing (mean difference -4.10 ; 95% CI -4.59- -3.60, p <0.0001) and experienced less quality of life (mean difference -0.057 ; 95% CI -0.064- -0.050, p <0.0001). Moreover, older persons reported more often limited social function (OR 1.50, 95%CI 1.39-1.62, p <0.0001) and limited perceived health (OR 1.50, 95%CI 1.39-1.62, p <0.0001). Finally, older persons with GPC contact more often used home care (OR 1.37, 95%CI 1.28-1.47, p <0.0001) or were more often admitted to the hospital (OR 2.88, 95%CI 2.71-3.06, p <0.0001).

Conclusions Older persons with out-of-hours GPC contact for an emergency care visit were significantly more frail on all domains, more likely to use home care or to be admitted to the hospital, compared to the reference group. Potentially frail older persons seem to require adequate identification of frailty, and support (e.g. advance care planning) before and after a contact with the out-of-hours GPC.
Background
Primary care settings, that are open 24 hours a day and seven days a week, vary within the western countries in line with the different healthcare organization models in use (1, 2). Out-of-hours primary care models are facing growing patient demands, an aging population, an increasing physician workload and financial issues. In the Netherlands, the out-of-hours primary care model has changed around the millennium year in response to these challenges. The current model in use is large-scale general practitioner cooperatives (GPCs) in which 50–250 general practitioners take care of populations ranging from 100 000–500 000 citizens (3). Nowadays, most Dutch GPCs are co-located with the emergency departments (EDs), where the GPC provides treatment to a large part of patients that formerly went to the ED (4).

Where worldwide an increasing demand of emergency care is perceived to be related to aging (5, 6), in the Netherlands it is seen that one in six patients in the out-of-hours GPC is an older person (defined as 65 + years or older) (7). Community dwelling older people with emergency complaints often suffer from a variety of multiple, potential life threatening, health conditions (e.g. cardiovascular, neurological, respiratory, musculoskeletal, abdominal, mental health conditions or a poor health status) (8). The same study showed that repeated emergency healthcare visits (in the ED) are related to sociodemographic characteristics (socioeconomic status), social problems, health problems, need for a systematic health assessment, healthcare service use and inadequacy of previous or current care provided. However, data on revisits of the out-of-hours GPC were not found.

Currently, the assessment of older persons in the out-of-hours GPC is mainly focused at physical problems, and less or not at the assessment of the psycho-social domain of functioning. At the same time, the Longitudinal Ageing Study Amsterdam showed that older persons with an increased level of physical complaints often have increased levels of psychological problems as well (9).

An accumulation of increased physical, psychological and social limitations in daily functioning can be seen as a process of frailty (10). The geriatric condition frailty is characterized by an increased vulnerability to external stressors, caused by the loss of reserve capacity in one or more domains of functioning (11–13). However, the multifactorial process can be influenced in a positive and negative
way. Frailty in older persons is known to be related to a variety of adverse health outcomes, such as falls, functional decline, hospital admissions and moreover an increased risk for mortality (11, 12). Therefore, it is important that frailty in older people is adequately addressed at an early stage in the (out-of-hours) primary care setting, and that older persons are supported to prevent unnecessary adverse health outcomes. However, frailty of older persons in the out-of-hours GPC remains often unnoticed due to a lack of communication between the personal GP of the older person and the GPC. Furthermore the physically oriented approach at the GPC for all patients, including older persons, results in lacking identification of frailty due to other domain problems in older persons. The hypothesis of this study was that older persons who visit the out-of-hours GPC with emergency complaints, have an increased risk to be or to become frail. The aim of the study was to provide insight into differences between older persons who contacted the out-of-hours GPC and a reference group of older persons without GPC-contact regarding: the level of frailty defined by (co)morbidity, functional limitations, psychosocial wellbeing, experienced quality of life, and healthcare use.

Methods
Design
In 2017, we performed a cross-sectional descriptive study, based on data from The Older Persons and Informal Caregivers Survey Minimum Dataset (TOPICS-MDS) repository (14). This public data repository contained information on physical and mental health, social wellbeing and health services utilization of older persons in the Netherlands. Projects with various study designs, sampling frames and inclusion criteria each delivered a minimal dataset based on a standardized baseline measurements (15). The included studies of the TOPICS-MDS repository were performed between 2009 and 2014. The TOPICS-MDS dataset for this study was fully anonymized, and therefore our study was exempted from ethical review by Dutch law (reference number 2012/120) (15).

Study population
The TOPICS-MDS study population consisted of 55 studies with a total of 44,979 older persons. We followed a stepwise in- and exclusion procedure at study level, followed by an in- and exclusion procedure at individual level, in order to select the sample for our study. (Fig. 1)
At study level we included studies based on the following criteria:

1. The study focused on older persons (65 + years)
2. The sampling frame included community dwelling older persons or older people living in a retirement home
3. The study provided valid responses of older persons on baseline measurements
4. The study included information of older persons regarding contact or absence of contact with the out-of-hours GPC
5. The study included information on frailty of the older persons

This procedure resulted in 39 studies with n = 33,628 respondents. We excluded at individual level respondents: living in a nursing home, with an unknown living situation, and respondents with no valid data on GPC-contact. The final study population consisted of n = 32,149 respondents. (Fig. 1)

^GPC = general practitioner cooperative

Study variables
Demographic variables

Demographic variables in the study were: gender, age, educational level, marital status, nationality, living situation and socioeconomic status of older persons. Age was classified in the five year categories: 65–69 years, 70–74 years, 75–79 years, 80–84 years, 85–89 years and 90 years and older. The educational level was classified as ‘low’ (defined as primary school or less education), ‘moderate’ (defined as four - five years high school or vocational training) and ‘high’ (defined as university or tertiary education). Marital status was described as ‘married or living together’, ‘single or divorced’, and ‘widow(er)’. Nationality of older persons was classified as ‘Dutch’ or ‘first or second generation migrants’. Living situation was described as ‘living at home’ or ‘retirement home’. The socioeconomic status (SES) as sum score was based on income, employment and educational level and determined at postal code level in the Netherlands in 2010 (16). The SES score was classified in quartiles: ‘SES 1st quartile: -3.3 – -0.7; ‘SES 2nd quartile: -0.6–0.0; ‘SES 3rd quartile: 0.1–0.6”; ‘SES 4th quartile: 0.7–5.2; where higher SES scores represented lower socioeconomic status of older persons.

Frailty

The concept of frailty was quantified by measurements in five domains (physical frailty, functional
frailty, psychosocial frailty, quality of life and total frailty index), using seven indicators (15):

Physical frailty: the TOPICS-MDS baseline questionnaire included questions on co-morbidity, in total 16 co-morbidities of older persons (e.g. diabetes, heart failure, hip fracture) were explored. The sum co-morbidity score (CM) ranged from 0–16; where higher CM scores represented more co-morbidity and a higher level of physical frailty of older persons.

Functional frailty: a modified version of the Katz Index of Independence Basic Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL) and an additional indicator of mobility were used to quantify functional limitations of older persons in the TOPICS-MDS (17, 18). The functional limitations score (FL) ranged from 0–15; higher scores represented more limitations and higher functional frailty of older persons.

Psychosocial frailty: The RAND-36 mental health subscale with five questions was used to assess emotional wellbeing (EW) (19, 20). The EW score ranged from 0-100; where higher scores represented better emotional wellbeing and lower psychosocial frailty of older persons. Social functioning (SF) was also derived from a RAND-36 question. The response options ‘all’ and ‘most of the time’ to the question how often in the past four weeks their physical health or emotional problems interfered with social activities indicated low SF and higher psychosocial frailty. The response options ‘fair’ and ‘poor’ to the question about their health in general were used to indicate a lower self-perceived health (PH) and a higher psychosocial frailty of older persons.

Quality of life: The TOPICS-MDS baseline questionnaire included the EuroQol Five Dimensions scale (EQ-5D), with application of the Dutch scoring values, to measure the health-related quality of life (21, 22). The EQ-5D utility score ranged from – 0.33 to 1.0; higher scores indicated a better quality of life of older persons.

Frailty index: Finally, a more comprehensive composite frailty measurement was used: the long TOPICS-MDS frailty index (FI), based on the concept of deficit accumulation. This index consists of 46 items, all included in the TOPICS-MDS baseline questionnaire and related to the physical, functional and psychosocial domain(23). In this study the frailty index ranged from 0.0-0.85; where a higher level of frailty of older persons is indicated by an higher score on the FI.

GPC-contact and healthcare use

To differentiate between older persons with and without GPC-contact the following question in the TOPICS-MDS baseline questionnaire was used: ‘Did you visit the general practitioner or did the general practitioner visit you during evenings, nights or weekend over the last 12 months? The response option was ‘Yes’ or ‘No’.

The variable ‘healthcare use’ was defined as ‘hospital admission’ and ‘use of home care’. For hospital admission the question in the TOPICS-MDS baseline questionnaire was used: ‘Have you been hospitalized in the last 12 months?’ The response option was ‘Yes’ or ‘No’. For home care use the question in the TOPICS-MDS baseline questionnaire was uses: ‘Have you used home care?’ The response option was ‘Yes’ or ‘No’.

Key outcome measures
The key outcome measurement of the study was frailty of older persons on the five domains presented earlier. The secondary outcome measurement of the study concerned healthcare use of older persons, defined as hospital admission and older persons’ use of home care. The independent variable of the study was contact of the older person with the out-of-hours GPC.

Statistical analysis
Respondents with and without GPC contact were compared with respect to demographic characteristics, frailty and healthcare use. Because of the hierarchical structure of our study (patient nested within studies) we performed multilevel (mixed model) analyses. We performed multilevel logistic regression analysis for dichotomous outcome measures and multilevel linear regressions analysis for continuous outcome measures. A random intercept model was used to test the difference between the group with GPC contact and the group with no GPC contact. Demographic variables that significantly differed between the group older persons with GPC contact and the group persons with no GPC contact were used as adjustment factors (confounders) in the multilevel analysis for outcome measures. Furthermore, we adjusted for SES in our frailty analyses, because frailty is associated with socioeconomic inequalities (24, 25). Finally, we adjusted for hospital admission in the analysis of frailty in older persons, as this appeared to be a significant relevant factor. A p-value of < 0.05 was considered to be statistically significant, based on two sided tests. We analyzed the data by using the statistical software program SPSS version 22.

Results
In total 32,149 older persons were included in the study, these respondents participated in 39 different studies in the TOPICS-MDS repository, see Table 1.
Table 1
Study population by TOPICS-MDS study indicator, number of respondents and percentage (n = 32149)

| Study indicator | Older persons n | %   | Study indicator | Older persons n | %   |
|-----------------|-----------------|-----|-----------------|-----------------|-----|
| 1               | 1769            | 5.5 | 26              | 105             | 0.3 |
| 4               | 2418            | 7.5 | 28              | 1466            | 4.6 |
| 5               | 2256            | 7.0 | 29              | 16              | 0.0 |
| 7               | 828             | 2.6 | 30              | 60              | 0.2 |
| 8               | 1113            | 3.5 | 31              | 170             | 0.5 |
| 9               | 978             | 3.0 | 35              | 213             | 0.7 |
| 10              | 3131            | 9.7 | 37              | 75              | 0.2 |
| 11              | 148             | 0.5 | 38              | 371             | 1.2 |
| 12              | 1539            | 4.8 | 39              | 91              | 0.3 |
| 13              | 574             | 1.8 | 41              | 491             | 1.5 |
| 14              | 556             | 1.7 | 42              | 206             | 0.6 |
| 16              | 1140            | 3.5 | 44              | 247             | 0.8 |
| 17              | 124             | 0.4 | 45              | 52              | 0.2 |
| 18              | 6391            | 19.9| 47              | 43              | 0.1 |
| 19              | 444             | 1.4 | 49              | 120             | 0.4 |
| 20              | 46              | 0.1 | 50              | 469             | 1.5 |
| 21              | 915             | 2.8 | 51              | 1012            | 3.1 |
| 23              | 473             | 1.5 | 52              | 332             | 1.0 |
| 24              | 406             | 1.3 | 53              | 152             | 0.5 |
| 25              | 1209            | 3.8 | Total           | 32149           | 100.0 |

Nearly a quarter of the older persons (n = 7,647; 23.8%) reported to have had contact with the GPC, either an out-of-hours GP consult at the GPC or a GP home visit. The demographic characteristics of the older persons with and without out-of-hours contact with the GPC are presented in Table 2.
### Table 2

Demographic characteristics of older persons with and without out-of-hours GPC\(^a\) contact (n = 32149)

| Characteristic                  | Out-of-hours GPC contact | No Out-of-hours GPC contact | OR\(^b\) | 95% CI\(^c\) | p-value\(^d\) |
|--------------------------------|--------------------------|----------------------------|----------|-------------|--------------|
| **Gender** (32136)             |                          |                            |          |             | <0.0001      |
| Male                           | 3239                     | 25.2                       | 9601     | 74.8        | 1.13         | 1.07-1.20    |
| Female                         | 4402                     | 22.8                       | 14894    | 77.2        | 1            |              |
| **Age** (32149)                |                          |                            |          |             | <0.0001      |
| 90 years and older             | 598                      | 21.8                       | 2141     | 78.2        | 1.11         | 0.98-1.25    |
| 85–89 years                    | 1318                     | 25.2                       | 3909     | 74.8        | 1.27         | 1.16-1.40    |
| 80–84 years                    | 1882                     | 24.0                       | 5955     | 76.0        | 1.16         | 1.07-1.27    |
| 75–79 years                    | 1870                     | 22.2                       | 6566     | 77.8        | 1.05         | 0.97-1.15    |
| 70–74 years                    | 1339                     | 22.4                       | 4643     | 77.6        | 1            |              |
| 65–69 years                    | 640                      | 33.2                       | 1288     | 66.8        | 1.10         | 0.97-1.24    |
| **Educational level** (31883)  |                          |                            |          |             | 0.017        |
| Low                            | 2802                     | 25.2                       | 8306     | 74.8        | 1.09         | 1.03-1.16    |
| Moderate                       | 3531                     | 23.1                       | 11747    | 76.9        | 1            |              |
| High                           | 1248                     | 22.7                       | 4249     | 77.3        | 1.02         | 0.94-1.10    |
| **Marital status** (32083)     |                          |                            |          |             | 0.876        |
| Widow(er)                      | 2939                     | 23.3                       | 9672     | 76.7        | 0.99         | 0.93-1.05    |
| Divorced/Single                | 879                      | 24.5                       | 2709     | 75.5        | 0.98         | 0.90-1.07    |
| Married/Living together        | 3804                     | 23.9                       | 12080    | 76.1        | 1            |              |
| **Nationality** (31708)        |                          |                            |          |             | 0.439        |
| First/second generation migrants| 770                      | 27.5                       | 2035     | 72.5        | 1.04         | 0.94-1.14    |
| Dutch                          | 6782                     | 23.5                       | 22121    | 76.5        | 1            |              |
| **Living situation** (32149)   |                          |                            |          |             | 0.250        |
| Retirement home                | 734                      | 21.0                       | 2754     | 79.0        | 1.07         | 0.95-1.21    |
| At home                        | 6913                     | 24.1                       | 21748    | 75.9        | 1            |              |
| **SES\(^e\)** (30118)         |                          |                            |          |             | 0.008        |
| SES 4th quartile (low SES)     | 1940                     | 26.5                       | 5381     | 73.5        | 1.14         | 1.05-1.25    |
| SES 3rd quartile               | 1621                     | 24.8                       | 4921     | 75.2        | 1.14         | 1.04-1.24    |
| SES 2nd quartile               | 2085                     | 22.9                       | 7022     | 77.1        | 1.13         | 1.04-1.22    |
| SES 1st quartile (high SES)    | 1424                     | 19.9                       | 5724     | 80.1        | 1            |              |

\(^a\) GPC = general practitioner cooperative. \(^b\) OR = Odds Ratio based on multilevel analysis, with correction for cluster effects between studies. \(^c\) CI = confidence interval. \(^d\) bold p-values are statistically significant. \(^e\) SES = socioeconomic status.

Males were significantly more likely to contact the GPC than women (OR = 1.13; 95% BI 1.07–1.20).

Furthermore, the age of older persons (categorized by 5 year clusters) showed to be significantly related (p < 0.0001) to GPC contact. Especially older persons between 80–90 years had a higher risk to GPC contact. The risk of GPC contact was significantly different for educational levels (p = 0.017)
and SES-levels (p = 0.008) of older persons. Persons with a low educational level had the highest risk and persons with a high SES had the lowest risk to contact the GPC (Table 2). Other demographic variables showed slight differences between older persons with or without GPC-contact, however these differences were not statistically significant.

The use of healthcare was measured by hospital admission in the last twelve months and use of home care. A quarter of the older persons (n = 8,190; 25.7%) reported to have been admitted to the hospital and a third of the older persons (n = 10,118; 36%) reported to have received home care. The association between GPC contact and the use of professional healthcare is presented in Table 3. Older persons who had GPC contact were more likely to be admitted to the hospital (OR 2.88, 95% CI 2.71–3.06), or to use home care (OR 1.37, 95% CI 1.28–1.47) compared to older persons who had no GPC contact.

| Use of professional healthcare (n) | Out-of-hours GPC contact | No out-of-hours GPC contact | ORb | 95% CIC | p-valued |
|-----------------------------------|--------------------------|----------------------------|-----|---------|---------|
| Admission to the hospital (29824) |                          |                            |     |         |         |
| Yes                               | 3204                     | 4986                       | 2.88| 2.71–3.06| < 0.0001|
| No                                | 4343                     | 19334                      | 1   |         |         |
| Home care (31602)c                |                          |                            |     |         |         |
| Yes                               | 3152                     | 7811                       | 1.37| 1.28–1.47| < 0.0001|
| No                                | 4294                     | 16345                      | 1   |         |         |

a GPC = out-of-hours general practitioner cooperative. b OR = Odds Ratio based on multilevel analysis, adjusted for: gender, age, socioeconomic status and cluster effects between studies. c CI = confidence interval. d bold presented p values are statistically significant. e only for older persons living at home.

Thirty nine percent (n = 12,384) of the older persons showed to be frail, they scored 0.25 or higher measured with the TOPICS-MDS frailty index. The associations between GPC contact and different domains of the concept frailty in older persons are presented in Table 4. Overall, older persons with GPC contact were significantly more frail compared to older persons with no GPC contact, these differences showed on all domains (p < 0.0001). Older persons with GPC contact had more (co)morbidities, and were more often limited in daily activities and social functions. The quality of life
experience and psychosocial wellbeing of older persons with GPC contact were significantly lower compared to older persons who had no GPC contact.

Table 4
Association between frailty and (no) out-of-hours GPC contact of older persons (n = 32149)

| Indicators of frailty | Older persons n | Out-of-hours GPC contact mean | No out-of-hours GPC contact mean | Difference b | 95% CI c | p-value d |
|-----------------------|----------------|-----------------------------|---------------------------------|--------------|---------|----------|
| Frailty index TOPICS-MDS (FI) e | 29465 | 0.27 | 0.21 | 0.037 | 0.034–0.040 | < 0.0001 |
| Co-morbidity (CM) f | 29672 | 3.43 | 2.76 | 0.52 | 0.47–0.57 | < 0.0001 |
| Functional limitations (FL) g | 29759 | 3.57 | 2.82 | 0.53 | 0.46–0.60 | < 0.0001 |
| Emotional wellbeing (EW) h | 29334 | 69.69 | 74.95 | -4.10 | -4.59 - -3.60 | < 0.0001 |
| Quality of life (EQ-5D) i | 29287 | 0.65 | 0.73 | -0.057 | -0.064 - -0.050 | < 0.0001 |
| Limited social functioning (SF) | 28993 | 23.84 | 13.77 | 1.50 | 1.39–1.62 | < 0.0001 |
| Limited perceived health (PH) | 29728 | 57.77 | 42.25 | 1.61 | 1.51–1.71 | < 0.0001 |

a GPC = general practitioner cooperative. b Difference between out-of-hours GPC contact and no out-of-hours GPC contact. c CI = confidence interval. d bold presented p values are statistically significant. e sum score range 0.00–0.85, a higher score represents a higher level of frailty. f sum score range 0–16, a higher score represents more reported co-morbidities. g sum score range 0–15, a higher score represents more functional limitations in daily living activities. h sum score range 0-100; a higher score represents more emotional wellbeing. i sum score range – 0.33–1.00; a higher score represents a better quality of life. j OR = Odds Ratio based on multilevel analysis with correction for: gender, age, socioeconomic status, hospital admission and cluster effects between studies.

Discussion
Principal findings

This secondary analysis of the TOPICS-MDS data provided insight into differences in level of frailty and healthcare use of older persons with or without out-of-hours GPC-contact. The study showed that persons of 65 years and older who had contact with the GPC, and received either an emergency consult at the GPC or an urgent GP home visit, were significantly more frail compared to older persons who had no GPC contact during out-of-office hours. Furthermore, we observed an increased level of frailty in all domains (e.g. (co)morbidity, daily living activities, social contacts, psychological wellbeing, quality of life). In addition, older persons who visited the GPC were significantly more often
admitted to the hospital and more often used home care, compared to older persons who had no contact with the GPC. In summary, this study shows that older people who had contact with the GPC had a relevant problem with frailty. Previous studies on frailty of older persons in the emergency care usually focused on the setting of the emergency department (26–29) or the general practitioners practice during daytime (30–33). Studies in the last group did not differentiate between regular, chronic and emergency primary healthcare. To our knowledge this is the first study that identifies frailty of older persons after contact with the emergency primary healthcare setting during out-of-hours.

The identified differences between older persons with GPC contact and the reference group, all pointed in the same direction. We showed statistically significant increased levels of frailty in older persons who contacted the GPC. However, it could be questioned, whether the identified differences were clinically relevant for older persons. As the differences in frailty levels of older persons with(out) contact with the GPC showed to be (more than) 5 percent, we also considered the identified levels of frailty as clinically relevant (34).

This secondary data analysis was based on TOPICS-MDS data, retrieved from baseline measurements in studies that were performed in the period between 2009 and 2014. Since that time, several policy measures were taken to reform the Dutch healthcare system, such as a reduction or abolishment of retirement homes and the introduction of increased thresholds for admission of older persons to nursing homes. Also, the financial reimbursement systems for long term care facilities (e.g. for older persons) changed in the Netherlands. As result, nowadays more older people stay longer at home with an accumulation of co-morbidities, psychosocial problems, and at the same time a (temporary) loss of reserve capacity in one or more domains of functioning. This, more often, leads to a crisis where older people seek emergency (primary) healthcare. Also, in the (inter)national literature the problem of emergency department crowding related to aging (6, 35), and an increased number of vulnerable older persons requiring care of general practitioners (7) has been described. The effect of these healthcare system reform measures were not represented in the TOPICS-MDS database in the period between 2009 and 2014. Therefore, our findings could underestimate the actual problem of
frailty in community-dwelling older persons who currently seek emergency healthcare. Older persons rarely use the word ‘frail’ to describe their situation, because they do not think about themselves in terms of frailty (36). Older persons who are classified as frail according to medical criteria do not always feel frail (37, 38). This difference in interpretation between doctors and patients is also known as the ‘disability paradox’ (39). Frail older persons are mainly concerned with their quality of life, asking questions such as ‘what is important’, ‘what do I value and what gives meaning to my life’. At the same time, older persons consider it relevant to talk to healthcare professionals about aspects of physical decline, psychosocial reserve capacities and (emergency) primary healthcare treatment in terms of opportunities and threats (risks) (36). As frailty is a process involving accumulation of physical, psychological and/or social deficits in functioning with the risk of adverse health outcomes (admission to a hospital, or sometimes death) (40), advanced care planning between older persons and their GP is important (41). Furthermore, circumstances and preferences in health care of older persons can rapidly change because of occurrence of (adverse) events such as a crisis or hospital admission (42). The preference of older persons to what extend and how to be involved in shared decision making in primary healthcare varies (43), whereas GP characteristics, communication skills, GP consultation duration, and continuity of (emergency) healthcare were described as important factors in the enhancement of shared decision making (44, 45). GPs themselves showed different perspectives on their role in the management of complex health problems of older persons in primary care, varying from ‘maneuvering along competence limits’, ‘Herculean task’, and ‘cooperation and networking’ (46).

To our opinion the GP in primary care plays an important role in: early identification of frailty, advanced care planning and the management of complex interventions in older persons. Where more adequate support to frail older persons can be provided, possibly (unnecessary) out-of-hours GPC contacts or ED admissions can be avoided.

Brouwers et al. 2017 showed in an explorative study amongst emergency healthcare providers that early identification of frailty, improving the continuity between primary and home healthcare and hospital based (emergency) care and vice versa is recommended (47). The last years, several
Instruments for the screening of frailty in older persons have been developed. Many of these instruments focus on the identification of physical, functional or cognitive aspects of frailty (31, 48), such as the ISAR (Identification of Seniors at Risk) (29), SHARE-FI (Survey of Health, Ageing and Retirement in Europe Frailty Instrument) (28), and APOP screener (49). While, other instruments are focused on a multi-dimensional screening of frailty in elderly such as Groningen Frailty Indicator (50), Frail-VIG (48) and Easy-Care TOS (30, 51). Based on our study results, we recommend to develop building blocks and tools for a multi-dimensional screening of frailty in emergency primary healthcare settings such as the GPC, in order to provide adequate psychosocial support and follow up care to older persons after a GPC visit.

If accessibility of older persons to primary care (including out-of-hours primary care) is high, than the rate of ED visits is significantly lower (52). Furthermore, structured and structural information exchange between healthcare providers in the emergency healthcare pathway and a more generalist approach of older persons in emergency healthcare is recommended in order to deliver appropriate emergency healthcare for older persons who are frail.

Strengths and limitations

An important strength of the TOPICS-MDS study is the large sample and therefore the ecological validity of the study results. Furthermore, differences between older persons who have (or haven’t) had contact with the GPC showed to be statistically and clinically significant. However, the study sample contains a combination of studies with different designs, in- and exclusion criteria, sample sizes, and data collection methods. Therefore, the representativeness of this cross sectional study sample for the whole Dutch population of persons 65 years or older could be questioned. Nevertheless, our results and associations are not less relevant (53). Furthermore, we corrected for the potential confounding demographic variables (gender, age and socioeconomic status) and for cluster effects between studies in the multilevel statistical analysis.

A disadvantage of secondary data analysis is that data quality control is a challenging issue. For instance, as ‘healthcare use’ outcome measures we have chosen to include only information on hospital admission and the use of home care in the analysis. And we omitted temporary admission of
older persons to a retirement or nursing home as an outcome measurement, due to insufficient quality of these data.

The data analysis was based on baseline measurements of older persons after they had GPC contact. Therefore, it is unclear whether frailty was present before GPC contact. Possibly frailty predicts a GPC contact of older persons, or on the other hand: perhaps a visit of the older persons to the GPC results in increasing levels of frailty. In line with this argumentation, the cross-sectional study design could be considered as a limitation.

Finally, the assumption that data from the primary studies included in this secondary data analysis are robust is an important point of departure in the multilevel analysis. However, during cross data quality checks, data of some variables appeared to be incorrect, such as the date and time of measurement at T0. Where possible, we corrected these data based on the original study publications. Despite these efforts, we cannot completely rule out some misclassifications.

Conclusions
Older persons who had out-of-hours GPC contact were significantly more frail on all domains (co-morbidity, functional limitations, psychosocial wellbeing, and experienced quality of life), compared to older persons without out-of-hours GPC contact. Furthermore, they were more likely to be admitted to the hospital, or to use home care compared to older persons who had no GPC contact. The findings imply that frailty in older persons should be early identified in primary care, by their own GP or at the GPC, in order to organize advanced care planning and possibly to prevent admission to the out-of-hours GPC. Moreover, adequate follow up and support of older persons after a contact with the out-of-hours GPC requires (more) structural attention.

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Abbreviations

ADL Activities of Daily Living

APOP Acutely Presenting Older Patients

CI Confidence Interval

CM Co-Morbidity

Easy-Care TOS European Assessment SYstem-Care Two-stage Ouderen (Elderly) Screening
Declarations

**Ethics approval and consent to participate**

The cross-sectional descriptive study was based on data from The Older Persons and Informal Caregivers Survey Minimum Dataset (TOPICS-MDS) repository. This public data repository contains 53 research projects with various study designs, sampling frames and inclusion criteria. Each research project delivered an anonymous minimal dataset based on a standardized baseline measurements and in some studies also follow-up measurements. The included studies of the TOPICS-MDS repository were performed between 2008 and 2016, all the respondents provided informed consent according to the original study design. The TOPICS-MDS dataset for this article was fully anonymized, as all the data in the repository are anonymous, and therefore our study was exempted from ethical review by Dutch Law. The research ethics committee of the Radboud University Medical Center, confirmed that
studies using TOPICS-MDS fall outside the remit of the Medical Research Involving Human Subjects Act (WMO). Therefore, such studies may be carried out in the Netherlands without additional approval by an accredited research ethics committee. Reference number 2012/120.

Consent for publication
The TOPICS-MDS Project Group and Societal Board approved the design and publication of this research project.

Availability of data and materials
The TOPICS-MDS data repository has been archived as a thematic collection by the TOPICS-MDS Project Group in DANS, the Dutch institute for permanent access to digital research resources. DOI: doi.org/10.17026/dans-xvh-dbbf. The thematic data collection comprehends three different datasets: 1) care receiver, 2) care giver and 3) care receiver – care giver dyads. The data selection used for this study originated from the first data set, doi: doi.org/10.17026/dans-xwf-g759. The TOPICS-MDS data are available through restricted access and after approval of the TOPICS-MDS Project Group. All other documents (background information on TOPICS-MDS, questionnaires, codebooks, SPSS syntax and metadata) are open access available.

Competing interests
The authors declared to have no competing interest.

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Authors’ contributions
All the authors meet the ICMJE criteria for co-authorship.
Anneke Bloemhoff and Sivera Berben have been responsible for the conception and design of the study, the grant application, the data analysis, data interpretation and drafted the manuscript.
Yvonne Schoon participated in the development of the study design, the grant application and the interpretation of results specifically from the clinical geriatrics perspective, and provided feedback on the manuscript. Karin van den Berg, Lilian Vloet and Kien Smulders provided feedback on the study design, and interpreted the study results from the perspective of general practitioners (Kien Smulders), regional collaboration in primary and hospital care (Karin van den Berg) and primary and emergency care research and education (Lilian Vloet). Reinier Akkermans provided statistical assistance in the design, performance and interpretation of the data-analysis. All the authors provided feedback on the manuscript. The TOPICS-MDS Consortium contributed to peer review of the design of the study and the data-collection, authorship of the consortium was a mandatory condition for use of the data for secondary analysis.

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**Figures**
Figure 1

Flow chart of the study population aGPC = general practitioner cooperative