



**Drug Labelling and the
Application of TALLman Lettering
Project Report**

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Executive Summary

Despite significant advances in medication safety, medication incidents remain one of the top patient safety priorities in Canada and around the world. Medication incidents are a leading cause of preventable adverse events. Drug name confusion, particularly because of look-alike/sound-alike (LASA) name attributes, can be a contributing factor to medication related adverse events.

TALLman lettering is a method of applying upper-case lettering to sections of look-alike, sound-alike (LASA) drug names as a differentiation strategy. TALLman lettering is only one of many risk-mitigation strategies to minimize errors involving LASA drug names. For example, enhanced use of technology such as automated identification (e.g., bar codes) may offer more advanced medication system safeguards.

The evidence for the effectiveness of TALLman lettering in reducing drug name confusion errors remains mixed. Further research is needed to study its effectiveness in practice environments. Limitations in interpreting existing evidence include inconsistent use of TALLman approaches, limited healthcare settings studied, limited pharmacological classes studied, and lack of an indication that end-users understood the purpose for the use of TALLman lettering.

Determining the LASA drug names that might benefit from TALLman lettering and selecting the capitalization approach can be a complex process. However, when TALLman lettering has been applied to a selected LASA drug name pair, the implementation of the capitalization approach into practice is simple and straightforward. As a result, it has become a widely accepted differentiation strategy for LASA drug names in healthcare settings.¹

The Institute for Safe Medication Practices (ISMP) in the U.S. and the Food and Drug Administration (FDA) have done leading work in TALLman lettering.² Other members of the international safety community have also embraced this approach.^{3,4,5,6} In 2010, ISMP Canada and the Canadian Association

¹ Institute for Safe Medication Practices Canada, Canadian Association of Provincial Cancer Agencies. Medication safety for drugs used in oncology. Drug labelling and the application of TALLman lettering. Project report [Internet]. Toronto (ON): ISMP Canada; 2010 Nov 8 [cited 2015 Mar 28]. Available from: http://www.ismp-canada.org/download/miscpub/ISMPCanada-CAPCA_Oncology_Drug_Safety_Project-2010Nov.pdf

² Institute for Safe Medication Practices. FDA and ISMP Lists of Look-Alike Drug Names with Recommended Tallman Letters. [Internet]. 2011 [cited 2015 Mar 24]. Available from <https://www.ismp.org/tools/tallmanletters.pdf>

³ Australian Commission on Safety and Quality in Health Care. National Tall Man Lettering List [Internet]. Sydney (AU): The Commission; 2011 [cited 2015 Mar 15]. Available from: <http://www.safetyandquality.gov.au/wp-content/uploads/2012/02/National-Tall-Man-Lettering-Report-and-final-list1.pdf>

⁴ Health Quality & Safety Commission, New Zealand. Tall man lettering list. Report [Internet]. Wellington (NZ): The Commission; 2013 Dec [cited 2015 Mar 15]. Available from: <http://www.hqsc.govt.nz/assets/Medication-Safety/Tall-Man-lettering/Tall-Man-report-Dec-2013.PDF>

of Provincial Cancer Agencies published a list of TALLman lettering recommendations to help distinguish names of select oncology drugs.⁷

This project builds upon previous national and international work on TALLman lettering and guides the use of this technique for a consistent approach among the healthcare community and pharmaceutical manufacturers in Canada. It is aligned with the Good Label and Package Practices Guide⁸.

To ensure that TALLman lettering has the greatest possible effect, its use should be reserved for those names associated with the *highest risk to patient safety* within the context of their end use.. High alert medications are drugs that bear a heightened risk of causing significant patient harm when they are used in error.⁹ Lists of high alert medications are available from ISMP US.^{10,11} A focus of this project was to identify the top high alert LASA drug name pairs of concern to Canadian practitioners.

Only confusable non-proprietary (generic) drug names have been considered for the application of TALLman lettering in Canada. Non-proprietary drug names are recognized globally¹² and are therefore most suitable to consistent approaches for TALLman lettering.

The project began with aggregate analyses of reported incidents from databases maintained by the Institute for Safe Medication Practices Canada and the Canadian Institute for Health Information¹³. The analyses and a Canada-wide survey of healthcare practitioners identified high alert drug name pairs that had the potential to cause harm or had been reported to cause harm through substitution errors.

A systematic risk assessment was then completed to identify which of the high alert drug name pairs would benefit most from the application of TALLman lettering as a differentiation strategy. This

⁵ International Medication Safety Network. Position statement on improving the safety of international non-proprietary names of medicines (INNs) [Internet]; 2011 Nov [cited 2015 Mar 25]. Available from: http://www.intmedsafe.net/wp-content/uploads/2014/05/IMSN_position_on_INNs_2011_10_24.pdf

⁶ Otero López MJ, Martín Muñoz R, Sánchez Barba M, et al. Development of a list of look-alike drug names with recommended tall man letters. *Farm Hosp.* 2011;35(5):225-235.

⁷ Institute for Safe Medication Practices Canada, Canadian Association of Provincial Cancer Agencies. Medication safety for drugs used in oncology drug labelling and the application of TALLman lettering. Project report [Internet]. Toronto (ON): The Institute; 2010 Nov 8 [cited 2015 Mar 25]. Available from: http://www.ismp-canada.org/download/miscpub/ISMPCanada-CAPCA_Oncology_Drug_Safety_Project-2010Nov.pdf

⁸ Health Canada Document for Industry. Draft Good Label and Package Practices Guide, 2015 March [cited 2015 Mar 15]. Available from: <http://www.ismp-canada.org/download/LabelingPackaging/Draft-GoodLabelandPackagePracticesGuide-EN-2015-03.pdf>

⁹ ISMP Canada. Definitions of Terms. Available at: <http://ismp-canada.org/definitions.htm>

¹⁰ ISMP. List of High-Alert Medications in Acute Settings. 2014. Available at: www.ismp.org/Tools/highalertmedications.pdf

¹¹ ISMP. List of High-Alert Medications in Community/Ambulatory Healthcare. 2011. Available at: www.ismp.org/communityRx/tools/highAlert-community.pdf

¹² Position statement on improving the safety of international non-proprietary names of medicines (INNs). Horsham (PA): International Medication Safety Network; 2011 Nov [cited 2015 Mar 25]. Available from: http://www.intmedsafe.net/wp-content/uploads/2014/05/IMSN_position_on_INNs_2011_10_24.pdf

¹³ National System for Incident Reporting. Ottawa (ON): Canadian Institute for Health Information [2015 Jan 31].

assessment examined orthographic (look-alike) and phonetic (sound-alike) similarities, clinical risk of confusability (e.g., similar dosing, availability in similar dosage forms, similar routes of administration, use for similar indications or in similar clinical settings), and potential or actual risk of harm should substitution errors occur.

The confusable sections of the drug name pairs were identified and TALLman lettering was proposed, with consideration of psycholinguistic factors, published international TALLman lists,^{14,15,16,17} results from the survey of Canadian practitioners, and recognized methods or approaches for applying TALLman lettering (e.g., CD3¹⁸ or Mid-TALLman¹⁹). When direct application of these TALLman lettering approaches made the names appear more similar to each other or to a drug name outside the identified pair, subjective expert opinion of the perception of similarity was considered. Feedback on the proposed TALLman lettering for high alert drug name pairs was obtained from members of the Project Working Group, Canadian practitioner survey participants, Expert Advisory Panel, and International Medication Safety Network (IMSN).

As a result of this project the list of “TALLman Lettering for Look-Alike/Sound-Alike Drug Names in Canada” is provided. ISMP Canada encourages the use of this list when TALLman lettering is chosen as a strategy for look-alike, sound-alike drug name differentiation. Consistency across the Canadian healthcare continuum, from manufacturers to end-users, is a key consideration. Principles for the Application of TALLman Lettering in Canada were developed and are also included in this report.

¹⁴ Australian Commission on Safety and Quality in Health Care. National tall man lettering list. Sydney (NSW): Commonwealth of Australia; 2011 [cited 2015 Mar 15]. Available from: <http://www.safetyandquality.gov.au/wp-content/uploads/2012/02/National-Tall-Man-Lettering-Report-and-final-list1.pdf>

¹⁵ Health Quality & Safety Commission. Tall man lettering list report. Wellington (NZ): Health Quality & Safety Commission; 2013[cited 2015 Mar 15]. Available from: <http://www.hqsc.govt.nz/assets/Medication-Safety/Tall-Man-lettering/Tall-Man-report-Dec-2013.PDF>

¹⁶ Otero López MJ, Martín Muñoz R, Sánchez Barba M, Abad Sazatornil R, Andreu Crespo A, Arteta Jiménez M, et al. Development of a list of look-alike drug names with recommended tall man letters. *Farm Hosp.* 2011;35(5):225-235.

¹⁷ Application of TALLman lettering for drugs used in oncology. *ISMP Can Saf Bull.* 2010 [cited 2015 Jul 9];10(8):1-4. Available from: <http://www.ismp-canada.org/download/safetyBulletins/ISMPCSB2010-08-TALLmanforOncology.pdf>

¹⁸ FDA and ISMP lists of look-alike drug names with recommended tall man letters. Horsham (PA): Institute for Safe Medication Practices; 2011 [cited 2015 Mar 24]. Available from: <https://www.ismp.org/tools/tallmanletters.pdf>

¹⁹ Australian Commission on Safety and Quality in Health Care. National tall man lettering list. Sydney (Australia): Commonwealth of Australia; 2011 [cited 2015 Mar 15]. Available from: <http://www.safetyandquality.gov.au/wp-content/uploads/2012/02/National-Tall-Man-Lettering-Report-and-final-list1.pdf>

Introduction

Drug name confusion due to look-alike/sound-alike (LASA) drug names can be a contributing factor to medication errors. Similarity between two drug names has been demonstrated to adversely affect accurate name recognition, which may lead to incorrect drug selection.²⁰ Drug name confusion and associated errors can occur at any point in the medication use process, including procurement, prescribing, dispensing, transcription, and administration.

TALLman lettering is a method of applying upper-case lettering to sections of LASA drug names to bring attention to their points of dissimilarity.²¹ Drug names presented in this format can appear novel to the reader, alerting them that there is a drug with a similar name and accentuating letter differences.²² The application of TALLman lettering to a drug name may assist with name recognition by affecting the reader's eye movements²³. Its use does not rely on characteristics of type, such as font or size and it can be used in electronic systems that have the ability to accommodate upper and lower case text options.

In the United States, ISMP and the FDA have done leading work on the topic of TALLman lettering.²⁴ Other members of the international safety community have also embraced this approach.^{25,26,27,28} In 2010, the Institute for Safe Medication Practices Canada (ISMP Canada) and the Canadian Association of Provincial Cancer Agencies (CAPCA) published a list of TALLman lettering recommendations to help distinguish the names of select oncology drugs.²⁹ Previous work has also resulted in the

²⁰ Lambert, BL. Effect of orthographic and phonological similarity on false recognition of drug names. *Soc Sci and Med* 2001 52, 1843-1857.

²¹ Institute for Safe Medication Practices Canada. Application of TALLman lettering for drugs used in oncology. *ISMP Can Saf Bull* [Internet]. 2010 [cited 2015 Mar 24];10(8). Available from <http://www.ismp-canada.org/download/safetyBulletins/ISMPCSB2010-08-TALLmanforOncology.pdf>

²² Gerrett D, Gale AG, Darker IT, Filik R, Purdy KJ. The use of tall man lettering to minimise selection errors of medicine names in computer prescribing and dispensing systems. 2009 [cited 2015 Mar 15]; 52 pages. Available from: <http://www.connectingforhealth.nhs.uk/systemsandservices/eprescribing/refdocs/tallman.pdf>

²³ Filik R, Purdy K, Gale A, Gerrett D. Drug name confusion: evaluating the effectiveness of capital ("Tall Man") letters using eye movement data. *Soc Sci Med*. 2004;59(12):2597-2601.

²⁴ FDA and ISMP lists of look-alike drug names with recommended tall man letters. Horsham (PA): Institute for Safe Medication Practices; 2011 [cited 2015 Mar 24]. Available from: <https://www.ismp.org/tools/tallmanletters.pdf>

²⁵ Australian Commission on Safety and Quality in Health Care. National tall man lettering list. Sydney (Australia): Commonwealth of Australia; 2011 [cited 2015 Mar 15]. Available from: <http://www.safetyandquality.gov.au/wp-content/uploads/2012/02/National-Tall-Man-Lettering-Report-and-final-list1.pdf>

²⁶ Health Quality & Safety Commission. Tall man lettering list report. Wellington (NZ): The Commission; 2013 Dec [cited 2015 Mar 15]. Available from: <http://www.hqsc.govt.nz/assets/Medication-Safety/Tall-Man-lettering/Tall-Man-report-Dec-2013.PDF>

²⁷ Position statement on improving the safety of international non-proprietary names of medicines (INNs). Horsham (PA): International Medication Safety Network; 2011 Nov [cited 2015 Mar 25]. Available from: http://www.intmedsafe.net/wp-content/uploads/2014/05/IMSN_position_on_INNs_2011_10_24.pdf

²⁸ Otero López MJ, Martín Muñoz R, Sánchez Barba M, [Abad Sazatornil R](#), [Andreu Crespo A](#), [Arteta Jiménez M](#), et al. Development of a list of look-alike drug names with recommended tall man letters. *Farm Hosp*. 2011;35(5):225-235.

²⁹ Institute for Safe Medication Practices Canada, Canadian Association of Provincial Cancer Agencies. Medication safety for drugs used in oncology: drug labelling and the application of TALLman lettering. Project report. Toronto (ON):ISMP Canada; 2010 Nov 8 [cited 2015 Mar 25].

recommendation that TALLman lettering be applied to the drug name HYDROmorphine to help prevent mix-ups with morphine. ISMP Canada's knowledge translation work has facilitated the uptake of this recommendation across Canada.

Several studies have suggested that TALLman lettering may help to distinguish similar names,^{30,31,32} making mix-ups less likely. Although no published studies have demonstrated the effectiveness of TALLman lettering in reducing errors in healthcare practice, TALLman lettering is perceived as a simple and straightforward approach to distinguishing words that look similar. As a result, it has become an accepted differentiation strategy for LASA drug names in healthcare settings.^{33,34,35} In a 2008 ISMP (US) survey of healthcare providers, 87% of respondents felt that TALLman lettering helped to reduce drug selection errors and 64% reported that it prevented them from dispensing or administering the wrong medication.³⁶ It was thought of as an inexpensive and sustainable approach that can be used on medication labels or with electronic dispensing and prescribing systems. Respondents considered it to be most effective on computer-generated pharmacy labels and least effective on preprinted order forms. It is noted however, that determining the LASA drug name pairs that might benefit from TALLman lettering, and determining the capitalization approach, can be complex and requires expert input.

Filik et al have also noted that TALLman lettering made similar names easier to distinguish when end users were informed about its purpose.²² Education regarding LASA drug names may help to promote a general awareness of the potential for LASA drug name confusion.

To provide consistency locally, nationally, and potentially internationally, the approach to TALLman lettering should ideally be standardized. Global consistency could minimize confusion and facilitate implementation among stakeholders, such as pharmaceutical companies, for labelling and packaging at

³⁰Filik R, Purdy K, Gale A, Gerrett D. Drug name confusion: evaluating the effectiveness of capital ("Tall Man") letters using eye movement data. *Soc Sci Med*. 2004;59(12):2597-2601.

³¹Filik R, Purdy K, Gale A, Gerrett D. Labeling of medicines and patient safety: evaluating methods of reducing drug name confusion. *Hum Factors*. 2006;48(1):39-47.

³²Filik R, Price J, Darker I, Gerrett D, Purdy K, Gale A. The influence of tall man lettering on drug name confusion: a laboratory-based investigation in the UK using younger and older adults and healthcare practitioners. *Drug Saf*. 2010;33(8):677-687.

³³ Use of tall man letters is gaining wide acceptance. *ISMP Med Saf Alert*. 2008 Jul 31[cited 2015 Mar 20]. Available from: <http://www.ismp.org/newsletters/acutecare/articles/20080731.asp>

³⁴ Van de Vreede M, McRae A, Wiseman M, Dooley MJ. Successful introduction of tallman letters to reduce medication selection errors in a hospital network. *J Pharm Pract Res*. 2008;38(4):263-266.

³⁵ Grissinger M. Tall man letters are gaining wide acceptance. *P T*. 2012 [cited 2015 Mar 19];37(3):132-133,148. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3351881/>

³⁶ Use of tall man letters is gaining wide acceptance. *ISMP Med Saf Alert*. 2008 Jul 31[cited 2015 Mar 20]. Available from: <http://www.ismp.org/newsletters/acutecare/articles/20080731.asp>

the manufacturing level.³⁷ The International Medication Safety Network (IMSN)* is leading collaborative work to acknowledge and build upon international efforts in this area. More specifically, the IMSN has proposed the use of TALLman lettering to improve differentiation among error-prone International Non-proprietary Names (INNs) of drugs.³⁵

TALLman lettering is only one strategy that can be used to mitigate the risks associated with drug name confusion. The issue of drug name confusion is complex, involves many potential contributing factors, and is unlikely to be resolved with only a single approach. Complementary strategies alternative or should be considered to assist with differentiation of LASA drug names. For a list of these strategies see Appendix 1: Principles for the Application of TALLman Lettering in Canada.

³⁷ Position statement on improving the safety of international non-proprietary names of medicines (INNs). Horsham (PA): International Medication Safety Network; 2011 Nov [cited 2015 Mar 25]. Available from: http://www.intmedsafe.net/wp-content/uploads/2014/05/IMSN_position_on_INNs_2011_10_24.pdf

* IMSN is an international network of established safe medication practice centres, operating medication error reporting programmes and producing guidance to minimise preventable harms from medicine use in practice. More information is available from: <http://www.intmedsafe.net/>

Project Overview

The application of TALLman lettering to high alert drug name pairs builds upon the Canadian TALLman list for select oncology drugs published in 2010³⁸ and the 2012 recommendation for the use of TALLman lettering in Canada to differentiate HYDROmorphine and morphine. It complements previous work by Health Canada and ISMP Canada to develop a framework for the assessment of LASA pharmaceutical product names and the development of a good practices guide for safe health product labelling and packaging.

The objectives of the TALLman lettering project were to:

- Identify additional high alert drugs in Canada that would benefit from TALLman lettering; and
- Identify principles for the application of TALLman lettering in Canada that can inform the development of a national position statement to guide use of this technique by manufacturers.

The project was divided into four distinct phases:

- Identification of confusable drug name pairs of concern to Canadian practitioners;
- Selection of high alert drug name pairs that would benefit from TALLman lettering;
- Development of principles for the application of TALLman lettering in Canada; and
- Enhancement of the Canadian list with application of TALLman lettering to selected confusable high alert drug name pairs.

ISMP Canada convened an eleven-member Expert Advisory Panel including pharmacists, nurses, quality experts, human factors specialists and a physician from across Canada to assist with, and help guide the project phases.

Literature Review

A literature review was completed using the PubMed database and was focused on original source documents published from 2000 to 2015 with select exceptions for earlier original research. The search was initially focused on published incidents involving LASA drug names and included search terms such

³⁸ Institute for Safe Medication Practices Canada, Canadian Association of Provincial Cancer Agencies. Medication safety for drugs used in oncology drug labelling and the application of TALLman lettering. Project report [Internet]. Toronto (ON): The Institute; 2010 Nov 8 [cited 2015 Mar 25]. Available from: http://www.ismp-canada.org/download/miscpub/ISMPCanada-CAPCA_Oncology_Drug_Safety_Project-2010Nov.pdf

as “look-alike, sound-alike”, “TALLman lettering,” “drug confusion”, and “wrong drug”. The literature search was extended to include publications of related research and work describing the application of TALLman lettering in other jurisdictions.

The number of published LASA incidents involving high alert drugs was limited and did not provide additional information beyond what had been identified through incidents reported in Canada. The earliest report of LASA noted in the literature review was reported in 1967³⁹ specific to psychiatric medications. In 1973, Teplitsky published a list of 50 LASA names in a letter to the editor.⁴⁰ USP began as early as 1993 reporting naming issues in Quality Reviews and in 1995 reported catastrophic errors resulting from similar names.⁴¹

The evidence for the effectiveness of TALLman lettering in reducing drug name confusion errors remains mixed. Limitations of interpreting evidence of studies include: inconsistent use of TALLman application, limited healthcare settings studied, limited pharmacological classes studied, and lack of indication that end-users understood the purpose for the use of TALLman lettering.

³⁹ Dembicki, EL. Psychiatric drugs and trends. Look-alike and sound-alike drugs. *J Psychiatr Nurs Ment Health Serv.*, 1967; 5(6):604:8.

⁴⁰ Teplitsky, B. Hazards of sound alike, look alike drug names. *CA Med* 1973; 119(5): 62. {Cited 2015 February 27}. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1455350/pdf/califmed00005-0094a.pdf>

⁴¹ Hicks, RW, Becker, SC., Cousins, DD, eds (2008). A report on the relationship of drug names and medication errors in response to the institute of medicine’s call for action. Rockville, MD: Center for the Advancement of Patient Safety, US Pharmacopeia. [cited 2015 Feb 26]. Available from: <http://www.labatecpharma.com/wp-content/uploads/2012/02/2008MEDMARX-DataReport.pdf>

Identification of Confusable High Alert Drug Name Pairs of Concern to Canadian Practitioners

Aggregate Analyses

Aggregate analyses of reported medication incidents involving LASA drug name confusion in Canada were completed. The aggregate analyses included reports of incidents extracted from:

- ISMP Canada databases (Analyze-Err, Community Pharmacy Incident Reporting program, Individual Practitioner Reporting and Consumer Reporting) for the date range 2001-December 31, 2014
- Canadian Institute for Health Information's National System for Incident Reporting (NSIR)** for the date range April 2009 – December 31, 2014⁴².

Inclusion Criteria

The data retrieval search terms were specific to the taxonomy of the respective databases. Search terms used in ISMP Canada databases included “incorrect drug”, “wrong drug” and “confusing drug name, label or packaging” which is a mandatory field completed by reporters. The NSIR search terms included “spell alike”, “sound alike, spell alike” and “confused”.⁴³

Near miss incidents and those that reached the patient and were reported to have resulted in harm or had the potential to result in harm were included. The search yielded 1955 incidents from the ISMP Canada databases and 1249 incidents from the NSIR database.

Exclusion Criteria

Three analysts (two nurses and a pharmacist) applied the following exclusion criteria to each dataset:

- incidents involving look-alike labelling and packaging e.g. IV solutions,
- incidents involving drugs that are not available in Canada, and
- incident reports with insufficient detail for analysis

The Project Working Group generated a list of high alert drug name pairs for initial consideration in the application of TALLman lettering.

** The National System for Incident Reporting (NSIR), provided by the Canadian Institute for Health Information, is a component of the Canadian Medication Incident Reporting and Prevention System (CMIRPS) program. More information about the NSIR is available from: <http://www.cmirps-scdpim.ca/?p=12>

⁴² National System for Incident Reporting. Ottawa (ON): Canadian Institute for Health Information [2015 Jan 13].

⁴³ Minimum data set. In: National System for Incident Reporting. Ottawa (ON): Canadian Institute for Health Information; 2012.

Consultation with Canadian Practitioners

A stakeholder survey was conducted inviting Canadian practitioners to identify confusable drug name pairs of concern in their clinical practice. Invitations to complete the survey were provided in an ISMP Canada Safety Bulletin, communicated on the ISMP Canada website and were distributed to members of various national and provincial pharmacy and related healthcare associations across Canada.

The survey was completed by a total of 232 respondents including pharmacists, pharmacy technicians, nurses, physicians and patient safety/risk management professionals from across Canada. While survey results included many of the pairs reported in the datasets described above, new confusable non-proprietary drug name pairs emerged. Additional confusable high alert drug name pairs of concern were identified by survey participants and are provided in Appendix 4.

The Project Working Group updated the initial list from incident analyses with the stakeholder survey results to create a final list of 117 confusable high alert drug name pairs of concern to Canadian practitioners, provided in Appendix 5.

This initial list of confusable drug names excludes pairs of confusable names involving two proprietary names. It includes reports of a single non-proprietary name confused with a single proprietary name, e.g. tramadol/Toradol, and these pairs were referred for Expert Advisory Panel (EAP) discussion. It was confirmed that this project would focus on non-proprietary drug name pairs only.

Selection of Confusable High Alert Drug Name Pairs That Would Benefit From TALLman Lettering

Additional Exclusion Criteria to Manage Project Scope

Additional exclusion criteria were applied to narrow the list of confusable high alert drug name pairs to those that would specifically benefit from the application of TALLman lettering.

The drug name pairs excluded from consideration for TALLman lettering were:

- different formulations of the same drug including those with prefixes and suffixes (e.g. oxycodone IR [immediate release] versus oxycodone ER [extended release])
- combination products (e.g., bupivacaine versus bupivacaine with epinephrine)
- salt formulations (e.g., potassium chloride versus potassium phosphate).

For the excluded drug name pairs it was uncertain whether the application of TALLman lettering would be of benefit and it was determined that, with the current level of evidence, other strategies to enhance differentiation might be of more benefit.

Risk Assessment Process

Research indicates that TALLman lettering may be effective because it draws attention to drug names presented in this format⁴⁴, and can act as a warning. Overuse of the technique, therefore, may reduce its effectiveness⁴⁵ as the names may no longer appear novel. To ensure that TALLman lettering has the greatest possible effect, its use should be reserved for those names associated with the *highest risk to patient safety* within the context of their end use. In acknowledgement of this potential concern, the project limited and prioritized the number of name pairs that might benefit from TALLman lettering. A systematic risk assessment process was applied to determine which drug name pairs might benefit from the application of TALLman lettering as a differentiation strategy.

The Project Working Group, in collaboration with the Expert Advisory Panel, developed criteria to assess the risk of confusability and harm associated with each drug name pair. Some criteria were linked to increased likelihood of a mix-up while others were linked to the magnitude of risk to a patient should an error involving the confusable drug name pair occur.

⁴⁴ Filik R, Purdy K, Gale A, Gerrett D. Labeling of medicines and patient safety: evaluating methods of reducing drug name confusion. *Hum Factors*. 2006;48(1):39-47.

⁴⁵ Emmerton L, Rizk MF, Bedford G, et al. Systematic derivation of an Australian standard for Tall Man lettering to distinguish similar drug names. *J Eval Clin Pract* 2015;21(1):85-90.

The final criteria were selected through consensus from the national Expert Advisory Panel and in consultation with an expert in psycholinguistics. The criteria used in the risk assessment were:

- orthographic (look-alike) and/or phonetic (sound-alike) similarity,
- clinical risk of confusability (e.g. similar dosing, availability in similar dosage forms, similar route of administration, use for similar indications and use in similar clinical settings), and
- potential or actual risk of harm should the two drugs be confused

Orthographic and Phonetic Similarity

Linguistics and bioinformatics disciplines have developed software programs to help identify look-alike (orthographic) names and sound-alike (phonetic) names. These programs can be used to analyze existing or proposed drug names for their confusability. The Phonetic Orthographic Computer Analysis (POCA) software is an example program designed to identify drug and biologic names that are phonetically and orthographically similar to one another.⁴⁶ Personal communication with G. Kondrak provided a brief overview of the evolution and application of the tools used to evaluate phonetic and orthographic similarity.

BI-SIM is a measure of orthographic similarity that combines the advantages of several other known measures.⁴⁷ A higher BI-SIM score indicates greater similarity. The edit distance (also referred to as the Levenshtein Distance) describes the minimum number of elementary edit operations needed to transform one string into another. A lower score indicates greater similarity.

The EDIT test (a measurement of orthographic distance) and the Bigram Similarity (BI-SIM) test were applied to the abbreviated list of name pairs using an online tool found at <http://www.cs.toronto.edu/~aditya/strcmp2/>.

As part of the risk assessment process, results were ranked in order of name similarity, with greater similarity associated with higher risk of confusability.

⁴⁶ Department of Health and Human Services. Food and Drug Administration. Federal Register 74:30. 2009;. Phonetic Orthographic Computer Analysis Software Program for Review of Proprietary Drug and Biologic Names. [cited 2016 Feb 8]; Available from: <http://www.fda.gov/OHRMS/DOCKETS/98fr/E9-3170.pdf>

⁴⁷ Kondrak G, Dorr, B. 2004. Identification of Confusable Drug Names: A New Approach and Evaluation Methodology. [cited 2015 Mar 20]; Available from: <http://www.aclweb.org/anthology/C04-1137>

Clinical Risk Criteria

In collaboration with the Expert Advisory Panel and internal ISMP Canada Project Working Group, risk assessment criteria were developed to assess the clinical risks associated with confusable drug name pairs. Some criteria were linked to increased likelihood of an error. Others were linked to the magnitude of risk to a patient should an error involving the confusable drug name pair occur.

Criteria	Example	Comments
Similar dosing	fentanyl and sufentanil	Both available as 50 mcg/mL; fentanyl moderate dose is 2-4 mcg/kg; sufentanil surgical analgesia dose is 2-8 mcg/kg.
Available in similar dosage form	dactinomycin and daptomycin	Both have intravenous dosage forms; dactinomycin available as 0.5 mg/vial; daptomycin available as 500 mg/vial.
Similar route of administration	dobutamine and dopamine	Both administered by intravenous injection
Similar indications or settings	amiodarone and amlodipine	Both used in cardiac care Amiodarone is an antiarrhythmic available as 100 mg; Amlodipine is a calcium channel blocker available as 10 mg
Available in similar strengths	dexmedetomidine and dexamethasone	dexmedetomidine 0.5 mg/mL, 100 mcg/mL; dexamethasone 0.5 mg, 1 mg/mL, 10 mg/mL Note: This criterion Included strengths that could be confused e.g. 50 mcg/mL vs. 500 mcg/mL
Reported harm	diltiazem and diazepam	Reports of significant harm with substitution errors
Potential risk of harm should they be confused	epinephrine and norepinephrine	<i>Potential risk of harm is relatively low for this pair since they have a similar clinical effect. They were not recommended for the list.</i>

A further consideration that served to remove drug name pairs from the initial list was the determination of whether or not the LASA drug names were the likely cause of the reported confusion or if it might have been more likely due to similarities in labelling and packaging, in which case other system solutions would apply.

Application of TALLman Lettering to Selected Confusable Drug Name Pairs

TALLman lettering is generally used in the context of a specific confusable pair or group of drug names. The application of TALLman lettering for more than two names in a group of similar names adds an additional layer of complexity.

A consistent method for applying TALLman lettering to more than two LASA drug names (ie. groups of LASA names) was not found in the literature review. It was noted, however, that some jurisdictions have applied TALLman lettering to more than one name in a group of LASA drug names; for example, oral chemotherapy agents including monoclonal antibodies with names ending in “mab” and drugs with names ending in “nib”.

In practice, TALLman methods or approaches serve as a starting point for the application of TALLman lettering to LASA drug name pairs. Ideally, a recognized TALLman method should be used to determine which letters to capitalize for a drug name pair. There is limited evidence supporting the use of one TALLman method over another.⁴⁸

Regardless of the approach selected, the capitalized letters should make the drug names more distinguishable from the user’s perspective. In some situations, strict application of TALLman methods may inadvertently make two names appear more similar to one another, or to a drug name outside the identified pair. Therefore, the optimal TALLman approach may be a blend of TALLman lettering methods and consideration of the user’s subjective perception of drug name similarity and whether the chosen approach makes the names distinguishable.

TALLman options for the confusable high alert drug name pairs identified in this project considered:

1. An environmental scan of TALLman lettering use across Canada including local, provincial and national jurisdictions.
2. Published lists of TALLman lettering used in international jurisdictions
3. Psycholinguist consultation

⁴⁸ Darker IT, Gerrett D, Filik R, et al. The influence of ‘Tall Man’ lettering on errors of visual perception in the recognition of written drug names [Internet]. *Ergonomics*. 2011 [cited 2015 Mar 19];54(1):21-33. Available from: http://www.academia.edu/4466213/The_influence_of_Tall_Man_lettering_on_errors_of_visual_perception_in_the_recognition_of_written_drug_names

4. Consultation with clinical experts (e.g. Expert Advisory Panel ; Canadian practitioners)
5. IMSN consultation
6. TALLman methods that have been identified in the literature

The TALLman methods that have been considered when applying TALLman lettering to the LASA drug name pairs of concern to Canadian practitioners are summarized below:

- i. **Natural**²⁰ is the deliberate use of all lowercase letters e.g., diazepam.
- ii. **FULL UPPERCASE**²⁰ is the use of all uppercase letters for the entire name.
- iii. **Mid Tallman**³ starts from either end of drug name and works towards the middle of the name and capitalizes the first letter encountered that differs across the two names *and* the letters between.
- iv. **CD3**² rule works first from the left of the word, capitalizing all characters to the right once 2 or more dissimilar letters are encountered. Then working from the right of the word back, returning 2 or more letters common to both words to lowercase letters. When the rule cannot be applied because there are no common letters on the right side of the word, then central letters are capitalized only. A maximum of 3 letters per drug name are capitalized. Where more than 3 letters are present in the critical portion of a drug name, the centre most 3 are capitalized – if the capitalized letters are *common* in the pairs, then the next most peripheral letters that differ are capitalized. The letter “i” is not capitalized to avoid confusion with the lower case letter “l”⁴⁹ While this rule is favored by many jurisdictions, as for other TALLman methods, it is not without limitation and it cannot be universally applied to all names.
- v. **Optimal Alignment Technique** capitalizes the unique letters in two LASA drug names. An example of this technique was computer-generated for the initial project list of LASA names and is provided in Appendix 5.
- vi. **Wild TALLman**²⁰ has no apparent rule for application of uppercase letters and has been used in the past by the FDA, ISMP in the US, and the National Patient Safety Agency⁵⁰.

⁴⁹ Darker, IT, Gerret, D, Filik, R, Purdy, KJ, & Gale, AG. The influence of Tall Man lettering on errors of visual perception in the recognition of written drug names. *Ergonomics*. 2011 54(1), 21-33

⁵⁰ Darker, IT, Gerret, D, Filik, R, Purdy, KJ, & Gale, AG. The influence of Tall Man lettering on errors of visual perception in the recognition of written drug names. *Ergonomics*. 2011 54(1), 21-33

In summary, the application of TALLman lettering is only one strategy to mitigate the risk of look-alike, sound-alike drug names. Complementary or alternative strategies should also be considered. Consistency in the application of TALLman lettering across the Canadian healthcare continuum, from manufacturers to end-users, is a key consideration. ISMP Canada encourages the use of the list of “TALLman Lettering for Look-Alike/Sound-Alike Drug Names in Canada” when TALLman lettering is chosen as a strategy for look-alike, sound-alike drug name differentiation.

APPENDIX 1

Principles for the Application of TALLman Lettering in Canada March 31, 2016

TALLman lettering is a method of applying uppercase lettering to sections of look-alike/sound-alike (LASA) drug names to bring attention to their points of dissimilarity.¹ By accentuating the points of difference, the application of TALLman lettering to a drug name may assist in alerting healthcare providers that the drug name in question may be confused with another drug name.² TALLman lettering may also assist with name recognition and comprehension by affecting the reader's eye movements.³ Its use does not rely on characteristics of type such as font or size. It can be used in any electronic system that accommodates uppercase and lowercase text options.

Several studies have provided evidence that highlighting sections of drug names with TALLman lettering may help to distinguish similar names,^{2,3,4,5} however the evidence for its effectiveness in reducing drug name confusion errors remains mixed. Further research is needed to study the effectiveness of TALLman lettering application in practice environments. Determining the drug name pairs that would benefit from the technique and the optimal capitalization is complex. However, the implementation of TALLman lettering into practice is a simple and straightforward approach to distinguishing words that look similar. As a result, it has become an accepted differentiation strategy for LASA drug names in healthcare settings.^{6,7,8}

In the United States, the Institute for Safe Medication Practices (ISMP) and the Food and Drug Administration (FDA) have done leading work on the topic of TALLman lettering.⁹ Other members of the international safety community have also embraced this approach.^{10,11,12,13} In 2010, the Institute for Safe Medication Practices Canada (ISMP Canada) and the Canadian Association of Provincial Cancer Agencies (CAPCA) published a list of TALLman lettering recommendations to help distinguish the names of select oncology drugs.¹⁴ Work by ISMP and ISMP Canada subsequent to a fatal incident has also resulted in the recommendation that TALLman lettering be applied to the drug name HYDROMorphone to help prevent mix-ups with morphine¹⁵. Knowledge translation work by ISMP Canada and partners has resulted in the uptake of this recommendation across Canada.

To provide consistency locally, nationally, and potentially internationally, the approach to TALLman lettering should ideally be standardized. Global consistency could minimize confusion and facilitate implementation among stakeholders, such as pharmaceutical companies, for labelling and packaging at the manufacturing level.¹² The International Medication Safety Network (IMSN)¹⁶ is leading collaborative work to acknowledge and build upon international efforts in this area. More specifically, the IMSN has proposed the use of TALLman lettering to improve differentiation among error-prone International Non-proprietary Names (INNs) of drugs.¹²

ISMP Canada has developed the list of "TALLman Lettering for Look-Alike/Sound-Alike Drug Names in Canada" (presented below). Development of this list was guided by the following principles

Consistency in Application of TALLman lettering

- TALLman lettering will have the greatest impact on the differentiation of LASA drug names if it is applied consistently. The list of “TALLman Lettering for Look-Alike/Sound-Alike Drug Names in Canada” was developed to provide consistency across the Canadian healthcare continuum (i.e., from manufacturers to end-users). Similar to international work in this area, the focus has been on confusable non-proprietary (generic) drug names, in particular prescription pharmaceuticals and biologics.
- TALLman lettering lists for confusable drug names have already been published in some other countries, e.g., the FDA and ISMP Lists of Look-alike Drug Names With Recommended Tall Man Letters (United States),⁹ the National Tall Man Lettering List (Australia),¹⁰ and the Tall Man Lettering List (New Zealand).¹¹ These lists were used as reference material for consideration in the local (Canadian) context.

Use of TALLman Lettering as a Differentiation Strategy

- TALLman lettering is one of several risk-mitigation strategies that can be used to differentiate LASA drug name pairs.^{17,18,19}
- TALLman lettering is used in the context of a specific confusable *pair* or *group* of drug names.
- The use of TALLman lettering should be limited to drug name pairs associated with high risk to patient safety²⁰.
- TALLman lettering may be effective because it draws attention to drug names presented in this format⁴, and can act as a warning. Overuse of the technique may reduce its effectiveness¹⁹, as names may no longer appear novel.
- The root causes for drug name confusion should be understood before TALLman lettering is considered as a potential solution. If the confusion arises from look-alike labelling or packaging or from knowledge deficits about drug names and their indications, alternative differentiation strategies should be applied.
- Systematic risk assessment processes should be used to determine which drug name pairs would most benefit from TALLman lettering.^{10,11,13} Risk criteria may include orthographic similarity (e.g., BI-SIM or EDIT distance scores²¹); similarity of dosing, route of administration, dosage form, indication, or environment of use (e.g., intensive care unit); and frequency of use. Reported incidents involving harm or the potential for severe or catastrophic harm if the drugs are confused should also be considered.
- TALLman lettering as a differentiation strategy has not been applied in the following situations, where alternative risk-mitigation strategies may be considered:
 - combination products (e.g., bupivacaine vs. bupivacaine with epinephrine)
 - different salts of the same drug (e.g., ferrous gluconate vs. ferrous fumarate)

Approaches to TALLman lettering

- In cases where drug name pairs have low orthographic similarity, the potential risk of harm and the clinical experience of practitioners should be considered before capitalization is applied. Orthographic factors that increase visual similarity include similar length of the names and number of groups of characters in the names.²²

- Healthcare practitioners should be involved in the process of identifying confusable drug name pairs relevant to their respective practice settings. They should also participate in reviewing proposed TALLman options and assessing risk-reduction strategies to be implemented in their practice settings.¹² The user’s subjective perception of drug name similarity is an important consideration. The capitalized letters should make the drug names distinguishable from the user’s perspective.
- A recognized TALLman method (e.g., CD3 or Mid-TALLman^{2,23}) should be used to determine which letters of a drug name pair are to be capitalized. However, direct application of a single rule may not always lead to the best TALLman option, and alternative TALLman methods or options should also be considered.
- In some situations, direct application of a specific TALLman method may inadvertently make two names appear more similar to one another or more similar to a drug name outside the identified pair. In these instances, no capitalization or an alternative capitalization approach should be considered.
- For groups of three or more confusable drug names, attempts should be made to apply a capitalization scheme that maximizes distinctiveness across all possible pairings.
- Capitalization should not be applied to the following elements of drug names:
 - common prefixes or suffixes
 - the letter “i”, to avoid confusion with lowercase letter “l” (consistent with CD3 rule)⁵
 - letters or sections of drug names that are phonetically similar, with the number of syllables, pronunciation stresses, and placement of vowel and consonant sounds being attributes that should be considered when determining the degree of drug name similarity²⁵ (e.g., vinCRISTine – vinBLASTine does not capitalize the “vin” or “tine”; daBRAFeNib – daSATinib does not capitalize the “da” or the “nib”.)
- Capitalization may not be helpful if it is applied to letters that affect the unique shape of a word. The shape of a printed word is important for word recognition and has been linked to proofreading errors.²⁴ It is affected by “ascenders” [letters with lines that extend upward, e.g., h or b], “descenders” [those with lines that extend downward, e.g., y or g], and “half-line” letters [e.g., e or r].²⁵

Implementation of TALLman lettering

- Providing education to end-users, such as healthcare practitioners, about the hazards associated with confusable drug name pairs and the purpose of TALLman lettering is a key implementation strategy. An awareness of the purpose of TALLman lettering can help users to distinguish between similar names when this approach has been applied.^{4,5}
- Periodic review of TALLman lists will allow the assessment of continued relevance of the selected drug name pairs in current practice. For example, new products with LASA names may become available, or existing products on the list may be discontinued.

Complementary or Alternative Strategies to Reduce Drug Name Confusion

- The following complementary or alternative strategies may help to reduce drug name confusion:
 - applying attributes such as bold, italic, colour, or colour backgrounds or enlarging the type

- size of capitalized letters to help distinguish dissimilar letters^{17,26}
- evaluating the potential for name confusion when adding new products to the formulary¹⁸
 - providing information to end-users about LASA drug names to help maintain awareness of this issue¹⁸
 - implementing bar coding or independent double checks (or both) for activities such as selection, dispensing, and administration of drugs^{14,18}
 - reducing the potential for confusion between confusable name pairs by including both the brand and non-proprietary drug names on prescriptions or orders, medication administration records, automated dispensing cabinets, and computer databases and displays^{16, 18}
 - configuring the screens of computers and automatic dispensing cabinets to prevent the consecutive appearance of potentially confusable drug names¹⁸
 - including the dosage form, drug strength, complete directions, and indications for use on prescriptions or orders, to help differentiate LASA drug names¹⁸
 - storing products with LASA drug names in different locations¹⁸
 - exploring and implementing drug-specific risk-reduction strategies for confusable drug name pairs,¹⁸ such as stocking different strengths of drugs with confusable names (e.g., morphine at 1 mg/mL and HYDROMORPHONE at 2 mg/mL)

References

¹ Application of TALLman lettering for drugs used in oncology. ISMP Can Saf Bull. 2010 [cited 2015 Mar 24];10(8):1-4. Available from: <http://www.ismp-canada.org/download/safetyBulletins/ISMPCSB2010-08-TALLmanforOncology.pdf>

² Gerrett D, Gale AG, Darker IT, Filik R, Purdy KJ. Tall man lettering: final report of The use of tall man lettering to minimise selection errors of medicine names in computer prescribing and dispensing systems. Loughborough (UK): National Health Service, NHS Connecting for Health; 2009 [cited 2015 Mar 15]. 52 pages. Available from: <http://www.connectingforhealth.nhs.uk/systemsandservices/eprescribing/refdocs/tallman.pdf>

³ Filik R, Purdy K, Gale A, Gerrett D. Drug name confusion: evaluating the effectiveness of capital (“Tall Man”) letters using eye movement data. Soc Sci Med. 2004;59(12):2597-2601.

⁴ Filik R, Purdy K, Gale A, Gerrett D. Labeling of medicines and patient safety: evaluating methods of reducing drug name confusion. Hum Factors. 2006;48(1):39-47.

⁵ Filik R, Price J, Darker I, Gerrett D, Purdy K, Gale A. The influence of tall man lettering on drug name confusion: a laboratory-based investigation in the UK using younger and older adults and healthcare practitioners. Drug Saf. 2010;33(8):677-687.

⁶ Use of tall man letters is gaining wide acceptance. ISMP Med Saf Alert. 2008 Jul 31 [cited 2015 Mar 20]. Available from: <http://www.ismp.org/newsletters/acutecare/articles/20080731.asp>

⁷ Van de Vreede M, McRae A, Wiseman M, Dooley MJ. Successful introduction of tallman letters to reduce medication selection errors in a hospital network. J Pharm Pract Res. 2008;38(4):263-266.

⁸ Grissinger M. Tall man letters are gaining wide acceptance. P T. 2012 [cited 2015 Mar 19];37(3):132-133,148. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3351881/>

⁹ FDA and ISMP lists of look-alike drug names with recommended tall man letters. Horsham (PA): Institute for Safe Medication Practices; 2011 [cited 2015 Mar 24]. Available from: <https://www.ismp.org/tools/tallmanletters.pdf>

¹⁰ Australian Commission on Safety and Quality in Health Care. National tall man lettering list. Sydney (Australia): Commonwealth of Australia; 2011 [cited 2015 Mar 15]. Available from: <http://www.safetyandquality.gov.au/wp-content/uploads/2012/02/National-Tall-Man-Lettering-Report-and-final-list1.pdf>

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- ¹¹ Health Quality & Safety Commission. Tall man lettering list report. Wellington (NZ): The Commission; 2013 Dec [cited 2015 Mar 15]. Available from: <http://www.hqsc.govt.nz/assets/Medication-Safety/Tall-Man-lettering/Tall-Man-report-Dec-2013.PDF>
- ¹² Position statement on improving the safety of international non-proprietary names of medicines (INNs). Horsham (PA): International Medication Safety Network; 2011 Nov [cited 2015 Mar 25]. Available from: http://www.intmedsafe.net/wp-content/uploads/2014/05/IMSN_position_on_INNs_2011_10_24.pdf
- ¹³ Otero López MJ, Martín Muñoz R, Sánchez Barba M, [Abad Sazatornil R](#), [Andreu Crespo A](#), [Arteta Jiménez M](#), et al. Development of a list of look-alike drug names with recommended tall man letters. *Farm Hosp*. 2011;35(5):225-235.
- ¹⁴ Institute for Safe Medication Practices Canada, Canadian Association of Provincial Cancer Agencies. Medication safety for drugs used in oncology: drug labelling and the application of TALLman lettering. Project report. Toronto (ON): ISMP Canada; 2010 Nov 8 [cited 2015 Mar 25]. Available from: http://www.ismp-canada.org/download/miscpub/ISMPCanada-CAPCA_Oncology_Drug_Safety_Project-2010Nov.pdf
- ¹⁵ An Omnipresent Risk of Morphine-Hydromorphone Mix-ups. *ISMP Can Saf Bull*. 2004 [cited 2015 Sept 1]; 4(6) 1-2. Available from: <http://www.ismp-canada.org/download/safetyBulletins/ISMPCSB2004-06.pdf>
- ¹⁶ International Medication Safety Network. About IMSN. Available from: <http://www.intmedsafe.net/about/>
- ¹⁷ Survey on LASA drug name pairs: who knows what's on your list and the best ways to prevent mix-ups? *ISMP Med Saf Alert*. 2009 May 21 [cited 2015 Mar 20]. Available from: <http://www.ismp.org/newsletters/acutecare/articles/20090521.asp>
- ¹⁸ Or C, Wang H. A comparison of the effects of different typographical methods on the recognizability of printed drug names. *Drug Saf*. 2014;37(5):351-359.
- ¹⁹ Cohen MR, editor. Medication errors. 2nd ed. Washington (DC): American Pharmacists Association; 2007, p. 100-101.
- ²⁰ [Emmerton L](#), [Rizk MF](#), [Bedford G](#), et al. [Systematic derivation of an Australian standard for Tall Man lettering to distinguish similar drug names](#). *J Eval Clin Pract* 2015;21(1):85-90.
- ²¹ Kondrak G, Dorr B. [Automatic](#) identification of confusable drug names. *Artificial Intelligence in Medicine*. 2006 [cited 2015 Oct 26]; 36(1):29-42.
- ²² Draft revised guidance document for industry - review of drug names for look-alike sound-alike (LASA) attributes. Ottawa (ON): Health Canada; 2013 Feb 19 [cited 2015 Mar 20]. Available from: <http://www.hc-sc.gc.ca/dhp-mps/consultation/medeff/2013/lasa-pspcs/lasa-pspcs-eng.php>
- ²³ Darker IT, Gerrett D, Filik R, Purdy KJ, Gale AG. The influence of 'tall man' lettering on errors of visual perception in the recognition of written drug names. *Ergonomics*. 2011 [cited 2015 Mar 19];54(1):21-33. Available from: http://www.academia.edu/4466213/The_influence_of_Tall_Man_lettering_on_errors_of_visual_perception_in_the_recognition_of_written_drug_names
- ²⁴ Haber RN, Schindler RM. Error in proofreading: evidence of syntactic control of letter processing? *J Exp Psychol*. 1981;7(3):573-579.
- ²⁵ Wickens CD, Hollands JG. Engineering psychology and human performance, 3rd Edition. Upper Saddle River (NJ): Prentice Hall; 2000.
- ²⁶ Gabriele S. The role of typography in differentiating look-alike/sound-alike drug names. *Healthc Q*. 2006 [cited 2015 Mar 25];9 Spec No.:88-95. Available from: <http://www.longwoods.com/content/18465>

APPENDIX 2

TALLman Lettering

for Look-Alike/Sound-Alike Drug Names in Canada



LASA Drug Names with Recommended TALLman Lettering	TALLman Lettering Source
AFAtinib / aXitinib	ISMP Canada
amLODIPine / amiodarone*	ISMP (US)
azaCITIDine / azaTHIOprine	ISMP (US)
azaTHIOprine / azithromycin*	ISMP (US)
CARBOplatin / CISplatin	ISMP (US)
cycloSERINE / cycloSPORINE	FDA
cyclophosphamide*	CAPCA/ISMP Canada
daBRAFenib / daSATinib	ISMP Canada
DACTINomycin / daptomycin*	ISMP (US)
DAUNOrubicin / DOXOrubicin	FDA
dexamethasone / dexmedeTOMidine	ISMP Canada
diITIAZem / diazepam*	ISMP Canada
dimenhyDRINATE / diphenhydrAMINE	FDA
DOBUTamine / DOPamine	FDA
DOCEtaxel / PACLitaxel	CAPCA/ISMP Canada
DOXOrubicin / IDArubicin	ISMP (US)
epinephrine* / ePHEDrine	ISMP (US)
epirubicin* / eriBULin	ISMP Canada
fentanyl* / SUFentanil	ISMP (US)
HYDROmorphone / morphine	ISMP (US)
hydroxyzine* / hydroxyUREA	ISMP Canada
iBRUtinib / iMATinib	ISMP Canada
inFLIXimab / riTUXimab	ISMP (US)
lamiVUDine / lamoTRIGine	ISMP (US)
mitoXANTRONE	FDA
niLOtinib / niLUTAmide	ISMP Canada
oBINutuzumab / oFAtumumab	ISMP Canada
PANitumumab / PERTuzumab	ISMP Canada
quiNIDine / quiNINE	ISMP (US)
sAXaglipitin / sitagliptin*	ISMP Canada
SORAFenib / SUNItinib	CAPCA/ISMP Canada
vanDETanib / vemURAFenib	ISMP Canada
vinBLASTine / vinCRISTine	FDA

ISMP Canada
Institute for Safe Medication
Practices Canada

ISMP (US)
Institute for Safe Medication
Practices (US)

FDA
US Food and Drug
Administration

CAPCA
Canadian Association of
Provincial Cancer Agencies

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*TALLman lettering is not applied to this drug name in Canada at this time

APPENDIX 3

National Practitioner Survey



Drug Labelling and the Application of TALLman Lettering for Select High Alert Drugs Your Participation is Needed

Learning from reported medication incidents has helped identify the drugs most frequently associated with harmful medication incidents and factors contributing to such incidents. A notable theme in qualitative analyses has been medication mix-ups due to look-alike/sound-alike drug names.

TALLman lettering involves the application of UPPER CASE lettering to certain syllables or groups of letters within names to bring attention to the points of dissimilarity between them. For example: vinCR**I**stine / vinBL**A**stine.

We are seeking participation and input from Canadian healthcare professionals. Please complete a brief survey to assist us in the identification of confusable drug name pairs and to provide us with your suggestions or comments about the application of TALLman lettering.

To complete the survey, click here <http://www.ismp-canada.org/TALLman/surveyv.php>

Please complete the survey by *Friday, February 20, 2015*.

Survey

1. Have you directly experienced or witnessed look-alike, sound-alike (LASA) drug name confusion that has had the potential to cause harm or has caused harm due to a mix-up?
 Yes No

2. Please list drug name pairs that you consider may have the potential to cause harm or have caused harm due to a mix-up.

If you are currently using TALLman lettering to differentiate between the names, please enter the drug names as you print or display them.

e.g., vinCR I stine	vinBL A stine
_____	_____
_____	_____
_____	_____

3. Please provide any comments or suggestions regarding LASA drug name confusion and/or the application of TALLman lettering:

Demographics

Province/Territory of Practice

- Alberta
- British Columbia
- Manitoba
- New Brunswick
- Newfoundland & Labrador
- Northwest Territories
- Nova Scotia
- Nunavut
- Ontario
- Prince Edward Island
- Québec
- Saskatchewan
- Yukon

Please check the category that best describes you

- Pharmacist
- Nurse
- Quality/Risk
- Physician
- Pharmacy Technician
- Unit Secretary
- Other:

If you would like to review and provide input on proposed TALLman lettering options for the identified confusable drug names, please provide your email address so that we can contact you.

Email _____

THANK YOU FOR COMPLETING THE SURVEY

Your survey responses will remain confidential

APPENDIX 4

Summary of National Practitioner Survey Results

Survey Respondent Demographics

Initial Practitioner Survey Results	
Respondents	Number of respondents, N (%)
TOTAL	232
By profession	
Nurse	52 (22.4)
Pharmacist	128 (55.2)
Pharmacy Technician	16 (6.9)
Physician	14 (6.0)
Quality/Risk	7 (3.0)
Other	9 (3.9)
Unspecified	6 (2.6)
By province	
Alberta	21 (9.0)
British Columbia	17 (7.3)
Manitoba	22 (9.5)
New Brunswick	31 (13.4)
Newfoundland & Labrador	2 (0.9)
Northwest Territories	0 (0.0)
Nova Scotia	24 (10.3)
Nunavut	0 (0.0)
Ontario	94 (40.5)
Prince Edward Island	2 (0.9)
Québec	5 (2.2)
Saskatchewan	8 (3.4)
Yukon	0 (0.0)
Unspecified	6 (2.6)
Directly experienced or witnessed LASA drug name confusion	179 (77.2)
Suggested additional drug name pairs	175 (75.4)
Provided comments	106 (45.7)
Provided contact information for continued participation in review process	111 (47.8)

Themes from Respondent Comments	Number of respondents (%)
TOTAL respondents	232
Provided comments	106 (45.7)
Supports TALLman lettering for confusable drug names	55 (51.9)
Supports development of a standardized TALLman list and/or TALLman principles	12 (11.3)
Supports development of an ISMP Canada TALLman list	5 (4.7)
Currently uses ISMP US/FDA TALLman lists	13 (12.3)
Expressed concerns with certain confusable drug name pairs on ISMP US/FDA TALLman list	3 (2.8)
Supports or currently applying TALLman lettering consistently throughout pharmacy and/or hospital systems (e.g., stocklists, MARs, pre-printed orders, shelf labels, pyxis, CPOE, drug formularies, pharmacy information, etc.)	7 (6.6)
Inquired about evidence or research needed for how to apply TALLman lettering and its effectiveness for preventing errors	4 (3.8)
Suggested use of an objective method of measure orthographic similarity (e.g., BI-GRAM, Levenshtein distance)	1 (0.9)
Currently does not use TALLman lettering in practice setting	1 (0.9)
Commented on challenges of implementing TALLman lettering for computer systems and/or practice setting (e.g., community pharmacy, primary care)	9 (8.5)
Currently applies TALLman lettering to high alert/high risk medications first	1 (0.94)
Concerned about the overuse of TALLman lettering, reducing its effectiveness and potentially increasing the potential for confusion	7 (6.6)
Expressed concerns or experience with increased practitioner confusion when TALLman lettering used	3 (2.8)
Expressed concerns or experience with TALLman lettering becoming less effective as the novelty wears off and practitioners become too accustomed to seeing the TALLman lettering	4 (3.8)

Survey Respondent Comments (Cont'd)

Themes from Respondent Comments	Number of respondents (%)
TOTAL respondents	232
Provided comments	106 (45.7)
Recommended complementary differentiation strategies	19 (17.9)
Recommended the use of larger fonts as a complementary differentiation strategy	2 (1.9)
Recommended the use of colour as a complementary differentiation strategy	1 (0.9)
Recommended the use of alert stickers as a complementary differentiation strategy	2 (1.9)
Identified prescribing as an important point of intervention to prevent confusable drug name errors	12 (11.3)
Identified illegible writing on prescriptions as an important point of intervention to prevent confusable drug name errors	7 (6.6)
Identified inclusion of brand name on labels and/or prescriptions as a complementary differentiation strategy	6 (5.7)
Identified inclusion of drug indication on prescriptions as a complementary differentiation strategy	3 (2.8)
Identified inclusion of drug class on prescriptions as a complementary differentiation strategy	1 (0.94)
Identified look-alike packaging as an important point of intervention to prevent confusable drug name errors	3 (2.8)
Recommends Health Canada regulate drug naming practices to limit the creation of look-alike/sound-alike drug names and/or collaboration with Health Canada on drug naming process	3 (2.8)
Recommends implementation of TALLman lettering or the involvement of practitioners in drug name selection at the manufacture level	8 (7.6)
Provided a patient case example	4 (3.8)
Recommended incident reporting of errors or near misses related to drug names	1 (0.9)

Survey Participant Feedback on Potential TALLman Lettering for Select High Alert Drug Name Pairs

		N = 39 respondents					
DRUG A	DRUG B	Agreed with the TALLman lettering selected		Recommended a different TALLman approach		Should not be on the List	
		Total	%	Total	%	Total	%
azaCITIDine	azaTHIOprine	34	94.4	2	5.6	0	0.0
lamiVUDine	lamoTRIGine	33	94.3	0	0.0	2	5.7
quiNIDine	quiNINE	35	100.0	0	0.0	0	0.0
DACTINomycin	DAPTOmycin	30	83.3	4	11.4	0	0.0
epirubicin	eribulin	8	24.2	17	51.5	7	20.0
DOBUTamine	DOPamine	31	86.1	4	11.4	0	0.0
EPINEPHrine	ePHEDrine	30	85.7	3	8.6	0	0.0
hydroxyzine	hydroxyUREA	18	51.4	13	37.1	4	11.4
fentanyl	SUFentanyl	25	69.4	9	25.7	1	2.9
amlodipine	amiodarone	6	17.6	16	47.1	11	31.4
azaTHIOprine	azithromycin	21	61.8	9	26.5	4	11.4
sAXaglipitin	sitaGLIPTin	24	68.6	10	28.6	1	2.9
gliCLAzide	glipiZIDE	27	81.8	6	18.2	0	0.0
gluLiSine	glARGine	26	78.8	4	12.1	3	9.1
dexamethasone	dexmedeTOMidine	22	66.7	5	15.2	6	18.2
diLTiAZem	diazepam	21	61.8	3	9.1	9	27.3
AFAtinib	aXitinib	28	82.4	4	11.8	1	3.0
PANitumumab	PERTuzumab	30	88.2	3	8.8	0	0.0
OBINutuzumab	OFatumumab	31	91.2	2	5.9	0	0.0
daBRAFenib	daSATinib	30	90.9	1	3.0	1	3.1
niLOtinib	niLUTAmide	28	84.8	2	6.1	2	6.3
vanDETanib	vemURAFenib	25	75.8	4	12.1	3	9.4
iBRUtinib	iMATinib	29	87.9	1	3.0	0	0.0
paZOpanib	poNATinib	27	81.8	3	9.1	2	6.3

Confusable Drug Name Pairs Identified by Survey Participants

DRUG A	DRUG B
dimenhydrINATE	diphenhydrAMINE
hydrALAZINE	hydroXYzine
medroxyPROGESTERone	methylPREDNISolone
ceFAZolin	cefTAZidime, cefTRIAxONE
valACYclovir	valGANciclovir
sAXaglipatin	sitaGLIPtin, SUMAtripan
PlaVIX	PraDAXA
amiodarone	ABIRATERone
acyclovir	valACYclovir
citalopram	Escitalopram
fentaNYL	REMIlfentanil
rifABUTin	rifAMPin
cloBAZam	clonazePAM
VIGAbatrin	dabigatran
cisatracurium	ROCuronium
ALPRAZolam	LORazepam
amiloRIDE	amLODipine
ARIPiprazole	RABEprazole
azaCITIDine	azaTHIOprine
azaTHIOprine	azithroMYCIN
azaCITIDine	azithroMYCIN
bisaCODYL	bisOPROLOL
BUpivacaine	ROpivacaine
buPROPion	busPIRone
caPTOPRil	caRVEDILOI
CARBOplatin	CISplatin
caRVEDILOI	caPTOPRil
ceFAZolin	Other cephalosporins
cefEPIME	Other cephalosporins
ceFIXime	Other cephalosporins
cefoTAXime	Other cephalosporins
cefOXITIN	Other cephalosporins
ceftAZIDime	Other cephalosporins
cefTRIAxone	Other cephalosporins
cephaLEXin	Other cephalosporins
cefuroxime	Other cephalosporins
cefoTETan	Other cephalosporins

ceftriaxone	cefotaxime
Cefuroxime	Cefotaxime
cefotaxime	ceftizoxime
cephalosporins	Other cephalosporins
antibiotics that start with C	
chlordiazePOXIDE	chlorproMAZINE
chlorproMAZINE	chlordiazePOXIDE
chlorproPAMIDE	clomiPRAMINE
chlorproPAMIDE	chlorproMAZINE
chlordiazePOXIDE	clomiPRAMINE
chlorproMAZINE	clomiPRAMINE
clomiPHENE	clomiPRAMINE
clomiPRAMINE	chlorproMAZINE
clomiPHENE	chlorproMAZINE
clonazePAM	cloNIDine
clonazePAM	cloZAPine
cloNIDine	cloZAPine
cycloSPORINE	cyclophosphamide
DACTINomycin	DAPTOmycin
dimenhyDRINATE	diphenhydrAMINE
DOBUTamine	DOPamine
DOCEtaxel	PACLitaxel
DOXOrubicin	DAUNOrubicin
DOXOrubicin	IDArubicin
DAUNOrubicin	IDArubicin
DULoxetine	Other SSRIs
EPINEPHrine	ePHEDrine
EPINEPHrine	NORepinephrine
EPINEPHrine	PHENYLephrine
ePHEDrine	NORepinephrine
ePHEDrine	PHENYLephrine
NORepinephrine	PHENYLephrine
fentaNYL	ALfentanil
fentaNYL	REMifentanil
fentaNYL	SUFentanil
ALfentanil	REMifentanil
ALfentanil	SUFentanil
flavoxATE	fluvoxaMINE
FLUoxetine	Other SSRIs
FLUoxetine	DULoxetine

FLUoxetine	PARoxetine
DULOoxetine	PARoxetine
FLUoxetine	fluVOXAMINE
fluPHENAZine	fluvoxaMINE
gliCLAZide	glyBURIDE
guaiFENesin	guanFACINE
hydrALAZINE	HYDRomorphone
hydrALAZINE	hydrOXYzine
HYDRomorphone	hydrOXYzine
HYDRocodone	oxyCODONE
hyoscine HYDRobromide	hyoscine BUTYLbromide
scopolamine HYDRobromide	hyoscine HYDRobromide
inFLIXimab	riTUXimab
ISOtretinoin	tretinoin (no tall man)
lamoTRigine	lamiVUDine
levETIRAcetam	levOCARNitine
medroxyPROGESTERone	methylTESTOSTERone
medroxyPROGESTERone	methylPREDNISolone
methylTESTOSTERone	methylPREDNISolone
metFORMIN	metroNIDAZOLE
mitoMYcin	mitoXANtrone
MOXifloxacin	NORfloxacin
NIFEdipine	niMODipine
NORepinephrine	EPINEPHrine
NORfloxacin	MOXifloxacin
OLANZapine	QUEtiapine
oxyBUTYNIN	oxyCODONE
PACLitaxel	DOCEtaxel
PARoxetine	Other SSRIs
penicillin G	penicillin V
PHENYLephrine	EPINEPHrine
POTASSIUM phosphate	SODIUM phosphate
prednisoLONE	predniSONE
proPOFol	proPRANolol
pyridoSTIGmine	pyriDOXine
QUEtiapine	OLANZapine
quinAPRIL	quiNIDine
quiNIDine	quiNINE
quinAPRIL	quiNINE
RABEprazole	ARIPiprazole
REMifentanil	fentaNYL

rifaMPin	rifaBUTin
riTUXimab	inFLIXimab
rOPINIRole	risperDAL
ROpivacaine	BUpivacaine
scopolamine HYDRObromide	hyoscine BUTYLbromide
SIrolimus	TACrolimus
sitaGLIPtIn	SUMAtriptan
SODIUM phosphate	POTASSIUM phosphate
SORafenib	SUNItinib
SUFentanil	fentaNYL
sulfaSALazine	sulfaDIAZINE
sulfiSOXAZOLE	sulfaDIAZINE
sulfaSALazine	sulfiSOXAZOLE
SUMAtriptan	ZOLMitriptan
sitaGLIPtIn	ZOLMitriptan
SUNItinib	SORafenib
TACrolimus	SIrolimus
traMADol	traZODone
trimEPRAZINE	trimIPRAMINE
valACYclovir	valGANciclovir
vinBLASTine	vinCRISTine
risperDAL	rOPINIRole
Calcium gluconate	calcium chloride
HYDRMorphone	morphine
atomoxetine	atorvastatin
levothyroxine	liothyronine
trastuzumab	trastuzumab emtansine
heparin	dalteparin
heparin	enoxaparin
dalteparin	enoxaparin
citalopram	escitalopram
levofloxacin	levothyroxine
metoprolol	metoclopramide
haloperidol	allopurinol
Esomeprazole	omeprazole
potassium chloride	potassium phosphate
potassium phosphate	SODIUM phosphate
demedetomidine	dexamethasone
carBAMazepine	ceFUROXime
etoposide	etoposide phosphate
gemcitabine	gemtuzumab

vinBLAS ^t ine	vinorelbine
vincristine	vinorelbine
levofloxacin	lovenox
afatinib	axitinib
fluphenazine	flupentixol
fluphenazine decanoate	flupentixol decanoate
omeprazole	oseltamivir
paclitaxel	nab-paclitaxel
clozapine	olanzapine
DOXOrubicin	epirubicin
methylprednisolone	methylphenidate
zuclopenthixol decanoate	zuclopenthixol acetate
hydroCODONE	hydroMORPHONE
pyrimethamine	pyridoxine
nitroGLY ^C erin	nitroPRUSSide
flupentixol	ZUCLOpenthixol
trastuzumab	pertuzumab
cloBAZam	clonazepam
levofloxacin	levetiracetam
acyclovir	valacyclovir
buserelin	busulfan
dabrafenib	dasatinib
nilotinib	nilutamide
meropenem	imipenem
flupentixol decanoate	fluphenazine decanoate
amlodipine	amiodarone
citalopram	clonazepam
oxycodone	oxazepam
amlodipine	amitriptyline
acetylsalicylic acid	acetaminophen
doxycycline	doxepin
hydrochlorothiazide	hydralazine
gliPIZide	gliBENCLAMide
ATORVAstatin	all statins
PRAvastatin	All statins
ROSUvastatin	All statins
SIMVAstatin	All statins
gliCLAZIDE	gliMEPIRIDE
betamethasone	beclomethasone
cis-retinoic acid	trans-retinoic acid
polyETHylene glycol 3350	polySTyrene

clonazepam	lorazepam
risperiDONE	riseperiDONE M-tab
lovenox	lactulose
CISplatin	OXALlplatin
CARBOplatin	OXALlplatin
CYTarabine	FLUDarabine
amitriptyline	nortriptyline
tiotropium	ipratropium
hydroxychloroquine	hydralazine
hydroxychloroquine	hydroxyzine
phenobarbital	pentobarbital
cytarabine	cladribine
cloNIDine	clomiphene
vincristine	vincristine liposomal
daunorubicin liposomal	doxorubicin liposomal
cytarabine	cytarabine liposomal
epirubicin	eribulin
epirubicin	eriBULin mesylate
eribulin	eriBULin mesylate
epirubicin	IDArubicin
eriBULin	DOXOrubicin
eribulin	IDArubicin
estramustine	exemestane
panitumumab	pertuzumab
anastrozole	anagrelide
oxycodone/acetaminophen	oxycodone long-acting
hydrochlorothiazide	chlorthalidone
methylPHENidate	methadone
IRINotecan	TOPotecan
glULISine (Apidra)	glARGine (Lantus)
iron DEXTRAN	iron SUCROSE
zuclopenthixol acuphase	zuclopenthixol decanoate
oxyCODONE	oxyCONTIN
methylprednisolone ACETATE	methylprednisolone SODIUM SUCCINATE
fomepizole	flumazenil
carBAMazepine	OXcarbazepine
glyBURIDE	glipiZIDE
traMADol	tramacet
capTOPRIL	Enalapril
GLICLAzide	glipiZIDE

metoLAZONE	metoPROLOL
metHIMAZOLE	methyIDOPA
carVEDilol	carBAMazepine
cycloBENZaprine	cycloSPORINE
methoTRIMEPRAzine	metroNIDAZOLE
phenyTOIN	PHENobarbital
bupropion hcl	bupreNORPHINE
buprenorphine/naloxone	bupreNORPHINE
buprenorphine/naloxone	bupropion hcl
perphenazine	perindopril
tacrolimus (Advagraf)	Tacrolimus (Prograf)
pneumococcal POLYSACCHARIDE 23-Valent	pneumococcal CONJUGATE 13-Valent
DOMperidone	metoCLOPramide
DESipramine	doxePINE
cycloSPORINE	cycloSERINE
cotazym	cotazym ECS
PALperidone	risperiDONE
penicillAMINE	penicilline
PROchlorperazine	Trifluoperazine
sildenafil	sirolimus
buscopan	bentropine
PANCuronium	ROCuronium
PANCuronium	VECuronium
ROCuronium	VECuronium
rASAgiline	rEPAglinide
AZithromycin	CLArithromycin
AZithromycin	ERYTHROmycin
CLArithromycin	ERYTHROmycin
somatostatin	somatropin
flupENTHIXOL decanoate	flupENTHIXOL dihydrochloride
flupHENAZINE decanoate	flupHENAZINE HCl
chlorPHENIRAMINE	chlorTHALIDONE
cycloBENZAPRINE	cycloPHOSPHAMIDE
trimebutine	trimethoprim
trifluoperazine	trihexphidyl
magnesium rougier	magnesium hydroxide
mycophenolate (Myfortic)	mycophenolate mofetil
acetaZOLAMIDE	acetoHEXAMIDE
flupHENAZINE Decanoate	flupHENAZINE Enanthate
modafenil	modenafil

rapaflo	rapamune
silodosin	sirolimus
DOXOrubicin	doxorubicin liposomal
DOXOrubicin	DOCEtaxel
TRImipramine	DESipramine
TRImipramine	imipramine
DESipramine	imipramine
risperiDONE	rOPINIRole
TOLBUTamide	TOLAZamide
PEMEtredex	PRALAtrexate
folic acid	folinic acid
sufentanil	sublimaze
hydrocortisone	cortisone acetate
morphine	morphien LA
HYDRMorPHONE	HYDRMorPHONE LA
niMODipine	niCARDipine
NIFEdipine	niCARDipine
tiZANidine	tiaGABine
clonazePMA	ALPRAZolam
HYDRocodone	oxyCONTIN
HYDRomorphone	HYDRomorphONE SR
hydroCORTisone	hydrochloroTHIAZIDE
HYDRomorphone	hydroOXYzine
hydrochloroTHIAZIDE	hydroOXYzine
acetaZOLAMIDE	n/a
HYDRomorphone	n/a
traMADOL	n/a
rifAMPin	n/a
FentaNYL	n/a
cycloBENZaprine	n/a
GLICLAzide	n/a
methHIMAZOLE	n/a
methyLDOPA	n/a
metoLAZONE	n/a
metoPROLOL	n/a
methoTRIMEPRAzine	n/a
phenyTOIN	n/a
epiNEPHrine	n/a
metoPROLOL	n/a
LORazepam	n/a
morphINE	n/a

oxyCODONE	n/a
BISOpIrolol	n/a
DOPamine	n/a
FLUpentixol	n/a
levoFLOXacin	n/a
mitoXANTRONE	n/a
tretinoin (Vesanoid)	n/a
denosumab (Prolia)	n/a
carbidopa-levodopa (Sinemet)	n/a
fluPHENAZine	flavoxATE
riva-cyclosporin	cyclosporin
LIRagliptin	linagliptin
SAXagliptin	sitaGLIPtin
Plavix	Pradaxa
Losec	Lasix
Diclectin	Dicetal
Paxil	Pariet
Xanax	Zantac
COzaar	HYzaar
Celebrex	celexa
Paxil	Prozac
CipraleX	CiprodeX
CipraleX	celexa
Seroquel	Sinequan
Seasonale	Seasonique
Sublinox	Suboxone
Novorapid	Novomix
Endocet	Indocid
LaMICtal	LamISIL
Accupril	Accutane
BuspAR	BusCOpan
Avonex	Arimidex
Norvasc	Navane
Versed	Valium
Taxotere	Taxol
Novomix 30	Novolin 30/70
Pen G benzathine	Pen G sodium
Infarix Hexa 6	Infarix IPV-Hib 5
Solu-MEDROL	Depo-MEDROL
Topamax	Fosamax

Prozac	Proscar
Dilaudid	Dilantin
Ceftin	Cefzil
Polysporin	Polytrim
Recombivax	Recombivax HB PED
HBIG	HIB (ACT-HIB)
Humalog Mix 25	Humulin 70/30
Humalog Mix 25	Novomix 30
Isordil	Plendil
Leukeran	Myleran
Lupron	Lupron Depot (various)
M-Eslong 10mg	M-Eslon 100mg
Ritalin	Ritalin SR
Alkeran	Leukeran
Ambisome	Amphotericin B
Tegretol	Tegretol CR
Temodal	tramadol
Tobradex	Tobrex
Wellbutrin SR	Wellbutrin XL
Valtrex	Valcyte
solu-MEDROL	solu-CORTEF
TEGretol	TRENTal
SEROquel	sertraLINE
humaLOG	humuLIN

APPENDIX 5

High Alert Drug Name Pairs of Concern to Canadian Practitioners with Example of TALLman Lettering Approach (using optimal alignment technique)

aFAtinib	aXItinib
ALfentanil	REMIfentanil
amlodIPIne	amiodAROne
amphotericin B LIPOSOMAL	amphotericin B
anaSTROZOLe	anaGRELIDe
azaCITIDine	azaTHIOPRine
azathIOPRine	azithROMYCIIn
BUpivacaine	ROpivacaine
carbAMazepine	OXcarbazepine
cARBAMAZEPINE	cEFUROXIME
cARBOplatin	cISplatin
CARBOplatin	OXALIplatin
carveDILOL	carBAMAZEPINE
CISplatin	OXALIplatin
cycloBENZAPrine	cycloSPORine
cycloSErine	cycloSPORine
cycloSPORINE	cyclophosphAMIDe
CYTarabine	FLUDarabine
cYTARAbine	cLADRIBine
cytarabine	cytarabine LIPOSOMAL
daBRAFEInib	daSATInib
daCTINomycin	daPTomycin
DALTEparin	ENOXAparin
daUNorubicin	dOXorubicin
daUNorubicin liposomal	dOXorubicin liposomal

DESMopressin	VASopressin
dexametHASOne	dexmedetOMIDIne
DilANTIN	diltIAZEM
dILTiazem	diazePAm
doBUTamine	doPAmine
DOCetaxel	PACLItaxel
DOXOrubicin	IDArubicin
DOXOrubicin	EPIrubicin
ePHEDrine	PHENYLephrine
EPHEDrine	NORepinephrine
EPinephrine	NORepinephrine
epINEPHrine	epHEDrine
EPInephrine	PHENYLephrine
ePIRUBicin	erIBULin
eSTRAMUstine	eXEMEstane
fentanYl	SUfentanIl
FenTANYL	PHenYTOIN*
FENTanyl	Alfentanil
FENTanyl	REMIfentanil
fluOROUracil	fludaraBINE
geMCITABINE	geNTUXUMAB
gliCLAzide	gliPIzide
glICLAZide	glyBURide
glIPIZide	glyBURide
glUCAGON	glyBURIDE
glULISine	glARGine
HEparin	ENOXAparin
HEparin	DALTeparin
hydrALAZIne	hydrOMORPHOne
hydroMORPHOne	hydroCODone

HYDROMORPHONE	OXYCODONE
hydroxyzine	hydroxyurea
INFLIXIMAB	RITUXIMAB
insulin ASPART	insulin NPH
insulin ASPART	insulin GLARGINE
insulin lispro	insulin lispro PROTAMINE
insulin LISPRO	insulin GLARGINE
IRINotecan	TOPotecan
ketOROLAC	ketAMINE
laBETOLOL	LaMICTAL
LABETolol	METOPROlol
lamIVUDine	lamOTRIGine
metFORMIN	metRONIDAZOLE
methADONE	methHYLPHENIDATE
mETHADOne	mORPHIne
meTHOTrexate*	medroXYPROGESTERONE
metocloprAMIDE	metoprOLOL
metoLAZONE	methHOTREXATE
metOPROLOL	metFORMIN
METOPROlol	ATENolol
metoPROLOL	metoLAZONE
metoPROLOL	metoLAZONE*
meTRONidazole*	mePERidine
mIDAZOLam	meTOCLOPRamide
mitoXANTRONE	mitoMYCIn
MORPHIne*	HYDRomorphOne
mORPHine	mEPERIDine
NADROparin	DALTEparin
nilotINIB	nilUTAMide
nitroGLYCERIN	nitroPRUSSIDE

nOREPInephrine	NEOSYnephrine
NOREPINephrine	PHENYLephrine
oBINUtuzumab	oFAtumumab
oxAZEPAM	oxYNEO
oxyBUTYNIN	oxyCODONE
OXYcodone	codeIne
oxyCODOne	oxyNEO
OXYcodone	HYDROcodone
oxycoDONE	oxyCONTIN
oxYCODONE	oxAZEPAM
PAClitaxel*	NABpaclitaxel
PANcuronium	ROcuronium
PANcuronium	VEcuronium
pANItuMumab*	pERTuZumab
PERCOCet	proPOXYPHene
phenyLEPHRine	phenyTOin
prAVACHol	propANOLol
propOFOL	proCHLORPERAZINE
propRANOLol	propofOL*
quinIDine	quinINE*
rEPagliniDe	rASagiliNe*
rEPAGLinide	rIFAMPin
rEPAGLINIDE	rIFAMBUTIN
ReplAVITe	repAGLINIDE
rISPERIDONE	rEPAGLINIDE
ROcuronium	VEcuronium
rOSUvastatin	rivaROXABAn
sAXagliptin	sITagliptin
siLDENAFIL	siROLIMUS
siLODOSIN	siROLIMUS

SIrolimus	TACrolimus
sITAGLiptIn	sUMATriPtAn*
SUfentanil	Alfentanil
SUfentanil	REMIfentanil
suFENTANIL	SuBLIMAZE
sUNITInib	sORAFEnib
TENEctEplase	ALteplase
tolBUTamide	tolAZamide
tramaDOL	tramaCET
traMAdoL	traZOdoNE*
tRAMAdol	TEModal
TRAMADol	LABETOLol
tRAMadol	TORadol
TRAStuzumab	RituXImab
trastuzumab	trastuzumab EMTANSINE
TRetinoIn	ISOtretinoIn
VIGABatrin	DABIGatran
vinBLAstine	vinCRISTine
vinBLASTine	vinORELBine
vinCRISTine	vinORELBine
vincristine	vincristine LIPOSOMAL

APPENDIX 6

Environmental Scan of TALLman Lettering In Use for High Alert Medications

Table A - Select Canadian TALLman Options for Identified High Alert Drug Name Pairs

DRUG A	DRUG B	LOWER MAINLAND PHARMACY SERVICES BRITISH COLUMBIA (2014)		ALBERTA HEALTH SERVICES (2013)		SASKATCHEWAN CANCER AGENCY (2015)		WINNIPEG REGIONAL HEALTH AUTHORITY (2013)		HAMILTON HEALTH SCIENCES CENTRE (2014)		CAPITAL HEALTH NOVA SCOTIA (2014)	
azacitidine	azathioprine	azaCITIDine	azaTHIOprine	azacitidine	azaTHIOprine	azaCITIDine	—	azaCITIDine	azaTHIOprine	azaCITIDine	azaTHIOprine	—	—
lamivudine	lamotrigine	lamiVUDine	lamoTRIGine	lamiVUDine	lamoTRIGine	—	—	lamiVUDine	lamoTRIGine	lamiVUDine	lamoTRIGine	—	—
quinidine	quinine	quiNIDine	quiNINE	quiNIDine	quiNINE	—	—	quiNINE	quiNIDine	quiNIDine	quiNINE	quiniDINE	quiNINE
dactinomycin	daptomycin	DACTINomycin	DAPTOmycin	—	DAPTOmycin	—	—	DACTINomycin	DAPTOmycin	DACTINomycin	DAPTOmycin	—	—
epirubicin	eribulin	—	—	—	—	EPIrubicin	eriBULin	—	—	—	—	—	—
dobutamine	dopamine	DOBUTamine	DOPamine	doBUTamine	doPAMine	—	—	DOBUTamine	DOPamine	DOBUTamine	DOPamine	DOBUTamine	DOPamine
epinephrine	ephedrine	EPINEPHrine	ePHEDrine	epiNEPHrine	ePHEDrine	EPINEPHrine	—	EPINEPHrine	ePHEDrine	EPINEPHrine	ePHEDrine	EPINEPHrine	epHEDrine
hydroxyzine	hydroxyurea	hydrOXYzine	—	hydrOXYzine	—	hydrOXYzine	—	hydrOXYzine	—	hydrOXYzine	—	hydrOXYzine	—
fentanyl	sufentanil	fentaNYL	SUFentanil	fentaNYL	SUFentanil	fentaNYL	—	fentaNYL	SUFentanil	fentaNYL	SUFentanil	Fentanyl	SUFentanil
amlodipine	amiodarone	amLODIPIne	amiODAROne	amLODIPine	—	—	—	amLODIPine	—	amLODIPine	—	amLODIPine	—
azathioprine	azithromycin	azaTHIOprine	azithroMYCIN	—	—	—	—	azaTHIOprine	—	azaTHIOprine	—	—	—
saxagliptin	sitagliptin	—	sitaGLIPTin	—	—	—	—	SAXAglipitin	sitaGLIPTin	—	—	—	—
glulisine	glargine	—	—	—	—	—	—	—	—	—	—	glULISine	glARGine
dexamethasone	dexamethasone	—	—	—	—	—	—	—	—	—	—	—	—
diltiazem	diltiazem	—	—	—	—	—	—	—	—	—	—	—	—
afatinib	afatinib	—	—	—	—	aFATinib	AXITinib	—	—	—	—	—	—
panitumumab	panitumumab	—	—	—	—	PANitumumab	perTUMumab	—	—	—	—	—	—
obinutuzumab	obinutuzumab	—	—	—	—	OBINutuzumab	OFAtumumab	—	—	—	—	—	—
dabrafenib	dabrafenib	—	—	—	—	daBRAFeNib	—	—	—	—	—	—	—
nilotinib	nilotinib	—	—	—	—	—	—	—	—	—	—	—	—
vandetanib	vandetanib	—	—	—	—	VANdetanib	VEMurafenib	—	—	—	—	—	—
ibrutinib	ibrutinib	—	—	—	—	IBRUTinib	IMATinib	—	—	—	—	—	—

Table B - International TALLman Options for Identified High Alert Drug Name Pairs

DRUG A	DRUG B	PSYCHOLINGUIST EVALUATION (2015)		ISMP/FDA (2015)		AUSTRALIA (2011)		NEW ZEALAND (2013)		ISMP-SPAIN (2011)		HONG KONG (2013)	
azacitidine	azathioprine	azaCITIDine	azaTHIOPRine	azaCITIDine	azaTHIOprine	—	—	—	—	—	—	—	AzathioPRINE
lamivudine	lamotrigine	lamiVUDine	lamOTRIGine	lamiVUDine	lamoTRIGine	lamIVUDine	lamOTRIGine	lamIVUDine	lamOTRIGine	—	—	—	—
quinidine	quinine	quinIDine	quinINE	quiNIDine	quiNINE	—	—	—	—	quiNINA	quiNIDina	QuiniDINE	QuiNINE
dactinomycin	daptomycin	daCTINomycin	daPTomycin	DACTINomycin	DAPTOmycin	daCTINomycin	daPTomycin	daCTINomycin	daPTomycin	DACTINomicina	DAPTOmicina	—	—
epirubicin	eribulin	ePIRUBicin	eRIBULin	epirubicin	eribulin	—	—	—	—	—	—	—	—
dobutamine	dopamine	doBUTamine	doPAMine	DOBUTamine	DOPamine	—	—	—	—	DOBUTamina	DOPamina	DoBUTamine	DoPAMine
epinephrine	ephedrine	epINEPHrine	epHEDrine EPHEDrine	EPINEPHrine	ePHEDrine	—	—	—	—	EPINEFrina	eFEDrina	—	—
hydroxyzine	hydroxyurea	hydroxyZINE	hydroxyUREA	hydrOXYzine	—	—	—	—	—	—	—	HydrOXYzine	—
fentanyl	sufentanil	fentanYL FenTANYL	SUFentanil Sufentanil	fentaNYL	SUFentanil	—	—	—	—	—	—	—	—
amlodipine	amiodarone	amloDIPIne	amiodAROne	amLODIPine	amiodarone	amLODIPIne	amIODAROne	amLODIPIne	amIODAROne	—	—	AmlODIPINE	—
azathioprine	azithromycin	azathIOPRine	azithROMYCIn	azaTHIOprine	—	azATHIOPRINE	azITHROMYCI	azATHIOPRINE	azITHROMYCI	azaCITIDina	azaTIOprina	AzathioPRINE	AzithroMYCIN
saxagliptin	sitagliptin	sAXagliptin	sITagliptin	—	sitaGLIPTin	—	—	—	—	—	—	—	—
glulisine	glargine	glULISine	glARGine	—	—	—	—	—	—	—	—	—	—
dexamethasone	dexametomidine	dexametHASOne	dexmedetOMIDIne	—	—	—	—	—	—	—	—	—	—
diltiazem	diazepam	dILTiazem	diazePAM	—	—	—	Diazepam	—	Diazepam	—	—	—	DIazepam
afatinib	axitinib	aFATinib	aXITinib	—	—	—	—	—	—	—	—	—	—
panitumumab	pertuzumab	pANItuMumab	pERtuZumab	—	—	—	—	—	—	—	—	—	—
obinutuzumab	ofatumumab	oBINUtuzumab	oFAtumumab	—	—	—	—	—	—	—	—	—	—
dabrafenib	dasatinib	daBRAFEInib	daSATInib	—	—	—	—	—	—	—	—	—	—
nilotinib	nilutamide	niLotINIB	niLUTAMide	—	—	—	—	—	—	—	—	—	—
vandetanib	vemurafenib	—	—	—	—	—	—	—	—	—	—	—	—
ibrutinib	imatinib	—	—	—	—	—	—	—	—	—	—	—	—

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