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Cost effectiveness of a new collaborative primary health care service based in Swiss community pharmacies

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Abstract

Background

In 2012, a new collaborative primary health care service («netCare») was established in Swiss community pharmacies. We compare treatment cost for netCare cases to the cost of alternative providers («comparators»).

Data and Methods

Our cost comparison is based on two datasets. The first documents all patients treated in the netCare scheme (n=4,118), the second comprises insurance claims data from patients with common conditions treated by other providers (n=73,853). We calculate different scenarios of comparators to account for the different treatment options that are available to patients. The first comparator is a GP visit, the second is a GP visit or a visit to a pharmacy, the third is a GP visit, a visit to a pharmacy or an emergency visit.

Results

If pharmacists and physicians are equally successful in treating common conditions, the netCare service is substantially less costly than the comparators. Depending on the scenario, the difference ranges from -6 to -41%. If pharmacists treat common conditions less successfully than physicians, the netCare service is still less costly as long as the differences are not too large.

Conclusions

We find strong evidence that the netCare service is less costly than treatment by other providers. While a comparative study of clinical outcomes is still missing, our analysis suggests that the collaborative primary health care service in the community pharmacy is not only convenient for patients but also cost effective.

1 Background

1.1 Introduction

Amidst a growing shortage of primary care providers, many countries recently established initiatives to expand the role of pharmacists in the management of common ailments [see amongst others the UK (Vohra, 2006), Canada (Noseworthy, 2013), and Switzerland (Erni et al., 2015)]. The aims of these programs are threefold: First, to offer patients a convenient and fast access to care; second, to decrease the workload of general practitioners (GP) and emergency rooms; third, to save cost by substituting high price providers.

Although these programs are relatively new, several evaluations have been published. Comparing patients treated at the pharmacy, at a general practice or at the emergency department, Watson et al. (2015) found that symptom resolution and overall patient satisfaction were the similar across the three settings. However, specific measures of patient satisfaction (e.g. communication and distress relief) were highest at the GP and lowest at the pharmacy. Puntong, Boardman, & Anderson (2011) found high levels of patient satisfaction with the pharmacy based scheme, especially in terms of ease of access and convenience.

With regard to the substitution of other providers, a systematic literature review by Paudyal et al. (2013) finds that the pharmacy-based minor ailment schemes tend to reduce GP workload on minor ailments, but the effects on total GP workload are less clear. Regarding cost, both Watson et al. (2015) and Baqir et al. (2011) find that the cost per visit are substantially lower at the pharmacy than at the GP or emergency department.

This paper contributes to the literature by analyzing a new collaborative service for patients with common conditions («netCare» hereafter) that was established by pharmaSuisse, the Swiss association of pharmacists in 2012. For 24 conditions, pharmacists provide medical triage with the help of decision trees (see Erni et al., 2015). As a backup, pharmacists and patients can request a real-time video consultation with a physician. This service offers patients a low-threshold access to care.

We compare the cost of the new service to other treatment options that are available to patients suffering from common conditions (comparators). In order to account for the fact that patients may choose several treatment options, we calculate different scenarios. We find that the triage offered by the netCare service is less costly than the triage by other providers.

1.2 Policy setting

Health insurance in Switzerland is mandatory for a broad basket of medical services. Insured patients enjoy almost unrestricted access to all outpatient providers in their geographic area. Primary care is mostly provided by physicians in individual or small group practice. Many patients (especially those in good health) have no family doctor and find it difficult to make short term appointments with a GP. Therefore, visits to emergency rooms increased strongly in recent years (Vilpert, 2013) and many emergency rooms experience problems with overcrowding (Sanchez et al., 2013).

The traditional role of the pharmacists has been to dispense drugs. In recent years, several initiatives strengthened pharmacists' roles in the management of health problems. For example, reimbursement was changed to be less dependent on drug mark-ups and more on personal services. The newly launched netCare service is another initiative to expand the role of pharma-

cists. Community pharmacists provide structured medical triage based on decision trees and document their findings. As a backup, they can collaborate with physicians via video consultation. The pilot roll out of netCare took place from April 1, 2012 to January 31, 2014. 196 pharmacies took part, representing 14.5% of the Swiss pharmacies affiliated with pharmaSuisse, the Swiss association of pharmacists.

2 Methods

We analyze the cost effectiveness of the netCare treatment by calculating standardized cost for both netCare and alternative treatment options («comparators»). Two main data sources are used for these calculations. First, participating pharmacists documented all cases treated during the netCare pilot project (April 2012 – January 2014). Second, routinely collected data of a large Swiss health insurer (Helsana) was used in order to identify cases that were treated by physicians, but could have been treated in the netCare setting.

2.1 Dataset 1: Case documentation by participating pharmacists

Participating pharmacists documented all cases treated within the netCare setting. The form contained patient information (age and sex), whether the patient had a GP, what his/her alternative choice of care would have been, the type of ailment and the triage decision. The patient gave his or her informed consent to participate in the study with his/her signature. The local ethics committee of the canton of Bern approved of the study. For further description of the service and the case documentation, see (Erni et al. 2015).

As shown in Table 1, over 4,100 patients were treated by netCare during the pilot study. Most of these patients were female. The average age of patients is about 43 years with the majority (75%) being between 20 and 65 years old. The most frequently treated ailments were cystitis and conjunctivitis, which is expected because of the high prevalence of these ailments and the need for quick access to care (Erni et al. 2015). One quarter of all netCare treatments took place on weekends, so patients likely used the netCare services as a substitute at times when it is difficult to find an appointment with a GP.

When asked about which provider they would have chosen if netCare had not been available to them, 41% of patients answered that they would either have gone to the emergency room or needed an immediate physician visit. Only counting the patients answering this question, this share rises to 56%.

In 17% of the netCare cases, a telemedical consultation with a physician took place. The cost of the netCare service was CHF 15 (approx. Euro 14) for the consultation by the pharmacists. If a teleconsultation with a physician was needed, an additional fee of CHF 48 was charged.

Table 1 Descriptive statistics of patients in the case documentation

Variable		Value
Number of patients		4,118
Age	Average (standard deviation)	42.93 (19.30)
	Missing	5.4%
Gender distribution	Men	3%
	Women	48%
	Missing	49%
Most frequent ailments	Cystitis	42%
	Conjunctivitis	23%
	Pharyngitis	6%
	Other ailments	29%
Share of netCare consultations that took place on weekends		25%
Provider chosen if netCare was not available (patient survey)	Emergency consultation	23%
	Immediate physician visit	18%
	Wait for availability of GP	14%
	Other	18%
	Missing	27%
Share of telemedical physician consultations		17%
Fee of pharmacist consultation		CHF 15
Fee of telemedical consultation (if needed)		CHF 48

1 CHF \approx 0.92 EUR.

Source: Case documentation reported by treating pharmacists, own calculations.

2.2 Dataset 2: Routinely collected data

The second data source is claims data from Helsana insurance from the years 2012 and 2013. Our goal was to identify patients with common conditions that could have been treated by netCare, but were treated by other providers («reference treatments», hereafter). Unfortunately, such treatments cannot be selected directly because diagnostic information on outpatient visits is not available in Swiss routine data. Instead, identification is based on drug prescriptions. The details of the selection process are described in the appendix.

Table 2 shows the descriptive statistics for the reference treatments. We identified over 73,000 consultations. The average age is 41 and thereby similar to the age of the netCare patients. Women account for about 70% of the patients treated. Cystitis is the most frequently identified ailment, followed by dyspepsia. The later was not so frequent in the netCare setting, probably because it is less of an acute problem and patients do not mind waiting for a physician appointment.

Table 2 Descriptive statistics on the reference treatments

Variable		Value
Number of patients		73,853
Age	Average (standard deviation)	40.78 (18.68)
Gender distribution	Men	31%
	Women	69%
Common conditions identified	Cystitis	20%
	Dyspepsia	19%
	Pharyngitis	17%
	Conjunctivitis	16%
	Sinusitis	3%
	Herpes zoster	5%
	Vulvovaginitis	6%
	Hand/foot mycosis	6%
	Low-back pain	8%
Providers	General practitioners	79%
	Specialist physicians	17%
	Hospital (emergency room)	4%
Share of consultations that took place on weekends		4%
Share of consultations with emergency fees		12%
Cost per consultation in a non-emergency setting	Average (standard deviation)	CHF 77 (37.8)
Cost per consultation in an emergency setting	Average (standard deviation)	CHF 118 (32.2)

1 CHF \approx 0.92 EUR.

Source: Routinely collected data from Helsana insurance, own calculations.

Only 4% of the reference treatments took place on weekends. The providers of the reference treatments mostly are general practitioners (79%), followed by specialist physicians¹ (17%) and emergency rooms in hospitals (4%). 12% of the reference consultations contain «emergency fees». These fees either compensate physicians for seeing patients at inconvenient hours or compensate hospitals for their increased cost of infrastructure. For treatments without emergency fees, the average cost amounted to CHF 77. With emergency fees, it was CHF 118.

2.3 Definition of comparators

Given the pro-market nature of the Swiss health care system, patients suffering from common conditions can choose among several providers. Therefore, no single provider can be seen as «natural» comparator. Taking into account this variability, we calculate three different options:

- Comparator 1: visit to GP
- Comparator 2: visit to GP or pharmacist
- Comparator 3: visit to GP, emergency room, or pharmacist

We use stylized facts from the two datasets to specify the details of the comparators.

The first comparator is a visit to a general practitioner. We assume that the consultation lasts for 15 minutes, because this is the most frequently observed consultation time in the reference

¹ Including paediatricians and gynaecologists.

treatments. It includes no additional services such as laboratory tests or technical services, because these are also not part of the netCare triage service.

The second comparator accounts for the fact that pharmacists advise patients with common conditions with or without the netCare service. The consultations without the netCare service are currently neither remunerated nor routinely documented, so we cannot assess their frequency directly. However, we construct an upper frequency bound by counting all netCare-patients that were treated by the pharmacists alone (i.e. without a video conference with a GP) and did not receive prescription drugs. This amounts to 37% of all netCare patients. We therefore assume in comparator 2 that 37% of patients receive help from pharmacists, while the remaining 63% of the patients consult physicians.

A similar number is given by Baqir et al. (2011) who analyze a pharmacy-based minor ailment scheme in the British NHS. Patients using the scheme were asked what they would have done if it had not been in place. 39% of patients reported they would have bought OTC drugs at the pharmacy.

In the third scenario, we additionally account for the fact that 12% of patients treated for netCare-relevant conditions (reference treatments) were charged emergency fees. We therefore modify scenario 2 as follows: Among the 63% of patients that are treated by physicians, 88% receive a standard consultation, while the remaining 12% receive an emergency consultation. Considering all patients, this yields the following numbers for comparator 3: 37% of patients are treated by pharmacists, 55% receive standard physician consultations and 8% receive emergency consultations.

Using the datasets and knowledge about pharmacists' role in the Swiss health care system, we think that comparator 3 is the most realistic scenario. Comparator 1 neglects the fact that community pharmacists advise patients with common conditions even without the netCare scheme. Comparator 2 neglects the role of emergency treatments, which is not realistic because many netCare triages took place on weekends.

2.4 Standardized cost of the netCare service and the comparators

In this section, we explain the calculation of standardized costs for the netCare service and the comparators. The term «standardized» reflects the fact that the costs are derived from stylized facts rather than observed for actual patients. While individual patients might have different costs because their treatment included other services, the numbers are realistic minimal costs for the comparators as defined in the previous section.

Standardized cost of the netCare service

We calculate the expected cost of the netCare service ($E[C_{\text{netcare}}]$) by adding up the fee for a pharmacist consultation ($Price_{\text{pharmacist}}$) and the telemedicine physician's consultation fee ($Price_{\text{telemedicine}}$) accruing only for part of the cases ($P_{\text{telemedicine}}$). The expected cost of the netCare treatment is given by equation (1).

$$E[C_{\text{netcare}}] = Price_{\text{pharmacist}} + P_{\text{telemedicine}} * Price_{\text{telemedicine}} \quad (1)$$

In the case documentation, 17% of patients had a video consultation with a physician which is the best assumption for $P_{telemedicine}$. The prices are part of the agreement of the netCare service. The components are summarized in Table 3.

Table 3 Cost components in netCare

Prices	Price _{pharmacist}	Price _{telemedicine}
CHF	15	48
Probabilities	P _{pharmacist}	P _{telemedicine}
	100%	17%

Source: Own calculations, 1 CHF ≈ 0.92 EUR.

Standardized cost of the comparators

In order to calculate the expected cost of the comparators 1-3, the prices of the different providers are weighted by the probabilities by which these providers are chosen in the different scenarios. While the probabilities of the services in the comparators are different in the three scenarios, the prices are constant. The general formula is:

$$E[C_{\text{comparator}}^{1,2,3}] = P_{\text{physician}}^{1,2,3} * Price_{\text{physician}} + P_{\text{pharmacist}}^{1,2,3} * Price_{\text{pharmacist}} + P_{\text{emergency}}^{1,2,3} * Price_{\text{emergency}} \quad (2)$$

The assumed probabilities ($P_{\text{physician}}^{1,2,3}$, $P_{\text{pharmacist}}^{1,2,3}$ and $P_{\text{emergency}}^{1,2,3}$) are explained and justified in the section «definition of the comparators». The prices amount to CHF 39.07 for physician consultations, zero for pharmacist consultations and CHF 80.07 for emergency consultations. These numbers are derived from Swiss tariff information and the reference treatments, see appendix for details.

Note that the assumed prices for physician visits and emergency visits are markedly lower than the cost per visit observed in the routinely collected data (CHF 77 and CHF 118 in emergency settings; see bottom line of Table 2). Our approach bears the risk of underestimating the cost of the comparators. However, using the cost observed in the reference treatments bear the risk of overestimating them, for two main reasons. First, because of the lack of diagnostic information, we use drug prescriptions to identify reference treatments. While this method identifies patients who sought help for a netCare-relevant ailment, it is unlikely that it identifies all such cases. In particular, cases treated by counselling and/or OTC medication alone are not identified. This might lead to a selection bias towards more severe cases with higher cost. Second, a detailed analysis of the reference treatments showed that many included laboratory tests or other technical procedures, which are not included in the netCare triage that we are analyzing.

Table 4 Cost components in the three scenarios

Prices	Price _{physician}	Price _{pharmacist}	Price _{emergency}
CHF	39.07	0	80.07
Probabilities	P _{physician}	P _{pharmacist}	P _{emergency}
Comparator 1	100%	0%	0%
Comparator 2	63%	37%	0%
Comparator 3	55%	37%	8%

Source: Own calculations, 1 CHF \approx 0.92 EUR.

3 Results and discussion

3.1 Results

With no evidence showing that netCare-pharmacists treat common conditions less successfully than physicians, we start with the assumption of equal treatment success. In this setting, the cost of a netCare treatment can be compared directly to the cost of the comparator treatment (cost minimization analysis). Using equations (1) and (2) and the information in tables 3 and 4, the cost comparisons are calculated in Table 5.

In the most realistic scenario 3, the costs of netCare are lower than the costs of the comparator by CHF 4.74 or -17%. In scenario 1, which only considers physicians in the comparator, the difference is CHF 15.91 or -41%. In scenario 2, the difference between netCare and the comparators is smaller (-6%). Still, as long as there are no differences in treatment success, the netCare triage is always cost effective.

We cannot test the assumption of equal treatment success. While Erni et al. (2015) report good symptom resolution for netCare patients, similar data is not available for the comparators in the Swiss setting. As an alternative, we calculate the minimum success rate of pharmacists which is needed for the netCare service to be cost effective, under the assumption that physicians are always successful. The later assumption seems very strong, but it could be relaxed without changing the interpretation of the results because only the relative difference between pharmacist and physician consultations is relevant for comparison.

Since most netCare treatments are for acute conditions such as cystitis, conjunctivitis or pharyngitis, patients usually will seek other treatments if not successful at first. Eventually, the vast majority of patients will get cured even with different treatment success of pharmacists and physicians, but at different cost. We therefore add the expected cost from follow-up treatments to the cost both of netCare and the pharmacist treatments in comparators 2 and 3 weighted with a probability of treatment success. Then we vary this probability and calculate the minimum success rate of pharmacists that is needed for netCare to be cost effective (see appendix for the details of the calculations).

Table 5 Cost comparison between netCare and the comparators with equal treatment success

Comparator	$E[C_{\text{netCare}}]$	$E[C_{\text{comparator}}]$	Difference in CHF	Relative Difference
1	23.16	39.07	- 15.91	$-15.91 / 39.07 * 100 = -41\%$
2	23.16	24.61	- 1.45	$-1.45 / 24.61 * 100 = -6\%$
3	23.16	27.90	- 4.74	$-4.74 / 27.90 * 100 = -17\%$

Source: Own calculations, 1 CHF \approx 0.92 EUR.

With comparator 3, the minimum success rate of pharmacists is 74%. The interpretation is that if pharmacists were only successful in three quarters of the cases, while physicians are always successful, the netCare triage would still be cost effective. Again, comparator 2 sets the strongest assumptions against netCare. For netCare to be cost effective, pharmacist consultations have to be successful in 92% of the cases. In comparator 1, the minimal success rate is 51%, saying that even if pharmacist consultations were only half as successful as physician consultations, netCare would still be cost effective.

3.2 Robustness tests

Both the composition of the netCare triage and the comparators were based on stylized facts derived from the two datasets. To test for sensitivity, we varied several of the assumptions.

One crucial assumption for the netCare service to be cost effective is the share of cases that would have been treated at a public pharmacy free of charge even without the netCare service. In comparator 3, which we consider to be most realistic, we used the share of netCare cases that was neither treated by prescription drugs nor had a telemedical consultation. This share was 37%. To test for sensitivity, we calculated the maximum share for which netCare still is cost effective (see appendices for details). The result is 47%, showing that if almost half of the netCare cases were usually treated in pharmacies free of charge, the netCare service would still be cost effective.

The second assumption to be varied is the share of telemedical consultations. It is possible that the share of telemedical consultations might change over time as patients and pharmacists get used to the system. If the share of telemedical consultations increases, the cost of netCare increases. We calculate the maximum share of telemedical consultations for which, other things equal, netCare would still be cost effective. This maximum share amounts to 27% in comparator 3. So even if there was a marked increase in the share of telemedical consultations over time, netCare would remain cost effective. The maximum share is 20% in comparator 2 and 50% in comparator 1 (See appendices for details).

The third robustness test accounts for the fact that pharmacists earn additional fees when dispensing prescription drugs. These fees occur more often in the netCare setting than in the comparators, as dispensing physicians do not charge them.² We find that including this fee (called LOA, i.e. Leistungs-Orientierte Abgabe), expected cost for the netCare treatment are about 13%

² Dispensing physicians might have longer consultation time, which we do not consider here.

lower than the cost of comparator 3, and about 37% lower than the cost of comparator 1. Net-Care and comparator 2 have equal expected cost in this scenario. The calculations are shown in the appendices.

3.3 Limitations

An important restriction in our study is that we analyzed only the direct medical cost for consultations at the first point of contact. Additional costs for referrals are not analyzed. The main reason is that we have no data on referral rates outside the netCare setting. For acute conditions like cystitis, conjunctivitis or pharyngitis, which make up over 70% of the netCare cases, we do not expect referrals to play a major role. Naturally, some patients will remain in the health care system or be treated for other conditions, but it is not evident that there should be a difference in this regard between the netCare service and the comparator treatments.

The second limitation is that our cost analysis was limited to the direct medical cost for consultations. Potential savings in indirect cost such as reduced waiting times are not considered. Moreover, differences in pharmaceutical cost are not analyzed because of lack of data for the comparators. However, we do not expect marked differences in pharmaceutical treatment because the recommendations given by netCare pharmacists are based on the current, evidence-based medical literature, which should be followed by other providers as well.

4 Conclusion

In this paper, we conducted a cost-effectiveness analysis of a new pharmacy-based treatment scheme for common conditions, which we compared to alternative treatments available to patients («comparators»). We used stylized facts from two datasets together with tariff data to define realistic comparators and to calculate minimal expected costs for all scenarios. All our assumptions were rather conservative, i.e. in favor of the comparators, to minimize a possible type I error (i.e. finding cost effectiveness of the netCare service when in fact it is not cost effective). We also conducted a series of robustness tests in order to check the many assumptions that were necessary to define comparators and costs.

We find strong evidence that the collaborative primary health care service netCare is less costly than the treatment by other providers. Although a comparative study of clinical outcomes is still missing, our analysis suggests that the program could provide patients with a convenient and low cost alternative for care, especially at weekends when GP practices are closed.

Competing Interests

The authors declare that they have no competing interests.

Authors' contributions

MT participated in the design of the study, performed the statistical analysis, and wrote the draft version of the manuscript. HT conceived of the study, and participated in its design and coordination and edited the manuscript. All authors read and approved the final manuscript.

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6 Appendices

6.1 Identification of reference treatments

This section describes how we identified the reference treatments (dataset 2).

The data source is routinely collected data by Helsana, a large health insurer in Switzerland. In this data, we wanted to identify consultations that netCare pharmacists could have provided, but actually were provided by physicians in independent practice or at the emergency room in hospitals. Because the data base does not contain diagnostic information, we used specific drugs and diagnostic tests as primary selection criteria for case identification. The criteria were provided by medical experts of pharmaSuisse. For example, the antibiotic Norfloxacin dispensed for 3 days is mainly used to treat cystitis and can therefore be used as a marker. For other ailments the medications are unspecific, so we used diagnostic tests as additional markers. For example, we identified pharyngitis (throat infections) by typical medication in combination with a diagnostic test for streptococcus.

Identification was possible for 9 of the 24 common conditions. These 9 conditions account for 84% of the cases in the case series. The primary selection criteria are shown in column two of Table 2. Because the first selection is rather broad, we applied further criteria to ensure that the selected cases were representative for cases netCare pharmacists could have treated. These criteria include age, gender and some restriction on the other pharmaceuticals that can be observed. Furthermore, we only selected cases in the bottom 80% of the cost distribution to make sure that patients with severe conditions or relevant comorbidities were excluded (see col. 4 in Table 6).

Table 6 Identifying reference treatments in insurance claims data

Common conditions	Primary selection criteria	Potential cases	Secondary selection criteria	Cases analyzed
1 Cystitis	Pharmaceuticals	92,139	Women aged 18–65; no pharmaceuticals except those used for identification; cost < CHF 145	14,511
2 Pharyngitis	Pharmaceuticals + test of streptococcus (codes 3319.00, 3320.00, 3469.00 on the list of analytic procedures)	16,711	Patients aged 7 or more; cost < CHF 166	12,889
3 Sinusitis	Pharmaceuticals + X-ray of the nose (Tarmed code 39.0100)	3,102	Patients aged 7 or more; cost < CHF 242	2,423
4 Dyspepsia	Pharmaceuticals + No ATC-code M01A, H02A, J01,B01A in the two weeks prior to the treatment	120,580	Patients aged 18–65; no pharmaceuticals except those used for identification; cost < CHF 162	13,854
5 Conjunctivitis	Pharmaceuticals; prescriptions by primary care providers only	16,936	Patients aged 2 or more; cost < CHF 105	11,475
7 Low-back pain	Combination pharmaceuticals	11,377	Patients aged 20–60; cost < CHF 170	6,076
17 Herpes zoster	Pharmaceuticals	6,505	Patients aged 12 or more; cost < CHF 162	2,750
20 Hand/foot mycosis	Pharmaceuticals	24,395	No pharmaceuticals except those used for identification; cost < CHF 129	4,594
24 Vulvovaginitis	Pharmaceuticals	23,332	Women, no pharmaceuticals except those used for identification; cost < CHF 187	4,161

Source: Criteria defined together with pharmaSuisse. Numbers calculated based on the reference treatments.

1 CHF ≈ 0.92 EUR

6.2 Definition of an emergency consultation

For the construction of comparator 3, we had to identify emergency consultations among the reference treatments.

A consultation in an emergency setting is identified by having tariff point 00.0010 plus one of the following tariff points: 00.2505, 00.2510, 00.2520, 00.2530, 00.2540, 00.2550, 35.0610, 35.0510. The tariff points starting by 00.25 can be billed by physicians in independent practice to compensate them for having to see patients immediately or at inconvenient times. The last two of those can be billed by emergency rooms in hospitals to compensate for the use of infrastructure.

6.3 Prices for physician visits

This section describes how we calculated the prices used in the cost comparison.

Visits to pharmacists are currently not remunerated, so we assume cost of CHF 0 for pharmacist consultations outside the netCare service. For physician consultations, there is a tariff system («Tarmed») assigning each service a number of tariff points. The tariff points are then multiplied by a monetary «tariff point value» in order to define payment. The points per service are the same nationwide, but the point values differ between cantons in order to reflect regional differences in factor prices (rents, salaries of staff, etc.).

A basic physician consultation³ contains the tariff codes listed in Table 7. This consultation is valued at 44.40 tariff points. We multiplied the tariff points by a weighted average of the cantonal tariff point values, using the number of inhabitants as a weight. This amounts to CHF 0.88, see column 4 in Table 7.

Table 7 Cost of a physician visit

Tariff code	Description	Tariff points	Average tariff point value	Average cost in CHF
00.0010	Diagnostics and treatment, first 5 min.	17.76	0.88	15.63
00.0020	Diagnostics and treatment, each 5 min.	17.76	0.88	15.63
00.0030	Diagnostics and treatment, last 5 min.	8.88	0.88	7.81
Total		44.40	0.88	39.07

Source: Own calculations, 1 CHF ≈ 0.92 EUR.

In order to calculate the cost of an emergency visit, we add the average emergency fee observed in the reference treatments. This amounts to CHF 41. The expected cost of an emergency visit to a doctor is therefore CHF 39.07 + CHF 41 = CHF 80.07.

³ This combination was most frequently observed in the reference treatments.

Table 8 Summary of prices in comparator setting

Consultation service	Price
Price of a visit to a pharmacist (without netCare)	CHF 0.00
Price of a visit to a physician in independent practice	CHF 39.07
Price of an emergency visit	CHF 80.07

Source: Own calculations, 1 CHF \approx 0.92 EUR.

6.4 Cost effectiveness with unequal treatment success

This section describes the calculation of results for unequal treatment success.

Since most netCare treatments are for acute conditions such as cystitis, conjunctivitis or pharyngitis, patients usually will seek other treatments if not successful at first. Eventually, the vast majority of patients will get cured from the minor ailment but at different cost. Therefore, we take into account follow-up cost of initially unsuccessfully treated patients. This leaves us with a 100% success rate in all scenarios and we can directly compare the adjusted treatment cost.

We assume that an additional visit to a physician is necessary if the pharmacist did not succeed in curing the patient. In these cases, the cost per treatment equals the cost of the pharmacist consultation plus the additional cost of a physician consultation (CHF 39.07). With $P_{success}$ denoting the probability of the pharmacist being successful, the additional follow-up cost per initially unsuccessful treatment can be described by equation (3).

$$\begin{aligned} \text{netCare: additional expected cost due to unsuccessful pharmacist} \\ \text{consultations} = & \quad (3) \\ (1 - P_{teleconsultation})(1 - P_{success}) * CHF 39.07 \end{aligned}$$

The first term of equation (3), $(1 - P_{teleconsultation})$ denotes the probability that the pharmacist treats the patient without the help of a physician. The second term is the probability that the pharmacist is not successful. Multiplied, they are the probability that the pharmacist treats the patient alone and is not successful. This probability is multiplied by the additional cost of a physician consultation.

The assumption of pharmacists and physicians not being equally effective also alters the expected cost of the comparators 2 and 3 because the cases treated by pharmacists (37% of all cases) have a risk of being not successful at first, $(1 - P_{success})$. The additional cost of comparators 2 and 3 therefore are described by equation (4).

$$\begin{aligned} \text{comp. 2, 3: additional expected cost due to unsuccessful pharmacist} \\ \text{consultations} = & \quad (4) \\ 0.37 * (1 - P_{success}) * CHF 39.07 \end{aligned}$$

Using these formulas, we are now able to calculate for each scenario the success probability $\tilde{P}_{success}$ that leads to equal cost between netCare and the comparator (see Table 9). In scenario 1, the expected cost of netCare would equal the expected cost of the comparator if the success rate of pharmacists was 51%. Put the other way, expected cost of netCare are smaller than those

of the comparator as long as the success probability is above 51%. In scenarios 2 and 3, the probabilities leading to equal expected cost amount to 92%, and 74%, respectively.

Table 9 Success probabilities of pharmacists leading to equal expected cost per patient treated between netCare and comparators

Scenario	Success probability leading to equal expected cost
1	$23.16 + 0.83 * (1 - \tilde{P}_{success}) * 39.07 = 39.07 \quad \Leftrightarrow \quad \tilde{P}_{success} = 51\%$
2	$23.16 + 0.83 * (1 - \tilde{P}_{success}) * 39.07 = 24.61 + 0.37 * (1 - \tilde{P}_{success}) * 39.07 \quad \Leftrightarrow \quad \tilde{P}_{success} = 92\%$
3	$23.16 + 0.83 * (1 - \tilde{P}_{success}) * 39.07 = 27.90 + 0.37 * (1 - \tilde{P}_{success}) * 39.07 \quad \Leftrightarrow \quad \tilde{P}_{success} = 74\%$

Source: Own calculations, 1 CHF \approx 0.92 EUR.

6.5 Robustness tests

This section describes the robustness tests mentioned in the discussion section of the paper.

6.5.1 Robustness test with regard to the share of consultations by pharmacists in scenario 3

In our view, scenario 3 is the most realistic one because it incorporates all different providers currently involved in the management of minor ailments in Switzerland. An important issue is the share of pharmacist consultations in the comparator. If the netCare-service would mainly replace «normal» pharmacy visits, it could not be cost effective. To assess sensitivity in this dimension, we calculate what share of pharmacy consultations ($\tilde{P}_{pharmacy}$) in the comparator would lead to equal expected cost. The result of 47% (see Table 10) can be interpreted as follows: If netCare replaces physician visits in only 53% of the cases, while in the other 47% it replaces «normal» pharmacy visits, the netCare service is still not more expensive than the comparator and therefore cost effective.

Table 10 Share of visits to pharmacists leading to equal expected cost between net-Care and the comparator in scenario 3

Probability of pharmacists consultations in the comparator that lead to equal expected cost in scenario 3	
$CHF\ 23.16 = (1 - \tilde{P}_{pharmacy}) * CHF\ 44$	$\Leftrightarrow \quad \tilde{P}_{pharmacy} = 47\%$

Source: Own calculations, 1 CHF \approx 0.92 EUR.

6.5.2 Robustness test with regard to the share of teleconsultations

An assumption that can be varied to assess the sensitivity of our results is the share of teleconsultations with physicians. Until now, we used the number reported in the netCare case documentation where 17% of all netCare patients had a teleconsultation with a physician. The higher the share of teleconsultations, the higher the costs of netCare since they come with an additional fee of CHF 48. Table 11 shows the probability of a teleconsultation leading to equal expected cost of netCare and the comparator ($\hat{P}_{teleconsultations}$). For comparator 1, this probability amounts to 50%. Even if teleconsultations occurred in half of the cases, the costs for netCare would still not be higher than the costs of the comparator. In scenario 2 and 3, equal costs result if a teleconsultation occurs in 20% and 27% of cases, respectively.

Table 11 Share of teleconsultations leading to equal expected cost between netCare and comparators

Scenario	Share of teleconsultations leading to equal treatment cost between netCare and the comparators	
1	$15 + \hat{P}_{teleconsultations} * 48 = 39.07$	$\leftrightarrow \hat{P}_{teleconsultations} = 50\%$
2	$15 + \hat{P}_{teleconsultations} * 48 = 24.61$	$\leftrightarrow \hat{P}_{teleconsultations} = 20\%$
3	$15 + \hat{P}_{teleconsultations} * 48 = 27.90$	$\leftrightarrow \hat{P}_{teleconsultations} = 27\%$

Source: Own calculations, 1 CHF \approx 0.92 EUR.

6.6 Fees for dispensing prescription drugs

The main part of the netCare service is the pharmaceutical triage. If indicated by the decision trees, pharmacists recommend prescription medication and dispense these drugs to patients. In such cases, there is an extra fee called LOA (Leistungs-Orientierte Abgabe) that compensates pharmacists for managing the patient's drug treatment. This fee is always charged if pharmacists dispense prescription medications and is not restricted to netCare. However, physicians dispense many drugs by themselves, especially in emergency situations and in the German speaking cantons of Switzerland. Physicians never charge the LOA fee, which might distort our cost comparison.

As a further test of sensitivity, we calculate the cost of netCare and the comparators, including LOA. Further assumptions are needed for this calculation. First, we need to define the share of patients receiving prescription medication in both netCare and the comparators. We cannot directly observe this number in the case series, but there are cases where we know that they did not receive prescription medication or a telemedical consultation. We assume that all the remaining patients received prescription medication, limiting the risk of underestimating LOA cost. The assumed share is the same for netCare and the comparators, because we do not think that there should be a difference in patient need for treatment (otherwise, the comparators would not be true alternatives to netCare).

For netCare patients, LOA is charged whenever a prescription medication was dispensed. In the comparators, it is only charged if a public pharmacy (rather than a physician) dispensed the drug. This was true for 36% of the cases in the reference treatments. We therefore assume that 36% of the comparator cases with prescription drugs were charged LOA.

The last assumption concerns the number of LOA tariff points. This differs between netCare and the comparators, because a part of the possible LOA services is already included in the net-

Care price. We therefore assume that pharmacists in the netCare setting charge four tariff points («Medikamenten-Check»), while pharmacists in the comparators charge seven tariff points («Medikamenten-Check» and «Bezugscheck»).

Table 12 summarizes the calculations. The expected additional cost for LOA fees is CHF 2.72 per netCare case and CHF 1.72 per case in the comparators. The expected cost of a netCare case is CHF 3.73 or about 13% lower than the expected cost of comparator 3, the most realistic comparator. In the case of comparator 2, netCare and the comparator have the same expected cost.

Table 12 Cost comparison including fees for prescription drugs

	$P_{\text{prescription}}$	$P_{\text{LOA prescription}}$	P(LOA)	Tariff points LOA	Tariff points value LOA CHF	Additional cost per case CHF	Total cost per case CHF
netCare	0.63	1	0.63	4	1.08	2.72	25.88
Comp. 1	0.63	0.36	0.23	7	1.08	1.72	40.78
Comp. 2	0.63	0.36	0.23	7	1.08	1.72	26.32
Comp. 3	0.63	0.36	0.23	7	1.08	1.72	29.61

Source: Own calculations, 1 CHF \approx 0.92 EUR.