

The challenge of rescheduling nursing staff; informing the development of a mathematical model decision tool.

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30th October 2014

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Executive Summary

This report presents the findings and recommendations from a preliminary investigation into how an NHS organisation manages sudden nursing staff shortfalls. Unexpected staff absences, which can occur on a daily basis, can impact on the optimum skill mix for safe effective care delivery. Ward managers would welcome methodological support for daily rescheduling staff (i.e., re-rostering) within electronic rostering systems.

1. Aims

This study aimed to provide a preliminary analysis of:

1. the characteristics of rescheduling events in an NHS organisation;
2. the managerial decision-making and initial resource implications associated with rescheduling nurse shift absences.

2. Methods

The *Critical Incident Technique* was used, logging over a week all Red and Amber critical incidents that required rescheduling of a nursing shift in four wards. Two weeks later, semi-structured interviews were held with the ward managers concerned, exploring the nature of the incidents, how they were managed, the rescheduling decision-making process, the time and resource costs of rescheduling. Ethical approval was obtained via UWE Bristol and NHS research governance approval via IRAS.

3. Findings from interviews with Ward Managers

Following thematic analysis, four theme areas were identified;

A. Inefficient formal systems

Managers felt that the current electronic rostering system could be more effective. There was a general mistrust of the system and feeling that the data it provided was inaccurate. Managers felt the in-ability to 'back-up' data left them vulnerable. In addition, when alerted to staff shortages, the bank were not always able to find appropriate cover, leading to staffing shortages which had to be managed locally, occasionally requiring the manager or other staff to work extended hours. Furthermore, those staff agreeing to additional shifts in advance may cancel if opportunities for work became available in 'more preferential' locations, leaving the wards without cover.

B. Informal support systems

It was clear that localized informal practices had emerged to manage difficulties experienced. Paper rotas were still in use as the electronic-system was believed to be regularly out of date. Ward Managers often searched for immediately-local staff and simultaneously verified if Bank staff were available. Managers also regularly emailed staff to update on shift changes or opportunities to cover gaps in the rota, and telephoned staff to check short-term availability. This took considerable time and effort, detracting from other duties.

C. Re-scheduled Cover Staff

The managers had a strong preference to employ cover staff who were familiar with the ward environment and the clients. This reduced the need for additional orientation and briefing. However, this was not always achievable, particularly for early shifts when the availability of staff was generally more problematic.

D. Time and resource impact of rescheduling

It was suggested that rescheduling takes time, costs money and impacts on the manager's ability to meet other targets. A red/amber incident often took four hours of manager and staff time to

address. Additional resource time was taken if the cover staff were not familiar with the clients and ward. To save resources resulting from staff absence, existing bank staff were employed as a preference, with more expensive agency staff seldom authorized.

4. Conclusions / Recommendations

This study has identified some of the complexity of rescheduling to cover staff absence in a mental health trust.

It is recommended that the Trust and the authors translate this understanding into refining the further development of our mathematical model to ensure the (re)scheduling reflects:

- Manager preferences (or not) for particular staff;
- Costs of ward, known, relief, bank and agency staff;
- Changing availability of staff, and out-of-date data;
- Individual staff preferences & constraints, so that it:
 - has staff commitment and credibility;
 - reduces manager time spent (re)scheduling.

The model should integrate with staff bank and electronic system to ensure it uses the same data, and is an effective management tool.

The authors propose ongoing collaboration with the Trust to implement the model as a pilot in order to:

- Learn rescheduling issues in practice, working with managers;
- Refine the model using it side-by-side with current practice;
- Implement it in cooperation with the bank and electronic system;
- Adapt the use of the model to cope with poor data;
- Improve the quality of data needed by the model by using health economist measures and tools to identify and cost of the time the manager spent rescheduling, the amount of time take up with ward familiarization by the cover staff, the additional cost of calling in cover from the internal bank or an external agency, and the travel costs of cover staff.

Background

The British NHS is labour-intensive and nursing is a major part of its workforce. The impact of nurse staffing levels and skill mix has been linked with poorer patient outcomes (Clark et al., 2013) and received considerable attention in recent enquiries investigating the quality of care delivery in one Trust (Francis Report, 2013).

Nurses constitute a significant part of the healthcare workforce in the British National Health Service (NHS). A daily challenge for any healthcare organisation is ensuring that appropriate nursing staff¹ are available to deliver safe and effective care. Effective scheduling is required to ensure nursing staff are allocated to cover the 24 hour cycle, seven days a week, to provide high quality care. This requires careful balance of number of staff per shift, and appropriate skill mix. Scheduling healthcare staff, in general, demands careful balance of the needs of the service, cost effectiveness and fair treatment of employees.

Irrespective of good planning, when staff originally scheduled to work unexpectedly become unavailable, shortfalls have to be managed. Rescheduling, specifically defined here as the activity of calculating a new schedule (roster) when individual rostered staff unexpectedly become unavailable, is a frequent event in many healthcare organisations (Clark et al., 2013). Rescheduling of nursing staff involves managing disruption, may produce less than optimum outcomes, can place extra financial stress on constrained budgets, and takes up significant management time. Accurate data on actual levels of disruption is difficult to access (Buchan & Seccombe, 2012), yet illness, absenteeism, staff development including mandatory training, requests for shift changes at short notice or unexpected workload demands make rescheduling a daily, and often invisible, activity of many nurse managers. When faced with scheduling disruptions the management imperative is to minimize any effects on the quality of care, or risks to patient safety, whilst incurring little or no additional financial burden.

The direct relationship between adverse outcomes (complications, shorter lengths of stay and lower mortality) and the number of qualified nurses available to meet the care needs of patients is now well documented (Aikin et al, 2002, 2012; Rafferty et al 2011, Needleman et al 2002, 2011). Poor staffing levels lead to burnout, increased incidence of adverse events, patient mortality, and higher levels of staff attrition, absenteeism and illness (Taylor et al 1999; Aikin et al, 2002; Silvestro and Silvestro, 2008). Staff fatigue and dissatisfaction are common nursing workforce complaints and the number of shift changes made at short notice impacts on increased levels of absenteeism (Aiken et al, 2002; Silvestro and Silvestro, 2008). Fatigue and timing has also been associated with musculoskeletal (back, neck) injuries (Bae et al, 2010; Welch and McPaul, 2013). Conceptualising what constitutes overtime is problematic in nursing (Lobo et al 2013). Rates of errors, and near misses, have been associated with working shifts longer than 12 hours, staff staying on duty longer than scheduled and overtime working (Geiger-Brown, 2010; Rogers et al., 2004) all strategies commonly used to manage nurse shortages. Temporary nurses (bank, agency [B&A]) are one solution. The use of B&A staff is regarded by some commentators as an indication of system inefficiency; others argue temporary staff offer flexibility and improved productivity both significant factors in times of budget restraint (Buchan & Seccombe, 2012).

Employing temporary staff at levels greater than 15 percent (%) have been linked to increased rates of medication error (Bae et al, 2010) as well as additional costs. Shift absenteeism is expensive, for example in 2012, spending on B&A staff (one proxy indicator) in the NHS in England increased overall. Levels of short notice shift requests (less than 24 hours) were reported at just below 20% of all requests for shift cover but accounted for a quarter of all, more costly, agency nurse usage (NHS Professionals 2012). Highest demand for B & A staff was at weekends, to cover afternoon (late) and night shifts (NHS Professionals, 2012). Out of hours has been identified as the period when greatest numbers of adverse events occur, least qualified staff are available (Wong and Morra, 2011), and

¹ Nursing staff in this context means the appropriate number and skill mix per shift of registered nurses (RN) and support staff (health care assistants, assistant practitioners, auxiliary nurses).

the periods when temporary staff are more likely to be used to infill for staff absences (Buchan & Secombe, 2012).

Applied mathematical optimisation, or intelligent computing, has much potential to assist managers involved in rescheduling (Clark & Walker, 2011), but is as yet largely unrealised (Moz and Pato, 2003, 2004, 2007; Bard and Purnomo, 2006; Kitada et al., 2010; Maenhout and Vanhouke, 2011). In a recent review of the application of mathematical/computational approaches to the challenges associated with rescheduling, few examples of end user involvement - nurse manager decision-making - were evident (Clark et Walker, 2011). Building on that review, we undertook a consultation exercise with ward and senior managers in several NHS trusts (Clark et al., 2013). This brought to the foreground the complexity of rescheduling decision-making, and the urgent imperative to interrogate managers more comprehensively, if such applications were to have operability. This research sought to capture that complexity and managerial intelligence, mapping the typology of decisions and costs associated with rescheduling in an NHS organisation and inform prototype development. It thus contributes to the development of a mathematic model based decision support tool for managers to use to make considered, operationally robust and speedier rescheduling decisions.

Aims

This report outlines the results of individual interviews with managers at a mental health Trust in order to better understand the management challenge and inform the development of mathematical-based tools for rescheduling. It aims to provide a preliminary analysis of:

1. the characteristics of rescheduling events in an NHS organisation
2. the managerial decision-making and initial cost information associated with rescheduling nurse shift absences

Methods

An explanatory observational case study design incorporating critical incident technique (CIT) (Flanagan, 1954) was used. An NHS organisation was identified as a case study site and agreed to participate. The organisation had participated in earlier preparatory work (Clark et al., 2013). Ethical approval was secured for all phases prior to data collection firstly through local NHS Research & Development permission and then through the UWE Faculty of Environment & Technology's Research Ethics Committee. The study design and all data collection tools were developed with input from the case study participants, experienced members of the research team and service managers. The organisation was a mental health Trust providing a range of provision including secure services to a population across a large rural and urban area of the South West. The Trust uses a computerised system for nurse scheduling. Working with key informants (local ward or unit managers), rescheduling 'critical incidents' over a given week were identified and recorded.

The case study data was collected through semi-structured interviews with three knowledgeable key informants who were Managers within the Trust, leading a total of four different wards. The interviews were used to explore the nature of the critical incidents recorded in the incident log, the decision making process which took place and how the incidents were managed. The interviews lasted between one to two hours in duration and were conducted over a period of one month.

Interviews are a highly efficient way to gather rich empirical data, their key strength is the provision of insight into perceived causal inference (Yin, 1994). The use of loose questions was used as a guide whilst remaining flexible, with an emphasis upon how the interviewee understands the issues and events that have taken place, and what they believe is important in explaining patterns and behaviour (Bryman & Bell, 2003, p343). When interesting avenues which were not directly related to the interview questions arose these were pursued and recorded which allowed the interviewer to address a number of predetermined questions in a systematic consistent order, whilst simultaneously allowing the interviewee to develop and speak more widely on issues raised by the

research (Berg, 2004). As part of this process a case narrative was produced (Voss et al., 2002) and further discussion were carried out with respondents in order to validate any discrepancies, fill in any missing information and prevent misunderstanding of issues and events.

Results

The results are presented in two sections. The first summarises the critical incidents recorded on the incident log; the second reports on the interview findings and is centred around the four themes: inefficiencies in the formal systems; informal support systems; the characteristics of cover staff and the impact of rescheduling.

Incident log

An incident log was used to record all critical incidents occurring in one week on the four wards. The incidents were recorded as either red or amber depending upon the severity of the incident; where:

- A Red incident was identified as a shortage/unexpected absence of any qualified nurse which reduced the staff to patient ratio to an undesirable level.
- An Amber incident was identified as a shortage/unexpected absence of any unqualified staff member which reduced the staff to patient ratio to an undesirable level (N.B., any further shortage/unexpected absence would lead to the recording of a red incident).

The causes of shortages include maternity leave, annual leave², sickness (short and long-term), difficulties in recruiting qualified staff, and delays while waiting for the DBS check of new staff. In the week under study, there 59 Red incidents and 7 Amber ones over the four wards, as shown in Table 1. An Amber Incident is considered to be less serious than a Red Incident. The general perception was that most red incidents were known / could be anticipated in advance. Red incidents can usually be avoided with good initial scheduling that takes into account the individual staff preferences (including their ability or willingness to cover in different geographical locations).

Date:		Mon 24			Tue 25			Wed 26			Thu 27			Fri 28			Sat 29			Sun 30			Week's Total
Shift:		E	L	N	E	L	N	E	L	N	E	L	N	E	L	N	E	L	N	E	L	N	
Ward 1	Red							1									1			1			3
	Amber							1			1						1			1			4
Ward 2	Red		1		1			1	1		1	2		2	1	1	1	1		1			14
	Amber																			1			1
Ward 3	Red	1	2	1	2	2	1	1	1		3	3		2		1	1	2	2	2	3	2	32
	Amber																						0
Ward 4	Red	1			1	1		1	1			1				1			1	1	1		10
	Amber	1									1												2
All Wards	Red	2	3	1	4	3	1	3	4	0	0	4	6	4	1	3	2	3	4	4	4	3	59
	Amber	1	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	1	0	1	1	0	7

Table 1: Red and Amber Incidents over a week in April 2014, by ward, type, day and shift.

² Annual leave was a particular issue during this time period as a number of staff needed to take leave before the end of March, which affected the March figures.

Interview Findings and Results

This section reports the findings from the interviews conducted with the Ward Managers as part of the empirical data collection phase. The wards and Ward Managers are referred to by code (W1, W2 and W3) and any quotations are annotated with this coding. To ensure anonymity, no information is provided which could link individual participants' roles with the verbatim quotes. A number of different themes emerged from analysis of the interview data. The main themes were:

- A. Inefficient formal systems
- B. Informal support systems
- C. Re-rostered cover staff
- D. Time and resource impact of rescheduling

A. Inefficient formal systems

Discussions centered around deficiencies in two formal systems, the formal roster system 'RosterPro' and the process for allocating Bank staff to staffing shortfalls.

RosterPro is used as the formal roster system across the three wards. This system was felt to fall short in a number of areas, from initial 'logging into' the system (which takes anything up to five minutes and requires a number of different passwords for each stage of the login process) to being blocked from the system if it is in use by another member of staff to the lack of 'read only' functionality.

Generally the staffing rota is completed up to eight weeks in advance by the team leaders and is revised on a monthly, weekly and daily basis to ensure staffing levels are adequate. A lack of trust in the system means that the team leaders regularly interrogate the data for accuracy.

"I am always looking at the system, it feels like you are always looking at it and checking it on a daily basis" (W2 Manager)

The process for dealing with possible red incidents includes putting the potential gaps into RosterPro and notifying the Bank. This is then distributed automatically to potential cover staff via email or text by the Bank. Access to the roster system is generally restricted to the admin staff and nursing staff at grade 6 and above (with the exception of one Grade 5 nurse). Changes can only be verified by the Ward Manager and there is no 'viewing' access for other staff to view the system; currently other staff only have access to request a shift change. The administrator is responsible for reconciling the actual staffing data with RosterPro at the end of each week, which is signed off by the Ward Manager.

The system is not backed up, and has led to the Ward Managers feeling vulnerable as occasionally the system fails completely and often to considerable amount of rework, should this occur.

"I authorized the March rota and this then disappeared, I had to reenter [the data], this took four hours to put back in" (W1 Manager)

Bank administrative costs are an overhead which is allocated within the ward costs. Using the Bank to find cover has the potential to be more convenient and take less time, however the perception is that the process cannot be relied upon. There was evidence of requests being placed to Bank several weeks prior to an incident which had not been filled by Bank (W1) and an example where Bank staff were organised well in advance to cover an anticipated shortfall, but then they cancelled at short notice and without prior notification from the Bank.

"..often Bank staff book far in advance for shifts and then cancel in order to take shifts [closer to home] ...the Bank does not understand the ramifications of one staff member being absent" (W1 Manager).

B. Informal support systems

Because there are concerns about the integrity and stability of the formal roster system a number of localized informal practices have emerged:

Paper rotas were used across all of the wards studied. In W1 because of the experience of losing RosterPro data, with no available backup, the Ward Manager was “pleased to have a paper roster to work from, though [they] are told not to keep paper copies” (W1 Manager). On W2, staff shift patterns were recorded using an informal paper system as not all staff had access to staffing levels in RosterPro and the information held in RosterPro was believed to be regularly ‘out of date’. W3 commented;

“Schedules are made four to six weeks in advance using paper to identify forthcoming shortages ... [from this] the Bank is constantly called upon with informal roster requests which eventually get reflected in RosterPro”.

Informal methods of communication have developed across the wards due to a lack of confidence in the formal systems. Because the RosterPro system is not always up to date Ward Managers will often simultaneously activate several staff search options for immediately-local staff and to verify whether Bank staff will be available. Ward Managers will regularly email staff to update them on shift changes or opportunities to cover gaps in the rota, they will also telephone to check availability.

“I am not always sure the Bank identify gaps in the rota, so I ring them as well. We also ask staff on the ward, on other wards and ring around other staff who sometimes cover for us at the same time” (W2 Manager)

At weekends, if there is no ward manager on duty, then staff can only telephone an online manager who is off-site and will not visit unless there is a Major incident.

C. Re-rostered cover staff

There is a strong preference to “have people that know the ward covering the shift” (W1 Manager). Staff re-rostered to the shift who are unfamiliar to the ward require additional briefing and support.

“There is more reliance on the support worker to know the ward ... the support worker must do more to keep the ward safe, taking up more of their time, which might mean less time for the clients” (W1 Manager)

Having staff who have worked on the ward before enables the manager to have immediate confidence in the covering staff as being competent; it is also likely they will already be familiar with the clients and their possible behaviour issues.

“...we have a list of people we know we can ring, we use RosterPro to see if they are covering shifts elsewhere, we can also ring the ward next door” (W1 Manager)

One manager also cited the case of a client whose abscondment could have been better foreseen and probably prevented by staff familiar with the ward and its clients.

There are difficulties finding cover for a qualified early shift, as possible cover staff are often working elsewhere on other wards. There are also difficulties finding cover for specific wards where the environments are more challenging (for example clients may be more aggressive).

“We have had some good bank and agency staff, but others we would not want to come back ... If someone is good or bad the Ward Manager hears about it. I listen to staff concerns and address it with the bank. The Bank has a complaint process and if we are unhappy we can go through this. I have used this in the past and the Bank investigates.” (W2 Manager)

D. Time and Resource Impact of rescheduling

The time spent rescheduling impacts a Ward Manager’s ability to meet other targets such as monthly one-to-one supervision meetings with staff. Red and Amber incidents regularly use up to one and a half hours per shift of management resolution time and also require cover of nurse briefing/support time; this increases if the covering staff do not know the ward. Typically a critical incident can absorb within the shift: one and a half hours of Band 7 manager time, one and a half

hours of Band 5/6 qualified staff time, one hour of Band 2 support staff time, and the cost of bank/agency staff.

Very occasionally a Ward Manager has to cover an absence or shortage themselves, in which case they are not available to fulfil immediate responsibilities (such as dispensing drugs for which they are the key-holder) and directly impacts their management work.

Using agency staff is very expensive; it is cheaper to agree overtime for existing staff. There were only a handful of instances over the preceding six months where the use of agency workers had been agreed.

“Agency cover is 100% your last resort. Agency costs are high; the more they are used the greater the cost, but sometimes we need to have agency. We have to work within our budget and need to get authorisation from the local Managing Director to get agency agreed” (W2 Manager)

In terms of clerical administration of this activity, the Ward Manager has to go onto the system and authorize payment of the Bank, checking for any changes

“This takes up to four hours a week. I can get the administrators to do it, but I am responsible and so I tend to go on the system and make any changes to staff [myself]” (W2 Manager)

Discussion and Limitations

It is important to acknowledge that the study was limited to one mental health Trust and accessed CIT and interview data from three in-patient ward areas. Conclusions are therefore based on a small sample of convenience and localised experience.

Computerised rostering systems had been introduced to all three-ward areas, however it was clear that staff experienced difficulties in use. In particular there were time delays in logging onto the system, an action routinely undertaken on a daily basis. It is acknowledged that health care staff are reluctant to engage with technology if it fails to meet their needs (Ward, 2013), indeed, a lack of confidence in the system meant ward managers were reluctant to rely on it. They felt the need to check the accuracy of data held. When a reduction in staff levels was recorded within the system, this triggered a request to the Bank for staff cover. In theory, such an alert should ensure planning to cover staff absence, however, pre-planning cover in advance failed to prevent issues of staff shortages, with potential ramifications for staff and client safety (Rafferty et al., 2011). Ward managers felt that Bank staff changed their work plans ahead of the rostered shift, resulting in shortages on the day.

A lack of trust in the accuracy and functioning of the system prompted staff to maintain their own informal paper based rosters. Whilst viewed as necessary by staff, this duplication of effort suggests the intended resource saving benefits of the computerised system are not being fully realised. Moreover, ward managers have implemented a wide range of informal measures to ensure safe levels of staff rostering and to overcome some of the shortfalls they see in the current system. In particular, ward managers telephone or email the Bank to ensure cover is in place. In addition, they often contact individual staff with shift availability to try and overcome staff shortages. Engaging end users in the development and use of technology may well help address some of these issues (Clark and Walker, 2011).

There was a strong preference to manage any staffing shortfalls from the existing staff base or those familiar with the ward environment and client group, as this was perceived to improve client care and avoid poor care (Francis Report, 2013). Having familiar staff available to work on the ward instilled confidence in the remaining staff and reduced the need for orientation to the ward environment, practices and client group. This was particularly important in high dependency areas, where client familiarity with the client group was important.

Managing a shortfall in staffing levels impacted on the manager's time, with considerable effort required to ensure a shift was adequately staffed. In addition, ward managers suggested they had

on some occasions had to extend their working hours and work beyond contracted hours (Lobo et al., 2013) to cover staff absence and ensure safe staffing levels. Furthermore, the need to replace absent staff resulted in additional resource costs to the clinical area (Buchanan and Seccombe, 2012), which could ultimately require funding of expensive over time payments and agency staff.

Conclusions and recommendations for further research

The use of CIT has facilitated an understanding of the complexity of rescheduling in a mental health Trust. It provided insight into how formal and informal managerial structures and decision-making functions. It also highlighted the difficulties experienced by those managing re-rostering and the potential impacts on resources, staff and client care. The study, though limited, suggests that electronic systems for re-rostering that are built into effective rostering programmes would be welcomed by staff and could help overcome some of the current difficulties experienced in managing staffing levels needed to maintain staff and client safety. To be effective any mathematically-generated re-rostering development would need to be reliable, reflect individual staff preferences and loyalties, and would be reliant on staff commitment.

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