

**ORIGINAL ARTICLE**

# A spotlight on lymphoedema Did Not Attends: Demographics and workforce costs

Melanie Jane Thomas<sup>1</sup> | Ioan Humphreys<sup>2</sup>  | Rhian Wyn Noble-Jones<sup>1</sup>

<sup>1</sup>Swansea Bay UHB - Lymphoedema UK Clinical Network, Port Talbot, UK

<sup>2</sup>School of Health and Social Care, Faculty of Medicine, Health & Life Science, Swansea University, Swansea, UK

**Correspondence**

Ioan Humphreys, MSc, School of Health and Social Care, Faculty of Medicine, Health & Life Science, Swansea University, Singleton Park, Swansea, SA2 8PP, UK.  
Email: [i.humphreys@swansea.ac.uk](mailto:i.humphreys@swansea.ac.uk)

**Abstract**

This unique evaluation aimed to estimate, the financial impact of non-attendance on a nation-wide hospital lymphoedema service. Along with gaining some understanding of patient characteristics of those who Did Not Attend (DNA) and were subsequently discharged. The evaluation design interrogated existing performance data from 2012 to 2022. This information was used to estimate the costs incurred based on national published sources and pay scales. Staffing costs of over £1.1 m in one decade related to the financial impact of over 23 000 unattended lymphoedema appointments. The characteristics of 870 patients from 2019/2020 were also evaluated suggesting that those with a wound alongside complex lymphoedema were less likely to DNA appointments. Two-thirds of patients were managing two or more comorbidities—obesity, cardiac conditions and diabetes being the most common. It seems likely that some DNAs are avoidable by adapting appointment administrative processes and greater understanding of patients' perception of value. However, the reasons for DNA are likely to be varied and nuanced so potentially a small proportion are unavoidable. Modernising appointment processes and identifying patient value may help minimise DNA costs in the future.

**KEYWORDS**

comorbidity, Did Not Attend (DNA), financial workforce impact, lymphoedema, wounds

**Key Messages**

- the workforce financial costs of over 23 000 Did Not Attend (DNA) events, in a decade of lymphoedema hospital appointments was examined at a national level
- closer examination of an anonymised data set of 870 patients, who DNA scheduled appointments from 1 year, gave an indication of the characteristics of this population with lymphoedema
- a financial cost relating to staffing of over £1.1 m was attributed to patient non-attendance of hospital lymphoedema appointments in one decade
- patients with a wound alongside complex lymphoedema were less likely to fail to attend appointments

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial](https://creativecommons.org/licenses/by-nc/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

© 2022 The Authors. *International Wound Journal* published by Medicalhelplines.com Inc (3M) and John Wiley & Sons Ltd.

- two-thirds of patients were managing two or more comorbidities—obesity, cardiac conditions and diabetes being the most common in people who DNA their lymphoedema appointment

## 1 | INTRODUCTION

A spotlight on the workforce costs of missed appointments and demographics of people who ‘Did Not Attend’ (DNA) lymphoedema hospital appointments has not previously been undertaken at national level. People with lymphoedema have a progressive condition, causing swelling (oedema), skin changes, poor wound healing and pain in the affected limb(s), face, trunk or genitalia. Comorbidity with lymphoedema has not been quantified in national DNA data. This paper is the first of a series to gain greater understanding of the DNA phenomenon in Lymphoedema Services nationally, leading to a future economic impact assessment including patient reported outcomes and wider health system costs.

Unattended appointments produce a considerable impact on the resources and daily schedules of hospitals, GP clinics, NHS services and treatment centres. Indicated in records as DNA, DNAs decrease the productivity and efficiency of health services and increase the costs of delivery. The financial burden of missed appointments in the NHS is significant. The NHS Benchmarking Network, which includes 129 NHS Organisations across England and Wales, reported an 8% DNA rate costing £1 billion in their 2019 Outpatients project.<sup>1</sup> Also in 2019, missed GP appointments in England alone were estimated to be in excess of £216 million.<sup>2</sup> In Wales, missed appointments between 2015 and 2019 were estimated to have cost £2.5 million, with regional variation of DNA rates ranging from 7.7% to 10%.<sup>3</sup>

Health care research has sought to uncover human characteristic or demographic factors for ‘no show’ behaviours, as well as process issues that may affect the DNA rates. A US systematic review in 2018 concluded that DNAs were most common in adults of a younger age group, lower socioeconomic status, increased travel distance to the clinic and a prior history of no shows; whilst a long lead time to the appointment was also significant.<sup>4</sup> Appointment process methods such as reminder letters and electronic methods of communication have been tested. A meta-analysis of the use of SMS text messaging in 2016 concluded it to be an effective way of improving attendance in health care appointments.<sup>5</sup> However, they could not conclude whether the effect was greatest in certain groups of people nor the ideal frequency or time interval of reminders.<sup>5</sup> A more recent study of young people with type 2 diabetes found that an SMS reminder

message more than doubled attendance.<sup>6</sup> Similarly, in a different hospital, implementing such reminders to dermatology outpatients reduced the mean DNA from 10.66% to 4.77%.<sup>7</sup> It may be that greater use of technology and understanding the demographics of those who are most likely to DNA would allow consideration of targeted processes to support patient attendance.

The economic burden of lymphoedema services have been examined for particular sub-group populations, for example, breast cancer-related,<sup>8</sup> and by specific provider groups, for example, independent hospices.<sup>9</sup> However, there appear to be no studies of the financial impact, in terms of staff costs, of patients who DNA scheduled outpatient appointments at Lymphoedema Services. Since the inception of a national lymphoedema service in Wales<sup>10</sup> lymphoedema services in each NHS health board provide performance data on numbers of patients attending and those who DNA. The data includes whether those individuals who DNA are new patients (NP) or follow-up (FU) patients. This information is already used for local service development, but has not been reviewed longitudinally nor has the financial impact been considered. These data also provide an opportunity to explore the demographics of people who DNA, that is, were discharged from the services for non-attendance of lymphoedema appointments with lack of response to correspondence offering another appointment.

Management of lymphoedema involves reducing the risk of infection (cellulitis) through good skin care, compression of the oedema and other interventions aimed at improving lymph flow and reducing consolidation into fibrosis and the occurrence of wounds.<sup>10</sup> The impact of daily life can be physical and psychosocial.<sup>11</sup> As with other progressive chronic conditions, non-attendance can lead to delay in diagnosis or lack of appropriate care, which in the long-term can mean increased demand on health care, for example, requiring unplanned admissions with infection, wounds or repeated GP episodes with recurrent cellulitis and increased risk of falls.<sup>12</sup> The impact of a lymphoedema appointment DNA is likely therefore be more than the burden to the service; the costs for the patient may be risk to employment, increased use of personal resources as a result of disability and reduction in quality of life.<sup>13</sup> However, this initial study focussed on staff costs and is therefore likely to be of interest to lymphoedema service providers and similar outpatient health care providers.

## 2 | AIMS AND OBJECTIVES

The aims of this evaluation study were to:

- estimate the financial workforce costs of DNAs on Lymphoedema Services across an entire nation,
- gain more understanding, from an anonymised data set, of patients who DNA scheduled appointments and were discharged from Wales lymphoedema services during 2019/2020.

The specific objectives were to:

- explore the numbers of DNAs since 2012 for NP and FU patients in Lymphoedema Wales (LW) providing an estimate of costs incurred to lost workforce hours,
- examine an anonymised data set of demographics from individuals who DNA and failed to respond to correspondence so were discharged from LW lymphoedema services in 2019/2020,
- estimate the lost workforce costs associated with DNAs at an individual health board level compared with population and lymphoedema activity,
- consider other factors that could influence DNA appointments in LW.

## 3 | METHODS

### 3.1 | Evaluation design and sample

The design of this study was a two-pronged observational data audit.

Firstly, the evaluation design interrogated existing performance data from LW from 2012 to 2022 on patients who attend or DNA appointments captured monthly and stored on the NHS Wales database. This information was used to estimate the lost workforce costs incurred owing to DNAs based on national published sources of unit outlays<sup>13</sup> and the Agenda for Change pay scale for NHS employees ([www.healthcareers.nhs.uk](http://www.healthcareers.nhs.uk)). To estimate the costs, the following specifics within LW were applied:

- NP lymphoedema assessments in Wales were allocated 1.5 hours of a registered professional. A Band 6 (average between Band 5-8a) has been pragmatically submitted plus 30 minutes of an administrator (Band 3). The administrator time includes inputting data into the NHS databases, generating a letter of appointment, creating a case file, checking patient status if DNA, sending a DNA letter, updating databases, producing another letter of discharge and filing.
- FU lymphoedema patients were allocated 45 minutes of a Band 6 and 30 minutes of a Band 3 administrator (Table 1).

Secondly, anonymous case note data (870 patients) on individuals who DNA and were discharged from LW (2019/2020) were collected from Lymphoedema Services in the NHS Wales Health Boards. These were entered into an MS Excel database indicating sex, age, type of lymphoedema (cancer/non-cancer), number of previous appointments attended, mobility, employment status, lymphoedema severity outcome including presence of wound, miles travelled to clinic location and any comorbidities noted. No personal identifiable data was gathered.

The perspective taken was that relating to NHS Wales, which could be inferred for other similar NHS environments.

### 3.2 | Data collection measures

The Lymphoedema Project Manager entered all the data and the authors of this paper (M.T. and R.N.J.) were responsible for data cleaning, checks and running any queries before the data were locked and transferred to the Swansea University researcher (I.H.) for statistical analysis. The data set was anonymous.

### 3.3 | Ethics and Research Governance

This study design was reviewed by the Joint Study Review Committee at Swansea Bay University Health Board and deemed a service evaluation/data audit in relation to ethical approval requirements. Swansea University College of Human and Health Sciences (CHHS) ethics committee provided permission to analyse the anonymised data.

### 3.4 | Resource use

Resource use associated with DNAs was summarised into relevant categories and valued in £ sterling using a price year of 2019/2020. The costs were determined from national published sources of unit costs from the Personal and Social Services Research Unit<sup>14</sup> (Table 1) and the Agenda for Change pay scale for NHS employees.<sup>13</sup>

### 3.5 | Data and statistical analysis

Data and statistical analysis was undertaken in MS Excel and SPSS Version 26 for Windows. Basic descriptive demographic statistics were collected alongside the resource use and cost data.

TABLE 1 Unit costs for new patient (NP) and follow-up (FU) appointments

NP cost items	Unit cost per hour	Unit cost source/description	Total cost	Comments
Lymphoedema specialist (band 6)	£48.00	PSSRU <sup>14</sup> Band 6—Page 119	£72.00	Based on 1 h 30 min needed for NP appointment
Band 3 (mid-scale)	£10.81	NHS <sup>15</sup>	£5.41	30 min administration
		Cost per DNA (NP)	£77.41	
FU cost items	Unit cost per hour	Unit cost source/description	Total cost	Comments
Lymphoedema Specialist (Band 6)	£48.00	PSSRU <sup>14</sup> Band 6—Page 119	£36.00	Based on 45 min needed for FU appointment
Band 3 (Mid-scale)	£10.81	NHS <sup>15</sup>	£5.41	30 min administration
		Cost per DNA (FU)	£41.41	

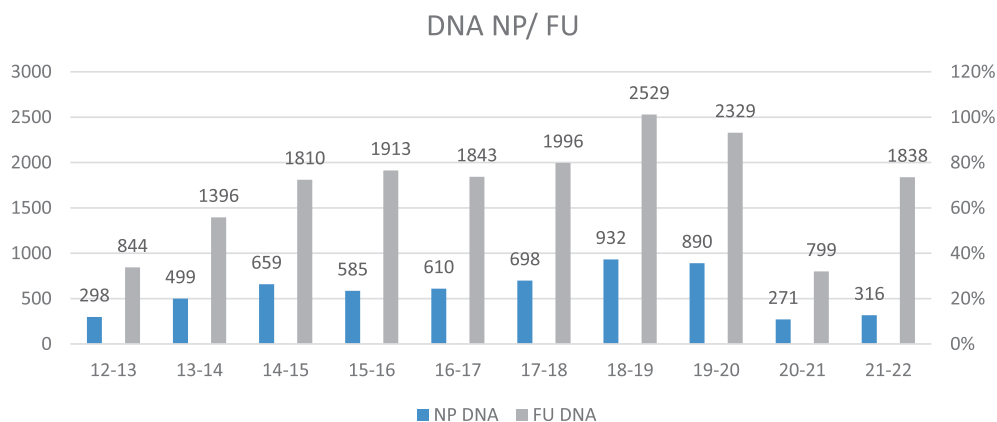


FIGURE 1 Numbers of Did Not Attend in Lymphoedema Clinical Network Wales (LW) 2012 to 2022

## 4 | RESULTS

### 4.1 | Number of unattended appointments (DNA)

Since the inception of LW the number of unattended appointments has grown proportionally each year as the caseloads increase (except for 2020 to 2022 which was influenced by the Covid19 pandemic). Since 2012, 5758 NP and 17 297 FU DNA events were recorded. This is broken down for each of the 10 years in Figure 1.

In the first year of the Covid19 pandemic (2020/2021), activity level (patient contacts) reduced by 9% compared with the previous year (39 978 to 36 373), however, the reduction in DNA was obvious (NP 890 to 271, a 69% reduction on the previous year; FU 2329 to 799, a 66% reduction). When seen as a percentage of overall activity for each of the 10 years (Figure 2), the NP DNA had remained consistently at 1% to 2% of all activity. Over the same period, the FU DNA rate had increased from 3% to a peak of 7%. The FU DNA rate in 2020/2021 reduced to 2%, resuming in following year to 5% (Figure 2). During 2020/2021 (first year of Covid19 pandemic) 60% of appointments were offered as virtual appointments

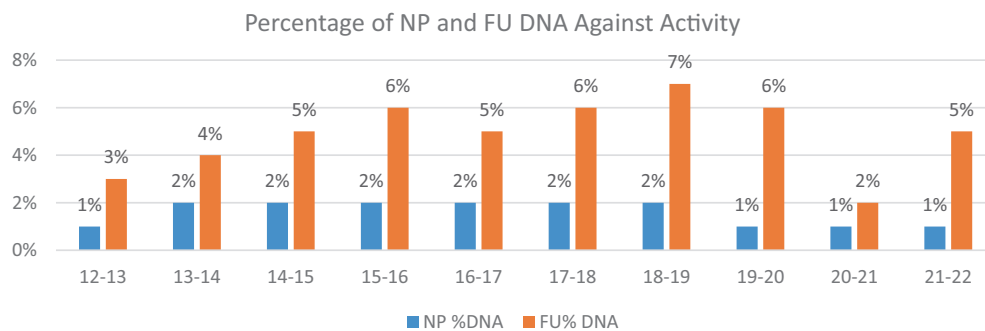
(phone/video), compared with only 2% previously. This was a significant difference in the service process. This may account for part of the change in DNA rate; however, the wider domestic context for UK patients was also unique because of the Covid19 pandemic.

### 4.2 | Staffing costs of unattended appointments

Using the resource use described in the Section 3, the DNA data suggest that over the 10 years (2012-2022) in lymphoedema, staffing cost of over £1.1 million pounds for these unattended appointments (Table 2).

The populations in the NHS Wales Health Boards range from 133 030 to 703 360 people. Some are low population rural areas (eg, Powys Health Board, PHB), others high population urban areas (eg, Cardiff and Vale University Health Board) or mixed (Health Board) or mixed (eg, Betsi Cadwaladr University Health Board). This is demonstrated using population density in Table 3. Each of the health boards also differ in their deprivation. As highlighted one of the health board has four areas in the top 10 of the Welsh Index Multiple Deprivation and two

**FIGURE 2** Percentage of new patients and follow-up Did Not Attend in Lymphoedema Wales



**TABLE 2** Numbers of NP and FU DNA in LW, and related staffing costs 2012 to 2022

Year	Patient activity of LW	Numbers of NP DNA	Cost @ £77.41	Numbers of FU DNA	Cost @ £41.41	Total costs owing to DNA
2012-2013	25 286	298	£23 068.18	844	£34 950.04	£58 018.22
2013-2014	32 943	499	£38 627.59	1396	£57 808.36	£96 435.95
2014-2015	37 569	659	£51 013.19	1810	£74 952.10	£125 965.29
2015-2016	32 665	585	£45 284.85	1913	£79 217.33	£124 502.18
2016-2017	35 164	610	£47 220.10	1843	£76 318.63	£123 538.73
2017-2018	33 395	698	£54 032.18	1996	£82 654.36	£136 686.54
2018-2019	38 066	932	£72 146.12	2529	£104 725.89	£176 872.01
2019-2020	39 978	890	£68 894.90	2329	£96 443.89	£165 338.79
2020-2021	36 372	271	£20 978.11	799	£33 086.59	£54 064.70
2021-2022	37 202	316	£24 461.56	1838	£76 111.58	£100 573.14
Total	348 640	5758	£445 727	17 297	£716 269	£1 161 996

Abbreviations: DNA, Did Not Attend; FU, follow-up; LW, Lymphoedema Wales; NP, new patients.

other health boards have three areas each. Using the year 2019/2020 as an example, the total lymphoedema activity (including DNAs) by health board is presented (Table 3). The DNA as a percentage of activity (events) differs from 3% to 13% across the different Health Boards giving a mean across Wales of 8% of appointments being unattended (Table 3). The health board with the highest DNA percentage also have the highest deprivation. The 3219 DNA events represent 870 patients who did not respond to reminder correspondence and were subsequently discharged from the service.

### 4.3 | Descriptive data analysis of 2019/2020 DNA discharged patients

In 2019/2020, a total of 870 people were discharged from LW as they DNA an agreed appointment, failed to respond to a formal notification letter of DNA and were therefore removed from the active caseload. Non-identifiable information on these 870 individuals were analysed. The mean age was 62 (range 25-98) where 73% (632) were female, and 27% (238) male.

Just under half of the discharged patients identified themselves as married (43%), 29% were retired and 16% were unemployed (Table 4). Half of the patients reported their mobility as 'independent' with only 3% recorded as house bound, requiring a hoist or using a wheelchair. However, these three pieces of information were missing for 289, 267 and 193 patients respectively (Table 4). One reason for missing data on NP is a lack of information on referral communication, another, that on attendance patients can decline to give their marital or employment status.

Of the 870 discharged patients, 30% (258) had failed to attend a first appointment (NP) while 70% (612) DNA a subsequent appointment (FU). Using the unit costs from Table 1 this equates to over £45 000 lost in staffing costs (Table 5). Of the 612 FU patients, data show that they had attended, on average, five times each prior to the DNA event (range 1-59). Amongst these, 31% attended only once and 37% had attended more than four times previously.

Cancer and non-cancer related lymphoedema status was included within the data set. Nearly a quarter of the discharged patients (209, 24%) had a cancer-related



**TABLE 3** Health Board population, density, deprivation, Lymphoedema activity data and Did Not Attend (DNA) data 2019 to 2020

Health Board	Population of health board and density per square kilometre	Welsh Index multiple deprivation WIMD top 10 areas	Total activity (including DNAs)	Total DNA events and % of activity	Total of patients discharged owing to DNA
Aneurin Bevan University Health Board (ABUHB)	598 194 (597)	Includes 3 of the top 10 deprived areas in Wales	6539	439 (7%)	107
Betsi Cadwaladr University Health Board (BCUHB)	703 361 (164)	Includes 3 of the top 10 deprived areas in Wales	7956	251 (3%)	72
Cardiff & Vale University Health Board (C and VUHB)	505 497 (1514)	None	4795	478 (10%)	146
Cwm Taff Morgannwg University Health Board (CTMUHB)	449 836 (567)	Includes 4 of the top 10 deprived areas in Wales	4021	510 (13%)	113
Hywel Dda University Health Board (H DUHB)	389 710 (66)	None	4985	331 (7%)	135
Powys Health Board (PHB)	133 030 (26)	None	1776	92 (5%)	17
Swansea Bay University Health Board (SBUHB)	390 949 (490)	None	9806	1018 (10%)	280
All Wales total	3 169 586 (153)		39 978	3219 (8%)	870

Marital status	N	Employment status	N	Mobility status	N
Divorced	21	Employed	208	Hoist	4
Married	378	Housewife	5	House bound	3
Single	154	Retired	249	Independent	434
Widow	28	Unemployed	141	Wheelchair	20
Not recorded	289	Not recorded	267	Not recorded	193
				With Aids	216
Total	870	Total	870	Total	870

**TABLE 4** Demographic data of 870 discharged patients 2019/2020**TABLE 5** Costs attributed by new patient (NP)/follow-up (FU) 2019/2020

NP or FU	N	SD	Cost
New patient	258	0.0	£19 972
Follow-up	612	0.0	£25 343
Total	870	16.5	£45 315

**TABLE 6** Costs of Did Not Attends (DNAs) by cancer/non-cancer related lymphoedema status

Cancer/non-cancer status	N	SD	Cost
Cancer related lymphoedema	209	17.0	£11 175
Non-cancer lymphoedema	661	16.3	£34 140
Total	870	16.5	£45 315

lymphoedema, of these, over half were breast cancer-related (56%), 9% were of the head and neck region, and both skin cancer-related and gynaecological-related accounted for 5%, while the sum of various other cancers amounted to 5%. Twenty percent had missing data on cancer type. The majority (661, 76%) of DNA discharged patients in 2019/2020 had non-cancer related lymphoedema. Table 6 shows the relative costing attributed to

cancer to non-cancer related lymphoedema types for 1 year.

Each time a patient attends a lymphoedema clinic the severity of their lymphoedema is recorded. Of those with data available (Table 7), 24% had Complex lymphoedema, defined as total volume difference between limbs of  $\geq 50\%$ , and/or limb shape distortion (proximal to distal ratio  $\geq 0.3/0.4$ ) and/or skin changes including fibrosis,

**TABLE 7** Classification of Lymphoedema severity 2019/2020

Lymphoedema classification	Did Not Attend (DNAs) 2019/2020		Overall attendances 2019/2020	
	N	%		%
At risk of Lymphoedema	71	8	3277	9
Mild Lymphoedema	166	19	7477	21
Moderate Lymphoedema	152	17	8403	23
Severe Lymphoedema	29	3	3647	10
Complex Lymphoedema	205	24	9853	28
Complex with a wound	16	2	3338	9
Not recorded	231	27	0	0
Total	870	100	35 995	100

**TABLE 8** Mean miles from patient home to clinic by Health Board 2019/20

Health board	N	SD	Sum	Mean miles to clinic
Aneurin Bevan University Health Board (ABUHB)	107	7.62	1186	11
Betsi Cadwaladr University Health Board (BCUHB)	72	6.82	536	7.4
Cardiff and Vale University Health Board (C&VUHB)	146	3.74	1001	6.9
Cwm Taff Morgannwg University Health Board (CTMUHB)	113	4.34	645	5.7
Hywel Dda University Health Board (HDUHB)	132	7.12	1096	8.3
Powys Health Board (PHB)	17	5.58	64	3.8
Swansea Bay University Health Board (SBUHB)	280	7.73	2813	10
Total	867	6.84	7340	8.5

papillomatosis, hyperkeratosis, skin folds, acute cellulitis or red leg syndrome. Mild lymphoedema was identified in 19%, described as 5% to 10% volume difference between limbs and/or limb shape is normal (proximal to distal ratio 0:0/0:1). Between these, the lymphoedema was categorised 'moderate' in 17% of patients meaning overall volume difference 11% to 20% between limbs and/or some limb shape distortion (proximal to distal ratio 0:1/0:2). Patients that were deemed 'At Risk of lymphoedema', who were referred for advice and support only, accounted for 8% of the DNA data. Only 16 patients who were DNA discharged were categorised as having Complex Lymphoedema with a Wound (2%). The category was 'not recorded' for 27% (231), NP who failed to attend account for the majority of these, as they were yet to be categorised. In Table 7 the DNA discharges are compared with the overall attendances for the same year, these latter figures give a snapshot of the spread of classifications across the caseload for that year. From this, we can see that those least likely to DNA seem to be the patients with severe lymphoedema and those classified 'Complex with a Wound'. However, the high proportion of DNA with classification 'not recorded' means direct comparison is not possible.

#### 4.4 | Distance from home area to clinic

We examined the distance from home area to clinic. The postcode area (not specific to individual house) of each patient was used to approximate the distance to the nearest Lymphoedema clinic. The mean miles to clinic for DNA discharged patients was 8.5 miles (SD 6.84). There was no statistically significant difference in mean distance travelled by age group.

In order to establish if there were regional differences, the mean distance to clinic for each of the Health Board Lymphoedema Services was calculated. Only three data sets were missing, providing 867. This showed that for DNA discharged patients the mean distance varied between 3.8 miles in Powys Health Board (PHB), a predominantly rural region, and a mean of 11 miles in Aneurin Bevan University Health Board (ABUHB) a mixed urban-rural health board (Table 8). Whilst individuals may find the distance to a clinic problematic, there was no statistical relationship between distance to clinic and rate of DNA.

Of the DNA discharged patients over Wales in 2019/2020, those who attended at least once (FU), lived a mean distance of 7.8 miles from the clinic, whereas those

who did not even attend their first appointment (NP) lived a mean 10.1 miles from their appointed clinic (Table 9). It may therefore be that distance to clinic is an inhibiting factor for some people so that these patients are not seen within the service.

#### 4.5 | Comorbidity

The data regarding each patient included whether they had co-existing health conditions (comorbidity)

**TABLE 9** Mean miles from patient home area to clinic by new patient/follow-up 2019/20

New/follow-up	N	SD	Sum	Mean miles to clinic
New patient	256	7.17	4741	10.1
Follow-up	611	6.58	2599	7.8
Total	867	6.84	7340	8.5

**TABLE 10** Co-existing morbidities for Did Not Attend (DNA) discharged patients

Health condition	No	Yes	Missing data
Obesity	239	422 (49%)	206
Cardiac	405	259 (30%)	203
Diabetes	486	178 (21%)	203
Mental Health	573	96 (11%)	198
Neurological	589	72 (8%)	206
Renal	603	21 (2%)	243
Dementia	655	13 (1%)	199

**TABLE 11** Sensitivity analysis of decrease of unit estimates in Table 2

Year	Patient activity of LW	Numbers of NP DNA	Cost @ £54.19	Numbers of FU DNA	Cost @ £28.99	Total costs owing to DNA
2012-2013	25 286	298	£16 148.62	844	£24 467.56	£40 616
2013-2014	32 943	499	£27 040.81	1396	£40 470.04	£67 511
2014-2015	37 569	659	£35 711.21	1810	£52 471.90	£88 183
2015-2016	32 665	585	£31 701.15	1913	£55 457.87	£87 159
2016-2017	35 164	610	£33 055.90	1843	£53 428.57	£86 484
2017-2018	33 395	698	£37 824.62	1996	£57 864.04	£95 689
2018-2019	38 066	932	£50 505.08	2529	£73 315.71	£123 821
2019-2020	39 978	890	£48 229.10	2329	£67 517.71	£115 747
2020-2021	36 372	271	£14 685.49	799	£23 163.01	£37 849
2021-2022	37 202	316	£17 124.04	1838	£53 283.62	£70 408
Total	348 640	5758	£312 026.02	17 297	£501 440.03	£813 466

Abbreviations: DNA, Did Not Attend; FU, follow-up; LW, Lymphoedema Wales; NP, new patients.

(Table 10). Obesity (BMI over 30) was common, recorded in just under half of the DNA population, followed by Cardiac issues (30%) and Diabetes (21%). The number of comorbidities were counted for each person, showing 11% had no comorbidities, 26% had one, meaning almost two-thirds of patients were managing two or more comorbidities (20% had two, 15% had three and 28% had four or more).

Lastly, of the 870 patients who were discharged only 50 (6%) were re-referred to the Lymphoedema Service within the year. Twenty-seven were FU patients and 23 were NP. Analysis of this subset showed no correlations between any of the variables.

#### 4.6 | Sensitivity analysis

A one-way sensitivity analysis was undertaken (Tables 11 and 12) to assess the extent to which reducing and increasing the unit cost estimates of the cost per DNA (FU) and the cost per DNA (NP) by 30% would have on the results seen in Table 2. Table 11 shows the new estimated costs when the cost of NP DNAs is reduced by 30% to £54.19. This equates to total estimated costs of £312 026.02.

When the estimated costs of follow-up patient (FU) DNAs is reduced by 30% to £28.99, this equates to total estimated costs of £501 440.03. The total combined costs of this reduction in unit costs by 30% is £813 466 (Table 11).

Conversely, Table 12 shows the new estimated costs when the cost of NP DNAs is increased by 30% to £100.63. This equates to total estimated costs of £579 427.54. When the estimated costs of follow-up



TABLE 12 Sensitivity analysis of increase in unit estimates in Table 2

Year	Patient activity of LW	Numbers of NP DNA	Cost @ £100.63	Numbers of FU DNA	Cost @ £53.83	Total costs owing to DNA
2012-2013	25 286	298	£29 987.74	844	£45 432.52	£75 420
2013-2014	32 943	499	£50 214.37	1396	£75 146.68	£125 361
2014-2015	37 569	659	£66 315.17	1810	£97 432.30	£163 747
2015-2016	32 665	585	£58 868.55	1913	£102 976.79	£161 845
2016-2017	35 164	610	£61 384.30	1843	£99 208.69	£160 593
2017-2018	33 395	698	£70 239.74	1996	£107 444.68	£177 684
2018-2019	38 066	932	£93 787.16	2529	£136 136.07	£229 923
2019-2020	39 978	890	£89 560.70	2329	£125 370.07	£214 931
2020-2021	36 372	271	£27 270.73	799	£43 010.17	£70 281
2021-2022	37 202	316	£31 799.08	1838	£98 939.54	£130 739
Total	348 640	5758	£579 427.54	17 297	£931 097.51	£1 510 525

Abbreviations: DNA, Did Not Attend; FU, follow-up; LW, Lymphoedema Wales; NP, new patients.

patient (FU) DNAs is increased by 30% to £53.83, this equates to an estimated £931 097.51.

The total combined costs of this increase in unit costs by 30% is £1 510 525 (Table 12).

## 5 | DISCUSSION

This analysis has provided a spotlight examination of the financial workforce burden of DNAs on Lymphedema Services; this is the first time this has been investigated at this scale. Approximately £1.1 million of 'lost staff hours' expenditure is accounted for by patients missing valuable appointment slots over the last 10 years of activity. DNAs cause delays in lymphoedema treatment for other patients. Improving the worst region from 13% (Table 3) to the national average of 8% could free up around 188 appointments per year in that health board alone. Furthermore, staff time is underused, creating negative impact on capacity and demand. The staff cost is mitigated to some extent as lymphoedema staff use the time to catch up on other tasks; however, it remains an inefficiency since this work cannot be planned.

In our study, most of the expenditure was on FU patients despite being allocated half the time of a first appointment; accounting for over £716 000 compared with NP at nearly £446 000. Managing non-attendance in people who are known to the service (FU) is likely to need a different approach to those who have never attended (NP). Despite a wide range of number of appointments being attended before DNA (1-59), almost a third had only attended one appointment. It would be useful to investigate whether this signalled dissatisfaction with the service, or indeed, that the patient had adopted

the self-management approach promoted in the clinics and felt further attendance was unnecessary. In relation to DNA management, this is an important point, because with chronic conditions, such as lymphoedema, improving the self-management capacity of patients has been shown to be associated with lower health care use and less wasteful utilisation across primary and secondary care.<sup>16</sup> This explanation is most likely for the 9% of patients classified 'at risk' of lymphoedema who were referred for advice and education. For others, such as the two-third of patients who were juggling two or more comorbidities, the lymphoedema may have become a lower priority once the condition and its management had been understood. This is where patient initiated FU (PIFU) appointments may be more beneficial instead of routine 6 month FUs and is a key recommendation for the NHS going forward<sup>17</sup>; although the evidence for cost savings was found to be weak.<sup>18</sup> In the overall caseload, 20% are cancer-related lymphoedema, whereas we found that 24% of the DNA discharged patients had cancer-related lymphoedema, this may again signal competing health care demands on the patients' time. Only 16 patients with a co-existing wound (2% of DNA) missed their appointment; this may highlight that patients recognised the role of lymphoedema management in their wound care making it a priority for them. Mental health as a key factor for DNA, described in primary care-based studies, does not seem to be as significant our data.<sup>19-21</sup> Almost half of the DNA discharged in 2019/2020 were living with obesity, much higher than the 24% prevalence of adult obesity in Wales.<sup>22</sup> Diabetes is an unsurprising comorbidity in an obese population but Wales' prevalence of diabetes as a proportion of its population is 7.4%<sup>23</sup> compared with 21% in our DNA cohort of 2019/2020. Similarly,

around 11% (340 000) of the Wales population have heart and circulatory disease<sup>24</sup> whereas this was noted in 30% of our DNA patients. Whilst the link between diabetes and cardiac/circulatory problems are recognised,<sup>24</sup> the link between these comorbidities and lymphoedema is less clear, except that they commonly co-exist. Further work is now required on examining the rates of these comorbidities in our wider caseload and in global research to better understand the physiological connections involved. Following on from this study, a new investigation has commenced to further understand why patients attending the Lymphoedema Service do in fact DNA appointments. Understanding patient's reasons may initiate necessary service improvements supporting a reduction in the DNA rates.

During the first year of the Covid19 pandemic 2020 to 2021, service activity reduced by 10% but proportionally, more people attended their appointments, that is, the proportion of DNA appointments greatly decreased, the DNA rate reduced from 6% to 2%. One reason for this could be that planned implementation of virtual consultations were expedited<sup>25</sup> with proven benefits including travel/waiting time and costs for the patient (time off work and childcare) being eliminated. The DNA percentage increased back up to 5% in 2021 to 2022 despite maintaining the availability of virtual consultations. It may be that contact with any health care professional during that first unsettling year of the pandemic was welcome or that other commitments were fewer during 'lockdowns' on social movement. One local finding was that during 2021 to 2022, some patients said they had assumed that the government reporting system for Covid infection would notify the NHS automatically that they were unable to attend appointments as a result of isolation regulations.

Previous studies have reported many reasons for people not attending appointments including forgetting, transportation, work commitments, oversleeping or illness of children.<sup>21</sup> The complexity of living in social deprivation and with comorbidity is a cause of higher DNA rates.<sup>19,20</sup> This is reflected in our findings with a higher than average DNA rate (13% compared with an 8% national average) in one Health Board (Cwm Taff Morgannwg University Health Board [CTMUHB]). This health board scores highest (ie, worst) for almost all Government indicators for deprivation, including income (18%), and, (in rates per 100), GP recorded chronic condition (15), limiting long-term illness (26.4) and second highest for GP recorded mental health condition (24.7).<sup>26</sup> These issues cannot be resolved by an individual service but focusing increased activity on increasing their capability for self-management may reduce future DNAs.<sup>16</sup>

In addition to making virtual consultation mainstream within the lymphoedema service, the recent

implementation of a lymphoedema-specific patients reported outcome measure (LYMPROM)<sup>27</sup> is hoped to further improve the patients' perception of value from the service. The patient rated aspects on the impact of lymphoedema on their life enables the service to prioritise those patients with the highest of level of need for face-to-face appointments.<sup>27</sup> Repeating the LYMPROM as care proceeds allows input to be titrated to the patients' perception of value from the service. These new data are now being evaluated and will be interesting to see in future if this changes the DNA rate based on patient outcomes.

Throughout the different Health Boards in Wales, there was a variety of standard operating procedures for making appointments. Some used appointments letters with a date specified, others invited the patient to telephone to make an appointment, others pro-actively telephoned the patient to agree a date, and FU appointments were made in person while a patient was in clinic or later by telephone. During the analysis of the 870 patients we did not analyse which method had been used. Some of the services had tried text reminders prior to the appointment but with their existing systems these had been disproportionately time consuming. It is hoped that with recent digital health care communication implementations in secondary care, a cheaper automatic reminder system will be possible such as patients have become familiar with from their GP practices. Furthermore, in supporting Value-Based health care the onus of when patients need to be reviewed (PIFU) could be initiated by them. Although we collected FU data we did not specify if these were annual or six monthly appointments. It may be that those patients waiting longer periods of time did not need to attend and PIFU may reduce subsequent DNA appointments.

Surprisingly, only 6% of DNA patients were referred back into the system within the same year (roughly half being FU and half NPs). As lymphoedema is a chronic condition it may have been expected that these patients would have been re-referred within the year as they would require further compression garments. However, this was not seen in the data but may have been affected by the Covid19 pandemic.

## 5.1 | Limitations

As with any study that incorporates a financial evaluation in its primary outcomes, there will be a level of uncertainty regarding the costing estimates used within the methodology used. Therefore, we feel that using the PSSRU<sup>14</sup> to estimate the 'per hour cost' of a lymphoedema specialist is justifiable as it takes into account all

the estimated overheads and indirect costs relating the per hour cost. Lymphoedema therapists/nurses regardless of discipline are salary banded in the same way. Furthermore, the lack of Band 3 (mid-scale) costing work within the PSSRU,<sup>14</sup> led us to use the next best estimate from the NHS agenda.<sup>15</sup> This source provided us with the most accurate rate of hourly pay available at the time of writing that we could have used. We have tried to address any uncertainty with the base case unit costs estimates used by conducting a one-way sensitivity analysis  $\pm 30\%$  shown in Tables 11 and 12. The results of this sensitivity analysis show that at the lowest estimate, the costs are still extensive at £813 466 (Table 11).

A wider economic impact would include the opportunity costs to staff and could include patient incurred costs. However, this narrow focus produced information which informed the direction of further evaluation. This is already underway and includes patients reported outcomes and additional health care costs to further inform service development.

Comparison of DNA patient demographics with our overall/attending caseload was not the purpose of this project since the focus was on DNA costs but it would be useful to do as a next stage. Seasonal variations and days of the week when DNA occurred were not investigated, neither was length of time waiting for FU appointments, this may offer potential areas for improvement and system cost effectiveness. For example, would a patient initiated FU reduce DNA rates instead of routine annual appointments and appreciate potential the cost benefits. Although gaining information on why DNA patient's DNA is difficult and is a limitation of this study, it is vital that we understand the barriers and how service improvements may support people attending appointments in the future.

## 6 | CONCLUSION

DNAs absorb a significant portion of health resources, including those of lymphoedema services. It seems likely that some DNAs are avoidable by adapting appointment-making processes and by working more closely with patients to understand their perception of value. However, when lymphoedema clinic attendees have a mean age over 60 and a higher than average prevalence of comorbidities, there is likely to be a percentage of DNA that is unavoidable. The reasons for DNA are likely to be varied and nuanced but modernising appointment processes, for example, digital and PIFU, and using PROMs to identify patient value may help minimise DNA costs in the future.

## ACKNOWLEDGEMENTS

The authors thank all the Lymphoedema Wales Clinical Network Leads and Programme Team for providing the data from each of the Health Board Lymphoedema Services in Wales.

## CONFLICT OF INTEREST

The authors had no conflict of interests in this study.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## ORCID

Ioan Humphreys  <https://orcid.org/0000-0001-7993-0179>

## REFERENCES

1. NHS Benchmarking Network. Outpatients project—results published. 2019. <https://www.nhsbenchmarking.nhs.uk/news/2019-outpatients-project-results-published>. Accessed July 13, 2022.
2. Oliver D. Missed GP appointments are no scandal. *BMJ*. 2019; 364:1545.
3. Incze E, Holborn P, Higgs G, Ware A. Using machine learning tools to investigate factors associated with trends in 'no-shows' in outpatient appointments. *Health & Place*. 2021;67:102496. doi:10.1016/j.healthplace.2020.102496
4. Dantas LF, Fleck JL, Cyrino Oliveira FL, Hamacher S. No-shows in appointment scheduling—a systematic literature review. *Health Policy*. 2018;122:412-421. doi:10.1016/J.HEALTHPOL.2018.02.002
5. Boksmati N, Butler-Henderson K, Anderson K, Sahama T. The effectiveness of SMS reminders on appointment attendance: a meta-analysis. *J Med Syst*. 2016;40:90. doi:10.1007/s10916-016-0452-2
6. Middleton T, Constantino M, McGill M, et al. An enhanced SMS text message-based support and reminder program for young adults with type 2 diabetes (TEXT2U): randomized controlled trial. *J Med Internet Res*. 2021;23(10):e27263. doi:10.2196/27263
7. Saffar N, Callander J, Yesudian PD. Does content of text message reminder affect dermatology clinic attendance rate? *Br J Dermatol*. 2020;183:39-40.
8. De Vrieze T, Nevelsteen I, Thomis S, et al. What are the economic burden and costs associated with the treatment of breast cancer-related lymphoedema? A systematic review. *Support Care Cancer*. 2020;28:439-449. doi:10.1007/s00520-019-05101-8
9. Brown A, Nicholson C, Fearing A, et al. Lymphoedema management by independent hospices: a cohort study. *BMJ Support Palliat Care*. 2019;9:389-396. <https://spcare.bmj.com/content/9/4/389.abstract>
10. Thomas MJ, Morgan K. The development of Lymphoedema network Wales to improve care. *Br J Nurs*. 2017;26(13):740-750.
11. Moffatt CJ, Burian E, Karlsmark T, et al. Factors predicting limb volume reduction using compression bandaging within decongestive lymphatic therapy in lymphedema: a

- multicountry prospective study. *Lymphat Res Biol.* 2021;19:412-422. doi:10.1089/lrb.2021.0060
12. Dai M, Nakagami G, Sato A, et al. Association between access to specialists and history of cellulitis among patients with lymphedema: secondary analysis using the national LIMPRINT database. *Lymphat Res Biol.* 2021;19:442-446. doi:10.1089/lrb.2021.0056
  13. Mercier G, Pastor J, Moffatt C, Franks P, Quéré I. LIMPRINT: health-related quality of life in adult patients with chronic edema. *Lymphat Res Biol.* 2019;17:163-167. doi:10.1089/lrb.2018.0084
  14. Personal Social Service Research Unit (PSSRU). Unit costs of health and social care. 2019. <http://www.pssru.ac.uk/project-pages/unit-costs/2019/>. Accessed April 1, 2020.
  15. NHS. Agenda for change—pay rates. 2020. <https://www.healthcareers.nhs.uk/working-health/working-nhs/nhs-pay-and-benefits/agenda-change-pay-rates/agenda-change-pay-rates>. Accessed April 1, 2020.
  16. Barker I, Steventon A, Williamson R, Deeny SR. Self-management capability in patients with long-term conditions is associated with reduced healthcare utilisation across a whole health economy: cross-sectional analysis of electronic health records. *BMJ Qual Saf.* 2018;27:989-999.
  17. NHS England and NHS Improvement. *Implementing Patient Initiated Follow-Up: Guidance for Local Health and Care Systems: Version 1, May 17, 2022*. NHS England and NHS Improvement; 2022 <https://www.england.nhs.uk/wp-content/uploads/2022/05/B0801-implementing-patient-initiated-follow-up-guidance-1.pdf>
  18. Whear R, Thompson-Coon J, Rogers M, et al. Patient-initiated appointment systems for adults with chronic conditions in secondary care. *Cochrane Database Syst Rev.* 2020;4:CD010763. doi:10.1002/14651858.CD010763.pub2
  19. Parsons J, Bryce C, Atherton H. Which patients miss appointments with general practice and the reasons why: a systematic review. *Br J Gen Pract.* 2021;71(707):e406-e412. doi:10.3399/BJGP.2020.1017
  20. McQueenie R, Ellis DA, McConnachie A, Wilson P, Williamson AE. Morbidity, mortality and missed appointments in healthcare: a national retrospective data linkage study. *BMC Med.* 2019;17(1):2. doi:10.1186/s12916-018-1234-0
  21. Williamson AE, Ellis DA, Wilson P, McQueenie R, McConnachie A. Understanding repeated non-attendance in health services: a pilot analysis of administrative data and full study protocol for a national retrospective cohort. *BMJ Open.* 2017;7(2):e014120. Published 2017 Feb 14. doi:10.1136/bmjopen-2016-014120
  22. Public Health Wales Observatory. Obesity in Wales. 2019. <https://phw.nhs.wales/topics/obesity/obesity-in-wales-report-pdf/>.
  23. Diabetes UK Cymru. The state of the nation: a review of diabetes services in Wales. 2019. <https://www.diabetes.org.uk/in-your-area/wales/diabetes-in-wales>.
  24. British Heart Foundation Cymru. BHF Cymru Wales Factsheet, January 2022. 2022. <https://www.bhf.org.uk/-/media/files/research/heart-statistics/bhf-cvd-statistics-wales-factsheet.pdf?la=en>.
  25. Noble-Jones R, Thomas MJ, Lawrence P, Pike C. Guidelines for managing people with Lymphoedema remotely: a post-Covid-19 response document. *BJN.* 2021;30(4):218-225. doi:10.12968/bjon.2021.30.4.218
  26. Welsh Government. WIMD indicator data—local health board. 2019. <https://statswales.gov.wales/Catalogue/Community-Safety-and-Social-Inclusion/Welsh-Index-of-Multiple-Deprivation/WIMD-Indicator-data-2019/indicatordata-by-localhealthboard>. Accessed July 22, 2022.
  27. Gabe-Walters M, Thomas M. Development of the Lymphoedema patient reported outcome measure (LYMPROM). *Br J Nurs.* 2021;30(10):592-598.

**How to cite this article:** Thomas MJ, Humphreys I, Noble-Jones RW. A spotlight on lymphoedema Did Not Attend: Demographics and workforce costs. *Int Wound J.* 2022;1-12. doi:10.1111/iwj.13999