Study of the effects of improving a process in a pharmaceutical laboratory

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Abstract

Improving processes has been a key focus recently, with pharmaceutical companies exploring various approaches, particularly in laboratory settings. Enhancing processes in regulated laboratories requires compliance with regulatory agencies, standard operating procedures, and the analytical methods used. Benefits include faster results, improved quality, and reduced cycle time. This study aimed to evaluate the impact of a reporting template on laboratory metrics during chromatography data reporting. Analysts' time spent generating chromatographic reports was measured and compared before and after the introduction of the template and guidelines. Additionally, errors in reports and participant feedback were analyzed. The results demonstrated significant improvements in time efficiency and a reduction in mistakes following the implementation of the template and guidelines. However, further research with a larger sample size is needed to confirm these findings, and after confirmation, it would be possible to standardize other parts of the analysis.

Key Terms — Improvement, laboratory, standardizing, chromatographic data.

Introduction

Pharmaceutical companies must ensure that their drugs meet established standards for identity, potency, safety, release timing, and that they will be effective for the intended use. Failure to demonstrate safety and efficacy may result in adverse situations for the patient and potential legal actions against the company. Analytic methods are used to prove efficacy and safety. The analytical test methods must produce reliable, regulatory-compliant results, although not all tests require the same parameters, thus making it more challenging to improve and standardize. Standardizing processes enhances result reliability, reduces errors, and improves quality and release timelines. This research is intended to optimize the reporting of chromatographic data by developing standardized tools and procedures to minimize the mistakes, improve efficiency and quality, and ensure that patients receive the expected product when needed.

Background

Current data and information present how companies evaluate and consider different mechanisms to improve quality control (QC) laboratories' processes. In the September 2004 article “Is there such a thing as a best-in-class lab? Benchmarking of QC operations” [1] presented the findings of a survey to have a better understanding of “what defines a best-in-class QC lab” [1]. With the data obtained, they identified and concluded that to be a “best-in-class QC lab” [1], they must have reduced testing programs, a good planning and scheduling system, and a balance between compliance, cost-effectiveness, customer service, and constant evaluation.

Two different approaches to becoming efficient in a pharmaceutical laboratory were presented in two articles. The first approach was presented in 1995 in the article “Managing laboratory automation in a changing pharmaceutical industry” [2], which explored why the automation process benefits the pharmaceutical laboratory. They presented how different tests can be automated, allowing a reduction in cost, an improvement in analyst safety, an increase in productivity, and a better use of human resources.

The second approach, presented in the article “Incorporating lean principles into pharmaceutical QC laboratory design” [3], was lean methodology. Lean is a Japanese method used to efficiently reduce waste associated with the process. The article presents some lean opportunities related to the design of space, inventory, and location of the laboratories, among other areas. These approaches will make the laboratory more productive by reducing the waste of motion, transport, and waiting.

As mentioned before, QC Laboratory played an essential role in the delivery of the drug products, and it is necessary to look for efficient and productive ways to deliver the work. Because QC laboratories share characteristics with manufacturing and service operations [4], not all approaches can be implemented, and more observation and studies are required.

Problem

Reporting chromatographic data is one of the steps that delays the release of results in a pharmaceutical laboratory. Many pharmaceutical products are received in this company, and having a standard format to report chromatography data is not easy. The standard operating procedure (SOP) establishes the minimum requirements for each report, but the analyst must create it and add any specific requirements that the test method indicates. Because not all analysts have the same knowledge, expertise, and time to perform the reports, in addition to having different opinions on how to create the report, reviewers found a significant number of errors that must be corrected and delayed the release of the sample. These errors affect the quality of the process and, as mentioned before, the delivery of results. This research will examine how the process is performed and suggest some tools to improve the process efficiency.

Methodology

The study will assess the time two analysts consume preparing chromatographic reports before and after the assessment.

Two analyst will prepare a chromatographic report of the assay test of the selected drug product. It will be prepare using the test method requirements, current SOP and USP Chromatographic Chapter <621>. A reviewer will verify the reports and submit the corrections required. It will be collected the time each analyst spend creating the reports and making the corrections. It will also tabulate the amount and type of errors found in each report.

The same analyst will prepare the same chromatographic report of the assay test of the selected drug product. In this part, in addition to following the same instructions that in the first assessment, they will have some work instructions and generic template report to prepare the report. The same reviewer will verify the reports and submit the corrections required.

It will be collected the time each analyst spend creating the reports and making the corrections. It will also tabulate the amount and type of errors found in each report. After creating both reports, it will be asked to the analyst and reviewers feedbacks about the process.

Quantitative data will be collected by measuring the time each analyst spends performing each report, including any rework. The number of errors found in each report, if any, will also be measured by the reviewer. Errors will be classified by type, and the frequency found in each report will be collected. The data will be analyzed using descriptive statistics and graphic representations to show the time consumed for each report and the errors found. A comparison will be made between the time spent creating new reports and the time spent creating reports from provided templates for each test.

Qualitative data will be collected from the analysts about how the guidelines and templates improve their work.

Notes
1- It will be used the chromatographic software used on daily basis by the company to acquire and report results.
2- Analysts will have different expertise and knowledge on the software.
3- Some specific information about the research will be omitted to ensure the confidentiality of the company, its products, and its systems.

Results and Discussion

Two analysts with different knowledge and expertise in the software created two reports, one from the beginning (report 1) and the other using a report template and work instructions or guidelines (report 2) for the assay test of a selected drug product. Analyst 1 was the analyst with less knowledge and expertise in the software, and Analyst 2 was the analyst with more experience and knowledge. Reviewers and management evaluated the report template and work instructions to create the second report to ensure they were aligned with the company policies and requirements. See Tables 1 and 2 for the collected information and Figures 1 and 2 for the graphic representation of the data.

Results and Discussion

Table 1
Results of time and errors obtained from creating reports

Analyst	Type of Report			
	Report 1		Report 2	
	Time (minutes)	Errors	Time (minutes)	Errors
Analyst 1	115	13	16	2
Analyst 2	59	4	8	1

Table 2
Type and frequency of errors found in each report

Type of error	Analyst 1		Analyst 2		Total of errors
	Report 1	*Report 2*	*Report 1*	*Report 2*	
Formatting	9	1	0	0	10
Missing information	4	3	2	1	10
Total	13	4	2	1	20

Figure 1
Comparison of time (minutes) to create reports by two analysts

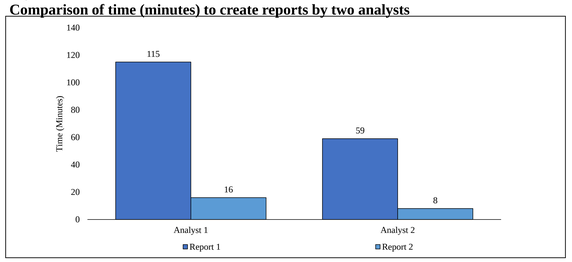
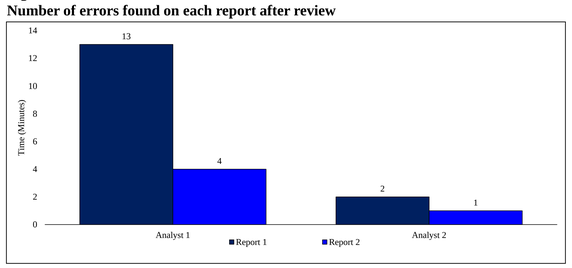


Figure 2
Number of errors found on each report after review



DISCUSSION

- Creating a report with work instructions and a report template reduces the time analysts take to generate the report by 86% and reduces the average error by 60%.
- Following the procedures and the template to create the report allows analysts with less knowledge and expertise in the software to generate the report with the expected quality and specifications.
- Using a paired t-test analysis [5] to evaluate the results, a p-value of 0.410 [6] and a t-value of 1.33 [6] was obtained for the time to create the reports, and a p-value of 0.430 [6] and a t-value of 1.25 [6] for the errors found. Because the p-values are greater than 0.05 and the t-values are significantly smaller than the critical t-value (12.71) [6] with 95% confidence, it is necessary to have more data to reject or accept the null hypothesis to confirm that the results are different and significantly improved with the actions taken.
- From the feedback obtained from the analyst and reviewer in the process, it was a very positive response to the guidelines and the template. Both analysts share that following the guidelines and template converted the process to a very easy one of what and where must be included. The proposed guidelines and template to create reports presented to management were well received and allowed them to make some necessary decisions to standardize how the reviewers perform the process and how analyst will present their data results.
- The work instructions, the report template, and the Standard Operating Procedure (SOP) will allow any analyst to perform the reporting process, even though they don't have enough experience with the software.
- The improvement will allow for reducing cycle times, improving quality, and standardizing the process.

Conclusions

Improvements in a pharmaceutical laboratory are necessary but difficult to perform because of the various tests and procedures performed. This research considered all the information and suggested an improvement process for standardizing a specific method of reporting chromatographic results that showed delays in delivering the results. The assay test results of a particular drug product were selected to evaluate the time and number of errors that two analysts spent creating a new report and another report after providing guidelines and templates to present the results. The results showed significant improvement in the time reporting and the number of errors on the reports and proved the necessity of having clear and specific instructions to perform a process. The guidelines and template allowed the analyst to create a report using the correct, expected, and established manner to report the chromatographic data obtained, improving the quality of the process. It would be necessary to get more data to compare the before and after results and prove the improvement obtained with more reliability. Further work will be suggested to continue improving the quality of the process of reporting results and ensuring a reduction in cycle time.

Future Work

- Increase the sample size to obtain more reliable statistical results and confirm the improvement hypothesis, reducing time and errors.
- Improve and update the SOP to report results of other tests to continue standardizing the process and reducing errors.
- Implement a new method of creating generic data folders that include generic templates of all tasks of the analysis process to continue minimizing errors, reducing analysis time and improving quality.

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