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Statistical Quality Control Tools for Total Quality Management in Pharmaceutical Product Development

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Abstract:

The pharmaceutical sector is known for being highly regulated, meaning the goods produced must adhere to strict industry standards. The development of pharmaceuticals incorporates total quality management (TQM) to ensure that patients receive products of the highest quality. TQM fosters an efficient approach for maintaining and improving product quality and customer satisfaction through systematic processes. Achieving TQM requires the critical implementation of statistical quality control (SQC) tools. The execution of TQM is based on data evaluation, reduced process variability, enhanced dependability, and improved decision-making due to the application of SQC tools. This review has a particular focus on the use of SQC tools in the development of pharmaceutical products with an emphasis on enhancing quality metrics, determining critical process variables, meeting regulatory requirements, applicability, benefits, and limitations. These tools enable organizations to exercise control over their processes, maintain compliance with regulations, decrease variability, and manage product quality. Through these approaches, pharmaceutical companies will exceed the compliance requirements set forth by the governing bodies and will be able to deliver quality products. The use of SQC tools demonstrates clear improvements in product quality, cost efficiencies, accelerated time-to-market, and reduced risks. Incorporation of SQC tools into the TQM framework greatly enhances operational efficiency, competitiveness in the market, and most importantly, patient and customer safety and satisfaction. The strategic use of these tools enables pharmaceutical companies to maintain an industry-leading position with high quality, long-term success, and sustainable growth.

Introduction:

In building a product, all components should function effectively and fit the standard requirements. There are instances where it was inappropriate to sell the product because the consumer found it unattractive. One must also understand the client's perspective when selling a product, especially if they want to successfully sell their product. To name the set of statistical

methodologies used by professionals working with products, it denotes a collection of numerical information that has been gathered, arranged in tables, and summarized through specific calculations that are designated for analysis and reporting to make informative conclusions. SQC is a system designed to improve the quality of products and, consequently, minimize waste and rework [1]. A quality product that naturally



MANUSCRIPT ID: BTS0926008

improves business performance. The operation of statistical methods to control a process or manufacturing system is known as statistical process control, or SPC. Process behaviour, diagnose internal system failures, and correct product malfunctions are monitored using SPC methods and techniques. Covering processes through automated and predetermined methods is termed supervising and controlling; thus, SPC is also the application of automated systems to supervise processes and ensure predetermined conditions of quality standards and nonsupervisory minima are satisfied [2]. Walter A Shewhart, at Bell Telephone Labs, came up with the control chart in the roaring twenties. His work was basically focused on the Plan-Do-Study-Act (PDSA) cycle, which, honestly, is just a fancy way of saying “try stuff, see what happens, fix it, repeat” [3]. Fast forward to post-World War II (1940s- 1950s), and W. Edwards Deming, hauling Shewhart’s ideas across the Pacific to Japan. The Japanese industry folks ate it up—turned those theories into a whole movement. Deming kept hammering the point that quality wasn’t just a bonus, but the actual secret sauce for business success. TQM became the backbone of Japanese manufacturing, and honestly, the rest is history thereafter.

In the post-World War II period, Joseph Juran concentrated on the directorial aspects of quality and introduced the concept of the “quality trio”: quality planning, quality control, and quality enhancement. In TQM Emergence (1960s- 1980s), the Integration of SQC in TQM was held. During this period, SQC tools became integral to TQM. Organizations began using tools like control maps, Pareto analysis, and cause-and-effect diagrams to identify and address quality issues. Totally, quality circles in Japan, workgroups known as quality circles, surfaced, encouraging hands-on

participation in problem-solving using SQC tools [4]. In global relinquishment (1980s- 1990s), the preface of the International Organization for Standardization (ISO) 9000 series in the late 1980s provided a standardized approach to quality operation, buttressing the use of SQC tools. In the U.S., the Malcolm Baldrige National Quality Award emphasized TQM principles, promoting SQC to achieve excellence. Ultramodern period (2000s- present) is the period of technological advancements in the rise of data analytics and software tools has converted how SQC tools are applied, making them more accessible and effective for associations with spare and Six Sigma. Unification of SQC tools has been integrated into methodologies like Six Sigma, focusing on waste reduction and process enhancement. SQC is applied sometimes to test a sizable population. As a result, only a small chance of the entire product is estimated for quality [5]. Some have stated that if nonstop monitoring were used, SQC wouldn’t be necessary. Originating in post-war Japan, quality operation for process enhancement comprises seven quality control tools. These seven quality control tools were introduced by Tokyo University engineering professor Kaoru Ishikawa. Given that these are simple, easy-to-use tools, workers were able to successfully raise the standard of the business process as a result [6]. Japan is now among the first countries to develop high-quality goods as a result.

The SQC tools enabled the businesses to make a significant quantum of profit in addition to meeting the requirements of the guests. The idea of quality enhancement was formerly limited to the manufacturing sectors [7]. Latterly, it spread to multitudinous other industries, like banking, drugs, government, and medicine. The American automotive and manufacturing sectors advanced the quality enhancement concept



when it came to the West to contend with their Japanese rivals' superior product styles. As a result, the ideas of spare and Six Sigma were presented, ultimately evolving into the keystones of quality management. Nevertheless, new process enhancement approaches, such as Six Sigma, TQM, and spare Six Sigma, are being used in conjunction with the seven quality control tools. Thus, it's allowed that the seven quality control tools of quality operations are the marks for process improvement [8]. In the pharmaceutical industry, ensuring high quality standards is not a non-supervisory demand, but crucial to making certain that the patient receives the necessary quality, safety, and efficacy products. SQC tools are indispensable and play an essential role in TQM involving the development of pharmaceutical products. They are important for completely covering, controlling, and perfecting the quality of pharmaceutical products throughout the development lifecycle [9]. Software tools involving statistics and complex data focusing on individualized drugs, perfect control of quality, and predictive analytics will forge the future of quality operations in pharma. Pharmaceutical product development involves multiple steps through a long and complex set of processes from drug discovery, through clinical research, and onto commercialization [10].

SQC consists of three main components. They are descriptive statistics, such as mean, standard deviation, and range, used to describe attributes of a sample of products. Products batch acceptance quotations are simply characterized by, at the standard of arbitrary descriptions and colorful descriptors that are then statistically examined. Products' whole batches may be either accepted, rejected, or reworked using these descriptors based on predetermined criteria. The other one is SPC, where a static

MANUSCRIPT ID: BTS0926008

analysis of said products is performed at random from the user product line as to whether the product processes are still able to work within predetermined tolerances [11]. This type of SPC is based on the analysis of the produced products and not the manufacturing process, as a colorful descriptor in an SQC analysis. The steps in the SQC analysis process happen in a specific order. This process guarantees complete examination of product quality and, therefore, eliminates the chance for error. The process taken to perform SQC analysis is problem definition, which relates to the problem to be analyzed. This sets the starting point for further steps and defines the objectives, goals, and purpose of the SQC analysis. Dimension: Identify and measure the indicators that define the problem. These measurements can be either attributes (qualitative) or variables (quantitative). All the data related to the dimensions selected are collected. A harmonious dimension that explains the quality characteristics to eliminate the amount is taken into consideration. These statistical analysis tools are used to analyze and evaluate the data. This can be anything from developing simple histograms to complex regression analysis. The results are interpreted, and the conclusions are obtained to improve the quality process from the analyzed results [12].

2. Methodology

A systematic literature search was performed across PubMed, Scopus, and Web of Science for Articles published in English between 2000 and 2025 were considered. The keywords used were "Statistical Quality Control," "Total Quality Management," "Pharmaceutical Development," and "quality assurance." Studies were included that discussed SQC tools in the context of pharmaceutical quality management. A total of 43 articles were identified for review. Studies were excluded if they did not involve



MANUSCRIPT ID: BTS0926008

SQC tools in the development of a pharmaceutical product. Quality control has been described as an assurance of marks and destination, and as control to ensure that the merchandise meets the standards. It compels you to identify the evidence, and the expatriation of forms of identification from an order of values. Quality control is a formal method for the analysis of performance and systematic steps to improve it. In simple terms, it is the systematic method of reducing or eliminating waste, rework, and losses during the process of making a product. There are a few simple tools and simple means that can effectively be used for quality operations and quality control [13].

3. Statistical Quality Control Tools in Pharmaceutical Development. The literature search report returned 100 articles, with 43 selected for full article review. The most frequently used SQC tools in pharmaceutical product development can be classified into basic and advanced tools. The next sections will highlight their usage in pharmaceutical product development [14].

3.1 Basic Statistical Tools

3.1.1 Histograms: Karl Pearson was the first to use the histogram. It is a bar graph that displays frequency distribution by showing one column for each group. It is used to look at what areas of improvement can be identified at any point in the product process. A histogram is a graphical representation of separate data. The length of the bar illustrates the value or frequency. The histogram makes it easy and fast to see where your processes need improvement. It shows the frequency distribution of the data separated among several sample groups. Each bar in a histogram is similar in shape to a bar graph, with each bar showing a group and showing frequency in the height of the bar [15]. Histograms can be very useful when you divide the frequency of your data into orders, like age, days of the week,

physical measures, or other orders that can be examined in numerical values or ordinal classification of time. Histograms are often used when looking at data distribution and variability in pharmaceutical processes. For example, when looking at the mean for table weight or the concentration of active ingredients, histograms can be useful to visualize the mean and identify deviations [16].

3.1.2 Control charts:

Control charts were developed by Walter A. Shewhart in 1924, who is the father of SQC. A control chart or map is a plot of compliance or measures, such as ranges, means, etc., and the measures can be either variables or attributes. Statistical control of the quality of the product being manufactured in a statistical system is used to control the quality of the manufactured product. The graphic representation of whether the sample quality is within the range of variation is a control map (sometimes called a process map or quality control map). Where cap represents the limits of approvable variation. Here are two lines on each map that represent limits: the upper control limit (UCL) and the lower control limit (LCL), which will allow variations in quality. By design, the process will be out of control, and the sample will be removed if the concluded data should be beyond the limits of approvable performance. This invite establishing assignable causes and taking immediate action to lift performance back to the standard. There are two forms of control maps: (i) control maps for variables (quality attributes are quantifiable). As an example, in a manufacturing environment, those reasons might include Machine setup, Tooling, Temperature, Voltage, Compressed air pressure, operating parameters, Material quality, measuring equipment, etc. The Shewhart map is among the oldest and simplest control maps. Control charts are vital for tracking critical process parameters



MANUSCRIPT ID: BTS0926008

(CPPs) over time, allowing for earlier detection of process deviations, procedures for monitoring process stability, and taking corrective actions when necessary [17, 18]. There are many types of control charts used in analytical quality assurance, including Shewhart (or conventional) charts, X-charts, Recovery rate control charts, Range control, X-R Combination charts, Difference charts, Standard deviation charts, and Custom control charts.

3.1.3 Pareto analysis:

The Pareto map was named after Vilfredo Pareto. The Pareto map is a quality control tool used to identify the largest contributors to a problem. The various factors a quality operations professional can combine would improve their sensitivity to the causes and assist in resolving the problem. A Pareto map is a mixture of a bar graph and a line graph, and this mix is useful for ranking problems or causes from most important to least important [19]. To complete the bar graph, you need to create a primary list of problem sets (disfigurement type: crack, scratch, stain, dent, gap, hole, etc.) and determine the conditions in each problem set. To complete a bar graph, you will have to sort out the problems in order of difficulty [20]. The map itself will graphically display each cause's relative contribution to the total in decreasing order. The situation will determine the relative contribution [21]. This tool's main objective is to prioritize human resources to find and fix the most critical quality issues by ranking issues according to their frequency and/or impact [22].

3.1.4 Scatter diagrams:

When establishing connections between quality flaws and potential causes such as terrain, effort, workforce, etc., scatter diagrams are an effective quality control tool. Focused results can be used with hopefully improved defects once a relationship

between a particular defect and its cause has been established. Of the seven high-quality charting tools, scatter diagrams are the most useful for showing how two variables relate to one another. For a quality assurance specialist, whose work frequently involves determining cause-and-effect relationships, this can be crucial. Scatter diagrams can assist in identifying factors influencing product quality by illuminating the relationships between variables [22].

3.1.5 Cause and effect diagram:

The cause-and-effect diagram, a visual representation first presented by Kaoru Ishikawa, can assist users in determining the factors or causes of an effect or issue so that they can address them. Since the cause-and-effect diagram uses the four fundamental components of any process, like the machines, people, materials, and methods, to identify the cause of the out-of-control situation, it may be a useful tool, as we will discuss in our review of its applications. With the help of cause-and-effect diagrams, you can document the most likely causes of a problem, circumstance, or conception and generate ideas about their most likely causes. The manufacturer will be able to create suitable plans to address the different kinds of causes in an efficient way for quality control if the diagrams are used to help identify the first (major) and second (minor) causes of quality variation. The five M's (machines, methods, men, materials, and measurement) and one E (environment) are currently the main sources of issues in a manufacturing facility. Minor causes connected to the major causes would also be included in each diagram, like minor causes linked to people could be poor supervision, lapses of attention, inadequate training [23].

3.1.6 Checklists:

Either quantitative or qualitative data are to be determined through checklists. If they are used to collect quantitative data, they

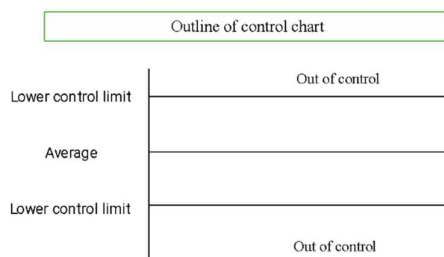
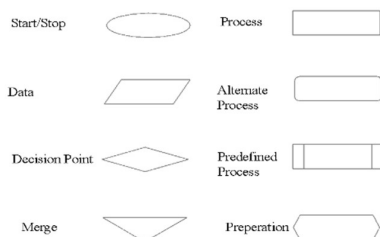


MANUSCRIPT ID: BTS0926008

may be called census waste. Checklists are used to collect data in the form of check marks or census marks to display the count of a single value. They allow you to quickly uncover defects and excrescences in your product or process, along with deformation trends and even the causation of individual defects. The check waste helps you to capture the primary frequency distribution data while measuring an operation because they are simply set up and easy to read. When creating bar graphs, histograms, and other quality tools, you can use this specific image as a primary data collection tool. This image can also be used as a primary data

collection tool when creating bar graphs, histograms, and other quality tools [24].

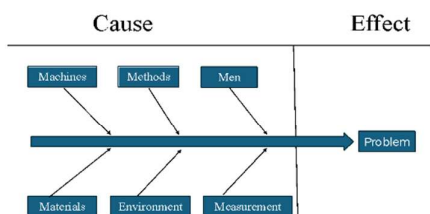
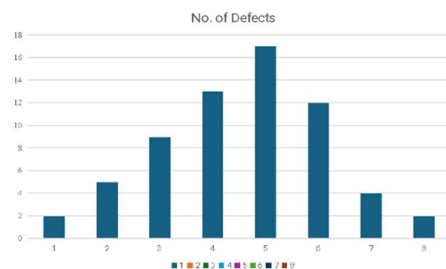
3.1.7. Position analysis: Position analysis is a quality assurance tool that allows for sorting data, objects, and people into separate and distinct groups. The data are separated using position, and doing so helps to interpret their meaning and reveal patterns that you would otherwise not perceive if they were grouped. Position analysis can be conducted for outfits, products, shifts, accoutrements, and days of the week, to help explain your data ahead, during, and after its collection [25].



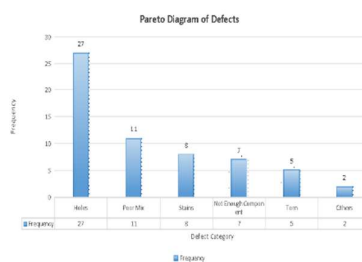


Customer Complaints Summary

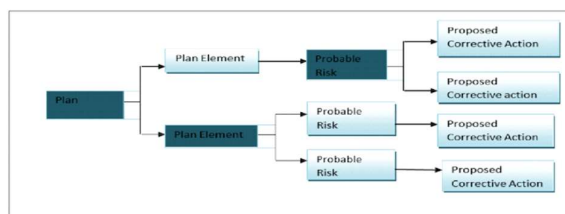
Problem	Sun	Mon	Tues	Wed	Thu	Fri	Sat	Total
Long wait	///	///	///	///	///	/	///	23
Parking	//	///	///	///	//	/	///	18
Table not clean	//	/	/	//	/	/	///	8
Bad Server	/	/	/	/	/	///	/	5
Cold Food	//	//	/	//	///	/	///	11
Others	/	/	/	//	/	/	///	9
Total	13	10	10	16	8	5	10	74



pareto diagram of defects



Plan - Risk - Corrective Action Diagram





MANUSCRIPT ID: BTS0926008

FIG.1: These are the seven statistical quality Basic Tools for Total Quality Management in Pharmaceutical Product Development: The seven basic Statistical Quality Control Tools for Total Quality Management in Pharmaceutical Product Development in Figure 1 along with images a detailed step by step for sqc tools.

3.2 Seven New Quality Tools

3.2.1. Affinity diagram: Affinity diagram can be applied to arranging concepts and data in a sensible order. Clearer thinking and decision-making are facilitated by the platooning discussion and feedback concept, which helps the pharmaceutical industry improve quality. A variety of ideas can be arranged using the affinity diagramming tool (KJ method) to identify the logical relationships between vibrant concepts. These diagrams can be used for verbal data analysis or following a brainstorming session. Furthermore, a group consensus is desired when decisions are made based on multiple pieces of data because the subject is too complicated to fully comprehend [26].

3.2.2. Activity network diagram: Activity network diagram is a visual representation of a system's tasks, and their interdependencies used in SQC. It helps brigades optimize workflows and ameliorate overall design effectiveness, making it essential for managing complex processes in the pharmaceutical industry [27].

3.2.3. Interaction diagram: Interaction diagram is used to fantasize and analyze the relationship among colorful factors or issues within a complex problem. The described fashion involves using plates to illustrate unproductive connections within a complex situation. It helps fantasize about how different factors are connected. The process starts by stating a problem on the left side of the illustration. Causes related to this problem are also arranged according to their relationship to it; those that are more nearly affiliated are placed nearer to the

problem, while those with weaker connections are deposited further down [28].

3.2.4. Tree diagram: A tree diagram describes a system for organizing and analyzing a main subject by breaking it down into increasingly detailed factors. This process helps to identify and arrange the conditioning required to reach a specific goal. The structure used for this breakdown can either be vertical or perpendicular, connecting different rudiments together. This system can be applied in colorful surroundings, such as creating a design quality plan (DQP) for a new product, setting objects and programs, outlining the implementation way, enhancing the effectiveness of factors, and managing functions effectively. It breaks down complex processes or ideas into simple, further manageable factors. It helps brigades totally assess issues and develop a comprehensive action plan, making it particularly useful in quality enhancement and problem-solving teams in the pharmaceutical industry [29].

3.2.5. Matrix data analysis: Matrix data analysis describes one specific quality tool out of seven new tools that utilize a fine system of temporalizing matrices. This system translates the relationships between colorful rudiments into numerical data, based on matrix conception. These data are displayed on a map. These maps of matrix data analysis classify particulars because they all recognize the association between two particularly important characteristics. As they relate characteristics, each data point is established as a point on a general X-Y map to visualize relationships. Matrix data analysis is used for displaying and analyzing the associations among multiple variables or

MANUSCRIPT ID: BTS0926008

factors and is structured for sharing. Matrix data analysis enables brigades to identify social relationships and impacts of colorful rudiments on quality [30].

3.2.6. Process decision program chart (PDPC): Process decision program chart is a structured methodology used to identify potential problems with a developing plan. It anticipates multiple potential problems that could occur and analyzes possible options and outcomes. In response to these problems, PDPC aims to prepare counter-measures that are the best way to manage resolution of these problems. PDPC anticipates potential problems with a project. It allows teams to be able to identify the preventative measures. It has value as a useful tool in quality control and quality

improvement initiatives in formatted out-rage within the pharmaceutical industry [31].

3.2.7 Matrix diagram: A matrix diagram is a visual display of linkages between different groupings of information. A matrix diagram organizes items into rows and columns on a chart to allow you to see if relationships exist across pairs of items. This diagram serves to showcase relationships and lets you measure corresponding relationships between a pair of records. It is a relationship between idea generation and helping to prioritize processes and resources. It can help organize data for effective collection. The diagram is often utilized to illustrate the relationship between two or three variables, also aiding teams with prioritizing their ideas [31].

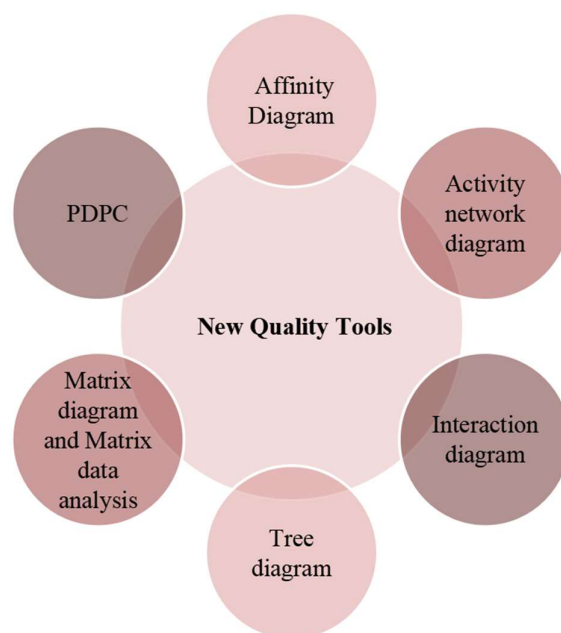


FIG .2 : These are the seven new statistical quality Tools for Total Quality Management in Pharmaceutical Product Development: The seven new Statistical Quality Control Tools for Total Quality Management in Pharmaceutical Product Development in Figure 2 along with a detailed step by step for sqc tools.



MANUSCRIPT ID: BTS0926008

3.3 Advanced statistical tools: The Japanese Scientists and Engineers Union (JUSE) recognized in 1976 the need for instruments to stimulate creativity, spread worthwhile knowledge, and organize large group projects. The seven new quality control instruments, or sometimes referred to as the seven tools, were developed by a group of researchers and developers. The seven tools progress from abstract analysis to full project planning [32].

3.3.1 Design of experiments (DoE): DoE is applied in pharmaceutical development to optimize formulations and process conditions, reducing variability. By systematically varying input factors, it identifies their effects on critical quality attributes (CQAs) [33].

3.3.2 SPC: SPC is the use of statistical methods in the monitoring and controlling of processes in real time. It permits a manufacturer to maintain consistency in drug manufacturing by reducing the amount of variability [34].

3.3.3 Process capability analysis: Process capability analysis tool allows for the ability to assess at what rate a given process can produce outputs within some limits, while providing a quantitative measurement of process performance. Capability indices may be used to assess the capability of the respective process and ensure the quality of the product [35].

3.3.4 Multivariate Analysis (MVA) MVA methods, such as principal component analysis (PCA), allow for complex data to be analysed, patterns to be identified, and simultaneous control over several CPPs to be permitted [36].

3.3.5. Six sigma: Six sigma is used to improve process efficiency and reduce defects. These SQC tools were applied in various stages of pharmaceutical product development, including formulation, manufacturing, and quality control [23].

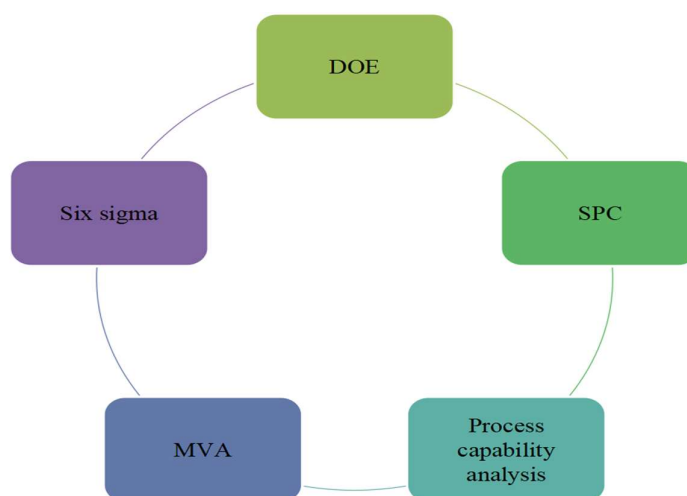


FIG. 3: These are the advanced statistical quality Tools for Total Quality Management in Pharmaceutical Product Development: The advanced Statistical Quality Control Tools for Total Quality Management in Pharmaceutical Product Development in Figure 3 along with a detailed step by step for sqc tools.



MANUSCRIPT ID: BTS0926008

4. Results and discussion

SQC tools are essential for achieving TQM in pharmaceutical product development. The effective implementation of these tools ensures the delivery of high-quality products, enhances patient safety, and reduces costs. Control charts and capability indices enable the detection of deviations and ensure process stability. DoE and SPC facilitate process optimization and real-time monitoring. Six Sigma methodology helps reduce defects and improve process efficiency. Pharmaceutical companies should invest in the development and application of SQC tools to ensure the quality of their products. By systematically applying these SQC tools in Pharmaceutical TQM, the following Opti Tech beneficial results are achieved. SQC tools enable the identification and reduction of variability, ensuring consistent product quality and enabling improved product quality [38]. They assist in maintaining regulatory compliance, e.g., Good Manufacturing Practices (GMPs) conditions and International Council for Harmonisation (ICH). Detecting quality problems early reduces waste, rework, recalls, and therefore costs. SQC tools are useful indicators of CPPs and CQAs and strengthen process design [39-41].

A case study considered the improvement in the quality of tablets by means of seven statistical QC tools, improving the weight variation and productivity of the tablets. One of the important purposes is to save the cost of rejection. The word quality's meaning is reduction in the variability or the quality, which is inversely proportional to variability. Some of the benefits of QC tools are the reduction of rejection costs by increasing the quality and customer satisfaction achieved by the improvement in the company, which helps to improve productivity. SQC is a very useful tool for the improvement of quality. A study demonstrating the implementation of SPC in the

sewing department garment industry for better quality was investigated. The objective of the study was to use SQC techniques for quality characteristics at the sewing floor level, in the garment industry. Among all SQC quality improvement tools, control charts were chosen. TQM is a people-based management system that focuses on continual improvement in customer satisfaction. The study found that SPC is harder to achieve in the garment industry at the outset because of the different parties involved in the process. A case study on Juran's quality planning and analysis for enterprise quality was demonstrated, where control charts were used to monitor variability in tablet weights to ensure uniform dosing. A pharmaceutical company designing a new tablet formulation, keeping a consistent tablet weight was essential. The challenge was that there were significant variations in tablet weights, leading to concerns about dosage accuracy. SQC tools like control charts, specifically X-bar and R-charts, were applied to monitor the variability in tablet weight over time. The outcomes are the control charts revealed periods of instability, particularly in the early stages of production. corrective actions were implemented to adjust the manufacturing equipment, leading to tighter control of the tablet weight. Implementations are the UCL and the LCL, which were set based on historical data. A study focused on a pharmaceutical company that implemented control charts to monitor the granulation process in tablet manufacturing. By utilizing X-bar and R charts, the company was able to identify variations in the granulation process, leading to reduced variability and improved product consistency. A case study reported the implementation of SPC for regulatory compliance in a pharmaceutical firm. Another case study of compliance monitoring highlighted a pharmaceutical company's implementation of SPC to ensure



MANUSCRIPT ID: BTS0926008

compliance with FDA regulations. By using SQC techniques, the company significantly reduced non-compliance incidents and improved overall product quality. Each example demonstrates how these methodologies can lead to improved quality, compliance, and operational efficiency in the industry [35-37].

5. Challenges and Future Directions

There are obstacles to using SQC tools to implement TQM in the pharmaceutical industry, such as a lack of qualified people, an unwillingness to change, and integrating SQC tools into the present system [42]. Future action should be directed to build an easier software package to use the SQC tools, train people on the statistical methods, and integrate SQC tools with emerging technologies such as Artificial Intelligence (AI) and Machine Learning (ML). The goal of root cause analysis (RCA) is to identify the "root cause" of an issue or non-conformance. The goal is to address or eradicate the root cause to prevent the issue from happening again. An organized method for determining the "root causes" of differences or occurrences and a strategy for applying the results is called RCA. Determining the problem, comprehending it, acting quickly, taking corrective action, and confirming that the solution is all the steps involved in an RCA process [43].

6. Conclusion

Pharmaceutical processes require strict adherence to quality standards to ensure safety, efficacy, and reliability. Ensuring the quality of these products is paramount, as it directly impacts patient safety and efficacy. TQM is a holistic approach that focuses on

continuous improvement by integrating quality principles into every stage of product development and production. SQC is a subset of TQM that employs statistical methods to monitor, control, and improve processes. SQC tools are essential components of TQM, enabling the detection and correction of defects, variations, and anomalies in the development process. This review systematically examines the role of SQC tools in enhancing quality management practices in pharmaceutical product development. SQC tools enhance process reliability, ensure regulatory compliance, and improve overall product quality. By addressing current challenges and leveraging emerging technologies, the pharmaceutical industry can fully realize the potential of SQC tools in achieving quality excellence. It depends on proper implementation and the organization's commitment to using data to drive quality enhancements. Balancing the benefits with the challenges is key to leveraging SQC tools. They support data-driven decision-making and continuous improvement. However, their effectiveness results in TQM. Therefore, management of these TQM tools can be utilized to enhance the quality of their products or services, and as technology in the new age develops, new ways will arise.

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