Medication Errors Related to LASA Drugs

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Abstract: The existence of confusing drug names is one of the most common causes of medication error and is of concern worldwide. With tens of thousands of drugs currently on the market, the potential for error due toconfusing drug names is significant. This includes nonproprietary names and proprietary (brand or trade marked) names. Many drug names look or sound like other drug names such as Losec(omeprazole) and Lasix(furosemide) Led to the incidents that the patients were given lasix instead of the prescribed losec, which resulted in the patient death. This type of LASA drugs had created vast number of medication errors due to confusion and put a question mark on safety of patients. To combat errors arise due to LASA drugs their identification and adequate policy to manage these errors is required. Along with this, there should be development of such effective methodology such as tall mann lettering and patient education and awareness to decrease negative consequences of look alike sound alike drugs. Therefore, to aware the community and health care workers this present study has been designed to get information about patient safety policy, medication safety, medication error, look-alike/sound-alike medication and risk management system. Also, to discover various strategies to prevent LASA medication errors.

Index Terms - **LASA drugs, Medication errors, Proprietary names, Strategies**

I. INTRODUCTION

Medications with drug names that look similar in print or sound similar to other drugs when their names are spoken. Such agents carry a significant risk of being administered improperly, esp. when exchanged for one another. The confusion of similar drug names is one of the most common causes of medication errors worldwide that threatens patients' safety . Some proprietary (brand name) and non-proprietary names (generic name) sound or appear to be similar to other drugs when written or spoken. These confusing drug names are one of the main causes of medication error. There are many sound and look alikedrugs that would result in medication error. These errors may cause harm or even death to patients [1], [2], [3].

According to the results from United States Pharmacopoeia, around 1400 commonly used medications were involved in such errors. A group of medicines that have similar actions often have similar sounding brand names. The generic medicine is one that contains identical amounts of the same active ingredient, in the same strength and in the same dosage form. When doctor writes a prescription they will nominate the medicine to be used-usually the originate brand name for the drug required. Certain drugs have names that may appear similar when carelessly written; liable to confusion. Problems are likely if the strengths and doses of the two preparations are similar [4], [5], [6].

As more medicines and new brands are being marketed in addition to the thousands already available, many of these medication names may look or sound alike. With a number of drugs currently available, both of brand name and generic in the market, the potential for medication error due to confusing drug names is significant. Causes of look-alike, sound- alike (LASA) medication errors were identified; and include illegible handwriting, unfamiliarity with drug names, similarity in the spelling and/or pronunciation of drug names, newly available products, similar packaging or labelling, similar clinical use, similar strength, dosage

forms, frequency of administration, incorrect selection of a similar name from a computerized product list ,and the failure of manufacturers and regulatory authorities to recognize the potential for error and to conduct rigorous risk assessments, both for nonproprietary and brand names, prior to approving new product names.[7], [8], [9].

The role of drug names in medication errors

Brand names for drug products are intended to be unique and memorable to provide a simple and convenient way to identify products and distinguish one manufacturer's product from its competitors. The IOM reported pharmaceutical trademarks that look or sound alike have a major role in medication errors. Confusion related to product names is one of the most common causes of medication errors reported to the USP, the U.S.FDA and the ISMP. The cause of drug name mix- ups occurred. Some would say that pharmaceutical manufacturers should be more careful in developing and adopting brand names. Other would say prescribers are too careless when they write or phone in order and too slow to adopt computerized prescribing. When names are blurred on handwritten prescriptions or slurred in spoken order, medication errors are more likely.[18], [20].

- Doubts should be resolved by checking with the prescriber. Most cases, mistakes have occurred, because the item was dispensed without a second thought. A large number of them have similar sounding or similar looking names, which is a reason for major concern among the prescribing physicians. All these factors should clearly be borne in mind by the drugs controller while a brand name is approved. Therefore no two drugs should differ by an alphabet, syllable, suffix or prefix. There should be absolute clarity and differentiation of any two drugs whether the name are spokenor written.[11]

- In addition, when patients take multiple prescription medications and/or receive care from different health care providers, medication history information may be less reliable and more difficult to verify. As a result; the problem of Look-Alike/Sound-Alike drug names has become a significant challenge to pharmacists, pharmacy technicians, patients, and prescribers.[

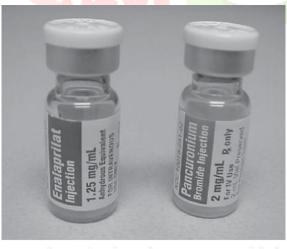TABLE 1: EXAMPLES OF SOUND-ALIKE BRANDED DRUG NAMES [32]

BRAND NAME (Generic name)	BRAND NAME (Generic name)
Celebrex® (*Celecoxib*)	Celexa® (*CitalopramHydrobromide*)
Losec® (*Omeprazole*)	Lasix® (*Furosemide*)
Lamictal® (*Lamotrigine*)	Lamisil® (*TerbinafineHydrochloride*)
Reminyl® (*Galantamine Hydrobromide*)	Amaryl® (*Glimepiride*)
Seroquel® (*Quetiapine Fumarate*)	Seroquel XR® (*QuetiapineFumarate*)
Yaz® (*Drospirenone and Ethinyl Estradiol*)	Yasmin® (*Drospirenone and Ethinyl Estradiol*)

- Medication incidents involving Look-Alike/Sound-Alike drug names can cause serious patient harm. It is often difficult to detect the error, as the dispensed medication is presumed to have been the one that is prescribed for the patient. In a community pharmacy, these errors can occur at any point in the medication use system, including prescribing, order entry, dispensing, administration and/or monitoring.1 Incident reporting can be used to gain a deeper understanding of contributing factors or potential causes leading to medication incidents involving look-alike/ sound-alike drug names.[10], [19].

- Errors from well knownlasa medication names have been reported for example the confusion between Losec(omeprazole) and Lasix(furosemide) Led to the incidents that the patients were given lasix instead of the prescribed losec, which resulted in the patient death.[29].

Table 2: Examples Of Sound-Alike Generic Drug Names[32]

Generic Drug Names	Generic Drug Names
Ranitidine	Roxithromycin
Hydralazine	Hydroxyzine
Glibenclamide	Glipizide
Lasix	Losec
Loratadine	Lorazepam
Gliclazide	Glipizide
Merislon	Mestinon
Voltaren	Ventolin

Source: Desselle SP, Zgarrick DP, Alston GL: *Pharmacy Management: Essentials for All Practice Settings*, 3rd Edition: www.accesspharmacy.com

Fig 1: EXAMPLES OF LOOK ALIKE MEDICATIONS

MEDICATION ERROR

The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) of USA defined a "medication error" as "any preventable eventthat may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing; order communication; product labeling, packaging, and nomenclature; compounding; dispensing; distribution;administration; education; monitoring; and use". [12], [25].

- ### CAUSES OF MEDICATION ERRORS

The Institute of Safe Medication Practices (ISMP) has identified 10 key system elements that have the greatest influence on medication use. System-based causes of medication errors can be directly traced to weaknesses of failures in thesekey elements.

1. Patient information,
2. Drug information,
3. Communication related to medications,
4. Drug labeling, packaging, and nomenclature
5. Drug standardization, storage and distribution,
6. Medication delivery device acquisition, use and monitoring,
7. Environmental factors,
8. Staff competency and education,
9. Patient education,
10. Quality processes and risk management.

From these 10 key elements, there were 2 elements relating to drug names or drug labeling, packaging namely communication related to medications and drug labeling, packaging and nomenclature [23].

- ### MEDICATION ERRORS ASSOCIATED WITH LOOK-ALIKE AND SOUND-ALIKE DRUGS.

Since 2000 FDA has received more than 95,000 reports of medication errors. Approximately 25% of errors reported to national medication error reporting programs result from confusion with drug names that look or sound alike. A retrospective study published in the American Journal of Health-System Pharmacy assessed deaths related to medication errors, including those resulting from confusing drug names. Of 5,366 medication errors identified between 1993 and 1998, 16% resulted from administration of the wrong drug and 10% from employment of the wrong administration route. Many of these errors were connected with LASA drug names. The April 2008 issue of CAPSlink reported that between 2003 and 2006 US healthcare providers confused more than 3,170 pairs of generic and brand drug names. The problem does not stop there. A 2005 report in the Journal of Postgraduate Medicine noted frequent instances of LASAs involving foreign drug names. Commonly, Americans traveling outside the United States return with medications purchased abroad. They may think these medications are identical to US products with brand names that are the same or similar, but often this is not the case. Examples cited included Dianben (metformin) and Diovan (valsartan) in Spain, Avanza (mirtazapine) and Avandia (rosiglitazone) in Australia, and Trip (nortriptyline) and Triz (cetirizine) in India. In February 2008, the USP released its 8th annual MEDMARX data report, detailing evaluations made between January 1, 2003 and December 31, 2006 of more than 26,000 records from more than 670 healthcare facilities. Among LASA drug errors, 384 (1.4%) had led to harmful patient outcomes. Of these, 64.4% originated at the dispensary, with pharmacy technicians committing the initial error in 39% of cases and pharmacists in 24% of cases [18], [19], [25], [26].

- ### DRUG LABELING, PACKAGING AND NOMENCLATURE

Labeling and packaging problems are the second most frequent category of medication errors reported to the US Pharmacopeia Medication Errors Reporting Program (USP MERP). They account for over 20% of all reports. Most reports find that commercial labeling and packaging were the cause. The problem often stems from the use of nearly identical packaging for two separate items[16], [20].

To facilitate proper identification and use of drugs, product manufacturers, regulatory agencies, and health care organization, especially pharmacies, should ensure that all drugs are provided in clearly labeled containers, including unit dose packages for institutional use, and should take steps to prevent errors with look-alike and sound-alike drug names, ambiguous drug packaging, andconfusing or absent drug labels.[30]

Based on the information above, drug name and drug packaging have been a cause of medication errors. The problem of drug name or drug packaging arose from LASA drug name and look-alike drug packaging. In

short, 2 elements related to drug names or drug labeling, packaging were the important cause of medication errors.[35]

- **Errors from well-known LASA medication names**

The confusion between Losec® (omeprazole) and Lasix®(furosemide), led to the incidents that the patients were given Lasix®instead of the prescribed Losec®, which resulted in the patients' death. Another example of asomewhat hazard-prone confusion between Levoxine® (levothyroxine sodium) and Lanoxin® (digoxin), where the patients received Lanoxin® instead of the prescribedLevoxine® [29]. During the timeframe 2003-2006, USP identified 1,470 unique drugs implicated in look-alike and/or sound-alike medication errors from the MEDMARX® andUSP-ISMP Medication Errors Reporting Program. These drug names contributed to more than 3,170 pairs and each drug was listed along with the other drugs involved inthe mix-up [13], [14], [27].

- **THE ROLE OF DRUG PACKAGING AND LABELING IN MEDICATION ERRORS**

Health professionals are taught to read labels three times, specifically, when obtaining a drug package, when using it, and when returning it tostock or discarding an empty package. Most claim to do this routinely, but there is much evidence to the contrary. Although proper training and increased vigilance are undeniably important, attention to the design of drug packaging and labeling is also essential. Poor labeling and packaging frequently contribute to medication error [20].

The example error includes a patient admitted to the oncology unit with electrolyte imbalances was mistakenly administered Primacor®(milrinone, for heart failure) instead of potassium chloride, because Primacor® and Potassium chloride injection had similar foil-wrap packages. This reflected a look-alike packaging medication error. The patient fortunately suffered no significant harmful effects from the administration of Primacor®. In Canada, in an infant requiring short-term ventilation and sedation, chloral hydrate oral liquid 70 mg was ordered for administration. Pharmacist inadvertently prepared and dispensed potassiumchloride oral liquid instead. The hospital, in investigating and analyzing the incident,identified that the two stock bottles of liquid preparation (chloral hydrate and potassium chloride) appeared very similar. Both products were manufactured by same pharmaceutical company .In addition, ISMP Canada reported a pharmacy technician picked up a carton of concentrated potassium chloride bottles instead of a carton of sodium chloride for injection of the renal dialysis patients. The confusion occurred because cartons of stocked potassium chloride solutions were located near sodium chloride solutions. The result of this incident was two patients deaths.[35]

LITERATURE REVIEW

Information from literature review relating to research objectives was obtained and presented below.This includes information about patient safety policy, medication safety, medication error, look-alike/sound-alike medication and risk management system. Some proprietary (brand name) and non-proprietary names (generic name) sound or appear to be similar to other drugs when written or spoken. These confusing drug names are one of the main causes of medication error. There are many sound and look alike drugs that would result in medication error. These errors may cause harm or even death to patients [31]. According to the results from United States Pharmacopoeia, around 1400 commonly used medications were involved in such errors. A group of medicines that have similar actions often have similar sounding brand names. The generic medicine is one that contains identical amounts of the same active ingredient, in the same strength and in the same dosage form. When doctor writes a prescription they will nominate the medicine to be used-usually the originate brand name for the drug required. Certain drugs have names that may appear similar when carelessly written; liable to confusion [3], [33]

More than 33,000 trademarked and 8,000 nonproprietary medication names were reported in the United States alone in 2004, and an estimated 24,000 therapeutic health products were reported in the Canadian market (WHO, 2007a). On June 2011, the Institute for Safe Medication Practices (ISMP) (2011a, b) reported a listing of confusing drug names involved in medication errors that were reported through the ISMP National Medication Errors Reporting Program (ISMP MERP) (ISMP, 2011a). The United States Pharmacopeia (USP) also publishes a list of look-alike and sound- alike drug names periodically [8], [34], [36].

In 2005, the World Health Organization (WHO) launched the World Alliance for Patient Safety and identified six action areas which look-alike, sound-alike medication names is one of the inaugural patient safety solutions (WHO, 2007b). Similarly, in Thailand, the Thai Patient Safety Goals 2008 program was developed to improve medication safety with focus on LASA drugs. These confusing drug names are one of

the main causes of medication error. There are many sounds and look alike drugs that would result in medication error [17], [27], [38].

A cross-sectional survey was designed to study look-alike, sound-alike (LASA) drugs in hospitals in Thailand. The questionnaires were developed and mailed to 1,380 hospitals throughout Thailand. The return rate was 11.16% or 154 hospitals, consisting of 5 tertiary hospitals (3.25%), 3 university hospitals (1.95%), 16 secondary hospitals (10.39%), 96 primary hospitals (62.34%), 26 private hospitals (16.88%) and 8 others (5.20%). A total of 5,327 pairs of drugs were identified as LASA drugs, including 3,695 tablets/capsules (Ranitidine-Roxithromycin pair in the highest frequency), 944 injections (Diazepam- Furosemide pair in the highest frequency), 307 liquid dosage forms (Alum milk-Milk of magnesia pair in the highest frequency), 367 external drugs (0.02% Triamcinolone cream and 0.1% Triamcinolone cream pair in the highest frequency) and 14 pairs of chemotherapeutic agents. This LASA report could be integrated into a suitable program used in hospitals in order to identify and prevent medication errors in the future[37], [44].

Multidisciplinary interest of the research on look-alike/sound-alike drugs, and the difficulty to perform systematic review or meta analysis for many clinical questions that have great relevance. This review has identified technology and management solutions that could effectively limit, or eliminate, look-alike/sound-alike drugs errors in hospital wards, or outside the hospital where the risk is more uncontrollable: however look-alike/sound-alike drugs therapy errors are not supported by reliable statistics but events reported in the literature cannot be underestimated [45].

 Results indicate there are more potential LASA generic drug name pairs in the oncology formulary than are published in the literature. The risk detection methods used in this study identified unique and common LASA drug pairs. The Bigram Similarity algorithm identified 186 LASA drug pairs from 3320 possible pairs. The Levenshtein Distance algorithm, same first and last letters, and Lexi-Comp[R] methods identified 42, 75, and 38 LASA drug pairs, respectively. Five generic LASA drug pairs were identified in common by all four of the risk determination methods [12].

STRATEGIES TO PREVENT MEDICATION ERRORS RELATED TO LASA DRUGS:-

Many strategies that may help prevent medication errors due to confusion between drug names can be implemented. Identifying look-alike and sound-alike drug pairs used in our facility that are most often involved in errors can be a helpful first step [24].Then incorporating the following strategies to reduce the riskof errors with those medications may be considered:

• *Writing orders and prescriptions*

A study estimated that one-third of physicians' handwriting was illegible.22 Presumably little has changed over the years. To ensure that orders and prescriptions are legible, these may be printed instead of handwriting, may be written in sitting position rather than standing and should be written in a quiet area for writing what safety experts describe as a "sterile cockpit" [39].

• *Problematic abbreviations*

The FDA and ISMP in July 2006 embarked on a joint campaign to eliminate the use of potentially confusing abbreviations, symbols and dose designations in various forms of medical communications. These abbreviations, symbols and dose designations have been proven to be a barrier to effectivecommunication and have resulted in significant harm to patients. For example, instead of writing "QD" which is often misread as QID, it is recommended that health care professionals spell out the word "daily ''[44,48]

• *Tall man lettering*

Tall Man lettering involves highlighting the dissimilar letters in two names to aid in distinguishing between the two for example HumaLOG and HumuLIN, oxyCODONE and OxyCONTIN; ceFAZolin and cefTRIAXONE; and FLUoxetine and DULOXetine; clonazePAM and LORazePAM [17]

In addition to the institution for safe medical process (ISMP), several studies have shown that highlighting sections of drug names using tall man (mixed case) letters can help distinguish similar drugnames, making them less prone to mix-ups. ISMP, FDA, the Joint Commission, and other safety conscious organizations have promoted the use of tall man letters as one means of reducing confusion between similar drug names. [26,28] To promote standardization, ISMP has created a list of Look-Alike Drug Name Sets with Recommended Tall Man Letters.[41], [46] A list of some drugs to which anesthesiologists are usually familiar is given in Table 3.

Table 3: Tall Man Lettering for some drugs

1.	alDACTONE	2.	humALOG
3.	alDOMET	4.	humULIN
5.	alODORM	6.	hydrALAZINe
7.	alphaprESS	8.	hydrOCHLOROTHIAZIDe
9.	alphaprIL	10.	ketALAR
11.	amARYl	12.	ketOROLAC
13.	amOXIl	14.	laRGACTIl
15.	amIODARONe	16.	laMICTAl
17.	amLODIPine	18.	methADONe
19.	amITRIPTYLIne	20.	methYLPHENIDATe
21.	amINOPHYLLIne	22.	meTOhexal
23.	aPomine	24.	meLLIhexal
25.	aVomine	26.	morphine
27.	arABLOC	28.	HYDROmorphone
29.	aTRopt	30.	NEOral
31.	aZopt	32.	INDEral
33.	azATHIOPRINE	34.	niFEDIPine
35.	ERYthromycin	36.	niMODIPine
37.	azITHROMYCIN	38.	niZATIDine
39.	bisOPROLOl	40.	proMETHazine
41.	bisACODYl	42.	proCHLORPERazine
43.	OXCARBazepine	44.	propRANOLol
45.	CARBAMazepine	46.	propOFol
47.	carbIMAZOLe	48.	tEGRETOl
49.	caRVEDILOl	50.	tRENTAl
51.	caPTOPRIl	52.	tEMOdal
53.	celAPRAM	54.	tRAMadol
55.	DOBUTamine	56.	tORadol
57.	DOPamine	58.	trimEPRAZINE
59.	DEPO-medrol	60.	trimIPRAMINE
61.	SOLU-medrol	62.	CLONazepam
63.	depo-PROVERA	64.	DIazepam
65.	solu-CORTEF	66.	OXazepam
67.	SOLU-medrol	68.	diPYRIDAMOLe
69.	diPRIVan	70.	diSOPYRAMIDe

Fig 2: Dosage forms with tall man lettering

• *Including the indication*

Including a drug's indication on the prescription is a simple safety measure. The indication, whether handwritten or communicated via check boxes, helps pharmacists and others avoid confusion between look-alike drug names. For example, if it is unclear whether a prescription says Celebrex or Cerebyx, a check mark in the "musculoskeletal" box would suggest that Celebrex is the desired drug [14], [15].

• *Orders should be read back*

Orders given verbally, rather than in written form, are inherently problematic because of different dialects and accents, misinterpretations of names and strengths, etc. The key to a safe process is using "read back." The staff member should record the order directly onto the prescription pad/order sheet/computer as the prescriber is relaying it and then should read back the information to the prescriber. The prescriber should request the read back if it is not offered. During this process, spell the drug name and strength of the medication. For example, errors have been reported when the number 15 has been misinterpreted as 50. Always say "one five" for 15 or "five zero" for 50.22 [40]

• *Use of electronic systems*

Electronic prescribing systems can produce computergenerated prescriptions or can electronically transmit the prescription directly to the pharmacy. These systems (e.g., iScribe, MEDeMORPHUS, TouchScript) not only eliminate illegible handwriting but also can automate screening for allergies, drug-drug interactions, duplication of therapy, etc.[42], [43].

• *Labeling and storage*

We should follow the safe practices mentioned below for storage and usage of any medications.[49].

Separation of problematic drugs

Drugs with look-alike names or similar packaging should not be stored in close proximity to each other inthe medication storage area; medication storage area, rooms or sample closet should be examined frequently. Alphabetized drug storage can cause inadvertent mixups. In addition, segregate any "high- alert" medications that may be used in the practice (e.g., sedating agents or anesthetics) [32]. Different vaccines, tuberculin purified protein derivatives (PPD) and other injectable products that may be confused should be kept separately and auxiliary labels may be used. ISMP has reported on several mix-ups with PPD being given in place of vaccines and vice versa.22 External solutions, non-drug items, testing solutions, reagents and chemicals from internal products should be separated. External products such as benzoin and podophyllin should be labeled "for external use only." Hemoccult developers and glucose monitoring chemicals have been mistakenly used as eye drops.22 [50].

Keeping the storage area well-organized

A staff member should be assigned to routinely check (at least quarterly) all medications (including samples), reagents and other products that carry an expiration date and items that have expired should be discarded. The storage area should be maintained at temperatures between 57 and 84 degrees, it shouldnot be cramped, shelves should be at eye level with labels facing forward, and the area should be well-lit making it less likely the staff will misread labels.[49].

Controling access to medications

Security of medication storage area should be ensured. In addition, strict procedures for logging, storing and monitoring drug samples should be followed. All medications dispensed to patients should be properly labeled with the name of the medication, strength, dose, frequency, purpose, lot number, expiration date and quantity of medication, along with the patient's name, date of dispensing and prescribing, and prescribing information. Patients should receive written and oral drug information for all sample medications. Any vaccines dispensed or administered by the practice must be documented in a logthat contains the name of the vaccine, lot number, expiration date, the patient name, dose and the date administered. All multiple-dose vials of injectable medication (e.g. lidocaine, dexamethasone, prochlorperazine, vitamin B12) should be labeled with the date opened and the date on which the unused product will be discarded (ideally no later than 30 days after opening) [7], [21].

- *DRUG DEVICES*

The use of proper drug devices, along with adequate training, can have a significant impact on patient safety. All liquid oral medications prescribed or dispensed in the office should be administered using a proper measuring device. For parenteral administration of any drug right syringes should be used. The use of parenteral syringes to administer oral medications, a common but dangerous practice, has resulted in aspiration of the syringe tips when they are not removed. (Liquid medications can be drawn into parenteral syringes without removing the tip of the syringe). Train staff to use the devices properly. All office personnel who dispense or prescribe any device (multiple daily injection devices, glucose monitoring devices, etc.) should be educated on its use. If staff members cannot educate the patient on how to use and maintain the device, they should instruct the patient to speak with the pharmacist.[22], [50].

- *PATIENT EDUCATION*

Patients should be given both oral and written instructions on the use of their medications, and they or their caregivers should be asked to repeat back the information to demonstrate complete understanding. While it may seem unnecessary, prescribers need to stress to patients the importance of getting the prescription filled and taking the medication as ordered. Health care professionals must provide adequate patient education about the appropriate use of their medications as part of any error prevention program. Proper education empowers the patient to participate in their health care and safeguard against errors. Some examples of instructions to patients that can help prevent medication errors are

1.   Know the names and indications of your medications
2.   Read the medication information sheet provided by your pharmacists
3.   Do not share your medications
4.   Check the expiration date of your medications and dispose off expired drugs
5.   Learn about proper drug storage
6.   Keep medication out of the reach of children
7.   Learn about potential drug interactions and warnings [43], [47]

- *CULTURE CHANGE*

We should look for system changes that will help prevent future errors. Office personnel should share past experiences and follow the literature for errors that have been reported in articles or case presentations. This mix-up of internal and external information can be effective in leading us to systemchanges that will ensure safe patient care.[40].

ROLE OF PHARMACEUTICAL COMPANIES

The factors for the medication-use process needs to be simple and should follow the principle of standardization, differentiation and lack of duplication. Unfortunately, these principles are not followed in drug naming, labeling, and packaging. Instead, current methods are based on long-standing commercial considerations and bureaucratic procedures. Drug companies have to undergo a lengthy and complex process for naming a marketable drug that involves submission of a new chemical entity and patent application, generic naming, brand naming, FDA review, and final approval. Pharmaceutical companies seek the fastest possible approval and may believe that the incremental benefit of evaluating human factors is small. "Trade dress" is the concept that underlies labeling and packaging issues for the drug industry. Even FDA standards do not require application of human factor principles, therefore drug names, labels, and packages are selected and designed in accordance with the marketplace rather than for practice conditions.

There are well-known, effective methods for minimizing confusion and making it more difficult to commit medical errors. However, pharmaceutical companies tend to resist implementing these methods because of the complexity, cost, concern about increasing already cumbersome regulations, fear of liability exposure, and loss of competitive advantage. Therefore, some new approach or combination of approaches is required to help us discover and continually define methods for improving safety. Pharmaceutical companies on the other hand do not seem to own the problem of safety associated with look-alike drugs; they are satisfied with meeting minimum regulatory requirements for labeling and packaging.[54], [56]

ROLE OF FDA IN PREVENTING MEDICATION ERRORS RELATED TO LASA DRUGS:-

Steps taken by the US FDA to curtail the medication errors are listed below.

a) Reviewing drug names to minimize confusion: the federation has launched "Name Differentiation Project" and issued letters to manufacturers of look-alike name pairs to voluntarily revise the visual appearance of their established names (e.g. acetahexamide and acetazolamide)

b) Use of bar codes: the use of machine-readable codes on all medication packages and containers is considered as a promising technology to reduce medication errors.

c) Analyzing reported errors: the FDA is analyzing the errors for causality and trying to prevent these

d) Creating guidances for industry: the NCC has also developed recommendations for prescribing, dispensing, manufacturing and storage to prevent medication errors and patient harm

e) Educating the public: public education and awareness about medication errors is essential for its prevention.[54], [55].

SUGGESTED ACTIONS BY WHO MEMBER STATES:-

The following strategies should be considered by WHO Member States.
1. Ensuring that health-care organizations actively identify and manage the risks associated with LASA medications by:

a)   Annually reviewing the LASA medications used in their organization.

b)   Implementing clinical protocols which: Minimize the use of verbal and telephone orders.
Emphasize the need to carefully read the label each time a medication is accessed and again prior to administration, rather than relying on visual recognition, location, or other less specific cues.
Emphasize the need to check the purpose of the medication on the prescription/order and, prior to administering the medication, check for an active diagnosis that matches the purpose/indication.
Include both the nonproprietary name and the brand name of the medication on medication orders and labels, with the nonproprietary name in proximity to and in larger font size than the brand name.
c.   Developing strategies to avoid confusion or misinterpretation caused by illegible prescribing or medication orders, including those that:
Require the printing of drug names and dosages.

Emphasize drug name differences using methods such as "tall man" lettering.

d.   Storing problem medications in separate locations or in non-alphabetical order, such as by bin number, on shelves, or in automated dispensing devices.
e.   Using techniques such as boldface and colour differences to reduce the confusion associated with the use of LASA names on labels, storage bins and shelves, computer screens, automated dispensing devices, and medication administration records
f.   Developing strategies to involve patients and their caregivers in reducing risks through:
g.   Providing patients and their caregivers with written medication information, including medication indication, nonproprietary and brand names, and potential medication side effects.
h.   Developing strategies to accommodate patients with sight impairment, language differences, and limited knowledge of health care.
i.   Providing for pharmacist review of dispensed medications with the patient to confirm indications and expected appearance, especially when dispensing a drug that is known to have a problematic name.
j.   Ensuring that all steps in the medication management process are carried out by qualified and

competent individuals.

k.　　　Incorporating education on potential LASA medications into the educational curricula, orientation, and continuing professional development for health-care professionals.

l.　　　Ensuring that organizations with responsibility for procurement of medicines.

Incorporate LASA considerations and user testing into the new product acquisition process. b.Are aware that a single brand name may be associated with different drugs in different countries.

2.　　　Advocating increased emphasis on patient safety in the naming of drugs and the elimination of LASA names through participation on national and international regulatory, standard, and advisory boards.

3.　　　Collaborating with international agencies and industries to implement: a)A universal drug naming convention.

b)　　　Screening of existing drug names for potential confusion with a new drug name prior toapproval of the latter.

c)　　　Standardized suffixes (e.g. sustained release medications). d)Strategies for focusing efforts on newly-introduced medications.[50], [57].

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