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DEVELOPING AN AUDITING SYSTEM FOR COOK CHILDREN'S REHABILITATION SERVICES

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DEVELOPING AN AUDITING SYSTEM FOR COOK CHILDREN'S REHABILITATION SERVICES

by

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May 02, 2017

ABSTRACT

DEVELOPING AN AUDITING SYSTEM FOR COOK CHILDREN'S REHABILITATION SERVICES

Abira Syed, B.S. Industrial Engineering

The University of Texas at Arlington, 2017

Faculty Mentor: Jamie Rogers

The Audiology Department at Cook Children's Rehabilitation Services has an internal monthly auditing process that is skewing compliance rates. Since the selection of the patient charts for the audits are chosen subjectively, the audits have been discovered to be inaccurate and defeating the purpose of randomized audits. The objective of this project is to aid in the development of an accurate auditing system that brings value to the stakeholders at Cook Children's. To accomplish the given task, the Define, Measure, Analyze, Improve, and Control (DMAIC) methodology will be used. DMAIC is a methodology utilized to solve business problems and ensures to effectively execute and implement the desired solution. After analyzing the current process, gathering the Voice of the Customer (VOC) from stakeholders, and collecting time studies, the results show the

audiologist needs proper randomization of auditing patient charts and a larger sample size of patient charts to conduct monthly audits.

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INTRODUCTION

With the emergence of the Industrial Engineering discipline, the field is used various industries from manufacturing to logistics. Industrial Engineering involves improving integrated systems of people, processes, and technology. While the discipline has not become prevalent in the healthcare industry, it is important to note that Industrial Engineers are not always knowledgeable in every field to its entirety. Industrial Engineers are the initiators to solve problems and must take into the consideration of the cost, schedule, and technical aspects of implementing solutions.

1.1 DMAIC Methodology

Define, Measure, Analyze, Improve, and Control (DMAIC) is a methodology that "provides a structured framework for solving business problems by assuring correct and effective process execution" (Hammer). Execution and sustainability of improving processes for quality is an important aspect of this methodology. A poorly executed, or poorly sustained improvement can backfire, regardless of how much data is gathered. Sustainability of an improvement prevents a company from reverting back to its previous state.

In the first stage of the DMAIC methodology, the current process must be fully defined to prevent the occurrence of scope creep. This problem can be avoided by using a process flow map to show the boundaries of the process and to remain objective of the project. Stakeholders, such as the quality department, the compliance department, Rehab

management, audiologists, governing entities, and other employees in this project are key individuals since they will be affected in the final decision making. Suppliers, Inputs, Process, Outputs, and Customers (SIPOC) is a tool that will be used to highlight key information from the current process performed. SIPOC helps to "obtain inputs from suppliers, add value through [the] process, and provide an output that meets or exceeds customer's requirements" (iSixSigma, 2017).

Measure represents "[developing] a data plan for the process" (iSixSigma, 2017). In this project, conducting time studies is a method to measure the length of time it takes the Audiology Manager to conduct an audit on average, also known as cycle time. Multiple time studies are needed to show accuracy of the auditing process. Variance in processes is natural, but instances such as power outages that may be reflected in a time study does not mean a power outage occurs every time the employee is performing their job, referred to as special cause variation. Also in the measure phase, a survey will be sent to key stakeholders to retrieve the voice of the customer (VOC). Data will be gathered through the survey and categorized accordingly.

In the *Analysis* phase, the team will evaluate survey responses from stakeholders to determine which indicators the stakeholders feel that need revision, clarification, or deleted. Pareto analyses shall be performed to show significance in the number of responses received for the various indicators. Trends will be developed of audit cycles and averaged with Personal, Fatigue, and Delay (PFD) allowance of 15%. After analyzing results, an improvement plan should be developed with revisions of the audit tool and how to control the improvement from veering back to the old processes through a robust auditing system.

1.2 Project Definition

The Audiology Department at Cook Children's Rehabilitation Services has an internal auditing process that does not satisfy the stakeholders in the department. The audits are performed on patient charts that are generated after every patient visit. The auditing tool used by the department contains objectives, or indicators, used to check patient charts; however, the tool vaguely describes the indicators, allowing for open interpretations, some of which are either redundant or unnecessary.

The Senior Design team is collaborating to determine what the current processes are and how to improve the auditing tool for a future sustainable auditing program that can be used within various departments of Rehabilitation Services. To accomplish the outlined goals, knowledge, and principles taught in the baccalaureate program of Industrial Engineering (IE) will be utilized. Due to the recent emergence of IE within the healthcare industry, using prior experience combined with coursework will show how IE principles are applicable in service industries.

Explained by Dr. Shernette Kydd, Director of Process Improvement at Cook Children's Medical Center, the current auditing program does not give the audiologists, or stakeholders any value and feels as if the auditing tool is a waste of time and labor. While the audit should be randomized, the Audiology Manager affirms that selectively choosing patient charts that are easier and take less time to process is common practice.

The selectiveness of data being used for compliance rates shows a 100% pass rate in multiple categories, portraying unrealistic performance metrics among 13 clinicians. It was further explained by management at Rehabilitation Services that two of 23 criteria being evaluated are reported to the Joint Commission on Accreditation of Healthcare

Organizations (JCAHO), a non-profit organization that certifies healthcare organizations for meeting quality performance standards (The Joint Commission, 2017). There are few criteria or indicators that are essential to hospital policies and Centers for Medicare and Medicaid Services, which are a "part of the Department of Health and Human Services" (U.S. Centers for Medicare & Medicade Services, n.d.).

With each indicator, there is no standardized procedure of how auditing is performed. There are some documents regarding healthcare policies required for auditing, but remaining criteria do not have process documentation on how to evaluate them.

1.3 Define

Mentioned in the project definition, Dr. Kydd explained the purpose of the project is to redesign the auditing tool to bring value to the Audiology department. The audit serves as the checks and balances. Fraud is a big concern in the healthcare field and the internal audit aids the department in double checking their performance. The stakeholders involved in Audiology are the compliance and quality departments, and the clinical coordinators. After meeting with the clinical coordinators, the Voice of the Customer was established. The three main areas of concerns are as follows:

1. Current tool is busy work to meet compliance standards.
2. Current tool does not address clinical quality items.
3. No standardized process to choose charts, audit charts or defined number of charts.

Given these three issues, the senior design team is assigned to increase the effectiveness level of the auditing tool to satisfactory levels of the stakeholders. When asked the origination of the auditing tool, it was noted that the tool was designed several

years ago. Since then, indicators have been added on, and consequently, there has not been a formal review for the audit tool. It is important to note that as industrial engineers, the team is initiating the formal review. While the team may not know which indicators are necessary for an audit, the team will lead the improvement process of the audit tool.

An indicator is an objective or criteria set by JCAHO, CMS, or internal criteria for the Audiology Department. One of the complaints of the audit tool is that there is no operational definition for the indicators. In other words, there is not a clear understanding of the origination and meaning behind the indicators. Policies from JCAHO, CMS, Cook Children's (CC), Rehabilitative Services (RS), and Quality Management (QM) were pulled to link indicators to policies.

For the team to get a general idea about monthly audits, there was no standardized time for an audit. While stated the audit time varies, the amount of time provided from Lisa Christensen, Audiology Manager, was between two to four hours. Christensen further explained that the time frame is wide because she sometimes has to track trends of clinicians' performances if there are issues in patients' charts. Being a manager, she also has responsibilities to oversee the department, and sometimes has to be interrupted during auditing, lengthening the audit time. It was then clarified that the audits performed on patient charts are based on the last patient visit, not the history of the patient with Cook Children's.

To provide an overview of the auditing process, a SIPOC diagram was created with critical stakeholders involved, which can be found in Appendix A.

1.4 Process Flow Chart

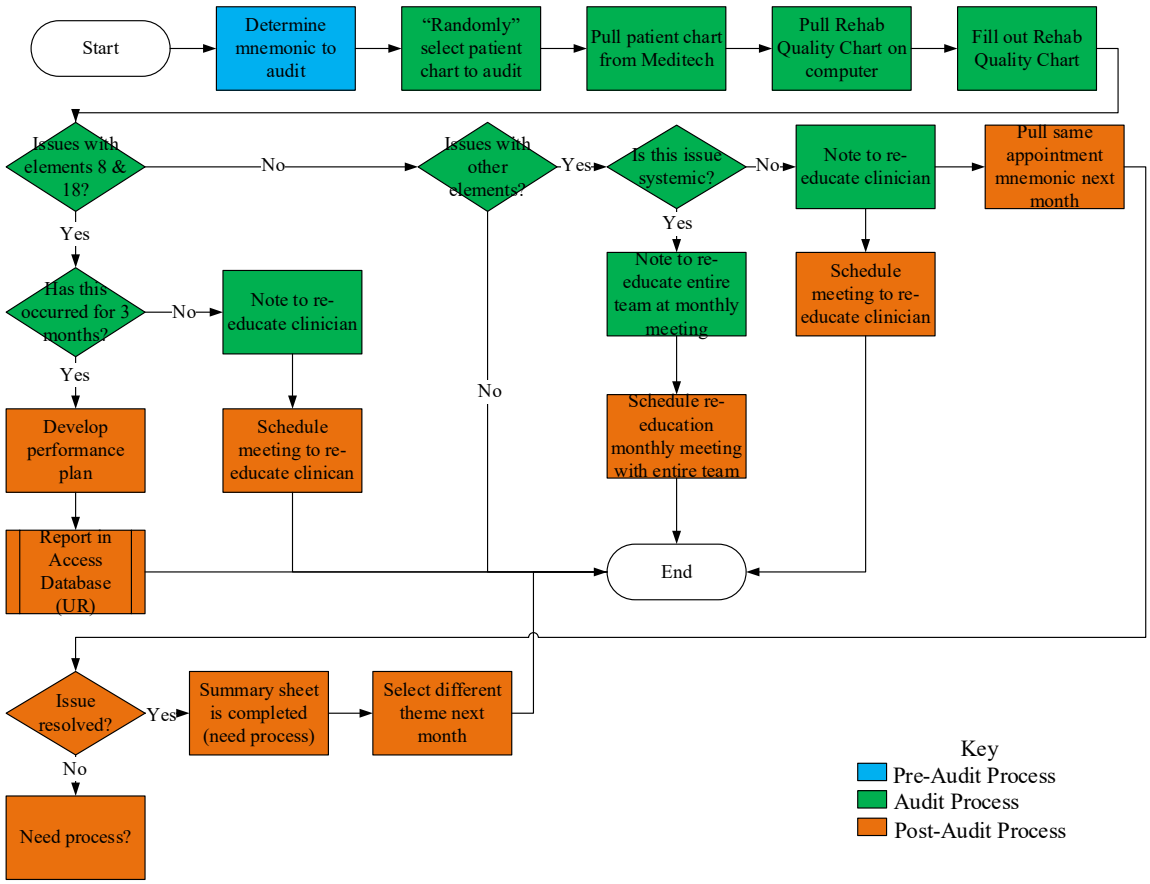


Figure 1.1: Current Process Map of Monthly Audits

A detailed process mapping activity of the auditing process was necessary for conducting time studies. Before the audit begins, the appointment mnemonic is selected, represented in blue. An appointment mnemonic is an abbreviation of a type of patient appointment. For example, "AUD30" is a 30-minute audiology evaluation. The mnemonic is determined by previous trends or flags. A flag is an indication of an arising issue from audiologists, either verbally, or through performance in patient charts. If Christensen does not see a flag occurring throughout the month for the monthly audit, she will choose a random mnemonic. After interpreting the randomness of mnemonics chosen, it was shown that there is no true randomization. Another area of concern for randomness of a monthly

audit is the selection of patient charts to be used during the monthly audit. When searching under a clinician, Christensen will choose the first appointment of the month corresponding to the selected mnemonic. Note that there are 13 charts for 13 clinicians. In a truly randomized audit, each clinician has an equal chance of being selected to pull patient charts; however, Christensen would like to see the performance of all clinicians from the five audiology clinics in the Dallas-Fort Worth Metroplex.

Next in the audit process, Christensen pulls the audit tool, (referred to as the Rehab Quality Audit Chart by Cook Children's) on the computer, and initially checks indicators eight and 18. These are the indicators reported to JCAHO through the liaison, Nancy Thurman. When the stakeholders mentioned the audit tool seemed like "busy work," it is interpreted that indicators eight and 18 were given more importance than the remaining 21. If both indicators do not have any issues, then the remaining indicators will be checked. If issues arise, it must be checked to see if the same issue with the clinician has been reoccurring for the past three months. If there are no reoccurrences, a note is written down to set up a meeting to re-educate the clinician. If there has been a pattern of issues for the past three months, after the audit, or post audit, a performance plan must be developed and documented.

With the remaining 21 indicators, less emphasis is given because there is a lack of understanding of from where the indicators originated, who is interested in these indicators, and the purpose of them. Eight and 18 are significant since they are reported to JCAHO for accreditation purposes, but the others lack meaning. If the remaining criteria or indicators have no issues, the audit is complete. On the contrary, if there are concerns with any of the indicators, the situation needs further evaluation to determine if it is systemic, or repeating

with one clinician or multiple clinicians in the department. During the audit, notes are taken and a meeting is scheduled to discuss a particular clinician's performance or a reoccurring trend among various clinicians. The post audit process of having the meeting will occur on a scheduled time outside of the audit time to raise the awareness of a lack of performance standards.

Post audit, portrayed in orange, shows the next step would be to pull the same appointment mnemonic audited last month to track improvement of performance. If the issue seen last month has been resolved, a summary sheet is filled out from Christensen, and is the end of the auditing process. Currently, there is not a process for continuation if the issue has not been resolved. While it is wise to audit the same mnemonic to track if performance has improved, this shows immediate improvement, similar to putting a Band-Aid on the situation. If the following month the issue resurfaces again, Christensen would not know unless a clinician gives the awareness to management. The Senior Design team will collaborate to develop a plan to track these trends in the *Control* phase demonstrated later in the report.

1.5 Voice of the Customer (VOC) Survey

Mentioned earlier, the Voice of the Customer (VOC) survey was developed to get a better understanding from the stakeholders involved regarding the importance of various indicators on the auditing tool. The survey listed each indicator to remind the audiologists and coordinators, rather than placing numbers alone. Before sending out the survey, a meeting was held with Rehab management to determine which indicators could be removed or merged from a quick glance. By this activity, the team and Rehab management were successful in reducing the number of indicators from the original 23 to 15. This is

because the indicators were either not applicable to the Audiology Department, checked in the process of another indicator, or did not bring value to management. As a result of the exercise, this reduced the number of indicators by approximately 30%.

1.6 Project Charter

The project charter sets the scope of the project. There were several revisions to the charter due to time constraints and a lack of data to support the previous charter. The project charter goes into further details about the opportunity statement, the goals or objectives of the project, the project scope to prevent scope creep, the business case, as well as the stakeholders involved in the project. The charter also stated a clear timeline of the project. By developing the project charter, the team could reference back to it when necessary and serves as the overview of the project.

Lean Focus (101) | Lean Focus (201) | Six Sigma Focus

Project Charter

Opportunity Statement:
The auditing system within the Rehabilitation Services' Audiology Department is not accurately measuring the quality of patient charts. There is no standardized system, or meaningful metrics in the current auditing process. Audiologists and stakeholders are not satisfied with the current metrics from the auditing tool.

Goals / Objectives:
To create and document a standardized auditing process for the Audiology department that will accurately capture errors by the end of April 2017.

Project Scope:
The process begins with the auditor choosing a mnemonic at random, and ends upon the completion of the auditing process within the Audiology department only.

Business Case:
To bring meaning to the auditing process and meet compliance and quality requirements. This will help to mitigate potential legal risk that comes with lack of traceability and documentation

Dates: *January 30th – May 2nd*

Champion: Jack Sosebee, *Jillian Lemonds*

Team Leader: *Laurie Lamb*

Facilitator: *Rama Koganti*

Team Members:

Bushra Rohaizad (UTA)
Abira Syed (UTA)
Bryan Pennington (UTA)
Stewart Lanie (UTA)
Jenny Griffin (UTA)
Lisa Vaughan-Christensen (Cook Children's Health Care System)
Kristi Reed (Cook Children's Health Care System)

Figure 1.2: Project Charter

1.7 Project Plan

The project plan is a schedule with critical due dates of the senior design project. Mentioned earlier, the initial project needed to be revised with the timeline given to the team; therefore, the team had a further time constraint to complete the project successfully. The plan was developed in Microsoft Project, a software package that shows predecessor events that must be completed to continue with the next task. During the *Define* and *Measure* phases, it is shown that the team had to undergo vaccinations and background checks to begin the project. As a result, there is overlap between these phases that should have been completed in their respective sections of the methodology.

GANTT CHART

	Task Name	Duration	Start	Finish	Pre	% Comp
1	**Phase 1: Define**	**14 days**	**Thu 1/19/17**	**Tue 2/7/17**		**100%**
2	Meeting with Dr. Kydd	1 day	Mon 1/23/17	Mon 1/23/17		100%
3	Signed Paperwork	10 days	Mon 1/23/17	Fri 2/3/17		100%
4	Team Agreement	1 day	Thu 2/2/17	Thu 2/2/17		100%
5	**Phase 2: Measure**	**20 days**	**Wed 2/8/17**	**Tue 3/7/17**		**100%**
6	Receive Vaccines	13 days?	Wed 2/8/17	Fri 2/24/17	3	100%
7	Background Check	13 days?	Wed 2/8/17	Fri 2/24/17	3	100%
8	Develop Process Flow	5 days?	Wed 2/15/17	Tue 2/21/17		100%
9	SIPOC Chart	1 day?	Tue 2/21/17	Tue 2/21/17		100%
10	Survey - VOC	11 days	Tue 2/21/17	Tue 3/7/17		100%
11	**Phase 3: Analyze**	**15 days**	**Wed 3/8/17**	**Tue 3/28/17**	**5**	**100%**
12	Conduct Audit	1 day	Mon 3/20/17	Mon 3/20/17	8	100%
13	Analyze Data	6 days?	Tue 3/21/17	Tue 3/28/17	12	100%
14	**Phase 4: Improve**	**15 days**	**Wed 3/29/17**	**Tue 4/18/17**	**11**	**100%**
15	Propose Corrective Action	8 days?	Wed 3/29/17	Fri 4/7/17	13	100%
16	**Phase 5: Control**	**15 days**	**Tue 3/28/17**	**Tue 4/18/17**	**11**	**100%**
17	Propose Sustainable Measures	5 days	Mon 4/10/17	Fri 4/14/17	15	100%
18	**Prep for Presentation**	**11 days**	**Wed 4/19/17**	**Wed 5/3/17**	**16**	**100%**
19	Develop Randomization Tool	5 days	Mon 4/24/17	Sun 4/30/17		100%
20	Work on Report	9 days	Wed 4/19/17	Mon 5/1/17		100%
21	Work on Presentation	10 days	Wed 4/19/17	Tue 5/2/17		100%
22	Present to Cook's	1 day	Mon 5/1/17	Mon 5/1/17	19	100%

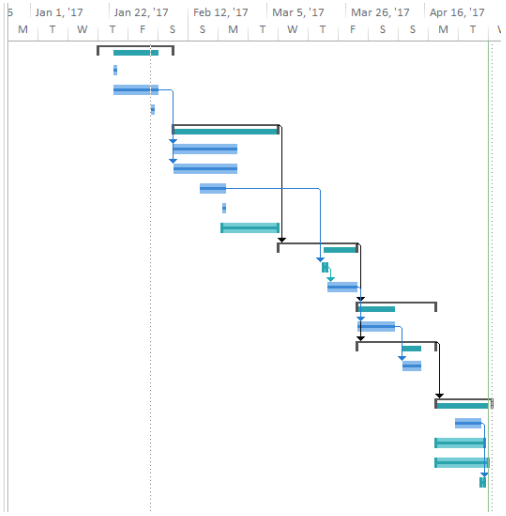


Figure 1.3: Project Plan

CHAPTER 2

MEASUREMENTS

2.1 Data Collection Plan

After fully defining the project's scope, a data collection plan is developed. The plan is pertinent and must be accurate to continue with the rest of the methodology. If the data collection plan does not gather the correct data, the rest of the project would reflect results based on incorrect data; therefore, it is crucial that a well-established plan is created and adhere to. The team collaborated with key stakeholders and concurred to collect time studies, results from the VOC survey, and develop an accurate sample size for the number of patient charts to be audited.

2.2 Time Studies

To develop a baseline time study of the auditing process, key metrics were essential. In Figure 4, Mikell Groover, author of Work Systems and the Methods, Measurement, and Management of Work, explained there must be an estimate of how long each process takes and historical records of how long auditing takes. Unfortunately, since there was no tracked time, the team conducted time studies to gather historical data. Mentioned previously, Christensen said auditing can take her an estimate of two to four hours, with auditing the indicators excluding eight and 18 taking about five to seven minutes on each patient chart, requiring the longest amount of time in comparison to the rest of the steps explained in the *Define* phase. Setup, including pulling a patient chart, pulling the audit tool, and filling out the chart takes approximately five minutes, putting

each audit of patient charts at 10 to 12 minutes. With 13 clinicians, the estimated time is 130 minutes to 150 minutes or 2.17 hours to 2.5 hours.

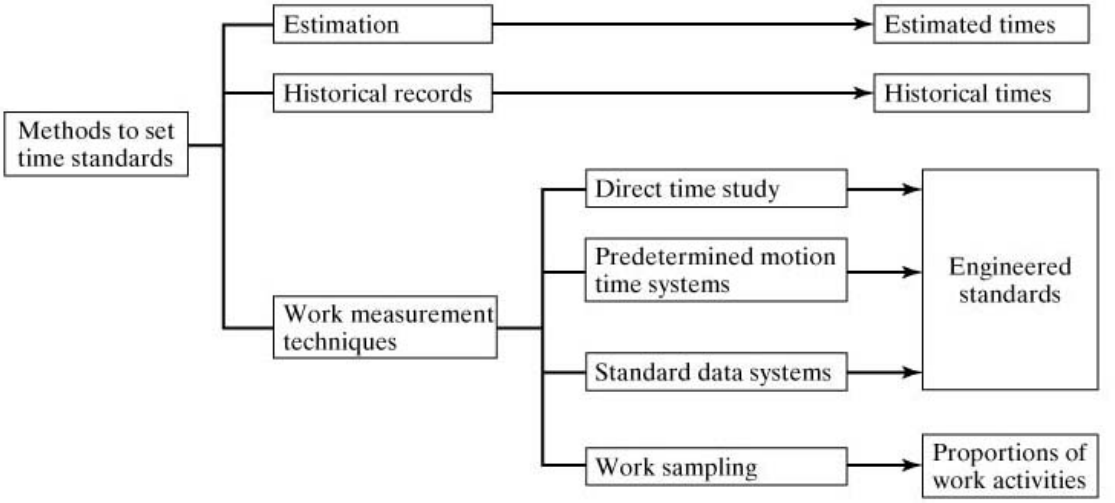


Figure 2.1: Groover, Methods to Set Time Standards

The initial time study was conducted with the original auditing tool of 23 mnemonics. Cell phones, with lapping stopwatches, were used to calculate times of each audit. Table 2.1 shows the raw data gathered during the first time study. The team observed Christensen select a mnemonic to audit the month's patient charts on. This mnemonic was carefully selected during the month, as the manager noted areas of work that may have needed to be further investigated to ensure quality was being carried through. Christensen then pulled up a document pre-populated with audiologist names, and proceeded to manually comb through Meditech, the medical record system, for a patient chart under each clinician that fell under that mnemonic. Once a patient chart was selected, the auditor would go through the document, checking off indicators from the audit sheet as they applied. If a patient chart of that mnemonic type could not be located for a specific audiologist, a chart of an existing mnemonic type was selected instead. This chart was selected at the discretion of the auditor, usually for ease of processing. As a result, there

were some fluctuations noted in the average cycle time per chart. Once all the auditing criteria had been accounted for, Christensen moved on to the next chart.

Audit 1 - (March 20th, 2017)															
Task	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 6	Cycle 7	Cycle 8	Cycle 9	Cycle 10	Cycle 11	Cycle 12	Cycle 13	Avg	Avg w/ 15% PFD
Pull Patient Chart from Meditech	0:00:44	0:00:46	0:00:42	0:01:02	0:00:58	0:00:43	0:02:25	0:01:26	0:00:30	0:01:20	0:00:22	0:00:52	0:01:57	0:01:04	**0:01:13**
Audit Chart	0:01:59	0:01:58	0:01:43	0:00:44	0:01:52	0:01:38	0:01:54	0:01:53	0:02:19	0:02:46	0:02:21	0:02:18	0:02:50	0:02:01	**0:02:19**
Total Cycle Time	0:02:43	0:02:44	0:02:25	0:01:46	0:02:50	0:02:21	0:04:19	0:03:19	0:02:49	0:04:06	0:02:43	0:03:10	0:04:47	0:03:05	**0:03:32**

Table 2.1: Audit 1 Cycle Times

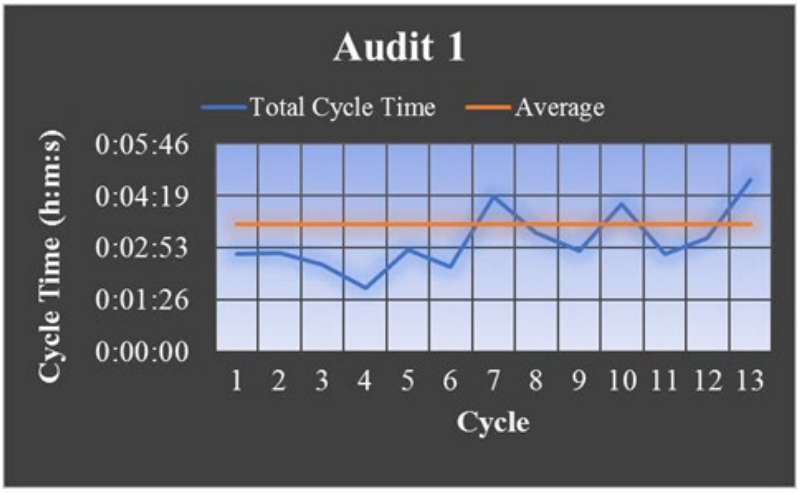


Figure 2.2: Audit 1 Cycle Times

The observed average audit cycle of a patient chart for the first time study was 03:05 minutes. Notice that the audit cycle time is based solely on observation. When conducting time studies, the next step is to develop a standard performance. A standard performance is "a pace of working that can be maintained by an average worker throughout an entire work shift without harmful effects on the worker's health or physical well-being" (Groover, 2007). To reach the standard performance, normal time must be calculated.

$$T_n = T_{obs}\,(PR)$$

Where: T_n = normal time

T_{obs} = observed time

PR = performance rating of the worker's pace

By using this equation, normal time can be calculated. The performance rating of Christensen is 100% since she is well-trained and has been conducting audits for several years. Observed time must be adjusted into decimal form for easier calculation.

$$T_n = T_{obs}\,(PR)$$

$$T_n = 3.083\ (1.00)$$

$$T_n = 3.083 \text{ minutes}$$

Time normal remained the same as time observed as a result of Christensen's performance rating. An example of when time normal does not equal time observed is in the process of training a new employee. Performance rating is lower in this scenario since the individual is not fully up to speed to another employee performing at a faster pace.

Final step of developing a performance standard is to adjust the normal time with a Personal time, Fatigue, and Delays (PFD) allowance. This allows for lost time in tasks being performed such as restroom and water breaks, fatigue due to work-related stress, and machine breakdowns. A standard PFD allowance in industry is 15%. To calculate the performance standard, the following formula will be used:

$$T_{std} = T_n(1 + A_{pfd})$$

Where: T_{std}= standard time

A_{pfd} = personal, fatigue, and delays allowance

By using this equation, a standard time can be calculated for a given task. The calculation of standard time can be seen below:

$$T_{std} = T_n(1 + A_{pfd})$$

$$T_{std} = 3.083(1 + 0.15)$$

$$T_{std} = 3.55 \text{ minutes}$$

With 15% PFD allowance, the average cycle time changed to 3.55 minutes or 3:33 minutes. In the process of observing the audit, it was shown that some clinicians do not see the same type of patients; therefore, the cycle times do not reflect the same appointment type. For example, cycle 4 reflected in Figure 5 shows a significant drop in cycle time. This is due to the change in mnemonics; however, it will be assumed that all appointment type audits take the same amount of time.

A second monthly audit was performed with the current patient chart. Raw data of the second audit can be seen in Table 2.2.

Audit for Audiology - (April 11th, 2017)															
Task	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 6	Cycle 7	Cycle 8	Cycle 9	Cycle 10	Cycle 11	Cycle 12	Cycle 13	Avg	Avg w/ 15% PFD
Change Chart Details	0:00:45	0:00:27	0:00:35	0:00:31	0:00:16	0:00:41	0:00:25	0:00:35	0:00:24	0:00:28	0:00:22	0:00:34	0:00:33	0:00:30	**0:00:35**
Pull Patient Chart		0:01:12	0:00:58	0:00:40	0:00:51	0:00:36	0:00:34	0:01:55	0:00:44	0:00:28	0:00:42	0:00:28	0:01:19	0:00:52	**0:01:00**
Audit Chart	0:04:17	0:01:40	0:02:16	0:01:32	0:02:45	0:01:42	0:03:05		0:02:20	0:01:07	0:01:54	0:01:07	0:02:12	0:02:10	**0:02:29**
Total Cycle Time	0:05:02	0:03:19	0:03:49	0:02:43	0:03:52	0:02:59	0:04:04	0:02:30	0:03:28	0:02:03	0:02:58	0:02:09	0:04:04	0:03:32	**0:04:04**

Table 2.2: Audit 2 Cycle Times

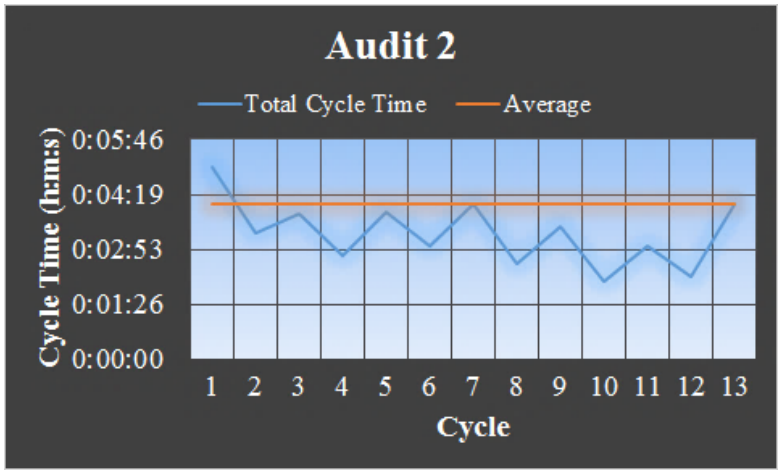


Figure 2.3: Audit 2 Cycle Times

In the second audit, the observed average cycle time was 3:32 minutes with a 15% PFD allowance equaling 4:04 minutes. There is an increase in the average in comparison to the first audit, which is driven by cycles one, seven, and 13. The slight increase is a result of Meditech being slow and causing glitches in the EHR system. The overall standard time among the two monthly audits initially observed averages to 3.80 minutes or 3:48 minutes.

2.3 VOC Survey Data

The survey designed for stakeholders addressed each indicator on the original auditing tool to receive valuable feedback for Rehab management. Questions such as "Does this indicator provide pertinent information to you or your department?" and "Why does [this] indicator pertinent to you or your department?" were asked. If the stakeholder did not find an indicator important, the survey would take the answer "No" and continue them to the next indicator until all questions pertaining to each individual indicator was answered. If a stakeholder answered "Yes" to the pertinence of the indicator, a further explanation was asked. The reason the stakeholders were not asked further questions if answered "No" was to match the objective of the project: to provide value or meaning to the auditing tool. By answering "No", the stakeholder felt the need to remove the indicator. The survey was geared more towards why a particular indicator should remain on the auditing tool. The responses to the survey are included in Figure 2.4.

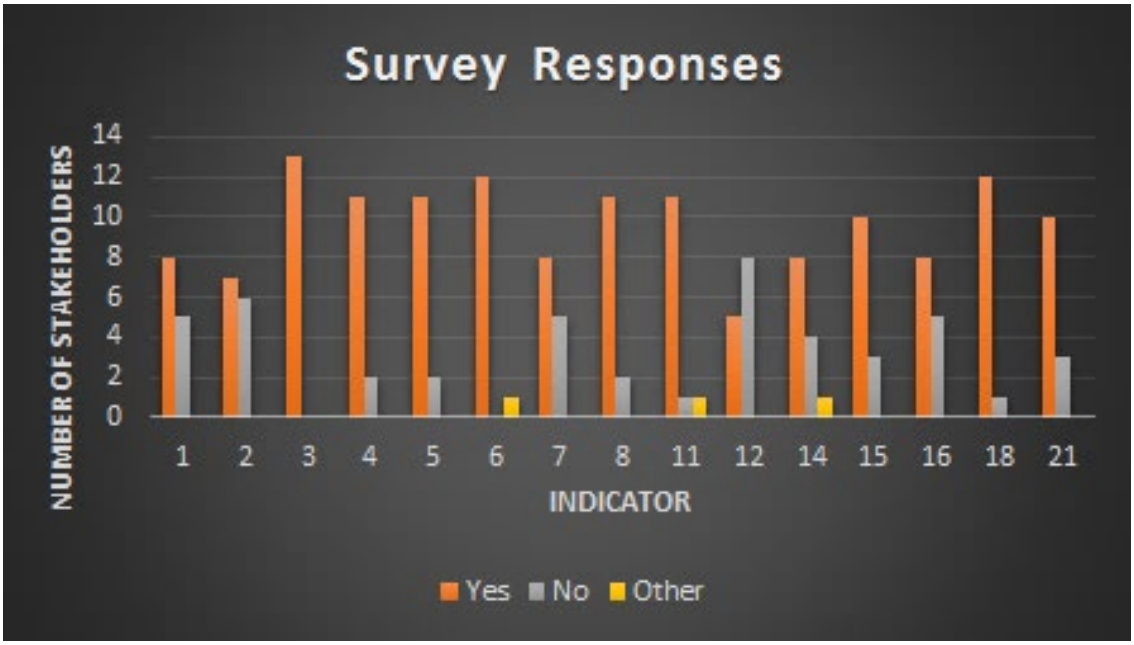


Figure 2.4: Survey Responses to Indicators

2.4 Sample Size

Currently, the sample size of 13 patient charts is used during monthly audits. This number was explained by Rehab management that 13 is an arbitrary number selected since there are 13 clinicians. To determine the accuracy of this sample size, the team coordinated with Lemonds to gather a monthly count of the number of patients seen by all Rehabilitation Services clinics in the Dallas-Fort Worth metroplex.

Month	South Rehab	CMC Rehab	NEC Rehab	Mansfield
December	382	181	103	121
January	444	240	130	109
February	413	207	131	119

Table 2.3: Rehabilitation Services Patient Visits

CHAPTER 3

ANALYZE

3.1 VOC Survey Results

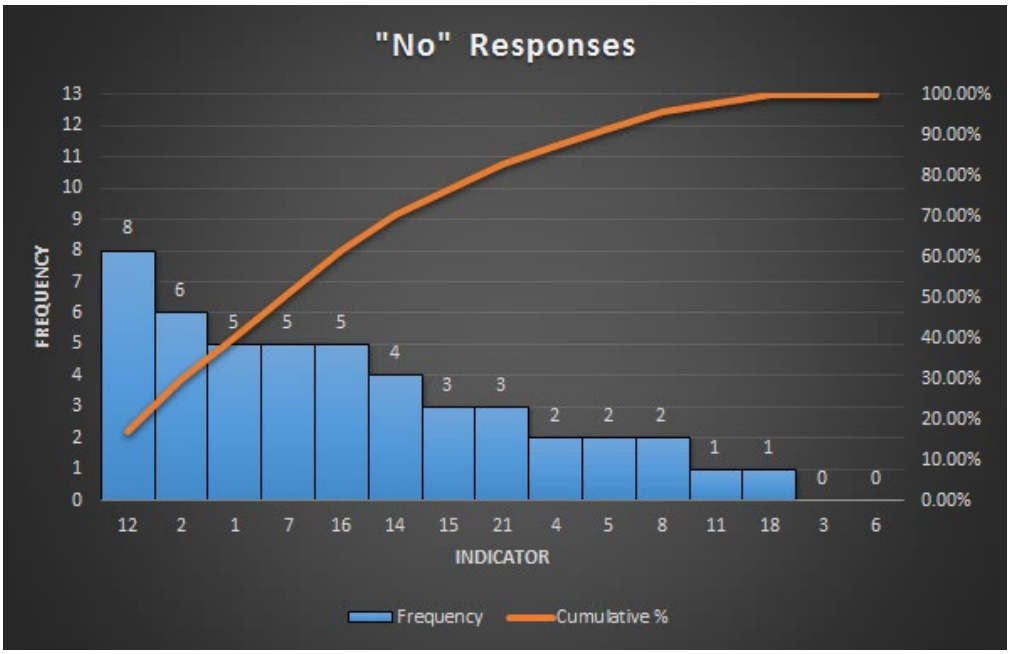


Figure 3.1: VOC Survey "No" Reponses

The survey results shown in Figure 3.1 is a Pareto chart indicating which criteria or indicators have the most "No" responses. Beginning with indicator 12 having a total of eight responses, the criteria states "Intervention is provided in a timely manner." Due to the vague interpretation of "timely" and clarified from Rehab management that an "intervention" is incorporated in every appointment, this indicator was removed from the auditing tool.

Subsequentially, indicator two ranked the second highest votes, stating "Consent to treat forms are signed at every eval/CLI appointment, and within the last 12 months for

longer plans of care." While the audiologists claimed that this indicator should be a reflection of the front desk instead of themselves, it was shown that the indicator serves as a regulation by JCAHO; therefore, the indicator needed to remain on the auditing tool.

Further evaluations, such as the ones expressed above, were used to thoroughly assess each indicator with survey responses to determine if an indicator should be eliminated or stay. As a result of this process, four more indicators were removed from the audit tool, thereby increasing the reduction of indicators by 17%.

3.2 Statistical Sampling

Month	South Rehab	CMC Rehab	NEC Rehab	Mansfield	Sum
December	382	181	103	121	787
January	444	240	130	109	923
February	413	207	131	119	870
Average	413	209	121	116	860

Table 3.1: Statistical Sampling Data for Patient Visits

Given the average number of patient visits by Rehabilitation Services of 860 per month, the team investigated the accuracy of sampling 13 patient charts out of 860. By such a small sample size, the team concluded that at a 95% confidence level, there is a 28% margin of error. Having such a high margin of error shows that one in every four patient charts will not properly reflect the entire population of 860 patient charts per month, therefore reducing the quality of the monthly audit. By increasing the sample size to 30 patient charts to be audited per month, the team managed to maintain a 95% confidence interval, while reducing the acceptable margin of error to 5%.

CHAPTER 4

IMPROVEMENTS

4.1 Auditing Cycle Time

While not initially having a targeted goal of reducing cycle time, the team opportunely drove cycle time down by approximately 39%, improving productivity during monthly audits. Currently in the auditing process, Christensen audits 13 patient charts in about 50 minutes in standard time, a cycle time of 3.80 minutes. With the reduction in the number of indicators, Christensen can audit 30 patient charts in 1 hour and 10 minutes, a cycle time of 2.32 minutes. This significant reduction from the original estimate of two to four hours shows that if Christensen is not interrupted of her duties, she can complete the monthly audit with over two times the number of patient charts in half the amount of time.

4.2 Auditing Tool

Through the initiation of reviewing the auditing tool and conducting a survey from stakeholders, the team eliminated 12 of the 23 indicators on the original auditing tool, a 52% reduction in the number of indicators. The current auditing tool had an effectiveness level of 24% through calculations from the VOC survey. The elimination process increased the effectiveness of the tool to 100% by Rehab management. The new auditing tool can be found in Appendix B.

Another improvement to the auditing tool the team performed was adding details to each indicator regarding to whom the indicator is important. There was a lack of information provided about the indicators leaving stakeholders confused about the value

of them. Resultantly, the team undertook the initiative to find the policies related to these indicators for an easier training process for the future. With Christensen needing help with auditing, she is looking towards training another individual and by corresponding the indicators with policies, this would help her reduce the amount of time spent on training.

4.3 Reduction in Mnemonics

The next improvement of the senior design team's project was to reduce the number of mnemonics or patient appointment types seen at the Audiology Department. When discussing mnemonics with Rehab management, Christensen verified the number of mnemonics in Audiology totaling 36. Amazed by the vast number of mnemonics, the stakeholders added that some of the mnemonics are rarely seen at the clinic and are redundant. The stakeholders decided to reduce the number of appointment types to 12, a reduction by 67%. The list of mnemonics can be seen in Appendix C.

4.4 Increased Sample Size

The final improvement the team was able to perform is the increase in sample size to properly reflect the number of patients seen by all clinics in Rehabilitation Services. While it may seem counterintuitive to increase the number of patient charts to sample from 13 to 30, the margin of error is reduced from 28% to 3% respectively, while maintaining a confidence interval of 95%. Through the increase in patient charts being audited, the quality of monthly audits to reflect Rehabilitation Services has positively increased.

CHAPTER 5

FUTURE IMPLEMENTATION

In the *Control* phase of DMAIC, an implementation plan shall be developed and suggested to Rehab management to sustain the project. This section of the methodology serves as the most critical segment. Reason being, humans tend to revert to old standards due to common practice. Through this section, the explanation of the team's control plan shows the benefits to Rehab Management.

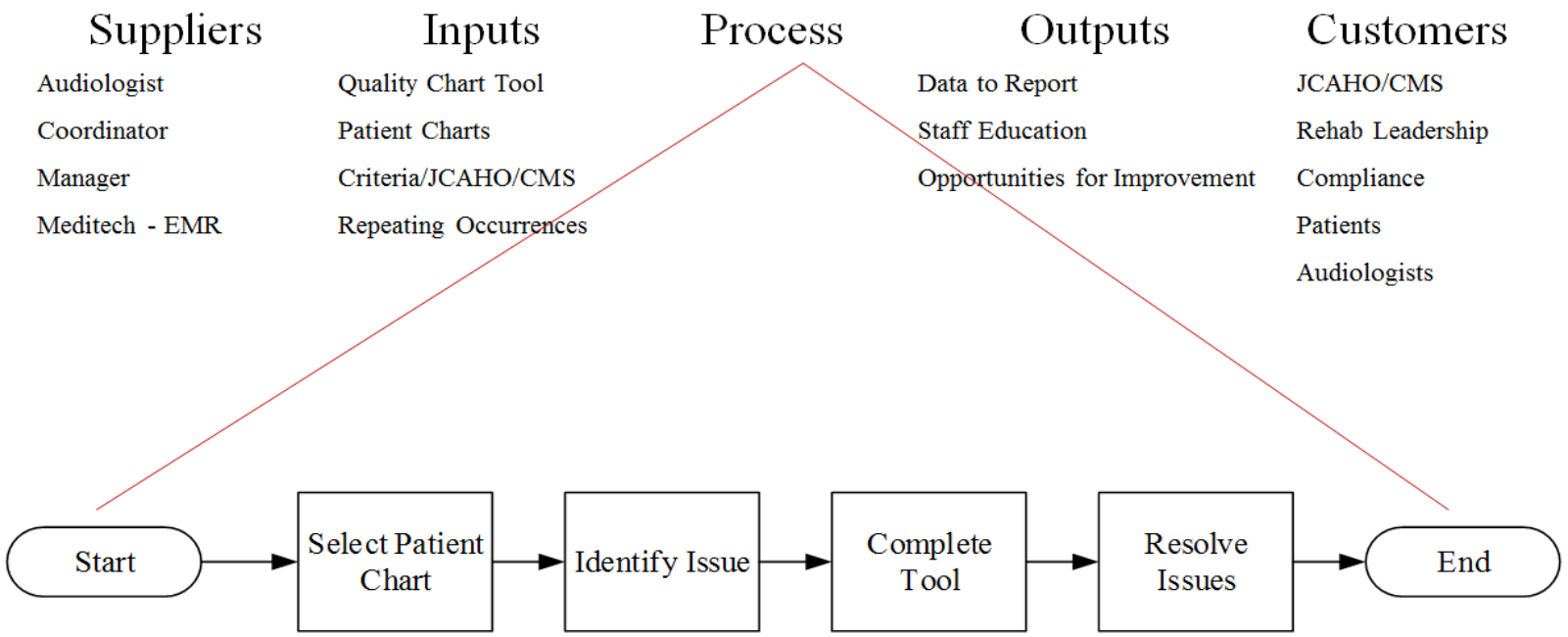
5.1 Userform Interface

In the current process of auditing, Christensen uses Microsoft Word to audit monthly charts. Seeing this, the team applied the knowledge and skills obtained from IE – 2305: Computer Applications in Industrial Engineering to develop a userform for Christensen. Explained earlier that the mnemonic to be audited for the month is based on the auditor's discretion, the senior design team utilized Microsoft Excel Visual Basic Applications (VBA) to code in a randomization for appointment mnemonics. By doing so, the auditor cannot subjectively select with mnemonic to audit when there is no arising issue from the clinicians. Keeping in mind that not all clinicians see the same types of patients every month, two randomization buttons were included as Plan A and Plan B mechanisms. Also, through this new tool, Microsoft Excel will populate 30 auditing charts for Christensen instead of having to manually copy, paste, and fill out 150 data points during auditing. An image of the new Excel VBA auditing tool can be found in Appendix B.

In the future, Christensen can also track trends of mnemonics, indicators being audited, and filtered per clinician. Not having these mechanisms in Meditech, this excited Rehab management. With the new tool, the Audiology Department can confidently report to JCAHO and CMS the details that are needed for accreditation and during random audits from these external entities.

APPENDIX A

SIPOC DIAGRAM


Suppliers
Audiologist
Coordinator
Manager
Meditech - EMR
Inputs
Quality Chart Tool
Patient Charts
Criteria/JCAHO/CMS
Repeating Occurrences
Process
Outputs
Data to Report
Staff Education
Opportunities for Improvement
Customers
JCAHO/CMS
Rehab Leadership
Compliance
Patients
Audiologists
Start
Select Patient Chart
Identify Issue
Complete Tool
Resolve Issues
End

APPENDIX B

AUDITING TOOLS

Rehab Quality Chart Audit-Audiology

Patient Medical Record Number	Audiologist & Location

Date Chart Reviewed	Reviewer	Date of Service
11/09/16		10/24/16

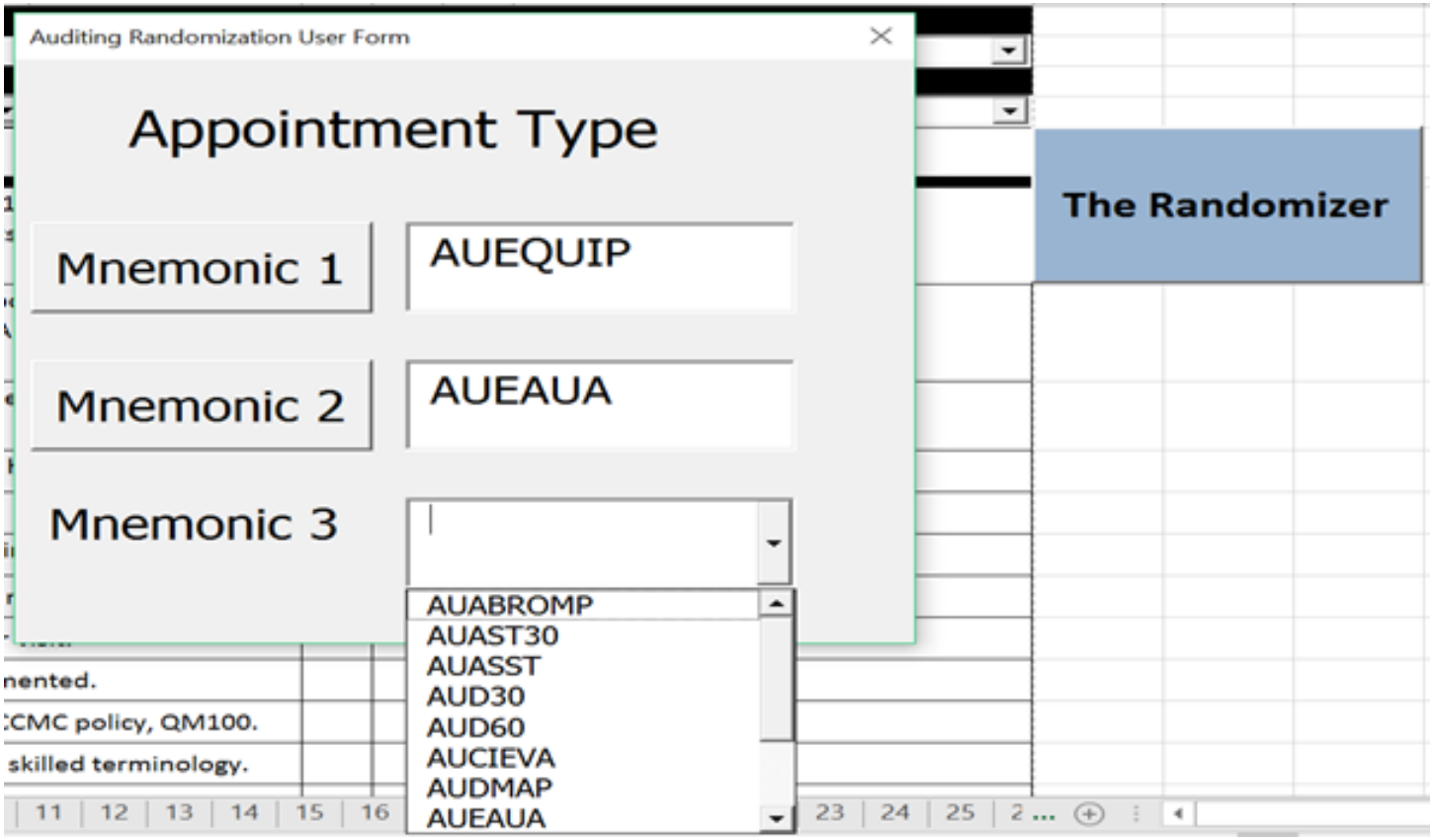
	Indicator	Documentation Present?			Comments
		Yes	No	N/A	✓✗
1.	Physician order present for current tx plan, including within 6 months for long-term patients? (Pat. Referral & Treatment or Physician Direction)	✓			
2.	Consent to Treat forms are signed at every new eval/CLI appointment, and within the last 12 months for longer plans of care? (Conditions of Admissions)	✓			
3.	Case history completed? (current medications, surgeries, allergies, etc) (Rehab Pat Info Sheet, Audiology Case History, Pertinent Case History updated in DTR)	✓			
4.	Assessment of visit is completed and documented timely? (within 72 hours for children with normal hearing, or within 24 hours when hearing loss is identified)	✓			
5.	Reason for visit is identified	✓			
6.	Otoclearance is present for service provided			✓	
7.	Sufficient case history is recorded	✓			
8.	Testing is sufficient to determine hearing status	✓			
9.	Testing is appropriate and accurate	✓			
10.	Necessary cross check methods are employed	✓			
11.	Testing is consistent with departmental protocols	✓			
12.	Intervention is provided in a timely manner	✓			
13.	Communication options counseling was performed, or a referral form was provided to the CI/Aural Rehab Coordinator			✓	
14.	Recommendations address the parental reported reason for visit	✓			
15.	Family/Patient Education and understanding is clearly documented	✓			
16.	Abbreviations used meet compliance guidelines per CCMC policy?	✓			
17.	Appropriate referrals are made	✓			
18.	Documentation reflects justification for CPT billed code with skilled terminology.	✓			
19.	Documentation is unique and specific to the DOS. There is no evidence of errors noted with the Meditech function of copy/paste or recall values.	✓			
20.	Collaboration among disciplines and other healthcare providers is documented	✓			
21.	Appropriate follow up visits have been recommended	✓			
22.	Appropriate follow up visits have been scheduled	✓			
23.	Other Notes				

Rehab Quality Chart Audit-Audiology

Patient Medical Record Number	Audiologist & Location

Date Chart Reviewed	Reviewer	Date of Service

	Indicator	Documentation Present?			Comments
		Yes	No	N/A	
1.	Physician order present for current tx plan, including within 12 months (Commercial) or 6 months (public pay) for long-term patients? (Pat. Referral & Treatment or Physician Direction) Compliance Audit				
2.	Consent to Treat forms are signed at every new eval/CLI appointment and within the last 12 months for longer plans of care? (Conditions of Admissions) Compliance Audit				
3.	Case history completed? (current medications, surgeries, allergies etc.) (Rehab Pat Info Sheet, Audiology Case History, Pertinent Case history updated in DTR) clinical audit; may go away with EPIC				
4.	Assessment of visit is completed and documented within 72 hours.				
5.	Reason for visit is identified. Compliance audit				
6.	Otoclearance is present for service provided. We want add this one-it is important to our practice, like an order. Compliance Audit				
7.	Testing is appropriate and accurate in accordance with departmental controls. Clinical Audit				
8.	Recommendations address the parental reported reason for visit. Clinical				
9.	Family/Patent Education and understanding is clearly documented. Clinical				
10.	No abbreviations were used from the "Do Not Use" list per CCMC policy. Compliance QM100				
11.	Documentation reflects justification for CPT billed code with skilled terminology. Clinical				
12.	Appropriate recommendations have been made.				


Auditing Randomization User Form
Appointment Type
Mnemonic 1
AUEQUIP
Mnemonic 2
AUEAUA
Mnemonic 3
AUABROMP
AUAST30
AUASST
AUD30
AUD60
AUCIEVA
AUDMAP
AUEAUA
The Randomizer
nented.
CMC policy, QM100.
skilled terminology.
11
12
13
14
15
16
23
24
25

APPENDIX C

APPOINTMENT MNEMONICS

1. AUABRCOMP – ABR comp w/o sedation
2. AUAST30 – audio eval w/assist 30
3. AUASST – audio eval w/assist
4. AUD30 – audio eval 30 min (this will also be used for OAE appointments)
5. AUD60 – audio eval 60 min
6. AUCIEVA – CI eval
7. AUDMAP – CI mapping 90 minutes
8. AUEAUA- aided unaided 90 minutes
9. AUEQUIP – equipment pick up
10. AUHAESA-exam and select assist (for HA and Baha)
11. AUHAESB - exam and select (for HA and Baha)
12. AUAHF – fitting (for HA and Baha)

REFERENCES

Groover, M. (2007). Work Systems and the Methods, Measurement, and Management of Work. Upper Saddle River: Pearson Education, Inc.

Hammer, M., & Goding, J. (2001). Putting six sigma in perspective. Quality, 40(10), 58.

iSixSigma. (2017). DMAIC. Retrieved from iSixSigma: https://www.isixsigma.com/dictionary/dmaic/

iSixSigma. (2017). SIPOC. Retrieved from iSixSigma: https://www.isixsigma.com/dictionary/sipoc/

The Joint Commission. (2017). About The Joint Commission. Retrieved from The Joint Commission: https://www.jointcommission.org/about_us/about_the_joint_commission_main.aspx

U.S. Centers for Medicare & Medicade Services. (n.d.). About CMS. Retrieved from Centers for Medicare & Medicaid Services: https://www.cms.gov/about-cms/about-cms.html

BIOGRAPHICAL INFORMATION

Abira Syed has been pursuing an Honors Bachelor of Science in Industrial Engineering from the University of Texas at Arlington since 2013. Her research interests include simulation and data analytics. She is currently conducting research in simulation under Dr. Brian Huff. This research project is a representation of the knowledge and skills she has obtained over the course of her baccalaureate program at the University of Texas at Arlington, and through her continuous education in her Lean Green Belt and Six Sigma Green Belt Certifications. Presently, she is interning at Texstars, LLC as an Engineering Intern and at Cook Children's Medical Center as a Process Improvement Intern. She will begin her career at Lockheed Martin Missiles and Fire Control as a Database Administration Associate in the summer.