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Improving the management of hospital waiting lists by using nudges in letters: A Randomised controlled trial☆

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ABSTRACT

Objective: A commonly adopted intervention to help to reduce wait times for hospital treatment is administrative validation, where administrators write to patients to check if a procedure is still required. The did not return (DNR) rate to validation letters is substantial. We tested whether the DNR rate was reduced by introducing nudges to validation letters.
Methods: Participants from eight public hospitals ($N = 2855$; in 2017) in Ireland were randomized to receive an existing (control group) or a redesigned validation letter including nudges (intervention group).
Results: Participants in the intervention group were less likely not to return it than those in the control group, $OR = .756$, $SE = .069$, $p = .002$. Control and intervention group DNR rates were 23.97% and 19.24%. This is equivalent to 1 in 5 non-responders changing their behaviour because of the redesigned letter.
Conclusions: The redesigned letter increased patient compliance with the validation process. The redesign has subsequently been adopted by public hospitals in Ireland.

Long waiting times for elective (non-emergency) specialist treatment in hospital can negatively affect patients' outcomes (Hurst and Siciliani, 2003; Siciliani, L. et al., 2013). Negative outcomes can include deterioration in health status, difficulties in daily life due to pain or disability, and loss of income (Hurst and Siciliani, 2003). Reducing waiting times for elective hospital treatments is a medium or high priority issue in most OECD countries (OECD, 2020). A commonly adopted intervention to reduce waiting times is to improve management of waiting lists. The idea is that "by eliminating inefficiency in the management of the list, the number of treatments for a given level of personnel and capital endowment can be increased" (Hurst and Siciliani, 2003, p. 29). In an OECD review of what works to reduce hospital waiting times, improved management of waiting lists was one of only three supply-side policies judged to have a potentially positive effect (Siciliani, L. et al., 2013).

Management of waiting lists can be improved by administrative validation, a process where administrators in a hospital write to patients on waiting lists to check if patients still require a procedure or wish to be removed from the waiting list. Experience shows that a proportion of

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patients on waiting lists no longer actually require treatment. They may, for instance, have had the treatment in another hospital, feel better, or no longer want a procedure. The removal of these patients, who no longer require treatment, from waiting lists reduces the size of waiting lists and enables procedures to be offered sooner to patients who require treatment. This ensures a better use of scarce resources. There is a lack of international data on the contribution of validation of waiting lists to reducing waiting lists and times but data from Ireland shows that administrative validation of waiting lists in 2022 reduced hospital waiting lists by 121,000 which is 8% of all outflows from public hospital waiting lists (National Treatment Purchase Fund (NTPF), 2023).

Minimizing the DNR rate during an administrative validation cycle is important not only because it increases the efficiency of the process implemented by health care organizations but also because it helps to achieve appropriate care pathways for patients. National protocols for administrative validation (National Treatment Purchase Fund (NTPF), 2017; NHS England and NHS Improvement, 2021) specify that patients should be asked to indicate not only whether they still require a procedure or not, but also to provide the reason if a procedure is no longer required (e.g., if they were treated elsewhere, if their condition has otherwise resolved, or other reasons). The rationale for this is that there is a risk that certain patients (e.g., patients with anxiety or depression, older patients with multi-morbidities) are more likely to believe that a treatment would no longer be useful because they are disengaging with health services rather than there being a change in underlying health needs. It is recognized (e.g., NHS England and NHS Improvement, 2021) that it is important to identify such patients so that their situation can be discussed in more detail using shared decision making. Increasing the proportion of patients who reply to administrative validation letters increases the chances of identifying such patients and supporting informed decision making.

A challenge for hospital administrators is that a substantial percentage of patients typically do not return (DNR) a "validation letter" to confirm whether the procedure is still required. DNR rates of 25% are common (A. Green, personal communication, June 15, 2017). A potential way to reduce DNR rates is to deploy nudges. A nudge is "any aspect of the choice architecture that alters behavior in a predictable way without forbidding any options or significantly changing their economic incentives" (Thaler, R. H. & Sunstein, C. R., 2009, p. 6). An application of nudges to the administrative validation of waiting lists could involve altering the content of validation letters by including design features (such as specific phrases or presentation devices) with the aim to increase the proportion of patients who reply. The use of nudges to improve the outcomes of public services has been endorsed by international organizations such as the Organization for Economic Cooperation and Development (Lunn, 2014), the World Health Organization (WHO Director-General, 2022), and the World Bank (World Bank, 2015). There is some evidence that using behavioural insights in health services can improve efficiency and patient engagement. For example, did not attend (DNA) rates for healthcare appointments have been reduced by sending short message service (SMS) reminders to patients in advance of appointments (Gurol-Urganci et al., 2013; McLean et al., 2016; Robotham et al., 2016), by altering the content of SMS reminders to include the cost to service providers of non-attendance (Behavioural Insights Unit (BIU), n.d.; Hallsworth et al., 2015), and by using social influence interventions when communicating with patients (Martin et al., 2012). However, we are not aware of any published literature that has tested the effect of incorporating nudges into validation letters.

How-to guides have been developed to help policy makers and service providers to apply nudges, such as checklists of non-coercive influences on human behavior (e.g., MINDSPACE by Dolan et al., 2012) or descriptions of ways to apply behavioral insights (e.g., EAST by the Behavioural Insights Team, 2014). Policy makers and service providers can use such guides to increase their awareness of and, perhaps, their capability to apply nudges. However, there is little tailored guidance available on how best to design correspondence to promote certain behaviors in specific contexts. Furthermore, there is no guidance on how best to combine multiple nudges in a single communication.

This paper describes a study that redesigned a waiting list validation letter and tested the impact of this on patient did not respond (DNR) rates. The study was part of a quality improvement project in Ireland, referred to as the Better Letter Initiative (BLI), that followed a collaborative approach involving a government department, state agencies responsible for hospital waiting lists, and a relatively small expert behavioral science advisory group drawn from universities and not-for-profit bodies (Murphy et al., 2020). The redesigned letter included multiple nudges, many of which have not previously been used in a health context. It has been argued that two of the ten most important nudges for policy are increases in ease/convenience and simplification (Sunstein, 2014). The use of increases in ease/convenience has been identified as one of the most used types of nudges in health (42% or 35/84 of interventions) but the use of simplification has not been identified by a review of studies (Hummel and Maedche, 2019). We used both types of nudges. We sought to achieve simplification by using plain English and by making important information salient by using bolding, and to increase ease and convenience by including a clear call for action and chunking of steps. We used four additional nudges that do not fall into the ten categories of nudges emphasized by Sunstein (2014). These included two nudges for which there is previous field evidence of positive effects, namely personalization (Edwards et al., 2009) and messenger effects (Dolan et al., 2012). We also included two additional nudges. An apology, for which there is no health context evidence but evidence from other sectors is mixed (Cheng and Tsai, 2014; Munichor and Rafaeli, 2007). Altruistic intentions as well as the value of the service and resource involved in the validation process was included, for which we were not aware of evidence from field trials but laboratory evidence suggests this may positively influence client response (Bridger and Wood, 2017).

The aim of the current study was to test the redesigned letter in a randomized controlled trial (RCT) in two hospital groups, one in the north-east and one in the mid-west of Ireland. Participants in the control group received a pre-existing validation letter used in that hospital group, while those in the intervention group received a redesigned validation letter. We hypothesized, straightforwardly, that the redesigned letter would lower DNR rates from patients who received the intervention letter compared to patients who received the control letter. From an applied perspective, if the intervention works, it would be important to know for which patients it occurs and across contexts, so we also undertook pre-planned exploratory analysis (see As Predicted: #98098) to see if the intervention held across patient characteristics of sex and age, and healthcare characteristics of hospital group and medical specialty. We tested the intervention across 2855 people in eight hospitals. The intervention was subsequently adopted by all public hospitals in Ireland.

1. Method

1.1. Sampling and allocation procedure

The quality improvement project was conducted in two healthcare administrative areas in Ireland, referred to as "hospital groups". Hospitals within each hospital group aim to operate as a single cohesive entity managed as one, to provide acute care for patients in their area, integrating with community and primary care. This study included three hospitals in the Royal College of Surgeons in Ireland (RCSI) Hospital Group located in the north-east of Ireland and five hospitals in the University of Limerick (UL) Hospital Group located in the mid-west of Ireland. All adult patients on a waiting list for three months or more were included for 14 hospital specialties (listed in Section 1, Supplementary file). At the time of this study, it was common practice in Ireland to use the same time threshold across all waiting lists to be

validated within a hospital (i.e., not to vary the time threshold by waiting list/disease type). Hospitals typically used a three-month or a six-month threshold. A three-month threshold was used for this study so that the required sample size could be achieved sooner.

Participants were randomly allocated to the control or intervention group by a computerized number generator, using block randomization with a predetermined ratio of 1:1. Allocation concealment and double blinding were maintained throughout data collection. Randomization was administered as follows: (a) a validation administrator working in the health service provided a researcher in the Department of Health with the total number of patients to be validated (e.g. 800), (b) a researcher in the Department of Health carried out randomization with the random.org list randomizer and returned to a validation administrator a list on which each number (e.g. 1 to 800) was randomly allocated to the letter type (existing or redesigned), and (c) a validation administrator printed and posted validation letters according to this allocation. This process was followed within each of the two hospital groups.

In the absence of previous similar studies, power calculations were based on the effect sizes from three studies in which nudges were used to improve attendance at healthcare appointments (Behavioural Insights Unit (BIU), n.d.; Chadborn, T & Berry, D, n.d.; Hallsworth et al., 2015). The simple arithmetic mean effect across these studies was 18.67%. Power calculations suggested that assuming a possible reduction in the DNR rate of 18%, a sample of 2718 was required to test with 80% power at the 5% significance level. The required sample size was achieved with 2870 participants (798 from RCSI Hospital Group and 2072 from UL Hospital Group). The validation letters were posted from the 27th of September to the October 24, 2017. The issuing of validation letters and the collection of data were undertaken by staff in the HSE and the NTPF as part of service management in line with the statutory functions of these state agencies. The lead author obtained access to an irreversibly anonymized data file containing responses to the postal validation, held by the Department of Health in compliance with data protection legislation. Ethical approval for statistical analysis of this data was provided by the University of Stirling Ethics Committee. There were 2855 participants included in the analysis, 9 letters were returned by the postal service (all from the control group) and 6 were excluded due to participants receiving multiple letters (2 from the control group and 4 from the intervention group). For the participant flowchart see Section 2, Supplementary file.

1.2. Validation letters

Each participant received either the control or intervention validation letter requesting confirmation of whether the relevant procedure was still required or not. In both conditions participants also received a prepaid addressed return envelope.

Control letter. At the time of the study, different hospital groups in Ireland used different validation letters. In some cases, different hospitals located in the same hospital group used different validation letters. This resulted in the study using two control letters that matched formats of validation letters used in each hospital group before the project. The five hospitals in the UL Hospital Group already used an identical validation letter, so this was used as the control letter for participants from the UL Hospital Group (see Section 3, Supplementary file). The three hospitals in the RCSI Hospital Group used similar but not identical validation letters before the project. The manager and administrator responsible for validation for these hospitals created a common validation letter based a review of the pre-existing validation letters used in these hospitals, which was then used as the control letter for participants from RCSI Hospital Group (see Section 4, Supplementary file).

Intervention letter. The intervention letter, presented in Appendix A, included the following design elements: simplified language, a call for action, personalization by addressing the patient by their first name, an apology for the wait, emphasis on the altruistic intentions of checking the waiting list and the value of the service and resource involved in the validation process, important information for the patient made salient by bolding, desired actions "chunked" in bullet points and an image, consequences of non-return, including observation made salient by bolding, and the name of the person sending the letter included to exploit any potential messenger effect. The redesign of the validation letter for the current study was informed by a review of existing practice in eight hospitals and a national validation protocol, literature on patient/customer engagement and increasing responses to surveys, and guides on how to apply behavioral insights and plain English. Research evidence used by the quality improvement team to inform the key design elements is presented in Table 1.

Feedback on the redesign was provided from the national agency responsible for waiting lists, hospital service providers and managers (via a national group and staff in the participating sites), and a patient advocacy group. An iterative design process was followed with an expert

Table 1
Nudge design elements used in the intervention letter.

Nudge Category[a]/ Design Element	Application in the Letter	Motivation
Simplification:		
Use of plain English.	A plain English practitioner simplified the language.	The easier it is for people to process information, the more likely they are to enact a behaviour (Dolan et al., 2012).
Salience.	Important information was made salient by bolding.	Highlighting key features can draw people's attention to important information quickly (Dolan et al., 2012).
Increases in ease and convenience:		
Call for action.	An action orientated heading: "Please reply to this letter".	Reducing barriers, including the time that it takes to understand what to do, makes a behaviour more likely Sunstein (2014)
Chunking.	The steps involved were broken into discrete tasks presented (a) in bullet points, and (b) an image.	Breaking tasks into chunks has been effective in supporting behaviours (Dolan et al., 2012).
Other nudges:		
Personalization.	Recipients were addressed by their first name.	Field studies show people are more likely to respond to letters that use their first name (Edwards et al., 2009).
Messenger Effects.	Closed by a named staff member. Direct phone number of the staff member is provided.	We are heavily influenced by who communicates information, and also affected by the feelings we have towards the messenger (Dolan et al., 2012).
Apology.	"I apologise you are still waiting."	Mixed evidence on the effect of an apology on wait tolerance (Cheng and Tsai, 2014; Munichor and Rafaeli, 2007) Some pre-existing validation letters included an apology.
Altruism, Value, Resource.	The letter stated: "We want to provide our valuable services to our patients as soon as we can. That is why we are checking our waiting list"	Lab research shows that clearly articulating intention (altruism), cost and value of the service positively influences client response (Bridger and Wood, 2017).

The Intervention Letter is presented as Appendix A. Font Arial was used; we aimed for 12 point as standard but had to use 11 in the study to fit the letter to one page).

[a] Sunstein (2014) argues that two of the ten most important categories of nudges are simplification (noting "Many programs fail, or succeed less than they might, because of undue complexity.") and increases in ease and convenience (defined as "reducing various barriers (including the time that it takes to understand what to do) is often helpful.").

behavioral science advisory group. Color was not part of the design as color printing was not available in all HSE hospital sites and this would have limited scalability. Following the behavioral analysis, it was pointed out by the BLI team to the NTPF that the existence of an option to reply online would make it more convenient for some patients to submit their validation return and therefore could help to reduce DNR rates. However, it was not possible to develop a facility for online responses within this study and so the design element of a QR code linking to an online response function was not part of the design. The issue of developing an additional online response option is returned to in the Discussion.

1.3. Outcome measure

The outcome measure was the DNR rate of patients to validation letters, as recorded by each hospital group. For each letter sent, an administrative dataset includes whether the letter was returned by recipient or not. The recording process is undertaken by experienced staff and follows strict protocols and audit procedures (National Treatment Purchase Fund (NTPF), 2017). Measurement error in the data used to compute the DNR rate is therefore likely to be very small. The DNR rate is a measure that may overestimate the level of true non-engagement with administrative validation. This is because some patients who do not require a procedure may imply that it is not necessary to reply as all validation letters in the study stated, in line with national protocol, that if a patient does not return the letter it will be assumed that a procedure is no longer required, the patient will be removed from the waiting list, and the patient's GP (family doctor) will be informed. The definition of the DNR rate used in this study is the same as the definition used in Ireland by public health organizations to monitor did not returns for administrative validation of waiting lists. At the time of the study many hospitals in Ireland requested patients to respond to an administrative validation letter within two weeks of the letter being issued, and hospital staff often allowed an additional two weeks before recording responses. For this study, hospital staff recorded responses in line with normal practice, so this was typically around four weeks from the date of issuing of a letter.

1.4. Statistical methods

Testing the study hypothesis. We applied a binary logistic regression model with DNR as the outcome variable (0 for returned, 1 for DNR) and included letter type as an explanatory variable (0 for control group, 1 for intervention group). The model tested whether the intervention lowered the percentage of recipients not returning a validation letter. A significant odds ratio (OR) of less than one would support the hypothesis. In addition, a separate multilevel model, which does not assume the units of analysis are independent, was also undertaken and running this analysis does not alter the study conclusions (results available upon request).

Pre-planned exploratory analysis. We pre-registered two forms of pre-planned exploratory analysis: (i) whether intervention effects hold across patient characteristics of sex and age group, (ii) whether intervention effects hold across hospital characteristics of hospital group and specialty. These were examined by applying binary logistic regression models with DNR as the outcome variable (0 for returned, 1 for DNR) and letter type as an explanatory variable (0 for control group, 1 for intervention group) and testing if the intervention interacts with each patient or hospital characteristic.

2. Results

2.1. Participant characteristics

The profile of the sample was 51.10% female with a mean age of 53.78 years (SD = 21.07, range: 2–99). The distribution of the intervention and control groups was similar by sex, age group, and hospital group (see Section 5, Supplementary file).

2.2. Study Prediction

The DNR rate was lower in the group that received the intervention letter than the control letter. Binary logistic regression revealed a significant odds ratio for letter type of less than one, $OR = .756$, SE = .069, $p = .002$, 95% CI [.632, .904]. The DNR rate of patients was 23.97% (343/1431) for the control group compared to 19.24% (274/1424) for the intervention group (see Section 6, Supplementary file). The intervention letter resulted in a reduction in the DNR rate of 4.73 percentage points, or a relative reduction of 19.73%.

2.3. Pre-planned exploratory analysis

Intervention effect by patient characteristics. A binary logistic regression model including a letter type and sex interaction term did not reveal a significant interaction, $OR = .849$, SE = .155, $p = .370$, 95% CI [.593, 1.215]. Directly comparing DNR rates between the control and intervention group for females and males suggests that the intervention held for both females and males (see Fig. 1), although the difference for females was significant only at the 10% level. To preserve power, we categorized age via a median split ($<57/\geq 57$ years). A binary logistic regression model including an interaction term for letter type and age revealed a significant interaction between letter type and age category, $OR = .681$, SE = .130, $p = .043$, 95% CI [.469, .989]. Separate DNR rates by age for the control and intervention group are shown in Fig. 1, displaying the stronger effect of the intervention among older participants. An interaction effect between age and letter type holds after controlling for sex and hospital group and the interaction of these covariates with letter type (see Section 7, Supplementary file).

Intervention effect by healthcare characteristics. A binary logistic regression model including a letter type and hospital group interaction term did not reveal a significant interaction between letter type and hospital group, $OR = 1.318$, SE = .1.37, $p = .171$, 95% CI [.888, 1.956]. It was not possible to run an equivalent regression analysis to test for interactions with specialty (which consisted of 14 levels) due to the small number of cells for many specialties. However, a direct comparison of DNR rates between the control and intervention groups found that the intervention effect was the expected sign for all six subgroups examined (relative reductions range of 14.61–31.60%) and that for four of the six the intervention effect achieved significance, see Fig. 1.

3. Discussion

3.1. Contribution to knowledge

This is the first study to test whether the did not return (DNR) rate of patients can be decreased by incorporating nudges into letters used in the administrative postal validation of hospital waiting lists. A redesigned letter containing multiple nudges resulted in lower DNR rates by patients, a DNR rate of 23.97% in the control group compared to 19.24% in the intervention group. The treatment effect of 4.73 percentage points is equivalent to 1 in 5 non-responders changing their behaviour because of the redesigned letter. Different communication mediums may be used internationally as part of administrative validation, nevertheless physical or digital letters are likely to be the most widely used medium. For example, in Ireland patients are sent physical validation letters (National Treatment Purchase Fund (NTPF), 2017). In England (NHS England and NHS Improvement, 2021) patients can be contacted by letter, email, or telephone but written communication is likely to be the most common as each hospital trust determines the means depending on the volume of patients, urgency of booking, patient demographics, and staff availability. In Wales as part of a new validation process patients are sent a text message with a link to view a digital letter or subsequently

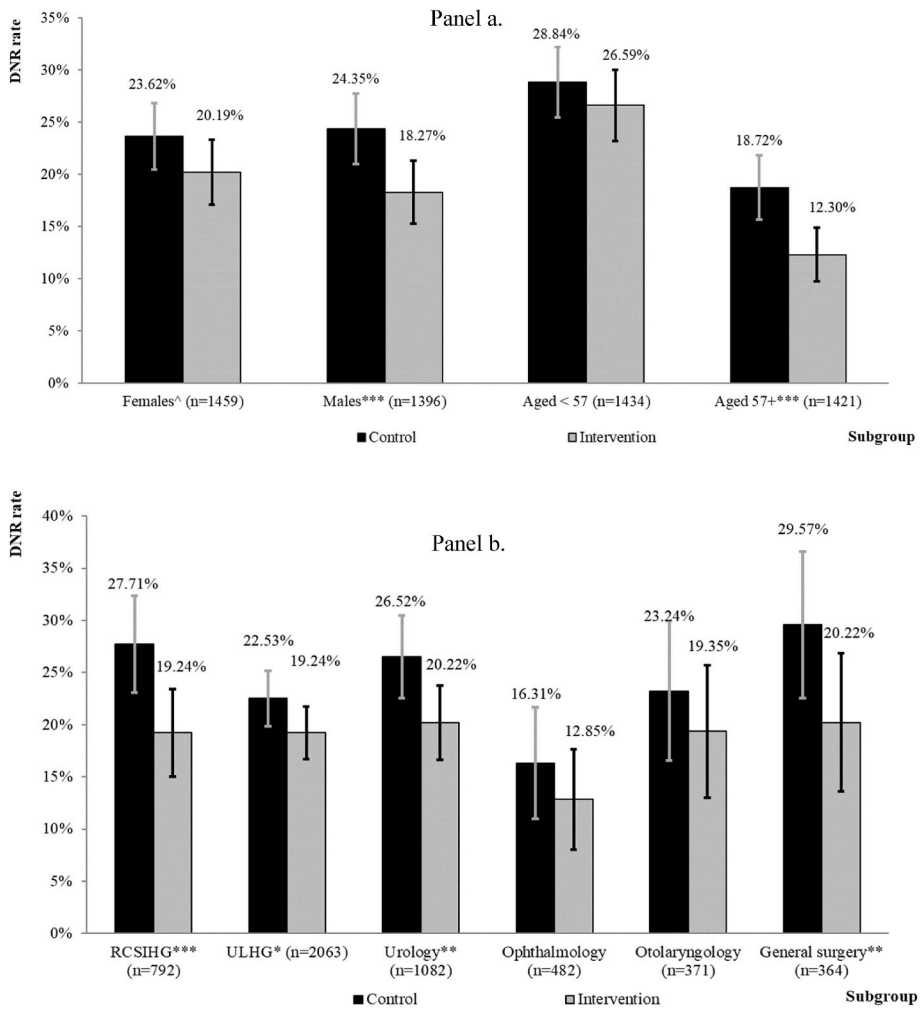

Fig. 1. Did not return (DNR) rate by participant and healthcare characteristic. Error bars represent the 95% confidence intervals. ^$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$. One-tailed tests.

sent a physical letter (NHS Wales, 2024). The content of the control letter in this study is based on pre-existing elements used in administrative validation letters in Ireland that are similar to those used in administrative validation letters internationally. Common elements within administrative validation letters are to ask the patient to indicate whether he/she still requires a treatment or not, to request the reason if a procedure is no longer required, and to provide information about the need to respond and next steps if a patient does not respond (National Treatment Purchase Fund (NTPF), 2017; NHS England and NHS Improvement, 2021; NHS Wales, 2024). Therefore, the intervention effect found in this study is relevant to international practice.

A recent review of the effectiveness of nudging (DellaVigna and Linos, 2022) identified four studies in which the effect of the inclusion of nudges in physical letters was tested. These studies included a range of nudges across different policy areas and behaviors. They included the policy areas of health (Milkman et al., 2011), the environment (Rommel et al., 2015) and revenue collection (registration for a TV/radio license, Fellner et al., 2013; and level of charitable donation, Goswami and Urminsky, 2016). The average treatment effect across the 12 intervention arms (eight interventions included a single nudge and four combined two or more nudges) in these four studies was 1.67 percentage points. This suggests that the effect size from this current study, 4.73 percentage points, is relatively large.

A recent review argues that the effectiveness of nudging may depend not only on the nudges used but also on how they are perceived by individuals and on the application context (Hummel and Maedche, 2019). From an applied perspective, we found that the intervention appears to work across the individual characteristics for which we have data of age and sex, and across the healthcare contexts for which we have data of hospital group and medical specialty. The finding of a stronger intervention effect for older adults (6.42 percentage points, DNR rates of 18.72% compared to 12.3%) was particularly welcome, as older people have more limited health literacy (Sorensen et al., 2015).

3.2. Strengths and Weaknesses

A strength of this study is that it was a randomized control trial with actual behavior as the primary outcome and has a large sample of more than 2800 patients. The intervention tested is also easily scalable. A weakness of this study is that the redesigned letter involved a combination of many nudges, so it is not possible to determine which specific nudges motivated the increase in engagement, nor to identify the psychological mechanisms behind the change in behavior. This limitation often arises when behavioral scientists are engaged by policymakers to work towards a specific policy outcome; from an immediate policy perspective, *that* the intervention works matters more than *how* it works. Field trials can test only a limited number of interventions so there is an argument for combining multiple nudges into one letter on the assumption that one may work and that none will interact negatively. This does not allow us to test mechanism but does increase the chance of having a positive impact. Either choice presents a risk, and this is a dilemma at the heart of scaling behavioral science interventions.

Nevertheless, the study demonstrates the feasibility of hospital administrators engaging with behavioral scientists to apply nudges to a day-to-day implementation problem and to test against existing practice. A separate limitation is that the sample was not selected to be representative of inpatient and day case waiting lists nationally, so the findings are not generalizable nationally. Nevertheless, the inclusion of waiting lists for eight hospitals from two hospital groups and from 14 specialties along with the lack of within sample variation in effect size suggests that the findings may hold in other hospitals.

3.3. Research impact

The Better Letter Initiative (BLI) quality improvement project had a substantial research impact, impacting on nationwide practice and government policy. When describing the research impact, we use a framework (Belcher and Halliwell, 2021) in which research outputs (such as methods, discoveries, policy briefs, or networking) may lead to outcomes (e.g., a change in knowledge or attitudes, or relationships which manifests as a change in behavior) which can generate realized benefits.

Outcome – National Practice. A brief report shared with the Head of the Unit in the NTPF with responsibility for waiting lists and with the Director in the Department of Health with responsibility for waiting list policy documented the impact on DNR rates and estimated that the use of the redesigned letter in bi-annual validation of 2017 waiting lists of three months plus for inpatient and day cases would result in at least 5000 more patients responding upon receipt of a validation letter. The research findings resulted in a change in the knowledge and attitudes of stakeholders, as the view emerged that using the redesigned validation letter would result in better use of resources. In early 2018, after considering the headline results, the NTPF recommended a change in organizational practice in all public hospitals in Ireland, stating that hospitals should use the redesigned validation letter for postal administrative validation of inpatient and day case waiting lists. This recommendation, along with the redesigned letter template, was sent by the NTPF to all hospitals and provided to all attendees of the NTPF's training program for waiting list management.

Outcome – National Policy. To generate a sufficiently large sample, all non-maternity hospitals in the ULHG took part for the first time in the same validation process. This highlighted the benefit of a larger scale standardized process as economies of scale provided the ability to validate a larger number of people and a reduction in waiting lists was achieved. As an estimated 20% of people on ULHG lists who replied indicated that they no longer required a procedure. (subsequent research, Murphy and Taaffe, 2020, showed that this was typically because they already had the procedure done). This change in knowledge led to a new national policy regarding the organization of the validation of hospital waiting lists. In June 2018 the Minister for Health wrote to the NTPF asking it (a) to develop a centralized process for validation and (b) to expand its validation remit to include outpatient waiting lists. The Minister's letter also requested that the NTPF use the learning from the BLI quality improvement project in this work. This change in policy was quickly implemented. By September 2018 a National Centralized Validation Unit (NCVU) was established within the NTPF which now works with public hospitals across Ireland to validate waiting lists.

Outcome – Scaling Up of Behaviorally Informed Interventions. A criticism of the application of nudges to public services is that, while hundreds of nudges have been tested over the past decades around the world, not many of these have been "scaled up" or successfully rolled out nationally. An outcome of the BLI administrative validation project was that two behaviorally informed letter templates (one for inpatient and day case procedure waiting lists and another for outpatient consultation waiting lists) were scaled up or rolled out nationally in the centralized postal service managed by the NCVU in the NTPF. Applying the terminology of the European Commission's classification of behavioral policy initiatives (Sousa Lourenco J et al., 2016), the BLI administrative validation project resulted in a behaviorally-tested application (i.e., the redesigned letter for validation of inpatient and day procedure lists that was scaled up after the initial experiment) and a behaviorally-informed application (i.e., a letter for validation of outpatient waiting lists that involved slight amendments to the redesigned inpatient/day case letter agreed between the NCVU and the researchers and behavioral science advisory group). During 2019 the redesigned letters were used in the validation of 266,493 waiting list places.

An online response option for patients as part of administrative validation was subsequently developed by the NTPF and the sequence leading to this was consistent with the research impact framework described earlier (Belcher and Halliwell, 2021). The discovery that a redesign of validation letters increased return rates (research output) lead to greater trust between staff responsible for validation nationally and the BLI research lead (change in relationship outcome) which manifested in a change in the validation process (change in behavior which realized benefits). The suggestion from the original behavioral analysis that it would be beneficial to also provide people with the option to reply online to validation, was restated to the NTPF lead by the BLI research lead during the first year of COVID-19. Considering the increased confidence in the behaviorally informed advice and the changed context, the NTPF developed an online response option for patients and worked with the BLI team on the design of this.

Realized Benefits. Patients are the main beneficiary of the project. Patients benefit in two ways. First, the use of the redesigned letters means that the validation process is clearer. Second, the more widespread checking of the accuracy of waiting lists on an ongoing basis improves patient waiting times by reducing the number of patients who do not attend for their appointment (National Treatment Purchase Fund (NTPF), n.d.). Between 2019 and 2021 the redesigned letters were used in the validation of 848,343 waiting list places.

Directions for future research

Research is needed on how patients who do not respond to administrative validation letters subsequently engage with health services and if such non-engagement is associated with use of higher cost health services than would otherwise be expected, such as out of hours services or emergency attendances. There are two specific nudges used in this study which would be of value to test separately in future research on patient engagement with the administrative validation of waiting lists. First, the inclusion of an apology for having to wait, as there is mixed previous evidence from non-health services on the effect of an apology on wait tolerance (Cheng and Tsai, 2014; Munichor and Rafaeli, 2007). Second, the nudge of stressing the altruistic intention, value, and resource of a service as lab research suggests these positively influence client response (Bridger and Wood, 2017) but we are not aware of field research on this. More generally, it would be beneficial to test the effect of the latter nudge on other types of patient engagement with health services such as attendance at appointments, adherence to medication, and adherence to treatment.

Ethics approval/EA not required Statement

Administrative validation is a process where administrators in a hospital write to patients on waiting lists to check if patients still require a procedure or wish to be removed from the waiting list. Undertaking administrative validation is part of the normal practice of Health Service Executive (HSE) hospitals with support from the National Treatment Purchase Fund (NTPF). The issuing of validation letters and the collection of data were undertaken by staff in the HSE and the NTPF as part of service management in line with the statutory functions of these state agencies.

The lead author obtained access to an irreversibly anonymized data file containing responses to the postal validation, held by the

Department of Health in compliance with data protection legislation. Ethical approval for statistical analysis of this data was provided by the University of Stirling, Management School, Ethics Committee.

CRediT authorship contribution statement

Robert P. Murphy: Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. **Carol Taaffe:** Conceptualization, Investigation, Project administration, Writing – review & editing. **Molly Byrne:** Conceptualization, Methodology, Writing – review & editing, Investigation. **Liam Delaney:** Conceptualization, Investigation, Methodology, Writing – review & editing. **Peter D. Lunn:** Conceptualization, Investigation, Methodology, Writing – review & editing. **Deirdre A. Robertson:** Conceptualization, Investigation, Methodology, Writing – review & editing. **Helen Ryan:** Conceptualization, Investigation, Writing – review & editing. **Alex M. Wood:** Conceptualization, Investigation, Methodology, Supervision, Writing – review & editing.

Data availability

The authors do not have permission to share data.

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Appendix A. Supplementary data

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