



National Mixed-Case Lettering List

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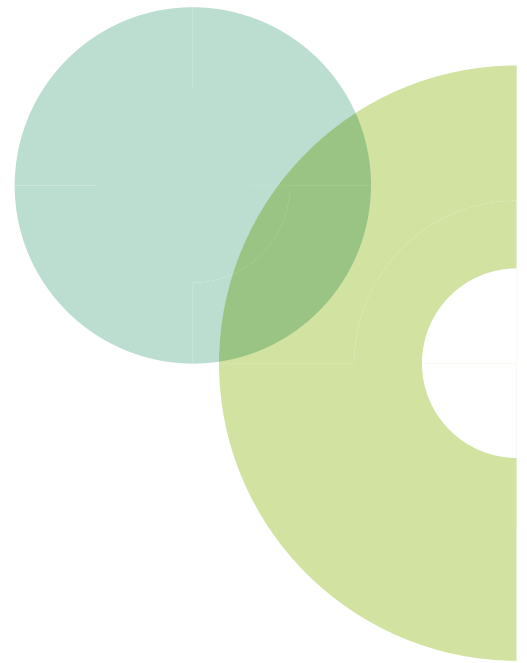
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Purpose

To present an update and renaming of the *National Tall Man Lettering List* published in 2020.

Introduction

The Australian Commission on Safety and Quality in Health Care (the Commission) is responsible for the development and stewardship of the *National Mixed-Case Lettering List* (the List).

This document is an update and renaming of the *National Tall Man Lettering List* published in 2020. This document has been updated by the Commission based on the changes to the Australian Register of Therapeutic Goods, changes to 'mixed-case' and 'Tall Man lettering' lists published by other countries (United States, Canada and New Zealand), and reported adverse incidents or near misses from hospital networks across Australia.

Medication errors are one of the most reported clinical incidents in acute healthcare settings. While rates of serious harm are low, the prevalence of medication errors is a concern, particularly as many are preventable. Medication incidents related to 'look-alike, sound-alike' (LASA) medicine names are one of the most common type of medication error.¹⁻³ In some instances, medication incidents involving LASA medicine names have the potential to cause serious patient harm, such as administering HYDROMorphone instead of morphine.

With several new medicines entering the market each year and in the absence of an effective pre-marketing screening method, LASA medicine names continue to pose a risk to patient safety. Whilst the majority of the medicines on the List are by active ingredient name, a small number of LASA medicine brand names are also included.

'Mixed-case lettering'

'Mixed-case lettering' (also referred to as 'Tall Man lettering') is a typographic technique that uses selective capitalisation to help make similar looking medicine names more easily distinguishable.⁴⁻⁶ Studies have shown its effectiveness on medicine name confusion error rate⁷, differentiation accuracy^{1,8}, and perception.⁹ Whilst other studies have suggested that the evidence is conflicting or suggests 'mixed-case lettering' is ineffective.^{10,11}

'Mixed-case lettering' uses a combination of lower- and upper-case letters to highlight the differences. For example:

- proGRAF and proZAC
- oBINUTUZumab and oFATUMumab.

Research based on experimental psychology suggests that 'mixed-case lettering' purposely disrupts the reading of a medicine name, drawing attention to, or accentuating, one or more differentiating syllables, and potentially preventing erroneous selection of a medicine with a similar name. This technique also alerts the health care professional that the medicine name has the potential for confusion with another medicine name.

The Institute for Safe Medication Practices (ISMP), the International Medication Safety Network (IMSN), the World Health Organization (WHO) and many other organisations have recommended 'mixed-case' or 'Tall Man lettering' as a strategy to minimise risk associated with LASA medicine names.¹¹⁻²⁵

Governance

The Commission has established an expert advisory panel consisting of frontline clinicians and a pharmacy and medication safety academic to advise the Commission on matters related to 'mixed-case' (or 'Tall Man') lettering. The panel is responsible for making recommendations on the medicine names that need to be included in the List. The panel follows a systematic process to decide on the medicine names that would most benefit from the application of 'mixed-case lettering' to highlight the risk of confusion.

In 2023, the panel considered and recommended changes, based upon local reporting of adverse events and near misses as well as review of international guidance, for instance, the Institute of Safe Medication Practices (ISMP) – for example, the following medicine name has been added to the list of medicines used predominantly in cancer therapy:

- CABAzitaxel.

One of the main recommendations was the renaming of this medication safety strategy to 'mixed-case lettering'. This was supported by the Commission's Health Services Expert Advisory Group (HSMEAG). Guidance has also been enhanced to include advice on the implementation of 'mixed-case lettering' following local assessment of LASA risk for medicines not included on the List.

The following medicine names have also been added as they appear close together on electronic medication management alphabetical drop-down lists – for example, within a smart infusion pump drug library:

- dexAMETHASone and dexMEDETOMIDine
- cyclONEX and cyclLIZINE
- flucLOXACILLIN and flucONAZOLe and flucYTOSINE.

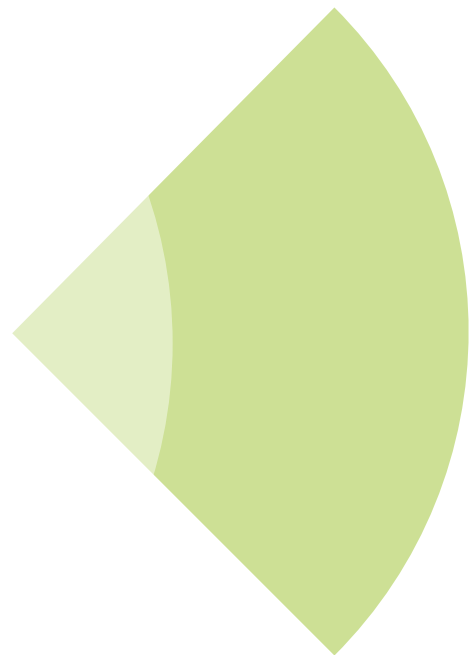
In 2019, a review of name similarity of monoclonal antibodies (MABs) and tyrosine kinase inhibitors was conducted.²⁶ This review led to the development of a 'supplementary list' for thirty-one specialised medicines, which has now been incorporated within this 2023 edition to include the following classes of immuno-modulating medicines:

- Monoclonal antibodies (MABs) (commonly ending in the suffix 'mab')
- Tyrosine kinase (factor) inhibitors (TKIs) (commonly ending in the suffix 'nib').

Limitations

The *National Mixed-Case Lettering List* does not aim to be an exhaustive list of all LASA medicine names (see [Risk management](#)). This list has been compiled to include groups (pairs and trios) of LASA medicine names that have been predicted to pose the greatest risks to patient safety at the time of publication. In addition, the Commission has taken the view consistent with published evidence that overuse of the 'mixed-case' (or 'Tall Man') lettering technique may reduce its effectiveness.

Health service organisations are encouraged to consider implementing other measures such as use of bar code scanners, electronic alerts, or separate storage locations to minimise harm associated with LASA medicines. The [Principles for safe selection and storage of medicines](#) provide further advice and examples of risk-reduction strategies with a focus on LASA medicines.



Guidance for use

Implementation of 'mixed-case' (or 'Tall Man') lettering should include educating health professionals about the risks associated with LASA medicine names and the application and purpose of 'mixed-case lettering'.

The [*National guidelines for on-screen display of medicines information*](#) and guidance for implementation of [*Electronic medication management*](#) systems published by the Commission recommend using 'mixed-case' (or 'Tall Man') lettering.

The Commission supports the use of 'mixed-case lettering' as part of a multi-faceted approach to reduce the risk of selection errors by health professionals associated with LASA medicines names.

Risk management

'Mixed-case lettering' should be used by clinicians and health service organisations to support safe selection of medicines in:

- Electronic medication management systems, including prescribing, dispensing and administration systems
- Printed labels used for inpatient dispensing, shelving in pharmacies, and ward medicines storage cupboards
- Drug libraries for smart infusion pumps
- Automated medicines storage and distribution systems.

Tables 1, 2, 3, 4 and 5 on the following pages provide the details of the medicine names with 'mixed-case' (or 'Tall Man') lettering applied. This information is provided for use as described above.

Given that this List is not exhaustive, it is recommended that health service organisations conduct their own assessment of LASA risk with medicine names. However, health service organisations also need to consider that overuse of the 'mixed-case' (or 'Tall Man') lettering technique may reduce its effectiveness (see Limitations).

The Commission's **LASA search tool** has been developed to assist with this risk assessment. Information on how to use this tool, including assessment of the 'clinical risk', and how to apply 'mixed-case lettering' to local medicine formularies, is also available:

- [Information sheet on using the LASA search tool](#)
- [Fact sheet: Principles for the application of 'mixed-case lettering'](#).



List of medicine names with ‘mixed-case lettering’ applied

Table 1: General list of medicine names arranged into groups of look-alike sound-alike (LASA) medicine name(s)

Medicine name	LASA medicine name(s)
actoNEL	actoS
aKAMin	aCLin
aLDMET	aLDACTONE aLODORM
amARYI	amOXil
amiODAROne	amLODIPine
amLODIPine	amiTRIPTYLine
amiTRIPTYLine	amiNOPHYLLine
aPomine	aVomine
arATAC	arOPAX arABLOC
ARIPiprazole	RABEprazole
aTROpt	aZopt
azATHIOPRINE	aziTHROMYCIN
ERYthromycin	
bisOPROLOI	bisACODYI
buMETANide	buDESONide
caRAFate	caLTRate
CARBAMazepine	OXCARBazepine carbiMAZOLE
carVEDILOI	caPTOPRil
celAPRAM	ceLEBREX
ciprAMIL	ciprOXIN
cLARITHROMYcin	ciPROFLOXAcin

Continued in next column

Medicine name	LASA medicine name(s)
cLOMIPRAMine	cLOMIFeNe cHLORPROMAZine
coUMADIN	coVERSYL
ciclosPORIN	cyclosERINE
cycLONEX	cycLIZINE
DEPO-medrol	SOLU-medrol
DEPO-medrol	depo-PROVERA
solu-CORTEF	SOLU-medrol
dePTRAn	deRALin
dexAMETHASOne	dexMEDETOMIDine
dilaUDID	dilaNTIN
diPRIVan	diTROPan
diPYRIDAMOLE	diSOPYRAMIDe
doSULepin (doTHiepin)	doXepin
flucLOXACILLIN	flucONAZOLE flucYTOSIne
humALOG	humULIN
hydreA	hydreNE
hydrALAZINE	hydrOCHLOROTHIAZIDe
isopto HOMATROPine	isopto CARpine
iSOTretinoin	tretinoin
januMET	januVIA
ketALAR	ketOROLAC

Continued in next column

List of medicine names with 'mixed-case lettering' applied

Table 1: General list of medicine names arranged into groups of LASA medicine name(s) (continued)

Medicine name	LASA medicine name(s)	Medicine name	LASA medicine name(s)
laMICTAI	laRGACTil laMISil	siTagliptin	sAXagliptin sUMATRIPTAn
lamiVUDine	lamOTRIGine	Sirolimus	TACrolimus
lanTUs	lanVis	sulfaSALazine	sulfaDiazine
linCOMYCIN	linEZOLID	toPAMAX	toFRANIL
loSEC	loVAN	tEGRETOI	tRENTAI
mercaptAMine (cysteamine)	mercaptOPURine	tRAMadol	tEMOdal tORadol tAPENTadol
methADONe	methYLPHENIDATe	trimETHOPRIM	alimemazine (trimEPRAZINE)
MOXifloxacin	NORfloxacin	valAciclovir	valGANciclovir
moBILis	moVALis	xalaTAN	xalaCOM
morphine	HYDROmorphone	zinVit	zinNAT
NEOral	INDeral	zoCOR	zoTON
nexAVAR	nexiUM	zoLOFT	zoCOR
niMODIPine	niFEDIPIne niZATIDine		
norVASC	norMISON		
novoMIX	novoRAPID		
oxyCONTIN	MS Contin oxyNORM		
paXTINE	paRIET		
pEXSIG	pRISTIQ		
primaXIN	primaCOR primaCIN		
proGRAF	proZAC		
proMETHazine	proCHLORPERazine		
propRANOLol	propOFol		
QUETIAPine	SERTRALine		
rifaMPICin	rifaXIMin		
riSPERIDONe	rOPINIROLe		

Continued in next column

Table 2: Medicines used predominantly in cancer therapy

Medicine name	LASA medicine name(s)
ALKeran	LEUKeran MYLeran
avaSTIN	avaXIM
ciSPlatin	cARBOplatin
daCTINomycin	daPTomycin
DAUNOrubicin	DOXOrubicin iDARubicin
iFOSFamide	CYCLOPHOSPHamide
PACLitaxel	DOCEtaxel CABAZitaxel
vinBLASTine	vinCRISTine vinORELBine

Table 3: Classes of medicines

Cephalosporins

- cefaLEXin
- cefALOTIN
- cefaZOLin
- cefEPIME
- cefOTAXIME
- cefOXITIN
- ceftAROLine
- cefTAZIDIME
- cefTRIAZONE

Benzodiazepines

- cloBAZam
- CLONazepam
- DIAzepam
- LORazepam
- OXazepam

SSRI/SNRI

- DULoxetine
- fluoxetine
- fluVOXAMine
- PARoxetine

Sulfonylureas

- gliBENCLAMide
- gliCLAZide
- gliMEPIRide
- gliPIZide



Specialised medicine names

The following lists of specialised medicines include a prioritised selection of thirty-one LASA medicine names within the MAB (with the suffix 'mab') and TKI (with the suffix 'nib') classes of immuno-modulating medicines, that have been predicted to pose the greatest risks to patient safety. The list also includes one additional anti-cancer medicine with the 'gib' suffix: soNIDEGib.

Table 4: Medicine names with the suffix 'mab'

Medicine name	LASA medicine name(s)
beNRALizumab	beVACizumab beZLOTOXumab
eCULizumab	eFALizumab eMICizumab
oBINUTUZumab	oFATUMumab
oCRELizumab	oMALizumab
pANITUMumab	pERTUZumab
raMUCIRumab	raNIBIZumab

Table 5: Medicine names with the suffix 'nib' and 'gib'

Medicine name	LASA medicine name(s)
aFATinib	aXITinib
bARICITinib	biNIMETinib
cABOZANTinib	cOBIMETinib
daBRAFEInib	daSATinib
laPATinib	leNVAInib
pAZOPanib	pONATinib
soNIDEGib	soRAFENib sUNITinib
tOFACItinib	tRAMETinib

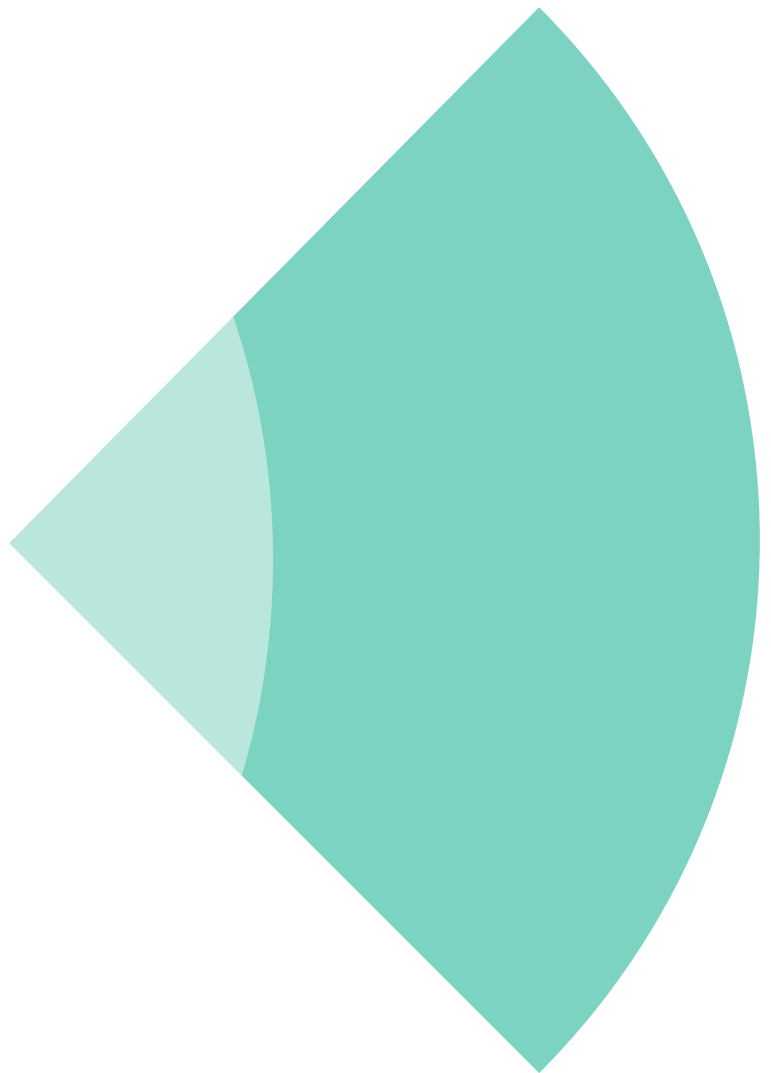


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