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ON SAFETY AND QUALITY IN HEALTH CARE**

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Development and Evaluation of a Subcutaneous Insulin Chart in Subacute Hospitals and Mental Health Facilities

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Context and background

In May 2017, the Australian Commission on Safety and Quality in Health Care (the Commission) released the national subcutaneous insulin chart for use in adult patients in acute hospitals.* The chart aims to improve the management of patients with increased glycaemic needs.

The chart allows blood glucose monitoring and management on the same chart that insulin is prescribed and administered.

During the consultation process that preceded the hospital pilot, it became clear that the guidelines for the management of abnormal blood glucose levels (BGLs), printed on the chart's reverse side, were not suitable for subacute and mental health facilities.

A modified guideline was developed by the national insulin form pilot advisory group and a pilot was conducted in three subacute and mental health hospitals.

For detailed information about the design and development of the national subcutaneous insulin charts, refer to *Development and Evaluation of a New Chart for Subcutaneous Insulin Administration in Acute Care Settings*[†], available on the Commission's website.

Objective

The objectives of the project were to evaluate the impact of the national subcutaneous insulin chart on:

- The safety and quality of prescribing and administration of subcutaneous insulin in the adult inpatient setting of a subacute care hospital
- Blood glucose control.

* <https://www.safetyandquality.gov.au/our-work/medication-safety/medication-chart/national-subcutaneous-insulin-chart/>

† <https://www.safetyandquality.gov.au/wp-content/uploads/2017/06/Development-and-evaluation-of-new-subcutaneous-insulin-chart-2017.pdf>

Method

The chart was piloted in three hospitals, one in Queensland (Toowong Private Hospital) and two in Victoria (St John of God Frankston Hospital and Epworth HealthCare). Pilot sites were selected through a targeted call for expressions of interest. This pilot concluded in January 2017, with a final version of the subacute care chart expected to be available in 2017.

The pilot consisted of the following phases:

- A pre-implementation (baseline) audit of insulin prescribing and documentation using the national inpatient medication chart or local hospital insulin form, before education of staff about the new form took place
- Education of medical, nursing and pharmacy staff on the pilot subcutaneous insulin chart using educational materials provided by the Commission
- Introduction of the subcutaneous insulin chart in each facility
- Audit of the subcutaneous insulin chart five months after implementation.

Evaluation

Data were collected at the hospitals at two points in time:

- Before the introduction of the subcutaneous insulin chart (pre-audit)
- After the chart was in use for four months (post-audit).

The evaluation measured the impact of introducing the pilot subcutaneous insulin chart on the safety and quality of insulin prescribing and administration, and on the documentation and management of BGLs in adult inpatients.

Pilot coordinators in each hospital gathered feedback about the chart from prescribers, nurses and pharmacists. This feedback was considered alongside the quantitative data gathered during the pilot.

Results

Data from the pilot hospitals were combined in the analysis. Data from individual hospitals were also reviewed for differences among healthcare settings. The charts of 85 patients prescribed insulin were audited:

- 41 inpatients during the pre-audit (n=122 charts)
- 44 inpatients during the post-audit (n=48 charts).

The sample size for this pilot was small and meant that calculations could not be performed for some indicators. There were fewer statistically significant improvements in the subacute pilot when compared to the acute hospital pilot and also fewer statistically significant areas of focus. The results from the two pilots were considered together in arriving at the conclusions and recommendations for the subacute pilot and chart.

Changes associated with use of the chart

The Commission analysed the data from the subacute care hospital pilot in relation to the new national subcutaneous insulin form. All baseline to post-audit changes that were statistically significant ($p < 0.05$) and could be categorised as either 'improvements' or 'areas of focus' were identified. The introduction of the new chart was associated with 24 improvements and two areas of focus.

A data point which showed generally positive changes after introduction of the chart was considered an improvement. Areas of focus are the data points where negative changes were observed. The measurements were grouped into five categories: patient identification and blood glucose level (BGL) documentation, routine insulin orders, supplemental insulin orders, stat/phone insulin orders, and sliding scale insulin orders.

Patient identification and blood glucose level documentation

The Commission recorded the following improvements in insulin prescribing:

- The average number of charts per patient was reduced
- The number of times insulin forms were cross-referenced in the regular medications section of the NIMC increased
- The recording of BGLs on the same chart where insulin is prescribed increased
- The number of BGLs recorded as accurate data points on the BGL line graph increased
- The documentation of the number of times the medical officer was notified of hypoglycaemia increased
- The proportion of BGLs in the range 12 to 20mmol/L decreased
- The proportion of BGLs in the range of 4 to 12mmol/L increased
- The prescribing of insulin on the NIMC decreased
- The prescribing of insulin on hospital-specific insulin forms decreased
- The number of supplemental insulin orders charted appropriately increased.

The pilot did not highlight significant issues with patient identification and BGL documentation. There was a small increase in the number of BGLs in the abnormal ranges. Overall, however, the proportion of hypoglycaemia changed from 3.5% in the pre-implementation audit to 4.1% in the post-audit. The proportion of hyperglycaemia changed from 1.2% in the pre-implementation audit to 2.1% in the post-audit. Neither of these changes was statistically significant.

Routine insulin prescriptions

The following improvements were observed in routine insulin ordering:

- The proportion of orders where route of administration was clear increased
- The proportion of orders where route of administration was unclear decreased
- The proportion of orders where the prescriber's name was clear increased
- The number of doses with the administration time documented increased.

The pilot highlighted the following areas that will require focus for future hospital implementations of the chart:

- The proportion of doses that are missing increased
- The proportion of doses initialled as having been administered decreased.

Supplemental insulin prescriptions

The following improvements were observed in supplemental insulin ordering:

- The proportion of orders where route of administration was clear increased
- The proportion of orders where route of administration was unclear decreased
- The proportion of doses prescribed that used unapproved abbreviations decreased
- The proportion of doses prescribed clearly increased.

The pilot did not highlight adverse issues with supplemental insulin orders.

Stat/phone insulin prescriptions

The following improvements were observed in stat/phone insulin prescriptions:

- The proportion of doses prescribed that are clear increased
- The proportion of doses with the administration time documented increased.

The pilot did not highlight adverse issues with stat/phone insulin prescriptions.

Subcutaneous sliding scale insulin prescriptions

The following improvements were observed in sliding scale insulin orders:

- The proportion of orders where route of administration is clear increased
- The proportion of doses prescribed clearly increased
- The proportion of doses with administration time documented increased.

Prescribers were discouraged from using subcutaneous sliding scale insulin in a written alert on the pilot chart. The audit did not identify significant use of subcutaneous sliding scale insulin prescriptions during the pilot. This may reflect prescriber adherence to the alert.

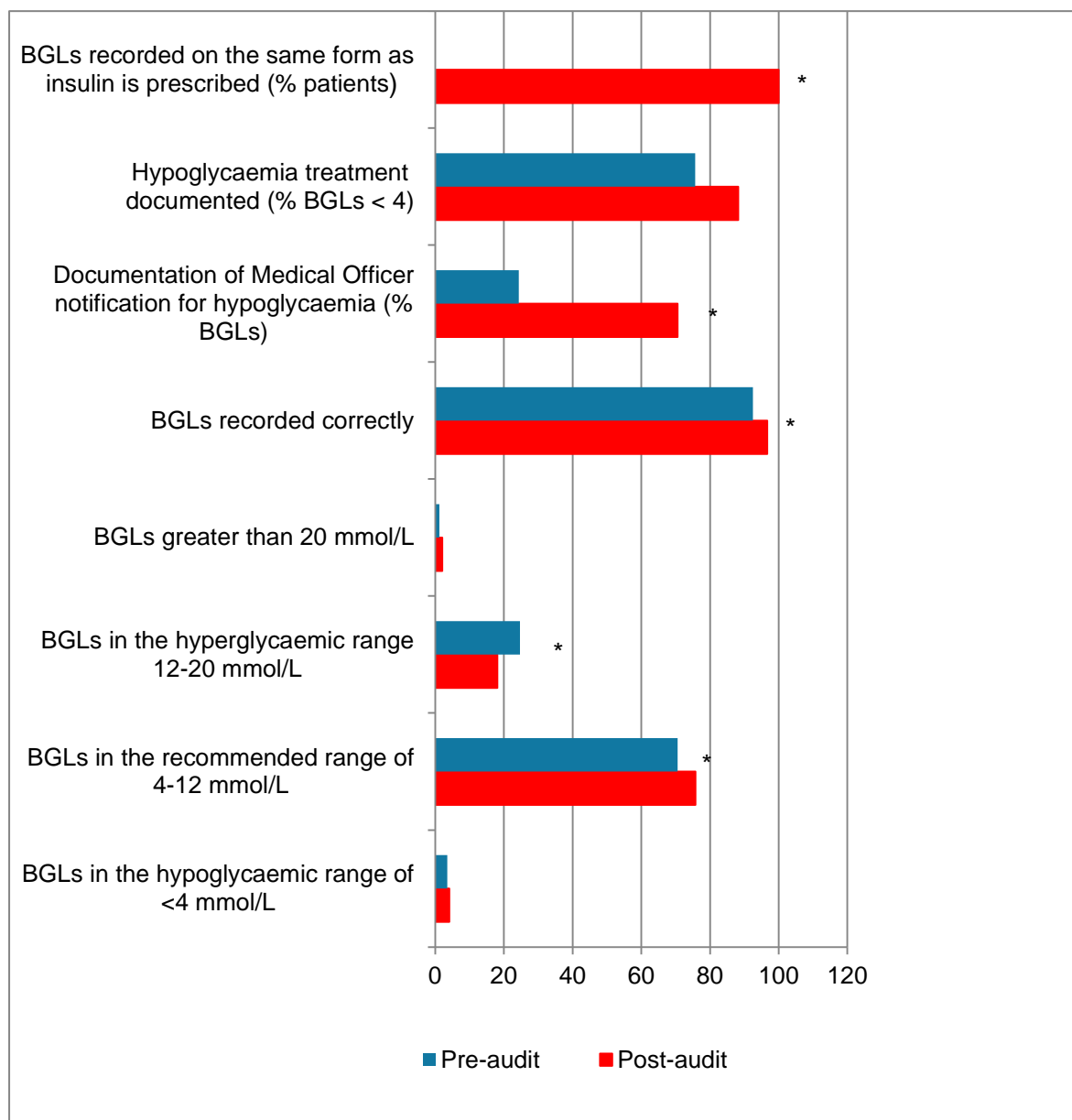
Use of charts in hospitals

In the post-audit period, only one patient was found to have insulin orders written on the national inpatient medication chart. This indicates that prescribers did not revert to using local forms and charts during the pilot.

Blood glucose control

Figure 1 outlines the improvements in glycaemia management before and after the chart was introduced.

Figure 1: Hypoglycaemia and hyperglycaemia, aggregated results

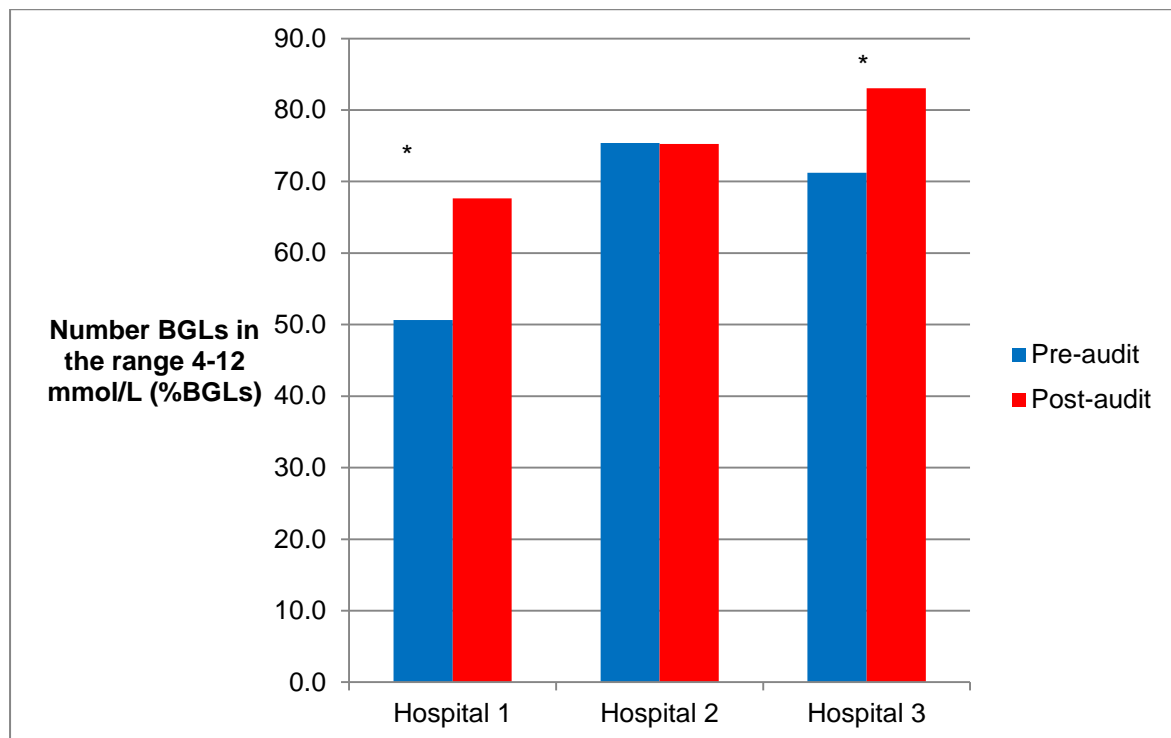


*= statistically significant, $p < 0.01$; BGL = blood glucose level

These improvements were likely to result in direct patient benefit as a greater proportion of total readings were in the recommended range and fewer readings outside of this range. That is, following the introduction of the chart patients were more likely to experience normal BGL.

The new chart led to improved BGLs in each of the three pilot hospitals. In two of the hospitals this improvement was significant. Figure 2 shows the number of BGLs recorded in the recommended range of 4–12mmol/L before and after the introduction of the new chart.

Figure 2: Blood glucose levels in the recommended range 4–12 mmol/L, by individual hospitals



*=P<0.001, statistically significant. BGL= Blood glucose level

Insulin prescribing and administration

Overall, the pilot hospitals showed some improvements in the prescribing of insulin for routine insulin orders and supplemental insulin orders, and to a lesser extent there was some improvement in the prescribing of stat/phone insulin orders. As noted earlier in this report, there was a reduction in the use of sliding scale insulin.

The two areas of focus identified in the pilot were also identified in the acute hospital pilot, showing lower levels of compliance at post-audit than at baseline. For example, each time a nurse administers a dose of insulin a signature is required on the chart to confirm the dose has been given. Compliance with this measure was lower in the post-audit than before the chart was introduced in the pilot hospitals.

Omitting a signature in this case is unlikely to adversely affect patients in a single instance; however, it is likely to make tailoring of insulin doses difficult.

Feedback received from prescribers at one of the pilot hospitals stated that:

Prescribing insulin is laborious on the new chart. Our patients are stable and often manage their own insulin.

The same group of prescribers stated that:

It is unreasonable to expect a psychiatrist to complete daily insulin orders when we do not routinely change patient doses for our patients.

In response to this feedback, a number of additional instructions have been added to the user manual to support prescribing on the subacute chart including:

- An example of how to carry orders from initial prescribing to a future review date, such as the last day of the chart
- Advice on developing local policies to manage forward prescribing of insulin for stable patients
- Directions on how to utilise the routine insulin section for phone orders where the stat/phone order section has been exhausted and where access to onsite medical officers is intermittent.

The section on self-administration has been highlighted, as have the instructions on how to adjust insulin dose depending on the anticipated amount of carbohydrate likely to be consumed.

These additions will further improve the impact of the chart on BGL management and the prescribing of insulin.

Conclusion

The pilot project showed that the new national subcutaneous insulin chart is beneficial to patients that need their diabetes monitored and controlled in subacute care hospitals and mental health facilities.

Most of the improvements identified are associated with direct patient benefit. Better BGL control and clearer subcutaneous insulin prescribing were observed where the chart was piloted.

Administrative errors were observed during the pilot and these were similar to errors seen during the previous phases of the pilot. These errors must be addressed when the chart is introduced to any facility. Errors of this type are common when new tools are introduced, such as the national subcutaneous insulin chart. Their resolution requires systematic monitoring of the chart's performance, continued education and positive reinforcement of practice change among clinicians.

The national subcutaneous insulin chart (subacute) yields better outcomes than alternative charts with which it was compared. The results support the hypotheses that using a standardised chart for prescribing and administering subcutaneous insulin and recording BGLs, when combined with planned implementation and education:

- Reduces errors in subcutaneous insulin prescribing and administration
- Does not result in inferior blood glucose control.

Further design work would not be beneficial at this stage. Rather than modifying the design of the chart, those issues that remain should be addressed through effective change management processes and training. These include providing more explicit training to all chart users on the phone order procedures that are currently outlined only in the 'frequently asked questions' document.

It is expected that the negative changes seen will decrease as the new chart becomes more commonplace and familiar to staff.

Because of space constraints on the printed chart, many instructions are not included and will thus require user training. The expert group advised that regardless of the improvements to the chart, user training is essential.

Recommendations

Based on the outcomes of the pilot and evaluation of the national subcutaneous insulin chart, the Australian Commission on Safety and Quality in Health Care recommends:

1. The national subcutaneous insulin chart (subacute/mental health) should be used in all subacute and mental health facilities, unless the existing chart or charts can be demonstrated to be as effective.
2. State and territory health authorities and private hospitals considering implementation of the national subcutaneous insulin chart (subacute/mental health) should:
 - a) confirm the expected benefits of implementation against local workflows and requirements in lead sites
 - b) establish a plan to monitor the performance of the national subcutaneous insulin chart (subacute/mental health) as part of the organisation's clinical governance processes.
3. The national subcutaneous insulin chart (subacute/mental health) should be implemented as part of an education program that explains how the chart should be used. Local variation should be minimal because the chart was extensively tested, meaning any changes could reduce the positive impact on prescribing. Permitted variations should be specified clearly in the accompanying support materials.
4. Support materials should be developed by the Commission to assist hospitals that wish to implement the national subcutaneous chart in subacute and mental health facilities.
5. Hospitals should support effective local implementation of the national subcutaneous insulin chart in subacute and mental health facilities by:
 - a) developing an implementation plan with key stakeholders in the institution
 - b) undertaking a risk assessment of the new chart and associated workflow changes
 - c) using the national subcutaneous insulin chart implementation material developed by the Commission for hospital communication and training.
6. The Commission incorporate stewardship and governance of the subacute and mental health insulin chart into the national implementation of the national subcutaneous insulin chart.
7. The existing evaluation of the acute sector chart should be expanded to include an evaluation of the subacute and mental health subcutaneous insulin chart and its implementation, with the expansion to be implemented no later than 18 months after the charts were launched..

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