

*Journal of Psychiatric and Mental Health Nursing*



An international journal for researchers and practitioners

**A mixed methods survey to explore views of staff and service users in mental health inpatient wards prior to introduction of a digital early warning system for physical deterioration**

Journal:	<i>Journal of Psychiatric and Mental Health Nursing</i>
Manuscript ID	JPM-18-0317.R2
Manuscript Type:	Original Article
Keywords:	Acute Mental Health, E-Health, Organisational Change/Development, Staff Perceptions, User Involvement

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Manuscripts

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3 **A mixed methods survey to explore views of staff and patients in mental health**  
4 **inpatient wards prior to introduction of a digital early warning system for physical**  
5 **deterioration**  
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10 **Abstract**

11 Introduction

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14 Technological innovation offers opportunities to improve mental health care, **however, little**  
15 **evidence exists regarding attitudes of inpatient staff and patients to such changes.** We  
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17 present a survey of staff and patients prior to introduction of a digital version of the National  
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19 Early Warning Score (eNEWS) system for identifying physical deterioration.  
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24 Aim

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27 To collate views of staff and inpatients related to prospective use of eNEWS, to inform the  
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29 plan for implementation.  
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32 Method

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35 Paper questionnaires were distributed to both groups in six wards prior to eNEWS  
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37 implementation. Two discussion groups were then held.  
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40 Results

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43 Eighty-two staff and 26 inpatients completed questionnaires. Some inpatients expressed  
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45 concerns about data confidentiality. Most staff were neutral or positive about the planned  
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47 change, but raised possible safety risks and the risk of electronic recording being  
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49 misinterpreted by patients. The implementation plan was modified in response to this  
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51 information, principally by improving communication processes with patients.  
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54 Discussion

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3 This study adds to the existing evidence by reporting specific staff and patient concerns  
4 towards a form of information technology. Further evaluations would help determine the  
5 transferability of these findings.  
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#### 9 10 Implications for Practice

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13 Listening to patient and staff views about planned technological innovation is essential for  
14 effective implementation.  
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#### 17 18 **Keywords**

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20 Mental health, inpatients, technology, surveys and questionnaires, psychiatric nursing,  
21 mental health services  
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#### 24 25 **Relevance statement**

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28 Developments in technology will inevitably change mental health nursing practice, yet there  
29 is little literature reporting nurses' and patients' views of such developments. Nurses are  
30 particularly key to successful innovation in inpatient settings. This paper reports on views  
31 regarding the introduction of an electronic recording system to detect physically deteriorating  
32 inpatients in a hospital setting. This issue is of direct relevance to the nurse's core role in  
33 ensuring the physical well-being of inpatients. The project found that surveying staff and  
34 patients was of great value in shaping the subsequent approach to implementing  
35 technological change and should inform similar future projects.  
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### ***Accessible summary***

What is known on the subject?

- The potential benefits of introducing technological innovation into all types of health services are recognised internationally.
- There are few studies exploring the use of technology in inpatient mental health settings, or the views of staff and patients regarding such developments.
- 'Early warning systems' are increasingly used in inpatient mental health services to detect physical deterioration in patients and prompt staff to take appropriate action.

We have identified no peer reviewed publications concerning this development

What the paper adds to existing knowledge?

- Using a questionnaire survey, this project gathered views from staff and patients on a planned change from a paper based 'early warning system' to one using handheld electronic devices (tablets).
- **This study adds to the existing evidence by reporting specific staff and patient concerns about a technological development in an inpatient mental health setting.** Some patients were concerned about confidentiality of data entered onto tablets. Whilst were either positive or neutral in attitude to the planned change some staff raised concerns that electronic devices could be used as weapons, and also that patients or visitors might misinterpret their use.

What are the implications for practice?

- Views of staff and patients must be considered when introducing new technology into clinical practice, in order to make the change successful and sustainable
- Inadequate or unclear information about the use and purpose of electronic devices may lead to misunderstandings as to their purpose and the security of their data, particularly in mental health settings.

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- Further exploration across a range of services and countries would be useful in determining whether attitudes towards implementing similar technological change in mental health practice are commonly shared.

For Peer Review

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3 **A mixed methods survey of the views of staff and patients in mental health inpatient**  
4 **wards prior to the introduction of a digital system to provide early warning of physical**  
5 **deterioration.**  
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10 **Introduction**  
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13 This paper presents results from a survey of the views of staff and patients from mental  
14 health inpatient wards in one mental health provider organisation (trust) in the United  
15 Kingdom (UK). This was carried out to inform the process of introducing, an electronic  
16 version of the UK National Early Warning Score (NEWS), which is a system designed to  
17 detect and respond to physical deterioration at an early stage (Royal College of Physicians  
18 2017).  
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27 The potential impact of using technological innovation in health services has been  
28 recognised internationally for some years (WHO 2005). The general public already  
29 frequently use technology to support their own healthcare, with 51% of adults accessing  
30 health related information on line (Office of National Statistics 2016). In health services,  
31 technology may take many forms, including the use of mobile electronic devices ('m-health')  
32 and the application of information, computer or communication technology to an aspect of  
33 health care ('e-health').  
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43 Examples of major change involving adoption of technology are already underway within the  
44 UK National Health Service (NHS), including an organisation-wide change from paper to  
45 electronic patient records by 2020 (National Information Board 2014), in line with evidence  
46 linking electronic notes with improved clinical outcomes in both general hospitals  
47 (Amarasingham et al 2009) and mental health services (Riahi et al 2017). In addition, the  
48 Nursing Technology Fund, launched in 2013, has provided financial support to enable  
49 nurses to incorporate innovative technology in their daily practice, in order to improve  
50 efficiency and patient care (NHS England 2013). The UK government has also highlighted  
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3 the need to evaluate the practical application of new technology in health care and to utilise  
4 the data that digital technology can produce (Department of Health 2017).  
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### 8 **Technology and mental health services**

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11 In contrast to the examples above, mental health trusts in the UK have been slower in  
12 adopting technology than the rest of society (NHS Confederation 2014). This is despite  
13 evidence as to the potential effectiveness of technological innovation in this clinical area and  
14 also that people with mental health problems typically use technology in ways similar to the  
15 rest of the population (Ennis et al 2015). However, many mental health Trusts in England do  
16 report having plans to develop a range of 'digital' services, including on line appointment  
17 booking and using online and mobile applications to support service delivery (Mental Health  
18 Network NHS Confederation 2014).  
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29 Largely independent of formal mental health services, there has also been major growth in  
30 the availability of mental health related apps (software programs that can be used online or  
31 on mobile devices) (Hollis et al 2015). However, to date, systematic reviews have suggested  
32 that apps are often not in line with practice guidelines or best evidence, and should be used  
33 with caution, in both bipolar disorder (Nicholas et al 2015) and depression (Huguet et al  
34 2016). Torous and Haim (2018) suggest that, although technological challenges persist, the  
35 major barriers for widespread use of apps now lie in issues of competing priorities, for  
36 example consumer versus clinical or big data versus privacy.  
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46 An international systematic review of m-health interventions for people with psychosis  
47 identified 7 controlled trials, with the largest improvements relating to medication compliance  
48 (Gire et al 2017). From these results, the authors saw potential to bridge the global mental  
49 health treatment gap by enabling individuals to receive treatment via their mobile phones.  
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51 However, there is, as yet, a dearth of research as to the effectiveness of online interventions  
52 in mental health within lower and middle income countries (Arjadi et al 2015).  
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3 We conducted a literature search to identify studies relating to the application of technology  
4 in mental health inpatient settings, using AMED (Allied and Complementary Medicine),  
5 British Nursing Index, Embase and Medline databases. Search terms used were 'technology'  
6 AND 'mental health' AND 'inpatients'. We included studies written in English and published  
7 in peer reviewed journals only, during the period 2008-2018, chosen as most appropriate to  
8 capture changing technology. We excluded conference abstracts and studies where  
9 technology was used solely as a means to gather data, rather than as part of a clinical  
10 intervention. After reviewing abstracts and confirming by reading full papers, 6 papers were  
11 initially identified as meeting the criteria, with three related to aspects of the same  
12 intervention (see Table 1). Two further papers (Ben-Zeev et al 2017; Riahi et al 2017) were  
13 identified through checking citations and references and subsequent citations of the initial list  
14 of six (See Table 1)

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INSERT TABLE 1. Studies on the use of technology in inpatient mental health settings 2008-18.

Five of the eight publications were from 2017 onwards, whilst the three earlier papers were all in relation to a single technological development in one country (Finland). These findings suggest a recent increase in the level of interest concerning evaluation of technological innovation in inpatient settings, but the field remains relatively unexplored.

Whether staff view new technology as potentially useful or not has been identified as an important factor in determining the success of newly introduced technological innovations (Gagnon et al 2016). Therefore, understanding and responding to their views is vital. Nursing is the largest profession in the global mental healthcare workforce and provides the majority of direct 24-hour care in inpatient services. Nurses' attitude to and engagement with technological developments are vital to support implementation and effective uptake (Kipturgo et al, 2014), More generally, attitudes of both staff and patients are reported as being important mediators of successful introduction of technology (Ward et al 2008; Hollis



1  
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3 et al 2015). Whilst technology may benefit staff by making their roles easier, the needs of  
4 patients should be central to how it is developed and implemented (Hollis et al 2015).  
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7  
8 Although acknowledged as important, there is a dearth of evidence as to attitudes of staff or  
9 patients towards technological developments in mental health inpatient settings. We  
10 identified just three studies presenting staff views (all nurses) on specific developments.  
11  
12 These reported findings from interviews on information technology for patient education  
13 (Koivunen et al 2012), questionnaires on an information technology education programme  
14 (Antilla et al 2008) and a focus group to discuss use of handheld electronic devices to record  
15 patient data (Killikelly and Quist 2017). Only one study reported patient views, and this was  
16 a qualitative evaluation around the use of barcodes to identify patients. (Strudwick et al  
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### **Physical deterioration and early warning systems**

31 Concern as to the dangers of health services failing to respond to the physically deteriorating  
32 patient are found worldwide (Vincent et al 2001; Australian Commission in Safety and  
33 Quality in Health Care 2012) and across healthcare specialities. As a result, many early  
34 warning systems have been developed (Gerry et al 2017). These are based on recording  
35 and scoring physiological indices, such as respiratory rate, oxygen saturation, temperature,  
36 blood pressure, pulse and level of consciousness. Depending on the total score and  
37 individual indices scores, a clinical response is suggested and, typically, local escalation  
38 procedures are defined.  
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Early warning systems show good ability to predict physical deterioration in a variety of  
specialties and countries, partly by facilitating communication between healthcare workers  
(Downey et al 2017). However, there is a lack of evidence of their effectiveness within acute  
mental health inpatient settings. Generally, studies in other settings, utilising paper based  
systems, report frequent non-compliance with early warning scoring protocols, potentially  
leading to high risk of death. The causes of non-compliance appear to be multi factorial and

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3 complex (National Patient Safety Agency 2007; Odell 2014). Whilst training staff has been  
4 shown to have improved vital signs recording and Early Warning Score calculation, there is  
5 only evidence of this effect in the short term (Saab et al 2017). Downey et al (2017)  
6 hypothesize that automation, i.e. the use of electronic hardware and software, may  
7 effectively reduce risks in a sustained way  
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11 Since the initial launch in of NEWS in 2012, it has seen widespread uptake across the NHS  
12 and is currently used by 70% of acute hospital trusts in England (NHS England 2018).  
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14  
15 Increasingly, government policy has directed nurses and other professionals to do more to  
16 reduce the poor health and shortened life span of people with severe mental health  
17 problems (Department of Health 2016). NHS England now recommends that NEWS should  
18 be used to assess physical deterioration in mental health facilities and to improve  
19 communication and handover when people are transferred between acute hospitals and  
20 mental health settings (NHS England 2018).  
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### 31 32 **'e-NEWS' implementation**

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35 In 2015, one inner London mental health trust used the National Nursing Technology Fund  
36 (NHS England, 2015) to develop systems to allow staff to record patient observations into a  
37 mobile device (such as an electronic tablet), quickly and at the point of care. Such mobile  
38 observations are typically termed 'eObs' The information is automatically uploaded into an  
39 electronic patient record system. 'eObs' may feature predefined algorithms (procedures for  
40 solving a problem, based on conducting a sequence of specified actions) to alert staff that an  
41 identified action is required in response to observations. The first such development planned  
42 by the trust was for a version of NEWS (referred to in this project as eNEWS), to replace a  
43 locally-developed paper-based early warning system, known as the Modified Early Warning  
44 System (MEWS). The rationale for this change was to adhere to national guidance  
45 regarding adoption of NEWS (NHS England 2018) and, additionally, for the electronic  
46 recording element of the change to improve patient safety by  
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- Enabling rapid access to physical health data through the electronic patient record, by replacing paper based records that were not immediately available to all staff, including on call doctors, unless first scanned into the electronic patient record.
- Improving compliance with escalation processes indicated by the early warning system when physical health deterioration is identified, e.g. calling medical staff or increasing observations.

The general technical approach to eNEWS, i.e. use of tablets to record patient information in the presence of patients, and data being uploaded by wi-fi from tablets into electronic patient records, was informed by the experience of a neighbouring acute NHS Trust, which had already carried out work in this area and from whom it seemed possible to learn technical lessons.

The implementation was led by information technology (IT) staff and a clinical lead (Author 2), who is a ward manager with experience of supporting a small-scale e-recording project (Killikelly and Quist 2017). A project steering group, including the organisations' Chief Informatics Officer and Director of Nursing, provided oversight. The IT lead drew up a project plan with support from the clinical lead, which detailed the time frame and communication strategy for the work. Advice on evaluation methods was provided periodically by an external nurse academic (Author 1). Initial outcomes from the project, in terms of staff and patient experience of early versions of the new system, are reported elsewhere (Gale-Grant and Quist 2018).

### **Aim**

We aimed to collate views of staff and inpatients related to prospective use of eNEWS, in order to inform the plan for implementation

### **Setting**

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3 Staff and patients were recruited from six mental health inpatient wards in one inner London  
4 hospital: four were acute adult wards, one was a psychiatric intensive care unit and one was  
5 an older people's ward.  
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## 9 10 **Method**

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13 The views of staff and patients were explored through self-completed questionnaires and  
14 follow up discussion groups. The evaluation had 4 components: a patient questionnaire,  
15 patient discussion group, a staff questionnaire and staff discussion group  
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20 The views gathered informed changes to the project plan.  
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## 23 **Questionnaire development for surveys**

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26 The patient questionnaire was developed by the clinical lead and contained seven questions  
27 (see Table 2), five with binary (Yes/No) responses, one with a choice of three answers and  
28 one with four.  
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33 The clinical lead also developed the nine-item staff questionnaire for staff, of which eight had  
34 binary responses, and one was open ended. The questions explored aspects of early  
35 warning systems that were already identified in the Trust as being important and had been  
36 incorporated into Trust audits of the existing warning system (MEWS).  
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42 Draft versions of both questionnaires were emailed by the clinical lead to senior nursing staff  
43 on the six participating wards for comment. All approved the initial versions and no changes  
44 were suggested. The questionnaires contained no identifying information, other than the  
45 ward, so all responses were anonymous.  
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## 51 **Recruitment:**

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54 a) Patients: Activity coordinators and ward managers on each of the participating wards  
55 were asked by the clinical lead to distribute hard copies of the questionnaires to patients and  
56 provide them with information about the evaluation. They provided assistance to complete  
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3 them if requested by the patient. Completed hard copies were collated by the ward staff and  
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5 handed to the clinical lead when she visited each ward.  
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8 b) Staff: Hard copies of the questionnaire were distributed to all staff attending eObs training  
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10 days (N = 82). They were allocated time to complete it before the training commenced and  
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12 responses were left in a box for collection by the clinical lead.  
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### 15 **Patient discussion group**

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18 One discussion group was conducted on an acute admission ward after questionnaire  
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20 responses had been collected and also prior to the introduction of eNEWS. All patients on  
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22 the ward (n = 18) were encouraged to attend through verbal invitations from the ward activity  
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24 co-ordinator through a flyer publicly displayed on the ward notice board. The discussion was  
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26 facilitated by the ward activity co-ordinator, with the support of the clinical lead. Notes from  
27  
28 the discussion were recorded in brief handwritten form by the clinical lead,  
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- 31 • Patients were verbally informed that the group offered them an opportunity to hear  
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33 about the prospective change from recording physical observations on paper charts  
34  
35 to recording on electronic tablets, and also prospective changes to how often these  
36  
37 observations took place  
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- 40 • Questions or concerns that patients had about the use of handheld tablets were  
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42 discussed in addition to any issues that might require changes in the project plan.  
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### 45 **Staff discussion group**

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48 Prior to introduction of eNEWS, staff were invited from each of the six participating wards to  
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50 attend a discussion group with the clinical lead, who recorded contemporaneous hand  
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52 written notes of the main points. The aims of this group were verbally outlined to staff by the  
53  
54 clinical lead,  
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- 57 • To provide information regarding the planned introduction of eNEWS
- 58  
59 • To seek clarification and provide responses to any staff concerns about the project  
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## Ethics

Approval from an NHS Research Ethics Committee was not required for the project, which was classed as a service development following Health Research Authority (HRA) Guidelines (HRA 2017), and was registered with the trust clinical audit team.

## Data recording and analysis

The clinical lead entered the data from the questionnaires into the SNAP Survey app (<https://www.snapsurveys.com/support/worksheets/snap-mobile-app-ipad-iphone-ipod-touch/>) which was then transferred to SPSS (IBM Corp 2013).

Responses to the open ended question in the staff questionnaire (*Do you think the introduction of technology to support observations is a good idea? If yes, why?*) were subject to a content analysis to identify common issues mentioned in data (Green & Thorogood, 2004), reducing data into a small number of meaningful categories (Smith 2000).

## Results:

### 1. Patient survey

Twenty-six completed questionnaires were returned from patients (see Table 2). The total number of patients on the six wards at this time was approximately 120, however the number who were approached to participate, who declined or did not respond was not collected. Ward staff informed the clinical lead that the majority of patients completed the questionnaire without any help, but a few requested assistance, which was given by staff.

INSERT TABLE 2 Patient questionnaire - physical observation processes

Most stated that they would like to be informed of results of observations, n= 22 (85%) and did not object to recording of observations on electronic tablets, n= 16 (61%). Views were more evenly divided as to whether physical and mental health needs were given equal importance whilst in hospital ('Yes': n= 15 /58%), whether they understood the reason for

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2  
3 taking physical observations ('Yes': n= 15/58%) and whether they had any objection to  
4 having observations recorded every day ('Yes': n= 12/46%). Most respondents reported that  
5 staff took their observations daily (n= 22/85%) and that results were shared with them  
6 ('Always': n= 16/61%).  
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## 11 **2. Patient discussion group**

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15 Nine out of eighteen patients who were on the ward at that time attended the group. They  
16 were provided with briefing information about the planned introduction of eNEWS following  
17 which they were encouraged to express any views, positive or negative, that they had about  
18 this. Two issues were raised:  
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### 23 *i. Security of the digital system and concern about personal information*

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27 Two patients were concerned as to what would happen to information recorded on electronic  
28 tablets.  
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32 "What if someone takes the tablet home, will my information be safe?" (SU1)  
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35 One patient expressed a specific concern that the eObs devices would be used to spy on  
36 them. A response was provided to indicate that no data would be stored on the tablets, but  
37 would be sent directly to the central electronic patient record and that only staff with regularly  
38 changed passwords could access this.  
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### 43 *ii. Increased physical observations and delayed leave*

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47 In explaining the introduction of eNEWS, staff explained that they believed that monitoring of  
48 patients' physical health was important whilst in hospital. Patients were asked whether they  
49 also considered the monitoring of their physical health to be important. A number of the  
50 patients stated that, unless they had something clearly wrong with them, they did not think  
51 that their physical health should be focused on or did not believe that staff were actually  
52 interested in their physical health.  
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3 '...not important unless I am physically unwell' (SU 2)  
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6 Two patients expressed concern about an increase in frequency of physical observations  
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9 "I don't want to have my observations taken more than once a week" (SU3)  
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12 "Taking my observations more than once a week will mean not being able to take my leave  
13 on time" (SU4)  
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17 This contrasted with the views of two others who said that their physical health care was just  
18 as important as their mental health and should be given equal attention. One stated that he  
19 felt that physical health was not given enough importance currently. He gave an example of  
20 when he had needed paracetamol and there was a delay in receiving it. He saw this as  
21 evidence of physical needs not being given the same importance as mental health needs in  
22 a mental health ward.  
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### 29 30 **3. Staff survey** 31

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33 All 82 staff attending training returned completed questionnaires. Seven (21%) were from  
34 older adults' services and 65 (79%) from acute adult services. All were registered mental  
35 health nurses or support workers.  
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40 Seventy-eight responded to the question as to whether introduction of technology to support  
41 observations was a good idea, of which 72 (91%) felt it was. They were asked to explain  
42 their response. Sixty did so. Four respondents' answers were unclear and were not included  
43 in the content analysis. The remaining 56 provided 68 reasons, and these were subjected to  
44 a content analysis. This was carried out independently by Author1 and Author 3 who  
45 generated 5 and 6 categories respectively, including an 'other' category for items cited less  
46 than 4 times.  
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56 The categories were then reduced to four through the authors jointly critically reviewing each  
57 for coherence and face validity and the relative frequency of reporting each. The four  
58 categories were efficiency, accuracy, safe practice and staying up to date with technology.  
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3 Responses allocated into the four categories are reported in Table 3, including examples  
4 from each category. Three answers that did not fit into the four were included in an 'Other'  
5 category.  
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10 The highest proportion were in 'Efficiency' (n = 29; 42%), including references to speeding  
11 up processes, accessing information easily and reducing paperwork. The second was 'Safe  
12 practices' (n = 16. 24%), including thoughts on potential improvements to the completion and  
13 safe storage of records and the escalation of risk  
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19 INSERT TABLE 3 Staff members' themed responses – 'Why is the introduction of  
20 technology to support observations a good idea?  
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23 Seven staff did not support the introduction of technology in this area, but only 2 expanded  
24 on their rationale. These stated:  
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28 'not sure as have not used the system yet'

29 'duplication- that there were already recording vital signs on different platforms'  
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31  
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33 Additionally, a response to Q1a stated that 'having a tablet in front of your face is likely to  
34 give a bad impression to your patients'.  
35  
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38 INSERT TABLE 4. Staff Survey responses. Questions 2-8.  
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40

41 Questions two to eight explored staff views as to the potential impact of eNEWS on  
42 processes (see Table 4). Most responses to questions were either positive about the effect  
43 of eNEWS (range across questions 28-51, 35-63%) or unsure (range 35-49, 36-49%). Few  
44 responses were negative (range across questions 0-4, 0-5%). There was most uncertainty  
45 as to whether the eNEWS system would help interaction with patients (Q7). There was most  
46 certainty as to eNEWS assisting staff to calculate the total eNEWS score more accurately  
47 (Q5).  
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#### 57 **4. Staff discussion group**

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3 Ten staff attended the discussion group, which focused on concerns regarding the  
4  
5 introduction of the eNEWS. Three in particular were highlighted  
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8 *i. Risks associated with using handheld devices on mental health ward.*  
9

10  
11 Several described the potential for an aggressive patient to snatch a device from staff and  
12  
13 assault staff or other patients with it. Some felt that patients might experience paranoid ideas  
14  
15 about the devices, “they may think that they are being recorded or pictures taken” or that  
16  
17 visitors to the ward might believe that staff were using the tablets for personal use, e.g.  
18  
19 looking at Facebook.  
20

21  
22 *ii. The impact of digital recording of observation on staff time and work load.*  
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25 Although, eObs was being introduced as to change the recording medium from paper to a  
26  
27 digital platform, some staff were worried that “it is yet another thing to do”, a sentiment often  
28  
29 linked to “too many change ideas“ being introduced to staff and there “ not enough time to  
30  
31 do it all”.  
32

33  
34 *iii. Concern about system reliability and fit with existing IT systems.*  
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37 General concerns were associated with previous negative experience with IT systems, such  
38  
39 as slow processing time and frequent network problems.  
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43 **5. Changes to the project arising from patient and staff comments**  
44

45 A number of modifications, were made to the detailed project plan for the implementation of  
46  
47 eNEWS in response to views elicited in the surveys and discussion groups (see Table 5).  
48

49 These focused largely on improving communication to patients and carers about the purpose  
50  
51 and processes of eNEWS,  
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54  
55 INSERT TABLE 5. Amendments to eNEWS Project Plan based on staff and patient views  
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58 **Discussion**  
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3 The use of technology has been widely recognised as providing opportunities to improve  
4 outcomes in mental health services (Hollis et al 2015) and the prevention or effective  
5 management of physical deterioration of inpatients is an important issue within such services  
6 (National Patient Safety Agency 2007). This is the first peer reviewed paper, to our  
7 knowledge, that considers the attitudes of staff and patients to the introduction of an e- Early  
8 warning system or, indeed, any other form of eObs system, in inpatient mental health  
9 settings.  
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19 This evaluation is an example of how simple data gathering techniques can be used to  
20 collate views from patients and staff, in order to guide the introduction of a change in a  
21 clinical area where there is limited research evidence. In this example, the project staff  
22 learned about the complexities of creating questionnaires from practical experience, as two  
23 categories of responses in the staff questionnaire were recognised as being very similar to  
24 each other, only after the survey had taken place. This was resolved by collapsing the two  
25 categories into one for the purposes of analysis (as reported above).  
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34 The 6 participating wards served a highly diverse inner London area. All those staff attending  
35 eNEWS training responded to the staff questionnaire and it is likely that these were fairly  
36 representative of the six wards from whence they came, but to attribute representativeness  
37 any further would be speculative. Patients were offered participation in the survey with only  
38 the criteria that they were willing (and able) to contribute. Twenty-six of approximately 120  
39 patients on the wards at the time participated. It is not possible to know how representative  
40 they were of the local patient population in the absence of any comparative demographic  
41 information.  
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51 The patient survey focussed on experience of physical health checks to date. This process  
52 sought to identify means by which such checks could be made as acceptable as possible, in  
53 the context of eNEWS increasing the number of checks for many. Most patients reported  
54 that they were receiving daily physical health checks (22/85%) and that they understood the  
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3 rationale (20/77%), although opinion was divided as to whether individuals minded this or not  
4  
5 (Yes = 12/46%; No = 14/54%). Subsequently, based on this feedback, a new leaflet was  
6  
7 designed for patients giving more explanation as to why physical health checks were  
8  
9 important for monitoring their well-being.  
10

11  
12 Ten respondents (39%) expressed dissatisfaction at the prospect of their physical health  
13  
14 check data being entered directly into a tablet. This was explored in the discussion group,  
15  
16 and it was clarified that the main concern of patients was that data entered into the tablet  
17  
18 could easily be lost or illicitly accessed. This reflected a lack of information provided to  
19  
20 patients at that point in time as to the mechanism of eObs. This detail was included in future  
21  
22 communications about the introduction of eNEWS.  
23

24  
25 Some of the concerns raised by patients as to increased frequency of physical observations  
26  
27 appear to have related to their personal experience of delays to leave commencing due to  
28  
29 poorly timed physical observations on the ward. As a result, an increase in physical health  
30  
31 observations was seen as potentially further delaying their leave. This highlighted the need  
32  
33 to understand context users' concerns in the local context to successfully engage them with  
34  
35 development projects.  
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38  
39 Although Karsh (2004) suggests that 'employee resistance is likely', this was not  
40  
41 demonstrated by the staff responses collated for this project. Their views of the potential for  
42  
43 the use of technology were cautiously positive, which Huryk (2010) noted as being typical  
44  
45 amongst nurses. Ward et al's (2008) review reported that the attitudes of staff to information  
46  
47 technology often simply relate to views as to whether the product is viewed as 'fit for  
48  
49 purpose'. Regarding eNEWS' ability to help improve essential processes, very few believed  
50  
51 it would not, although others were evenly divided between uncertainty and positivity.  
52  
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54  
55 The findings are congruent with the concepts of the Technology Acceptance Model (Davis  
56  
57 1989), whereby acceptance and use of technology depends on perceptions of ease of use  
58  
59 and usefulness. Holden and Karsch (2009) report that this model has been applied in  
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3 numerous health studies and the relationship between staff's perception of the usefulness of  
4 technology and the intention of staff to use it, was significant in every study reviewed.  
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8 The most frequent expectation for improvement related to features inherent in the eNEWS'  
9 system design, such as improving the calculation of risk scores, whilst other more  
10 speculative improvements, such as improving staff/service use interaction, were seen as  
11 less likely. The lack of expectation of improved interaction may have arisen from, either, staff  
12 believing that staff-patient interactions would be largely unchanged from when physical test  
13 results were recorded on paper or, alternatively, that staff were worried that patients being  
14 suspicious of the use of technology could damage relationships.  
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23 Staff most frequently expected eObs to be useful for reasons of 'efficiency', including  
24 timeliness of notes access and less duplication of paperwork. This echoed the objectives of  
25 the Trust in introducing eNEWS, although whether this is reflected in practice is yet to be  
26 demonstrated through evaluation. One particularly interesting response theme, categorized  
27 as 'staying up to date with technology', appeared to demonstrate a general acceptance of  
28 new technological developments due to them being modern, which was seen in a positive  
29 light.  
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39 Only two staff participants in the survey expressed specific concerns about the use of  
40 electronic systems, however more were forthcoming about this in the discussion group.  
41 Here, concerns were raised that electronic tablets could be used as weapons or that patients  
42 or carers might misinterpret the use of tablets and become angry towards staff. These  
43 corresponded with the concerns expressed by patients, as to the safety of their electronically  
44 recorded information. A study of using mobile devices to monitor symptoms in people with  
45 schizophrenia has also reported patient wariness (Ben-Zeev et al 2016), whilst press reports  
46 describe a spike in mistaken complaints that staff were frequently making personal phone  
47 calls on wards following introduction of eObs in one acute hospital (Scunthorpe Telegraph  
48 2017). However, it also seems reasonable to expect that provision of clear information,  
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3 directly by staff and as written information explaining exactly what was happening and why  
4 may lessen some of these risks. The project plan was changed significantly in response to  
5 comments made with a greater focus on providing clear information and encouraging  
6 questions from patients, whilst lighter versions of the electronic tablets were ordered to  
7 partially address prospective risks from the tablets themselves.  
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14 There is a plethora of frameworks that identify typologies of factors hypothesized to affect  
15 implementation outcomes (Chaudoir et al 2013), although such measures are often  
16 developed with minimal analysis of psychometric properties, such as internal reliability and  
17 construct validity (Squires et al 2011). Implementation science frameworks were not  
18 specifically used in this project, but may have been helpful, as the project sought to  
19 introduce new practices. Utilizing a framework could have provided the Project with a  
20 methodical approach to scanning for likely facilitators and obstacles that might affect the  
21 outcome, to assess such issues as leadership within the trust, external issues such as  
22 current societal expectations of technology, as well as the attributes and attitude of both staff  
23 and patients.  
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### 35 36 **Limitations of the project –**

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39 The survey was conducted by clinical staff working in pragmatic ways to understand views of  
40 both staff and patients and to ensure that these views made a difference. This was done  
41 without additional resource or funding to carry out technically robust surveys or in-depth  
42 analysis.  
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49 The absence of patient consultation in the design meant that a personally informed  
50 perspective was missing. Neither staff or patients had actually seen eObs in practice, so  
51 answers were based only on their understandings of what this might be like. The  
52 questionnaires were designed to be brief, easy to complete and anonymous, but the lack of  
53 any demographic information restricted the ability to explore any differences between  
54 groups. The questionnaires were not subject to any psychometric evaluation, as the sample  
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3 sizes were not large enough to make this meaningful. Inclusion of an innovation science  
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5 framework may have assisted implementation of the change, as discussed above.  
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8 Groups were facilitated as discussion and information giving groups, and focused on  
9  
10 identifying and understanding concerns that might need to be addressed. Data collection  
11  
12 from the discussion groups was only in general note form, which somewhat limited the  
13  
14 analysis that could subsequently be carried out. There was also no process of checking with  
15  
16 participants as to whether we had accurately interpreted their views in our analysis. The  
17  
18 facilitation of both the patient and staff groups by a staff member could potentially have  
19  
20 restricted the openness of discussion.  
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23  
24 Changes were made to the implementation plan based on comments received through the  
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26 survey. However, the scope and resources of the study did not allow for measurement of the  
27  
28 impact of these modifications on implementation.  
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31 **Overall, the methodology and sample size was such that generalisability can only be made**  
32 **in general terms, i.e. that engaging early with patients and staff can produce useful**  
33 **information to inform implementation of new technology.**  
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38 The survey was conducted by clinical staff working in pragmatic ways to understand views of  
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40 both staff and patients and to ensure that these views made a difference. This was done  
41  
42 without additional resource or funding to carry out technically robust surveys or in-depth  
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44 analysis. We would undertake the project differently were it to be repeated as a formal piece  
45  
46 of research, taking into account the limitations above.  
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### 49 **Conclusions/Implications for practice**

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52 The caution expressed by patients as to the use of electronic recording devices suggests  
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54 that mental health staff may need to be aware of possible misinterpretations of technological  
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56 developments and to ensure that information provided is clear and consistent.  
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3 Further research into patients' views would be of value in planning large scale future  
4 technological developments, as these will inevitably be required with increasing opportunities  
5 presented by technology and increased pressure to use staff time as efficiently as possible  
6 in the context of long term staff shortages in mental health services in England, and  
7 worldwide (Kakuma et al 2011).  
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14 The broadly positive views expressed by staff regarding this particular use of technology  
15 appear to be relatively typical, although in this case views were somewhat marred by poor  
16 previous experiences of unreliable IT systems  
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21 This project explored issues associated with the prospective introduction of an eNEWS  
22 system. Further investigation is required as to the impact of this system on patient and staff  
23 outcomes in mental health inpatient settings. Such studies would also potentially help inform  
24 the development of other types of eObs in the future.  
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31st May 2018

For Peer Review

**Table 1. Studies of applied technology in inpatient mental health settings 2008-18.**

<b>Authors</b>	<b>Country</b>	<b>Year of publication</b>	<b>Topic</b>	<b>Patient group</b>
Anttila et al,	Finland	2008	Information technology based patient education	Acute adult inpatients
Anttila et al	Finland	2011	Information technology based patient education	Acute adult inpatients
Koivunen et al	Finland	2012	Information technology based patient education	Acute adult inpatients
Kuosmanen et al 2017	Finland	2009	Technology-based patient education	Inpatients with schizophrenia spectrum disorders
Strudwick et al	United States	2017	Barcode medication administration identification practices	Inpatients from a range of ward types
Ben-Zeev et al	United States	2017	Mobile phones measuring activity and link with risk of violence	Inpatients with a diagnosis of schizophrenia, bi-polar disorder
Killikelly and Quist	United Kingdom	2017	Development of a mobile device to record observational clinical data	Adult inpatients with autism
Riahi et al	Canada	2017	Introduction of electronic medical records	Inpatients on 16 wards for those with complex, serious, and persistent mental illness



**Table 2. Patient questionnaire - physical observation processes**

		Yes (%)		No (%)	
1	Are your physical and mental health needs given equal importance whilst in hospital?	15 (58)		11 (42)	
2	Do you understand the reasons for taking physical observations?	20 (77)		6 (23)	
3	Would you like to be informed of results of observations?	22 (85)		4 (15)	
4	Do you have any objections to having observations taken every day?	12 (46)		14 (54)	
5	Do you have any objections to recording of observations on electronic tablets?	10 (39)		16 (61)	
6	How often do the nurses take your physical health observations?	Daily	≥ 3 / week	X1 per week	Never
		22 (85)	3 (11)	1 (4)	0
7	How often do the nurses share the results with you?	Always	Sometimes	Rarely	Never
		16 (61)	4 (15)	3 (12)	3 (12)

**Table 3. Staff members' themed responses – 'Why is the introduction of technology to support observations a good idea?'**

No.	Theme	Examples of content	Times cited (N = 68/%)
1	Improving efficiency	Note accessibility, supporting mobile working, reducing paperwork, speeding up processes	29 (42%)
2	Improving accuracy	Minimizing recording errors, accurate calculations	13 (19%)
3	Safe practices	Completion of observations, secure records, escalation of risk.	16 (24%)
4	Modernising with technology	'moving forward', 'with the times', 'abreast with current trends'	7 (10%)
5	Other	Cost reduction, improved engagement, positive attitudes	3 (5%)

**Table 4: Staff Survey responses. Questions 2-8.**

Question	n =	'It will not help' n (%)	'Unsure' or 'it may help' n (%)	'It will help' n (%)
Q2 Do you think eNEWS will help you perform observations in a timely way?	82	1 (1.2)	40(49.4)	40 (49.4)
Q3 Do you think eNEWS will help you complete the right number of required observations per day?	82	1 (1.2)	44 (49.4)	37 (45.1)
Q4 Do you think eNEWS will help you calculate the accuracy of the observations you record?	81	0 (0)	36 (43.9)	46 (56.1)
Q5 Do you think eNEWS will help you calculate more accurately the total score you record?	81	1 (1.2)	29 (35.8)	51 (63.0)
Q6 Do you think eNEWS will help you better comply with the escalation of observation policy?	81	2 (2.5)	35 (43.2)	44 (54.3)
Q7 Do you think eNEWS will help your interaction with service users?	81	4 (4.9)	49 (60.5)	28 (34.6)
Q8 Do you think eNEWS will improve the speed and efficiency of your observations?	81	1 (1.2)	44 (54.3)	36 (44.5)

**Table 5: Amendments to eNEWS Project Plan based on staff and service user views**

Source	Concern	Action taken
Service users	What might happen to data recorded on tablets?	<ul style="list-style-type: none"> <li>Information given at community meetings prior to eNEWS implementation on each ward.</li> <li>Information added to ward posters distributed pre implementation. Information leaflets developed for service users (Appendix A)</li> </ul>
	Additional health checks associated with NEWS will interfere with leave.	<p>Information added to poster re physical health care risks with medication and weight gain that require careful monitoring.</p> <p>Training for staff re NEWS includes emphasis on staff explaining reasons for health checks.</p> <p>Information on poster explains that that initial frequency of NEWS checks would be higher, but would be later reviewed</p>
	Not always getting feedback after physical tests about their findings	The importance of offering feedback to service users after taking physical observations added to eNEWS training
Staff	Tablets may be used as weapons if seized from staff.	<p>Discussed in staff training sessions prior to implementation, with an onus on individual risk assessment of service users and proportional caution regarding use of tablets.</p> <p>A planned replacement of tablets will seek lighter devices to reduce risk.</p>
	Service users and visitors may misinterpret staff working with tablets as them using them for personal reasons	Notices put up on all ward entrances where tablets are used, explaining their purpose,