

# Improving safety of insulin administration: A pilot audit of hospital staff knowledge

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## Article points

1. Patient safety is paramount in the prescribing and administration of insulin.
2. Frequent prescribing and administration errors are apparent in clinical practice.
3. Staff knowledge about insulin in acute hospital wards can be limited, potentially causing administration errors.
4. Hospital protocols to support development of staff knowledge and education regarding insulin administration are lacking.

## Key words

- Audit
- Insulin
- Patient safety
- Safe administration

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An analysis of patient safety incidents has noted that the prescribing and administration of subcutaneous injection (SC) insulin has been performed in an unsafe manner on frequent occasions, resulting in poor diabetes control, increasing hospital admissions and potentially putting lives at risk. The National Diabetes Inpatient Audit of acute hospitals found outcomes for people with diabetes were poorer due to common medication errors, and their hospital stay was on average three nights longer (NHS Diabetes, 2010). This article presents an in-depth examination and critical analysis of the process of safe administration of SC insulin within an acute setting. A pilot study was undertaken to investigate the knowledge of insulin and administration safety in one hospital surgical ward.

The National Patient Safety Agency (NPSA) reviewed 16600 reported patient safety incidents involving insulin, including six deaths and 12 incidents resulting in severe harm, and found that 26% were due to the administration of the wrong insulin dose, strength or frequency, and 20% were due to omitted medication (NPSA, 2011). Cases of insulin errors, including prescribing and administration errors, are consistently high in hospital inpatient scenarios (Grant, 2011).

The Nursing and Midwifery Council code of practice acknowledges the importance of personal accountability for actions and omissions within practice, which must be able to be justified (Nursing and Midwifery Council, 2008).

## Prescribing of insulin

Accurate prescribing is a vital aspect of safe insulin administration. Common prescribing errors observed in practice include incorrect insulin type, dose, time allocation, the use of abbreviations (such as U or IU for units) and illegible handwriting. All of these errors can cause harm to people with diabetes.

## Using abbreviations

The severity of harm caused by the use of abbreviations for units was one of the key factors leading to an NPSA rapid response report on safer administration of insulin (NPSA, 2010).

The report highlighted that abbreviating the term “unit” caused some incidents of

10-fold dosing errors, leading to severe harm and death (NPSA, 2010). This is supported by evidence from Grant (2011) and Dooley et al (2011) of prescribing anomalies causing patient harm where U was being misread as a zero, causing potential for a large insulin overdose, e.g. 10U read as 100.

Cousins et al (2011) highlighted the use of abbreviations as having potential for U being read as IU and O being read as 10, leading to actual experience of 10 times and 100 times dosing errors.

### Administration errors

The second most common error identified by the NPSA rapid response report included the administration of SC insulin (NPSA, 2010). In clinical practice, this includes the incorrect equipment, technique, timing and dose of insulin. The main concern for investigation is the timing of the administration of SC insulin. Within the acute setting, drug rounds frequently commence after mealtimes which are protected to allow patients to eat without interruption.

Ng et al (2010) acknowledged that the introduction of protected mealtimes was potentially of concern to people with diabetes, due to the timing of insulin administration in relation to meals and the consequences this may have on outcomes. When this is the hospital routine, people often receive their insulin after they have finished their meal. Holt et al (2010) acknowledge both the unpredictable nature of the ward environment and meal-to-medication timing as a barrier to safe and effective delivery of diabetes care in hospitals.

The timing of SC insulin may lead to short- and long-term complications, with hypoglycaemia a common outcome. Frier and Fisher (2007) recognised six key causes of hypoglycaemia in people with type 1 diabetes; the incorrect timing of insulin was identified within the sub-heading of inappropriate insulin injection as one of the main contributors to hypoglycaemia. A consequence of recognition of this has been to change drug rounds within some wards. This has enabled a pre-meal insulin administration round to

occur first, then the oral medication round to follow this.

### Omission of insulin

The final issue is the omission of insulin. This has been documented by nurses on prescription charts, where insulin has been omitted for the following reasons:

- Blood glucose levels considered too low.
- Patient not eating much.
- Nil by mouth.
- Patient vomiting.

Insulin should never be stopped, even in times of illness, because this can lead to severe complications such as diabetic ketoacidosis (Bilous and Donnelly, 2010).

Kaufmann (2008) argues diabetic ketoacidosis also can be precipitated by factors such as major stress, infections or trauma. However, a common cause is the omission of insulin, often withheld in practice because the patient has been unwell and there is a fear of causing hypoglycaemia.

### Pilot study

A pilot study was undertaken within the acute setting to investigate the knowledge of insulin and administration safety in one hospital surgical ward. The audit arose from the unit's staff, who perceived a need for development of knowledge.

### Aims and objectives

To examine the knowledge and understanding of the administration of insulin within the clinical environment, a pilot audit (*Box 1*) was undertaken. According to NICE (2002), an audit carried out in a clinical setting is a process in which the overall patient care and outcomes are improved, achieved through the reviewing of care against explicit criteria and the implementation of change. The relevance of knowledge is highlighted because the majority of people on insulin therapy within the clinical setting might have periods during their admission where they are unable to self-administer their prescribed insulin, mainly due to health-related conditions or undergoing surgery.

### Page points

1. Within the acute setting, drug rounds frequently commence after mealtimes, which can lead to patients not receiving their insulin before meals.
2. Incorrect timing of insulin has been identified as one of the main contributors to hypoglycaemia.
3. The pilot audit was set up to examine the knowledge and understanding of the administration of insulin within the clinical environment.

**Box 1. Pilot audit questionnaire.**

1. How many patients do you have on the ward today with diabetes?
2. How many of these patients are:  
Type 1?  
Type 2?  
On subcutaneous insulin?
3. In the prescribing of insulin, units can be written as:
  - a) IU
  - b) U
  - c) Units
  - d) Any of the above
  - e) Not sure
4. Which of the following insulins is recommended to be administered 30 minutes prior to meals? (Circle one or more answers)
  - a) Humulin M3
  - b) NovoRapid
  - c) Humalog
  - d) Humulin S
  - e) Apidra
  - f) Lantus
5. In your clinical place of work, when is insulin normally administered in relation to mealtimes, and why?
6. It is safe to omit insulin if: (circle one or more answers)
  - a) The patient's blood glucose levels are low.
  - b) The patient is nil by mouth.
  - c) The patient had a hypo prior to the previous meal.
  - d) The prescription is unclear.
  - e) The patient's insulin pen has run out because they can omit one dose while re-ordering it.
  - f) The patient has been vomiting.
  - g) Insulin should never be omitted.

Patients who are initially assessed as competent to safely self-manage their diabetes might require guidance due to changes in mealtimes and undergoing investigations, which may alter their ability to self-manage, resulting in superseding the patient's right to self-care (Holt et al, 2010).

The pilot audit aimed to gain an insight of the clinical staff's knowledge of the people with diabetes in their care. The questions were designed to provide evidence for critical analysis around the three main issues of safe insulin administration identified by NPSA. Experience

guides the belief that the pilot audit results will show there is a lack of understanding within clinical practice, which may reflect the problem on a national scale.

**Methods**

The six questions formulated in the pilot audit were written mainly as multiple choice due to time constraints within the clinical setting. It has been observed that questionnaires in the clinical area have been poorly carried out or not completed due to lack of time and their length. A study by McDaniel (1990), which researched the effects that time pressure and audit programme structure have on audit performance, supports this occurrence in the clinical setting.

The audit took place over a 24-hour period during a weekend, involving early, late and night shifts, with the aim of questioning as many staff members as possible. This was similar to Strider and Phillips' (2011) audit which took place over three shifts to incorporate the night staff. A time constraint for completing the audit within 24 hours over the weekend was necessary to minimise the likelihood of a change in patient numbers.

The clinical area on the day the audit was undertaken had 30 inpatients, 11 of whom had diabetes. One person had type 1 diabetes, and 10 had type 2 diabetes. Five people with type 2 diabetes were prescribed SC insulin. In total, 10 clinical members of staff, eight registered nurses and two student nurses on duty completed the pilot audit questions. The healthcare assistants did not complete this audit, because they are not involved with the administration of insulin in the ward. The nursing staff and student nurses had received handover at each shift change of all 30 patients prior to completing the pilot audit.

**Results**

The main results from the pilot audit (*Figure 1*) are displayed in a clustered column chart.

**Awareness of diabetes**

The first four questions were designed to highlight the awareness of the clinical staff's knowledge of people with diabetes in their

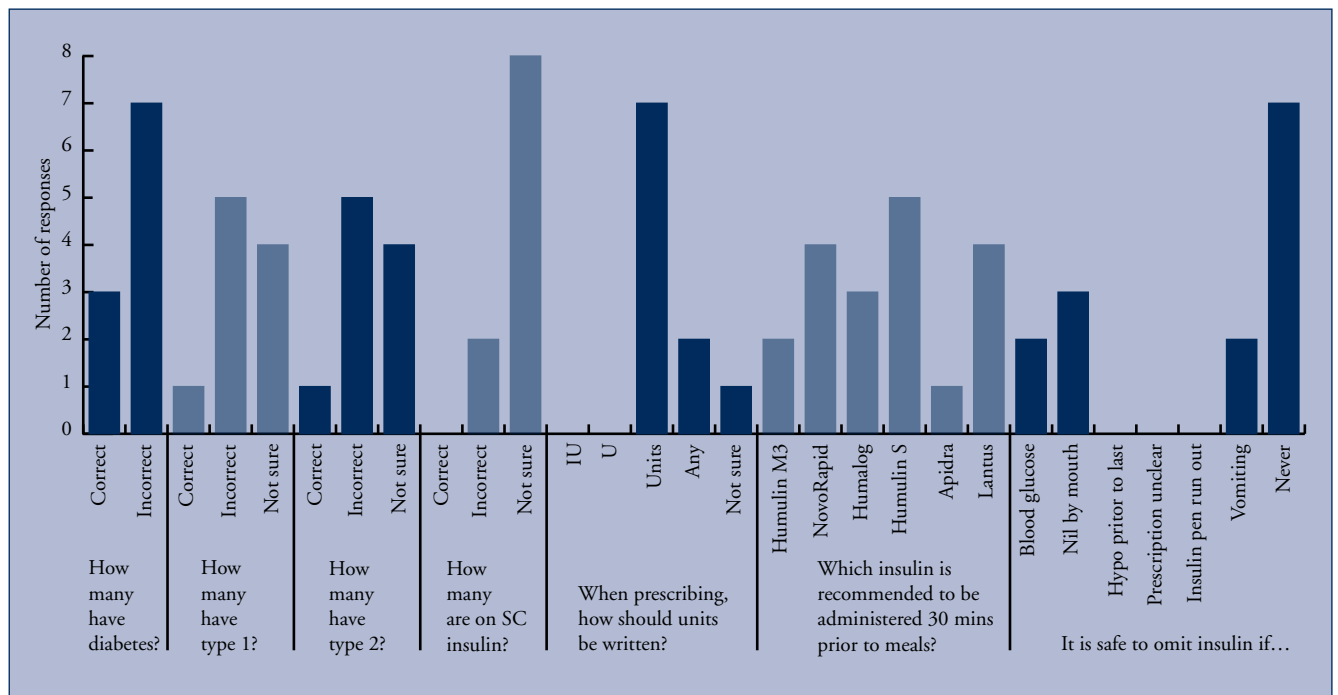


Figure 1. Results of the pilot audit.

care. There was a limited awareness of the patients on the ward with diabetes, with only 30% ( $n=3$ ) of staff correctly identifying that there were 11 people with diabetes. Significantly only 10% ( $n=1$ ) could further identify which of those 11 people had type 1 or type 2 diabetes, with the majority of staff being incorrect or not sure on both these questions, despite having staff handover (Kerr et al, 2011).

Each member of staff had a paper handover that they used as a tool to answer these questions. However, these answers illustrated that the handover was not updated and unclear in displaying which type of diabetes individuals had. The problem of poor handover practice has recently been further exacerbated by the trust requesting that handover time is reduced to 30 seconds per patient, which raises serious questions about safe practice and enabling change.

In order to safely administer SC insulin, it is vital for clinical staff to identify patients taking insulin, as identified by the TREND-UK (2011) competency framework: a competent nurse should be “familiar with the person with diabetes’ treatment regimen and device or delivery systems”. No member of clinical staff

answered correctly for the six people prescribed insulin – the majority (80%,  $n=8$ ) answered “not sure”. This distinguishes a vital aspect in which change could be implemented to improve staff knowledge of the people in their care. This further reinforces what NHS Diabetes (2010) and NPSA (2011) have highlighted as a priority for patient safety.

### Prescribing of insulin

To consider an aspect of the prescribing of insulin, the question examined the clinical staff’s knowledge of how units is required to be prescribed. The majority 70% ( $n=7$ ) correctly identified that only clearly writing the word “units” is acceptable.

The use of the term units is mandatory in all contexts since NPSA identified alternative abbreviations as a key aspect in errors of the administration of insulin (NPSA, 2010). As nurses regularly administer insulin it is important to recognise, question and educate prescribers in the correct and safe way to prescribe insulin to avoid medication errors (Derr et al, 2007; Grant, 2011).

### Timing of insulin

There was limited staff awareness regarding

### Page points

1. The trust has adopted the ThinkGlucose campaign. Within the clinical area, large posters provided by the ThinkGlucose campaign are visual aids for diabetes management.
2. Protected mealtimes have been introduced by the trust, but these also has an effect on managing people with diabetes.
3. The undertaking of the pilot audit and reviewing of policies and guidelines have provided a foundation for making recommendations within clinical practice.

which insulin is recommended to be given 30 minutes prior to meals, with only 50% ( $n=5$ ) correctly identifying Humulin S, and 20% ( $n=2$ ) identifying the second insulin, Humulin M3 (as outlined in local training materials; Phillips and MacArthur, 2011). These results clearly identify an area of concern within the administration of insulin. Furthermore, the audit also enquired when the staff actually administered insulin in relation to mealtimes. The most frequently reported outcome was that insulin was given after meals as mealtimes are protected. Also commonly reported was that insulin was given on the drug round – which at the time of this audit, commenced after meals.

Finally the audit discovered that 70% ( $n=7$ ) of ward nursing staff acknowledged that insulin was never to be omitted. In spite of this, a significant number ( $n=3$ ) of ward staff thought that there were one or more reasons when insulin may be omitted. These findings highlight the need for protocols and policies to be in place and to be implemented.

### ThinkGlucose campaign

There are no local trust policies available on the administration of SC insulin within the clinical area. However, the trust has adopted the ThinkGlucose campaign which began in 2009 with the aim of improving the care of inpatients with diabetes (NHS Institute for Innovation and Improvement, 2011). Within the clinical area, large posters provided by the ThinkGlucose campaign are visual aids for diabetes management.

A useful aid provided by this campaign is the traffic light system. On admission of a person with diabetes, this assessment prompts appropriate referrals to be made to the diabetes inpatient specialist nurse. A sticker is then placed in the patient's notes to alert other clinical team members if the patient has type 1 or type 2 diabetes, medication requirements and action taken for that individual.

### Protected mealtimes

The trust embraced the policy on protected mealtimes which was introduced to tackle the

issue of malnutrition; this also has an influence on the management of people with diabetes (Gosmanov and Umpierrez, 2011). This policy was implemented to allow people to eat their meals without interruptions, which can include clinical procedures, visiting times and drug rounds.

Nutrition in the hospital environment is often an issue of concern (Barker et al, 2011; Saunders et al, 2011); there is a significant number of people with poor appetites, palatability or timeliness of delivery. It is recognised that to obtain optimum control of diabetes and to reduce the person's risk of developing long-term complications, nutritional management is deeply involved (Gosmanov and Umpierrez, 2011; Holt et al, 2010). Ng et al (2010) examined the effect that protected mealtimes have on a group of inpatients with diabetes; their main findings suggested that protected mealtimes did not improve glycaemic control.

### NICE Quality Standards

NICE's Quality Standards for adults with diabetes define clinical best practice to which healthcare providers should aspire (NICE, 2011). Standard 11 acknowledges the importance of the delivery of diabetes care in hospitals to be provided by trained staff who enable the option of self-management of blood glucose monitoring and administration of SC insulin.

Guidelines are vital in providing recommendations for practice. However, turning these recommendations into practice does require knowledge, education, support and opportunity.

### Consequences of this pilot audit in changing and improving practice

The undertaking of the pilot audit and reviewing of policies and guidelines have provided a foundation for making recommendations within clinical practice regarding the safe administration of SC insulin. Education is essential, as identified by NICE Quality Standards recommending that people in an acute setting are appropriately

cared for by trained, knowledgeable members of staff (NICE, 2011).

One recommendation put forward is for all staff to undertake the NHS Diabetes *Safe Management of Insulin* e-learning course annually as mandatory training. This could incorporate the recently launched intravenous insulin infusion e-learning course. This is, however, yet to be approved.

Based on the findings of the pilot audit, several recommendations are proposed to address the issues surrounding the administration of SC insulin:

- Education.
- A separate insulin prescription chart, where guidelines on prescribing and administering are available with contact numbers of diabetes specialists for advice.
- Ensure information regarding diabetes care is regularly updated on staff handovers.
- A new routine at mealtimes. A bell is rung when the meal trolley has arrived to alert everyone there is approximately 30 minutes to meals being handed out. This will allow people on SC insulin types which are due prior to meals to administer their insulin.
- Advocate people with diabetes to monitor their blood glucose levels and manage their own administration of insulin.

Healthcare professionals undertaking structured education in diabetes care will be able to implement these recommendations in practice under the title of a competent nurse in diabetes care as suggested by TREND-UK (2011). The acute trust is in the process of developing accessible guidelines for inpatients with diabetes to standardise care.

### Conclusion

The process of safe administration of SC insulin within an acute environment is a key aspect in the management of people with diabetes. The pilot audit undertaken in the acute setting highlighted several areas in which a change in practice could result in an improved quality of care for people with diabetes receiving insulin.

It is important to acknowledge that the pilot audit included only a small number of

participants; however, the results do reflect the concerns of national organisations, and also reflect the observations of other published studies (Derr et al, 2007; Cousins et al, 2011; Grant, 2011).

If the pilot audit were to be repeated, the questions would be written as open, rather than multiple choice, to encourage a broader insight into the healthcare professional's knowledge of diabetes management.

The findings from the pilot audit led to recommendations to be implemented in clinical practice; these will need evaluating to measure their impact on the care that people with diabetes receive.

The guidelines on the administration of SC insulin set a high standard of care. To achieve these standards in practice, it is vital that healthcare professionals undergo the training necessary to competently deliver safe care. It is clear from the pilot audit that further education in practice regarding diabetes management is essential to reach these high standards.

Significantly, it is important to acknowledge that recommendations have been introduced for the safe administration of SC insulin as a result of audits. These recommendations aim to ensure that safer practice is provided for people with diabetes. Severe harm or death are potential consequences of insulin errors, and such errors could be avoided by implementing change. ■

1. One recommendation is for all staff to undertake the NHS Diabetes *Safe Management of Insulin* e-learning course annually as mandatory training.
2. Based on the findings of the pilot audit, several recommendations were proposed to address the issues surrounding insulin administration.
3. The acute trust is in the process of developing accessible guidelines for inpatients with diabetes to standardise care.

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