

BMJ Open What is the impact of introducing a non-clinical community health advice and navigation service on the demand for primary care in socially deprived areas? Evidence from an observational panel study with difference-in-differences design

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ABSTRACT

Objectives To examine the effect of introducing a non-clinical community health advice and navigation service on the demand for primary care in a socially deprived area.

Design Observational panel study with difference-in-differences design. We conducted fixed-effects negative binomial regressions to compare changes in the number of visits to general practitioners (GPs) in individuals who visited the health advice and navigation service and a matched control group of individuals who did not visit the service. In addition, we analysed the effects of visiting the service multiple times.

Setting and participants Our empirical setting is a socially deprived urban area in Germany with a multicultural population of about 110 000 people. Our analyses are based on patient data (N=1044) from a non-clinical community health advice and navigation service and from two statutory health insurers.

Outcome measures Patient demand for primary care measured as the number of visits to GPs before and after the first visit to the health advice and navigation service.

Results Visiting the service for the first time significantly decreased the number of GP visits compared with the control group ($\beta=-0.113$, $p<0.1$). Each additional visit to the service, however, significantly decreased the effect of the first visit ($\beta=0.037$, $p<0.05$).

Conclusions Our findings suggest that non-clinical community health advice and navigation services can serve as a low-threshold first point of contact. As first point contact, such services might possibly reduce the burden of primary care physicians in socially deprived areas. At the same time, such services might function as a gateway to accessing the health system, reducing unmet care needs and stimulate demand. Ongoing counselling in the service can identify medical needs that require a physician visit. Our findings may be useful for policymakers and healthcare leaders seeking to reduce the demand on the primary care workforce and can stimulate further research in this area.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This study used administrative data from two large statutory health insurers to calculate patient demand for primary care.
- ⇒ This study used a difference-in-differences regression approach allowing to control for observed and unobserved effects and time trends by comparing patients who used the non-clinical community health service, with a control group of matched patients who did not.
- ⇒ The study only estimated overall effects and did not distinguish between different types of services by their potential of substitution.
- ⇒ Due to the time frame of the data, this study could not determine whether the short-term intervention leads to a long-term change in demand for primary care.

INTRODUCTION

Health systems worldwide are facing shortages of primary care physicians, particularly in socially deprived areas.¹⁻³ As a result, demand for these services in such areas exceeds the available supply, leading to inequalities and a decline in the quality of healthcare.^{4,5} This imbalance of supply and demand is further exacerbated by so-called misplaced demand: especially in socially deprived areas, patients often do not distinguish between social and medical problems when seeking help from primary care physicians. Thus, physicians are more likely to be confronted with questions about social concerns that do not actually fall within the scope of their practice and expertise. In fact, around 20% of patients are estimated to consult their general practitioners (GPs) about primarily social concerns.^{6,7} In

these areas, the concentration of social problems, however, implies that the social determinants of health and well-being must be addressed alongside medical care.⁸ Indeed, a qualitative focus group study conducted in an area of high socioeconomic deprivation in Scotland found that patients from deprived areas require more holistic care, which implies an understanding by GPs of the realities of life in such areas, as well as continuity of relationships, empathy and sufficient time in the consultation.⁸ However, these expectations and requirements are often met by an understaffed primary care workforce and cannot be adequately addressed. The resulting work overload can lead to stress and burnout,⁹ which in turn exacerbates the inadequate and inappropriate healthcare provided in these areas. Thus, misplaced demand and the scarcity of primary care services are mutually reinforcing problems in socially deprived areas, which urgently need to be addressed.

One approach to solving this problem is to create a range of integrated clinical and non-clinical health services that, in addition to medical matters, can also address concerns about the social determinants of health, for example, through advice and counselling. In this context, the non-clinical health services provided by community or voluntary sector organisations are increasingly being advocated as a way to help primary care and other office-based physicians in the community deal with complex social, mental, and physical problems and improve health outcomes.^{10–14} These services have also been repeatedly credited with the potential to relieve the burden on primary care physicians and other community-based medical professionals and improve their working conditions in the long term.^{15 16} Thus, non-clinical health services have the potential to enable a more effective health service provision and thereby reduce GP use. At the same time, non-clinical community and voluntary sector health services can also improve access to primary care and thus also increase demand for and use of primary care services.¹⁷

To date, evidence on how integrating non-clinical community and voluntary sector health services with primary care affects the demand for GP visits is mixed and remains inconclusive. Some studies have provided initial evidence for a reduction in the demand for primary care,^{15 16} which might be due to a shift in the volume of consultations to the community sector.¹⁸ These studies, however, have focused mainly on approaches like social prescribing schemes, which offer primary care professionals the opportunity to refer people to a range of local, non-clinical services to support their health and well-being. Other studies have found no statistically significant reductions in patient demand for primary care.^{17 19 20}

Adding to the inconsistency of the evidence available to date are a range of methodological and data limitations. First, the majority of studies have analysed patient-reported use of services or physician reports of perceived drops in demand,^{15 19} both of which were subject to recall bias in these non-blinded trials. Second, a common

methodological strategy in prior research has been to use average-based change statistics to compare the demand for primary care before and after non-clinical community and voluntary sector health service interventions.^{15 16 20} However, a simple before–after comparison does not allow the effect of a new service to be disentangled from further potential factors that change over time, such as other developments affecting the demand for physician services, including general time trends. Also, when investigating average-based change statistics, it is not possible to account for a decrease or increase in individual demand for primary care while also considering individual-level factors that might explain some of the variation in physician visits, such as age, gender and health status.

In our study, we aimed to address this gap in the literature by examining the effect of introducing a non-clinical community health advice and navigation service on the demand for GP visits in a socially deprived area. We addressed the limitations outlined above, extending previous research in two ways: first, we drew upon administrative data from two statutory health insurers to calculate patient demand for primary care. Second, we applied a difference-in-differences (DiD) regression approach, in which we controlled for unobserved effects and time trends by comparing patients who used the non-clinical community health service with a control group of matched patients who did not.

Our results can inform policymakers and healthcare leaders about the ways in which expanding non-clinical community and voluntary sector health services can affect demand for primary care. This knowledge is urgently needed as we search for effective ways to ameliorate the burden of the primary care workforce and improve the quality of healthcare in socially deprived areas.

METHODS

Research setting and data

This study was part of a larger research project evaluating an integrated care model in a socially deprived urban area in Germany. Whereas the following description of the setting applies to the whole project, the data, methods and statistical analyses are unique to this specific study. Our empirical setting was a socially deprived urban area in Germany with a multicultural population of about 110 000 people. Our analyses are based on data from a non-clinical community health advice and navigation service introduced in October 2017. The service offers one-on-one sessions and group interventions in which patients can receive health advice and education from nurses and allied health workers on topics such as dietary change, smoking cessation, social and family issues, as well as assistance with administrative procedures, in their first language. The service aims to help patients better understand their individual burden of disease and opportunities for prevention. In addition, the service helps patients prepare for and follow up on physician visits,

provides information about other services in the community, and helps patients find and arrange appointments with the appropriate health professionals and existing local community services, groups, and activities. Patients can take two distinct pathways to use the service: social prescription (ie, a physician refers a patient to the service) or self-referral (ie, patients make an appointment with and access the service without first seeing, and being referred to it, by a physician). Regardless of the pathway taken, the service is free at point of use for all patients.

Our data stem from two sources: first, we extracted information on patients' initial visit to the service and the number of subsequent visits to the service based on electronic visitor records. The data set accounts for all patients who visited the service at least once from 1 January 2018 to 31 December 2019 and includes the exact dates of the visits. Second, we extracted information on patient demand for GPs (ie, the exact date of all visits to any GP) between 1 October 2017 and 31 December 2019 from the administrative data of two statutory health insurers (covering more than one-third of the statutory health-insured inhabitants in this area) (Around 88% of the German population are covered by statutory health insurance, 10% are privately health insured, and 2% have other or, to a very small share, no health insurance. The two statutory health insurers that provided the data in this study provide health insurance to more than 3 million persons in Germany each and to more than 35 000 of the 105 000 inhabitants in this local area.). We constructed a control group from the second data set by matching individuals in the intervention group (ie, individuals who visited the service at least once during the observation period) to individuals who did not visit the service.

Measures

Table 1 gives a description of the study variables. The dependent variable of interest was patients' demand for primary care measured as the *number of visits to any GP before and after* the first visit to the health advice and navigation service. GPs in Germany deliver a range of services, such as first-contact care, preventive care, diagnosis, treatment, and follow-up of diseases, referral to specialists, and health promotion.^{21 22} Although these services have traditionally involved a mostly biomedical approach to healthcare, concerns about the social determinants of health have been raised with increasing frequency over the past two decades, especially in deprived urban areas. It can therefore be assumed that the non-clinical community health advice and navigation service examined in this study might influence the demand for visits to GPs.

Because there is no common definition of, or empirical evidence on, the optimal length of an observation period for counting GP visits, we used 4 months in our main analyses and conducted sensitivity analyses using observation periods of different lengths to test the robustness of our results (see sensitivity analyses in the Results section).

The main independent variables of interest were a dummy for whether the patient visited the health advice

Table 1 Description of study variables

Variable	Description
Dependent variable	
Number of GP visits	Count variable: total number of patient visits to any GP in the 4 months before/after patient's first visit to the health advice and navigation service
Control variables	
First visit to the service	Binary variable 0=patient visited the health advice and navigation service at least once (ie, intervention group) 1=patient did not visit the health advice and navigation service (ie, control group)
Subsequent visits to the service	Count variable: total number of patient visits to the health advice and navigation service following the first visit
Post	Binary variable 1=pre-intervention period (ie, before the first visit to the service) 0=post-intervention period (ie, after the first visit to the service)
Gender	Binary variable 0=male 1=female
Age	Continuous variable: age in years
Overweight	Binary variable 0=patient had at least one registered overweight diagnosis 1=patient had no registered overweight diagnosis
Comorbidity (Elixhauser Index)	Continuous variable: measure of patient comorbidity based on the sum of 31 binary comorbidity categories ^{28 29}
Number of specialist visits	Count variable: total number of patient visits to specialists in the 4 months before/after patient's first visit to the health advice and navigation service
GP, general practitioner.	

and navigation service at least once ('first visit to the service', corresponding to being in the intervention group) and the total number of subsequent visits to the service during the 6 months following their initial visit within the observation period ('subsequent visits to the service'). In the control group, we assigned each individual a fictitious date for the first visit to the service, which corresponded to the date on which their matched partner in the intervention group visited the service for the first time. We controlled for patient gender, age, comorbidity and overweight diagnosis (due to the high share of patients with this diagnosis in the intervention group and a high correlation between the prevalence of overweight and socioeconomic status²³⁻²⁵). Finally, because there is

no gatekeeping system in Germany^{21 22} and patients have direct access to specialist care, we included the number of specialist visits as a control variable in order to avoid bias due to substitution effects.

Matching and sample

We excluded patients who were younger than 18 years, switched during the observation period from one statutory health insurer to another, were not covered by any of the two statutory health insurers in our study, moved (ie, changed their address), or whose physician visits could not be classified as GP or specialist care. As a result, our final data set consisted of data from 1044 patients who had visited the health and navigation service at least once (intervention group).

The second data set comprised information on 33 165 other individuals from the same urban district who had no visits to the service (potential control group). We applied Mahalanobis matching with a calliper of 1.0 and with replacement in order to match patients in the intervention group to patients who did not visit the service based on the following covariates: gender, age, comorbidity (Elixhauser score), overweight diagnosis for the years 2015–2017 and number of physician visits (GPs and specialists) in the years 2015–2017 (ie, before visiting the service). After finding a match and in order to calculate the number of physician visits (GPs and specialists) before and after the first visit to the service, we assigned the dates of the initial visit to the service of their individual matches in the intervention group to the control group. We conducted sensitivity analyses for our matching approach by (1) removing the calliper (ie, finding a match for all observations) and (2) additionally excluding outliers with respect to the number of GP visits in the pre-intervention period of the years 2015–2017 (outliers were defined as being more than 1.5 times the interquartile distance from the 75% quantile). We assessed the appropriateness of the matching with an unpaired t-test for indicator variables and by calculating the variance ratio for continuous variables. The detailed results of the different matchings are listed in the online supplemental appendix 1A–C. Overall, the quality of the matching was high, with the variance ratios of the continuous variables all being close to one and all significant differences in the means of the indicator variables having been eliminated. Although our matching was successful at reducing standardised differences on all matched variables, trend analyses showed that the intervention and control groups did not perfectly align. To ensure that this bias did not drive our findings, we also present the results of the baseline analyses focusing on the intervention group only (ie, pre/post-regressions, see below).

Statistical analyses

DiD analyses with a matched control group

We estimated the effect of visiting the health advice and navigation service on the number of GP visits using a DiD approach. Moreover, we extended the standard DiD

approach by additionally taking account of the intensity of using the service (ie, the number of *subsequent visits to the service* after the first visit to it). We therefore included an additional interaction term, which represents the effect of each visit subsequent to the first visit to the service.

For our regressions, we used a fixed-effects negative binomial regression model because our dependent variable (ie, the number of GP visits) was count data. Our regression model is specified as follows:

$$Y_{iT} = \beta_0 + \beta_1 \text{Post}_T + \beta_2 \text{First_visit}_i + \beta_3 \text{Post}_T + \beta_4 X_{iT} + \beta_5 \text{Post}_T \text{First_visit}_i \text{Add_visits}_i + u_i \varepsilon_{iT}$$

where Y_{iT} is the number of GP visits made by patient i in period $T=T_1, T_2$, with T_1 representing the pre-intervention period (ie, 4 months before the first visit to the service) and T_2 representing the post-intervention period (ie, 4 months after the first visit to the service); *Post* is an indicator variable that has a value of 0 in period T_1 and a value of 1 in period T_2 and represents the intervention-independent time effect; *First visit* is an indicator variable that has a value of 1 for patients in the intervention group and a value of 0 for patients in the control group and controls for time-invariant differences between the intervention and control groups; X_{iT} are observable factors affecting the number of GP visits made by patient i in period T . We also included time-invariant factors, because the fixed-effects negative binomial regression specification in Stata is implemented as the Hausman *et al* model,²⁶ which actually allows time-invariant regressors. Finally, u_i is the patient's fixed effect, and ε_{iT} is the random error. The intervention effect of the first visit, coefficient β_3 , identifies changes in the number of GP visits in the intervention group relative to changes in the number of GP visits in the control group, and coefficient β_5 is the intervention effect of each subsequent visit to the service compared with no (subsequent) visit.

Pre/post-analyses in the intervention group

To account for the fact that the DiD approach might not fulfil the parallel trend assumption, we conducted additional analyses focusing on the intervention group only. In particular, we conducted fixed-effects regressions to assess whether there was a significant change in the number of GP visits from before to after the first visit to the health advice and navigation service (ie, pre/post-regressions). In a second model, we included an interaction term for the effect of each subsequent visit to the service. In contrast to the DiD approach, this model assumes that all changes occurring over time relate only to the intervention; thus, we cannot estimate a separate time effect.

Additional analyses

To assess whether there have been differences in the use of services by different types of patients, we conducted subgroup analyses stratified by patient gender, age, Elixhauser score and the existence of an overweight diagnosis. For the continuous variables, we used median splits;

we repeated the analyses for the resulting two groups of observations and compared the regression coefficients in terms of direction and magnitude.

Sensitivity analyses

To ensure the robustness of our findings, we repeated the analyses with varying time periods, data analysis methods and changes in samples based on the matching variations described above. First, we repeated our regression analyses using periods of different lengths before and after patients' first visit to the service—that is, 3 months, 5 months, 6 months and 1 year (instead of 4 months). Second, as there are ongoing discussions about the robustness of the fixed-effects negative binomial regressions model, we (a) omitted the control variables from our regressions and (b) used a standard negative binomial regression model with SEs clustered at the individual level. Finally, we repeated the analyses with the different samples resulting from the matching variations: first, based on all observations (matching without calliper) and, second, based on a more restricted sample that additionally excluded outliers with respect to physician visits before the use of the service.

We performed all analyses with Stata V.16 (College Station, Texas, USA).

Patient and public involvement

This study is part of a larger project evaluating an integrated care model in a socially deprived urban area in Germany. The public—that is, a statutory health insurer, physicians, local healthcare managers and patient representatives—were involved in the design and implementation of the overall project. In addition, practitioners (physicians, local healthcare

workers, healthcare managers) and scientific experts were involved in discussing the research idea of this study. The results of the study and the overall project will be disseminated to the participants via practice-oriented publications and newsletters.

RESULTS

Descriptive results

Table 2 contains descriptive statistics for the study variables. The visitors to the health and navigation service, that is, individuals in the intervention group (IG1), were somewhat older on average than the population sample (CG0; 49.5 years compared with 41.7 years), had more comorbidities (Elixhauser score of 3.7 compared with 2.7), and comprised a larger share of women (68% compared with 51%) and of persons with an overweight diagnosis (42% compared with 18%). For the matched control groups, the differences to the intervention groups were eliminated.

Regression results

The results of our regressions are summarised in table 3. Whereas the first two columns of table 3 report the results for the total sample of patients (ie, the control and intervention groups), the latter two columns report the results only for the intervention group. The coefficients of interest with regard to our research questions are marked in bold. The intervention effect of the first visit was significantly negative—that is, visiting the service once significantly decreased the number of GP visits. However, the intervention effect of subsequent visits was significantly positive: each additional visit to the service significantly

Table 2 Characteristics of the study population

	IG1	IG2	IG3	CG0	CG1	CG2	CG3
n	1044	534	527	33 165	1004	523	516
Control variables							
Female	68%	63%	63%	51%	68%	63%	63%
Age	49.5	44.5	44.5	41.7	49.4	43.9	43.8
Elixhauser score	3.7	1.3	1.3	2.7	3.3	1.2	1.2
Overweight	42%	29%	29%	18%	42%	29%	29%
Number of specialist visits (mean) in the 4 months							
Before the first visit to the service	6.7	5.0	5.0	n.a.	4.6	2.9	2.9
After the first visit to the service	6.4	4.6	4.7	n.a.	4.1	2.4	2.4
Dependent variable							
Number of GP visits (mean) in the 4 months							
Before the first visit to the service	5.6	4.0	4.0	n.a.	4.0	2.4	2.4
After the first visit to the service	4.9	3.1	3.2	n.a.	3.5	2.1	2.1

IG1: whole intervention group (IG); IG2: IG after main matching (with calliper); IG3: IG after excluding outliers; CG0: all observations not using the intervention (potential matches); CG1, 2, 3: matched control group (CG) of IG1, 2, 3 (fewer observations than in the IG because some observations serve as match for several observations in the IG).

GP, general practitioner; n.a., not available because no fictitious service use date assigned.

Table 3 Regression results

Variables	Difference-in-differences regressions		Pre/post-regressions	
	First visit only	First and subsequent visits	First visit only	First and subsequent visits
Intervention effect (first visit)	-0.113* (0.067)	-0.175** (0.073)	-0.110** (0.044)	-0.170*** (0.053)
Intervention effect (subsequent visits)		0.037** (0.018)		0.036** (0.018)
Intervention-independent time effect	0.004 (0.052)	0.004 (0.052)		
Service users	0.077 (0.475)	0.109 (0.479)		
Age	0.022 (0.014)	0.023* (0.014)	0.003 (0.017)	0.004 (0.017)
Gender (female=1)	0.242 (0.446)	0.193 (0.454)	0.250 (0.543)	0.165 (0.554)
Elixhauser score	0.072 (0.059)	0.068 (0.059)	0.081 (0.061)	0.074 (0.060)
Overweight	0.721 (0.558)	0.761 (0.570)	0.715 (0.726)	0.776 (0.744)
Specialist visits	0.020*** (0.005)	0.022*** (0.005)	0.017*** (0.006)	0.018*** (0.006)
Constant	45.118* (27.146)	47.404* (27.322)	7.025 (34.252)	10.113 (34.436)
Observations	1388	1388	756	756
Number of groups	690	690	378	378

We estimated fixed-effects negative binomial models and present robust SEs, shown in parentheses. Statistical significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Analyses are based on IG2 and CG2. Individuals with missing data and all zero outcomes dropped. CG, control group; IG, intervention group.

increased the number of GP visits or, in other words, decreased the effect of the first visit. One useful way to interpret the magnitude of the effects of the regression models in [table 3](#) is through the use of incidence rate ratios. The fitted model parameters describing the effects of visiting the service on GP visits, when exponentiated, give an estimate of the incidence rate ratio: this rate ratio can be interpreted as the proportionate increase in the number of GP visits for a one-visit increase in the number of service visits. In other words, visiting the service once (compared with no visit) was associated with 0.86-unit decrease in the number of (ie, 14% fewer) GP visits. A 1-unit increase in the number of subsequent service visits was associated with a 1.03-unit increase in the number of (ie, 3% more) GP visits.

Regarding the other variables, the results of the DiD regressions show that there was no significant intervention-independent time effect—that is, on average, the number of GP visits did not differ before and after the time of the first visit. Because most of the individual variation is captured in the individual fixed effect, the time-invariant control variables do not significantly affect the number of GP visits (except for a positive age effect in the last

regression), whereas a change in the number of specialist visits positively relates to a change in the number of GP visits, suggesting that there are complementary rather than substitution effects between GP visits and visits to specialists. The analyses focusing on the intervention group support these findings.

The additional stratified analyses reveal that the direction of the intervention effects (negative for first visit and positive for subsequent visits) remains stable for all subgroups (detailed results are provided in the online supplemental appendix 2A–D). In terms of magnitude, effects seem slightly more pronounced for men. The DiD regression results point towards slightly more pronounced effects for persons without overweight diagnosis (compared with persons with overweight diagnosis) and a more pronounced effect of the first visit for older persons (compared with younger persons). No substantial differences in effect sizes can be observed based on patient comorbidities (ie, low vs high Elixhauser score).

The results of our sensitivity analyses are summarised in [tables 4 and 5](#) (only the coefficients for the intervention effects are presented). These largely support our findings. Altering the time periods to 3

Table 4 Results of sensitivity analyses for difference-in-differences regressions

Model changes: time periods	Time period 3 months		Time period 5 months		Time period 6 months		Time period 12 months	
	First visit only	First and subsequent visits	First visit only	First and subsequent visits	First visit only	First and subsequent visits	First visit only	First and subsequent visits
Intervention effect (first visit)	-0.168** (0.073)	-0.224*** (0.081)	-0.114* (0.061)	-0.157** (0.066)	-0.051 (0.058)	-0.107* (0.063)	0.019 (0.055)	-0.011 (0.061)
Intervention effect (subsequent visits)		0.035* (0.021)		0.026* (0.016)		0.033** (0.015)		0.015 (0.013)
N	1428		1350		1270		932	

Model changes: data analysis method and sample	Fixed-effects model without control variables		Negative binomial regression with clustered SEs		Sample with all observations		Sample excluding outliers	
	First visit only	First and subsequent visits	First visit only	First and subsequent visits	First visit only	First and subsequent visits	First visit only	First and subsequent visits
Intervention effect (first visit)	-0.088 (0.069)	-0.138* (0.075)	-0.093 (0.074)	-0.117 (0.08)	-0.016 (0.037)	-0.017 (0.04)	-0.103 (0.067)	-0.166** (0.074)
Intervention effect (subsequent visits)		0.031* (0.019)		0.014 (0.021)		0.000 (0.008)		0.038** (0.018)
N	1388		1664		3094		1380	

We report the main coefficients of interest from the sensitivity analyses (all other variables from main analyses included but not shown) and present robust SEs in parentheses. Statistical significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

and 5 months did not change the regression results. Extending the observation period to 6 or 12 months led to some of the regression coefficients becoming non-significant, whereas the direction of the coefficients remained the same. Using fixed-effects negative binomial regressions without control variables and negative binomial regressions with clustered SEs also led to similar results, although with fewer significant effects in the DiD regressions. Finally, when changing

the sample (ie, extending it to all observations or excluding outliers), the results of the DiD analyses became mostly non-significant, which might be due to reduced comparability between the intervention and control groups for the samples including all observations and a lower power for the sample excluding outliers. The effects remained stable across sample variations when focusing on the intervention group only (table 5).

Table 5 Results of sensitivity analyses for pre/post-regressions

Model changes: time periods	Time period 3 months		Time period 5 months		Time period 6 months		Time period 12 months	
	First visit only	First and subsequent visits	First visit only	First and subsequent visits	First visit only	First and subsequent visits	First visit only	First and subsequent visits
Intervention effect (first visit)	-0.118** (0.049)	-0.174*** (0.059)	-0.110*** (0.039)	-0.150*** (0.047)	-0.064* (0.038)	-0.115** (0.046)	-0.012 (0.039)	-0.04 (0.047)
Intervention effect (subsequent visits)		0.035* (0.021)		0.025 (0.017)		0.030* (0.015)		0.014 (0.014)
N	784		730		680		486	

Model changes: data analysis method and sample	Fixed-effects model without control variables		Negative binomial regression with clustered SEs		Sample with all observations		Sample excluding outliers	
	First visit only	First and subsequent visits	First visit only	First and subsequent visits	First visit only	First and subsequent visits	First visit only	First and subsequent visits
Intervention effect (first visit)	-0.104** (0.045)	-0.155*** (0.054)	-0.109** (0.047)	-0.136** (0.056)	-0.061** (0.024)	-0.060** (0.029)	-0.108** (0.044)	-0.170*** (0.053)
Intervention effect (subsequent visits)		0.031* (0.019)		0.016 (0.02)		0.000 (0.008)		0.037** (0.018)
N	756		832		1608		750	

We report the main coefficients of interest from the sensitivity analyses (all other variables from main analyses included but not shown) and present robust SEs in parentheses. Statistical significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

DISCUSSION

With its thorough empirical and methodological approach, our study extends the existing evidence base on non-clinical community and voluntary sector health services and their effect on the demand for primary care. We found that making one visit to such a service, which offered health advice and assistance navigating the health system, led to a significant decrease in the number of GP visits in our empirical setting. When we investigated the effect of subsequent visits, however, our findings indicated that each additional visit to the service had a significant positive effect on the number of GP visits, attenuating the significant negative effect of the first visit. Importantly, however, the effect of the first visit on the number of GP visits was significantly larger (0.86; -14%) than that of subsequent service visits (1.03; 3%).

Our results suggest that some service provision may have shifted from GPs to the health advice and navigation service, decreasing the number of GP visits. This would fit the notion that introducing such a service might reduce the burden and work overload of primary care and other community-based physicians.¹⁶ This finding might also indicate that a service of this nature could serve as a low-threshold substitute for the first-contact care function of GPs. In particular, the medical and social concerns of patients with minor health complaints and a generally good health status might have already been adequately addressed after a single visit and possibly resolved more in a more comprehensive and sustainable way than would have been possible in a GP visit, especially if reason for consulting the service was a social one. This possible explanation needs to be empirically investigated in further research.

Some of the main goals of the health advice and navigation service examined in this study were to educate or reassure patients, motivate them to help themselves and appropriately manage their demand for healthcare services. Our results carefully suggest that the service may indeed have contributed to the delivery of more holistic care and thus the possibly reduced misplaced demand for primary care.

Interestingly, subsequent visits to the service seemed to attenuate this substitution effect. One explanation for this finding could be that offering such a service in a deprived urban area might facilitate better access to care through its support in making appointments with the appropriate health professionals, and multiple visits to the service might have uncovered unmet health needs that were best addressed by a GP. Another potential explanation could be that patients who visited the service only once may have had less serious medical or social problems and therefore were less likely to visit a GP, whereas those who visited the service multiple times may have had more serious or complicated concerns that ultimately required medical care. In the latter case, the substitution effect would be less pronounced or even negative, and the health and navigation service would act as a complement to primary care. In the long run, this might lead to

improved population health through better prevention and earlier treatment, reducing the burden on the health system. Empirical investigation of these possible explanations would be a highly relevant and interesting avenue for future research.

Overall, our findings on the effects of single and multiple visits to the health advice and navigation service add further insight into the findings of studies that have focused on social prescribing schemes and not found any statistically significant reductions or increases in patient demand for primary care.^{19 20 27} Taken together, the two main opposing effects identified in our study seem to work as underlying mechanisms: visiting the health and navigation service can function as a gateway to accessing the health system and stimulate demand, but it can also function as part of the health system and take over demand from other health system actors or institutions. Ideally, these counteracting effects will not take place for all types of visit, but rather depend on the underlying health or social issue. An effective health advice and navigation service would, for example, reduce the number of GP visits made for social concerns while at the same time increasing the number of GP visits made to address medical issues—that is, improving access to care and reducing unmet care needs. Unfortunately, our data do not allow us to determine which GP visits could actually be substituted by a visit to the health advice and navigation service. The results of the stratified analyses point towards slight differences in magnitude of effects, yet the direction of the coefficients of the intervention effects remains stable across patient gender, age, overweight diagnosis and comorbidity score.

When interpreting the results of our study, a number of additional limitations need to be considered. The first set of limitations relates to the limited set of moderating factors we were able to test. We could not distinguish between different types of services by their potential for substitution. In addition, we do not have information on patients' health literacy, prevention behaviour or detailed medical records to investigate further for which types of patients the use of the non-clinical health and community service might improve access to care and hence increase GP use. Future research could try to disentangle the potential counteracting effects of reducing misplaced demand and increasing access to care as well as assessing the health outcomes associated with each care pathway (GP vs non-clinical community health counselling and navigation). Second, due to the time frame of our data, we could not see whether short-term increases in access to (and use of) care resulted in a decrease in GP visits over the long term. Further studies may wish to adopt a longer time horizon. Third, we cannot rule out all potential sources of endogeneity. There may have been time-variant unobserved characteristics that we could not control for and might distort our findings. However, by including variables identified as relevant by prior researchers and by eliminating the effect of time-invariant variables through the DiD approach, we were able to

address many of the methodological concerns that have been voiced with regard to the descriptive before–after comparisons that have been used in much of the previous research. One major precondition for the DiD approach is the parallel trends assumption—that is, the assumption that the control and intervention groups would have had behaved in the same way if the intervention had not taken place. Although this cannot be tested directly, two ways to provide support for the legitimacy of this claim are the comparability of the groups and the parallel trends of the outcome before the intervention. Regarding the former, our matching achieved comparability of intervention and control groups in all observable characteristics. Regarding the latter, our tests showed that trends in the control and intervention groups before the intervention did not perfectly align; therefore, we compared our results with the regression focusing on the intervention group only. Both approaches yielded the same results, speaking for the robustness of our findings. However, future research might seek to replicate our methodological strategy in a similar setting and find a more appropriate control group. Fourth, the generalisability of our findings cannot fully be ensured. While the large data set warrants some robustness, the sample description reveals some peculiarities, such as the deprived setting and a large share of persons with overweight diagnosis in the intervention group. Yet, the matching procedure ensured a comparable control group and subgroup analyses showed that the direction of effects did not differ for persons with/without overweight diagnosis. Finally, as some of the effects became partially non-significant in the sensitivity analyses, our results should be interpreted as tentative and the need for further research is warranted.

Our findings can inform policymakers and healthcare leaders about the ways in which expanding non-clinical community and voluntary sector health services might affect the demand for primary care. This knowledge is urgently needed as we search for more effective ways to ameliorate the work overload faced by the primary care workforce and improve the quality of healthcare in socially deprived areas. Our findings suggest that non-clinical community health advice and navigation services can serve as a low-threshold first point of contact, reducing the burden of primary care physicians and improving access to healthcare. Our study also provides some initial indication that such services might be helpful in reducing social inequities in healthcare access and population health. With this study, we intend to stimulate further research that replicates or builds upon our methodological approach to further examine the effect of non-clinical community and voluntary sector health services on the demand for GPs in socially deprived areas.

Contributors E-MW and VW designed the study. E-MW, VG, VW and VR acquired and analysed the data. All authors contributed to the interpretation of the data. VG drafted the article, and E-MW and VW critically and substantially revised it. All authors give final approval of the version to be published and agree to be accountable for all aspects of the work. No further writing assistance other than basic copyediting was provided. E-MW is responsible for the overall content as guarantor.

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Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not required.

Ethics approval This study involves human participants. A declaration of compliance with terms of use and ethical standards from the University of Hamburg's WiSo Laboratories was obtained on 28 March 2017 (no approval number provided). Participants in the intervention group gave informed consent for their data to be used for scientific purposes. For participants in the control group, informed consent was not required as legally stipulated in approval pursuant to Section 75 (2) SGB X for the transfer of social data for the research project 'Scientific Evaluation of the INVEST Billstedt/Horn Project'.

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Data availability statement Data may be obtained from a third party and are not publicly available. The data are, in large part, owned by the German statutory health insurers BARMER and AOK-RH. To fulfil the legal requirements to obtain the data, researchers must obtain permission for a specific research question from the German Federal (Social) Insurance Office. Approval pursuant to Section 75 (2) SGB X for the transfer of social data for the research project 'Scientific Evaluation of the INVEST Billstedt/Horn Project' was granted on 23 April 2018 by the competent authority: Ministry of Labor, Health and Social Affairs of North Rhine-Westphalia, Düsseldorf, Germany. Additionally, researchers must conclude a contract with the statutory health insurer regarding data access.

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REFERENCES

- Bauer J, Brueggmann D, Ohlendorf D, *et al*. General practitioners in German metropolitan areas – distribution patterns and their relationship with area level measures of the socioeconomic status. *BMC Health Serv Res* 2016;16:1–9.
- Gong G, Phillips SG, Hudson C, *et al*. Higher us rural mortality rates linked to socioeconomic status, physician shortages, and lack of health insurance. *Health Aff* 2019;38:2003–10.
- Petterson S, Phillips RL, Bazemore A. Unequal distribution of the U.S. primary care workforce. *Am Fam Physician* 2013;87.
- Macinko J, Starfield B, Shi L. Quantifying the health benefits of primary care physician supply in the United States. *Int J Health Serv* 2007;37:111–26.
- Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *Milbank Q* 2005;83:457–502.
- Low Commission. The role of advice services in health outcomes: evidence review and mapping study; 2015.
- Citizens Advice Bureau. *A very general practice: how much time do GPs spend on issues other than health?* London: Citizens Advice Bureau.



- 8 Mercer SW, Cawston PG, Bikker AP. Quality in general practice consultations; a qualitative study of the views of patients living in an area of high socio-economic deprivation in Scotland. *BMC Fam Pract* 2007;8:22.
- 9 Sabitova A, Sajun SZ, Nicholson S, et al. Job morale of physicians in low-income and middle-income countries: a systematic literature review of qualitative studies. *BMJ Open* 2019;9:e028657.
- 10 Alderwick HAJ, Gottlieb LM, Fichtenberg CM, et al. Social prescribing in the U.S. and England: emerging interventions to address patients' social needs. *Am J Prev Med* 2018;54:715–8.
- 11 Bickerdike L, Booth A, Wilson PM, et al. Social prescribing: less rhetoric and more reality. A systematic review of the evidence. *BMJ Open* 2017;7:e013384.
- 12 Crampton P, Dowell A, Woodward A. Third sector primary care for vulnerable populations. *Soc Sci Med* 2001;53:1491–502.
- 13 Moffatt S, Steer M, Lawson S, et al. Link worker social prescribing to improve health and well-being for people with long-term conditions: qualitative study of service user perceptions. *BMJ Open* 2017;7:e015203.
- 14 Munford LA, Wilding A, Bower P, et al. Effects of participating in community assets on quality of life and costs of care: longitudinal cohort study of older people in England. *BMJ Open* 2020;10:e033186.
- 15 Grayer J, Cape J, Orpwood L, et al. Facilitating access to voluntary and community services for patients with psychosocial problems: a before-after evaluation. *BMC Fam Pract* 2008;9:27.
- 16 Krska J, Palmer S, Dalzell-Brown A, et al. Evaluation of welfare advice in primary care: effect on practice workload and prescribing for mental health. *Prim Health Care Res Dev* 2013;14:307–14.
- 17 Carnes D, Sohanpal R, Frostick C, et al. The impact of a social prescribing service on patients in primary care: a mixed methods evaluation. *BMC Health Serv Res* 2017;17:835.
- 18 Faulkner M. Supporting the psychosocial needs of patients in general practice: the role of a voluntary referral service. *Patient Educ Couns* 2004;52:41–6.
- 19 Grant C, Goodenough T, Harvey I, et al. A randomised controlled trial and economic evaluation of a referrals facilitator between primary care and the voluntary sector. *BMJ* 2000;320:419–23.
- 20 Loftus AM, McCauley F, McCarron MO. Impact of social prescribing on general practice workload and polypharmacy. *Public Health* 2017;148:96–101.
- 21 Greiner GG, Schwettmann L, Goebel J, et al. Primary care in Germany: access and utilisation—a cross-sectional study with data from the German socio-economic panel (SOEP). *BMJ Open* 2018;8:e021036.
- 22 Simic D, Wilm S, Germany RM. Building primary care in a changing Europe: Case studies. In: Kringos DS, Boerma WGW, Hitchinson A, eds. Copenhagen, Germany: European Observatory on Health Systems and Policies, 2015.
- 23 Kuntz B, Lampert T. Socioeconomic factors and obesity. *Dtsch Arztebl Int* 2010;107:517–22.
- 24 Mensink G, Schienkiewitz A, Haftenberger M. Overweight and obesity in Germany. In: *Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz*. Robert Koch-Institut, Epidemiologie und Gesundheitsberichterstattung, 2013.
- 25 Buoncristiano M, Williams J, Simmonds P, et al. Socioeconomic inequalities in overweight and obesity among 6- to 9-year-old children in 24 countries from the World Health organization European region. *Obes Rev* 2021;22 Suppl 6:e13213.
- 26 Hausman J, Hall BH, Griliches Z. Econometric models for count data with an application to the patents-R & D relationship. *Econometrica* 1984;52:909.
- 27 Maughan DL, Patel A, Parveen T, et al. Primary-care-based social prescribing for mental health: an analysis of financial and environmental sustainability. *Prim Health Care Res Dev* 2016;17:114–21.
- 28 Elixhauser A, Steiner C, Harris DR, et al. Comorbidity measures for use with administrative data. *Med Care* 1998;36:8–27.
- 29 Van Walraven C, Austin PC, Jennings A, et al. A modification of the elixhauser comorbidity measures into a point system for hospital death using administrative data. *Med Care* 2009;47:626–33.