



Author: Diana C. Pérez Veliz  
 Advisor: Rafael A Nieves Castro  
 Industrial Engineer Department

## Abstract

The inventory process of clinical laboratories was evaluated to detect common problems, waste and identify areas of improvement. The objective of this project was to assess the impact of lean in health care environment. Medical Technologist participated in a survey were data gathering of collective problems and waste in the process of inventory control was obtained. Participants responded that the most common problems were the expiration of unopened reagents and out of stock. Medical Technologists selected transportation as the number one waste followed by waste of waiting and motion. The lack of organization was the main driver for waste in the inventory process. As a way to address the deficiencies, eliminate waste and improve quality a 5S lean tool was suggested to aid in the inventory process. A lean design project can be implement in a clinical laboratory to determine the impact of lean methodology in a health care environment.

## Introduction

During this research, clinical laboratory inventory process was evaluated to identify areas of waste and improvement. Lean tool was selected to be applied on the clinical laboratory inventory process with the purpose of improve process by remove waste. This research will help to understand the inventory process in a clinical laboratory and how lean tools can help to improve the quality of service by eliminating wastes and increasing performances of excellence. Applying Lean -at a small scale- in the clinical laboratory inventory will provide data of the impact of lean in a health care environment. This information can be used by other health care departments as reference to improve service and quality.

## Background

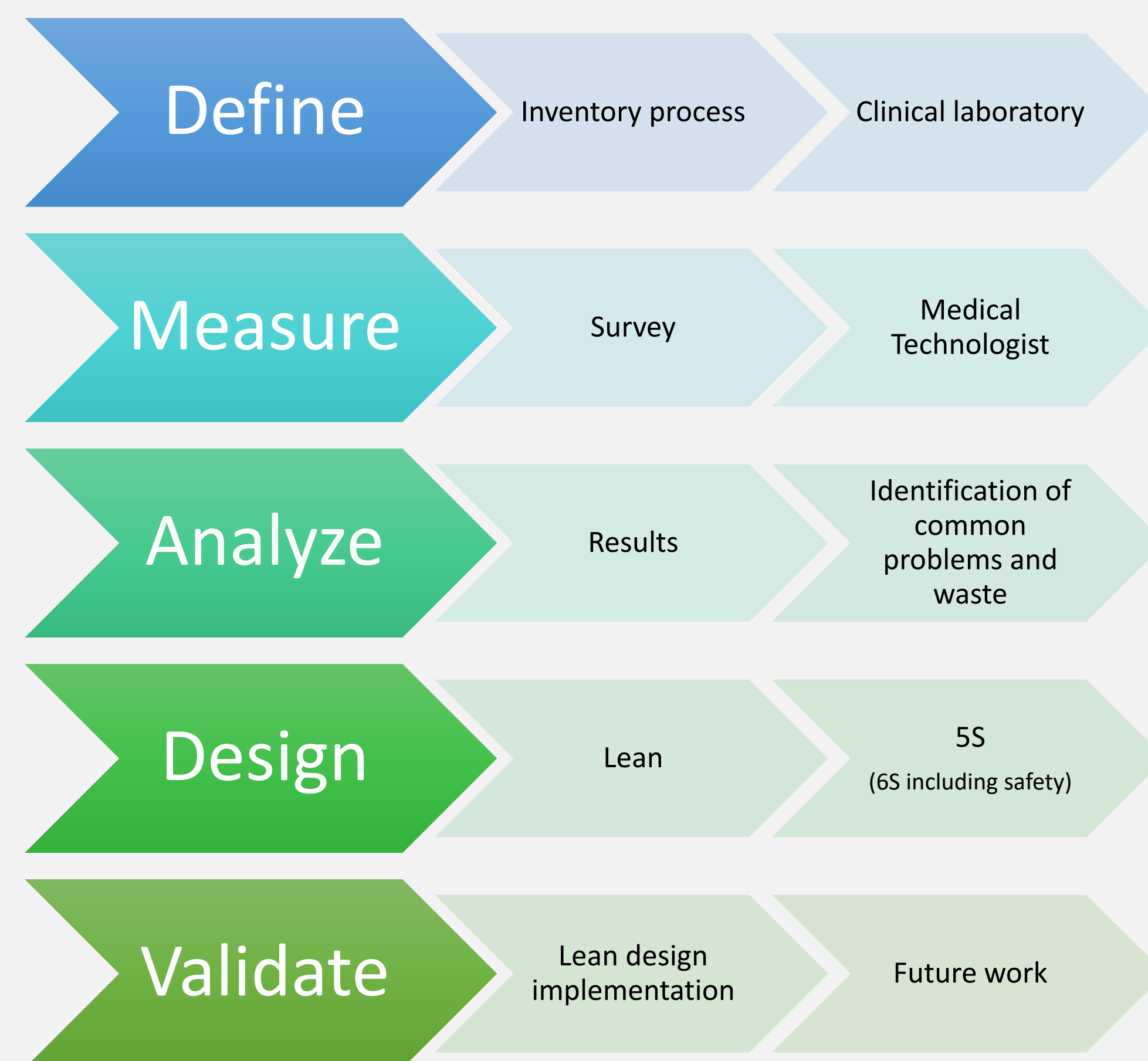
Clinical Laboratories are well recognized by the accustomed need for quality assurance and quality control [1]. In a clinical laboratory quality control is essential to guaranty precise and accurate results. Excellent QA/QC programs guarantee the accurate reporting of results that are vital for clinical decision regarding diagnostic and treatment of patients [1]. Laboratories are expanding the quality assurance programs to include improvement initiatives that pursuit the enhance of efficiency [1]. Lean thinking is an initiative that can assist to reduce waste while improving efficiency in a health care environment [2]. A Lean Lab Design can be created to eliminate waste, improve workflow, turnaround times (TAT's), quality and employment engagement [3]. Identifying value and waste in the process will help to select the appropriated lean tools to improve the process. Lean tools as 5S principals can contribute to generate and support order while promoting a standardized value-based process resulting in an improve patient care [4]. The development of a lean design can be tried at first in a small scale, for example in the inventory process of the laboratory or a department to evaluate the impact. If the results are positive it can be applied in a higher level. Provide accurate result for patients benefit while reducing waste and mechanical errors makes lean methodology the best choice. Lean implementation can create a positive impact on small to large scale in a clinical laboratory.

## Problem

The focus of this project is to evaluated the inventory process of a clinical laboratory to identify areas of improvement and common problems. The objective of this research is to assess how the application of lean in a clinical laboratory inventory promotes waste reduction while improving turnaround time and quality of service.

## Methodology

A survey was conducted to understand the inventory process in a clinical laboratory. The survey helped to identify collective problems and waste in the inventory process. The survey was administrated to Medical Technologist of different clinical laboratories were information of the inventory process, location of reagents and materials, waste identification and possible options to improve the laboratory inventory was gathered.



Understanding the laboratory inventory flow, collecting the information from the people that use and manage materials, identifying waste in the process and acknowledge the safety protocol for storage of materials lead us to select the right tools to improve the process. When common waste identification was completed, a lean tool was selected.

## Results and Discussion

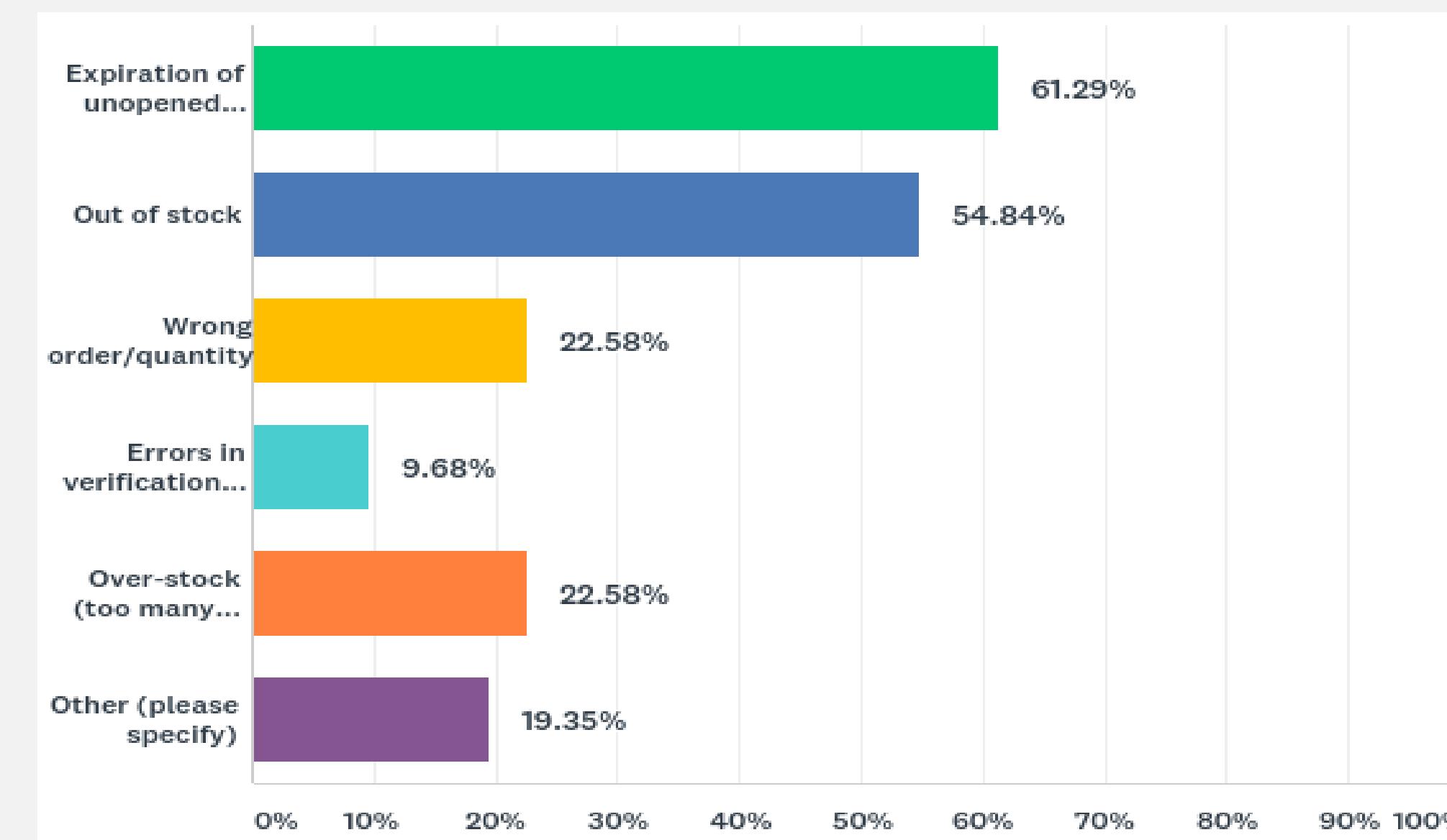


Figure 1. Common problems in the inventory process of a clinical laboratory

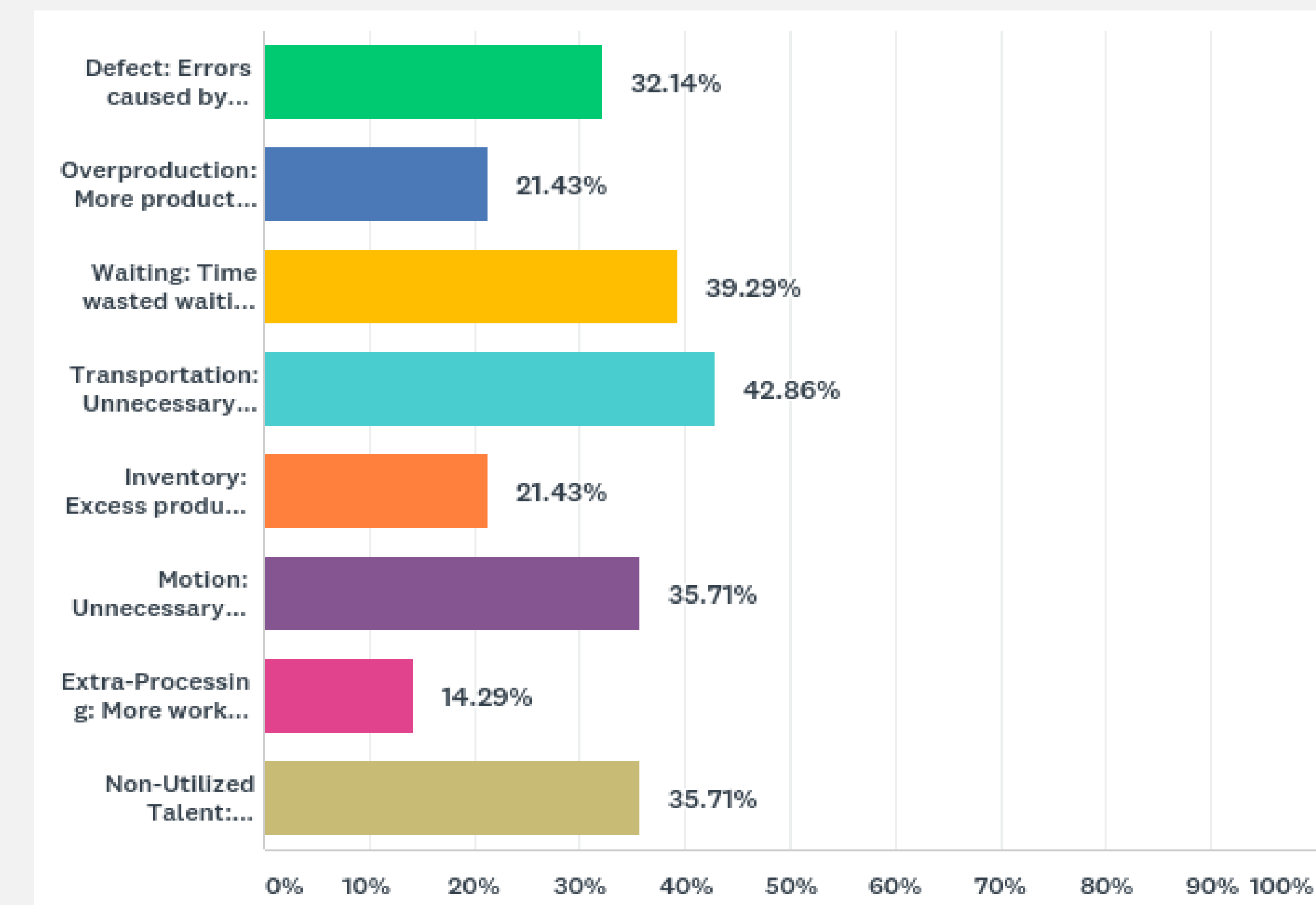


Figure 2. Types of waste on the inventory process of a clinical laboratory

Table 1. Possible improvements for the inventory process of a clinical laboratory

Improvements for the inventory process of a clinical laboratory suggested by Medical Technologist	
Ideas of improvement	Frequency
Organization	9
New method to perform inventory	4
Barcode system	3
Frequency of performing inventory	2
Quantity order	2
Personnel in charge of the inventory process	3

We can sustain that according to results there is area for improvement in the inventory process of a clinical laboratory were lean methodology can be implement. According to the medical technologist there are four major problems; 1) expiration of unopened materials/reagents, 2) out of stock, 3) wrong order/quantity, and 4) over stock. Three major waste were identified by the Medical Technologist: transportations, waiting, and motion. We identify that the root of this common problems was poor organization. The methods employed to perform the inventory created a lot of waste. As listed in table 1, organization was the number one suggestion follow by implementation of a new method to performed inventory.

Analyzing the data collected through the survey we detected lack of organization in the process. A lean tool that can be used to improve the inventory process could be a 5S helping to create and sustain order and as a result eliminate waste, reduce turnaround times and improve quality of service. Safety can also be included in the 5S, since we are working in a laboratory environment were chemicals and biohazard materials are implicated. In order to create a lean design model applying 6S (sort, set in order, shine, standardize and safety) for the inventory control the storage and localization of materials needs to be rearrange in a lean approach were transportation and motion waste can be eliminated. The method applied to performed the inventory can be modified applying lean methods to help improve the process.

## Conclusions

Lean tools application in a health care environment can be beneficial for patient care, since helps to increase quality of service and to reduce turnaround time. Lean can be implemented at a small scale in the clinical laboratory inventory process to reduce common problems and reduce common wastes. A lean design model can be created to improve the efficiency of the inventory process of a clinical laboratory taking in consideration the laboratory needed. A before and after implementation of lean 5S (or 6S) tool can be evaluated to determine the impact of lean in patient care. Staff compromise and cooperation is important for the success of the lean implementation.

## Future Work

A lean design project can be implement in a clinical laboratory to evaluate the before and after results and determine the impact of lean methodology at a small scale in a health care environment.

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