A Report On

PROBLEMS ASSOCIATED WITH MEDICATION, PATIENT TRANSPORTATION, AND SPECIMEN DELIVERY
(from the Child and Adolescent Psychiatric Hospital and the Kellogg Eye Center to the B2 Pharmacy and New University Hospital)

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by Industrial and Operations Engineering 481 Hospital Special Projects Group
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EXECUTIVE SUMMARY:

This project came as a result of Child and Adolescent Psychiatric Hospital (CAPH) Nursing complaints to Pharmacy Services of missing and incorrect medications. Dr. Nabil Khalidi, Assistant Director of Pharmacy Services, contacted Management Systems for assistance in investigating the Nurses' complaints. The project group was formed from Industrial and Operations Engineering 481, Special Project in Hospital Systems, and was coordinated by Neal Gilbert, Senior Management Engineer of Management Systems. The project was later expanded by Dr. Khalidi to include Kellogg Eye Center (KEC) and other problems experienced by the remote sites.

Interviews with management and end use personnel at the Remote Sites and in the Pharmacy were conducted. Then flowcharting of the current delivery and ordering system for medications, patient delivery from the Remote Sites, and specimen delivery to the New University Hospital were prepared. Next, data was collected in the Pharmacy from 11/1/88-11/11/88 to time the steps involved in ordering and preparing medications. The information gathered from these methodologies uncovered the following problem areas with medication delivery, listed in respect to the order they appear on the flowcharts, (Appendix--). A complete list of the problems associated with patient and specimen delivery, along with other concerns voiced by the Remote Sites is located on page --- in Appendix--.

1. Lack of standard procedures for ordering medications.
   This was evident from missing patient information, delays in sending orders, and mistakes in order dosage changes.
2. Poor facsimile system.
Studies conducted indicate over 50% of the transmissions are unreadable and cause delays due to the necessary phone calls to confirm orders.

3. Inconsistent Pharmacy turnaround times.
Turnaround time is defined as the time from which Pharmacy receives the order from the Remote Site, to the time Pharmacy completes the order. Currently there is frequent delivery of incorrect orders inside the cassette; this was witnessed in a one week study for the CAPH cassette, in which Pharmacy was responsible for 5 of 11 errors which occurred.

4. Inadequate delivery service to the Remote Sites.
Presently the KEC nurses receive orders on the first floor, resulting in large delays; CAPH nurses have no delivery service, other than the 2:20 cassette delivery which has a drop-off point located on the other side of the building, two to three floors down.

5. Uncommon service level expectations.
Pharmacy Services and the Remote Sites have different ideas of quality service. Not enough attention is being given to satisfying the customer's needs. In some cases, this is Pharmacy, such as when the orders do not meet the needs of Pharmacy. At other
times, it is the Remote Sites, such as when the delivery time or location is unsatisfactory to the Remote Sites.

Their is no communication between the involved entities. Feedback on late orders and untimely deliveries is non-existent. Pharmacy and the Remote Sites do not have regularly scheduled meetings, nor do they have a procedure for registering complaints.

RECOMMENDATIONS
To solve the problems mentioned above and improve the efficiency of Pharmacy operations, the Project Group believes that the following recommendations should be considered.

1. Adopt standard procedures.
The Remote Sites should be informed of their obligation to consistently send all relevant patient information and missing med. forms to Pharmacy. Standard procedures should be adopted for order dosage changes, and other areas where clinical interpretations promote errors.

2. New facsimile system.
A new facsimile system or maintenance system should be considered for purchase.
3. Sixty minute turn around.
Pharmacy should work to provide a turn around time of 60 minutes on all orders. Pharmacy should re-check and update the cassette box less than one hour before Materiel Management picks it up for delivery.

4. Agree on mutually - acceptable drop points.
Pharmacy should meet with representatives of the Remote Sites and Materiel Management, and come to an agreement about the exact location of the order deliveries.

5. Five o'clock delivery for CAPH.
The Pharmacy should provide a 5:00 daily delivery to CAPH to transport afternoon orders.

6. Meet and adopt criteria list.
A criteria list, located in Appendix -- of this report, should be used as a guideline by which service level providers could be measured against. These criteria lists, should be adopted in a meeting with Pharmacy and Remote Site Representatives.

7. Feedback system, Remote Site liaison.
A feedback system to the Remote Sites, for late deliveries, should be established. A present employee should be appointed as a liaison to handle problems or concerns of a
designated unit (CPH5, CPH6, KEC). This will give the units a familiar person to voice their concerns. This will also assure them that actions are being taken to remedy their problems. Furthermore, regular meeting should be held between Pharmacy and the Remote Sites to discuss problems and improve service.

CONCLUSIONS

A common cause of most problems was a lack of shared expectations, which has led to mistrust on the part of both Pharmacy and the Remote Sites. The recommendations contained in this report represent the Project Group's attempt to provide acceptable service for all parties involved, but cannot serve as a substitute for improving communications. The problems between Pharmacy and its customers are everchanging, and must be dealt with on a continuing basis.
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INTRODUCTION AND BACKGROUND

This project resulted from Child and Adolescent Psychiatric Hospital (CAHP) Nursing complaints of missing and incorrect medications (meds). Dr. Nabil Khalidi, Assistant Director of Pharmacy Services, University of Michigan Hospitals (UMH), contacted Management Systems for assistance in investigating the complaints.

A project group was formed from Industrial and Operations Engineering Course 481, Special Project in Hospital Systems. Neal Gilbert, Senior Management Engineer of Management Systems, acted as project coordinator. The project was later expanded by Dr. Khalidi to include medication (med or meds) deliveries to Kellogg Eye Center (KEC), and also a cursory analysis of the blood transportation and patient transportation systems provided to/from the Remote Sites. Flowcharts of these systems appear in appendix A of this report.

CAHP consists of two nursing units of 12 and 14 beds, located on the 5th and 6th floors of the CAHP building. CAHP is next to but a separate building from the New University Hospital. KEC consists of one nursing unit of 26 beds, located on the 2nd floor of the KEC building. KEC is located about ½ mile from the New University Hospital. Both CAHP and KEC receive medications from the B2 Pharmacy in the New University Hospital, and rely on Material Management
for transportation of the medications between the Pharmacy and the remote nursing units.

THE INVESTIGATION

The Project Group interviewed key people in the units involved with remote sites medications. The purpose of these interviews was to provide background information concerning the medication delivery system, and to survey the attitudes of everybody involved. Interviews were conducted with:

- Amy Perry, MSN, RN, CS; Assistant Director of Psychiatric Nursing
- Desiree Blake, BSN, RN; Assistant Head Nurse, KEC
- Sharad Khanderia, Supervisor of B2 Pharmacy
- Suzanne Bihan, BSN, RN; Head Nurse, CAPH 5

At the completion of the preliminary interviews, the Project Group submitted a project proposal to Dr. Khalidi, which when accepted defined the project scope and desired outcomes, and became the foundation for all project efforts.

Following approval of the project proposal, the Project Group continued interviewing key people, including Materiel Management staff, and flowcharted the existing medication delivery systems. The project group then formulated service level criteria to provide a draft outline by which each service provider could be compared.

The next step in the investigation was to collect data to confirm or refute CAPH Nursing allegations of late and wrong medications. A one
week timing study was conducted by the Project Group to measure each segment of ordering, preparing, and delivering medications to and from CAPH and KEC. Simultaneously, Lisa Vartanian, a Pharmacy Resident, conducted an accuracy study of daily cassette delivery to CAPH, in which she compared the cassette to the patient profiles.

The other Remote Site problems were addressed through interviews with staff personnel. Specimen and patient transport systems, which have different methods dependent on the time of day, were flowcharted. See Appendix A. A list of concerns voiced by the Remote Sites, which have resulted due to their distance from the New University Hospital, were written. This was a cursory report, and therefore the Project Group has no Conclusions or Recommendations on these problems. See Appendix B.

SUMMARY OF DATA COLLECTED IN MEDICATIONS-RELATED TIME STUDY

The terms used in Table 1, on page 8.1, and hereafter are defined as:

**Turnaround time:** Time period from time med order is received at Pharmacy, to the time the order is ready for pickup or delivery from Pharmacy.

**In-house time:**
- CAPH: delay period from the time the physician writes the order to the time the order is delivered to Pharmacy.
- KEC: delay period from the time meds are
received at KEC first floor to the time meds reach the Unit on the 2nd floor.

The definitions differ due to the fact the time delay from floor to floor does not apply to CAPH, since they pick-up orders by hand. A summary of the data collection of Pharmacy activities are contained in Table 1, on page 8.1.

It seems appropriate here to make a general comment. It was evident while working on the project, that there is a need to define terms frequently used when describing the process of ordering/filling medications. It appears, each unit has different definitions for terms such as turnaround time, preparation time, etc. This may contribute to the misunderstandings and differences of expectations which exist between the groups.

Limitations:
Some of the statistics should be interpreted with care. For instance, 17% of the data collected was considered unusable due to incomplete information and "wild" values. The small sample sizes of the collected data may yield statistically insignificant conclusions. Also, for the period 9:00pm - 7:30am, no data was collected. This was because data sheets from this period were never returned to the project group. Weekend and after-hours Kellogg delivery and turnaround times, were too few to be statistically significant ( < 5 data points).
Interpretations of data collected:
The following interpretations are listed in an order consistent with the flow of ordering, filling, and receiving medications, outlined in the flowcharts of Appendix A, of the present medical delivery system.

1. **In-House Times.**
The in-house times, located in Table 1, page 8.1 reveal large delays for both KEC (58% < 60 min) and CAPH (50% < 60min).

2. **Facsimile Device Problems.**
Complaints prompted a facsimile (FAX)/Printer study which was conducted in the Pharmacy from 11/21 to 12/1. The sheets were useful for KEC only. The study averaged 11 orders per day, 5.9 unreadable, necessitating phone calls by Pharmacy to confirm. Comments from Pharmacy Supervisor, Sharad Khanderia, suggested the forms were partially complete, indicating actual FAX/Printer errors to be greater than shown in the FAX/Printer Study.

3. **Faxed Orders.**
Approximately 93% of the CAPH orders and 99% of the KEC orders were received via FAX.
   Of the 179 orders recorded from 7:30am-9:00pm daily in 11 days, 57 were for/from CAPH and 122 for/from Kellogg.

5. Percent of orders included in cassette.
   Of the CAPH orders, 60% were in time to be included with the cassette delivery, and 40% occurred in the afternoon & evening. Of the KEC orders, 55% were before the cassette delivery and 45% after the cassette delivery.

6. Total Order Preparation.
   Out of the total KEC and CAPH orders, 17, (9.4%) took over one hour to prepare. The breakdown of these orders were; six, the 6th floor satellite left for B2 Pharmacy to fill; two were prescriptions requiring Pharmacy compounding, and the remaining were due to Pharmacy delays.

7. Time Period With the Most Orders Over One Hour.
   The time period from 2:00pm-5:00pm had the largest proportion of turnaround times over one hour (17%). This value is for both KEC and CAPH orders combined. This high value may be due to the fact that the cassettes have just been delivered, and
the orders received during this period may not have been needed until later in the day, or even the following cassette delivery.

8. Time Period With the Least Orders Over One Hour.
As seen in Table 1, page 8.1, the time period from 11:00am-2:00pm, had the smallest proportion of turn around times over one hour, 6%. This is likely because the orders should be filled before the 2:20 cassette box delivery. The time period 8:00am-11:00am had 10% of its turn around times over one hour, and 5:00pm-9:00pm had 7% over one hour.

The median turnaround time was 18 min. which is well below the Pharmacy standard of a one hour turnaround time; the median was used because of the presence of extremely high values which affect the mean time to a greater degree. The high standard deviation of 25.6 indicates a high degree of variation. The cause of this large standard deviation is difficult to understand. Perhaps future orders were queued and/or Pharmacy failed to meet the 60 minute turnaround time.

The turnaround times for CAPH and KEC are very close in
### Statistical Results from Time Study for Med Delivery System from 11/1/88 - 11/11/88

<table>
<thead>
<tr>
<th>TIME</th>
<th>COUNT</th>
<th>TIME (s, std. dev) (minutes)</th>
<th>TIME X (mean) (minutes)</th>
<th>TIME X (median) (minutes)</th>
<th>% &lt; 60min</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Turn Around Time</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAPH</td>
<td>28</td>
<td>33</td>
<td>30</td>
<td>82</td>
<td></td>
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<tr>
<td><strong>Stat Orders Total</strong></td>
<td>9</td>
<td>19</td>
<td>17</td>
<td>67 &lt; 15 min</td>
<td></td>
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<tr>
<td><strong>In-House Time</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>CAPH</td>
<td>29</td>
<td>62</td>
<td>47</td>
<td>51</td>
<td>50</td>
</tr>
<tr>
<td>KEC</td>
<td>21</td>
<td>45</td>
<td>39</td>
<td>46</td>
<td>58</td>
</tr>
<tr>
<td><strong>Turn Around Total</strong></td>
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<td></td>
<td></td>
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<tr>
<td>8-11</td>
<td>40</td>
<td>24</td>
<td>23</td>
<td>10</td>
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<tr>
<td>11-2</td>
<td>46</td>
<td>19</td>
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<td>6</td>
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<td>24</td>
<td>18</td>
<td>6.5</td>
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<td><strong>Delivery from Pharm to KEC</strong></td>
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<tr>
<td>8-5</td>
<td>16</td>
<td>78</td>
<td>61</td>
<td>47</td>
<td>56</td>
</tr>
</tbody>
</table>
FIGURES 1A AND 1B: Pharmacy Turnaround for the Remote Sites

Jan. 20, 1989
page 8.2

FIG 1A: Pharmacy Turnaround for CAPH

NOTE: There were no occurrences for the 100 or 120 minute time intervals.

FIG 1B: Pharmacy Turnaround for KEC
distribution of turnaround times and have approximately the same percentage under 60 minutes. This is shown in the figures 1A and 1B, on page 8.2

11. Mean Turnaround for STAT Orders.

The mean turnaround time for stat orders was 19 min. with a standard deviation of 17 minutes. These values indicate a large degree of variation and several stat orders did not meet the 15 minute Hospital standard.

FINDINGS AND CONCLUSIONS

The following is a list of problems currently hindering the smooth delivery of medications to the Remote Sites studied. The results emphasize CAPH since this was the primary unit of our study. The results, written in boldface, were based on statistical data or surfaced from interviews. The conclusions drawn from the findings immediately follow the results. The list follows an order consistent with the flow of ordering, filling and receiving medication orders, outlined in the flowcharts of Appendix A.
1. Ninety percent of all orders to Pharmacy are received by facsimile transmission:
The present fax system is heavily relied upon. The remaining 10% of the orders, are received by phone or hand carried by a CAPH clerk to the Pharmacy Service Window. Interviews indicated hand-delivery is the preferred method by CAPH ward clerks who do not trust the fax system because of the lack of feedback and poor transmission quality. A FAX study was conducted in the Pharmacy from 11/25/88 - 12/1/89. Fifty percent of the orders from KEC were found to be unreadable due to the poor quality of the FAX copies. Interviews with Pharmacy personnel suggest the figure of 50% to be conservative.

2. Accuracy of Cassette Study: Out of 26 beds, each with multiple orders, their were 11 errors; 5 Pharmacy, 2 CAPH, 4 unaccountable:
This study was performed by sixth year Pharmacy Resident, Lisa Vartanian. See Appendix B for details of methodology and clinical analysis of errors. A large proportion of cassette errors were due to the Pharmacy. The Project Group believes this was primarily due to the present cassette filling method which does not re-check the cassette before delivery.
3. Ninety four percent of the CAPH orders received between 11:00 am and 2:00 pm were turned around in less than one hour, compared to the average of 86%. The fact that Pharmacy performed better immediately before the cassette delivery shows that Pharmacy is making a sincere effort to dispense as many medications to CAPH as possible.

4. Mean Pharmacy turnaround time was 26 minutes with an 18 minute median, and a 26 minute standard deviation. Pharmacy turnaround time is usually well below the 60 minute hospital standard, but has an extremely high standard deviation. This high variation results in inconsistent service and service level problems such as negatively affecting CAPH nurses' schedules and patient care.

5. Pharmacy turnaround times for CAPH were measured to have 14% > 60 minutes, and CAPH time to deliver an order to Pharmacy were found to have 29% > 60 minutes. CAPH complained that Pharmacy was taking too long to fill an order, but this statistic shows that CAPH themselves are contributing a significant amount to the delay in filling an order, by not promptly faxing or taking the order to Pharmacy.
6. The CAPH cassette is locked at 12:30, but is not picked up for delivery until 2:15. The meds prepared between 12:30 and 2:15 are delivered in paper bags, which accompany the cassette. The delivery of meds in paper bags was a major area of concern for the CAPH clerks, who stated that the shuttle driver sometimes left the bags on the shuttle. The large time lapse between locking the cassette, and picking it up for delivery, causes delivery by paper bag to occur almost daily. The lack of a master slip, describing the contents of the delivery to be made, leaves the clerks with no means of checking the accuracy of the delivery.

7. CAPH receives med deliveries via daily cassette Monday through Friday only. The lack of deliveries forces the CAPH unit clerk to walk to Pharmacy and pick-up orders. The absence of the clerk from the nursing unit puts a strain on the staff which must perform his/her duties while s/he is away. This is where Pharmacy discriminates against the remote sites. All units in the University Hospital, Mott/Womens/Holden Hospitals receive hourly delivery during the day in addition to the med cart, and have delivery by tube available to them as well.
8. The shuttle delivery to the CAPH loading zone was within 1 minute of the scheduled delivery during a study of 8 cassette deliveries. The delivery by shuttle was determined to be very dependable and consistent, contrary to allegations by CAPH nurses that it is sporadic and inconsistent.

9. The shuttle driver delivers to the CAPH ward clerk at the CAPH Loading Zone only, and will not leave drugs unattended. If the clerk is not there to receive the delivery, the shuttle driver takes the cassette back to loading zone 5. The shuttle driver handles the medications responsibly when they are under his control and follows hospital policy of not leaving drugs unattended. However, this places a great responsibility on the CAPH ward clerks to meet the shuttle driver at the delivery time, with no room for error. This inconvenience is compounded by the fact that the CAPH Loading Zone is not in a main area of the building, forcing the clerks to go out of their way to receive the cassette.
10. The CAPH ward clerks reported that they are averaging 2 trips per day to the Pharmacy:
Although CAPH has a low volume of drug orders, enough problems are occurring that CAPH nurses must respond on a daily basis. These errors necessitate a trip to the Pharmacy by the unit clerk.

11. The CAPH Ward Clerks reported that they never know if an order will be ready when they attempt to pick it up.
Pharmacy turnaround time was found to be very short, but with a high standard deviation. The problem is compounded by the fact that there is no feedback to CAPH; that is, CAPH does not know that an order is not ready until they walk to the hospital to pick it up.

12. Interviews with Pharmacy have indicated that CAPH is not consistently sending complete patient information to Pharmacy.
Pharmacy has inconsistently received post-op and pre-op orders, patient allergy information, and bed assignment sheets. This delays the entire filling process for Pharmacy due to time spent on the phone trying to contact the nurse or physician to get the needed information. Also, there is potential risk involved when prescriptions are filled without having the proper allergy information.
13. Generic drugs wrongly labeled Pharmacy errors by CAPH Nursing staff:
During Lisa Vartanian's study of cassette deliveries to CAPH, it was determined that some cassette "errors" were actually substituted generic drugs. The nurses were not up to date with current acceptable substitutes and did not recognize them when they were received.

14. Interviews with Pharmacy indicated Missing med forms not received from CAPH.
CAPH reports missing meds by calling Pharmacy and requesting drugs over the phone. This is not consistent with Hospital policy of reporting all missing meds on missing med forms, and is not an acceptable practice.

RECOMMENDATIONS
In the course of the investigation, the project group found that a major obstruction to the smooth operation of the medication delivery systems to CAPH and KEC, is a lack of common understanding of the wants and needs
of the different organizations, (CAPH, KEC, Pharmacy, Material Management). Because the organizations did not have common definitions of acceptable service, the project group developed service level criteria to use as a guideline by which service providers could be measured against. The following recommendations were developed while formulating the service level criteria:

1. KEC and CAPH should deliver any medication orders as soon as possible.

2. Pharmacy should improve the fax system to obtain readable copies.

3. Medications should be delivered to the nursing unit, preferably the nurses' desk.

4. Pharmacy should take on the responsibility of ensuring that the nurses know acceptable substitutes for drugs ordered.

5. Pharmacy should provide a daily 5:00 delivery to CAPH, utilizing Material Management.

6. Pharmacy should provide 60 minute turnaround for all orders, or notify the customer that the order will not be
ready on time.

7. The remote sites should send missing med forms when required.

8. The remote sites should send appropriate patient information.

9. Pharmacy should provide KEC and CAPH with a customer liaison to provide more personalized service.

Note: The following recommendations were developed separately from the service level criteria:

10. Pharmacy should update the cassette as late as possible before Material Management picks it up for delivery.

11. Pharmacy should set up a check system to ensure the cassette is consistent with the patient profile before delivery.
12. The Pharmacy supervisor should meet with KEC and CAPH nurses regularly, to improve service and open lines of communication.

CONCLUSION

The project group believes that the majority of problems associated with medication deliveries to CAPH and KEC can be minimized through better communication. The common cause of most of the problems was a lack of shared expectations, which has led to mistrust on the part of both Pharmacy and the remote sites. The recommendations contained in this report represent the project group's attempt to provide acceptable service for all parties involved, but cannot serve as a substitute for improving communication. The problems between Pharmacy and its customers are ever-changing, and must be dealt with on a continuing basis.
OTHER PROBLEMS

Transportation of patients, medications, and other materials are seen by the remote sites as a significant problem. Due to their actual location, the remote sites often do not get the same service as the other units that are connected to the main hospital. These sites tend to feel neglected by other units in the main hospital. Consequently, conventional service provided by the various units of the hospital are perceived as unsatisfactory. Below we have prepared a list of services to CAPH and KEC that the nurses have indicated should be improved.

Along with medication delivery, some other problems at CAPH (Priority decreases with order) are;

1. Transportation of patients to University Hospital.
None of the diagnostic units will come to CAPH, requiring CAPH to transport their patients to EEG, EKG, Cat Scan, Psych, Neuropsych, and Speech and Language. If patients are able to walk, transportation is usually handled by one or two nurses escorting them to their appointments. When it is necessary to sedate the patients, they are transported by the University ambulance. Many times the University ambulance is on call and does not come at the time requested, so CAPH has to reschedule the appointment.

2. Transportation of Bloods to University Hospital.
CAPH has blood pickups twice a day, but these have proven ineffective. They have complained of numerous occasions when the shuttle driver did not see the bloods at the designated drop point. Because of this the blood has to be redrawn, and many times, this upsets the patients.

3. Lack of Feedback.
CAPH staff complain that they receive no feedback when they send something to the University Hospital. Because most of the materials are handled by more than one person in the transportation process, problems occur frequently, and it is difficult to hold anyone accountable.

4. Treatment by Other Units.
CAPH reported that some of the diagnostic units, such as EEG and Cat Scan, do not treat CAPH as an inpatient unit; they require CAPH patients and their escorts to wait in line. CAPH perceives this system to be inefficient, and believe that they are receiving different treatment than other inpatient units.

CAPH reported that no one has been assigned to clean their computers. Housekeeping does not clean them and CAPH has no idea who is supposed to clean them.
Along with medication delivery, some other problems at KEC (Priority decreases with order) are:

1. **Transportation of patients to University Hospital.**
   KEC must call the ambulance service to carry patients who cannot walk to their appointments. Many times the University ambulance is on call and does not come at the time requested, so the patients are either very late, or miss their appointments. When the University ambulance cannot come, the nurses are required to call Huron Valley ambulance, and once again the patients are very late or miss their appointment. If neither ambulance cannot come, the nurse must reschedule an appointment which may take weeks. Then after the patients have their appointments they may have to wait for up to an hour for the ambulance to pick them up, which may alter their medication and/or food schedules.

2. **Transportation of Blood and Urine to University Hospital.**
   When blood and urine is to be transported by the University Ambulance, it must be taken downstairs to the front desk before they will pick it up and take it to University Hospital.

3. **Respiratory therapy.**
   When the request is not STAT the Respiratory therapists are hesitant to go to KEC to see if patients need or do not need respiratory therapy, or
often they will come hours late.

Such as an overhead trapeze for the beds, brought by material management is often delivered late and/or picked up late. This causes delays in preparing specialized rooms for patients.

5. Medical Records.
Sometimes if patients need medical records to be discharged with them, the medical records department will not send them to KEC. Someone from KEC’s staff must go to the main hospital to get the records.

6. EKG’s and Chest X-rays.
When patients go to get their EKG’s and Chest X-rays between 6:30 and 7:00, they often must wait for up to three hours to receive treatment. Being geriatric patients, this causes them much mental strain.

7. Insufficient delivery and pick-up of linens on weekends or holidays.
Dirty linen often sits in the loading area all weekend until the driver comes to pick it up. If a driver is running late on his or her schedule, they will not stop to pick up dirty, and deliver clean linen at KEC because it is “out of the way.”
Such as the Kangaroo pump or intravenous pump (IVAC) has to be cleaned by the KEC staff sometimes, because housekeeping will not clean them. Patient equipment cleans those items in the main hospital, but gripes when they have to go to KEC to clean them.

9. Sterile supply cart.
The sterile supply cart goes to most units daily, but only Mon-Fri at KEC.

10. Insufficient training of support staff.
If there has to be a substitute messenger or shuttle driver that is unfamiliar with deliveries to KEC there are many problems with the delivery of materials. Many times the substitute will not know where to bring the medications.

11. General Statements or Problems.
KEC staff was promised an in-house messenger by the building manager but never received one. The staff believe that their efficiency suffers because they are doing work that should be done by the in-house messenger, such as retrieving medications from the mail room.

After regular hours, Mon-Fri 8am.-8pm, the delivery of almost everything becomes inefficient, this is because the shuttle stops running and it takes
extra effort for other units to get materials to KEC.
APPENDIX A

FLOWCHARTS OF MEDICATION DELIVERY SYSTEM,
PATIENT TRANSPORTATION,
AND BLOOD DELIVERY
Ordering Medications at CAPH

1. Start
2. Doctor writes order in order book
3. Doctor puts order book in Nursing office, flags book green
4. Clerk sees flagged order book
5. Is clerk planning on going to the hospital?
   - Yes: Clerk takes order to the FAX machine on CAPH 6
   - No: Clerk takes order to EI Pharmacy service window

1
Pharmacy Fills CAPH Medication Order

1. Receive med order (PDX machine or service window)

2. Is it between 7:30 am and 12:30 pm?
   - yes: Fill order, document change in computer
   - no: Replace or change meds in cassette

3. 12:30 pm
   - Pharmacy Technician takes cassette to dock 5

4. Is it before 2:00 pm?
   - yes: Put meds in paper bag, indicate nursing unit on bag
   - no: Leave meds at service window for pickup by CAPH personnel

5. Is it before 9:00 pm?
   - yes: 6th floor Pharmacy fills order
   - no: 6th floor Pharmacy calls ambulance

    Take med to emergency room
CAPH receives Medication

Is med needed before next delivery?

Is it after 9:00 pm?

Shuttle driver picks up cassette and bags at Dock 3

Clerk walks to B2 Pharmacy service window to pick up meds

Ambulance driver takes meds to CAPH front door

Are meds ready?

End
CAPH Patient Transportation to EEG and Cat Scan

sta)

er... takes n... to acility

wait until there's a canceled appointment

receives call that appointment is open immediately

does patient need to be sedated?

yes, clerk calls for ambulance

is ambulance available?

no, clerk cancels appointment

yes, nurse available?

no

yes, nurse escort patient to appointment

end
CAPH Patient Transportation to EKG, Psych, Neuropsych, and Speech & Language

Start

Clerk calls on admission, makes appt for next day

Doctor: does patient need to be sedated? yes: clerk calls for ambulance, no: nurse needs to escort patient

Is ambulance available? yes: clerk calls and reschedules appt, no: reschedules appt

End
Ordering Medications at KEC
Cassette delivery to KEC from Pharmacy

1. Receive order (fax)

   Is it between 7:30 am and 12:30 pm?
   - Yes: Fill order, document change in computer
     Replace or change meds in cassette box
     At 12:30, UMH messenger takes cassette to Taubman front desk
   - No: Is it before 3:00 pm?
     - Yes: Fill order, document change in computer
       6th floor Pharmacy fills order
     - No: call UMH messenger to take meds to Taubman front desk

2.
Cassette delivery to KEC from Pharmacy cont.

2

Shuttle driver picks up cassette at Taubman front desk.

Is it before 3:00pm?

no

goes

Shuttle driver contacts pharmacist.

Shuttle driver picks up meds at Taubman front desk.

Ambulance driver gets meds at emergency room.

Shuttle driver takes meds to KEC and gives them to nurse.

Shuttle driver drops cassette at KEC desk.

Shuttle driver takes meds to 2nd floor.

Shuttle driver picks up meds from front desk.

Therapist takes meds to 2nd floor.

Stores order 2nd floor.

End.
CAPH Patient Transportation to EEG and Cat Scan

clerk takes paperwork to facility

wait until there's a canceled appointment

CAPH receives a call that appointment is open immediately

does patient need to be sedated?

clerk calls for ambulance

is ambulance available?

clerk cancels appointment

are nurses available?

nurses escort patient to appointment

end
Cassette delivery to KEC from Pharmacy cont.

1. Shuttle driver picks up cassette at Taubman front desk.

2. Is it before 9:30pm?
   - Yes
   - Shuttle driver continues route.
   - Shuttle driver picks up med at Taubman front desk.

3. Ambulance driver gets med at emergency room.

4. Shuttle driver arrives at KEC.
   - Shuttle driver takes cassette to KEC desk.

5. House takes med to 2nd floor.

6. Stores clerk picks med from 2nd floor.

7. Stores clerk walks med to 2nd floor.

End.
KEC Patient Transportation

start

need for patient transport is determined

is it between 9:00 am and 5:00 pm?

no → nurse calls ambulance driver

yes → patient gets on shuttle to go to hospital

patient goes to appt. (a door attendant will escort patient if needed)

end

no → nurse calls vet cab

yes → ambulance driver takes patient to appt.

cab takes patient to appt.
Blood and Specimen Deliveries from CAPH

start

Nurse

Draw blood

Nurse

Send bloods to clerk

Clerk

Send bloods to first floor business office

Bloods

Shuttle Driver

Bloods sit until shuttle comes (9:02 & 12:22)

Shuttle Driver

Refrigerated in business office

Shuttle Driver

Ret bloods to transport to dock 3

Shuttle Driver

Leave bloods on dock 3

Bloods

Shuttle Driver

Wait until messenger comes

Shuttle Driver

Take the bloods to central discrete

Shuttle Driver

End
APPENDIX B
INDEPENDENT PHARMACY REPORT
(CASSETTE DELIVERIES TO CAPH)
Children's and Adolescent Psychiatric Hospital: A Pharmacy Service Study

PROBLEM:

A large amount of medication errors and missing medications have been reported to pharmacy by the nursing personnel at the Children's and Adolescent Psychiatric Hospital (CPH). These errors are intensified by the fact that the majority of time when an error occurs, CPH personnel must come to the pharmacy to pick up the medication. This leaves CPH short-staffed during these times.

METHODS:

A list of problems was compiled by interviewing CPH nursing personnel. The problems chosen to focus on during this study are as follows:

1. Prescription orders needed immediately are often not ready when CPH personnel come to pick them up.

2. Orders faxed to the sixth floor satellite after the B2 pharmacy closes do not make it back to B2 and therefore are not included in the next day's cart fill.

3. Carts delivered to CPH are not accurate.

To evaluate the first complaint (orders are not ready when CPH personnel come to pick them up), a data sheet was drawn up to record the time sequence of prescription orders. The purpose of this log is to determine the amount of time it takes pharmacy to process a prescription. This data is currently being collected and will be analyzed by management engineering students who are also working on the study. In addition time data is being collected from the sixth floor satellite to monitor the prescription orders from CPH more closely in order to evaluate any problems that occur. This will also be analyzed by the management engineering students.

In order to evaluate the accuracy of the carts, the following procedures were followed:

1. The study began on Wednesday, November 2 and ended on Tuesday, November 8.

2. Using an updated fill list, the cart was checked in the pharmacy prior to its delivery to CPH. Any errors which were found at this time were corrected and documented.

3. The cart was met at CPH each day.

4. The cart was rechecked when it arrived at CPH with nursing on both floors (5 and 6) using the Kardex and the updated fill list.

5. Any discrepancies between nursing and pharmacy were recorded and investigated further.

6. Pharmacy and nursing signed the fill list to verify that the cart was checked.
<table>
<thead>
<tr>
<th>Date/Unit</th>
<th>Problem</th>
<th>Responsible Party</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-2/CP5</td>
<td>RX: Kopak, Matthew - IM Demerol 25 mg, Phenergan 25 mg, Thorazine 25 mg given 30 minutes prior to CT scan. Since the medications were not used right away, a nurse thought they were not needed and sent them back on the cart.</td>
<td>CPH</td>
</tr>
<tr>
<td>11-2/CP6</td>
<td>No problems found when cart was checked in pharmacy or CPH, but later in the evening a nurse called to report a missing 20 mg Inderal dose was missing for Shira Zelinger. Pharmacy sent another 20 mg tablet. The following day (11/3), this 20 mg tablet came back in drawer.</td>
<td>CPH</td>
</tr>
<tr>
<td>11-3/CP5</td>
<td>No problems</td>
<td>N/A</td>
</tr>
<tr>
<td>11-3/CP6</td>
<td>No problems</td>
<td>N/A</td>
</tr>
<tr>
<td>11-4/CP5</td>
<td>Amitriptyline 25 mg at bedtime for Corey Patterson was missing from cart when checked in pharmacy.</td>
<td>Pharmacy</td>
</tr>
<tr>
<td>11-4/CP6</td>
<td>Lithium for Sonja Anderson was interpreted as being discontinued when actually serum levels of Lithium were being ordered. (RX - Se:Lithium) After reviewing the prescription it was easy to understand how this misinterpretation occurred since the Se looked very much like a DC.</td>
<td>The person who wrote the order is responsible. Care should have been taken to make his/her writing more legible.</td>
</tr>
<tr>
<td></td>
<td>Trifluoperazine (Stelazine) 5 mg every morning was reported as missing. Since this occurred on a Friday, 3 tablets were missing.</td>
<td>While this would appear to be a pharmacy error, it is questionable since the cart was checked prior to delivery to CPH and no errors were</td>
</tr>
</tbody>
</table>
RESULTS: (continued)

<table>
<thead>
<tr>
<th>Date/Unit</th>
<th>Problem</th>
<th>Responsible Party</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-4/CP6</td>
<td>Lorazepam (Ativan) 2 mg every 4 hours for Jamison Messerly was discontinued at 8:30 AM on Friday but was delivered anyway. No order was found in pharmacy when the matter was further investigated.</td>
<td>Pharmacy</td>
</tr>
<tr>
<td></td>
<td>a) Mellaril 25 mg every 4 to 6 hours was prescribed for Jamison Messerly. Nine 25 mg tablets should have been delivered, instead seven 25 mg and two 50 mg tablets were in the cart.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) When the cart was checked at CPH only three 25 mg Mellaril tablets were found. This cart was checked at the pharmacy by one individual and at CPH by a different individual. This may account for the discrepancies found.</td>
<td></td>
</tr>
<tr>
<td>11-7/CPS</td>
<td>Cloral Hydrate in cart for Matthew Kajak, but there was no current order for this medication.</td>
<td>Pharmacy</td>
</tr>
<tr>
<td></td>
<td>Selcane in cart for Everette Rodgers who was discharged from hospital.</td>
<td></td>
</tr>
</tbody>
</table>
RESULTS: (continued)

<table>
<thead>
<tr>
<th>Date/Unit</th>
<th>Problem</th>
<th>Responsible Party</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-7/CP6</td>
<td>No problems reported</td>
<td>N/A</td>
</tr>
<tr>
<td>11-8/CP5</td>
<td>Double doses of all medications for Paul Hackbarth were in the cart.</td>
<td>Pharmacy</td>
</tr>
<tr>
<td></td>
<td>Ibuprofen 200 mg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bethanechol 10 mg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phenelzine 45 mg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MOM 15 ml</td>
<td></td>
</tr>
</tbody>
</table>

The breakdown of errors is as follows:

Pharmacy: 5 errors: missing medication - 1; extra meds sent or meds sent when not needed - 3.

CPH: 2 errors: needed med returned - 1; misplaced medication - 1

Unable to determine responsibility: 4 errors: missing meds - 3; extra meds sent - 1.

CONCLUSION AND SUGGESTIONS:

There are two areas which require further investigation.

1. Over half of the total errors occurred on one single day (Friday). There are a couple reasons why this is significant.
   a) The person who checked the cart at pharmacy was different than the person who checked it at CPH.
   b) No representative from pharmacy was present when the cart was checked at CPH.

Because of the above reasons, it is difficult to evaluate the problems which occurred on this day, and not possible to determine the cause of these discrepancies.

2. Pharmacy errors consisted mainly of sending too many meds. This is not consistent
with CPH complaints that the major problem is incorrect or missing medications. A possible explanation could be that since the carts were being verified by pharmacy at CPH there were fewer misunderstandings and therefore fewer missing or incorrect medication complaints. Situations such as extra meds were generally not regarded by CPH as a big problem and were probably not reported prior to the study.

Pharmacy did however commit the majority of error, and action should be taken to avoid their recurrence. A possible method for error reduction would be to require the CPH cart to be double checked before it is taken to the delivery site. The initials of both checkers would be placed on the cart, and the cart would not be delivered until it has a sticker with two sets of initials on it.

It was suggested by members of the pharmacy staff that there has been confusion on the part of CPH staff regarding brand and generic names. Although this problem did not appear during the study it is quite possible that it occurs. A suggestion made by one of the pharmacists was to compile a list of commonly used drugs and their brand and generic names, which could be sent to CPH and posted.

Suggestions by nursing at CPH included a messenger run in the evening at approximately 5:00 - 6:00 PM, and a contact person in pharmacy to help communications.

I would suggest that any prescription order that is even slightly unclear or vague be clarified by calling CPH before any medication is dispensed. Another suggestion would be to have regular messenger delivery service to CPH. If hourly runs were not possible, runs every two hours could be made since most psychiatric drugs are not urgent. This would simplify the responsibilities of CPH and decrease the amount of time involved when an error occurs. Since the major problem seems to be the relatively large amount of time and effort required to correct an error, regular deliveries would greatly reduce the frustration caused by mistakes and lead to better relations between pharmacy and CPH.

Because the study took place for only one week, these results cannot be considered conclusive. Also because approximately one-third of the errors could not be explained or were not the fault of pharmacy or CPH it is important to realize that mistakes will happen regardless of how closely a process is monitored. The intent should be to minimize the impact these mistakes have on hospital personnel and patient care.
APPENDIX C

CRITERIA FOR PHARMACY, CAPH, AND KEC
Pharmacy Criteria

For the smoothest operation, I want to consistently...

°Receive the right orders
The right order is:
(1) Legibly written.
(2) Dark enough to be read after fax transmission
(3) The time needed, if that time is not implied by the prescription.
(4) Clearly marked post-op or pre-op if applicable.
Examples of criteria not met:
- Orders usually are not dark enough to be read after fax transmission
- Time needed is not consistently written on the order.
- Post-op and pre-op orders are sometimes not marked clearly, or not at all.
- FAX printer of poor quality; names and orders often illegible.
- Nurses or clerks sometimes call about missing meds without looking for accompanying paper bags.

°Delivered to the right site and location
The right site is:
(1) The Pharmacy window or
(2) The fax machine

°At the right time
The right time is:
(1) As soon as possible after the physician writes the order and
(2) Early enough to allow one hour preparations time or
(3) Early enough to allow fifteen minutes preparations time for STAT orders.
Examples of criteria not met:
- Pharmacy often doesn't receive orders until several hours after physician writes the order.
- KECII desk often receives meds hours after delivery.
- Sometimes Pharmacy receives orders labeled STAT but are not.
- 6th floor waits until B2 Pharmacy opens instead of filling orders.
Receive the right patient Information

The right information is:

(1) Delivered in a timely fashion, which must be included for correct Pharmacy and hospital procedures and regulations include;

1. Missing medication forms will be consistently sent to Pharmacy whenever meds are missing. If applicable, reasons for missing the med should be written on the form. This allows Pharmacy to trace where errors occur.

2. Patient allergy information consistently sent to Pharmacy in a timely manner.

3. Admission slips and discharge slips consistently sent as soon as possible to Pharmacy.

4. Pharmacy consistently sent a full patient list twice a day indicating bed assignments and changes; this is necessary for accurate cassette box assignments.

Examples of criteria not met:

- Allergy information written on admission slip is not acceptable to hospital regulations.
- Missing med forms never sent by CPH; inconsistently by KECII.
- Possible reasons for missing meds not mentioned (patient vomits, pill damaged.
- Allergy information sometimes written on admission slip; this is not acceptable to hospital regulations.
- Allergy information often never sent.
- Admission and discharge slips often sent too late for med orders to be filled/cancelled.
- Patients in KECII have switched rooms; Pharmacy not told.
Remote Sites Criteria (CA PH)

For the smoothest operation, I want to consistently . . .

° Receive the RIGHT meds

The right med is:

(1) The same medicine and dosage that appears on the med order or
(2) An acceptable substitution.
(3) If the right med cannot be delivered, Pharmacy will notify the
unit that ordered the med, no later than the expected delivery

time.

Examples of criteria not met:
- Generic drugs sent in the place of the drug ordered; Nurse didn't
  know that the generic is an acceptable substitute.
- Same dosages inconsistently labeled from day to day.

° Delivered to the RIGHT site and location

The right site and location is:

(1) the desk in the nurse's office of the unit that ordered the med if
  the med is delivered or
(2) the Pharmacy walk-up window if the med is to be picked up.
(3) If the med cannot be at the right location, Pharmacy will notify
  the unit that ordered the med, no later than the expected
delivery time.

Examples of criteria not met:
- Daily cart is delivered to the CAPH loading dock.
- Meds sent by Pharmacy but not received by CAPH have been found on
  the shuttle and in a telephone booth.

° At the RIGHT time

The right time is:

(1) 2:20 p.m. for any meds ordered before 12:00 noon and
(2) 5:00 p.m. for any meds ordered between noon and 4:00 p.m. and
(3) within one hour if meds are needed before the next delivery and
(4) within 15 minutes if the order is marked STAT.
(5) If the med cannot be delivered at the right time, Pharmacy will
  notify the unit that ordered the med, no later than the expected
delivery time.

Examples of criteria not met:
- Meds ordered between 9:00 am and noon have not been delivered at 2:20.
- No delivery besides the 2:20 delivery exists
- Meds often take more than one hour to prepare
- The CAPH clerk has been told that it would take 2.5 hours to prepare an
order she requested be filled as soon as possible.
Remote Sites Criteria *(KEC II)*

For the smoothest operation, I want to consistently . . .

°Receive the **RIGHT** meds

  The right med is:

   (1) The same medicine and dosage that appears on the med order or
   (2) An acceptable substitution.
   (3) If the right med cannot be delivered, Pharmacy will notify the unit that ordered the med no later than the expected delivery time.

**Examples of criteria not met:**

- Generic drugs sent in the place of the drug ordered; Nurse didn't know that the generic is an acceptable substitute.
- Same dosages inconsistently labeled from day to day.

°Delivered to the **RIGHT** site and location

  The right site and location is:

   (1) the nursing desk on the second floor of the Kellogg Eye Center.

**Examples of criteria not met:**

- Meds sent by Pharmacy are left in the mail room.
- Meds sent by Pharmacy "disappear" and are not received by Kellogg

°At the **RIGHT** time

  The right time is:

   (1) delivered by 1:30 p.m. for any meds ordered before 12:00 noon and
   (2) delivered within one and-a-half hours of the time ordered and
   (4) delivered within 45 minutes if the order is marked STAT.
   (5) If the med cannot be delivered at the right time, Pharmacy will notify the unit that ordered the med no later than the expected delivery time.

**Examples of criteria not met:**

- Meds ordered before noon have not been delivered at 1:30.
- Meds often take more than one hour to prepare.