

# Analysis of Measured Employees' Absenteeism in the Forensic Science Laboratory

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## Abstract

A detailed analysis of the measured absenteeism data for employees in a forensic science laboratory (FSL) is presented. About 134 employees out of 172 were used as a sample. The factors assumed to affect absenteeism included differences in gender, departments/units, period of the year, skill-levels and professions. The data were collected throughout a calendar year, using a biometric system infrastructure incorporating fingerprint capturing device, IP camera, database server and software (Bio Star Version 1.62). The calendar was used to establish the total working days and hours while employee absenteeism data in percentage were established by computation of days and hours absent for a given period, based on days or hours attended. Equations were derived to determine the absenteeism ratios expressed in percentage ( $A_{bd}$  and  $A_{bh}$ ). The absenteeism ratio,  $A_{bh}$ , was observed to be the most appropriate parameter. The business development department (BDD) shows the lowest  $A_{bh}$  compared to other departments. Female employees show higher  $A_{bh}$  and lower  $A_{bd}$  than male employees, while accountants show lowest absenteeism compared to Employees in professional level who had highest absence rate compared to skilled, semi-skilled and unskilled employees. Most hours were lost during September-December compared to the rest of the year. The results reveal higher employee absenteeism in the FSL affecting its performance.

## Keywords

Absenteeism, Absenteeism Ratio, Biometric, Forensic Science Laboratory, Gender, Laboratory Professions

## 1. Introduction

### 1.1. What Is Absenteeism?

Absenteeism in work places is a critical problem affecting performance and competitiveness. In this study, absenteeism is defined as the absence of an employee at work, whether scheduled or not. In all workplaces, absenteeism falls into three categories: scheduled, unscheduled and partial shift absences. Scheduled absences consist of vacation or personal time, whether it is part of a paid time off (PTO) plan or separate. For such absences, excess costs arise when time is taken but not reported. Secondly, unscheduled absences include sick days, disability, family and medical leaves absence (FMLA), and workers' compensation leave. Finally, partial shift absences include arriving at work late, leaving early, or taking longer breaks or lunches than allowed. The direct impact for FSL is reduced or delayed analytical work, or customers not being serviced. Unscheduled absenteeism is a chronic problem for FSL employers, conservatively costing very high unknown rates per salaried employees per year.

Absenteeism is a bigger problem in the FSL that managers have to face on daily routine [1]. The majority of employers have limited ability to accurately and regularly track how much absenteeism is reducing their bottom-line performance. This study uses the biometric data from a recently installed system to assess the extent of absenteeism among the FSL staff. Absenteeism can only be reduced if it can be measured accurately. The quantity used to estimate absenteeism is the absenteeism ratio; that is, hours absent over the total working hours expected expressed as a percentage. Reducing absenteeism will also help employers to better meet production and service demands without requiring an increase in headcount.

There is always little focus on absenteeism, compared to other costs like healthcare, for example, because healthcare is a unique line item in most organization's budget, as compared to absenteeism, which rarely appears in any reports that corporate managers see on a regular basis. Moreover, healthcare costs are usually reported to management by external providers who maintain the data on more reliable systems than those used internally to track workforce-related costs. Equally, even amongst the largest companies, there is rarely a corporate manager who oversees the costs associated with absenteeism so that it goes unnoticed. Even in the FSL studied, the human resource officers are responsible for overseeing the data and not costs. Forensic science services are known for stressful working conditions and high rates of overtime with highest rates of absenteeism, necessitating quantification.

Many researchers have studied absenteeism in different areas with different approaches. An adequate approach to reducing absenteeism has been focused on medical absenteeism as this is the most prevalent form of absenteeism [2]. Others define *absenteeism* as a legitimate or illegitimate absence from school or class [3]. Absenteeism rates range differently amongst the workforce as long the employee is missing from work. In this study, absenteeism rates may be either high

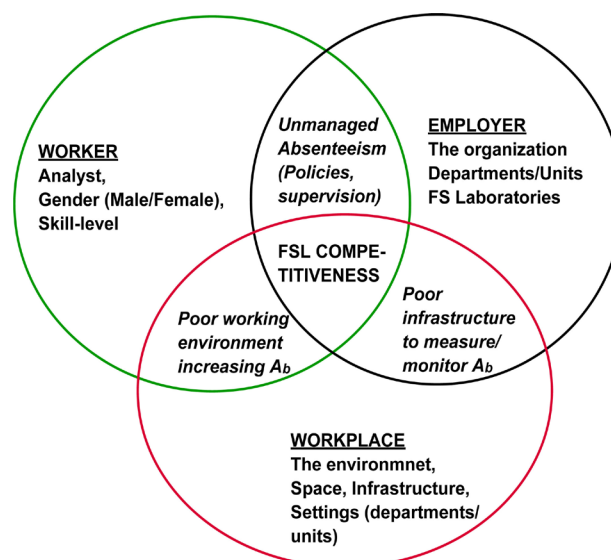
or low depending on the frequency of absenteeism in hours or days according to the period of study.

## 1.2. The Impact of Absenteeism to FSL Performance and Competitiveness

Workplace attendance and its converse absenteeism in any workplace are complex multi-dimensional issues involving the interaction and subtle interplay between employees, employer and its different departments leading to unknown impacts. In this study, employees in a workplace consisting of different laboratory disciplines, departments and units were studied. While the availability of resources such as reagents, facilities, instruments and equipment affect FSL performance, absenteeism plays a vital role, worth exploring [4]. The interactions between employees, employer and workplace conditions can have big effect on competitiveness [5], as shown in **Figure 1**. Results of interaction between the three can affect the performance of the FSL via creation of case file backlogs, extended turnaround time (TAT), etc.

**Figure 1** presents interplay between employees, employer and workplace with a critical focus on absenteeism, but can be extended to portray other aspects of interaction like engagement and job satisfaction [6] [7] [8]. Workplace attendance and absenteeism are of fundamental importance to FSL and the society it serves [9].

Absenteeism adds to the total cost of operating the FSL and may reduce the quality, of FSL services. Consequences of laboratory-workplace non-attendance include but not limited to amplified costs, lesser morale, increased workloads and backlogging, non-achievement of objectives, reduced provision of services, decreased services quality, increased training costs and loss of key skills. Absenteeism is, therefore, a significant concern in the field of human resource management



**Figure 1.** Interplay between FSL competitiveness key components and the general causes of absenteeism.

which requires attention [10] [11] [12]. The prevalence of absenteeism in the FSLs necessitates research so that valuable contributions may be made that will, ultimately, empower management and positively contribute to the discipline being studied. The aim of this study was to measure or quantify absenteeism followed by investigating the contributing factors, and hence develop a framework for improving performance of the FSL [13].

Whenever laboratory employees are absent, changes by the management have to be made to the usual operations. This may mean working the present employees longer and harder, allowing analytical processes to build up (*i.e.* backlogging) or be delayed (extended TAT), excluding certain services, hiring temporary replacements or permanently maintaining an extra workforce to cover absenteeism [12].

The effects of absenteeism are most pronounced when the laboratory processes are interdependent, for instance, in processing criminal exhibits that require maintaining the chain of custody. FSL has complex, specialized and technological processes, operations of which will not proceed without competent staff and without legally authorized officers in all action points. The FSL has four departments and five units. All other units and departments (for instance, finance, human resource office, quality control coordination, procurement management unit, internal audit and ICT) work towards supporting the laboratory workflow. Absence of any employee in the laboratory and in support units impairs the performance of the laboratory as a whole.

As a result, laboratory and support cadre's non-attendance leads to frustrated managers and supervisors, increased supervisory and administrative costs, adverse public perception and reduced confidence, of stakeholders [14] [15]. In addition, unseen costs such as additional supervisory time, extra staff, and overtime, and employment of temporary staff, result from absenteeism.

### **1.3. The Impact of Biometric Use in Time and Attendance Tracking on FSL Productivity**

This study was possible after installation of a biometric time and attendance system within the FSL. Biometric time and attendance solutions have a direct impact on employee productivity increasing employee's efficiency, accuracy and eliminating time stealing. Using a manual process for verifying the extra time the FSL has been working and reentry of data into the pay list, time required to process pay list for the entire FSLs were tedious and laborious in the past. The extent it takes to compile the time and attendance data through manual practices is significantly reduced to few minutes with a biometric time and attendance system. Also, productive hours are saved and the related personnel pay is reallocated elsewhere increases performance level through higher efficiency which in addition, when the biometric time and attendance registration and identification systems are integrated, they reduce and eliminate the need for any manual reentry of timekeeping data into a pay list system. This results in increased accuracy

and reduced time in pay list processing and hence, another positive impact of biometric system.

#### **1.4. The Use of Time and Attendance Biometric System in Studying Employees' Absenteeism**

Absenteeism data collection by biometric system is a process by which a person's unique physical and other traits (such as facial marks, voice, finger scan, etc., are utilized to identify the employees. Such traits are sensed and recorded by an electronic device or system as a means of approving his or her identity. Biometric systems rely on specific data about unique biological traits such as the finger prints in order to work effectively. Of all the developing biometric technologies, fingerprint identification is one of the most distinguished and revealed biometrics for the reason of their distinctiveness and reliability over time [16]. Using biometrics have an advantage for FSL managers as it will only identify the specific employee by scanning his or her unique features such as fingerprint, iris or face. This will eliminate the problem of employees clocking in for one another, or needs to carry the card or remember passwords.

Absenteeism has a material effect on the bottom line of the organization with no exception of FSLs. In the absence of tracking tools and systems such as biometric systems, employers cannot adequately estimate their accrued liabilities, potentially creating an issue that impacts the performance of the FSLs. Before biometric system was installed, the attendance was marked manually in registers. Entry and exit times were unreliable and non-verifiable. Moreover, transferring register holding attendance records was an inefficient and highly time consuming process, making it difficult for laboratory managers to access it. However, employers such as in FSL have also introduced biometrics in the laboratories as a way of monitoring their staff [17], making it easier to measure and quantify absenteeism.

In addition, laboratory managers have limited ability to accurately and regularly track to which extent absenteeism is reducing their bottom line competitiveness. This study provides a means of tracking absence for managers and supervisors. Reducing absenteeism will also assist the FSLs managers better to meet their expected turnaround time, reducing backlogging in sample analysis and case file management.

#### **1.5. Factors Affecting Absenteeism in the FSL**

This study is part of the root cause analysis for productivity losses and competitiveness improvement framework, which is a critical step of determining corrective actions [18] [19]. In relation to quality management system, absenteeism is one of the non-conformity affecting the accreditation and certification process. Absenteeism may be considered as an unfaithful action, caused by either violation, routine or special causes. As far as violations are concerned, such as attending family issues, visiting the bank and late in to work or illegitimate breaks

which are not reported, routine acts are those of extended tea and lunch breaks, whereby, employee need to have such breaks but are extended. Exceptional acts are those legitimate that are known, called for and are reported and always granted such as attending professional meetings, seminars, scene of crime visits and attending court sessions periodically. Other factors causing increased absenteeism are long work hours, increased workload and unsatisfactory work conditions [20].

## **2. Literature Review**

### **2.1. Concepts Used by Other Researchers to Describe Absenteeism**

Many researchers have used different concepts to describe absenteeism. However, they all explain the absence of an employee to assigned work station no matter what reasons are given [21]. With the FSL, focus is on absence of employees at the headquarter laboratories premises, but absence from other work stations like inspection sites at ports of entry (PoE) and industrial premises, or sample collection areas are not scrutinized. Absenteeism has also been described as a concept of psychological problems or a form of withdrawal behavior when it is used as a means to escape an undesirable working environment [22]. Researchers further describe absenteeism as a challenge to corporate social responsibility, which impedes the efforts of the business to transform social problems into economic opportunities and economic benefits [23]. According to literature, absenteeism is also a measure of job dissatisfaction [6] [13]. As pressures increase on the budgets and competitiveness of the laboratories, more attention should be given to reducing workplace absenteeism and its related costs.

### **2.2. Outcomes of Absenteeism to the FSL**

Organizations handle unscheduled absences in a number of ways. In some cases employees are simply not replaced, resulting in lost productivity. In other cases, organizations maintain excess staff, utilize overtime, or substitute with workers from specialized agencies. In any case, unscheduled absences are very disruptive to the business and result in increased indirect costs of absenteeism.

Case file processing in the FSL proceeds across several action points from receiving samples and requests to issuing approved reports, while maintaining the chain of custody. However, to complete case file processing other employees are required to support this system, absence of which affects the whole process. Lost productivity means that the organization runs too lean and production or service requirements are not met, leading to lost revenue paid by clients [14] [23].

Overtime levels are higher in facilities with high absenteeism than in facilities with low absenteeism. FSL is one of the higher absenteeism organizations which require attention [24]. When excess staffing is practiced to overcome absenteeism, the headcount is higher than necessary in order to cover unplanned absences, all of which adds to the total running costs. This study focuses on the absenteeism of salaried employee as distinguished from hourly employees.

### 2.3. Direct and Indirect Costs of Absenteeism for Salaried Employees

It is less usual for a salaried employee to be replaced when absent. Instead, the demands of customers (internal or external) are not met and depending on the employee's position in the organization, the ability to create revenue or services delivery to clients is always affected. Compared to hourly workers, salaried workers are just as likely to be absent. Calculating the cost of absenteeism is more difficult for the salaried employees [25]. Excess absenteeism can also lead to increased healthcare costs, greater safety concerns and accidents (due to fatigue for workers in attendance), higher turnover and poor morale [26]. Therefore, total potential savings that could be achieved by reducing absenteeism and eliminating PTO abuse are significantly higher.

Safety issues arise in any workplace due to absenteeism, such that less-trained employees end up doing most of the work while tend to rush work after arriving late. Absenteeism is low in facilities with few fatigue issues (tired employees lead to more frequent and severe accidents). Poor health may result from absenteeism (if too much overtime is being used). Employees who work too many hours of overtime (which is associated with excess absenteeism) tend to get less sleep, and have a greater prevalence of cardiovascular and gastrointestinal disease, diabetes and musculoskeletal conditions [27] [28] [29].

Understanding and defining workers absenteeism often receives only passing attention in more intervention-based studies. Absenteeism is an organizational problem that can be solved [9] [12] [15]. Moreover, there is surprisingly little up-to-date information on absence causes and controls available in a form that can be directly used by the FSL management.

However, the expected loss in daily productivity is incurred from employing a temporary substitute to replace a regular worker of average productivity. It is also significant that, daily productivity losses decline with the length of an absence spell due to increase in work load for the employees that continued working or taking over the part of work that the absent staff would have done. Different from this work, majority of organizations do not have automated means to track every instance of absence in one system and therefore lack the visibility necessary to address this critical business problem [12] [30].

## 3. Methodology

### 3.1. Data Collection Using Biometric System

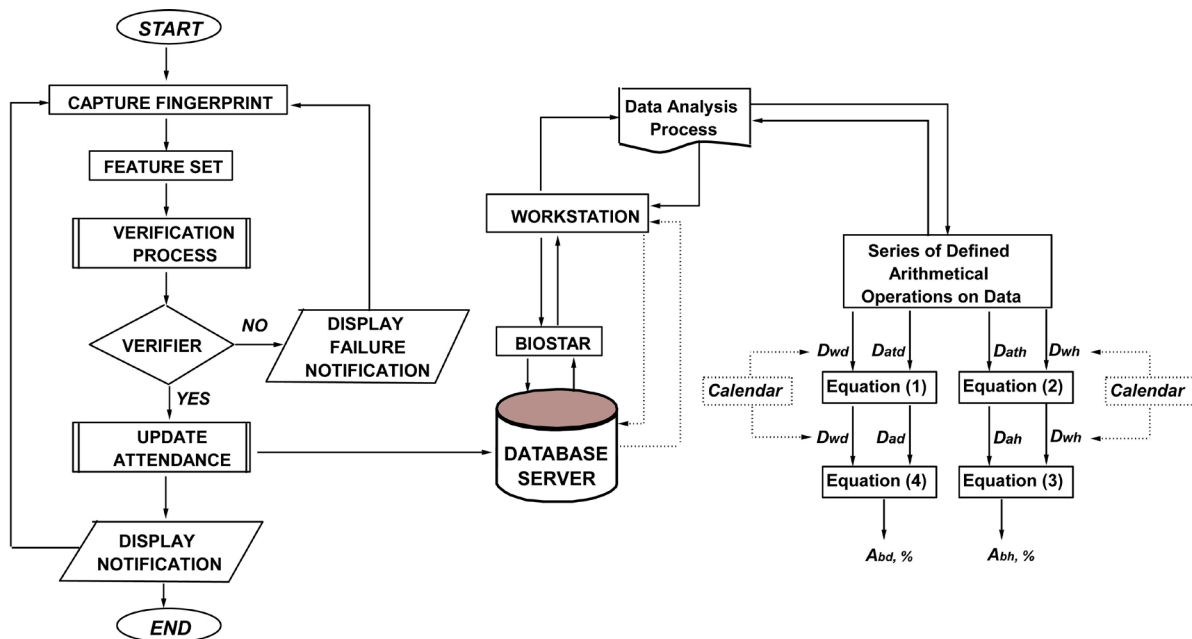
The data was collected through the process and the infrastructure shown in **Figure 2**. The infrastructure comprises of biometric figure detection system, camera (with IP address and staff photograph), network connections to server, PC at the data access point containing the Bio Star software (Version 1.62) to extract data from server. **Figure 2** shows the biometric system setup used in this study for employee attendance data capture and analysis. The system comprised of finger-print capturing device, digital image from finger print and the pattern-matching



software converted into a code producing a digital image. Every time an employee punches the finger, the system performs quality check using pre-stored fingerprint features. On acceptance, the attendance details of the employee are stored in the server. Biometric systems rely on specific data about unique biological traits such as the finger prints in this case in order to work effectively. To start data analysis, a PC connected to the server via local area network (LAN) reads the database and transforms the data into MS Excel datasheet for analysis.

### 3.2. Sample Size and Biometric Data Analysis

**Table 1** shows the sample biometric data exported to the PC via options offered



**Figure 2.** The biometric system process flow chart for absenteeism data collection and its infrastructure.

**Table 1.** The details of parameters assessed.

S/N	Parameter	Description of the parameter	Value/Number
1	Total number of employees (gender)	Male	55
		Female	79
		Total	$N = 134$
2	Period of the year (three consecutive 4-months intervals)	January-April	3
		May-August	
		September-December	
3	Departments/units	BDD, FSDS, CMD, PQSD, UNITS grouped together, including zonal laboratories (like EZL)	6
4	Professions studied	Accountants, technologists and chemists	3
5	Skill-levels studied	Professionals, skilled, semi-skilled and unskilled	4
6	Total working days required, $D_{wd}$	January-April	82 days
7	Total working hours required, $D_{wh}$	January-April	656 hours



by the Bio Star software, giving attendance details for nine selected staff identified by an identification numbers, for four months period. Based on user name information like gender, age, profession and skill levels were established. Biometric system was introduced by accommodating the attendee during the coming in and out when he winds up or closes. Therefore, the data analyzed in this study only calls for the individual working hours and days only. The total number of employees was 172 with some of employees in long study leave or maternity and sick leave. The data analyzed comprised of  $N = 134$  staff which is about 78% of total number of staff. The data was collected for 12 months January to December 2016, which is a huge data assisted by use of automated system and server storage.

### 3.3. Factors Assumed to Affect Absenteeism

Overall absenteeism data collected was based on hours and days for all FSL employees. Absenteeism data was grouped according to departments, female and male gender [31], time period of the year, professions (accountants, chemists and technologists), and also based on staff skill-levels (professionals, skilled, semi-skilled and unskilled levels). These are the factors assumed to affect absenteeism among a long list in literature [18] [19] [20]. For the purpose of this study, absenteeism was determined based on not being at the work station at that particular period of time, also regardless of reasons. Table 1 shows the details of the parameters assessed.

### 3.4. Determination of Staff Absenteeism in FSL Based on Attendance Data

Since the biometric software yields total number of hours attended by a given employee,  $D_{ath}$ , then the hours an employee was absent,  $D_{ah}$ , were determined as per Equation (1):

$$D_{ah} = D_{ath} - D_{wh} \quad (1)$$

where  $D_{wh}$  is the total number of hours an employee is supposed work for the specific period under study, that is, four months in this case. Similarly, given the total number of days attended by an employee in a given study period,  $D_{atd}$ , the number of days an employee was absent,  $D_{ad}$ , was determined as per Equation (2):

$$D_{ad} = D_{atd} - D_{wd} \quad (2)$$

where  $D_{wd}$  is the total number of days an employee was supposed work for the specific period under study.

Based on the biometrics data for each individual employee, given the total number of hours an employee attended work,  $D_{ah}$ , and the total number of hours the given employee was supposed to work in the selected study period,  $D_{wh}$ , then absenteeism ratio based on hours, also expressed as a percentage [17], was determined as per Equation (3):

$$A_{bh} = \frac{D_{ah}}{D_{wh}} \times 100\% \quad (3)$$

Similarly, absenteeism ratio based on days,  $A_{bd}$ , expressed as a percentage, was defined as a ratio between the numbers of days an employee is absent,  $D_{ad}$  to the total number of days an employee was expected to be at work,  $D_{wd}$  in the period considered as per Equation (13):

$$A_{bd} = \frac{D_{ad}}{D_{wd}} \times 100\% \quad (4)$$

After establishing the absenteeism ratio, the cause factors of absenteeism were assessed and compared based on individual employees and also based on different factors affecting absenteeism as shown in **Table 1**. On the other hand, **Table 2** summarizes the sample calculations for  $A_{bh}$  and  $A_{bd}$  expressed as percentage of hours or days the respective worker was absent, for total of 656 hours and 82 days required for January to April, respectively, as per **Table 1**.

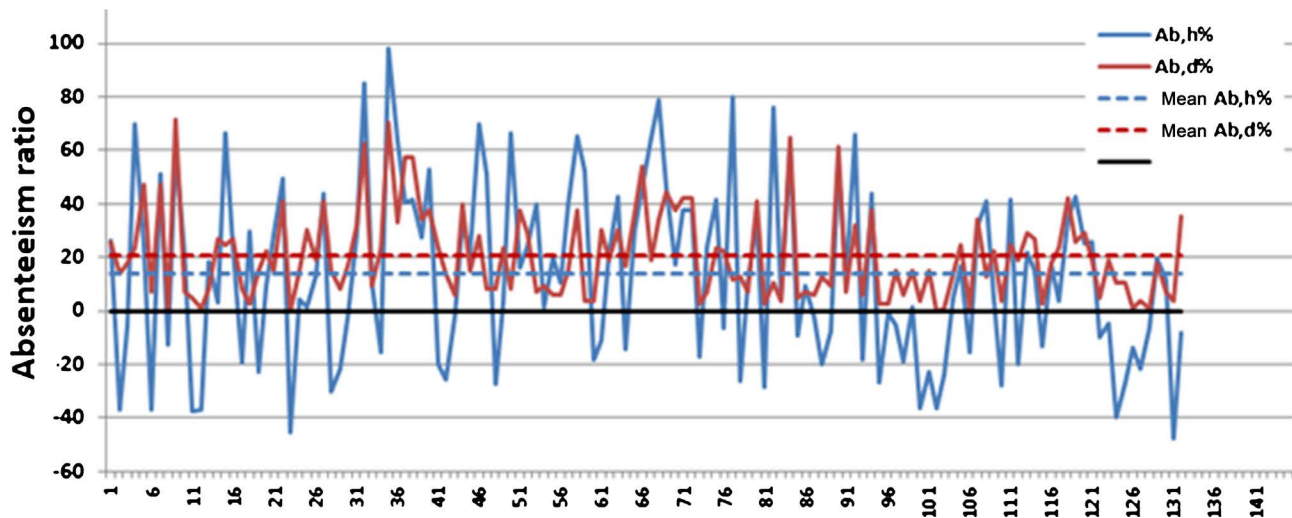
## 4. Results and Discussion

### 4.1. Comparing Individual Staff Day- and Hour-Based Absenteeism Data

In this study, individual staff absenteeism is expressed as percentage absenteeism in days denoted as  $A_{bd}$  or in hours  $A_{bh}$ . **Figure 3** shows the overall percentage absenteeism in hours and day per individual staff identification number. It shows that  $A_{bh}$  is higher compared to absenteeism in days. This may be due to the employees absenting themselves during working hours, which is mostly coming late at work and leaving early. Therefore, the biometric system identifies or detects that the individual has arrived at work late and thereafter calculates

**Table 2.** Determination of absenteeism ratios based on days,  $A_{bd}$ , and hours,  $A_{bh}$  using a sample of 11 employees (for  $D_{wh} = 656$  hours and  $D_{wd} = 82$  days).

Name code	Department or Unit	$D_{ath}$ [h]	$D_{ah}$ [h]	$A_{bh}$ [%]	$D_{atd}$ [days]	$D_{ad}$ [days]	$A_{bd}$ [%]
A	BDD	780.78	-124.78	-19.02	77	5	6.1
B	CMD	632.35	23.65	3.61	65	17	20.7
C	EZL	857.53	-201.53	-30.72	68	14	17.1
D	EZL	697.35	-41.35	-6.30	75	7	8.5
E	FSDSD	625.45	30.55	4.66	71	11	13.4
F	IAU	394.95	261.05	39.79	54	28	34.1
G	ICTU	592.12	63.88	9.74	62	20	24.4
H	LSU	605.13	50.87	7.75	73	9	11.0
I	PMU	113.78	542.22	82.66	31	51	62.2
J	PQSD	330.6	325.4	49.60	47	35	42.7
K	RQAU	683.12	-27.12	-4.13	79	3	3.7



**Figure 3.** Comparison between overall absenteeism in hours and days using arbitrary staff identification number for January-April period.

the total hours worked, stayed or present at work when the individual punches out.

**Figure 3** shows also that the average value of  $A_{bd}$  is higher than  $A_{bh}$ . This indicates that employees often miss work for the whole day compared to missed hours of the working day. The values of absenteeism in days ( $A_{bd}$ ) have the lowest value of 0% (there are no negative values, that is, either the individual came to work or not but not fractions of a day as easily depicted in hours). Negative values of  $A_{bh}$  means that this individual works more than the 8 hours of work day, that is, extra working hours which is frequently practiced in the FSL as a means of reducing backlogs. Thus, there are negative values for  $A_{bh}$  up to  $-50\%$ , which is a good observation. The overall average value of  $A_{bh} = 13.69\%$ , while that of  $A_{bd} = 20.46\%$  for the months of May-August. Higher values of  $A_{bh}$  and  $A_{bd}$  may also be reflected as the causes of extended turnaround time (TAT) in laboratory processes which causes the FSL to have a reduced performance and competitiveness. The fact that  $A_{bh} < A_{bd}$  was observed for all three periods studied.

#### 4.2. Statistical Analysis of Overall Absenteeism Data

To study variations in the  $A_{bh}$  and  $A_{bd}$  statistical analysis was conducted for different periods of January to April and May to August and September to December 2016, that is, at an interval of 4 months, regardless of gender, departments, skill levels, professions, etc., as shown in **Table 3**. The statistical analysis of overall  $A_{bh}$  data shows that the mean values of absenteeism ratio changed between the three periods of the year, that is,  $A_{bh} = 14.82\%$ ,  $13.69\%$  and  $20.46\%$ , for January-April, May-August and September-December, respectively, being highest in the September-December period. The lowest minimum values of  $A_{bh}$  were observed for January-April ( $A_{bh} = -66.91\%$ ) with the corresponding highest maximum values around  $100\%$  for all the three periods. On the other hand, the

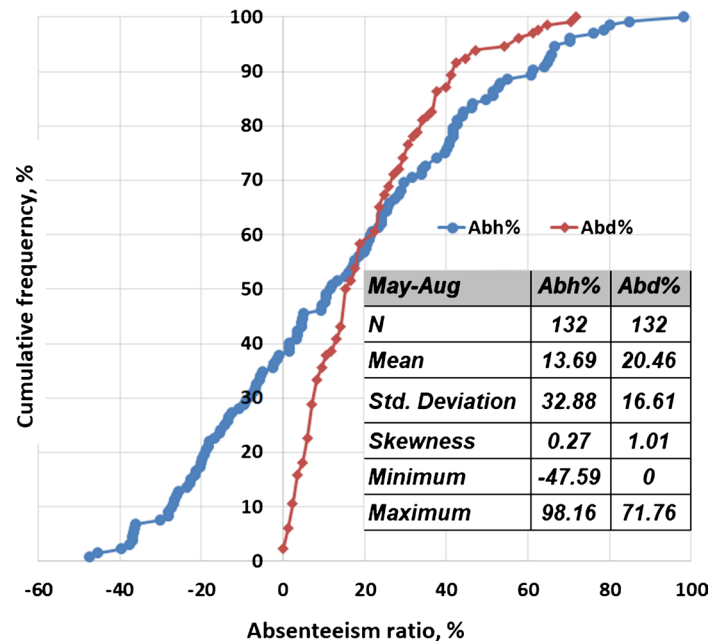
**Table 3.** Statistical analysis of the overall absenteeism data for different periods of the year.

Statistics	$A_{bh}$			$A_{bd}$		
	January-April	May-August	September-December	January-April	May-August	September-December
$N$	134	132	128	134	132	128
Mean	14.82	13.69	20.46	20.80	20.46	20.94
Std. Deviation	37.07	32.88	29.27	19.56	16.61	15.21
Skewness	0.651	0.269	0.506	1.727	1.009	1.013
Kurtosis	0.006	-0.702	0.086	3.152	0.593	0.703
Minimum	-66.91	-47.59	-52.37	-1.25	0	1.22
Maximum	100	98.16	97.32	88.75	71.76	74.39

$A_{bd}$  data revealed higher but similar average values of  $A_{bd} = 21\%$ , with higher minimum values of  $A_{bd} = -1.25\%$ ,  $0\%$  and  $1.22\%$  for the periods of January-April, May-August and September-December, respectively, compared to  $A_{bh}$  values. The maximum value of  $A_{bd}$  was highest for January-April compared to the rest of the periods of the year. In general,  $A_{bd}$  values are lower than  $A_{bh}$  values. That is, overall analysis shows that the average absenteeism ratio based on hours was lower than values based on days for the three periods studied. That is, employee's absence is high on hourly basis than day basis. It is easier for employees to be absent for a part of the day (hourly absenteeism) than the whole day. Therefore, in terms of sensitivity analysis, hourly absenteeism is more sensitive than daily absenteeism. Negative minimum values of  $A_{bh}$  indicate that employees work for extra hours than for extra days, frequency of which has to be increased for improved competitiveness of the FSL.

Based on the values of standard deviation, there is an indication of strong variations in  $A_{bh}$  data than  $A_{bd}$  due to higher values of the former. Since all data series indicates positive skewness, it is obvious that the absenteeism data is skewed towards the higher values of absenteeism ratio, also indicating a high tendency of absenteeism in the FSL, which require supervisors to investigate for root causes followed by improving or reducing  $A_{bh}$ . Higher kurtosis values for the  $A_{bd}$  data indicates that the PDFs of such data have high peaks than those of  $A_{bh}$ , showing high uniformity in the  $A_{bd}$  data, which concentrate around the mean values. There is a need for stringent control in attendance based on time, since proper management of time may help to reduce absenteeism by giving strict measures to a FSL staff that come in late frequently and leave early. A demarcation should be stipulated and agreed upon via an organizational staff attendance policy.

The decrease in overall average  $A_{bh}$  compared to  $A_{bd}$  can be attributed to a wide range of employees exhibiting very low values of absenteeism,  $A_{bh}$  below  $0\%$ , as shown in **Figure 4**. Also, for  $A_{bh} > 20\%$ , the cumulative frequencies are highest for  $A_{bd}$  compared to  $A_{bh}$ , indicating large number of employees with high absence rates. On the other hand, **Figure 4** shows the cumulative distribution



**Figure 4.** Comparison between cumulative distribution functions for  $A_{bh}$  and  $A_{bd}$  data from the same period of the year (May-August, 2016).

functions of the absenteeism ratios  $A_{bh}$  and  $A_{bd}$ . The two parameters differ in terms of span of values, where  $A_{bh}$  ranged between  $-50\%$  and  $100\%$  while  $A_{bd}$  ranged between  $0$  and  $71.7\%$  only. Thus,  $A_{bh}$  is the suitable parameter for quantifying absenteeism due to its sensitivity, as the parameter allows assessment of slight changes in absenteeism.

### 4.3. Variation of Absenteeism Rate with Time of the Year

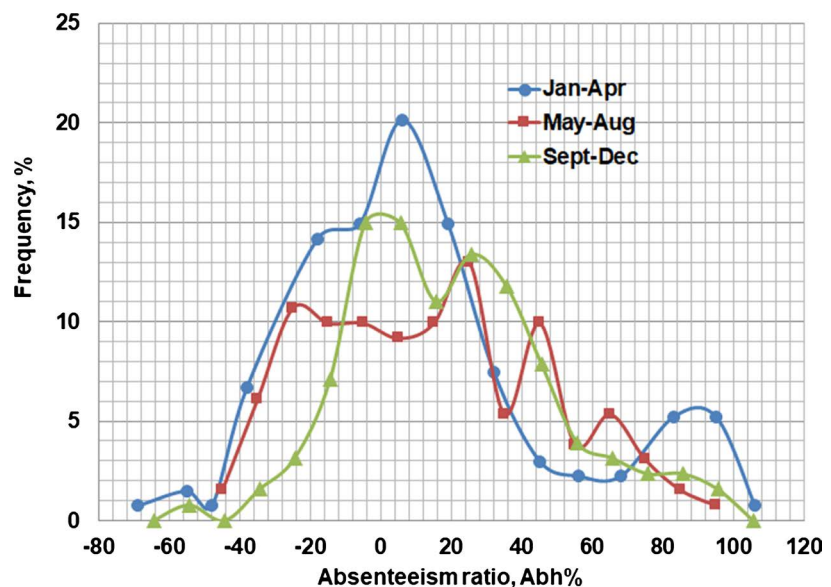
#### 4.3.1. Analysis of Overall Absenteeism Based on Hours

Statistical analysis of overall absenteeism data based on hours,  $A_{bch}$ , was conducted for the three periods of the year regardless of departments or units. The total number of employees included in this analysis was  $N_1 = 134$  for January-April,  $N_2 = 132$  for May to August and  $N_3 = 128$  for September to December, as shown in **Table 4**. The probability density functions of  $A_{bh}$  data for the three different periods of the year 2016, that is, indicate that a good number of employees work extra hours exhibiting the lowest values of  $A_{bh} < 0\%$ . On the other hand, it was observed that most of the FSL employees were absent to a very large extent, up to  $A_{bh} = 100\%$ , as shown in **Figure 5**, which affects FSL performance in case file processing and service delivery.

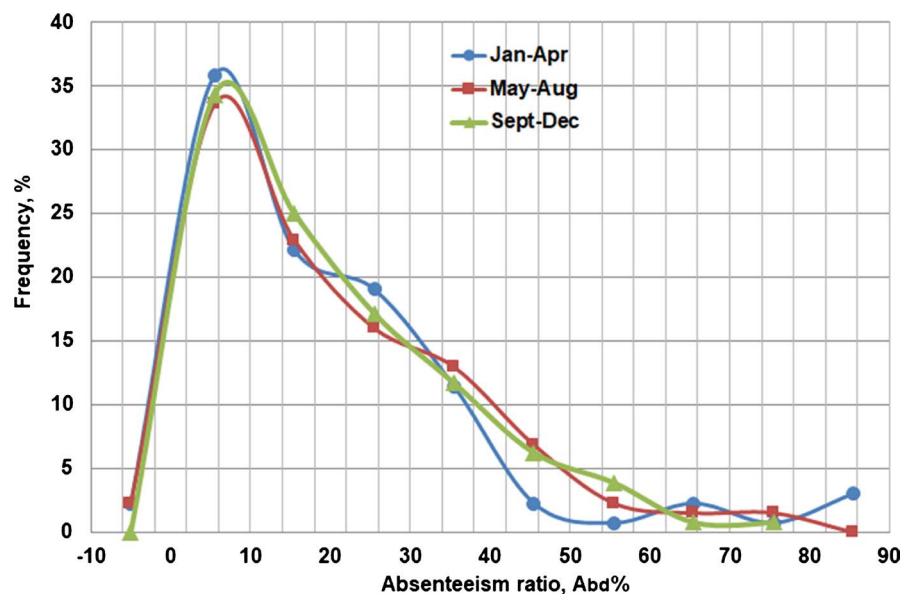
As shown in **Figure 5**, the peak frequency for January to April was observed at  $A_{bh} = 5\%$ , whereas, the absenteeism data for May to August did not reveal proper peak. The maximum values of  $A_{bh}$  ranged up to  $100\%$  for both periods of the year with small peaks near maximum values. It was also observed that, the minimum values of  $A_{bh}$ , which indicates highly available employee of the FSL, was about  $-70\%$  for January to April, while May to August the minimum  $A_{bh}$  was only  $-45\%$ .

#### 4.3.2. Analysis of Overall Day-Based Absenteeism Data

**Figure 6** shows the PDFs of overall absenteeism data ( $A_{bd}$ ) for the three different periods of the year. The PDFs have a similar shape for both periods, indicating that there are no differences in the absenteeism characteristics or habits practiced by employees throughout the year in terms of days absent. Moreover, the  $A_{bd}$  data shows different PDF shapes from  $A_{bh}$  (also revealed by values of skewness and kurtosis in **Table 4**). Most of the employees were observed to have  $A_{bd} = 5\%$  for the three periods. Compared to data presented in **Figure 5**, there is a difference in absence characteristics between days and hours. This shows that the factors controlling daily absence are different from those affecting hourly



**Figure 5.** PDFs of the overall absenteeism data,  $A_{bh}$  for different periods of the year 2016.



**Figure 6.** PDFs of overall absenteeism data ( $A_{bd}$ ) for different periods of the year 2016 (January to April and May to August).

absence behaviors among employees in the FSL.

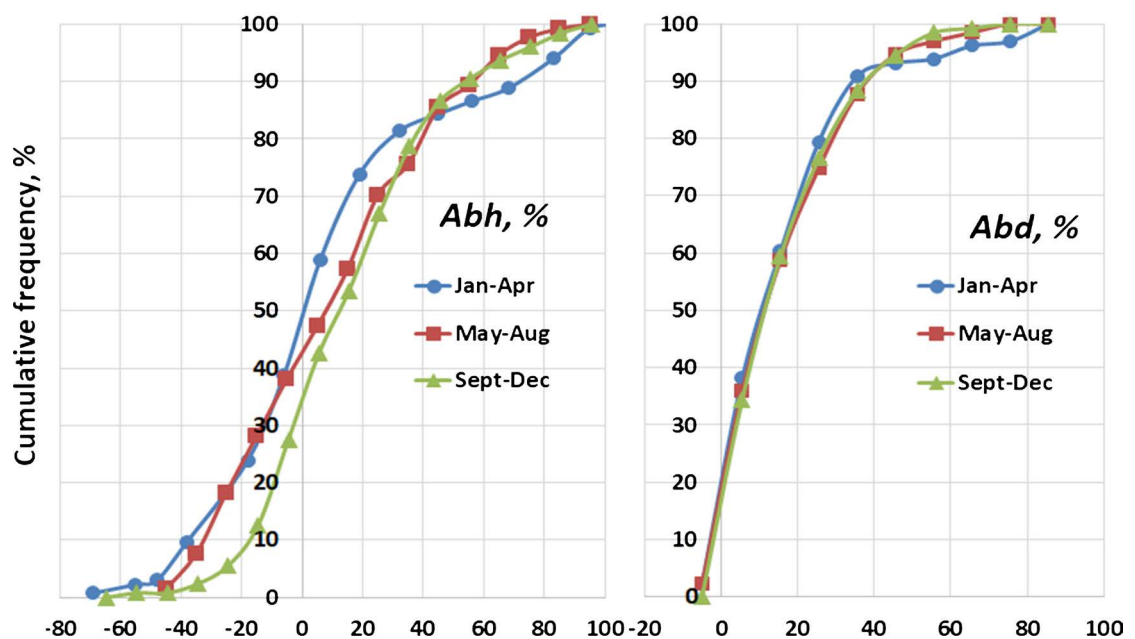
**Figure 6** also shows that the maximum values of  $A_{bd}$  were high, up to 85% for the three periods. All PDFs have long tails towards the right hand side indicating extended day-based absenteeism within the FSL. This is attributable to staff travel for assignments outside Dar es Salaam in addition to unplanned absences. The unplanned absences require action by the management including changes in administrative sanctions. Moreover, comparing results presented in **Figure 5** and **Figure 6**, it is evident that the sensitivity in detecting absenteeism is higher for  $A_{bh}$  than for  $A_{bd}$  based on spans of the data. The latter shows very minimal extra days worked while the former shows higher extra hours attended by employees.

**Figure 7** presents the CDFs of  $A_{bh}$  and  $A_{bd}$  data for the three periods studied, respectively. There is still a strong resemblance in the shapes and span of CFDFs for the three periods, while  $A_{bh}$  shows more details and slight differences. It is important for the FSL management to make sure that the inevitable hours worked by employees outside the FSL (being absent) as revealed in **Figure 5** and **Figure 7** are turned into useful outcomes by improving supervisory roles.

#### 4.4. Analysis of Absenteeism Data from Different Departments and Units

##### 4.4.1. Comparison between $A_{bh}$ Data from Different Departments

The essence of comparing absenteeism between different departments and units is to establish if departmental functional settings, nature of jobs and leadership affect absenteeism in the FSL. In spite of the type and complexity of processes that are performed in the FSL (such as large number of case files and samples received and analyzed, for instance the biological materials and drugs of abuse samples) which could have been the reason for having a low absenteeism rate in

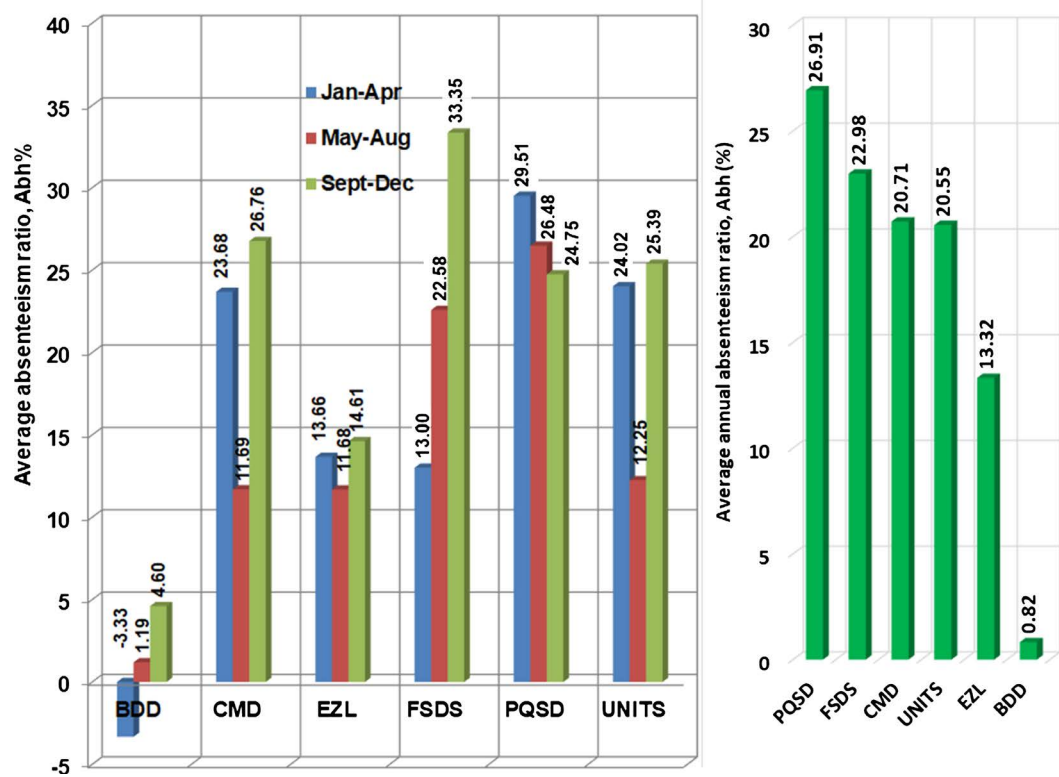


**Figure 7.** Comparison between CDFs of  $A_{bh}$  and  $A_{bd}$  data for the three periods of the year 2016.



the laboratories, this is not the case as CMD, FSDS and PQSD still exhibit high absenteeism rate, as shown in **Figure 8**. The FSL in general still exhibit high absenteeism rate in terms of hours lost. The BDD shows lowest values of  $A_{bh}$  indicating that its employees worked extra hours during three periods studied. Results show also that FSDS had higher  $A_{bh}$  value of about 33.35% while other technical departments such as PQSD and CMD had lower values of  $A_{bh}$ , that is, 24.75% and 26.76%, respectively, from September to December. However, for the period of January-April, PQSD, CMD and UNITS had high values of  $A_{bh}$ , which decreased during the second period of May-August. As shown in **Figure 8**, FSDS and other departments show high absenteeism rate with exception of BDD, which shows lowest values. Moreover, for the following months of May to August, the FSDS increased its absenteeism rate from 13.00% to 22.58%. This can be attributed to more court sessions attended which keeps the analysts away from the laboratory work. The increase in absenteeism for FSDS may be attributed also to attending meetings associated with criminal justice. However, the FSDS leadership in collaboration with the FSL management is required to establish the true causes of absenteeism in the departments like PQSD and CMD.

**Figure 8** shows also that the highest value of average absenteeism ratio based on hours lost was observed to be 26.91% from PQSD for the whole year, while the minimum absenteeism ratio was observed to be 0.82% from the department of BDD for January to December. Highest values of absenteeism in the PQSD require further investigation as it indicates large number of working hours lost.

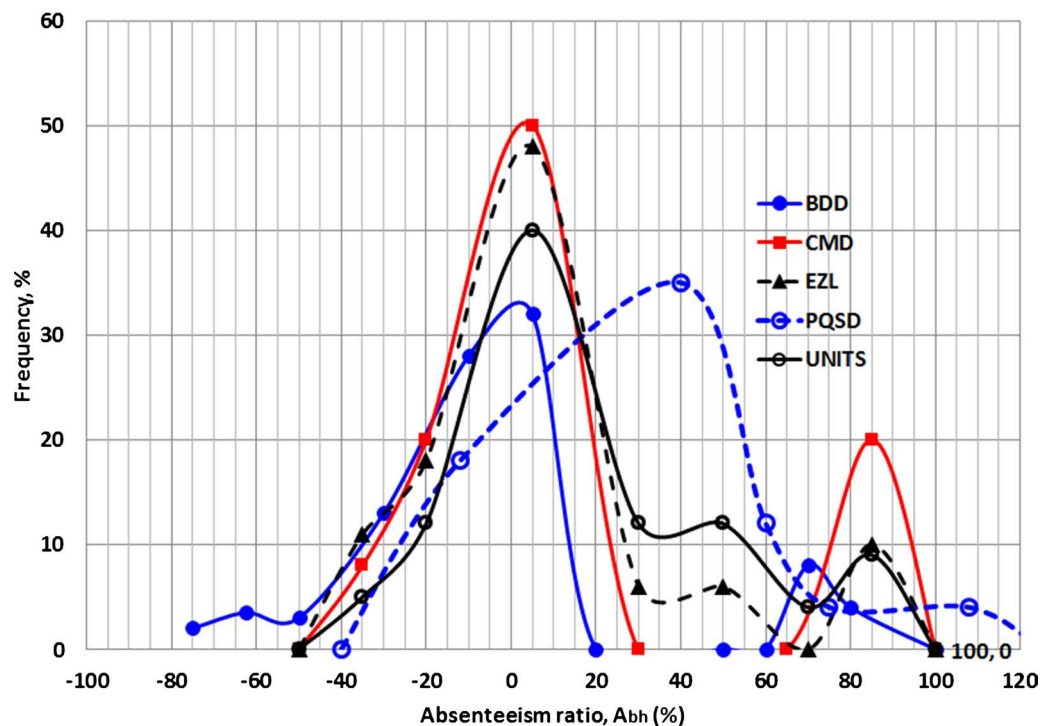


**Figure 8.** Comparison of average absenteeism ratio,  $A_{bh}$ , by departments for different periods of the year 2016.

There were also notable changes in  $A_{bh}$  between the two periods for CMD and UNITS, from 23.68% to 11.69% and 24.02% to 12.35% from January-April to May-August, respectively, which necessitates further investigation for the reasons which triggered decrease in absenteeism to half between the two periods studied. The low  $A_{bh}$  values for BDD can be attributed to the fact that there is low interaction among employees of the same department, with employees from other departments or units required to accomplish their tasks and also due to the fact that the duties among BDD do not require assistants to be accomplished different from laboratory work where more than one person are required to be present for the tasks to proceed. Moreover, the tasks involved as per SOPs in the BDD are not time-limited as tasks can be started and completed at any time of the day or few hours after working hours, allowing engaged employees to proceed with work after working hours.

The lower absenteeism ratio in EZL can be attributed to the fact that the inherent activities are manageable and do not require long and strict sequence of standard operating procedures, also, do not require assistants to accomplish given task different from the laboratory work. This allows independent working style, leading to minimal absenteeism in terms of hours lost. Moreover, since establishment of the EZL in 2014, it has been strongly supervised acting as a power bank for accomplishing tasks related to chemicals management and also as a revenue collection center. This area requires a well-focused manager with good leadership traits.

The PDFs of absenteeism data for different departments are shown in **Figure 9**.



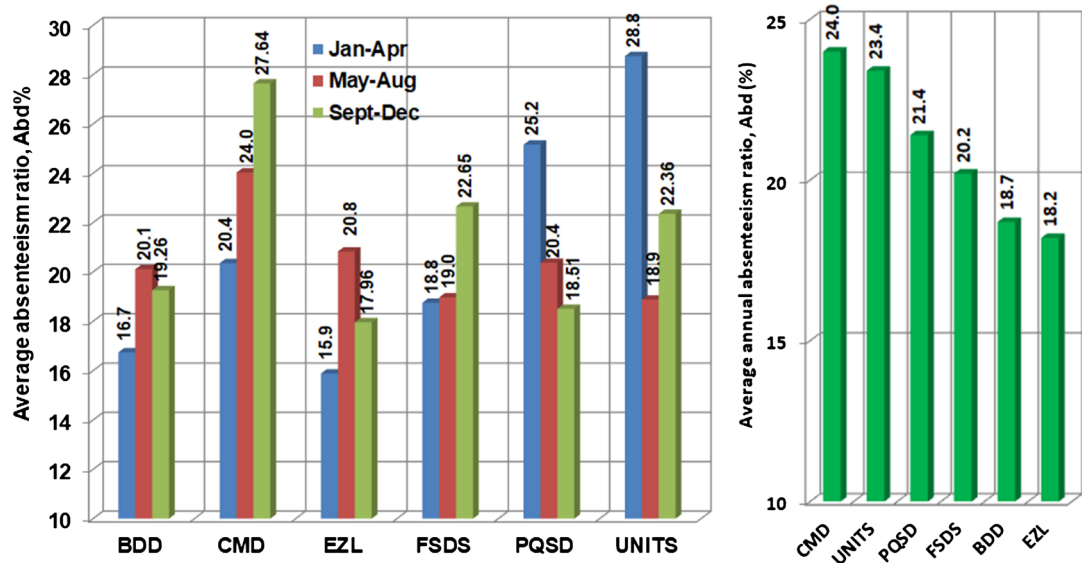
**Figure 9.** Probability density functions of absenteeism ratio  $A_{bh}$  for different departments for the period of January-April.

With exception of BDD where  $A_{bh}$  extends to  $-75\%$ , all the data from the rest of departments and units ranged within  $-50\%$  to  $100\%$ . However, UNITS exhibited highest minimum values of  $A_{bh}$  indicating high absence rate. This shows that biometric and attendance system is capable of identifying differences in absenteeism caused by nature of activities and processes, absenteeism behavior among different disciplines and differences in leadership methods, and administrative controls on absenteeism imposed by directors and heads of units. Absenteeism is also compared within the department using the PDF to show that there are abnormalities in the extent of absenteeism among employees within different departments which require action by management as they affect performance of the FSL.

According to **Figure 9**, the PDFs of absenteeism data for different department exhibit bimodal behavior with large and small peaks. It is only the BDD which shows a minimum  $A_{bh}$  beyond  $-50\%$  while PQSD, on the other hand, shows maximum absenteeism ratios beyond  $A_{bh} = 100\%$ . Moreover, while other departments show similar peak location close to zero, the PQSD has its peak shifted to as far as  $40\%$  which may be attributed to the low workload imposed by directors and managers or lack of employee supervision and engagement. The bimodal behavior prominent. In the EZL, BDD and CMD for  $A_{bh}$  is an indication of more than one factor contributing to the workers' absence.

#### 4.4.2. Comparison between $A_{bd}$ Data from Different Departments

The average values of absenteeism ratio,  $A_{bd}$  were observed to differ among departments and between different periods of the year 2016, as shown in **Figure 10**. The highest value of average absenteeism ratio based on days was observed to be  $28.8\%$  for the UNITS during the period of January to April. This was followed by  $A_{bd} = 27.64\%$  for CMD from September to December. The minimum value of average absenteeism ratio  $A_{bd}$  was observed to be  $15.9\%$  in the EZL



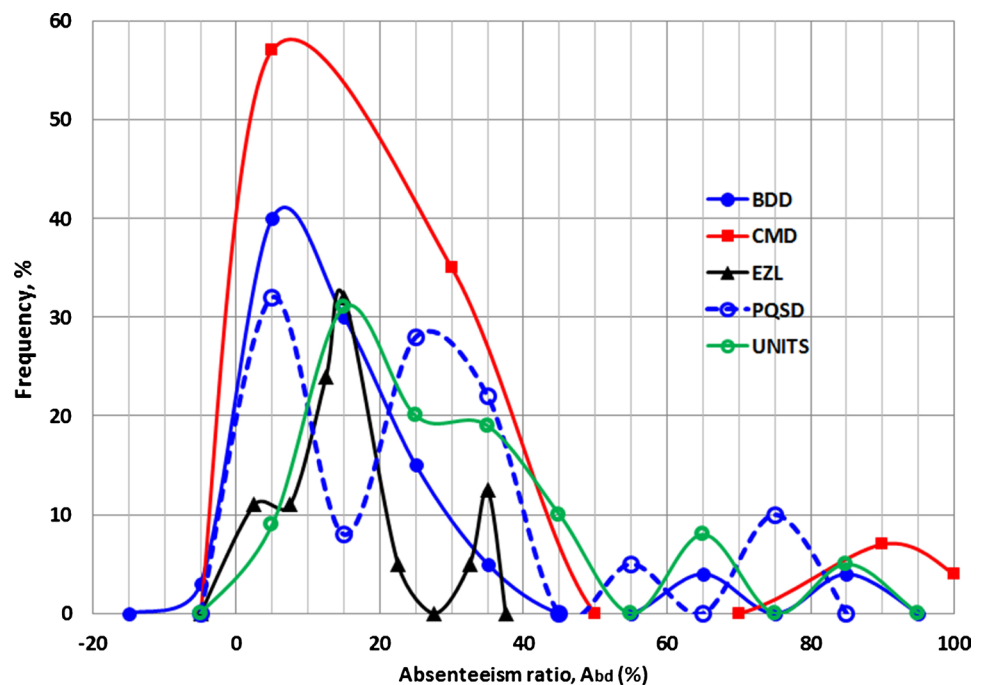
**Figure 10.** Comparison of average absenteeism ratio,  $A_{bd}$  by departments for different periods studied.

during January-April. The low absenteeism observed in EZL can be attributed to the fact that the main activity is processing of chemical import and export permits and registration of dealers together with writing inspection reports which do not necessitate travel outside the FSL. Moreover, there was an increase in the  $A_{bd}$  between January-April and September-December 2016, for all departments combined, with a minimum in May-August. The increase in absenteeism for CMD, FSDS and UNITS necessitates root-cause analysis followed by action by the FSL management. The BDD follows EZL in terms of low values of  $A_{bd}$ . This is because EZL staffing focuses on placing staff with demonstrated performance and enthusiasm towards work, followed by strong supportive supervision by the manager.

Comparing absenteeism among departments and units of FSL addresses not only the nature of assignments, workload and working conditions, but also leadership characteristics. Leaders (directors and managers) taking priority in solving analysts' and support staff problems fast, with the right and satisfactory solutions are considered to be a critical component in minimizing absenteeism [32]. Managers should further complement staff on work well done because the absence of positive feedback is also considered to be a leading cause of absenteeism.

High absenteeism ratio within the department indicates that there are many instances where the employees are not present at work leading to lost productivity and increased workload for those in attendance. On the other hand, lower values of  $A_{bd}$  indicate that some employees go to work during public holidays for instance EZL and BDD.

**Figure 11** compares the individual values of  $A_{bd}$  among departments and



**Figure 11.** Comparing PDFs of absenteeism ratio ( $A_{bd}$ %) according to FSL departments and units for January-April, 2016.

units using PDSFs. The PDFs show different characteristics (patterns) between departments, indicating that the employees of the respective departments are affected differently by standard operating procedures (SOPs), administrative and financial circulars, work interactions among staff, external stakeholders, etc. A clear difference is depicted for DBDD for which employees show lowest absenteeism ratios up to  $-20\%$ . This analysis helps to compare the behaviors among the departments and units and to assess how employees and managers accept a culture of absenteeism.

The lowest values of  $A_{bd}$  for BDD employees below  $-10\%$  indicate that employees in the respective department work extra days on weekends and public holidays. The lowest values of  $A_{bd}$  for CMD, FSDS and UNITS reached  $-5\%$  only. In general, higher  $A_{bd}$  values beyond  $40\%$  were not observed for EZL. The PQSD and EZL show distinct peaks between  $0$  and  $+40\%$  indicating two categories of absence behaviors or cause factors. While the maximum value of  $A_{bd}$  for EZL was  $40\%$ , whereas, higher values up to  $100\%$  were observed in other departments. The FSL units like procurement management unit (PMU) and internal audit are supposed to have very low values of  $A_{bd}$  but the opposite was observed where up to  $100\%$  absence were observed.

#### 4.5. Effect of Gender Difference on Absenteeism

In this study, the absenteeism rates were compared for male and female employees in the FSL during the period from January to April. The study involved 134 employees out of which 55 (41%) were female and 79 (51%) were male. **Table 5** shows the statistics of the  $A_{bh}$  and  $A_{bd}$  data. The statistical data from **Table 5** shows the average values to be  $A_{bd} = 20.36\%$  and  $21.10\%$  for female and male employees respectively. The higher  $A_{bh}$  values for female employees can be attributed to breast feeding, pregnancy and maternity related absences. The purpose of the analysis was to determine if male and female employees had different patterns of absenteeism and how the two dynamics are affected by different factors. Although women perceived some work related factors differently than men and took substantially more hours off than men, their absence occurrences were not significantly different from men compared using  $A_{bd}$ . Even under presumably very similar employment and working conditions, women have 1.3 to 1.7 times as many absences as men [33]. Similar observations were reported in literature [11] [34]. In addition, **Table 4** shows the values of standard deviation of  $A_{bh}$  and  $A_{bd}$  data (being higher for male than female employees) indicating that the absence rate for male employees vary more widely than female employees. Skewness of the absenteeism data shows similarity between female and male employees, while kurtosis shows that the PDF of  $A_{bh}$  is flatter than that of  $A_{bd}$ .

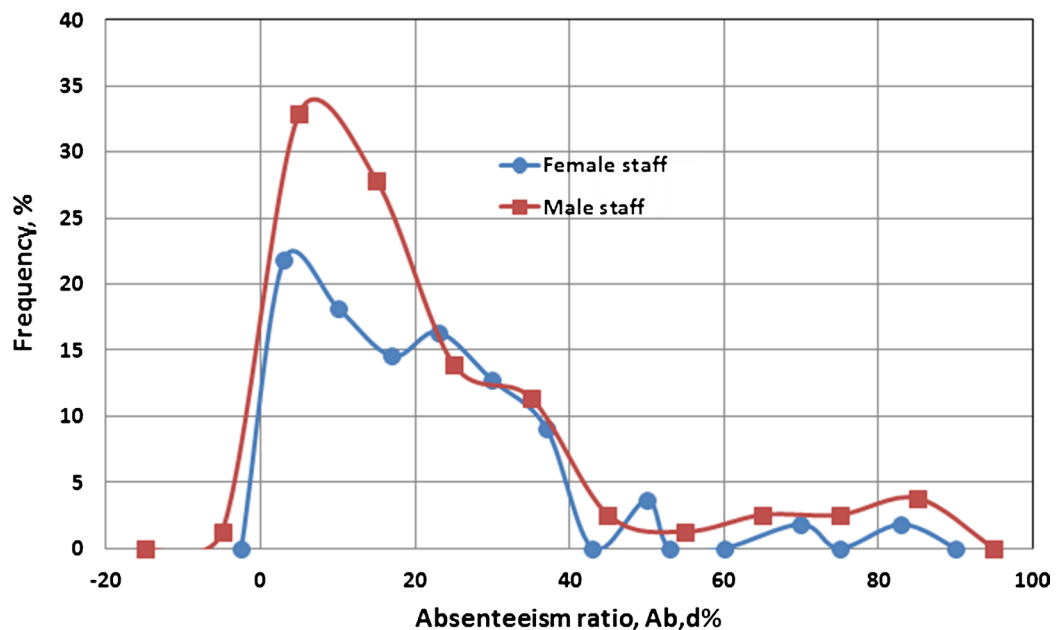
On average, female employees have high hourly absenteeism than male employees, while the observation was different for  $A_{bd}$  whereby, male employees have high daily absence. That is, female employees work less hours per day, but more days than male employees in the FSL. Comparing the standard deviation

values, it can be concluded that men's absenteeism was less predictable compared to female employees, for both days and hours. Moreover, male employees were on the extremes of both hourly and daily absenteeism, that is, lowest minimum and highest maximum values with high skewness compared to female employees.

**Figure 12** compares the  $A_{bd}$  data for male and female employees using PDFs. Both male and female employees have similar characteristics rate of absenteeism in days as shown in **Figure 12** based on span of  $A_{bd}$  and shape of PDFs. **Figure 12** shows also that the peak frequency of absenteeism rate,  $A_{bd}$  for both male and female employees was observed at  $A_{bd} = 5\%$ , whereas, the maximum values of  $A_{bd}$  ranged up to 100% for both male and female employees. Absenteeism data based on days may indicate travel days to attend duties outside the workplace like zonal laboratories and that male employees have external responsibilities outside the FSL more often than female employees. Such duties include crime

**Table 4.** Statistical analysis of absenteeism data by gender (January to April, 2016).

	$A_{bh}$ [%]		$A_{bd}$ [%]	
	Female	Male	Female	Male
$N$	55	79	55	79
Mean	17.54	12.93	20.36	21.11
Std. Deviation	34.24	39.02	16.66	21.45
Skewness	0.541	0.747	1.662	1.706
Kurtosis	0.577	-0.152	4.138	2.616
Minimum	-66.91	-61.87	1.25	-1.25
Maximum	97.02	100.00	86.25	88.75



**Figure 12.** PDF of absenteeism data,  $A_{bd}$  for female and male employees in the FSL.

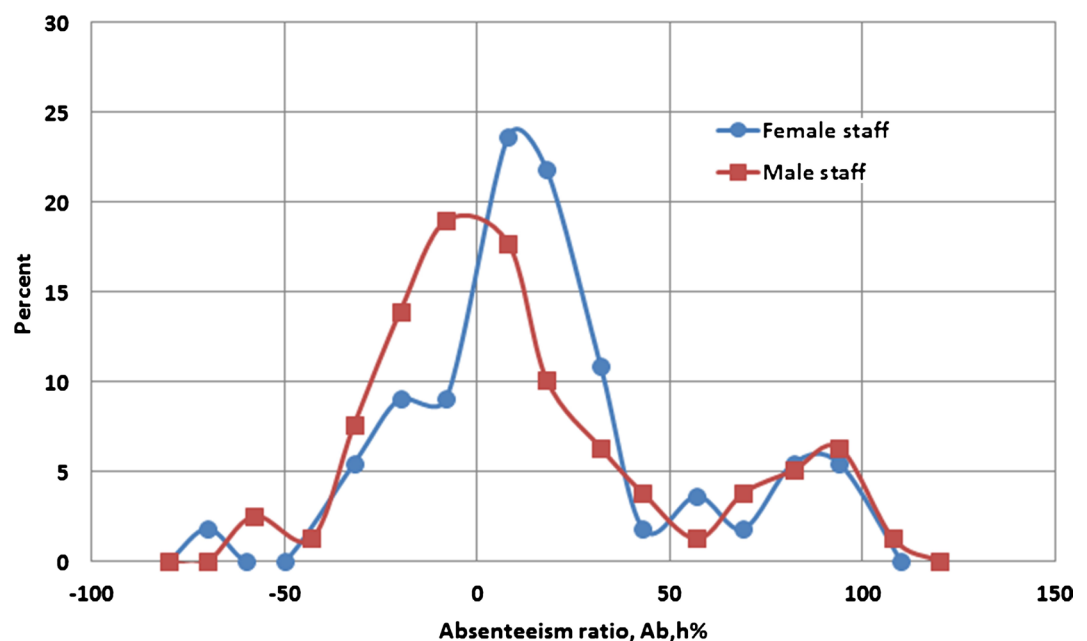
scene visits and court sessions for expert witnessing. This shows that gender difference strongly affects absenteeism rate in the FSL.

**Figure 13** presents a comparison between  $A_{bh}$  data for female and male employees using PDFs, showing the frequency distributions of  $A_{bh}$  data for female and male employees in the FSL are shown. With peaks at 5% and -5% for female and male employees, respectively, results show that female employees generally had higher rates of hourly absence. Results show that more female workers take time off work during work days more often than males. This observation is similar to literature reports which indicate that women have short spells of absence consistent with other studies comparing sickness absence in men and women [35]. A peak at  $A_{bh} = -5\%$  for male employees indicates that they attend work for extra hours more often than female employees.

The span of  $A_{bh}$  data were the same for both female and male employees extending from -80% to 120%. However, as shown in **Table 5**, male employees are slightly on the extremes. Although  $A_{bh}$  values up to 120% were observed at low frequency, it is still important for the management to take prompt action especially for male employees. While the shapes of PDFs were similar for both male and female employees, the  $A_{bh}$  data shows higher peak 5% for female compared to male employees with peak at -5%. Also, with standard deviation of 34.24% and 39.02% for female and male employees, it indicates that the absence behavior of male employees is less uniform or unpredictable than for female employees, that is female employees have common absence behavior which is affected by common causes of absence while men's absence are caused by large number of factors.

#### 4.6. Effect of Employees' Skill Levels on Absenteeism

At this stage, absenteeism data was compared among skill levels to establish if

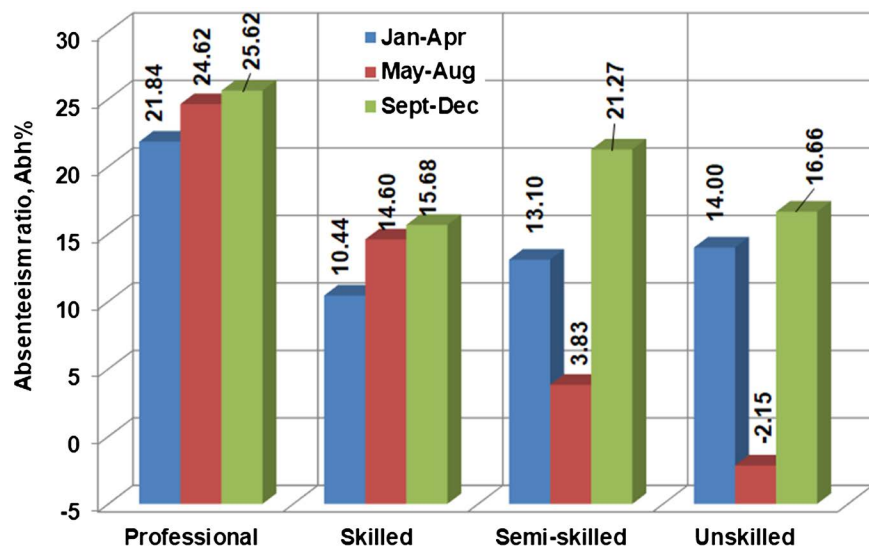


**Figure 13.** PDF of absenteeism data,  $A_{bh}$  for female and male employees in the FSL.



highly skilled or professional employees significantly exercise more absence than less skilled employees due to differences in nature of assignments. **Figure 14** shows the analysis of average absenteeism data based on four employees' professional levels, that is, professional, skilled, semi-skilled and unskilled. Observing more closely at how chronic absenteeism is defined and measured in these skill-levels, results indicate critical absenteeism among the professional cadre, being highest at  $A_{bh} = 25.62\%$  on average during September-December. For the professional employees,  $A_{bh}$  was observed to increase during the three periods studied, but dropped considerably during the May-August period for semi-skilled and unskilled employees. This can be attributed to external assignments for the professionals and skilled employees compared to the unskilled employees. Financial year closes during May-August each year, requiring skilled and professional employees to travel to zonal laboratories for inspection, monitoring and evaluation purposes, and for attending budget presentation to the National Assembly. For all skill levels, absenteeism was highest during September-December, especially during end of the year which requires management action as more revenue is lost.

Therefore, it will be considered high absenteeism or low when the rate of missing at work in hours or days is related to value in terms of services offered or revenue collection. High absence rate for professional employees require scrutiny and possibility of directing the professional employees to produce high value output from whatever they do outside the FSL, as it impacts competitiveness. The high absence rate for professionals is again of high value only when individuals utilize their skills to bring benefit to the FSL when they attend external duties. Moreover, absence of semi-skilled and unskilled employees is also of value when they can acquire skills and experience useful to FSL during their absence. Because their operations are tied to the professional employees, semi-skilled and unskilled employees' absence can disrupt productivity of the professionals,

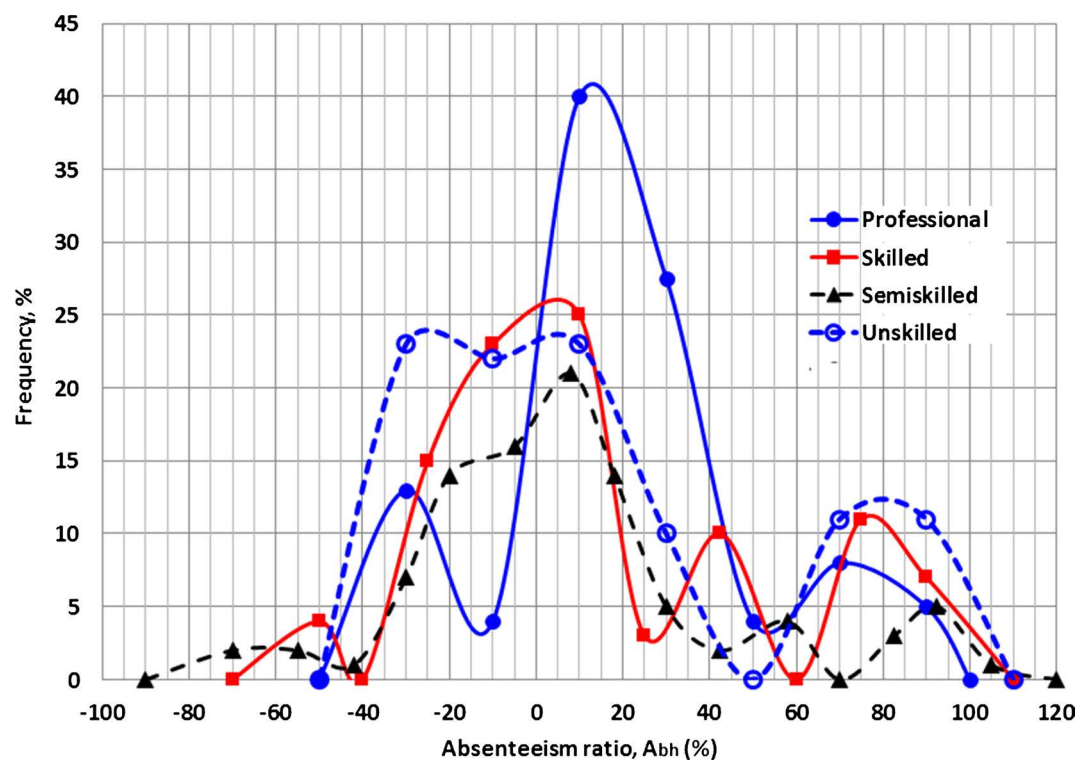


**Figure 14.** Analysis of absenteeism based on staff skill-levels for different study periods.

for example, workflow relationship between a director and an office management secretary, or laboratory manager and analyst or laboratory attendant.

**Figure 14** shows also that professionals had the highest absenteeism during all three periods studied, with the highest value of  $A_{bh} = 25.62\%$  due to the fact that more external interaction is practiced by professionals than other skill levels such as skilled, semi-skilled and unskilled. Low absenteeism rate was observed in unskilled staff with a value of  $A_{bh} = -2.15\%$  during May-August, attributable to the fact that such skill levels do not attend any external FSL issues. Most of the time, these unskilled staff perform their work by following stipulated daily instructions, being assigned instantly by their superiors. This skill level represents employees who clean, wind up analytical service areas, and put back in place all items such as cleaning tools, dustbins and washing instruments after analytical work in the laboratory. There are times when they spend extra time after working hours, and also during weekends and public holidays, leading to large number of hours worked and hence very low absenteeism ratio. The absenteeism data analysis based on skill levels, offers a unique nationwide relationship between the FSL and other organizations, a link created via professionals and skilled staff.

**Figure 15** shows the PDFs of  $A_{bh}$  data for different skill-levels among FSL employees. The results show that skill-levels lead to dissimilar trends in absenteeism with respect to  $A_{bh}$ , that is, skill-levels influence the absence behavior strongly causing different shapes and span of PDFs. Only the skilled and semi-skilled employees showed lower values of  $A_{bh}$  beyond  $-60\%$ . The peak location in the  $A_{bh}$  data varied between the skill-levels, with the unskilled staff



**Figure 15.** Comparison between of  $A_{bh}$  data for different FSL skill-levels using PDFs within the FSL.

showing a peak at  $A_{bh} = -30\%$ , while the rest of skill-levels show a peak at  $A_{bh} = 10\%$ . It is interesting to note that there is extended absenteeism ratio up to  $A_{bh} > 100\%$  observed for all skill levels, especially the semi-skilled employees, for which  $A_{bh}$  reached up to 120%.

#### 4.7. Effect of Employees' Professions on Absenteeism in the FSL

Figure 16 presents analysis comparison of absenteeism data according to staff professions for the three different periods of the year. In this study, three different professions in FSL were selected, that is, accountants, chemists and technologists. Technologists and accountants are the main support cadres for the chemist profession. When  $A_{bh}$  data was compared between the three professions, the trend shows that absenteeism is most experienced among technologist which not only put burden on chemists, but also the quality of analytical services delivered to the clients is affected [1].

While chemists and technologists work in the same place and conditions, hourly absenteeism varies among these professions (Figure 16) and fluctuates differently with time. Based on Figure 16, the technologists have the highest observed absenteeism rates of  $A_{bh}$  up to 43.48% (comparably the highest average value for all periods of the year), followed by chemists. The least values of  $A_{bh}$  were observed for accountants, being down to  $-35\%$  for the periods of May-August. Results show that, the chemists and the technologists have high positive values of  $A_{bh}$ , indicating that they have more off laboratory work hours than the accountants who have negative values of  $A_{bh}$ . This shows that technologists arrive late at work and leave early.

Results from this study show that the accountants are present at work more than the expected 8 hours of work implying that they punch in early and exit

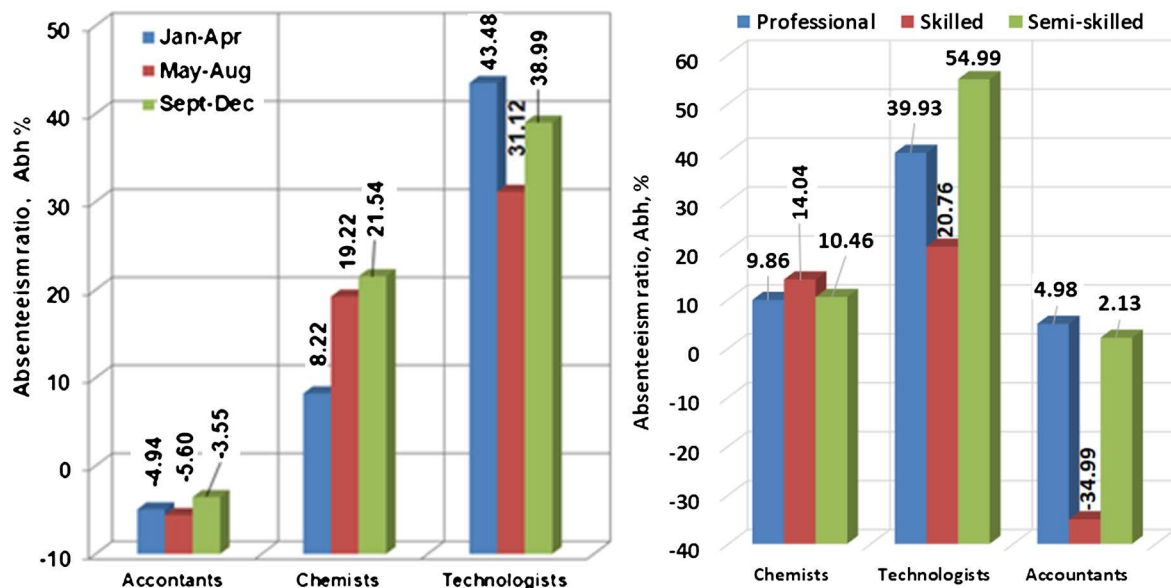


Figure 16. Analysis of absenteeism data by staff professions for different periods of the year and cross-tabulation between professions and skill-levels.

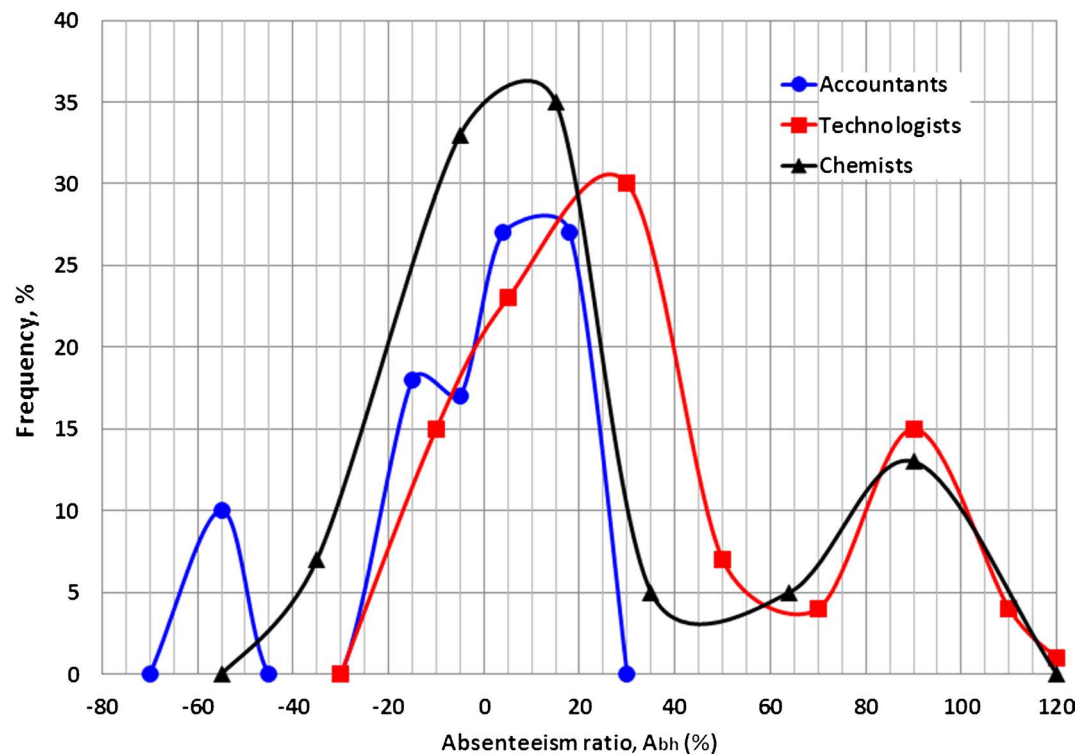
late, contributing to extended working hours. This is encouraging since payments preparations for internal and external clients are effectively done and on time, minimizing complaints. The lowest value of absenteeism observed among accountants for both period of the year, may also be caused by the type of work involved in the accounts section. Preparation of budget, balancing all the accounts and making sure that funds are available for either emergency or for the planned activities of FSL, are independent tasks, not requiring presence of other staff. As a results, such tasks can be done off-working hours for committed staff, leading to lower absenteeism ratio. On the other hand, the increase in absenteeism among technologists may be due to their job description, which is dependent on chemists. Moreover, the lower absenteeism ratio for chemists compared to technologists, can be attributed to the fact that chemists hold leadership positions, making them more responsible in terms of attendance and presence at work than technologists.

**Table 5** shows the statistical analysis of the absenteeism data for the period of January-April, and also compares the average values of hourly absenteeism data for different professions within the FSL. The observed negative values of  $A_{bh}$  for the accountants (with mean of  $-4.94$ ), compared to technologists and chemists (which shows mean values of  $A_{bh} = 36.58\%$  and  $12.58\%$ , respectively), is also an indication of differences in the nature of work and required interactions among staff for completion of different tasks. However, higher  $A_{bh}$  values for technologists and chemists require action by the FSL management. While chemists are required to interact with staff from other sections of the FSL to accomplish their tasks, the case is different for accountants. Thus, absence among chemists affects strongly the performance of FSL.

Chemist is the profession that has the duty to prepare procedures and methods and supervise all the analytical work. If absenteeism is experienced among the chemist profession, it will be exhibited 3 times more among technologist, as shown in **Table 5**. This means, technologists have to wait for case files and instructions from chemists after which, data analysis and report writing and review is done by chemists. Where chemists have  $A_{bh} = 12.58\%$ , the observed value

**Table 5.** Statistical analysis of hour-based absenteeism data for selected FSL professions during January-April.

Parameter	Accountants	Chemists	Technologists
$N$	11	39	26
Average, $A_{bh}$	$-4.94\%$	$12.58\%$	$36.58\%$
Std. Deviation	22.95	37.44	33.84
Skewness	$-1.593$	0.981	0.615
Kurtosis	3.339	0.066	$-0.548$
Minimum	$-61.87\%$	$-45.6\%$	$-12.57\%$
Maximum	$21.85\%$	$92.87\%$	$100\%$



**Figure 17.** Comparison between PDFs of hour-based absenteeism data for three FSL professions.

for technologist is 3 times, at 36.58%.

**Figure 17** shows PDFs of hourly absenteeism data for different professions within the FSL. While accountants have the main peak at about  $A_{bh} = 15\%$ , and a small peak around  $A_{bh} = -55\%$  exhibiting bimodal behavior, technologists have a main peak shifted to the right at 30%, and a small peak further to the higher absenteeism values at  $A_{bh} = 90\%$ . A peak at  $A_{bh} = -55\%$  for accountants implies that this profession works extra hours more often than chemists and technologists. The main peaks for accountants and chemists are located at 10%. Both chemists and accountants have the tendency to work extra hours compared to technologists, as depicted in **Figure 17**.

## 5. Conclusions

It can be concluded from this study that employee absenteeism in the FSL was high, and necessitating action by the management. Absenteeism based on hours ( $A_{bh}$ ) was highest for the period of September-December, while  $A_{bd}$  remained the same for the three periods.

For all the three periods of the year studied, the PDFs of absenteeism data based on days,  $A_{bd}$ , had the same pattern with peak absenteeism of 5%. The highest average absenteeism ratio based on hours,  $A_{bh}$ , was observed in PQSD while the lowest values of  $A_{bh}$  were revealed in BDD for the different periods studied. According to the probability density functions of  $A_{bh}$  data, absenteeism ratio for different departments follows a multimodal behavior. The department of BDD shows extended negative values of absenteeism by hours indicating that

employees work extra hours, whereas, the highest hourly absenteeism ratio  $A_{bh}$  was observed in the UNITS supporting the FSL.

Gender difference was observed to affect absenteeism; whereby, higher average  $A_{bh}$  was observed for female employees, showing that female employees spend more hours off than males. In contrary, the average  $A_{bd}$  was higher for males than female employees, which shows that male employees spent days away from the workplace than female employees. Both, male and female employees have the same pattern of frequency distribution of absenteeism ratios  $A_{bh}$  and  $A_{bd}$ .

It is further concluded that employees in the professional levels have highest average absenteeism ratio  $A_{bh}$ . The semi-skilled employees work more extra-hours compared to other skill-levels. Moreover, technologist had the highest absenteeism ratio based on hours ( $A_{bh}$ ) compared to chemists and accountants.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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