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Introduction of a Microsoft Excel-based unified electronic weekend handover document in Acute and General Medicine in a DGH: aims, outcomes and challenges

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ABSTRACT

On-call weekends in medicine can be a busy and stressful time for junior doctors, as they are responsible for a larger pool of patients, most of whom they would have never met.

Clinical handover to the weekend team is extremely important and any communication errors may have a profound impact on patient care, potentially even resulting in avoidable harm or death.

Several senior clinical bodies have issued guidelines on best practice in written and verbal handover. These include: standardisation, use of pro forma documents prompting doctors to document vital information (such as ceiling of care/resuscitation status) and prioritisation according to clinical urgency.

These guidelines were not consistently followed in our hospital site at the onset of 2014 and junior doctors were becoming increasingly dissatisfied with the handover processes.

An initial audit of handover documents used across the medical division on two separate weekends in January 2014, revealed high variability in compliance with documentation of key information. For example, ceiling of care was documented for only 14-42% of patients and resuscitation status in 26-72% of patients respectively. Additionally, each ward used their own self-designed pro forma and patients were not prioritised by clinical urgency.

Within six months from the introduction of a standardised, hospital-wide weekend handover pro forma across the medical division and following initial improvements to its layout, ceiling of therapy and resuscitation status were documented in approximately 80% of patients (with some minor variability). Moreover, 100% of patients in acute medicine and 75% of those in general medicine were prioritised by clinical urgency and all wards used the same handover pro forma.

PROBLEM

On-call weekends in medicine are often busy: having to respond to “bleeps” whilst sorting out through long lists of jobs and

clinical reviews handed over by the weekday teams can be a stressful experience for junior members of the team. The time spent to prioritise patients to be reviewed and tasks is time subtracted to direct patient care. On top of that, decisions made on the basis of incomplete information may lead to incorrect prioritization and delays in reviewing sick patients.

The setting where this project took place consisted of a district general hospital in the outskirts of London, with approximately 500 inpatient beds. The medical division is composed of ten general medical wards and two acute medical wards. In addition, the on-call medical team also covers a haematology/oncology ward, a Coronary Care Unit, medical outliers in the Hyper Acute Stroke Unit and surgical wards. Each ward has an average of 20 beds.

During weekends and bank holidays, patients are cared for by an on-call team. To facilitate this process, every Friday afternoon, ward doctors would produce a handover document, specifying which patients on their ward need to be reviewed by the on-call team, or have outstanding investigation results to be chased. The templates for these lists had been designed by ward doctors themselves, and typed on Microsoft Word. Ward doctors would save the list in their wards' respective folder on a shared network drive, accessible from any computer within the hospital. Figure 1 shows an example of one old handover template, which was used on 'M1' ward (See figure 1 in supplementary information – Handover form designs).

Weekend teams were responsible for printing out handover lists, allocating tasks amongst themselves and deciding how to prioritise reviews.



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Although individual ward lists were similar, there was no hospital-wide agreed standard of what information should be provided and each ward had developed their own template. As a result, due to time pressures and lack of standardization, vital information such as ceiling of care and resuscitation status was often omitted. Moreover, there was no suggestion as to which patients should be prioritized, leaving this task to an already over-stretched on-call team.

BACKGROUND

Clinical handover has been identified internationally as a critical time at which human errors can occur, which may lead to avoidable patient harm. With the implementation of the European Working Time Directive, which limited the number of consecutive hours of work for doctors and the consequent introduction of shift-pattern of work, as well as with an ever-increasing number of hospital admissions in a context of limited resources, the need for effective communication and handover amongst clinical teams is paramount. However, studies have shown that, despite this, the quality of handover processes remains highly variable across the UK,¹⁻³ thus becoming an important focus of quality improvement initiatives, which are well documented in the literature.

For example, in some hospitals, Friday ward round forms were introduced, to encourage doctors to summarise crucial information about the patient prior to the weekend, thus sparing the on call team the time that would be required to review extensive medical records.⁴ Others have either adapted IT-based handover systems^{5,6} or introduced new standardised, paper-based handover forms.^{7,8} A low-cost but effective approach documented in the literature involves the use of centralised, Microsoft Excel-based electronic handover tools, which can be saved as a shared file and accessed from different computers. Columns are labelled appropriately to prompt doctors to provide specific information, in accordance with RCP Acute Care Toolkit 1 guidelines.^{2,9,10,11} Qualitative evaluations of such standardised, centralised, electronic-based systems suggest that users find them more effective¹¹ and conducive to patient safety⁹ than, for example, de-centralised, paper-based systems. At least two studies have shown that such standardised and centralised electronic handover tools can also be more effective at capturing specific information.^{9,10}

Several national bodies, such as the BMA Junior Doctors Committee, the Royal College of Physicians and the Association of Medical Royal Colleges, have issued guidance on how to design an effective handover system, in order to maximise efficiency, patient safety and enhance patients experience.¹²⁻¹⁴ Recommendations for written handover include the use of standardised forms, which set essential information to be provided and are tailored to the needs of each unit and specialty, as well as Red - Amber - Green colour coding, based on clinical urgency.¹² These are particularly relevant for weekend

handover, given the increased need for prioritisation of care in a setting of limited resources, and formed the basis of this quality improvement project.¹³

BASELINE MEASUREMENT

A retrospective audit of weekend handover lists for all medical wards, produced by ward teams on Friday afternoon, on the first and third weekend in January 2014 was performed. Acute medicine and general medicine were audited separately, given the organisational divide between these two areas of the hospital, which are staffed by different teams on weekdays and weekends.

All patients included in the weekend handover lists were audited, for a total of 83 in the first and 90 in the third weekend of January 2014. A breakdown of the number of patients included is provided in [table 1](#).

The handover documents were audited for compliance against the following measures:

- Complete patient identification (name, hospital number and date of birth)
- Complete patient location (ward and bed number)
- Working diagnosis field completed
- Clinical priority field completed/appropriate colour coding applied
- Reason for handover field completed
- Action required field completed
- Grade of reviewer field completed
- Treatment escalation plan field completed
- Resuscitation status field completed

This list had been devised following consultation within the audit team and after review of handover guidelines published by the Academy of Medical Royal Colleges,¹⁴ and the Royal College of Physicians.¹² The AoMRC, in its publication 'A clinician's guide to record standards', suggested that, as a minimum requirement, the following information to be included in weekend handover documentation: patient identification, location, background/allergies/risks, working diagnosis, reason for handover, tasks that must be done, who is handing over and who is receiving handover (including grade). Subsequently, the RCP Acute Care Toolkit 1,¹² also highlighted the importance of documenting the immediacy of review by the on-call team, via red-amber-green patient risk assessment, as well as suggesting that the template design be adapted to the local situation. In our hospital, for example, 'ceiling of therapy' and 'resuscitation status' were incorporated as separate fields, given the focus in the Trust on improving documentation regarding escalation plans.

Table 1 Number of patients handover details audited

Weekend dates	Acute Medicine	General Medicine	Total
4/1-5/1/2014	37	46	83
18/1-19/1/2014	19	71	90

Results for both weekends, which are displayed in figures 2 for general medicine and figure 3 for acute medicine (see supplementary information – baseline measurements), highlighted three key themes. First, there was no suggestion as to how patient reviews should be prioritised. Secondly, compliance with documentation of ceiling of therapy and resuscitation status was poor. In fact, fewer than 50% of patients in the handover documents had a documented ceiling of therapy and 26-70% of patients had a documented resuscitation status. Thirdly, except for Working Diagnosis in the Acute Medicine set, none of the other data sets achieved 100% compliance across both weekends.

DESIGN

This improvement initiative aimed to create a unified handover document for the medical department, which would include treatment escalation plans and indication of clinical priority, in order to support the on-call team in prioritisation of tasks and decision making. This would help to ensure that, for example, patients who were deemed to be more unwell could be seen earlier in the day and, where appropriate, escalated to senior doctors and the critical care outreach team.

A medical handover improvement initiative was launched, with the aim that, within 12 months:

1. All medical patients handed over to the weekend team would be listed on a unified handover document
2. All patients handed over would be prioritised according to clinical urgency
3. For each patient, handover documentation would specify the minimum information, as recommended by the Royal College of Physicians and the Academy of Medical Royal Colleges (three patient identifiers, location, medical background/diagnosis, reason for handover, actions that must be taken, appropriate member of staff to complete those actions/seniority level, escalation plans and prioritisation).

Following the baseline audit and consultation with consultant colleagues in the medical division, one of the Acute Medical Consultants devised an Excel-based handover template, which prompted essential information to be documented for each patient, as well incorporating as a system of colour-coding prioritisation. For example, the tool allowed for unstable or complex patients requiring registrar review to be flagged in red, those whose response to treatment required a clinical review which could be performed by junior doctors were highlighted in amber, and stable patients, who were deemed ready for discharge, were highlighted in green.

The decision to use an electronic tool was based on the premise that this would reduce the risk of doctors losing or misplacing paper-based lists, as well as allowing the weekend team to access the list from anywhere in the hospital and update it throughout the weekend, for example, in case of changes in clinical picture, location, or needing to add new patients for review on Sunday.

Given the organisational divide in weekend on call teams amongst the acute medical unit and general medical wards, two separate templates of this handover document were devised: one for the acute medical unit and another for the general medical wards. The template was saved as a shared document in a shared folder on a network drive and could be accessed simultaneously by doctors from different areas of the hospital. A screenshot of the first standardised handover document (Handover Template 1.0), introduced in April 2014 on the General Medical Wards, can be seen in figure 4 (see supplementary information - handover form designs).

STRATEGY

Strategy for making change

This project involved various Audit cycles:

Cycle 1:

Aim: to improve compliance with weekend handover documentation in the medical division across all audited data sets, with a focus on ceiling of therapy, resuscitation status and colour coding prioritization.

Change hypothesis: it was hypothesised that a standardised handover document shared across all wards in the medical division, and with pre-determined columns which would prompt junior doctors to provide specific information, as well as encouraging them to colour-code on the basis of clinical priority, would result in better compliance with documentation of each required dataset.

Implementation: standardised handover documentation template 1.0 (see figure 4 in supplementary information – Handover form designs) was introduced in April 2014 across all wards within the medical division.

Data: on two non-consecutive weekends in May, handover documentation comprising all patients handed over in written form (via the electronic handover tool) to the weekend on call team was audited retrospectively. The number of patients handed over and audited is specified in Table 2.

Impact of intervention: as expected, colour-coding prioritisation improved in acute and general medicine (see figure 18 in supplementary information – run charts). However, deterioration in compliance was noted in several data sets, including patient identifiers, grade of reviewer and recommended action. Compliance with ceiling of therapy and resuscitation status remained poor (see figures 11, 13, 17, 14 and 15 respectively in supplementary information - run charts).

Table 2 Number of patients included

Weekend dates	Acute Medicine	General Medicine	Total
3/5-4/5/2014	33	74	107
17/5-18/5/2014	31	112	143

Reflection: it was hypothesised that doctors were still familiarising themselves with the new template and process and therefore the results were worse than anticipated. Additionally, the high number of patients handed over in general medicine on the third weekend in May might have been a reflection of unusually busy period in medicine, with doctors having less time to dedicate to handover documentation. Alternatively, it could be that the new template had encouraged doctors to lower the threshold to hand over a patient, at the expense of quality of documentation. It was recommended that a repeat audit be completed by the new rotation of junior doctors and, if results remained poor, the new standardised handover template would need reviewing.

Cycle 2:

Aim: To provide additional data points to compare with the May 2014 audit results and minimise the impact of confounding variables such as lack of familiarity with new template or higher than usual level of activity in general medicine (as seen in 3rd weekend in May 2014), a repeat retrospective audit was performed, this time comprising two non-consecutive weekends in July 2014. The repeat audit showed ongoing poor compliance with documentation of vital information, such as patient identifiers, grade of reviewer, ceiling of therapy and resuscitation status, reinforcing the need for change (see figures 11, 13, 14 and 15 in supplementary information – run charts).

Change hypothesis: The following hypotheses were made. First, dividing the patient details column into three, one for name, one for DOB and one for hospital number would prompt doctors to provide all the three patient identifiers. Second, standardisation of ceiling of therapy, resuscitation status and grade of reviewer terminology, clearly highlighting the possible options in drop-down menus, would lead to better compliance in this area. Third, introducing additional colour codes of yellow (results to be chased) and blue (patients to be aware of) would better support the on call team and lead to improved colour coding in general medical wards.

Implementation: standardised handover template 2.0 was introduced in September 2014, with the following changes: the patient identification column was divided into 3 columns, one for name, one for number and one for date of birth; resuscitation status was equipped with a drop down menu, as was ceiling of therapy, which now allowed doctors to choose between five possible ceilings of therapy, ranging from end of life care to intensive care review. The standardisation of ceiling of therapy was based on a new ‘treatment escalation plan’ form, which had recently been successfully piloted in the acute medical unit, and which defined five possible levels of escalation). A drop-down menu was also introduced for grade of reviewer, with four options (FY1 to Consultant). Additionally, two new colour codes were introduced: Yellow for patients who simply needed investigations results to be chased and Blue for patients to be

aware only (usually regarding patients with complex pathology, clinical information handed over in case of clinical deterioration prompting clinical review). All doctors were notified verbally and via email about the changes (to view Template 2.0, see figures 5 and 6 in supplementary information - handover form designs).

Data: documentation compliance was audited retrospectively, including all patients handed over both for the first and third weekend in November 2014. This represented a total of 50 patients in the first, and 77 patients in the second round, as shown in [table 3](#).

Impact of intervention: the audit showed improvement in compliance in several areas: patient identifiers, grade of reviewer, ceiling of therapy, resuscitation status, and (see figures 11, 13, 14 and 15 in supplementary information - run charts). However, it also highlighted a drop in compliance with reason for handover and action/tasks to be completed across both acute and general medicine, as well as colour coding and location in general medicine (see figures 16, 17, 18 in supplementary information – run charts).

Reflection: drop-down menus proved very popular amongst doctors. Unfortunately, they also caused unintended consequences, such as making it technically impossible to colour code rows which contained drop-down menus. This resulted in a drop in compliance with colour coding in general medicine, where this had to be done manually. The ongoing poor documentation of reason for handover and documented action across both areas, as well as location in general medicine, suggested that those columns in the template might need adjusting further.

Cycle 3:

Aim: to remove barriers to compliance with colour coding prioritisation in general medicine, as well as to prompt better compliance with reason for handover, suggested action and location in both areas. The aim was also to fix a technical issue - the fact that occasionally the list would be ‘locked for editing’ when multiple users were accessing it at the same time, resulting in several duplicate copies of the list being saved in the shared drive.

Change hypothesis: the following three hypotheses were made. First, introducing a drop-down menu to enable general medical ward patients to be prioritised as well as for bed numbers would improve compliance. Second, splitting the column encompassing reason for handover and documented action would lead to better compliance (as it had been the case for patient details column). Third, splitting the handover document

Table 3 Number of patient handover details audited

Weekend dates	Acute Medicine	General Medicine	Total
1/11-2/11/2014	18	32	50
15/11-16/11/2014	26	51	77

template for general medicine in two, one covering the first floor and another the second floor (to match the divide in on-call doctors' teams), would make it less likely that the list is saved separately due to being 'locked for editing'.

Implementation: the following three changes were made: first, drop-down menus were introduced in the general medical ward template, to specify level of urgency and bed number. Second, separate columns were introduced for doctors to specify reasons for hand-over and actions to be taken on Saturday and Sunday (two columns for each day). Third, the handover tool for general medical wards was also divided into two, with a separate tool being dedicated to the 'first floor' wards and one for the 'ground floor' wards. These can be seen in handover 3.0, displayed in figures 7 and 8 (see supplementary information – handover form designs).

Data: a retrospective audit was conducted, comprising two non-consecutive weekends in January 2015. A total of 84 patients were included in the first and 67 in second weekend, as shown in table 4. On this occasion, the second and the fourth weekends of January were selected, to minimise confounding variables, such as increase in workload and necessary amendments to the template, due to a long Bank Holiday weekend.

All patients handed over in general medicine during the two specified weekends were included. In Acute medicine, a reorganisation of work pattern, which made daily reviews of all AMU patients routine, resulted in the discontinuation of weekend handover list for this area, as the ward patient list was now being updated on a daily basis, including weekends.

Impact of intervention: location, action to be completed and colour coding prioritisation all improved and compliance with other domains remained at good level (see figure 10, 17 and 18 in supplementary information – run charts).

Reflection: although the changes resulted in improved compliance in all three domains addressed, it did not go above 80%, and remained below 70% for 'action to be taken'.

RESULTS

Handover documents were stored in a shared drive and could be accessed retrospectively for audit purposes. Audits were performed following the same methodology, on ten separate occasions, consisting of non-consecutive weekends. On each occasion, all patients handed over to the weekend on-call team were included in the audit, with the exception of the acute medical patients in cycle

3, who were excluded as explained above. No statistical analysis was performed. Run charts, comprising all data collection points including baseline measurements, are incorporated in supplementary information - run charts (Figures 9-18). A summary for each parameter, as well as an overview of fluctuations in the total number of patients handed over, is provided below.

Figure 9 Total number of patients handed over (in supplementary information - run charts)

As shown in figure 9, the number of patients handed over was variable, especially in general medicine, where a sudden peak in activity was shown on the weekend 17-18th May 2014. It is possible that this peak in activity contributed to the drop in compliance with documentation of grade of reviewer, ceiling of therapy and resuscitation status (see figures 9, 13, 14 and 15 in supplementary information – run charts). Whether the increased number of patients handed over in general medicine towards end of May 2014 was triggered by the ease of handing over patients with the new handover tool, or due to other factors (such as more unwell patients presenting through A&E), is difficult to establish.

Figure 10 Compliance with documentation of patient's location (ward + bed number) (in supplementary information – run charts)

Patient location: As shown in figure 10, prior to intervention, compliance with documentation of location (ward + bed number) was 85-100% in acute medicine and 80-96% in General medicine and remained at a similar level after the standardised handover tool was introduced. However, a drop is noted with template 2.0 of the new tool, reaching compliance levels as low as 55% for general medicine, which improved with template 3.0, with the introduction of drop-down menu for bed number, although it remained below baseline. It might be that, with the increasing complexity of the form, doctors were more likely to write the minimum essential information.

Figure 11 Compliance with documentation of three patient identifiers (in supplementary information - run charts)

Patient identifiers: As shown in figure 11, compliance with documentation of patient identifiers was 60-100% in acute medicine and 87-100% in general medicine prior to intervention. In general medicine, with the introduction of the standardised tool template 1.0 it fluctuated between 60-90%. After splitting patient identifiers into three columns (templates 2.0 and 3.0), it continued to improve steadily, to reach levels close to 100%. An even steeper initial drop was observed in acute medicine, where it dropped to below 40% following the introduction of template 1.0, but improved again to above 90% with template 2.0.

Figure 12 Compliance with documentation of working diagnosis (in supplementary information - run charts)

Working diagnosis: as shown in figure 12, compliance with documentation of working diagnosis remained above 90% in acute medicine and above 80% in general

Table 4 Patients included in audit

Weekend dates	Acute Medicine	General Medicine	Total
10/1-11/1/2015	Excluded	84	84
24/1-25/1/2015	Excluded	67	67

medicine throughout the project. Without making any changes to the relevant column on the standardised form, it eventually improved to nearly 100%, similar to what it was at the onset of the project/prior to introducing the standardised handover form.

Figure 13 Compliance with documentation of suggested grade of reviewer (in supplementary information - run charts)

Grade of reviewer: as shown in figure 13, compliance with grade of reviewer fluctuated between 80 and 100% in general medicine throughout the project. In acute medicine, it dropped to about 40% following the introduction of standardised handover template 1.0. However, once the drop-down menu was introduced for this section (template 2.0), it improved to reach nearly 100% compliance.

Figure 14 Compliance with documentation of ceiling of therapy (in supplementary information - run charts)

Ceiling of therapy: as shown in figure 14, compliance with ceiling of therapy was between 20-40% prior to, and following the introduction of handover template 1.0. However, with the introduction of drop-down menu with a pre-determined set of options (template 2.0), it improved to approximately 80% and was sustained at that level, both in acute and in general medicine.

Figure 15 Compliance with documentation of resuscitation status (in supplementary information - run charts)

Resuscitation status: As shown in figure 15, compliance with resuscitation status fluctuated between 40-70% in general medicine and 10-60% in acute medicine, prior to and following the introduction of standardised handover template 1.0. However, once template 2.0 was introduced, with a drop-down menu for resuscitation status, compliance improved to above 80%, and remained between 70-80%.

Figure 16 Compliance with documentation of reason for handover (in supplementary information - run charts)

Reason for handover: as shown in figure 16, reason for handover remained well documented in general medicine, fluctuating between 90 and 100%, regardless of any changes in the handover tool. In acute medicine, however, it dropped following the introduction of standardised handover template 1.0, reaching as low as 65%. Following the division into two columns, one for reason for handover and another for action to be taken, it initially improved to 100%, however the second weekend in November, audit showed a recurrent drop to 50%. This would suggest that there were probably other factors independent from the design of the template itself, which affected compliance. The drop in acute medicine towards the end of the project is probably a reflection of it being perceived as unnecessary information, given that under new rules, all AMU patients had to be reviewed daily.

Figure 17 Compliance with documentation of suggested action (what if...?) (in supplementary information - run charts)

Suggested action to be taken: as shown in figure 17, compliance with documentation of suggested actions fluctuated between 60-80% in general medicine prior to and following the introduction of handover template 1.0 and deteriorated slightly following the introduction of templates 2.0 and 3.0, despite the fact that a separate column was dedicated towards this in template 3.0, suggesting that simply adjusting the template might not be sufficient. Perhaps foundation year 1 doctors, who often completed the template, did not feel confident to suggest an action, which might be carried out by someone more senior than them. In acute medicine, deterioration was even more significant, reaching compliance as low as 30% following the introduction of handover template 2.0. This drop towards the end of the project is likely to be a reflection of it being perceived as unnecessary information, given that under new rules, all AMU patients had to be reviewed daily.

Figure 18 Compliance with traffic light prioritisation (in supplementary information - run charts)

Traffic light prioritisation: as shown in figure 18, traffic light prioritisation improved immediately after the introduction of the standardised handover form template 1.0. It remained at 100% compliance in acute medicine, given that the template was designed in such a way that it was simply not possible to add patients without appropriately categorising them. In general medicine an improvement was also noted, although it deteriorated sharply immediately after the introduction of the new template 2.0, due to technical reasons preventing doctors from colour coding. After introducing a 'drop down' menu for colour coding, compliance rate improved again, to reach 80%.

LESSONS AND LIMITATIONS

This handover improvement project highlighted the benefits of standardization of handover documentation, as well as illustrating an example of how colour coding prioritization could be applied in practice. Several lessons were learnt.

Firstly, the introduction of a standardised electronic handover documentation tool across the medical division helped to improve compliance with some information, in particular ceiling of care and resuscitation status, in handover documentation. Secondly, the project highlighted some effective design elements of a low-cost electronic handover form, which could be easily adapted and introduced elsewhere. These include using one column per data point (as demonstrated with patient identifiers) and using drop down menus to collect information where the number of responses is limited (ceiling of therapy/resuscitation status/prioritisation/task allocation), which can be set up on Microsoft Excel. Finally, the project also highlighted the importance of multiple audit and change cycles and the benefits of trying to improve what initially appeared to be an ineffective intervention, prior to considering alternative solutions or giving up.

However, several limitations were noted, which might be addressed in future projects.

Firstly, there was a significant gap between data collection points. In the first cycle, this was due to a delay in reaching consensus and devising an appropriate intervention. However, this did not apply to cycles 2 and 3, where it might have been more appropriate to undertake more frequent small scale audits and only introduce one change at a time. However, this would make it more difficult to recruit junior doctors to take part, as they were having to balance their time between clinical commitments, improvement work, and educational initiatives. To maximise the educational value of the project for trainee doctors, whilst ensuring that handover was appropriately audited and constantly improved, within each rotation, doctors rotating across the AMU were encouraged to make a minimum of one full audit cycle, with appropriate amendments introduced to the template following the audit. Each time, at least two non-continuous weekends were audited prior to introducing any changes, to account for random variation. Ideally, at least three rounds of measurements would be required, to assess trend in between each set of changes to the template.

Secondly, in order to assess for long term sustainability, further audit cycles would be required in the months following the project, to assess the feasibility of reducing variation and increasing compliance sustainably over time. However, once the template was deemed satisfactory, contained all the essential handover fields and was sufficiently user-friendly, no further changes were introduced, in order to consolidate its use and avoid change fatigue. Although additional audit cycles were initially planned, the announced planned introduction of an EPR system with a dedicated handover tool made this become a lower priority, and efforts were diverted to other projects thereafter. Moreover, the removal of the 'Acute Medicine' list made it a less appealing audit for trainees in the acute medical unit. Nevertheless, throughout the course of the project, sufficient rounds of measurement were completed to identify fluctuations in compliance.

Third, every possible effort was made to minimise confounding variables, for example by choosing random weekends to audit retrospectively, ensuring that no other interventions were introduced at the same time as the template was amended and avoiding auditing weekends involving additional bank holidays. However, some potential confounding variables could not be fully excluded. For example, there is a possibility that handover documentation improved over the course of each rotation, as junior doctors became more familiar with handover and more aware of its importance, given the regular notifications about changes to the handover template. Moreover, it is not possible to reliably exclude the possibility that the improvements noted could simply amount to random variation, particularly in those data sets where there was high degree of variability across the

different rounds of audit (resuscitation status, suggested action, location).

Finally, the project did not evaluate the impact of the intervention on junior doctors. A qualitative evaluation, to assess junior doctor satisfaction with the new handover system would have been beneficial to provide a more comprehensive evaluation of the new handover tool and might have highlighted some of the reasons why 100% compliance was not achieved in all domains.

CONCLUSION

The project highlighted the impact of having a standardised, electronic handover tool, on compliance with documentation. This was particularly relevant for those areas where difficult or complex decisions require a good understanding of the patients' condition. Comprehensive handover and pre-prioritisation of reviews were expected to help the on-call team with time management, as they had to spend less time sorting out through tasks, or spend time reviewing many pages of patient records.

Although 100% compliance was not achieved across all domains, it was either comparable or superior to that reported in similar studies on Ms Excel-based handover tools. For example, Goveir and Medcalf¹⁰ reported a slightly higher compliance rate with location (98.6%) and resuscitation status (87%), however their project was limited to simply one round of measurement and therefore does not account for the possibility of random variation. Mehra and Henein⁹ performed several rounds of measurement and, despite educational interventions complementing their new handover system, reported a maximum ceiling of therapy compliance of only 60%. Ashton,¹⁵ who introduced a new paper handover pro forma with a specific column for patient stickers, as well as a specific column for escalation of care, reported compliance with 3 patient identifiers improved to 80%, but ceiling of therapy only improved to 20%, far below the level achieved here.

Other hospitals could learn from this project, either in its current form, or as a reference point for the development of more sophisticated handover software solutions. However, each hospital differs in their IT systems, availability and type of electronic tools to support handover. Our example, based on commonly used software, is applicable to hospitals without dedicated handover software and with a departmental network drive available. The ideal solution would be a dedicated software integrated with EPR (where available) and PAS in order to track patient location automatically.

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Dr S. Al Dahash contributed towards data collection, analysis and presentation of audit cycle 2.

Declaration of interests None to declare.

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REFERENCES

1. Pfeffer PE, Nazareth D, Main N, Hardoon S, Choudhury AB. Are weekend handovers of adequate quality for the on-call general medical team? *Clinical Medicine*, 2011, Vol 11: 536–40
2. Curtis O, Fisher R. Improving medical SHO weekend handover at a tertiary referral centre. *BMJ Quality Improvement Reports*, 2013, 2
3. Horwitz LI, Moin T, Krumholz HM, Wang L, Bradley EH. Consequences of inadequate sign out for patient care. *Arch Internal Medicine* 2008; 168, 1755–60
4. Yusuf C., Buss I., Ward A., Snead C., Cole M., Coulter A. Improving handover of patient care using a new weekend proforma with a focus on ceiling of care. *BMJ Quality Improvement Reports*, 2014, 3
5. Michael E, Patel C. Improving medical handover at the weekend: a quality improvement project. *BMJ Quality Improvement Reports*, 2015, 4
6. Till A, Sall H, Wilkinson J. Safe Handover: Safe Patients - The Electronic Handover System. *BMJ Quality Improvement reports*, 2014, 2
7. Ferrari N, Metcalfe A, O'Doherty D. Standardised proformas improve patient handover: audit of trauma handover practice. *Patient Safety in Surgery* 2008; 2:24
8. Sneller S, Lada K, Turner Ch *et al*. Improving the quality of weekend handover at Yeovil District Hospital. *BMJ Quality Improvement Reports*, 2014; 3
9. Mehra A, Henein C. Improving Hospital Weekend Handover: a user-centred, standardised approach. *BMJ Quality Improvement Reports*, 2014, 2
10. Govier M., Medcalf P. Living for the weekend: electronic documentation improves patient handover. *Clinical medicine*, 2012, Vol 12: 124–7
11. Rohan Vithlani: Introduction of a new electronic medical weekend handover at Tunbridge Wells Hospital. *BMJ Quality Improvement Reports*, 2015, 4
12. Royal College of Physicians. Acute Care Toolkit 1: Handover (May 2011)
13. British Medical Association Safe Handover, Safe Patients. *Guidance on Clinical Handover for Clinicians and Managers*, 2004
14. Academy of Medical Royal Colleges: A Clinician's Guide to Record Standards - Part 2: Standards for the structure and content of medical records and communications when patients are admitted to hospital, 2008
15. Ashton C: Improving weekend handover. *BMJ Quality Improvement Reports*, 2013, 2