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Does deprivation affect the demand for NHS Direct? Observational study of routine data from Wales

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ABSTRACT

Objective To estimate the effect of deprivation on the demand for calls to National Health Service Direct Wales (NHSDW) controlling for confounding factors.

Design Study of routine data on over 400 000 calls to NHSDW using multiple regression to analyse the logarithms of ward-specific call rates across Wales by characteristics of call, patient and ward, notably the Welsh Index of Multiple Deprivation.

Setting 810 electoral wards with average population of 3300, defined by 1998 administrative boundaries.

Population All calls to NHSDW between January 2002 and June 2004.

Main outcome measures We used ward populations as denominators to calculate the rates of three categories of calls: calls seeking advice, calls seeking information and all calls combined.

Results Confounding variables explained 31% of variation in advice call rates, but only 14% of variation in information call rates and in all call rates (all significant at 0.1% level). However, deprivation was only a statistically significant predictor of information call rates. The proportion of the ward population categorised as 'white' was a highly significant predictor of all three call rates. For advice calls and combined calls, rates decreased highly significantly with the proportion of those who called the service for themselves. Information call rates were higher on weekdays and highest on Mondays, while advice call rates were highest on Sundays.

Conclusions Deprivation had no consistent effect on demand for the service and the relationship needs further exploration. While our data may have underestimated the 'need' of deprived patients, they yield no evidence that policy-makers should seek to improve demand from those patients. However, we found differences in the way callers use advice and information calls. Previously unexplored variables that help to predict ward-specific call rates include: ethnicity, day of the week and whether patients made the calls themselves.

Strengths and limitations of this study

- This is the first large, national study in Wales to explore the demand for telephone-based healthcare—with data on over 400 000 calls over 30 months.
- This is the first study to make a distinction between calls for advice (eg, immediate help for illness) and calls for information only (eg, how to quit smoking).
- Fully to understand the influence of deprivation on demand we included 14 potential independent variables, many of which (eg, who made the call, distance to nearest emergency department and population density), were previously unexplored.
- Limitations include that, as we could not trace callers through the dataset, we were unable to distinguish between many unique calls or the same caller phoning several times.
- Our study is also limited by the 'ecological fallacy'—the danger of inferring individual trends from grouped data.

INTRODUCTION

Healthcare is free of charge in the UK and equal access for all is one of the guiding principles of the National Health Service (NHS). The founders of the NHS believed that inequalities in access would fade away. Yet those most disadvantaged often make less use of services[1] and those living in deprived areas generally have worse health status.[2–4] So improving access to health services for those who are disadvantaged is a prerequisite for improving the health of the population. The provision of healthcare over the telephone eliminates issues of location—of patient and provider—potentially enabling policy-makers to improve access. NHS England introduced NHS Direct (NHSD), a 24-hour nurse-led health information telephone line, to provide 'easier and faster advice and information to people about health, illness and the NHS, so that they can better care for themselves and their families'.[5] More recently '111' has replaced NHSD as the number to ring in England to facilitate access to the many urgent care services.[6] The 111 services now exist both in Scotland (NHS 24) and alongside NHS Direct in Wales (NHS Direct Wales (NHSDW)). Callers can use these services to seek advice (eg, on which further healthcare service to use) or for information only (eg, location of nearest pharmacy). Indeed

in Wales, 111 is described as 'a national single point of access to a wide range of reliable information, advice and assistance'.[7]

With the introduction of 111 the telephone continues to play an important role in healthcare access. However, early concerns from evaluators,[8] policy-makers[9] and nurses[10] suggested that NHSD and its counterparts were not reaching all the population equally. Indeed early evidence suggested that NHSD was generally used by those who are less disadvantaged: individual socioeconomic indicators showed patients were less likely to use the service if: they did not own a car or lived in rented or social housing[11–13]; had left education at a young age or with fewer qualifications[12] or had lower household incomes or manual jobs.[13] Evidence at area level about calls to NHSD in England is also mixed. Across all calls there appears to be a general increase in call rates with deprivation[14] although this drops off in the most deprived areas.[15 16] However, call rates for children were lower in the most deprived areas[14 16 17]; while call rates for males and older people were higher in the most deprived areas.[14 17] Other studies showed no clear relationship between deprivation and use.[18 19] In contrast deprivation increased the chance that those calling NHSD in Wales would receive more urgent advice, especially to call an emergency ambulance.[20]

This evidence shows that the use of healthcare is complex; to understand access correctly, one must take account of all contributing factors.[21] Confounding variables are those whose relationship with both dependent and independent variables can obscure true associations.[22 23] For example, the relationship between call rates and deprivation changes when age and gender are considered. This is also apparent in studies exploring access to telephone advice across general practitioner out-of-hours (GP OOH) services, which suggest an interaction between use and distance[24–26] and between use and the rurality of an area.[25] However, the existing literature on NHSD often relates demand to patient deprivation in isolation and rarely considers other confounding variables. Furthermore, all researchers have combined calls for advice with those only for information before analysis. However, there is no evidence that these types of calls are homogeneous. By analysing over 400 000 anonymous calls to NHS Direct in Wales, we aimed to estimate the intrinsic effects of deprivation on the demand for advice calls and information calls separately, after controlling for potential confounding factors. Though these calls are 15 years old, we know of no new policy initiatives in Wales targeting access to healthcare specifically by socioeconomic groups. Furthermore, most of the existing literature is no younger and less rigorously analysed.

METHODS

This doctoral study analysed routinely collected data on calls to NHSDW. We complemented these with data on the associated wards, notably from the 2001 Census. We describe our methods in full elsewhere.[27]

Patient and public involvement

As doctoral researcher and supporting committee, we analysed anonymous routine data acquired from the NHSDW. We judged that it would have been difficult to engage relevant patients or members of the public in this mainly technical task.

Time and place

In 2003, Wales comprised 22 unitary authorities or 865 electoral wards with an average population of 3300. We acquired anonymous data on all calls to NHSDW originating from Wales between January 2002 and June 2004 (n=615 739). To protect patient confidentiality, an NHSDW data analyst removed all patients' identifying information, replacing this information with unitary authority, ward and the Welsh Index of Multiple Deprivation (WIMD) as an indicator of deprivation. Though this was necessary for ethical approval, we lost the ability to link calls and identify repeat callers. We excluded duplicate records of known calls, and calls which had been transferred from an emergency department (ED) or GP OOH services. We also excluded 59 253 patients without information on postcode since we could not assign a WIMD score or other ward-specific data. Initial exploration of the data suggested that NHSD in England had received the majority of calls from Flintshire and one adjacent ward in Wrexham. NHSD confirmed that these wards had English dialling codes, which routed calls automatically to England. We, therefore, excluded all calls from these areas.[27] The final number of calls available for analysis was 409 611 across 810 wards (figure 1).

We separated calls seeking advice on symptoms from those seeking only information. As potential explanatory variables we included several reported in the literature as affecting demand and others new in our dataset and thus previously unexplored (table 1). We considered two categories of such variables—relating to the call or to the ward.

Data

Individual NHSDW call variables

For all calls NHSDW provided data on date and type (advice or information), age, gender, ethnicity and presenting symptom of the patient, the relationship of caller to patient and the advice given by the NHSDW nurse advisor.

We analysed the effect of deprivation and other variables on call rates by ward, the natural unit of analysis. So we converted individual variables to proportions by ward, for example, the proportion of females per ward. Before doing so, we coded symptoms according to the International Classification of Primary Care-2 (ICPC-2)[28]; ethnicity data according to the Office for National Statistics (ONS) categories[29] and relationship of caller to patient as self or surrogate. From the date of the call,

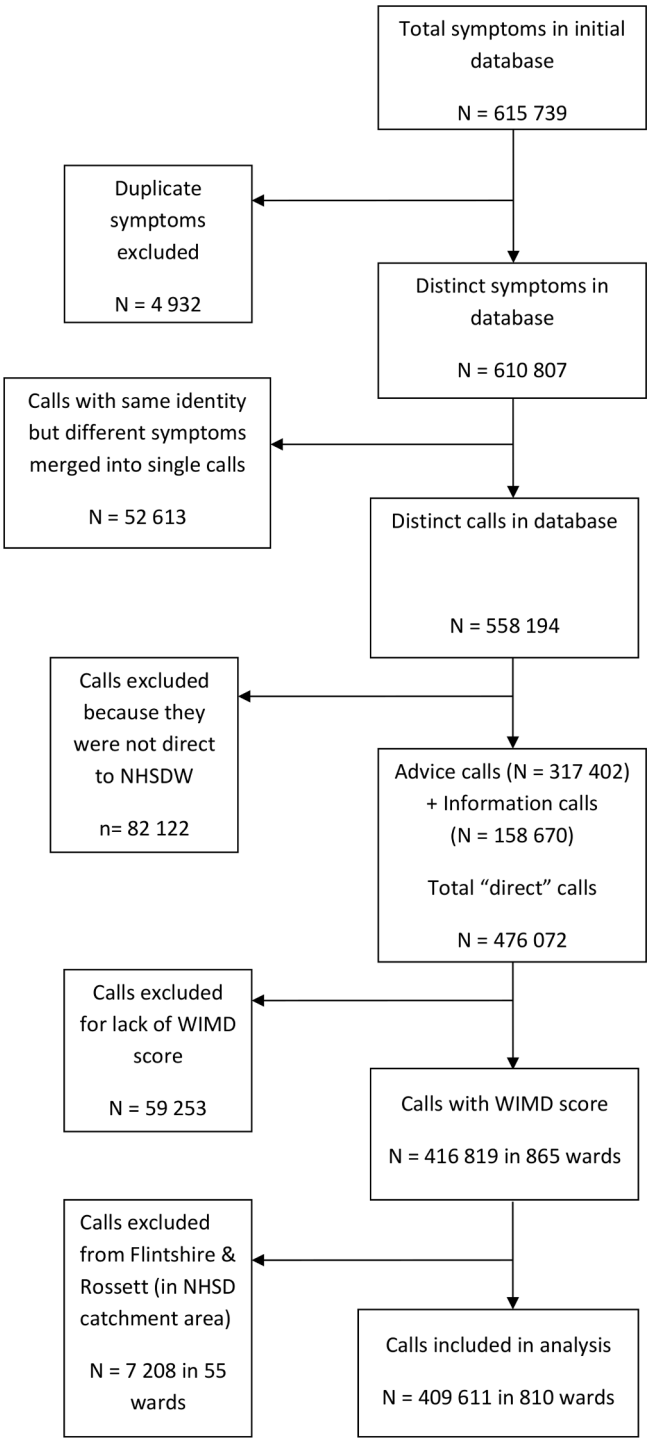

Figure 1 Flow chart showing selection of calls for analysis. NHSD, National Health Service Direct; NHSDW, National Health Service Direct Wales; WIMD, Welsh Index of Multiple Deprivation.

we calculated the day of the week. As some patients call NHSDW frequently, it would have been much less robust to analyse the characteristics of individual callers.

Ward-specific variables

Our main explanatory variable was the WIMD, the deprivation index used in Wales during data collection and since. Although used mainly as a single score, the WIMD comprises six domains of deprivation: (1) income (with a weight of 25%),(2) employment (25%), (3) health and disability (15%), (4) education, skills and training (15%), (5) housing (10%) and (6) geographical (10%).[30] The least deprived ward in Wales at the time of data collection was Cyncoed in Cardiff, a ward including a small village with some of the highest property prices and the most popular schools and a WIMD score of 1.13. The most deprived ward was Rhyl West, a seaside town with many inhabitants receiving governmental financial assistance, with a WIMD score of 74.9. Figure 2 shows variation in WIMD scores across Wales. To each call with a defined postcode (each of which covered an average of 18 residents), the NHSDW data analyst assigned the WIMD score for the corresponding ward.

We mapped the location of each of the 23 hospitals in Wales or on the English-Welsh border with an ED at the time of data collection. As data on individual distances to ED were not available, we used the geographical centroid of each ward (the geometric centre of the ward's shape) to calculate the straight-line distance for patients in that ward to the nearest ED. This is a widely accepted measure for estimating distances to health services.[31 32] As an indicator of the concentration of people in a ward, we derived population density from the 2001 Census and the 2003 ward boundaries using GeoConvert.[33] Though NHSDW had provided the age, gender and ethnicity of individual patients, we derived the corresponding ward-specific proportions from the more accurate 2001 Census (table 1).

Outcome measures and statistical methods

As calls for advice differ in purpose and practice from calls only for information, we used three dependent variables for wards—call rates for advice, calls for information and total calls. We calculated these by dividing the number of each type of call in each ward by the 2001 Census population of that ward from the ONS. As early analysis showed that the distribution of residuals was not normal, we transformed call rates by taking square roots and logarithms. As the logarithmic transformation brought the distribution of residuals much closer to normality, we adopted that throughout. We used SPSS V.16.0 to develop multiple linear regression models for each of our three outcome measures. First we entered all variables except day of the week and deprivation; then we added weekday; and finally we added 'deprivation' as a continuous variable. By adding deprivation to the statistical model at the final step we were able to estimate its true contribution after accounting for known and potential confounding variables. We assessed multicollinearity using tolerance levels provided by the regression package.[27]

Most NHSDW variables were missing fewer than 1% of their data. Not surprisingly very few (3.1%) of those calling only for information had a symptom recorded. Hence, when we analysed information call rates, we did not include symptom as a potential confounding variable. Though NHSDW collected ethnicity data only in the final

Table 1 Study variables

Variable	Definition of categories	Equivalent ward variable	Confounder from literature on NHS Direct
NHSDW call variables			
Type of call	For advice; only for information	Proportion of advice calls from ward	No
Patient's age	Age in completed years	Mean age of ward population from 2001 Census	Yes (refs [14 16 17])
Patient's gender	Male, female	Proportion of females in ward from the 2001 Census	Yes (refs [14 17])
Patient's main symptom	International Classification of Primary Care 2[28]	Proportion of patients with digestive symptoms (most common) in ward	No
Patient's ethnicity	White, other specified ethnicity, not specified	Proportion of 'white' residents in ward from 2001 Census	Not together with deprivation
Relationship of patient to caller	Self caller, surrogate caller	Proportion of self callers in ward	No
Day of week when call occurred	Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday	Proportion of calls from ward on each day	No
Advice given	Advice given by NHSDW	Not applicable (analysed in reference 20)	No
Ward variables			
Call rate (dependent variable)	Not applicable	No of calls from ward divided by 2001 Census population	Not applicable
Deprivation score (main explanatory variable)	Not applicable	Measured by Welsh Index of Multiple Deprivation[26]	Yes (refs [14 16 18 19])
Distance to ED	Not applicable	Measured by straight line from geographical centroid of ward to nearest ED	No
Population density	Not applicable	No of people per hectare in ward from 2001 Census	No

ED, emergency department; NHS, National Health Service; NHSDW, National Health Service Direct Wales.

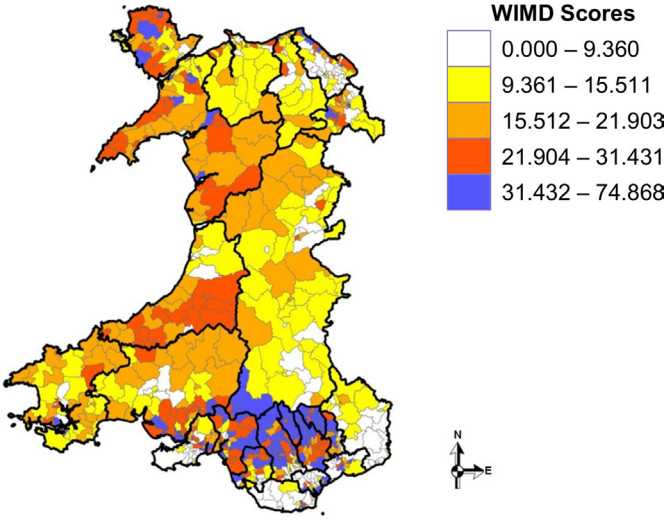

Figure 2 Variation in WIMD scores across Wales. ' Welsh boundaries were derived from Edina Digimap (https://digimap.edina.ac.uk), an online map and data delivery service run by University of Edinburgh. WIMD scores were transposed onto the Welsh map using ArcGIS (www.arcgis.com), a geographical information system for maps and spatial data'. WIMD, Welsh Index of Multiple Deprivation.

year, we were able to derive appropriate proportions by ward (table 2). As we could not identify repeat callers, we could not estimate the effect of different advice given on future calls, and therefore did not include advice as a potential confounding variable. Instead we report elsewhere on the effect of deprivation on the advice given by the NHSDW.[20]

RESULTS

Table 2 summarises the patients and their calls to NHSDW. Most calls (69%) were for advice; more than half (58%) were on the caller's behalf. Most patients (62%) were female; the mean age of callers was 33.4 years—well below 40, the average age of residents in Wales.[27] Sunday was the most popular day for calls (16%). More symptomatic calls concerned digestive symptoms (16%) than any other group. Table 2 also suggests that call rates may have been highest among the most and least deprived groups. Table 3 aggregates data across wards. Call rates varied widely across the country with little discernible pattern (figure 3). Bronington in Wrexham, a rural ward close to the Welsh-English border had the lowest call rate at 0.029

Table 2 Characteristics of patients and their calls (n=409 611)

NHSDW call variable	N of calls made by each subgroup	% of calls made by each subgroup
Call type		
For advice	281 223	68.7
For information only	128 388	31.3
Day on which call occurred		
Sunday	66 297	16.2
Monday	61 502	15.0
Tuesday	56 341	13.8
Wednesday	55 863	13.6
Thursday	55 488	13.5
Friday	52 836	12.9
Saturday	61 284	15.0
Relationship of caller to patient		
Self	237 356	58.0
Surrogate	172 064	42.0
Not recorded	191	<0.1
Gender		
Male	155 279	38.0
Female	253 843	62.0
Not recorded	489	0.12
Ethnicity		
White background	180 308	44.0
Any other background	3929	1.0
Not recorded (mainly before July 2003)	225 374	55.0
Symptom (from ICPC-2)		
Digestive	67 190	16.4
General and unspecified	32 262	7.9
Skin	30 304	7.4
Musculoskeletal	27 982	6.8
Respiratory	27 325	6.7
Neurological	21 260	5.2
Female genital	6929	1.7
Eye	6390	1.6
Ear	6410	1.6
Psychological	6106	1.5
Urological	5964	1.5
Pregnancy and childbearing	4266	1.0
Cardiovascular	2620	0.6
Male genital	2387	0.6
Not recorded (mainly information calls)	162 216	39.6
Advice given		
999 or ambulance	12 791	3.1
ED or other hospital	29 865	7.3
Emergency GP or dentist	89 902	21.9
Other GP or dentist	82 149	20.1
Other	27 131	6.6
Self-care	154 584	37.7
Not assessed	13 189	3.2
Deprivation (from WIMD)		
Least deprived fifth	83 071	20.3
Second least deprived fifth	64 652	15.8
Third least deprived fifth	74 167	18.1
Fourth least deprived fifth	85 024	20.8
Most deprived	102 697	25.1

ED, emergency department; GP, general practitioner; ICPC-2, International Classification of Primary Care-2; NHSDW, National Health Service Direct Wales; WIMD, Welsh Index of Multiple Deprivation.

per inhabitant over 30 months; Gorseinon East, a ward near Swansea, the second city of Wales, with a history of coal mining, tinplate factories and woollen mills, had the highest at 0.337. Distances to hospital EDs ranged from 0.2 to 56 km; and population density from 0.04 to 100 people per hectare. Ward populations were predominantly 'white' (98.6%); 51.5% were female.

The correlation between advice call rates and information call rates was low (r=0.097, p=0.006). Correlations between deprivation scores and call rates were positive for advice calls (r=0.166, p<0.001) and negative for information calls (r=−0.123, p<0.001). At first sight this suggests that the more deprived are more likely to phone NHSD for advice than for information. Table 4 shows variation in the correlations between deprivation scores and the proportion of calls by day of the week, suggesting that the more deprived are more likely to phone NHSD at weekends. These findings confirmed our plan to separate advice and information calls, then to model the effect of known confounding variables, next to add the effect of day of the week, and only finally to test whether deprivation improves the resulting models.

Deprivation and demand for NHSDW

We developed three multiple regression models to explore the relationship between deprivation and demand in the form of logarithms of call rates – for advice, for information and for advice or information (all calls combined). Tables 5–7 summarise the change in each model with the addition of each 'block' of explanatory variables. The known confounding variables ('Block 1') achieved the highest adjusted R^2 of 0.307 for advice call rates, compared with 0.141 for information call rates and 0.144 for all call rates (all significant at 0.1% level). In other

Table 3 Characteristics of 810 wards: continuous (with means) and binary (with proportions)

Variables	Minimum	Maximum	Mean	SD
Continuous (summarised by mean/ward)				
Total call rates	0.029	0.337	0.144	0.051
Advice call rates	0.014	0.260	0.093	0.043
Information call rates	0.015	0.147	0.051	0.024
Deprivation (from WIMD)	1.13 (least)	74.9 (most)	22.2	14.2
Distance to ED (in km)	0.200	56.0	13.8	11.4
Population density (people/hectares)	0.043	100	9.70	13.2
Age of residents (years)	28.8	52.2	40.4	3.3
Binary (summarised by proportion/ward)				
Self callers	0.357	0.900	0.609	0.107
Digestive symptoms	0.109	0.663	0.315	0.105
Female residents	0.456	0.571	0.515	0.014
'White ethnicity' residents	0.676	1.000	0.986	0.024
Calls on a Sunday	0.036	0.273	0.148	0.046
Calls on a Monday	0.065	0.289	0.159	0.033
Calls on a Tuesday	0.056	0.237	0.144	0.028
Calls on a Wednesday	0.060	0.267	0.141	0.027
Calls on a Thursday	0.034	0.243	0.137	0.024
Calls on a Friday	0.053	0.245	0.133	0.026
Calls on a Saturday	0.036	0.280	0.139	0.041

ED, emergency department; WIMD, Welsh Index of Multiple Deprivation.

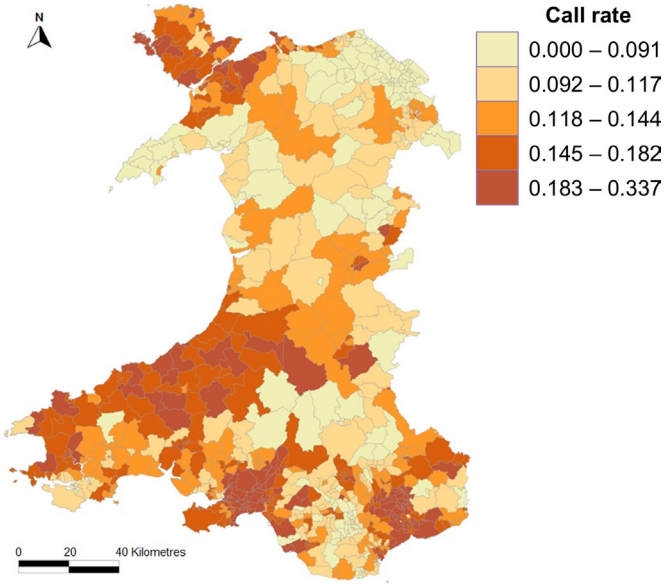

Figure 3 Variation in call rates across Welsh wards. 'Welsh boundaries were derived from Edina Digimap (https://digimap.edina.ac.uk), an online map and data delivery service run by the University of Edinburgh. Estimated call rates were transposed onto the Welsh map using ArcGIS (www.arcgis.com), a geographical information system for maps and spatial data'.

words these variables explain 31% of variability in advice call rates, but only 14% of variability in information or all call rates. Adding the proportions of calls on each day of the week ('Block 2') explained a further 2.2% of variability in advice call rates, 13.3% of variability in information call rates and 1.0% of that in combined call rates.

As table 2 shows higher call rates among the most and least deprived groups, we added deprivation ('block 3' models) using two the approaches—first, as linear and quadratic terms; second, as five ordered groups. The first approach proved more effective; tables 5–7 (summarising this approach) show that the adjusted R^2 improved marginally by 0.001–0.330 for advice call rates, by 0.008–0.282 for information call rates and by 0.002–0.156 for combined call rates, compared with counterparts for 'block 2' models. Thus, our final models explained 33% of the variability in advice call rates, 28.2% in information call rates and only 15.6% in combined call rates. The second, less effective, approach of using deprivation in fifths showed smaller marginal improvements in the adjusted R^2 for the three variables.

Generally, there was little change in the direction and size of the standardised coefficients in models for the three call rates. Deprivation (when included as linear and quadratic terms, as above) only significantly improved prediction for information call rates; however, the

Table 4 Pearson correlation coefficients between deprivation and ward-level proportion of calls by day of week for advice, information and total calls

	WIMD	Sunday calls	Monday calls	Tuesday calls	Wednesday calls	Thursday calls	Friday calls	Saturday calls
Correlations between deprivation (WIMD) and proportion of advice calls by day of week								
WIMD	1	0.048	−0.082	−0.076	−0.055	0.161	−0.105	0.082
P value		0.171	0.019	0.030	0.118	0.000	0.003	0.02
Correlations between deprivation (WIMD) and proportion of information calls by day of week								
WIMD	1	0.167	−0.151	−0.034	−0.102	−0.017	−0.042	0.145
P value		0.000	0.000	0.339	0.004	0.634	0.236	0.000
Correlations between deprivation (WIMD) and proportion of total calls by day of week								
WIMD	1	0.154	−0.166	−0.117	−0.127	0.078	−0.130	0.162
P value		0.000	0.000	0.001	0.000	0.026	0.000	0.000

WIMD, Welsh Index of Multiple Deprivation.

direction of the standardised coefficient differed whether using WIMD as a linear or a quadratic term (table 6). The proportion of the ward population categorised as 'white' was a significant negative predictor of all three call rates with standardised coefficient of −0.137 (p<0.001) for advice calls, −0.113 (p=0.001) for information calls and −0.184 (p<0.001) for combined calls; the more people with a 'white' ethnicity in a ward, the fewer calls. The proportion of callers who called NHSDW for themselves was a strong negative predictor of call rates both for advice (standardised coefficient=−0.252, p<0.001) and combined (standardised coefficient=−0.267, p=0.001): the more who called for themselves in a ward, the fewer calls. The coefficient for distance to ED was also negative for both advice and all call rates; as distance to the nearest ED increased, the call rates decreased. However, neither self-call rates nor distance significantly predicted information call rates.

DISCUSSION

Main findings

Call rates to NHSDW, deprivation scores, distance to hospital EDs and population density all varied greatly across wards in this small but heterogeneous country. Included in our linear regression models, these variables explained much of the variability in call rates across the wards. The low correlation (r=0.097) between advice call rates and information call rates justified the need to look at these separately. However, deprivation only contributed significantly to explaining variation in information call rates, yielding inconsistent evidence of an intrinsic relationship between call rates and deprivation. While the proportion of 'white' residents in a ward predicted all call rates, patterns of use also varied by the proportions of those who called for themselves and day of the week.

Strengths and limitations of this study

This is the first large national study in Wales exploring demand for telephone-based healthcare—with data on over 400 000 calls over 30 months. To understand the influence of deprivation on demand, we included 14 potential independent variables, informed by the existing literature on deprivation and healthcare. We sought transparency in recoding variables using recognised systems[28–30 32 33] and used accepted methods to overcome lack of individual distances to ED.[32 33] We explored advice calls and information calls both separately and together, and rigorously tested the relationships between deprivation and demand in sequence. Throughout these detailed explorations findings remained consistent: in this population there is no consistent evidence that deprivation affects demand. However, our study has limitations as well as strengths. In particular our data are 15 years old. Also we could not trace callers through the dataset, or distinguish between many unique calls or the same caller phoning several times. Although this study used the recognised ICPC-2 system to code patients' symptoms, this does not measure severity of complaint. Hence, we cannot tell whether those calling from deprived areas had worse health and how this affected demand. Another limitation is the 'ecological fallacy'—the danger of inferring individual trends from the grouped data.[34] Finally, we could not include those 60 000 calls (12%) without a deprivation score; they could be genuine emergencies where it was not possible to collect all information or uncooperative callers who refused to give their address.

Findings in context

Other studies have found that call rates to NHSD rose with increasing deprivation but tailed off in the most deprived areas. Our findings show little evidence of any consistent relationship between call rates and deprivation, we judge because of the inclusion of previously overlooked confounding variables like population density, distance to ED and day of the week, which may minimise the intrinsic role of deprivation. Even when deprivation was found to be a significant predictor of information call rates, the direction of the relationship varied whether

Table 5 Factors affecting (logarithm of) call rates to NHS Direct Wales for advice: multiple regression

	Block 1				Block 2				Block 3			
Adjusted R^2	0.307				0.329				0.330			
	Unstandardised coefficients		Standardised coefficients		Unstandardised coefficients		Standardised coefficients		Unstandardised coefficients		Standardised coefficients	
	β	SD	β	P value	β	SD	B	P value	B	SD	β	P value
Distance	−0.006	0.001	−0.157	<0.001	−0.006	0.001	−0.165	<0.001	−0.007	0.001	−0.172	<0.001
Population density	0.004	0.001	0.105	0.004	0.003	0.001	0.092	0.010	0.003	0.001	0.089	0.012
Mean age	−0.011	0.005	−0.076	0.023	−0.011	0.005	−0.080	0.016	−0.009	0.005	−0.064	0.068
Proportion female	2.408	1.017	0.077	0.018	2.225	1.005	0.071	0.027	1.996	1.016	0.050	0.048
Proportion 'white'	−0.023	0.006	−0.121	<0.001	−0.025	0.006	−0.133	<0.001	−0.026	0.006	−0.137	<0.001
Proportion digestive symptoms	−0.391	0.162	−0.090	0.016	−0.041	0.179	−0.010	0.817	−0.076	0.181	−0.017	0.676
Proportion self-callers	−1.656	0.174	−0.345	<0.001	−1.273	0.192	−0.265	<0.001	−1.212	0.195	−0.252	<0.001
Proportion on Monday	Not entered				−1.814	0.560	−0.136	0.001	−1.833	0.560	−0.138	0.001
Proportion on Tuesday	Not entered				−2.477	0.583	−0.162	<0.001	−2.476	0.583	−0.162	<0.001
Proportion on Wednesday	Not entered				−1.584	0.547	−0.106	0.004	−1.627	0.547	−0.109	0.003
Proportion on Thursday	Not entered				−1.509	0.560	−0.096	0.007	−1.588	0.564	−0.101	0.005
Proportion on Friday	Not entered				−2.832	0.565	−0.185	<0.001	−2.843	0.564	−0.186	<0.001
Proportion on Saturday	Not entered				−1.595	0.542	−0.138	0.003	−1.629	0.542	−0.141	0.003
WIMD score	Not entered				Not entered				0.005	0.003	0.143	0.147
WIMD*WIMD	Not entered				Not entered				<0.001	0.000	−0.103	0.294

NHS, National Health Service; WIMD, Welsh Index of Multiple Deprivation.

Table 6 Factors affecting (logarithm of) call rates to NHS Direct Wales for information: multiple regression

	Block 1				Block 2				Block 3			
Adjusted R^2	**0.141**				**0.274**				**0.282**			
	Unstandardised coefficients		**Standardised coefficients**		**Unstandardised coefficients**		**Standardised coefficients**		**Unstandardised coefficients**		**Standardised coefficients**	
	β	**SD**	**β**	**P value**	**β**	**SD**	**B**	**P value**	**β**	**SD**	**β**	**P value**
Distance	0.004	0.001	0.096	0.013	<0.001	0.001	−0.003	0.945	<0.001	0.001	−0.008	0.837
Population density	−0.003	0.001	−0.091	0.022	−0.001	0.001	−0.037	0.315	−0.001	0.001	−0.036	0.326
Mean age	0.008	0.005	0.060	0.110	0.009	0.005	0.064	0.065	0.007	0.005	0.052	0.149
Proportion female	2.664	1.103	0.086	0.016	1.978	1.016	0.064	0.052	2.091	1.021	0.068	0.041
Proportion 'white'	−0.018	0.007	−0.097	0.009	−0.020	0.006	−0.108	0.002	−0.021	0.006	−0.113	0.001
Proportion self-callers	2.245	0.267	0.295	<0.001	0.368	0.293	0.048	0.209	0.348	0.298	0.046	0.244
Proportion on Monday	Not entered				2.916	0.423	0.309	<0.001	2.813	0.422	0.298	<0.001
Proportion on Tuesday	Not entered				2.521	0.458	0.232	<0.001	2.496	0.457	0.230	<0.001
Proportion on Wednesday	Not entered				2.805	0.474	0.256	<0.001	2.724	0.472	0.249	<0.001
Proportion on Thursday	Not entered				2.654	0.474	0.224	<0.001	2.663	0.471	0.225	<0.001
Proportion on Friday	Not entered				1.568	0.476	0.132	0.001	1.550	0.473	0.131	0.001
Proportion on Saturday	Not entered				0.188	0.578	0.019	0.745	0.205	0.575	0.021	0.722
WIMD score	Not entered				Not entered				0.008	0.003	0.254	0.012
WIMD*WIMD	Not entered				Not entered				<0.001	<0.001	−0.308	0.002

NHS, National Health Service; WIMD, Welsh Index of Multiple Deprivation.

Table 7 Factors affecting (logarithm of) call rates to NHS Direct Wales for advice or information: multiple regression

	Block 1				Block 2				Block 3			
Adjusted R^2	**0.144**				**0.154**				**0.156**			
Independent variables	**Unstandardised coefficients**		**Standardised coefficients**		**Unstandardised coefficients**		**Standardised coefficients**		**Unstandardised coefficients**		**Standardised coefficients**	
	β	**SD**	**β**	**P value**	**β**	**SD**	**β**	**P value**	**β**	**SD**	**β**	**P value**
Distance	−0.004	0.001	−0.116	0.004	−0.004	0.001	−0.114	0.004	−0.004	0.001	−0.114	0.005
Pop density	0.001	0.001	0.047	0.244	0.001	0.001	0.043	0.284	0.001	0.001	0.043	0.285
Mean age	0.005	0.004	0.048	0.209	0.006	0.004	0.053	0.176	0.005	0.005	0.043	0.281
Proportion female	0.716	0.918	0.048	0.435	0.573	0.915	0.023	0.531	0.669	0.922	0.026	0.468
Proportion 'white'	−0.027	0.006	−0.181	<0.001	−0.028	0.006	−0.183	<0.001	−0.028	0.006	−0.184	<0.001
Proportion digestive symptoms	1.537	0.193	0.446	<0.001	1.578	0.200	0.457	<0.001	1.572	0.201	0.456	<0.001
Proportion self-callers	−1.120	0.238	−0.332	<0.001	−1.094	0.223	−0.325	<0.001	−0.899	0.260	−0.267	0.001
Proportion advice calls	0.461	0.249	0.162	0.065	0.390	0.270	0.137	0.150	0.450	0.272	0.158	0.099
Proportion on Monday	Not entered				−0.961	0.661	−0.089	0.147	−0.923	0.661	−0.085	0.163
Proportion on Tuesday	Not entered				−1.096	0.686	−0.085	0.111	−1.017	0.689	−0.079	0.140
Proportion on Wednesday	Not entered				−0.654	0.672	−0.050	0.330	−0.634	0.672	−0.048	0.346
Proportion on Thursday	Not entered				−0.133	0.655	−0.009	0.840	0.005	0.662	0.000	0.993
Proportion on Friday	Not entered				−2.235	0.667	−0.158	0.001	−2.212	0.667	−0.156	0.001
Proportion on Saturday	Not entered				−1.248	0.670	−0.141	0.063	−1.201	0.670	−0.136	0.074
WIMD score	Not entered				Not entered				0.004	0.003	0.139	0.201
WIMD*WIMD	Not entered				Not entered				<0.001	0.000	−0.183	0.096

NHS, National Health Service; WIMD, Welsh Index of Multiple Deprivation.

deprivation was included as a linear or quadratic term. Indeed, our findings suggest that demand for NHSD is not as simple as presented in many previous studies conducted at ward level.[15–19] For example, no study had distinguished between deprivation and advice and information calls separately—types of calls that we have shown behave differently with deprivation. However, our study can identify only socioeconomic influences that operate at ward level and could obscure evidence that suggests that NHSD is being used by those who are better off.[11–13]

Implications

While we recognise that data presented here are 15 years old, telephone access to service remains a key component of the urgent care system. This study suggests that NHSDW could be one of the least discriminatory health services, and that several of the nine similar previous studies (five of which analysed data at least as old as ours) have overestimated the effect of deprivation on demand. However, the role of patient symptoms in predicting demand needs further exploration, particularly severity of complaint. In future, fortunately, the Secure Anonymised Information Linkage (SAIL) databank[35] will overcome the other two major limitations of the present dataset—inability to identify repeat callers to NHSD, and lack of data on individual patient circumstances, especially socioeconomic. By combining datasets through anonymous linkage, SAIL can trace patients who contact any service during the period studied, yielding a more accurate picture of service use. We, therefore, recommend anonymous data linkage as an important early step in pursuing these issues.

That said, our finding that there is little evidence in our large national dataset that deprivation affects demand is reassuring. Nevertheless, the expanding breadth and depth of data in SAIL will increasingly enable NHS Wales to monitor whether NHSDW favours any subgroup of society, notably the affluent. Similarly, the NHS in the rest of the UK has increasing capacity to monitor inadvertent discrimination in service delivery. Finally, the finding that calls varied by day of week has implications for staffing of telephone-based healthcare services

CONCLUSIONS

This study has identified previously unexplored differences in the rates of calls to NHSD for advice and for information. We have characterised many factors that influence demand for NHSD. Nevertheless, much variation in call rates remains unexplained. In particular, individual socioeconomic indicators that we did not have may yet help to predict call rates. While our data may have underestimated the 'need' of deprived patients for healthcare, they yield no evidence that policy-makers should seek to improve access to NHSD for those patients. Although these patients may go elsewhere for healthcare, we have shown that NHSD Wales provides equitable access in response to ward-specific deprivation.

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