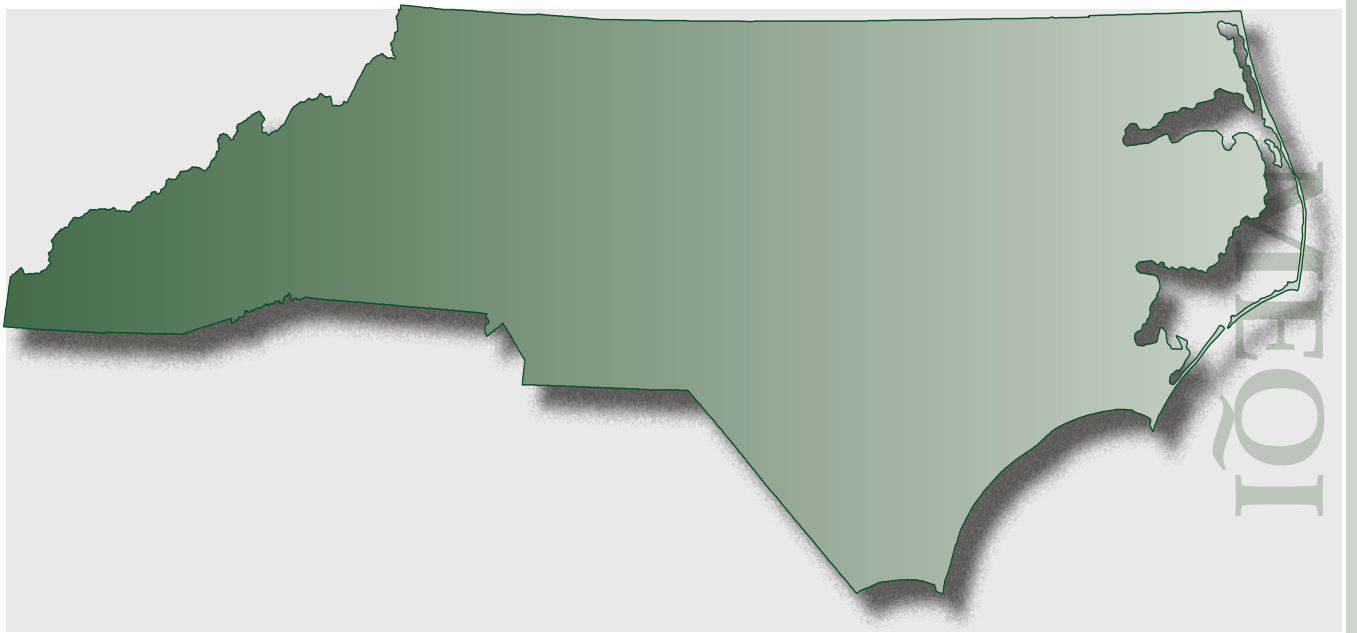
Nursing Home Medication Error Quality Initiative

MEQI Report: Year Four

October 1, 2006 to September 30, 2007

(Includes minor medication data corrections 7.08)



A report on the fourth year of mandatory reporting of medication errors for all state licensed nursing homes in North Carolina.

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MEQI Overview

The Medication Error Quality Initiative (MEQI) has now collected a fourth year of data on medication errors reported in nursing homes in North Carolina. Nursing homes licensed by North Carolina are required by law (Senate Bill 1016) to report all actual and potential medication errors. Data have been successfully submitted for 100% of open and functional facilities during this time. For the first three years, sites utilized an online annual summary reporting format, submitting summary data for one year at a time—this system is now referred to as ***MEQI-Annual Report*** or ***MEQI-AR***. During the last reporting year access to an improved interactive online individual incident reporting system was made available as an option to all sites—this system is referred to as ***MEQI-Individual Error*** or ***MEQI-IE***. MEQI-IE provides greater functionality and access to data for the nursing home staff, and provides more detailed and useful data for the MEQI project. During this reporting year 203 of 393 sites (52%) utilized the MEQI-IE System, while 190 sites (48%) continued to use MEQI-AR. **(See Table 1 and Table 2 for additional summary data)** Some of the specific data reporting categories were changed with the introduction of the new system, therefore comparisons to past years data are limited in this report. The MEQI-IE data are reassuring since trends are similar to those seen in the MEQI-AR data. Facilities are appreciative of the new system and are beginning to use it as tool for improved internal quality initiatives

MEQI

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This report is the fourth in a series produced by: The Cecil G. Sheps Center for Health Services Research (Sheps Center) at the University of North Carolina at Chapel Hill and the North Carolina Department of Health and Human Services, Division of Health Services Regulation.

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MEQI Summary Results

Table 1. MEQI Summary Results (10-1-06 to 9-30-07)

Summary	MEQI-AR Error Report	MEQI-IE Error Report	MEQI-IE Repeat Occurrence
TOTAL ERRORS	7,749	5,802	27,926
NUMBER OF SITES	190	203	203
MEAN (AVERAGE PER SITE)	41	28	137
MEDIAN PER SITE	19	18	78
ERRORS PER 100 BEDS	34	23	115

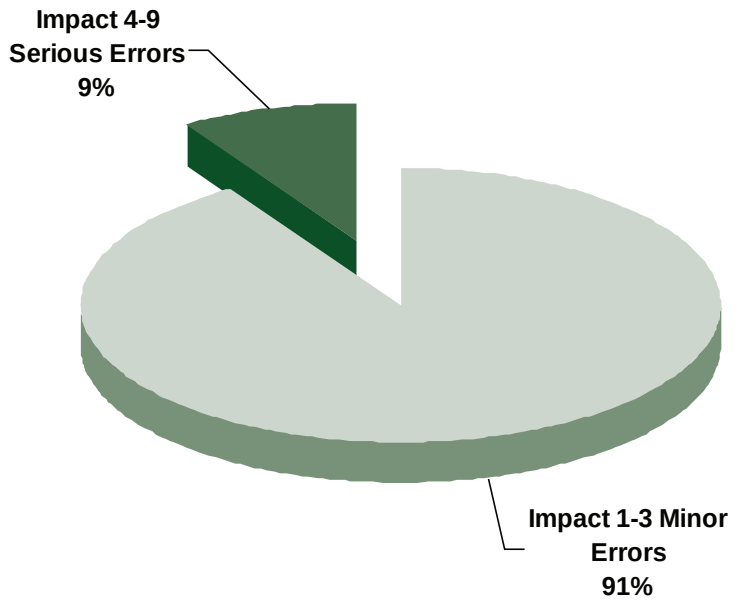
MEQI-AR errors are entered in summary form. Repeat errors are not reported consistently in MEQI-AR. MEQI-IE errors are submitted as individual "error reports" that describe a distinct error. When MEQI-IE error reports are submitted sites are asked to indicate the number of times the error is repeated, this is noted above as the "repeat occurrence". An example would be an incorrect dosage of a once daily medication (1 error report) that is given incorrectly for five days before noticed (5 repeat occurrences).

Table 2. MEQI Impact/Outcome (10-1-06 to 9-30-07)

Impact/Outcome	# MEQI-AR error reports	% MEQI-AR error reports	# MEQI-IE error reports	% MEQI-IE error reports	# MEQI-IE repeat occurrence	% MEQI-IE repeat occurrence
Impact 1: Capacity to cause error (no patient involved)	176	2.2%	252	4.4%	1,059	3.8%
Impact 2: Error did not reach the patient	1,137	14.7%	414	7.1%	1,492	5.3%
Impact 3: Error reached but did not harm the patient	5,802	74.9%	4,526	78.0%	22,665	81.1%
Impact 4: Required monitoring / intervention to preclude harm	589	7.6%	551	9.5%	2,193	7.9%
Impact 5: Resulted in temporary patient harm	31	0.4%	43	0.7%	468	1.7%
Impact 6: Resulted in temporary harm, required trip to ER	14	0.2%	16	0.3%	49	0.2%
Impact 7: Contributed to permanent patient harm	0	0.0%	0	0.0%	0	0.0%
Impact 8: Intervention necessary to sustain patient's life	0	0.0%	0	0.0%	0	0.0%
Impact 9: Contributed to patient's death	0	0.0%	0	0.0%	0	0.0%

Impact, Population

Figure 1. Impact/Outcome Over Four Years (1-1-04 to 9-30-07)



Data Limitations

- Self-report by all sites
- Self-selection to MEQI-IE
- MEQI-AR sites might include repeats as separate errors
- Submitted data are not validated.
- Blame is sometimes assigned elsewhere
- Forms request limited information.
- Fear of reporting might leave some errors unreported.
- Lack of technological expertise/ computer support can lead to incorrect data.

The nursing home patient population affected by medication errors is mostly female, which is reflective of the overall nursing home population. Over half of the error reports involve those over age 80. Most of the patients involved in errors (over 65% in both systems) are determined by staff to be unable to direct their own care. (Table 3)

Table 3. Characteristics of Population Affected by Medication Errors
(10-1-06 to 9-30-07)

Age	Percentage AR errors n = 7,749	Percentage IE errors n = 5,802
64 years or younger	9%	14%
65-79 years	34%	29%
80 years or older	55%	53%
Not applicable (no patient involved - Impact #1)	2%	4%
Gender	**AR errors**	**IE errors**
Male	25%	29%
Female	73%	67%
Not applicable (no patient involved - Impact #1)	2%	4%
Patient Ability	**AR errors**	**IE errors**
Patient Able to Direct Own Care	25%	27%
Patient Unable to Direct Own Care	70%	66%
Not applicable, no patient involved or unknown	5%	7%

Primary Types of Error

Table 4. Primary Types of Error
(10-1-06 to 9-30-07)

Primary Types of Error	% MEQI-AR n=7,749	% MEQI-IE n=5,802	% MEQI-IE Impact 1-3 Minor n=5192	% MEQI-IE Impact 4-9 Serious n=610
Dose omission	53%	41%	43%	23%
Overdose/multiple dose	9%	13%	12%	**18%**
Wrong product strength	6%	6%	6%	7%
Wrong product	4%	6%	5%	**12%**
Under dose	4%	4%	4%	3%
Wrong time	4%	3%	3%	3%
Expired order	4%	2%	3%	2%
Wrong documentation	4%	6%	7%	3%
Wrong patient	3%	4%	3%	**16%**
Wrong duration	2%	2%	2%	1%
Monitoring error	2%	2%	2%	1%
Wrong form of product	1%	1%	1%	0%
Labwork error	1%	1%	1%	2%
Wrong rate of administration	1%	0%	0%	0%
Wrong technique	0%	1%	0%	1%
Wrong route	0%	0%	0%	0%
Expired product	0%	0%	0%	0%
Other	2%	8%	8%	8%

Most medication errors in NC nursing homes are dose omission errors which account for 53% of MEQI-AR errors and 41% of MEQI-IE errors. The primary types of error are consistent between MEQI-IE and MEQI-AR. The differences that occur are most likely due to MEQI-AR sites including "repeat occurrences" as errors, or due to the nature of the homes that have chosen to begin using MEQI-IE (early adopters of new technology might tend to differ from others).

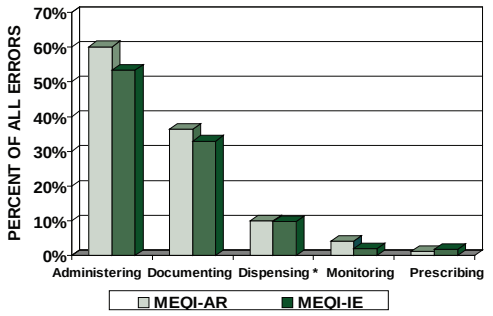
Table 4 shows the primary types of errors for both MEQI-AR and MEQI-IE, and also by impact category for MEQI-IE. There are clear differences between the types of error that are *minor* (impact 1-3) and those that are *serious* (impact 4-9). Some of the primary types of errors are much more likely to have serious patient impact; 5.5 times more likely for wrong patient, 2.3 times more likely for wrong product and 1.5 times more likely for overdose/multiple dose errors. Though dose omission errors are less likely to have serious patient outcomes, they still cause the largest percentage of serious errors (23%).

Phase, Personnel, Shift

Figure 2 shows the phase of medication delivery during which the error first occurred. During the four years of reporting, nursing home errors have primarily originated in the administering and documenting phases. MEQI-AR reports slightly more errors in documenting, administering and monitoring, possibly due to repeat errors. Data from MEQI-IE indicate that errors that began in the prescribing phase are more likely to be serious—of the 107 errors in this category 23% lead to a serious outcome compared to 9% for all errors. However the numbers of errors in this category are small.

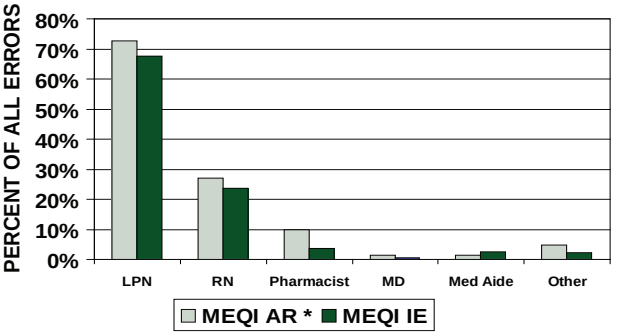
Most of the errors in nursing homes are made by LPNs and RNs, as they are the primary personnel on site (Figure 3). There are no significant differences between the two systems or between minor and serious errors in the personnel category.

Figure 2. Phase Where Error First Occurred
(10-1-06 to 9-30-07)



*Note: We know that some administration errors are being incorrectly reported as dispensing errors.

Figure 3. Personnel Involved in Error
(10-1-06 to 9-30-07)



*Note MEQI-IE numbers are primary personnel only, secondary personnel are separate. MEQI-AR sites might have multiple personnel for one error.

With MEQI-IE we can also now look at the shift on which errors occur (Table 4a). Most errors occur during the day on the 7 a.m. to 3 p.m. shift. However when we focus on the serious errors we see that while only 9.8% of the 7 a.m. to 3 p.m. shift errors are serious, a significantly greater proportion, 12.3% of the 3 p.m. to 11 p.m. shift, are serious (Figure 4b).

Figure 4a. Work Shift of Error Occurrence
(10-1-06 to 9-30-07)

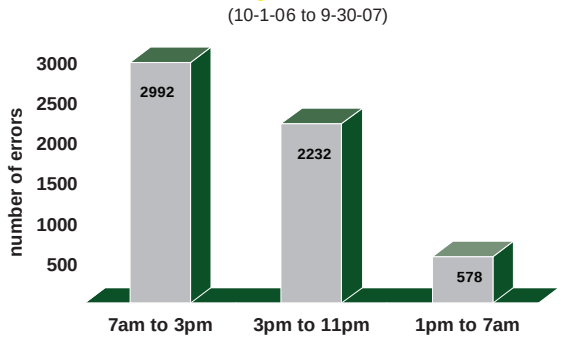
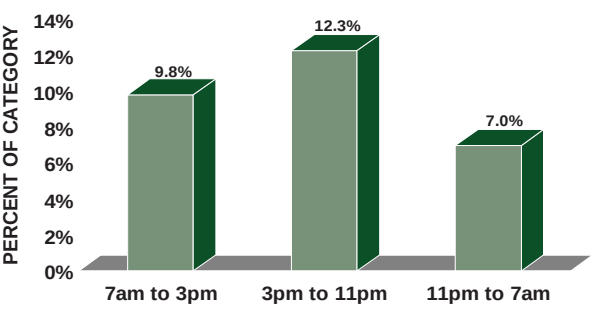


Figure 4b. Percent of Errors By Work Shift That Have a Serious Outcome
(10-1-06 to 9-30-07)



Error Effects, Transition

Table 5. Common Effects of Error (10-1-06 to 9-30-07)

Effect	MEQI-AR	MEQI-IE
Change in Blood Sugar	131	69
Somnolence (& lethargy)	54	46
Change in Blood Pressure	38	34
Excessive Side Effects	46	22
Cognitive Change	39	16
Nausea/Vomiting	14	8
Allergic Reaction	10	8
Constipation/Diarrhea	25	8
Edema	9	8
Fall	13	7
Headache	14	7
Other effects. Examples: pain, seizure, weight loss, agitation/anxiety	182	81

Medication errors lead to physical effects, some more serious than others. For both systems nursing homes were allowed to select more than one physical effect per error report. *Change in Blood Sugar* was the most noted effect in both the MEQI-AR and MEQI-IE systems (Table 5).

In the 7,749 MEQI-AR error reports 1,272 physical effect responses were included. Of these, 697 (55%) of the responses were listed as inadequate effect of the medication. The remaining 575 (45%) of responses reported a specific physical effect of the error on the patient. In the 5,802 MEQI-IE error reports 907 physical effect responses were included. Of these, 593 (65%) were listed as inadequate effect of the medication. The remaining 314 (35%) of responses reported a specific physical effect of the error on the patient.

Figure 5. Effects of Error MEQI-IE
(10-1-06 to 9-30-07)

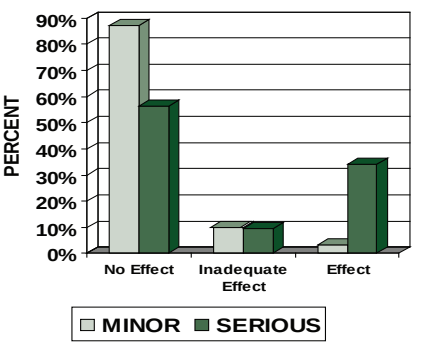
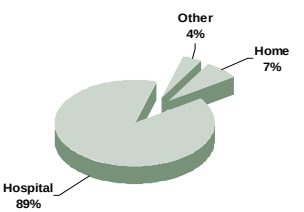


Figure 5 compares the minor and serious error effects in MEQI-IE. As expected, the error reports on more serious errors are more likely to have a physical effect on the patient than minor errors. The large percentage of no effect errors in the serious group, most likely fall in the Impact 4 category—monitoring and/or intervention was required—the patient was monitored but no harm, or effect, occurred.

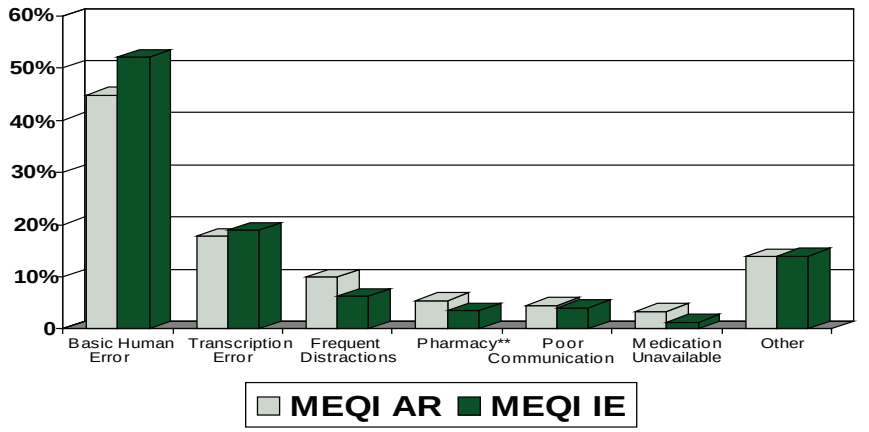
Figure 6. MEQI-IE Error Occurred During Transition, n=581
(10-1-06 to 9-30-07)



The MEQI-IE system now records whether or not the error occurred during transition. About 10% of MEQI-IE errors (581) are reported as occurring during a patient transition. These errors occur primarily in transition from the hospital. Seventy-three or 12.5% of these transition errors were in the serious outcome categories.

Possible Causes of Error

Figure 7. Possible Cause of Error
(10-1-06 to 9-30-07)



*More than one cause can be selected in either system. Percent is of total causes submitted (AR n= 11,414 , IE n = 7,779)
** Pharmacy includes 4 variables: pharmacy closed, pharmacy delivered to wrong facility, pharmacy delivered wrong med, pharmacy dispensing.

Facilities are also asked to provide information on the cause of the error (Figure 7). More than one cause can be selected for any individual error. In MEQI-AR, which is provided in summary format, there is no way to link a cause to a specific error. For MEQI-IE, the cause is linked to the incident, so the data can be used to determine causes that lead to more serious errors. In over 50% of the errors *basic human error* is listed as one of the causes. *Basic human error* was not one of the original allowable causes; however it was later added because of the large number of requests from nurses who felt that many errors were explained, at least in part, by human failings. With MEQI-IE we can analyze which causes were selected in combination with basic human error.

Figure 6 has an *other* category that includes causes which were indicated in a small number of errors, however some of these are of interest for further exploration. These include: *medication name confusion* (176 AR, 82 IE), *packaging design* (121 AR, 80 IE), *product labeling* (80 AR, 59 IE), *shift change* (113 AR, 61 IE), *improper training* (127 AR, 64 IE), and *too much workload/overtime* (94 AR, 37 IE). For some of these causes a more detailed analysis by medication, primary type of error, or personnel will be conducted and results, if significant, will be shared with sites. For example, Table 6 shows some of the year 4 *name confusion* errors.

Table 6. Name Confusion Errors: Selected Errors from MEQI-IE
(10-1-06 to 9-30-07)

hydroxyzine	hydralazine
TOPAMAX®	TOPROL-XL®
BENADRYL®	benazapril
glyburide	glipizide
clorazepate	clonazepam
ZETIA®	ZEBETA®
CEFTIN®/cefuroxime	CEFZIL®/cefprozil
AMBIEN®	ATIVAN®

Common Medications

Table 7 shows the medications reported by those sites using the MEQI-AR summary form. MEQI-AR only requires the sites to list 10 medications and how many times this medication was involved in an error. Though this is less accurate than our MEQI-IE data, it was purposely designed this way when the reporting process was started to limit the information requested and reduce the reporting burden for sites. If a site has more than 10 errors or medications, they are asked to list the medications from the most serious or the most frequent errors. For MEQI-IE we have at least one medication listed for each error report (Table 8). In the cases where there were two drugs involved both the medication intended to be given, and that involved in the error is collected. In the 5,802 error reports submitted there were 472 individual medications that were given to the patient or involved in error. Medications are not manually entered into MEQI-IE, but rather are selected from

Table 7: MEQI-AR: Most Common Medications Involved In Error (10-1-06 to 9-30-07)

Active Ingredient Name	# of errors
WARFARIN	311
LORAZEPAM	245
INSULIN	228
FUROSEMIDE	227
OXYCODONE (and combinations)	199
HYDROCODONE (and combinations)	165
SENNA	144
FENTANYL	109
QUETIAPINE	94
PREDNISONE	90
DOCUSATE	89
ALPRAZOLAM	88
DONEPEZIL	84
SIMVASTIN	78
FERROUS SULFATE	71
MULTI-VITAMIN	65
ZOLPIDEM	65
POTASSIUM CHLORIDE	62
LEVOTHYROXINE	57
TRAZADONE	54

Table 8: MEQI-IE: Most Common Medications Involved In Error (10-1-06 to 9-30-07)

Active Ingredient Name	# of errors
WARFARIN	312
LORAZEPAM	293
INSULIN	262
HYDROCODONE (and combinations)	253
OXYCODONE (and combinations)	207
FENTANYL TOPICAL	167
ALPRAZOLAM	129
FUROSEMIDE	111
MORPHINE	87
POTASSIUM CHLORIDE	85
CLONAZEPAM	77
OMEPRAZOLE	71
ZOLPIDEM	70
DOCUSATE	64
LEVOTHYROXINE	62
ACETAMINOPHEN	59
METOPROLOL	54
QUETIAPINE	54
LEVOFLOXACIN	49
PREGABALIN	49

Therapeutic Class

a searchable, automated drug search tool. This drug search tool can be used with brand name or active ingredient. Information selected includes brand name, active ingredient, form, dosage and route. Despite the difference in how we collect the MEQI-AR and MEQI-IE data, the medications lists are very similar. Over four years we continue to see the same medications in our list of most common drugs. Many of these medications previously have been shown to be error prone or otherwise dangerous to use in older patients.

Classifications were done using primarily the American Hospital Formulary Service (AHFS) therapeutic class codes with some modifications (*http://www.ashp.org/ahfs/index.cfm*). In cases where a medication could be placed in more than one class, selections were made on common usage of such drugs in the elderly or most common use of a specific dosage (Table 9 and Table 10).

Table 9: MEQI-AR: Therapeutic Class Involved In Error
n=4481 (10-1-06 to 9-30-07)

Therapeutic Class	# errors	% errors
Central Nervous System Agents (lorazepam, oxycodone, morphine)	1733	39%
Hormone and Synthetic Substitutes (insulin, levothyroxine)	562	12%
Vitamins and Nutritional Products (nutritional supplements, vitamins)	418	9%
Blood Formation, Coagulation, and Thrombosis (warfarin)	401	9%
Gastrointestinal Agents (omeprazole, docusate)	358	8%
Cardiovascular Agents (metoprolol, digoxin)	299	7%
Electrolytic, Caloric and Water Balance Agents (furosemide)	241	5%
Anti-infective Agents (vancomycin)	207	5%
Miscellaneous Therapeutic Agents	72	1%
Skin and Mucous Membrane Agents (lidocaine, nystatin)	44	1%
Respiratory Tract Agents (guaifenesin, benzonatate)	42	1%
Diagnostic Agents (tuberculin purified protein)	25	1%
Antihistamine Drugs (benadryl)	24	1%
Other: Autonomic Drugs,Serums, Toxoids, and Vaccines, Eye, Ear, Nose and Throat Preparations, Anti-Neoplastics, Local Anesthetics, Heavy Metal Agonists, Smooth Muscle Relaxants	55	1%

Table 10: MEQI-IE: Therapeutic Class Involved In Error
n=5,802 (10-1-06 to 9-30-07)

Therapeutic Class	# errors	% errors
Central Nervous System Agents (lorazepam, oxycodone, morphine)	2259	39%
Hormone and Synthetic Substitutes (insulin, levothyroxine)	571	10%
Cardiovascular Agents (metoprolol, digoxin)	491	8%
Gastrointestinal Agents (omeprazole, docusate)	447	8%
Blood Formation, Coagulation, and Thrombosis (warfarin)	469	8%
Anti-infective Agents (vancomycin)	437	8%
Vitamins and Nutritional Products (nutritional supplements, vitamins)	354	6%
Electrolytic, Caloric and Water Balance Agents (furosemide)	148	3%
Eye, Ear, Nose and Throat Preparations (gentamicin, tobramycin)	126	2%
Autonomic Drugs (baclofen)	122	2%
Respiratory Tract Agents (guaifenesin, benzonatate)	100	2%
Skin and Mucous Membrane Agents (lidocaine, nystatin)	90	1%
Miscellaneous Therapeutic Agents	80	1%
Other: Serums, Toxoids, and Vaccines, Antihistamine Drugs, Smooth Muscle Relaxants, Anti-Neoplastics, Diagnostic Agents, Heavy Metal Agonists, Local Anesthetics	108	2%

Focus Areas for Year 5

The medication errors reported to the MEQI program are a small percentage of the probable opportunity for error in the nursing home setting. The 393 licensed nursing homes in North Carolina have close to 47,000 beds. We estimate that each nursing home resident takes 8.07 different medications per day, and an additional 3.15 possible as needed medications *(2003 National Medication Usage Study Data, Tobias and Sey, unpublished).* Many of these medications are taken multiple times per day, leading to many additional opportunities for error. North Carolina is the only state collecting this level of information on each error and potential error in the nursing home setting, and the nursing home staff have responded with a high level of reporting, and a desire to improve patient safety by adopting new forms and technologies—even when their staff time and resources are limited. For those nursing homes using MEQI-IE, this year will bring a new improved drug search tool and additional reporting features that will allow sites to print expanded reports for use by their medication management advisory committees.

Items for Consideration

- ► Improve training on high-alert common medications that cause the most serious errors: warfarin, insulin, oxycodone, metoprolol, potassium chloride.
- ► Take steps to reduce *wrong patient* errors. Make sure orders are written in the correct chart. Make sure orders are transcribed correctly and to the correct chart/ MAR. Check medications that come from the pharmacy to make sure they are for the correct patient. Have systems in place for making sure that residents can be correctly identified, even by new or temporary workers.
- ► Take steps to reduce *wrong product* errors. Put systems in place for double checking medications prior to administration.
- ► Take steps to reduce *overdose* errors, Put systems in place for checking dosages. Make sure nurses are recording administration, so that a second dose is not given inadvertently.
- ► The 3-11 pm (evening) shift appears more likely to have serious errors. If errors are occurring during this shift at your facility, take extra steps to ensure adequate training and provide additional support for that shift.
- ► All MEQI-AR sites should consider switching to the new MEQI-IE system to take advantage of the automated drug search tool, on site report printing, and site accessible data.

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