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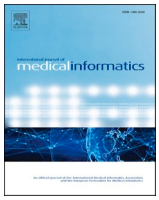

A digital platform to support communication and organization in the general practice: Evaluation of healthcare usage and costs using claims data of a health insurer

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ABSTRACT

Introduction: The pressure on general practitioners (GPs) is rising due to the increasing demand for care and a decreasing availability of GPs. eHealth is seen as one of the solutions to enhance accessibility and reduce workload. A platform supporting the organization and communication in general practice has been developed offering services, such as econsultations. This study aims to evaluate healthcare usage and costs of patients using this platform by comparing these outcomes (1) before and after implementation and (2) an intervention with a matched control group.

Material and methods: This study is a retrospective observational cohort study. To evaluate the longitudinal impact of the implementation on healthcare usage, mixed model Poisson analyses were used with time as a factor term for the within-subject analysis and exposure to the platform as a factor term and an interaction term (i.e., exposure X 6-months) in the between-subject analysis. Cost analyses were done with mixed model analyses of variance over time.

Results: The total number of GP consultations significantly increased after compared to before implementation (i.e., Rate = 1.52; $p < 0.001$). The number of GP consultations was higher in the intervention compared to the control group (respectively, Rate = 1.23; $p = 0.035$). Healthcare costs increased for GP consultations after compared to before implementation (€13,57; $p < 0.001$). The costs for GP consults were significantly higher in the intervention compared to the control group (€7,06; p 0.018).

Conclusion: This study showed a rise in GP consultations and costs when implementing a digital platform. This increase was presumably and partly caused by circumstances in one of the two included practices. Moreover, creating new options for contacting and communicating with the GP can enhance care accessibility and thereby driving an increase in consultations. This digital platform is a promising working method in general practice to facilitate patients and provide GPs with more flexibility.

1. Introduction

The pressure on general practitioners (GPs) is rising due to the increasing demand for care, which is increasing worldwide due to an aging population and a rising amount of individuals with chronic conditions [1]. The shift from secondary- and social care to primary care [1–3] and patients' preference for more personalized healthcare [4], add to the increasing workload of GPs. The pressure on GPs has further risen because of a decrease in the availability of GP care [1,5]. Less practice-holding GPs and more (temporary) interim GPs have become available [6]. GPs availability varies per region and it is especially hard to find successors for retiring practice-holding GPs in rural areas [1,7]. Interim GPs are hesitant to start or take over a practice (due to among others high administrative and organizational workload). Furthermore, they

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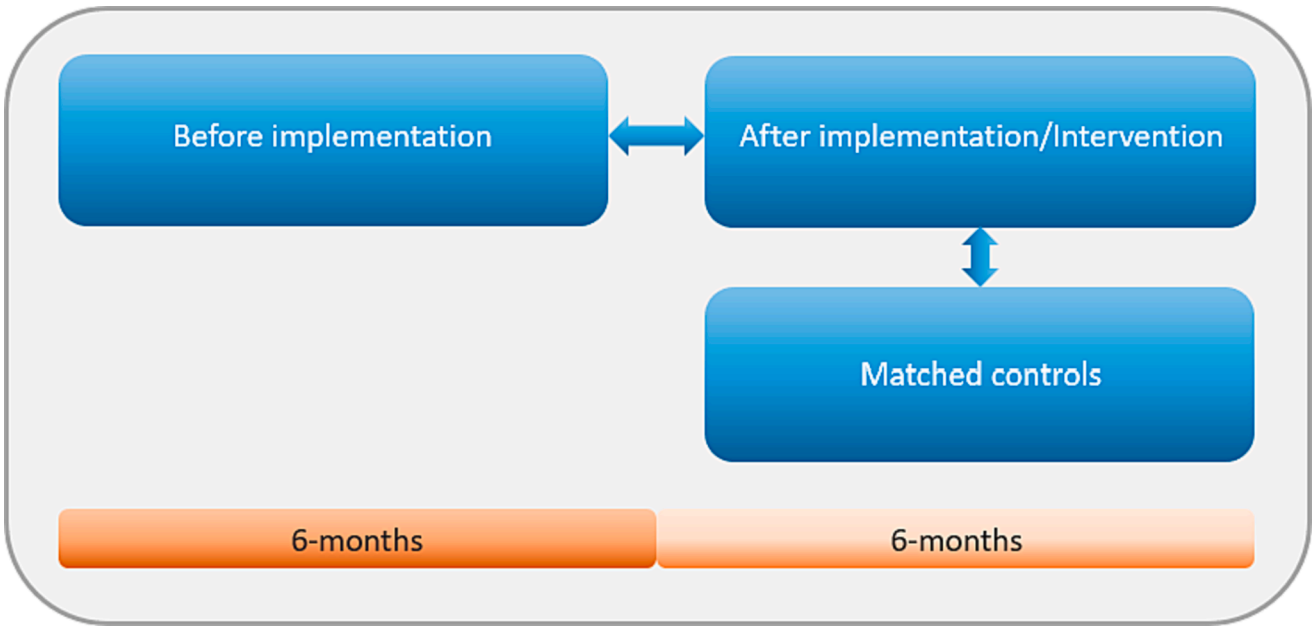

Fig. 1. Overview of the study design.

are also indecisive about settling in these rural areas, as they consider the living environment, the labour market for their partner and proximity to family [8]. It has also proved difficult to find supporting personnel [5]. Finding ways to maintain and enhance the accessibility of primary care is crucial as a solution to the current and growing shortage of care delivery in primary care [1]. Accessible primary care is essential for good quality of life and 'inclusive growth', a main objective of the Europe 2020 strategy [9].

eHealth is seen as one of the solutions to provide personalized and high-quality care while enhancing accessibility and reducing workload [1,10,11]. Up until now, most studies look at the implementation or effect of econsultations, both written (i.e., where the patients describe their health issues in an online form and healthcare professionals provide a written response) or video consultations, in general practice [12–17]. Results vary, however, econsultations might provide the possibility to reduce workload and costs when it is particularly used for simple or administrative queries and implemented well [13,15]. Nevertheless, econsultations, especially consultations about new conditions and written econsultations, need follow-up via an onsite- or telephone consultation [12,15,16]. Besides e-consults, many more digital opportunities are available to improve organization and communication in general practice, for example enabling patients to access their medical records or to reorder medication online). Digital platforms for primary care that combine multiple functionalities are also available [18]. Such platforms may not only help to enhance accessibility of care and workload, it also potential to support chronic disease management (e.g. platform could help to efficiently and effectively support chronic disease patients).

To our knowledge, limited scientific research has been conducted on digital platforms for improving organization and communication in the general practice by offering various options for consultations and by changing the processes in the practice. Specifically, literature on pre- and post-implementation costs of such platforms is scarce. A platform supporting these aspects has been developed, providing patients with the opportunity to schedule their onsite-appointment online, send a written e-consult or chat with the GP, have access to their medical record and reorder medication. Next to the digital platform, patients can call the practice for a call-back appointment. First contact (i.e., triage) and call-back appointments are with the GP instead of the GP assistant. A cooperation offers, maintains and develops the platform and multiple practices are connected to it. Since a substantial part of the care is delivered online, practices can support each other in answering econsultations, chats and telephone consults. This study aims to evaluate healthcare usage and costs of patients using this platform through claims data. First, by comparing healthcare usage and costs before and after implementation and second by comparing patients' healthcare usage and costs in practices working with the platform with a matched control group.

2. Materials and methods

2.1. Design and setting

The current study is a retrospective observational cohort study, comparing general practices using the digital platform (intervention) with practices not using the platform (control) (see Fig. 1). Routinely gathered data on patients' healthcare usage and costs was provided by a Dutch insurance company (i.e., named Zilveren Kruis), and this data was used in this study. The within-subject analysis compared healthcare usage and costs before and after implementation. The between-subject analysis compared patients' healthcare usage and costs in practices working with the platform with matched individuals from various practices not using the platform. The data collection and analyses of this study were performed under the strict privacy rules and regulations of the Dutch laws and Health Insurance Companies. Patients in the analyses could not be identified, therefore no informed consent or approval of a Medical Ethical Committee was necessary. The need for ethical approval was waived by the Medical Ethics Committee of Leiden – Delft – Den Haag (P2. N20.118).

2.2. Intervention

The digital platform focuses on digital communication and remote healthcare delivery in primary care. It consists of a web application, through which patients can book onsite appointments, chat or econsultation (i.e., e-mail) (both written consultations), reorder medication for chronic conditions, and access part of their medical records. Moreover, patients can call the practice for a call-back appointment, the patient receives the time when the GP is going to call back. The practice cannot be contacted directly in case of an emergency. Appointments are

exclusively scheduled in advance, except for emergency care. First contact (i.e., triage) and telephone consultations are always with a GP working at the or an affiliated practice.

2.3. Study population

Data from patients of two Dutch general practices using the platform was used (for practice details see Appendix A). Per practice, data from half a year before and half a year after the implementation was obtained. Data collection was finished in March 2020. Patients from these practices were matched to patients from various practices not using the platform.

Patients were included in the study when they were a patient at one of the two practices (within-subject analysis) or were matched to one of these patients (between-subject analysis). Additional criteria were: (a) age $\geq$ 18 years and (b) insured by Zilveren Kruis over the whole study period.

2.4. Outcomes

Sociodemographic and clinical characteristics

Sociodemographic and clinical characteristics were obtained, such as sex, age, socio-economic status (SES; i.e., approximation by postal code), diagnosis (yes 1, yes 2 or more, no) and historic healthcare costs. Diagnosis was based on the Dutch FKG (Farmaceutische Kosten Groep) criteria [19]. For the between-subject analysis, the historic healthcare costs were the costs in the year before implementation. For the within-subject analysis, the historic healthcare costs were the costs in the half year before the studied period (i.e., month 12- month 6 before implementation). This was done to avoid overlap with the study period.

Primary outcomes

Objective data on healthcare usage contained: number of GP consultations (i.e., total; short: <20 min; long: >20 min), number of general practice center visits (i.e., patients go to the general practice center with health problems outside of office hours), number of prescribed medications per 6-months, referrals to specialist care (yes/no), mental healthcare (yes/no), and physiotherapy visits per (yes/no), hospital admissions (yes/no), emergency room visits (yes/no), and deaths (yes/no) (i.e., only in between-subjects analyses). Cost data were the costs associated with GP consultations, general practice center visits and prescribed medication.

2.5. Sample size calculation

The calculation was based on the primary outcome, GP consultations per person per half year (estimated at 2.25) [20] and is described in detail in Appendix A. The required sample size was 442 pairs (both in within- and between-subject analysis). Power Analysis & Sample Size Software ([21]) was used to perform the sample size calculation.

2.6. Statistical analysis

Analyses were conducted in Statistical Analyses Software version 9.4 'SAS' [22]. Descriptive statistics were used to describe sociodemographic and clinical characteristics and healthcare usage and cost data. For healthcare usage: when there were < 70 observations of an outcome variable, it was not analysed. This was the case for: visits to a mental healthcare professional, emergency room visits or hospital admission, and the number of deaths.

2.6.1. Within-subject analysis

To evaluate the longitudinal impact of the implementation on healthcare usage, mixed model Poisson analyses were used for the number of GP consultations, number of short and long GP consultations, visits to the general practice center and prescribed medication with time as a factor term (i.e., before and after implementation). Logistic Generalized Estimating Equation (GEE) analysis (Proc Glimmix) was used to evaluate the longitudinal impact on the number of patients to specialist care and the number of patients to physiotherapy per 6-month time frames.

Cost analyses were done with mixed model analyses of variance over time. To correct for non-normality, a gamma distribution of the error was applied. A correction in healthcare usage was made to control for differences in the rate of healthcare usage at the moment of implementation. Costs were standardized to values corresponding to the year 2020 to control for inflation.

2.6.2. Between-subject analysis

First, patients were matched. Scores were derived using a Poisson regression with the number of GP consultations before implementation, per 6 months, as the outcome and with age, sex, SES, clinical characteristics, and historic healthcare costs as exposure variables. A factor term (i.e., exposure to the intervention) and an interaction term (i.e., exposure to the intervention X 6-month time frames) were added to the models for both healthcare usage and costs. This was done to correct for the fact that the platform was implemented at two practices and during different periods.

Gender, age, SES, diagnosis, practice and historic healthcare costs were added to the models to adjust for confounding.

Table 1
Sociodemographic- and clinical characteristics of the intervention, control and total group.

	Intervention (n = 985) *M* + *SD* or N (%)	Control (n = 985) *M* + *SD* or N (%)	Total *M* + *SD* or N (%)
Sociodemographic characteristics			
Sex			
Men	554 (56.3)	554 (56.3)	1108 (56.3)
Women	431 (43.7)	431 (43.7)	862 (43.7)
Age	50.75 (16.1)	50.76 (16.1)	50.76 (16.1)
18–40	250 (25.4)	250 (25.4)	500 (25.4)
40–55	338 (34.3)	343 (34.3)	681 (34.3)
55–65	179 (18.2)	176 (18.2)	355 (18.2)
65+	218 (22.1)	216 (22.1)	434 (22.1)
SES[1]			
0 (missing)	30 (3.0)	30 (3.0)	60 (3.0)
1	72 (7.3)	72 (7.3)	144 (7.3)
2	131 (13.3)	131 (13.3)	262 (13.3)
3	470 (47.7)	470 (47.7)	940 (47.7)
4	139 (14.1)	139 (14.1)	278 (14.1)
5	143 (14.5)	143 (14.5)	286 (14.5)
Clinical characteristics			
Yes, 1 diagnosis	202 (20.5)	197 (20.5)	399 (20.5)
Yes, 2 or more diagnoses	55 (5.6)	63 (5.6)	118 (5.6)
No diagnosis	728 (73.9)	725 (73.9)	1453 (73.9)
Historic healthcare costs	2596259.41	2876375.04	–

[1] SES – Socioeconomic Status. A higher SES score means a higher socioeconomic status.

3. Results

The majority of the study population was male (56 %), below 55 years old (60 %) and had no clinical diagnosis (74 %) (See Table 1). Half of the population had an average SES (48 %).

3.1. Healthcare usage

Within-subject analysis

The total number of GP consultations significantly increased after compared to before implementation (i.e., Rate = 1.52; $p < 0.001$) (See Table 2). Both the number of short (i.e., Rate = 1.28; $p < 0.001$) and long

Table 2
The within-subject and between-subject analyses for healthcare usage. The Poisson and logistic mixed models are shown. The models are adjusted for sex, age, SES[1], diagnosis (1, 2 or none) and historic healthcare costs. Moreover, an interaction effect is added in the between-subject models between intervention and practice.

	Before implementation (n = 985) N or Mean	After implementation (n = 985) N or Mean	Fully adjusted model Rate or Odds ratio (SE), *p*
Number of GP consultations (Total)			
Total	2333	3552	
Per person	2.37	3.61	Rate = 1.52 (1.03) ($p < 0.01$)
Number of short GP consultations (<20 min)			
Total	1344	1718	
Per person	1.36	1.74	Rate = 1.28 (1.04) ($p < 0.01$)
Number of long GP consultations (>20 min)			
Total	329	695	
Per person	0.33	0.71	Rate = 2.10 (1.16) ($p < 0.01$)
Number of general practice center visits			
Total	93	82	
Per person	0.09	0.08	Rate = 0.88 (1.16) ($p = 0.406$)
Number of prescribed medication			
Total	10,181	10,308	
Per person	10.33	10.47	Rate = 1.01 (1.01) ($p = 0.385$)
Number of patients to specialist care			
Total	159	198	Odds ratio = 1.38 (1.14) ($p = 0.01$)
Number of patients to physiotherapy			
Total	202	231	Odds ratio = 1.93 (1.24) ($p < 0.01$)
	Control	**Intervention**	
Number of GP consultations (Total)			
Total	2349	3552	
Per person	2.38	3.58	Rate = 1.23 (1.10) ($p = 0.035$)
Number of short GP consultations (<20 min)			
Total	1200	1748	
Per person	1.22	1.73	Rate = 1.15 (1.15) ($p = 0.450$)
Number of long GP consultations (>20 min)			
Total	396	695	
Per person	0.4	0.67	Rate = 1.11 (1.14) ($p = 0.450$)
Number of general practice center visits			
Total	74	82	
Per person	0.07	0.08	Odds ratio = 0.13 (1.79) ($p < 0.01$)
Prescribed medication			
Total	7967	10,308	
Per person	7.63	10.07	Odds ratio = 1.75 (1.07) ($p < 0.01$)
Number of patients to specialist care			
	143	198	Odds ratio = 1.54 (1.49) ($p = 0.272$)
Number of patients to physiotherapy			
Total	215	231	
	0.22	0.23	Odds ratio = 0.54 (1.40) ($p = 0.471$)

[1] SES – Socioeconomic status.

(i.e., Rate = 2.11; $p < 0.001$) GP consultations significantly increased after compared to before implementation. Moreover, the number of visits to specialist care (i.e., Rate = 1.38; $p = 0.013$) and physiotherapy (i.e., Rate = 1.93; $p < 0.001$) increased after compared to before implementation. No significant differences were observed in the number of general practice center visits and medication.

Between-subject analysis

The number of GP consultations and prescribed medication was significantly higher in the intervention compared to the control group (respectively, Rate = 1.23; $p = 0.035$ and Rate = 1.75; $p < 0.001$) (See Table 2). The number of general practice center visits was significantly lower in the intervention compared to the control group (i.e., Rate = 0.88; $p < 0.001$). No differences between the intervention and control group were observed for short (i.e., $p = 0.450$) and long GP consultations (i.e., $p = 0.450$), specialist care visits (1.54 (0.272) and physiotherapy visits (i.e., $p = 0.471$).

3.2. Healthcare costs

Within-subject analysis

Healthcare costs increased for GP consultations and short and long GP consultations after compared to before implementation (Table 3). The costs per patient increased with on average €13,57 ($p < 0.001$) for GP consultations, €3,77 ($p < 0.001$) for short consultations, and €7.16 ($p < 0.001$) for long consultations. No significant differences were found for general practice center visits (i.e., $p = 0.811$) and prescribed medication (i.e., $p = 0.137$).

Between subject analysis

The following healthcare costs were significantly higher in the

Table 3
The within-subject and between-subject analyses for healthcare costs. The linear mixed models are shown. The models are adjusted for sex, age, SES[1], diagnosis (1, 2 or none) and historic healthcare costs. Moreover, an interaction effect is added in the between-subject models between intervention and practice.

	Before implementation (in €) (n = 985) N or Mean	**After implementation (in €)** (n = 985) N or Mean	**Fully adjusted model (in €, SE) (*p*)**
Number of GP consultations (total)			
Total	24302.20	37672.61	
Per person	24.67	38.25	13.57 (4.47) ($p < 0.01$)
Number of short GP consultations (<20 min)			
Total	13155.84	16867.20	
Per person	13.36	17.12	3.77 (2.01) ($p < 0.01$)
Number of long GP consultations (>20 min)			
Total	6339.52	13392.00	
Per person	6.44	13.60	7.16 (2.43) ($p < 0.01$)
Number of GP center visits			
Total	8015.34	8399.33	
Per person	8.14	8.53	0.39 (5.10) ($p = 0.811$)
Medication			
Total	197810.92	214945.41	
Per person	200.82	218.22	17.39 (120.692,14) ($p = 0.137$)
	Control	**Intervention**	
Number of GP consultations (total)			
Total	24381.15	37672.61	
Per person	24.50	36.37	7.06 (19.51) ($p = 0.018$)
Number of short GP consultations (<20 min)			
Total	11752.09	16867.20	
Per person	11.61	16.41	3.63 (4.20) ($p = 0.011$)
Number of Long GP consultations (>20 min)			
Total	7630.55	13392.00	
Per person	7.83	12.58	0.87 (5.46) ($p = 0.606$)
Number of GP center visits			
Total	6406.47	8399.33	
Per person	6.81	8.05	(-)1.19 (14.15) ($p = 0.652$)
Medication			
Total	214945.41	187481.02	
Per person	177.47	220.63	112.33 (48.12) ($p = 0.020$)

[1] SES – Socioeconomic status.

intervention compared to the control group: GP consultations €7,06 ($p = 0.018$), short consultations €3,63 ($p = 0.011$) and medication €112,33 ($p = 0.020$) (Table 3). No significant differences were found for long GP consultations (i.e., $p = 0.606$) and general practice center visits (i.e., $p = 0.652$).

4. Discussion

This study aimed to evaluate healthcare usage and costs after the implementation of a digital platform to support communication and organization in general practice. Results showed that the number and costs of total GP consultations were significantly higher 1) after compared to before implementation and 2) in the intervention compared to a matched control group. Other forms of healthcare usage also increased after compared to before implementation, i.e., the number of patients to specialist care and the number of patients to physiotherapy. Compared with the control group, the number of general practice center visits and prescribed medication was significantly higher in the intervention group. Contrarily, the costs associated with prescribed medication were lower in the intervention compared to the control group. All in all, especially the number and the costs of GP consultations were higher after compared to before implementation and in the intervention compared to the control group.

4.1. Comparison to literature

The increase in GP consultations was strongest in the practice located in the rural area (see Appendix A). In this practice, before implementation, the practising GP was about to retire and struggling to find successors. In the end, successors were found who immediately started working with the digital platform. The increase in GP consultations may be explained by several factors. First, care delivery was less available before the practice was taken over (i.e. before implementation) and this care may have been provided after implementation. Second, after implementation more introductory consultations may have been scheduled by both patients or GPs to get to know each other and to update the medical records. Third, the introduction of a new platform to patients might have led to questions or concerns arising, which may have led to an increase in consultations, such as those intended for asking practical questions. Lastly, the new GPs may have a different working method of seeing patients and how to declare consultations. Unfortunately, the effects of the new GPs and the implementation of the new digital platform could not be differentiated. In the other practice, however, no large differences in healthcare usage and costs before and after implementation were observed. The transition in that practice was smaller since the same GPs worked before and after the implementation, and over the years modern technologies were already implemented in the practice.

Enhanced accessibility of care could also have played a role in the increase in healthcare usage [14]. Providing econsultations increases care accessibility, for example, for individuals who are employed, have family commitments, have mental health problems or mobility problems. Nevertheless, others could experience care as less accessible, such as less digitally literate individuals [14]. Also, the need to follow-up consultations, especially written econsultations, can lead to an increase in consultations [12,15,16,18].

An increased amount of consultations can increase the workload for the GP and the practice [12]. However, a higher number of consultations does not necessarily mean an increased workload [17,23]. To ensure workload does not increase with an increased amount of consultations, consultations must be handled efficiently. For example, econsultations in less time than onsite appointments and these econsultations should only when necessary lead to onsite follow-up [17]. Efficiency can be accomplished when econsultations are adequately implemented in the processes of the general practice and staff and patients receive adequate training [23,24].

Studies showed that econsultations are mostly used for small and simple, medication-related and administrative questions, to report a specific symptom or for infections/immunological issues [13,15,25]. When such issues are efficiently handled online, it frees up time for individuals with more complex health needs [14]. In this study, we do not know if workload increased as no data is available on the duration of the econsultations and chats. To our knowledge, there is only one study that studied this for an integrated digital care platform [18]. Carter, Fletcher [18] studied a type of platform, the concept WebGP, which offered, multiple functionalities, mostly providing information about symptoms and self-help guidance and an econsultation service. The platforms' uptake was, however, low and no conclusion could be drawn on workload. Nevertheless, they showed that a substantial amount of written econsultations needed telephone or onsite consultation (72 %), as judged by GPs. No comparable platforms are yet studied, limiting conclusions on what communication method patients prefer, for which health issues, and how this influences the workload of the GP.

4.2. Strengths and limitations

To our knowledge, this is one of the first studies evaluating a digital platform to support communication and organization in general practice with claims data, which is objective data. Another strength is that it was possible to include 985 patients and 985 matched controls, which is more patients than required by the sample size calculation. Regarding the study population, one urban and one rural practice was included. Moreover, all Zilveren Kruis patients of a practice were included and not just patients interested in digital health. These two factors improve the generalizability of the study. Finally, this study evaluated an integrated digital platform whereas most available studies focus on only econsultations [12–17]. Within the integrated platform, patients could choose what they thought suited their health issue best (i.e., chat, econsultation, onsite appointment or a call-back consultation). Such integrated platforms hold great potential in fitting the needs of the patients and supporting general practices in their work.

A limitation is that we do not know whether an increase or decrease in healthcare usage is beneficial or disadvantageous. Potential safety risks with online consultations are e.g. missed diagnoses, a possible tendency to overprescribe medicine, fragmentation of care and increasing health inequalities due to the digital divide [14,23]. The current study also does not allow us to make statements about whether the post-implementation costs outweigh the benefits of the digital platform, for example, in terms of community or public health. More research is needed for this. The claims data has several limitations as well. First, no clear distinction could be made between the duration of chat, econsultation, telephone and onsite appointments. Only data was available on whether a consultation was short or long. More details are necessary to study the GPs workload. Second, there are no clear guidelines on how to declare consultations (i.e. an onsite appointment can be declared as, but several chats can also be counted as a long consultation), and GPs will likely declare consultations differently. This further limits our ability to conclude whether an increased amount of consultations leads to an increased workload of GPs, since econsultations can be handled more efficiently.

4.3. Future studies

To gain more insight into healthcare usage and costs after the implementation period, a future study should include a longer period after implementation and include more practices to increase the sample size to allow for subgroup analyses. Moreover, to study the impact of the digital platform on the workload, data should differentiate between chats, e-consultations, telephone and onsite consultations, including time spent per consultation. Moreover, an in-depth cost evaluation of the digital platform should be performed, including personnel and office space costs. Also, workload or number of patients treated per time frame should be taken into account, since the hypothesis is that digital consultations will take less time, allowing more time for complex health issues. In addition to the proposed research to get a more comprehensive understanding of the post-implementation healthcare usage and costs, it would be interesting to study the impact of implementation on the health in the community and the experiences of the patients. Such information would allow us to identify whether an increase in costs can outweigh the (perceived) benefits.

Table A1
Overview of location, number of patients and number of patients insured with Zilveren Kruis.

Practice location	Number of patients (approximately)	Insured at Zilveren Kruis
Urban area	3500	374
Rural area	1700	611

4.4. Conclusion

This study showed a rise in GP consultations and costs when implementing a digital platform. This increase was presumably and partly caused by circumstances in one of the two included practices. Moreover, creating new options for contacting and communicating with the GP can enhance care accessibility and thereby driving an increase in consultations. If chats and econsultations can be managed in less time than traditional onsite consultations, an increased number of consultations may not necessarily burden GPs with an increased workload. This digital platform is a promising working method in general practice to facilitate patients and provide GPs with more flexibility.

Author statement

The data collection and analyses of this study were performed under the strict privacy rules and regulations of the Dutch laws and Health Insurance Companies. Patients in the analyses could not be identified, therefore no informed consent or approval of a Medical Ethical Committee was necessary. The need for ethical approval was waived by the Medical Ethics Committee of Leiden – Delft – Den Haag (P2. N20.118).

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

Details on methods section

Study population

See Table A1.

Sample size calculation

The sample size calculation was based on the primary outcome, GP consultations per person per half year. The estimated number of GP consultations per person per half year was 2.25 (Nivel, 2018). We wanted to be able to detect a change of 0.25 GP consultations per person per half a year (i.e., 11 % change) (Nivel, 2018). The healthcare usage data originated from two different practices, which could lead to variation between practices in GP consultations per person per half year (i.e.,). To take this between cluster variation into account, a correlation

coefficient of 0.2 was incorporated in the sample size calculation. Power was set at 0.8 and alpha at 0.05. Leading to a needed sample size of 442 pairs, which is both before and after implementation of the platform and patients from practices with or without the platform. Power Analysis & Sample Size Software ((*Pass Software*)) was used to perform the sample size calculation.

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