High Risk Situations: High Alert Medications

High alert medications are those with the potential to cause significant patient harm when used in error.[56,57] There is a need for greater caution when prescribing, dispensing, and administering these medications.

General recommendations for policy development related to high-alert medications include:

- Develop specific policies and identify safe processes for prescribing, dispensing, and administering that include restrictions on the use of abbreviations at all stages of the medication cycle.
- Prohibit the use of error-prone abbreviations or ambiguous dosage expressions when prescribing or transcribing. The following are of greatest risk with insulin, anticoagulants, and narcotics:
  - **U or IU** – spell out 'units'
  - **zeros, either trailing or lack of leading** – never use a zero after the decimal (trailing zero); always use a zero before the decimal for dosage units less than one (leading zero);
  - **< (less than) and > (greater than)–** never use the symbols because they can be mistaken for the opposite meaning, or for numbers, or letters
  - **lack of commas with large numbers (e.g., 10000 units)** – use commas appropriately to make it easier to see what the intended dose is
- Use pre-printed order forms or electronic order sets to minimize the need for handwritten orders.

Insulin

Insulin is the medication most commonly associated with serious medication errors.[34,37,45,58-61] The use of error-prone abbreviations to communicate a dose (e.g., in medication orders, administration records, progress notes) contributes to the risk of an error. The use of the abbreviation 'U' instead of 'units' is particularly problematic and accounted for 55 per cent of medication errors that resulted in patient harm in one study.[12] However, other abbreviations also are potentially hazardous and an expanded list of abbreviations to avoid when communicating about insulin has been proposed (Table 3).[60] Two studies demonstrated a significant decrease in the use of unit-related abbreviations with insulin orders following extensive educational programs.[31,32]

Table 1. Examples of consequences of abbreviation use with insulin[2,45,61]

Abbreviation	Interpretation	Consequence	Recommendation
20 U insulin	'U' misinterpreted as a 'zero' – 200 units	Ten-fold dose (200 units) administered resulting in death	Write out 'units'
4 U Humalog insulin	U misinterpreted as a '4' – 44 units	Single dose of 44 units administered – no harm to patient	Write out 'units'
6 IU insulin	IU mistaken as a '1' – 61 units	61 units administered	Write out 'units'

Table 2. Recommendations for the safe use of insulin[58-61]

Policy	• Designate insulin as a high-alert medication and develop a policy to define safe use.
	• Avoid abbreviations when prescribing or transcribing insulin orders.
	  – use 'units' instead of 'u' or 'U'
	  – no zeros after a decimal point ('trailing zeros')
	  – zeros always used before a decimal point ('leading zeros')
	  – use 'sliding scale regular insulin' rather than 'SSRI' to avoid confusion with the antidepressant medication class of selective serotonin reuptake inhibitors
	• Clarify all illegible, incomplete, or ambiguous orders.
	• Reserve verbal orders for an emergency; if a verbal order must be taken, write it out and 'read back' rather than just 'repeat back' to the prescriber.

Education	• Educate all staff involved in prescribing, dispensing, and administering insulin about the safety issues and medication system safeguards. • Consider including a competency assessment for staff.
Standardization, Enforcement, Audit	• Consider requiring orders containing unapproved abbreviations to be rewritten. • Create standardized evidence-based order sets that are pre-printed or in an electronic format to minimize handwriting or free-text entries. • Review insulin orders that have been transcribed onto handwritten medication administration records for unapproved abbreviations.
Technology	• Eliminate the use of error-prone abbreviations on pharmacy generated labels and medication administration records. • Work with software vendors to eliminate short forms of medication names, and to change the screen display and label so the insulin name and dose are displayed together.

Table 3. Expanded list of error-prone abbreviations to avoid when prescribing insulin[60]

Abbreviation	Intended Meaning	Misinterpretation	Correction
BT	bedtime	b.i.d. (twice a day)	Use at bedtime
CC	cubic centimeters (millilitre)	U (units)	Use mL
D/C	discharge	interpreted as discontinue and medications are stopped	Write out discharge or discontinue
IJ	injection	i.v. or i.j.(intrajugular)	Use injection
HS	at bedtime	half-strength	Use at bedtime
IU	international unit	i.v. or 10	Use units
q.d. or QD	daily	q.i.d.(four times a day)	Use daily
QHS	at bedtime	q hr (every hour)	Use nightly or at bedtime
QN	nightly or at bedtime	q h (every hour)	Use nightly or at bedtime
q6pm, etc.	every evening at 6 pm	every 6 hours	Use daily at 6 pm
subq, sq (e.g., subq 2 hours before surgery)	subcutaneous	q interpreted as every (every 2 hours before surgery)	Use subcut or subcutaneously
U or u (e.g., 4 U)	unit	0, 4, or cc (40, 44, or 4 cc)	Use unit
Trailing zero after decimal point (e.g., 1.0 mg)	1 mg	10 mg	Do not use trailing zeros
No leading zero before a decimal point (e.g., .5 mg)	0.5mg	5 mg	Use a zero before a decimal when the dose is less than a whole unit

Anticoagulants

Warfarin and heparin have a narrow therapeutic window and miscommunication about the dose can put the patient at significant risk of harm. Medication errors related to abbreviation use with other anticoagulants have also occurred (Table 4).

Table 4. Examples of consequences of abbreviation use with anticoagulants[62,63]

Abbreviation	Interpretation	Consequence	Recommendation
Warfarin .5 mg Warfarin 1.0 mg	Warfarin 5 mg Warfarin 10mg	Ten-fold increase in dose	Use a leading zero for doses less than one mg – e.g., 0.5 mg Do not use a trailing zero for whole number doses e.g., 1mg
NOAC	No anticoagulation instead of starting a 'Novel/New Oral Anticoagulant (NOAC)'	Warfarin was discontinued instead of starting a novel oral anticoagulant	Use a specific medication name – e.g., dabigatran, rivaroxaban or apixaban
Heparin Sub q 2hours before surgery	'q' mistaken for every 2 hours before surgery	Numerous doses given instead of a single pre-op dose	Write out sub-cutaneous Create pre-printed order sheets

Narcotics

The most commonly documented abbreviation issue with narcotics is the omission of a leading zero when designating doses less than 1 mg, contributing to a 10-fold overdose of medication. In addition, truncated medication names (e.g., morph, hydromorph) and use of abbreviations for morphine sulfate (e.g., MS, MSO4) can contribute to medication errors (Table 5).

Table 5. Examples of consequences of abbreviation use with narcotics[45,64]

Abbreviation	Interpretation	Consequence	Recommendation
.2 - .4 mg hydromorphone	misread as 2-4 mg	Ten-fold error	A zero should always precede a decimal point for doses less than one mg.
'MS' 'MSO4' 'MgSO4'	Morphine sulphate (when magnesium sulphate was intended)	Wrong medication administered	Avoid abbreviating medication names

Digoxin

Miscommunication about the frequency of digoxin administration has occurred when the abbreviation 'qd' is used for daily or the abbreviation 'qod' (every other day) is misinterpreted (Table 6).

Table 6. Examples of consequences of abbreviation use with digoxin[45,62]

Abbreviation	Interpretation	Consequence	Recommendation
Digoxin 0.125 mg qd	'qd' was misinterpreted as 'qid'(four times a day)	4 times the daily dose given	Write out 'daily'
Digoxin 0.125 mg po QOD	'qod' (every other day) misinterpreted as qd (daily) – can also be interpreted as qid	Extra doses administered	Write out 'every other day'

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Note: Taken from the complete reference list for the Abbreviations Toolkit

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