Impact of Pre-appointment contact and Short Message Service alerts in reducing ‘Did Not Attend’ (DNA) rate on rapid access new patient breast clinics: A DGH perspective

Pasupathy Kiruparan (kiruparan@hotmail.co.uk)  
Blackpool Teaching Hospitals NHS Foundation Trust  
https://orcid.org/0000-0003-3314-9285

Nanthesh Kiruparan  
Blackpool Teaching Hospitals NHS Foundation Trust

Debasish Debnath  
Blackpool Teaching Hospitals NHS Foundation Trust

Research article

Keywords: Outpatients, breast, Patient appointment, Patient Non-Attendance, Telephone, Text message, Short Message Service

DOI: https://doi.org/10.21203/rs.3.rs-24826/v2

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License
Abstract

Background: Failure to attend the clinic without prior intimation, known as “Did Not Attend” (DNA) is a significant global issue. There have been no published studies attempting to reduce DNA rates in breast clinics. We aimed to assess the impact of contacting patients prior to clinic attendance and Short Message Service (SMS) reminder on DNA rates in rapid access new patient breast clinics, evaluate 'Could Not Attend' (CNA) rate, and explore any correlation between age, sex, clinic days and sessions.

Methods: Initially, DNAs at the rapid access new patient breast clinics between 01/04/2018 and 31/03/2019 at a district general hospital in the North-West of England was assessed (Cycle 1). Changes were introduced in terms of contacting patients prior to offering appointments, followed by SMS reminders nearer the clinic dates. Subsequently, DNA was reassessed between 01/10/2019 and 31/03/2020 (Cycle 2).

Results: Following implementation of changes, DNA rate reduced from 8.2% to 4.1% (p<0.00001). CNA rates were 0.9% (Cycle 1) and 1.1% (Cycle 2) [p=0.36]. Evening clinics had the lowest DNA rates throughout. DNA patients in cycle 2 were significantly older than those in cycle 1 (p=0.002).

Conclusions: Contacting patients prior to clinic appointments and sending SMS reminders helped reduce DNA rates significantly in rapid access new patient breast clinics. Scheduling clinic sessions with least DNA rates, such as evening clinics, should be contemplated. One should be cautious of mobile phone technology that conveys SMS, which can potentially disadvantage the older age group. This model could be considered across the board to improve DNA rates.

Background

“Spare a thought for that empty chair…”[1]

Failure to attend outpatient appointments without any advance intimation, commonly known as “Did Not Attend” (DNA) in the UK, is a common problem encountered globally [2]. NHS Scotland launched the ‘Spare a thought for that empty chair…it could be costing more than you think’ campaign to raise awareness on DNA [1]. Such clinic DNAs delay patient health care management, increase waiting times and can impact on patient satisfaction [3]. The non-attendance of medical appointments is a multifactorial issue that negatively affects patient health, physician time, and resource management [4]. Rescheduling appointments stretches the already limited services even further.

Various studies have explored the underlying reasons for DNAs [5]. Issues such as transport, childcare, work commitments and forgetfulness are documented to be associated with DNAs [5,6]. Factors noted to be predictive of DNA-behaviour include previous DNA history, high lead time, younger age and distance from the clinic [7].

According to National Health Service (NHS) England quarterly activity return data (2008-2018), the average DNA rate for first outpatient appointments has been 8.7% [8]. DNA rate has fallen in most quarters, despite an increase in both first and subsequent outpatient attendances since 2008/09 [9]. However, the DNA rate in recent quarters appears to have levelled off. For example, DNA rate for quarter 2 of 2017/2018 and 2018/2019 has been 8.9% [9]. The cost of missed outpatient clinic appointments in the NHS England in 2017/2018 was projected to be £1 billion [10]. This undoubtedly causes a huge economic burden on an already stretched NHS.

In contrast to DNA (also known as ‘No-Show’), a patient may be categorised as “Could Not Attend” (CNA) when the hospital is notified in advance of patient's unavailability to attend on the offered admission date, or for any appointment [11]. CNA rate can be quite high. For example, CNA rate for NHS Northern Ireland was 11.3% for 2018/2019 [12].

Healthcare providers are increasingly using Short Message Service (SMS) or text message-based reminders to reduce DNA rates [13]. Some hospitals have tried to compensate DNAs by overbooking clinics, with ensuing problems [14]. A Cochrane review conducted on the use of SMS reminders adjudged the evidence available to be low to moderate in quality. However, it did show superiority in attendance rates when compared to no reminder service or a postal reminder service [15].

Breast cancer is the most commonly occurring cancer in women and the second most common cancer overall in the world [16]. Breast cancer is the commonest cancer in the UK, accounting for 15% of all new cancer cases [17]. The importance of early diagnosis and treatment of breast cancer is paramount. Breast referral pathway takes into account the need for rapid access, so that patients are seen by a specialist within 2 weeks of referral, usually in a rapid access new patient clinic [18]. The latter, also known as one-stop clinic, allows triple assessment at a single visit, which is currently considered as the best practice [19].

The breast unit under consideration is based at a 760-bedded District General Hospital (DGH) in the North-West of England and provides a range of acute services to the 352,000 population [20]. The breast unit deals with approximately 3500 new breast referrals annually [21].
Reducing the number of missed and cancelled appointments would help improve revenue, hospital efficiency and ultimately patient safety [6]. There is a growing interest in making the health care services more efficient. We searched PubMed, Ovid MEDLINE®, CINAHL and Google Scholar databases using Medical Subject Headings (MESH) entry terms 'Outpatients', 'Breast', Patient appointment', 'Patient Non-Attendance', 'Telephone', 'Text message', 'Short Message Service'. Literature search found studies which looked at improving DNA in breast screening [22, 23]. However, as per the current literature, we could not find any study that attempted reducing DNAs in the breast clinics.

**Aims:**

Primary aim:

To assess the DNA rates at rapid access new patient breast clinics and reassess the impact of contacting patients prior to clinic appointment to confirm clinic attendance and introduction of a SMS-based reminder service on DNA rates at a single breast unit in the North-West of England.

Secondary aim:

To evaluate CNA rate, and any correlation between DNA and patients' age, sex, clinic days and sessions.

**Methods**

**Setting**

A single breast unit at a district general hospital in the North-West of England.

**Design** [Figure 1]-

The study was performed in three phases and data were collected in two cycles.

- Phase 1/Cycle 1 - Assessment of DNA and CNA rates over a 12-month period; Retrospective collection of data.
- Phase 2 - Implementation of changes carried out by a dedicated breast administrative team working beyond core hours: i) patients were contacted by telephone prior to offering a clinic appointment to confirm their attendance; ii) letters were sent as an additional measure of confirmation of the appointment, and iii) a SMS-based reminder was subsequently sent close to the clinic date.
- Phase 3/Cycle 2- Re-assessment of DNA and CNA rates; Prospective collection of data.

**Calculation** [12] -

- DNA rate = \( \frac{\text{Number of missed appointments}}{\text{Total attendances} + \text{Number of missed appointments}} \times 100 \)

- CNA rate = \( \frac{\text{Number of cancelled appointments}}{\text{Total attendances} + \text{Number of cancelled appointments}} \times 100 \)

**Period** -

- Phase 1 and Cycle 1 - Between 01 April 2018 and 31 March 2019
- Phase 2- Between April 2019 and September 2019
- Phase 3 and Cycle 2- Between 01 October 2019 and 31 March 2020

**Inclusion criteria** -

All new patients seen, or expected to be seen in the rapid access breast clinic during the study period.

**Exclusion criteria** -

None

**Approval** -
The study was approved and supported by the hospital Research and Development (R&D) committee as a service improvement project, confirming that National Research Ethical approval is not required. Informed patient consent was not required in view of the fact that this was a service development project without any patient participation entailing additional clinical intervention; or sharing of identifiable individual information.

Data collection -
- Number of patients - i) expected to attend; ii) cancelled appointments in advance; iii) attended the clinic; and iv) failed to attend without prior intimation.
- Clinic sessions - i) morning ii) afternoon; iii) evening.
- Clinic days - i) weekdays and ii) weekends. Anonymised patient demographics - i) age and ii) sex of patients who did not attend.

Statistical analysis -
Chi-Square test, Fisher's Exact test and Student's t-test were performed using SPSS version 25 (IBM® Corp; Armonk, NY). Statistical significance was taken to be p<0.05.

Results
A total of 3600 new patients were expected to attend 383 rapid access breast clinics between 01 April 2018 and 31 March 2019 (Cycle 1). During this 12-month period of phase 1 (prior to implementation of changes), 33 patients cancelled their appointments in advance and 293 patients did not attend the clinic with a median age of 38 years, (DNA rate = 8.2%). Following implementation of changes (Phase 3), which entailed establishing contacts successfully with all patients by phone prior to sending appointments, a total of 1782 new patients were expected to attend 194 clinics between 01 October 2019 and 31 March 2020 (Cycle 2). Twenty-one patients cancelled their appointments in advance in Cycle 2 and 73 patients did not attend clinic appointments with median age of 47 years, (DNA rate = 4.1%). The reduction in DNA rates was found to be statistically significant, except amongst male DNAs [Table 1]. Patients who did not attend clinics in cycle 2 were significantly older than those in cycle 1 [Table 1].

Sub-group analysis comparing DNA rates of weekdays with weekend showed that most of the clinics took place during the weekdays. Overall (both cycles combined) DNA rates of clinics during weekdays and weekends were 6.9% and 4.7%, respectively (p=0.28). Intervention made a statistically significant difference in total and female DNA rates during weekdays (p<0.00001), but not weekends (p=0.14). DNA age group in post-intervention phase was significantly older than pre-intervention phase (0.0002) during weekdays, but no such association was noted during weekends [Table 2].

Overall DNA rates in the morning, afternoon and evening clinics were 7.7%, 6.5% and 5.3%, respectively (p=0.07). Significant reductions in the occurrence of DNA in the morning (p=0.0001) and afternoon (p<0.00001) clinics were noted following intervention. The latter did not make any significant difference in DNA rate of evening clinics. However, the patients who did not attend the evening clinics in post-intervention phase were significantly older than pre-intervention group [Table 3].

The incidence of DNA was not significantly higher amongst the male (p=0.61). The odds ratio for male sex as a risk factor for DNA was 1.12 [Table 4].

Table 5 shows highest occurrence of male as well as female DNAs on Mondays and weekdays. Fewest DNAs were noted in evening clinics amongst both male and female patients.

CNA rate over a 12-month period prior to the intervention (Cycle 1) was 0.9%. Post-intervention (Cycle 2) CNA rate was 1.1%. There was no significant difference in CNA rates between Cycle 1 and Cycle 2 (p=0.36) [Table 1]. All the clinic cancellations took place amongst the female patients only (male CNA rate = 0%). Slightly higher proportions of clinics were cancelled over the weekends. Most of the individual clinic cancellations took place on Mondays and in the afternoon [Table 6].

Discussion
"Did Not Attend" (DNA) has impact on resources and outcomes [1]. Unfortunately, DNA remains a global issue [2]. The financial cost of annual DNAs in NHS England is equivalent to staggeringly high 257,000 hip replacements or 990,000 cataract operations [10].
Incidence of breast cancer in the UK is approximately 55,200 per annum, and is projected to rise by 2% between 2014 and 2035 [16]. Cancer Waiting Times standards monitor the length of time that patients with cancer or suspected cancer wait to be seen and treated in England [24]. These were first introduced through the NHS Cancer Plan (September 2000). The current measures and the operational standards include:

1. Two weeks from urgent GP referral for suspected cancer to first outpatient attendance (93% target)
2. Two weeks from referral with breast symptoms (where cancer is not suspected) to first hospital assessment (93% target).

All new breast referrals are seen at the rapid access breast clinic, which allows triple assessment in a single visit, hence the clinic is also known as one-stop breast clinic. Triple assessment includes clinical assessment, radiological evaluation (mammogram and/or ultrasound scan) and/or tissue sampling (biopsy or cytology). Needless to say, triple assessment involves in-depth multidisciplinary inputs and is time-consuming. Patients are made aware in advance of the waiting time for triple assessment, which can sometimes take up to 4 hours. Given the nature of the assessment, only a limited number of patients can be seen in a rapid assessment new patient breast clinic. In our set-up, the clinic template provides slots for ten new patients per clinician per session. Clinics are held usually within routine working hours and weekdays. Depending on the workload, sometimes clinics are held on weekends and evenings as well. Waiting times are under constant scrutiny and NHS Foundation Trusts are held accountable through Monitor via the NHS Foundation Trust (NHSFT) Compliance Framework [25]. Any DNA, therefore, can lead to an increase in the waiting time, be costly, and reduce productivity [26]. It is expected that organisations should be monitoring DNA data and making a decision locally on what is an acceptable DNA rate for the organisation [25].

During first phase of our study, we initially assessed the DNA rate over a 12-months period (2018/2019) in retrospect (Cycle 1), which was found to be 8.2%. The Trust all-specialty DNA rate for the same period was 8.8%. Our findings are in accordance with annual average 2018/2019 DNA rates of 8.6% and 7.8% noted across the NHS in England and Northern Ireland respectively [12,27]. There is no NHS data available for comparison of DNA in the breast clinic. NHS Northern Ireland data provides an insight into DNA rates of different specialties. For example, the highest DNA rate in Northern Ireland during 2018/19 was Urology, with a rate of 14.6%, followed by Dermatology (9.3%), Cardiology (9.2%), Trauma and Orthopaedic Surgery (8.7%), ENT (8.3%) and Ophthalmology (5.1%). Most of the DNAs in our study took place during weekdays and specifically on Mondays. Least DNAs were noted in the evening clinics. These might reflect rigid commitments at work or home.

In some cases, DNAs may be associated with clinical risk or less favourable outcomes, for which hospitals may face financial and regulatory penalties [28]. Providers should therefore ensure there are local policies in place to deal with DNAs and clinic cancellations by the patients (CNAs), which reflect the spirit of cancer access guidance [25]. NHS Scotland has issued guidelines about managing DNAs [29]. NHS Improvement has provided tools for reducing DNAs [26]. Many Trusts have adopted guidelines and put local DNA policies in place [28, 30]. Communication failure, short notification, timing or day of appointment, age and sex, have all been cited as important reasons for DNA [26]. We therefore considered these factors in our study.

Changes were implemented during second phase of the study in order to address potential causes of DNA. Hospitals, as per the Department of Health (DoH) guidelines, aim to give appointments to rapid access new patient breast clinics within 2 weeks of referral to maintain a minimum target of 93%. Therefore, quite often, patients are offered appointments at a short notice. It is a traditional practice to send the clinic appointment letters by post. Unfortunately, letters do not always get delivered on time. Also, the appointment date and time may not always be suitable to the patients. Therefore, a dedicated breast appointment team was designated to work beyond routine hours and make contacts with patients by phone prior to offering appointments. This served two purposes, namely it mitigated uncertainty over postal delay and patients could opt for the days and times most convenient to them. Subsequently, appointment letters were also sent by mail. To be sure, a SMS reminder was sent close to the clinic date as well. These steps helped address potential underlying causes of DNA, such as poor communication, short notification, and inconvenient timing or day of appointment [26]. Prior to embarking on data collection (cycle 2), we allowed a period of 6 months for implementing the changes. The six months period was deemed necessary and adequate to sort out any teething issues encountered during the process. The change in practice continued through the whole of cycle 2 as well.

Third phase of the study, which involved assessment of DNA following implementation of changes, showed a DNA rate of 4.1% (Cycle 2), a significant improvement by 50%, compared to Cycle 1. This is not surprising as patients found it convenient to be contacted beforehand and they could make necessary changes at work and/or home. It is worth emphasizing that the reduction in DNA rate was achieved despite raised DNAs that took place at the end of March 2020 due to COVID-19 pandemic, which affected almost every aspect of the National Health Service. Some studies have shown a reduction in missed clinic appointments, to a varied degree, following interventions [6, 13, 15]. However, no study has been performed involving direct patient contact prior to appointment and SMS alert nearer the time in regards to breast clinics.

There is still a paucity of well-conducted SMS alert-based studies in reducing DNA [31]. Unfortunately, in some cases in our study, it was not possible to contact patients or send text messages, particularly if they were away or simply not contactable by phone, or did not have mobile phones. SMS alerts rely on mobile phone technology. It’s true that not growing up with technology from a young age can put older generations
at a disadvantage to start learning, and that age-related health issues can make navigating a smartphone much trickier [32]. We therefore looked at age distribution of those who did not attend.

The median ages of patients who did not attend appointments following intervention were almost 9 years older, compared to the pre-intervention group. One explanation for this may be that by providing a mobile phone-based reminder service we are catering more for the younger population and this may not be suitable to reduce the number of DNA of the older population, who are more likely to be reluctant in using mobile phone technology. One corollary that consequently follows is that breast cancer, which predominantly affects the older population, may potential be missed as a result [33].

An analysis of outpatient appointment DNA data in NHS Highland found the risk of DNA to be higher for men than women [34]. Hence, we explored the possibility that sex could be a risk factor and hypothesised male sex as a potential for higher DNA. However, the odds ratio (1.12) ruled out any such association between sex and breast clinic attendance.

Some have compared DNA with the ‘No Show’ encountered in the airline practice, which involves intentional overbooking of seats in anticipation of no-shows [35]. A similar action entailing overbooked clinics has been tried. But unlike airlines, clinics cannot refuse (or ‘bump’ as colloquially known in the airline practice) patients from being seen, Unsafe practice may ensue and serious capacity issue can occur, if all patients turn up on the day [35]. Therefore, blind overbooking of clinics simply is not a solution [36]. Instead, the underlying booking processes should be optimized. This would explain, rather than overbooking the clinics, why we endeavored to make changes in our booking process to address the issue with DNA,

Sometimes patients cancel in advance (CNA), even at a short notice, which changes official DNA rate [37]. Due to late cancellation of clinics, the vacant slots may not always be taken by other patients [1]. We therefore assessed CNA rate as well, which were 0.9% and 1.1% in Cycle 1 and Cycle 2, respectively. There was no statistically significant difference in the occurrences of CNA between Cycle 1 and Cycle 2. Lack of any significant change between pre- and post- intervention CNA rates could be explained by the fact that the occurrence of CNA was very low (0.9%) to start with. A larger study over a longer period would be warranted to assess whether, despite a low baseline rate, it is possible to reduce CNA rate significantly by pre-emptive actions. Out of four countries in the UK, NHS Northern Ireland is the only NHS body that has published data on CNA. Indeed, the CNA figures in our study were all along better than the available data from the NHS Northern Ireland that showed a CNA rate of 11.3% for 2018/2019, which remained mostly unchanged compared to preceding years [12]. The specialty with the highest CNA rate in Northern Ireland was Chemical Pathology (20.4%). Once again, like DNA, no data was available on CNA for breast clinics. However, a relatively low CNA rate, as noted in our study, is a welcoming finding. Interestingly, we also noted that most of the cancellations of clinics took place on Mondays and in the afternoon. This may perhaps reflect unexpected changes or situations that patients occasionally face, which are unavoidable and can't be swayed by SMS alerts. Awareness of higher chance of clinic cancellation on Mondays or of afternoon sessions helped our appointment team to stay alert, so that vacant slots could be offered to other patients. NHS Scotland has issued guideline as how to define and manage CNAs, assuming a reasonable offer of appointment has been made [29]. Late cancellation of clinics can interfere with the ability to utilize clinic capacity fully and some Trusts feel that insufficient notice of cancellation of the clinic by the patient should be classed as DNA rather than a CNA. Such a premise may potentially introduce a subjective element to the criteria of ‘insufficient’ timescales deemed appropriate by different Trusts. Hence, as per NHS Scotland, the current definition of CNA stands unchanged [38]. However, NHS Wales guidance states that ‘When a patient contacts the Trust to cancel a second appointment, the Trust may treat the cancellation as a DNA and not make an appointment’ [39].

DNA rates have been noted to decline monotonically over the week, as found by Ellis et al. [40]. We therefore assessed the association between DNA and days of the week. Highest occurrence of DNAs took place on Mondays. Least DNAs were noted in evening clinics, which was not significantly affected by the intervention. The reasons for this may be because evening (being after office hours) is the most accessible time for the majority of the working population, requiring minimum adjustments at work place. Evening clinics also allow flexibility in terms of working partners of patients being free to cater for the child-care. Hence, evening clinics can be considered as a model for those set-ups with a high DNA rate. By virtue of being aware of the distribution of DNA amongst weekdays and sessions, it is possible to reduce DNA rates by modifying appointment allocation strategy [40].

Cost of each DNA in NHS England in 2017/2018 was assessed at £120 [10]. Our study showed that even prior to the intervention, the breast unit was performing slightly better than national average in terms of clinic DNA rates [8, 9]. With the application of our intervention, we were able to reduce 73 projected DNAs over six months. The latter equated to a projected £17,520 annual savings due to missed rapid access new patient breast clinic appointments, not considering the potential penalties for unachieved targets as well as extra health and financial implications of possible missed cancers through DNAs. The actual financial saving would be more than the above figure as the cost of referral to one-stop (rapid access) new patient breast clinic is significantly higher than general clinic in view of the extra time and resources required for triple assessment. However, our Trust currently holds a block contract for the breast services with the Clinical Commissioning
Group (CCG) and therefore, we could not confirm the individual cost for the breast clinic referral on its own. The annual efficiency saving would help fund the appointment team working beyond core hours and could potentially make the project self-sustainable.

In summary, it is possible to significantly reduce DNAs in new patient rapid access breast clinics by introducing changes such as contacting patients prior to giving appointments and sending SMS alerts. One has to be mindful of the limitation of mobile phone technology that can potentially disadvantage the older age group. The study also showed a very low CNA rate, and that patient's sex was not a risk factor for DNA in breast clinic. Evening sessions encountered least DNAs and opens the possibility of holding evening sessions as an option to reduce DNAs. Therefore, it would be worth a consideration whether such changes in practice (namely, contacting patients in extended hours prior to offering appointments and sending SMS alerts close to clinic dates) could be implemented across the board in order to attempt to reduce DNA rates.

Limitations of our study include a relatively smaller number of male patients, shorter period of study in the post-intervention period and the focus on a speciality clinic. General clinics may have different set-ups and our experience may not necessarily be transferable to all set-ups. Nevertheless, the changes introduced in our study are essentially a reflection of good practice and can still be used as a model for introducing changes. Moreover, this is the first study on DNA involving a speciality breast clinic and our findings will add to the existing literature in addressing reduction of DNAs.

Conclusions

Contacting patients prior to clinic appointments and sending Short Service Message reminders nearer the clinic dates, helps in reducing DNA rates significantly in rapid access new patient breast clinics. Scheduling clinics on certain times and days with least DNA rates, should be contemplated. This model could be considered across the board to improve the rate of clinic DNA, which remains a global issue.

List Of Abbreviations

| Abbreviation | Description          |
|--------------|----------------------|
| DGH          | District General Hospital |
| DNA          | Did Not Attend       |
| CNA          | Could Not Attend     |
| SMS          | Short Message Service|
| NHS          | National Health Service|
| R&D          | Research and Development|
| NHSFT        | National Health Service Foundation Trust|
| DoH          | Department of Health |
| CCG          | Clinical Commissioning Group |

Declarations

Ethics approval and consent to participate:

Local Research and Development department confirmed that National Research Ethical approval is not required and provides authorisation for this Service Evaluation to commence (reference provided).

Consent for publication:

Consent not required in view of the facts that this was a service development project without any patient participation entailing additional clinical intervention; or sharing of identifiable individual information.

Availability of data and materials:

The data that support the findings of this study are available from the Blackpool Teaching Hospitals NHS Foundation Trust, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Blackpool Teaching Hospitals NHS Foundation Trust.
Competing interests:
The authors declare that they have no competing interests.

Funding:
None.

Authors’ contributions:
Each author (KP, NK, DD) made substantial contributions to the conception and design of the work; the acquisition, analysis and interpretation of data; and drafted the work and substantively revised it. Each author (KP, NK, DD) approved the submitted version and all agreed both to be personally accountable for the author's own contributions and ensured that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, were appropriately investigated, resolved, and the resolution documented in the literature.

Acknowledgements:
Not applicable.

Authors' information (optional)
None

References
1. NHS Borders. The real cost of a missed appointment. http://www.nhsborders.scot.nhs.uk/patients-and-visitors/latest-news/2016/july/7/the-real-cost-of-a-missed-appointment/ Accessed 14 June 2020.
2. Shahab I, Meili R. Examining non-attendance of doctor's appointments at a community clinic in Saskatoon. Can Fam Physician. 2019;65(6):e264-e268. PMID: 31189640
3. Partin MR, Gravely A, Gellad ZF, Nugent S, Burgess JF Jr, Shaukat A et al. Factors Associated With Missed and Cancelled Colonoscopy Appointments at Veterans Health Administration Facilities. Clin Gastroenterol Hepatol, 2016;14(2):259-67. PMID: 26305071 DOI: 10.1016/j.cgh.2015.07.051
4. Capko J. The price you pay for missed appointments. J Med Pract Manage. 2007;22(6):368. PMID: 17612315
5. Torres O, Rothberg MB, Garb J, Ogunnemee O, Onyema J, Higgins T. Risk factor model to predict a missed clinic appointment in an urban, academic, and underserved setting. Popul Health Manag. 2015;18(2):131-6. PMID: 25299396 DOI: 10.1089/pop.2014.0047
6. Covert LT, Slevin JT, Hatterman J. The Effect of Telerehabilitation on Missed Appointment Rates. Int J Telerehabil. 2018;10(2):65-72. PMID: 30588277 DOI: 10.5195/ijt.2018.6258
7. Dantas LF, Fleck JL, Cyrino Oliveira FL, Hamacher S. No-shows in appointment scheduling - a systematic literature review. Health Policy. 2018;122(4):412-21. PMID: 29482948 DOI: 10.1016/j.healthpol.2018.02.002
8. NHS England. Quarterly Hospital Activity Data. https://www.england.nhs.uk/statistics/statistical-work-areas/hospital-activity/quarterly-hospital-activity/qar-data/. Accessed 16 June 2020.
9. Tither K. Operational Information for Commissioning NHS England. NHS inpatient admission and outpatient referrals and attendances. https://www.england.nhs.uk/statistics/wp-content/uploads/sites/2/2018/11/QAR-commentary-Q2-1819-VERSION-2.pdf. Accessed 16 June 2020.
10. NHS England. NHS to trial tech to cut missed appointments and save up to £20 million. 2018. https://www.england.nhs.uk/2018/10/nhs-to-trial-tech-to-cut-missed-appointments-and-save-up-to-20-million/. Accessed 15 June 2020.
11. Information Services Division, NHS National Services Scotland. Data Dictionary. 2012.https://www.ndc.scot.nhs.uk/Dictionary-A-Z/Definitions/index.asp?Search=C&ID=175&Title=&Title2=CNA%20see%20Could%20Not%20Attend Accessed 12 June 2020.
12. Finlay J, Robinson A, Farrelly M, Morgan S. Hospital Statistics: Outpatient Activity Statistics 2018/19. Information Analysis Directorate, Department of Health, Northern Ireland. 2019. https://www.health-ni.gov.uk/news/publication-northern-ireland-hospital-statistics-inpatient-day-case-and-outpatient-activity Accessed 20 June 2020.
13. Hallsworth M, Berry D, Sanders M, Sallis A, King D, Vlaev I et al. Stating Appointment Costs in SMS Reminders Reduces Missed Hospital Appointments: Findings from Two Randomised Controlled Trials. PLoS One. 2015.10(9):e0137306. PMID: 26366885 DOI: 10.1371/journal.pone.0137306
14. LaGanga LR, Lawrence SR. Clinic Overbooking to Improve Patient Access and Increase Provider Productivity. Decision Sciences. 2007;38:251-76. https://doi.org/10.1111/j.1540-5915.2007.00158.x

15. Gurov-Urganci I, De Jongh T, Vodopivec-Jamsek V, Atun R, Car J. Mobile phone messaging reminders for attendance at healthcare appointments. Cochrane Database Syst Rev. 2013(12):Cd007458. PMID: 24310741 DOI: 10.1002/14651858.CD007458.pub3

16. The Global Cancer Observatory. Cancer today. 2019. ttp://gco.iarc.fr/today/data/factsheets/cancers/20-Breast-fact-sheet.pdf Accessed 16 June 2020.

17. Cancer Research UK. Breast Cancer Statistics. https://www.cancerresearchuk.org/health-professional/cancer-statistics/statistics-by-cancer-type/breast-cancer Accessed 14 June 2020.

18. National Institute for Health and Care Excellence. Breast cancer - recognition and referral. 2015. https://cks.nice.org.uk/breast-cancer-recognition-and-referral#topicSummary Accessed 20 June 2020.

19. Breast Cancer Expert Advisory Group. Assessment and diagnosis, Clinical Guidelines for the Management of Breast Cancer. 2018. https://www.england.nhs.uk/mids-east/wp-content/uploads/sites/7/2018/02/guidelines-for-the-management-of-breast-cancer-v1.pdf. Accessed 14 June 2020.

20. Blackpool Teaching Hospitals NHS Trust. About Our Trust. https://www.bfwh.nhs.uk/about-our-trust/ Accessed 14 June 2020.

21. Blackpool Teaching Hospitals NHS Trust. Our Services, Breast Care Centre. https://www.bfwh.nhs.uk/breastcare/index.php/our-services/ Accessed 18 June 2020.

22. Hudson S, Brazil D, Teh W, Duffy SW, Myles JP. Effectiveness of timed and non-timed second appointments in improving uptake in breast cancer screening. J Med Screen. 2016;23(3):160–63. doi:10.1177/0969141315624937

23. Renshaw C, Jack RH, Dixon S, Moller H, Davies EA. Estimating attendance for breast cancer screening in ethnic groups in London. BMC Public Health. 2010;10:157. https://doi.org/10.1186/1471-2458-10-157

24. National Cancer Registration and Analysis Service (NCRAS), Public Health England. Operational Standards, Cancer Waiting Times (CWT). http://www.ncin.org.uk/collecting_and_using_data/data_collection/gfocw Accessed 14 June 2020.

25. Coomber N. A Good Practice Guide; Delivering Cancer Waiting Times. 2014. https://www.england.nhs.uk/wp-content/uploads/2015/03/delivering-cancer-wait-times.pdf Accessed 15 June 2020.

26. ACT Academy. Reducing did not attends (DNAs). Online library of Quality, Service Improvement and Redesign tools. https://improvement.nhs.uk/documents/2108/reducing-dna.pdf Accessed 20 June 2020.

27. NHS England. Quarterly Hospital Activity Data 2018-19. https://www.england.nhs.uk/statistics/statistical-work-areas/hospital-activity/quarterly-hospital-activity/qar-data/ Accessed 28 June 2020.

28. Jane E (The Tavistock and Portman NHS Foundation Trust). Managing DNA (Did Not Attend) and Cancelled Appointments Procedure. 2016. https://tavistockandportman.nhs.uk/documents/11/procedure-dna-cancelled-appointments.pdf Accessed 14 June 2020.

29. Information Services Division, NHS National Services Scotland. NEW WAYS of defining and measuring waiting times; Applying the Scottish Executive Health Department guidance. 2007. https://www.isdscotland.org/Health-topics/Waiting-times/Hospital-waiting-times/Rules-and-Guidance/New-Ways-Applying-Guidance-V3.pdf Accessed 18 June 2020.

30. Black Country Partnership NHS Foundation Trust. Did Not Attend (DNA) and Cancellation Policy. 2018. http://www.bcpft.nhs.uk/documents/policies/d/1842-did-not-attend-dna-and-cancellation/file. Accessed 15 June 2020.

31. Kannisto KA, Koivunen MH, Välimäki MA. Use of mobile phone text message reminders in health care services: a narrative literature review. J Med Internet Res. 2014;16(10):e222. PMID: 25326646 DOI: 10.2196/jmir.3442

32. Age Co. A review of the best mobile phones for the elderly. https://www.ageco.co.uk/viewpoint/health-and-lifestyle/the-best-mobile-phones-for-the-elderly/ Accessed 16 June 2020.

33. Glaser R, Marinopoulos S, Dimitarakakis C. Breast cancer treatment in women over the age of 80: A tailored approach. Maturitas. 2018;110:29-32. PMID: 29563032 DOI: 10.1016/j.maturitas.2018.01.014

34. Campbell K, Millard A, McCartney G, McCullough S (NHS Health Scotland). Who is least likely to attend? An analysis of outpatient appointment DNA data in NHS Highland. 2015. https://www.scotpho.org.uk/media/1162/scotpho150319-dna-analysis-nhs-highland.pdf Accessed 15 June 2020.

35. Huang Y, Hanauer DA. Patient no-show predictive model development using multiple data sources for an effective overbooking approach. Appl Clin Inform. 2014;5(3):836–60. PMID: 25298821 doi:10.4338/ACI-2014-04-RA-0026

36. Kendall P. Overbooking in Medical Clinics: Do or Don’t? 2015. https://www.petalmd.com/blog/overbooking-in-medical-clinics Accessed 16 June 2020.

37. What if managing hospital appointments was easy? 2018. https://www.drdoctor.co.uk/resourses/what-if-managing-hospital-appointments-was-easy Accessed 17 June 2020.
38. Information Services Division, NHS National Services Scotland. Query resolution (CNA/DNA-Data Definition/Local Recording). https://www.ndc.scot.nhs.uk/Dictionary-A-Z/Appendices/Appendix-E/1998-DLG/DLG153.asp#CNA-DNA Accessed 17 June 2020.

39. Hutt J (Welsh Assembly Government). A guide to good practice. Tools and Techniques to enable NHS Trusts to improve the delivery of healthcare. 2004. http://www.wales.nhs.uk/technologymls/english/resources/pdf/tools/service_dev/Guide%20to%20Good%20Practice%20Outpatients.pdf Accessed 28 June 2020

40. Ellis DA, Jenkins R. Weekday affects attendance rate for medical appointments: large-scale data analysis and implications. PLoS One. 2012;7(12):e51365. doi:10.1371/journal.pone.0051365

Tables

**Table 1.** Distribution of attendances, DNA, age and CNA according to the intervention.

|                         | Pre-intervention (Cycle 1) | Post-intervention (Cycle 2) | p-value   |
|-------------------------|-----------------------------|-----------------------------|-----------|
| Attended clinic (total) | 3274                        | 1688                        | <0.00001  |
| DNA (total)             | 293                         | 73                          |           |
| Attended clinic (Male)  | 208                         | 110                         | 0.906     |
| DNA (Male)              | 14                          | 7                           |           |
| Attended clinic (Female)| 3066                        | 1578                        | <0.00001  |
| DNA (Female)            | 279                         | 66                          |           |
| Age (DNA) (total)       | Median 38 (range, 14 - 85)  | Median 47 (range, 15 - 92)  | 0.0004    |
| Expected (total)        | 3600                        | 1782                        | 0.369     |
| CNA (total)             | 33                          | 21                          |           |

(DNA= Did Not Attend; CNA= Could Not Attend)

**Table 2.** Occurrences of DNA as per weekdays and weekends.
|                  | Pre-intervention (Cycle 1) | Post-intervention (Cycle 2) | p-value |
|------------------|-----------------------------|-----------------------------|---------|
| **Weekdays**     |                             |                             |         |
| Attended clinic  | 3230                        | 1573                        | <0.00001|
| DNA (total)      | 289                         | 69                          |         |
| **Weekends**     |                             |                             |         |
| Attended clinic  | 27                          | 132                         | 0.140   |
| DNA (total)      | 3                           | 5                           |         |
| **Weekdays**     |                             |                             |         |
| Attended clinic  | 206                         | 103                         | 1.000   |
| DNA (Male)       | 14                          | 7                           |         |
| **Weekends**     |                             |                             |         |
| Attended clinic  | 2                           | 7                           | NA      |
| DNA (Male)       | 0                           | 0                           |         |
| **Weekdays**     |                             |                             |         |
| Attended clinic  | 3024                        | 1470                        | <0.00001|
| DNA (Female)     | 275                         | 62                          |         |
| **Weekends**     |                             |                             |         |
| Attended clinic  | 25                          | 125                         | 0.132   |
| DNA (Female)     | 3                           | 5                           |         |
| **Weekdays**     |                             |                             |         |
| Age (DNA)        | Median 38 (Range, 14-85)    | Median 47 (Range, 15-92)    | 0.0002  |
| **Weekends**     |                             |                             |         |
| Age (DNA)        | Median 36 (Range, 28-38)    | Median 40 (Range, 23-54)    | 0.606   |

**Table 3.** Total attendance, DNA and age distribution as per clinic session.
Table 4. Distribution of clinic attendance and DNA as per sex.

|        | Attended clinic | DNA | OR (95% CI) |
|--------|----------------|-----|-------------|
| Male   | 318            | 21  | 1.12 (0.71-1.77) |
| Female | 4644           | 345 |             |

(OR= Odds Ratio; CI= Confidence Interval)

Table 5. Incidence of DNA as per sex, tabulated according to sessions, weekdays, and weekends, as well as days of the week.

|          | Male DNA | Female DNA | p-value |
|----------|----------|------------|---------|
| Morning  | 5        | 161        | 0.12    |
| Afternoon| 13       | 153        |         |
| Evening  | 3        | 31         |         |
| Weekday  | 21       | 337        | 0.48    |
| Weekend  | 0        | 8          |         |
| Monday   | 8        | 135        | 0.55    |
| Tuesday  | 6        | 89         |         |
| Wednesday| 5        | 88         |         |
| Thursday | 1        | 23         |         |
| Friday   | 1        | 2          |         |
| Saturday | 0        | 5          |         |
| Sunday   | 0        | 3          |         |

Table 6. Occurrence of all cancellations in both cycles combined, as per sessions and days of the week.

|                | Number of appointments scheduled originally | Number of Cancellations | Total CNA rate (%) |
|----------------|---------------------------------------------|-------------------------|--------------------|
| Monday         | 1632                                        | 26                      | 1.6                |
| Tuesday        | 1438                                        | 9                       | 0.6                |
| Wednesday      | 1549                                        | 12                      | 0.8                |
| Thursday       | 574                                         | 5                       | 0.9                |
| Friday         | 20                                          | 0                       | 0.0                |
| Saturday       | 90                                          | 1                       | 1.1                |
| Sunday         | 79                                          | 1                       | 1.3                |
| Morning        | 2163                                        | 16                      | 0.7                |
| Afternoon      | 2581                                        | 34                      | 1.3                |
| Evening        | 638                                         | 4                       | 0.6                |
| Weekday        | 5213                                        | 52                      | 1.0                |
| Weekend        | 169                                         | 2                       | 1.2                |

Figures
Figure 1

Flow diagram of study design and data collection (DNA- Did Not Attend; CNA- Could Not Attend).