Exploring Procalcitonin Testing At a Busy Public Hospital

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Abstract

Background

The introduction of procalcitonin (PCT) testing at the National Health Laboratory Service in 2004 has shown a gradual increase in request volumes.

Aim and objective

The aim: To review the utilisation of PCT test in a busy academic hospital. The objective: To study the requesting wards, analyse the PCT results and the test cost; and, compare findings with the general practice in other institutions.

Methods

Using laboratory data, records of requests from all 110 wards at Chris Hani Baragwanath Academic Hospital that requested PCT between January 2010 and January 2011 (n=6177), were studied. The wards were categorised into (i) emergency departments (ED) (ii) intensive care units (ICU) and (iii) nonemergency departments (N-ED), based on the type and intensity of clinical care they are expected to provide. Combined ED and ICU wards were assigned category "suspicious wards". The distribution for each PCT concentration, quantity and percentage contribution was calculated. N-ED requests were compared with suspicious wards. PCT utilisation cost by different categories was assessed.

Results

PCT≤0.05ng/ml contributed 158 (3%) tests and PCT≥10ng/ml 1728 (28%). Top 10 requests were from suspicious wards. Volume distribution of results consistent with sepsis (>2.0ng/ml) was: N-ED (11%), ED (32%) and ICU (57%) or

suspicious wards (89%) ED and ICU combined). Total respective cost for N-ED and suspicious wards were ZAR255,659 and ZAR2,144,352.

Conclusion

Concentrations of PCT was increased in septic condition. Serum PCT concentrations from ED and ICU were consistent with sepsis. The audit results showed that clinicians are following global guidelines for requesting PCT.

Keywords: bacterial infection, sepsis, clinical significance, laboratory diagnosis, PCT, CHBAH.

Introduction

The most significant effort resulting in introducing procalcitonin (PCT) at National Health Laboratory Service (NHLS) was an unpublished study at Red Cross War Memorial Children's Hospital that was conducted to investigate low (C-reactive protein) CRP results from Mowbray Maternity Hospital in 2004. NHLS conducted a similar study that compared CRP to PCT at Chris Hani Baragwanath Academic Hospital (CHBAH) Chemical Pathology (Tanyanyiwa *et al.*, 2018). Since its introduction, volumes of PCT test requests have been gradually increasing. The increase in requests implies that the test has been accepted and has value in the optimisation of patient management. NHLS and the Department of Health (DoH) conduct National Coverage presentations to clinicians at district and regional hospitals on the rational utilisation of pathology laboratory services.

The aim was to review the utilisation of PCT test in the hospital. The objective was to look at the requesting wards, analyse the PCT results and, compare findings with the general practice in other institutions. The study also looked at the cost related to the PCT requests.

PCT, described as "a 116 amino acid polypeptide precursor of calcitonin", is a widely used biomarker in the differential diagnosis of viral to bacterial infection and other microbial infection or organ rejection in hospitalized patients (Assicot *et al.*, 1993; Ballot *et al.*, 2004; Carrington *et al.*, 2004; Schuetz *et al.*, 2008; Jin and Khan, 2010; Schuetz, 2011; Schuetz *et al.*, 2011; National Institute for Health and Care Excellence, 2014; Chakraborty, 2015a).

Many studies have shown that PCT is superior to CRP, white blood cells and blood culture because of its rapid rise in blood concentrations in sepsis caused by bacterial infection (Assicot *et al.*, 1993; Chiesa *et al.*, 1998; Müller *et al.*, 2000; Harbath *et al.*, 2001; Carrington *et al.*, 2004; Christ-Crain *et al.*, 2006; Stolz *et al.*, 2009; Heyland *et al.*, 2011; Liew *et al.*, 2011; Azeem *et al.*, 2013; National Institute for Health and Care Excellence, 2014; Chakraborty, 2015a, 2015b;

Harrison and Collins, 2015; Kalil and Schooneveld, 2018; Schuetz *et al.*, 2018; Schuetz 2019).

Studies reported that PCT rises 3 to 6h in blood in response to bacterial infection (National Institute for Health and Care Excellence, 2014; Schuetz, 2019). Sepsis can be defined as the life-threatening condition that occurs in response to bacterial, viral or other micro-organisms infection (National Institute for Health and Care Excellence, 2014).

The National Institute for Health and Care Excellence (NICE) has provided information on interpretation of PCT results for differential diagnosis of sepsis, management algorithms for population in ICU who are at risk of sepsis with symptoms of lower respiratory tract infection (LRTI) and also a list of situations where PCT levels may be high in the absence of bacterial infection (National Institute for Health and Care Excellence, 2014).

A US study has put diagnostic pathology and treatment of sepsis as the major expenditure and cause of a large number of deaths with little progress in avoiding large scale deaths caused by sepsis (Assicot *et al.*, 1993). A physician's proficiency in identifying clinical manifestation of sepsis is critical in diagnosing sepsis as some common diagnostic tools such as blood, urine or cerebrospinal fluid (CSF) may show negative results in the presence of sepsis (Assicot *et al.*, 1993).

The PCT has been recognized as one of the superior biomarkers in bacterial sepsis diagnosis than most of the other biomarkers (Assicot *et al.*, 1993; Ballot *et al.*, 2004; Schuetz *et al.*, 2008; Jin and Khan, 2010; Liew *et al.*, 2011; Schuetz, 2011; Schuetz *et al.*, 2011; Lee *et al.*, 2013; National Institute for Health and Care Excellence, 2014; Chakraborty, 2015a, 2015b; Schuetz, 2019). However, studies are still insistent that the PCT test alone is not adequate to diagnose sepsis and recommend proper clinical evaluation of the patient as key in diagnosing sepsis (Liew *et al.*, 2011; Azeem *et al.*, 2013; Lee *et al.*, 2013; Chakraborty, 2015b).

PCT comes at a much higher price (Ballot *et al.*, 2004; Chakraborty, 2015a), than the traditional biomarkers such as CRP, white cell count, urine, blood or CSF culture (Schuetz, 2019). PCT's higher price may be outweighed by its superiority in early diagnosis and monitoring of antibiotics as studies have shown that PCT test aids in reducing the average length of stay in ICU while on antibiotics therapy and lessening exposure to other life-threatening situations and mortality (Liew *et al.*, 2011; Azeem *et al.*, 2013; Lee *et al.*, 2013; Chakraborty, 2015b; Harrison and Collins, 2015). The cost-effectiveness of PCT test in diagnosing and monitoring

sepsis is supported by studies that reported that PCT test reduces cost by reducing antibiotic therapy and in the long-term decreases drug resistance caused by overuse of antibiotics in critical care (Lee *et al.*, 2013; Chakraborty, 2015a, 2015b; Schuetz, 2019).

Major beneficiaries of PCT testing include emergency wards (ED) and intensive care units (ICU) (Lee *et al.*, 2013; Chakraborty, 2015a, 2015b; Schuetz, 2019). Sepsis is common in older people and children, severe burns, immunocompromised people and chronic organic diseases (Lee *et al.*, 2013).

Several studies have assigned specific conditions where PCT test benefits patients especially those admitted in ICU and burns units (Liew *et al.*, 2011; Azeem *et al.*, 2013; Chakraborty, 2015b). According to these studies, conditions include those that predispose patients to bacteraemia, septicaemia, severe urinary tract infection (UTI) in children, a bacterial infection in neutrogenic patients; and, diagnosis of systemic secondary infection post-surgery, and severe trauma, burns and multiorgan failure (Chiesa *et al.*, 1998; Harbath *et al.*, 2001; Christ-Crain *et al.*, 2006; Stolz *et al.*, 2009; Heyland *et al.*, 2011; Lee *et al.*, 2013; Chakraborty, 2015a, 2015b; Harrison and Collins, 2015; Kalil and Schooneveld, 2018; Schuetz, 2019).

Guidelines recommend PCT concentration of >2.0ng/ml suggestive of sepsis, and this value assists clinicians in making a differential diagnosis of bacterial infection from viral which can cause sepsis and this PCT concentration also aid in a guided decision in the starting of antibiotics (National Institute for Health and Care Excellence, 2014; Chakraborty, 2015b; Christ-Crain *et al.*, 2006).

Design and Methods Literature Search

Searches focused on the clinical significance of PCT, laboratory diagnosis and interpretation, the cost-effectiveness of PCT and review papers on differential values of PCT testing from 1998 to 2018.

Data selection criteria

Using the laboratory information system of PCT requests from all wards (n=110), between January 2010 and January 2011 (n=6177), were considered and used for analyses. Retrieved data was classified from low (≤ 0.05 ng/ml) to highest (≥ 10.0 ng/ml) measured result.

Data analysis

The data requests were collated on an MS Excel 2016 version spreadsheet (Redlands, WA, USA). The wards were categorized into (i) emergency

departments (ED) (ii) intensive care units (ICU) and (iii) non-emergency departments (N-ED) based on the type and intensity of clinical care they are expected to provide. Percentages were mostly used to compare department results. Categorized results were arranged and displayed according to the clinical interpretation of PCT (2) ranging from ≤ 0.05 ng/ml to >10 ng/ml.

Top 10 PCT tests by volume sorted in descending order with each ward percentage contribution was established. Distribution of PCT among three categories (N-ED, ED, and ICU) was analysed. Contribution of N-ED to the range of PCT concentration (≤ 0.05 to ≥ 10 ng/ml) was compared with the suspicious wards (combined ED and ICU). Test results from each category that were consistent with sepsis were isolated and N-ED, ED and ICU ward categories compared.

Test Costs

The direct cost of PCT testing was assessed by analysing costs for different PCT concentrations contribution (from lowest to highest) to the total cost. To establish an impact for each department category on the total requests cost, contribution for N-ED, ED and ICU and suspicious wards cost were determined. Percentage costs were graphically presented.

Public health price list from the NHLS 2018/2019 period was used to calculate the direct cost of PCT tests done for 6177 requests that were charged. All costs were reported in local currency (ZAR) and in US\$, using an exchange rate of ZAR13.66 per 1US\$) (Foreign Exchange, 2019).

Results

Figure 1 shows the volumes arranged according to the clinical interpretation of PCT ranging from ≤ 0.05 ng/ml to ≥ 10 ng/ml. The figure shows that PCT tests were lowest for PCT ≤ 0.05 ng/ml (n=154) and highest for PCT ≥ 10 ng/ml (n=1728). Percentage contribution to the lowest concentration was 3% and the highest was 28%.

Table 1 shows the top 10 wards by volume of PCT test requests from the total 110 wards that requested PCT. Although N-ED wards contributed 87 (79%) of test requests, these wards did not feature in the top 10 wards request by volume. Six out of ten in the top 10 wards were from the ICU and burns unit. Figure 2 shows the distribution of PCT results for three categories; namely, N-ED, ED, and ICU for the total test requests (n=6177). N-ED contributed only 11% (658/6177), ED had 32% (1964/6177), and ICU 57% (3555/6177) of tests done. This shows that ED and ICU were the main contributors to PCT tests performed.

Table 2 compares the number of requests for N-ED and suspicious wards in a range of PCT concentrations from ≤ 0.05 ng/ml to ≥ 10 ng/ml. N-ED contributed 11% (658/6177) and suspicious wards made up 89% (5519/6177).

Table 3 summarises the contribution of each category on results that were consistent with sepsis (PCT \geq 2ng.ml). The classification table shows that N-ED only contributed 6% (200/3086), ED had 22% (687/3086) and ICU had 71% (2199/3086) with suspicious wards making up 94% (2886/3086). The table also shows that suspicious wards contributed significantly to the increase in results that were consistent with sepsis (>2.0ng/ml).

Figure 3 shows total respective charges for N-ED - ZAR255, 659 (US\$18, 716); ED - ZAR763, 093 (US\$55, 863); ICU - ZAR1, 381, 260 (US\$101, 117); and, suspicious wards - ZAR2,144,352 (US\$156, 980).



Figure 1. PCT concentration volume distribution

Distribution of concentration ranging from low (PCT≤0.05ng/ml to highest (PCT≥10ng/ml) concentration as described (2). The range is 3% to 28%.

Table 1. List	Table 1. List of top 10 wards that requested PCT						
Ward	Quantity	% Contribution					
ICU	288	4,7%					
MICU	257	4,2%					
PBU	237	3,8%					
44	178	2,9%					
CCU	56	0,9%					
43	40	0,6%					
20	33	0,5%					
TICU	31	0,5%					
ABU	26	0,4%					
23	21	0,3%					
2	21	0,3%					

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The table shows individual ward volume contribution and percentage contribution to the total PCT requests. Quantities are arranged in descending order. The top 10 requests of PCT were all from ED and ICU wards; with top 6 from ICU and burns units.



Figure 2. Distribution of PCT test requests among 3 departments

The figure illustrates the percentage contribution by each category department to the total requests assessed. ICU had the highest contribution at 57% followed by ED at 32% and N-ED the lowest at 11%.

Table 2. List of requesting departments according to the concentration of
PCT and contribution

PCT Concentration	N-ED (%)	Suspicious wards (%)
≤0,05 ng/ml	67 (1.1%)	87 (1.4%)
≤0,5 ng/ml	273 (4.4%)	1352 (21.9%)
≥0,5<2,0 ng/ml	118 (1.9%)	1194 (19.3%)
≥2,0<10 ng/ml	101 (1.6%)	1257 (20.3%)
≥10 ng/ml	99 (1.6%)	1629 (26.4%)
Total	658 (11%)	5519 (89%)

Volume distribution of PCT test results from lowest to highest PCT concentration between N-ED and combined ED and ICU (assigned suspicious wards). Requests show low requests for N-ED (658/6177) compared to requests for ED and ICU (5519/6177).

Table 3. Category units list of PCT results ≥2,0 ng/ml									
PCT N-ED ED ICU Suspected									
Concentration				wards					
≥2,0 ng/ml	200 (6%)	687 (22%)	2199 (71%)	2886 (94%)					

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The table shows the volume and the percentage impact of the different units contributing to the results that are consistent with sepsis. Suspected wards (combined ED and ICU) have the highest contribution of 94%.

PCT Concentration	Test volume	Charge ZAR (US\$)
	(%)	
≤0,05 ng/ml	154 (2%)	R59, 835.16 (4, 380.32US\$)
≤0,5 ng/ml	1625 (26%)	R631, 377.50 (46, 220.90US\$)
≥0,5<2,0 ng/ml	1312 (21%)	R509, 764.48 (37, 318.04US\$)
≥2,0<10 ng/ml	1358 (22%)	R527, 637.32 (38, 626.45US\$)
$\geq 10 \text{ ng/ml}$	1728 (28%)	R671, 397.12 (49, 150.59US\$)
Total	6177 (100%)	R2, 400, 01.58 (175, 696.31US\$)

Table 4. Cost breakdown for PCT at different concentrations

Contribution by charge for each level of PCT concentration from low to high. The high charges were concentrated at ≥ 2.0 m/ml PCT levels. This is a level that was dominated by ED and ICU departments with PCT concentration consistent with sepsis.



Figure 3. A summary of charges for the requesting departments

Charges for 1 year at 2018/2019 price in ZAR, which respectively translates to approximately ZAR 255, 659 (US\$18, 716); ZAR763, 093 (US\$55, 863); ZAR1, 381, 260 (US\$101, 117); and, ZAR 2, 144, 352 (156, 980US\$). The figure depicts charges from N-ED, ED, ICU and, suspicious wards departments.

Discussion

Surgery (Wards 1,2,3,4,5)

Post-operative levels of PCT depend on the type of surgery. Intestinal surgery, as well as major operations, often increase PCT. Minor and minimally invasive surgery, as well as aseptic surgery, are associated with normal PCT.

Elevated PCT post gastrointestinal surgery has been attributed to the transient bacterial translocation from the gastrointestinal tract secondary poor gut perfusion (Meisner *et al.*, 1998).

Trauma Wards (TEU)

PCT may be useful in identifying infection in trauma and post-operative acute care surgery. However, heterogeneity exists among patients, and surgery and trauma alone elevate PCT even in the absence of infection (Parli *et al.*, 2018).

Ward 20 (High Care-Pulmonary Unit)

PCT-guided antibiotic treatment in patients with acute respiratory infections has been reported to reduce patient exposure to unnecessary antibiotics, thus reducing antibiotic side effects (Delgado-Guay *et al.*, 2015). However, most of these patients are seen in the Monday CHBAH Respiratory Out-Patients clinic.

Outpatient and Non-Emergency and Non Intensive Care Units

Patients previously admitted with malignancy and pulmonary infections are usually followed up as outpatients. Sometimes, they are admitted as cold cases in normal wards for observation and it is during such times that PCT requests may be made in out-patient units or cold/transitional wards (Wirz *et al.*, 2018).

ICU and Emergency wards

Timely and accurate diagnosis of sepsis results in improved patients' outcomes and reduction in costs (Azeem *et al.*, 2013) with this disease that is complex and difficult to diagnose (Wirz *et al.*, 2018). A South African study concluded that PCT was "related to the category of infection", but cautioned that it "is not sufficient as a single marker for neonatal sepsis diagnosis" (*Ballot et al*, 2004). However, review studies concluded that serum PCT has very good accuracy and of good diagnostic value for the diagnosis of neonatal sepsis (Vouloumanou *et al.*, 2011; Ali *et al.*, 2018), but stated that because of lack of a uniform definition of neonatal sepsis the interpretation of the findings should be done with caution (Vouloumanou *et al.*, 2011; Ali *et al.*, 2018). In a multi-centre study conducted in Canada, the USA, and central Europe, procalcitonin levels were higher in deceased patients than those who survived and these patients presented in ED and they required ICU therapy (Bloos *et al.*, 2011).

In a review study of 255 articles, authors found no evidence of PCT being diagnostically better than the CRP in children presented in ED but pointed out that PCT has the advantage over the CRP because it increases earlier, therefore, they cautioned that different cut-off points should be applied when a serious infection is suspected (Van den Bruel *et al.*, 2010). In this study suspected wards (combined ED and ICU), showed an increased number with 5519 out of 6171 of PCT requests (table 2), and their percentage contribution of 89% PCT requests compared to 11% contributed by non-emergency departments (N-ED). Three categories of departments, namely ED, ICU, and N-ED are shown (figure 1).

In this figure, the most contributors are from ED (32%) and ICU (57%). Respective increased PCT concentrations of 22% (ED), 71% (ICU) and 93% (suspected wards), which is consistent with sepsis (≥ 2.0 ng/ml) were observed (table 3). The study confirmed findings of the previous studies that reported increased PCT concentration in patients admitted in ICU and presenting in ED (Assicot *et al.*, 1993; Harbath, 2001; Schuetz *et al.*, 2011; Kalil and Schooneveld, 2018; Wirz *et al.*, 2018; Schuetz, 2019).

PCT cost estimation

Laboratory data show that in approximately 50% of biochemistry test throughput at CHBAH, PCT makes up 1% of the volume and 5% of charge. PCT is 5 and 12 times higher in cost when compared to common acute phase reaction markers like CRP and white blood cell count, respectively and therefore, request for PCT must be done after comprehensive clinical evaluation.

PCT levels measured on hospital admission were found to substantially reduce the utilisation of antibiotic treatment in low risk situations and the findings also showed that for more severe infections starting antibiotic stewardship by monitoring of PCT kinetics resulted in shorter antibiotic treatment durations with early cessation therapy (Sager *et al.*, 2017). PCT per test is expensive (Ballot *et al.*, 2004; Chakraborty, 2015a), and over-utilisation incurs high charges. Properly utilised PCT has potential savings by reducing overuse of antibiotics (Delgado-Guay *et al.*, 2015; Ali *et al.*, 2018).

Evaluation of direct cost on the utilisation of the PCT test showed that more charges were from the results that were consistent with suspected sepsis (table 4). High charges were also from these departments (figure 3).

PCT-guided treatment algorithm decrease overall treatment cost and mortality (Ballot, 2004; Schuetz *et al.*, 2008; Jin and Khan, 2010; Schuetz, 2011; Schuetz *et al.*, 2011). Another study showed that PCT guidance has a significant reduction in antibiotic exposure in patients with CAP (p<0.001) with 95% confidence intervals compared with patients treated according to guidelines (Schuetz, 2011). An economic evaluation study showed that PCT-guided antibiotic therapy reduced the overall cost of care by 2 days compared to usual care (Schuetz, 2008). A recent review revealed studies on PCT-guided therapy were associated with a 1.5 and 1.3-days shorter antibiotic treatment and a shorter stay in ICU (Jin and Khan, 2010; Harrison and Collins, 2015). Another recent review reported that use of PCT testing on the first day of ICU admission was associated with significantly lower hospital and ICU length of stay, and decreased total, ICU and pharmacy cost of care (Balk *et al.*, 2017).

Conclusion

The concentration of PCT is increased in septic condition. Serum PCT concentrations from ED and ICU are consistent with sepsis. Requesting wards and the PCT results show that clinicians at CHBAH have optimally utilised the test according to the guidelines followed around the world.

The increase in requests implies that the test has been accepted and found to optimise patient management including rational utilisation of the PCT test. The high proportion of results from departments (ED and ICU) that are known to be associated with high sepsis levels together with increased results that are consistent with sepsis may indicate that the test has not replaced proper clinical assessment. This may indicate that the DoH and NHLS coordinated presentations on the optimal utilisation of laboratory medicine are effective.

Recommendations

It is important to remember that biomarkers no matter how good they can be; they should not replace a thorough clinical evaluation of the patient. PCT test and results assist clinicians in the commencement of antibiotic, monitoring infections, and limit the number of prescriptions for antibiotics. As identified in an earlier study, PCT in conjunction with another marker(s) may be recommended as an ideal profile for sepsis (Tanyanyiwa *et al.*).

Strength and Limitations

Strength

- \checkmark The study looked at >6000 PCT request and results.
- \checkmark The study was conducted at the largest hospital in the southern hemisphere.
- \checkmark It was done across all age groups.
- ✓ To our knowledge it is the first audit study in Africa, other studies have looked at the diagnostic use of the PCT in different settings.

Limitations

- ✓ Reported studies based algorithms are limited to observational studies.
- ✓ The current study did not show the comparison of PCT requests before and after initiation of implementation.
- ✓ The study could not estimate cost-effectiveness or demonstrate the quality of care as a result of increased utilisation of PCT in relation to antibiotic stewardship.

Ethical approval: CHBAH Medical Advisory Committee, Department of Health and University of the Witwatersrand Ethics Committee.

Competing interests: None

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Author Contribution

Donald Moshen Tanyanyiwa-Designed the study and wrote the manuscript.

Jeannette Wadula-Writing and revision of the manuscript

Ernest Philani Buthelezi-Writing and revision of the manuscript, data analysis, and corresponding author.

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Consumer Motivation and Adoption of Point of Sales of Selected Small and Medium Enterprises (SMEs) in Lagos State, Nigeria

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Abstract: Nigerian payment systems are cash-driven and it is the main mode of payments transactions. However, the Point of Sales (POS), which is meant to encourage cashless economy as against the cash-centered operations, is challenged with issues of consumer motivation and security. This study examined the consumer motivation and adoption of POS of selected SMEs in Lagos state, Nigeria. The study adopted a cross-sectional survey research design. The population of the study consisted of selected SMEs who are users of POS in Lagos State estimated at 11,663 and sample size of 2,059. The respondents were selected from among the SMEs used for this study. A validated questionnaire from the sectors surveyed was used for the study. The sectors include: oil & gas, banking and insurance, and manufacturing. A total of 2,059 copies of the questionnaire were administered, with a response rate of 77.1%. The Cronbach's alpha coefficients for the constructs are 0.727 for adoption of POS, 0.719 for consumer motivation and 0.758 for POS security. The data were analysed using descriptive and inferential (Pearson Product Moment correlation) statistics. The findings revealed that there was a significant relationship between consumer motivation and Adoption of POS (r=0.429; p < 0.01) and similar relationship between POS security and Adoption of POS (r = 0.437; p < 0.01). The study concluded that consumer motivation had significant and positive relationship with adoption of POS of selected business organisations who are SMEs in Lagos State, Nigeria. The study thus recommended that adequate consumer motivation be effected so as to encourage various stakeholders to adopt POS and assure of security of data transactions and reports generated using the device by the selected organizations in Lagos state, Nigeria.

Keywords: consumer motivation, adoption of POS, e-payments, POS security.

1. Introduction

Organizations have become increasingly dependent on technologically based information to support and drive operational, tactical and strategic business activities, thereby making information technology intrinsic in today's business enterprise (Okpara and Mohammed, 2012). Consequently, there is a global advancement in technological development; and Nigeria is not left out of this advancement. Information and Communications Technology (ICT) has evolved and has become a vehicle for technological growth in the economy of many societies as it has unarguably made life easier (Okpaku, 2003; Indjikian et al., 2005). Therefore, the global acceptance of Information and Communications Technology as well as its usage have attracted and received the interest of researchers who are on regular basis out to proffer solutions to problems related to technology development for decades (Davis, 1989; 1993; Park et al., 2007). This development had prompted further research on the motivating factors necessary for utilization and benefits of ICT and particularly its devices to several nations in order to improve their economic development (Venkatesh, 2000; Indjikian and Siegel, 2005).

The current system of high level of cash management with the attendant cost and hazard involved in moving large amount of cash, necessitates the introduction of POS. Business Information System (BIS, 2003) stated that POS is widely regarded as safe and efficient retail payment system, which enhances the effectiveness of the financial systems, boost consumer confidence and facilitates the functioning of commerce, hence motivation for its adoption needs to be addressed. Since Nigerian consumers hitherto, largely depended on the use of cash to conduct transactions, the introduction of POS by organisations in the country is expected to ease the carriage of large sums of money by consumers. Furthermore, the use of POS is also meant to enhance the effectiveness of organizations' operations and transactions by ensuring the security of monetary assets. In this regard, it has been observed that funds that circulate outside the banking sectors are over 90% (Ovia, 2003; Ojo, 2004; Adeoti and Oshotimehin, 2011), reasons are attributable to lack of motivation of the use of POS, and security especially from the bank to destinations and transactions generated from it.

In a recent study, evolution of technology for use in financial transactions poses a lot of challenges as questions arose regarding the stability of the instrument in guaranteeing the efficiency and effectiveness of monetary policies of nations worldwide (Odior and Banuso, 2012). From history, different payments systems have been used e.g. barter system was common, but double coincidence of want necessitated the use of coins and paper money.

However, technological development gave rise to the use of superior instruments as with advancement in technology (Odior and Banuso, 2012). A little over three decades ago, the use of cash in making purchases in the United States of America declined, and increasingly adopts the use of electronic payments systems. However, developing economies like Nigeria are still at the introductory stage of the use of alternative payments platform as recently introduced by the monetary policy maker in Nigeria, the Central Bank of Nigeria (CBN) (Humphrey, 2004). Studies have shown that the use of cash for transactions made for payments of goods and services in many nations of the world is risky and complex, and is gradually giving way to alternative payments platform. This is because money outside the bank that is kept at a place other than the bank cannot be subjected to financial regulations and operational procedures by regulatory agency, and this limit the ability of the regulator to achieve the set objectives (Adeoti and Oshotimehin, 2011).

In the CBN (2011) reports cited in Adeoti and Oshotimehin (2011), the cost of cash management was huge and given as follows: in 2009, CBN spent the sum of N114.6b, this rose to N135b in 2010, and N166b in 2011, and an estimated sum of ¥196b was projected for 2012, to manage currency production and services. These amounts are substantially large and require an urgent attention to address the situation, and this could be reduced to a minimal level should the economy embrace cashless and other alternative payments system especially POS. The result of this cashless system would be the reduction in the cost of printing currencies, cost of transportation of cash, cost of sorting currencies, and security cost of managing the printed currencies. Although an average Nigerian businessman prefers cash transactions and will embrace an alternative if they are well informed or educated of its benefits and assured of its transactional integrity. This therefore prompted the Federal government coming up with policy that upon implementation would reduce the volume of cash in the economy using Lagos as the pilot state. The acceptance and increase in the use of alternative payments platform (e-payments) notwithstanding, the adoption rate of POS was still low and this was attributable to inadequate motivation and security issues (Mohammed and Mohammed, 2012; Adeoti, 2013; Ebietomere and Ekuobase, 2014). A major challenge identified in the implementation of the cashless policy hinges on the lack of awareness by the citizens, hence the urgent need to address this challenge.

A CBN report shows the following data in volume of transactions: ATM 470,894,452; Cheques 9,764,546; Web 10,499,911; POS 47,743,919; (CBN, 2016) the data indicates low penetration of POS compare to ATM. Reasons given by CBN for low adoption rate of POS include but not limited to inadequate

awareness creation and security of the transactions among others. This observation also indicated that many buyers of goods and services still do that by cash, this brings about enormous risk and high cost of cash management. It also brings about inefficiency and corruption (Omotayo and Dahunsi, 2015).

Similarly, as reported in Adeoti and Oshotimehin (2012), the general increase in the adoption rate of electronic payments instruments and the rate of growth in the adoption of POS are still low compared with other e-payments platform such as ATM. Among the factors identified as responsible for this low adoption rate is lack of motivation (Hassenzahl, 2003, Hassenzahl and Allrich, 2007). Similarly, it has been posited that the mode of use of technology is closely related to motivation and motivation is of intrinsic or extrinsic (Sun and Zhang, 2008), while intrinsic motivation can be described as performing an activity in order to achieve a given objectives.

Another issue of concern in the adoption of technology in an organisation is security; this has been stressed in an article challenges to the efficient use of POS terminals in Nigeria (Adeoti, 2013). The author asserted that the efficient use of POS terminals in Nigeria will reduce the security challenges arising from fraud, and robbery occasioned by withdrawal of cash by unsuspecting customers from the bank. The importance of security of communication over the network as the network becomes available to the public is also of immense importance. Just like security on smart card a device used in POS terminal has become a critical issue as various transactions involving exchange of data and those through the internet must be well protected.

The concern over the security of the smart card is premised on the need to prevent unauthorized access to critical data and other information of great importance by fraudsters and hackers who daily attempt breaking into systems. This is one of the problems the adoption of POS in an organization is meant to address (Taherdoost *et al.*, 2011). Similar research work done by Ebietomere and Ekuobase (2014) also aligns with the opinion that the adoption of the POS system will help check the rampant incidence of hacking into systems. Another study indicated that relying on traditional security control of physical access controls, security guards at the gate of the organisation securing their assets, processes and communications has become obsolete (Tarimo, 2006).

The complex nature of the device and the intelligence of hackers make it mandatory that adequate security be put in place in order to avoid or reduce the vulnerability of its use.

2. Literature Review Theoretical Foundation

A number of theories have evolved to explain adoption of technology including POS in an organization. One of the theories used in this article is Technology Acceptance Theory (Davis, 1989). This theory has two main constructs, which are perceived ease of use and perceived usefulness. Perceived ease of use posits that a person believes that using a particular system would be free of efforts and perceived usefulness believes using a system is useful for its operation. The two constructs aligned with the import of this study and major motivating factors in technology adoption such as POS. The other theory used in this study is motivational theory of Davis and Warshaw (1992) as applied in Long (2010) to study information technology adoption and use. The Motivation Model suggests that individuals' behavior is based on two characteristics that is, extrinsic and intrinsic motivations. As defined by Davis and Warshaw (1992) extrinsic motivation is the perception that users want to perform an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, such as improved job performance, pay, or promotion, therefore, this enhances the adoption of POS. Intrinsic motivation relates to perceptions of pleasure, satisfactions from performance of the behavior (Vallerand, 1997). This means users want to perform an activity for apparent reinforcement other than the process of performing the activity (Davis and Warshaw, 1992).

3. Literature Review and Hypothesis Development

In examining the implications of adoption of POS, it is necessary to look at how consumer motivation and POS security relates with the adoption of POS of selected SMEs in Lagos state, Nigeria.

The intention of earlier inventors of cash register was to create a system that will be used for recording cash transactions to prevent employee from tampering with the profit of the organisation (Ritty, 1879). This device soon became a tool for financial transactions as it issues receipts, functioning like sales as well as keeping the records and the reports generated from it. Improvements of technology over the years gave rise to what is today referred to as POS.

Cumbersomeness and risky nature of reliance on cash based economy in any society necessitates the adoption of POS, because money outside the banks cannot be subjected to regulatory and operational procedures and the ability of monetary policy to achieve set objectives in the presence of sizeable currency out of Bank is limited (Adeoti and Oshotimehin, 2011) This simply means the adoption of POS signify the acquisition and usage of POS.

POS as defined by some notable researchers is that it is a device used for recording transactions in a store, which can be said to be a modern day cash register (Shari, 2012). Gilaninia *et al.*, (2011) defined POS as a device that is installed in the center of the sale of goods and services instead of paying cash by physical transportation of money, the transaction amount from an account holder i.e. customer are deducted from their accounts electronically, using an electronic card, while the card acceptor (seller) is paid. Therefore, in this study, POS can be described as a device deployed in a merchant location where users swipe their electronic cards in order to make payment for purchases or services as against the use of cash.

Conceptually, there are benefits attributable to the use of POS. For example, World Bank says globally, the use of electronic payments systems was strategic in fast-tracking growth among the nations all over the world's financial sectors. For world body like the World Bank to emphasize the pivotal role of electronic payment system underscores its importance Ashike, (2011) outlined the following benefits of electronic payment system:

1. Faster transactions, that is, reducing queue at the point of sale.

2. Improving hygiene on site, that is, eliminating bacteria through the spread of notes and coins;

3. Increase in sales, that is cash collection made simple.

4. Managing the entitlements of staff.

Other benefits include but not limited to the following: improves customer services, such as removes the need for invoice, cheques clearance etc; allow purchase and instant payments through the point of sale; discount to allow online purchases etc. The utilization of the electronic payments systems will also benefit stakeholders.

Banks and card manufacturers have over the past decades been involved in processing of financial transaction electronically. The recent technological developments in the field of e-commerce have opened up other areas of development in the electronic payments system. First, the prospects of electronic commerce over the internet are creating a large demand for electronic payment methods for open networks. Secondly, the introduction of nation-wide electronic pursue schemes is creating many more opportunities where smart cards can be used for cost-effective off- line payments. There is need for adequate security in POS electronically as the device is used to transact financial businesses. In the Nation newspaper of Sunday July 16, 2017, on Cashless policy: Nigeria was reported to have incurred losses in billions, in addition to security concerns in banking application and POS (The Nation, 2017).

Visa International in its report showed that high net worth account holders neither own nor use ATM cards the channels of communications with POS, confirming that majority of the rich think that avoiding debit cards is the best way to stay protected from online fraud. The Nigeria public especially those within the scope of this study need to be motivated to adopt POS.

The main objective of this study is to examine what factors motivates consumer in adoption of POS and evaluate the relationship between POS security and adoption of Point of Sales of selected SMEs in Lagos State. In an attempt to come up with acceptable conclusions the study tested the following null hypothesis:

 H_{01} : There is no significant relationship between consumer motivation and adoption of POS of selected business organisations in Lagos State, Nigeria.

 $H_{02:}$ There is no significant relationship between POS security and adoption of POS of selected business organisations in Lagos State, Nigeria.

4. Methodology

This study employed a cross-sectional survey research design, employing well validated questionnaire as the main research instrument. This is consistent with the view of Mann (2003) who noted that many cross-sectional studies are completed with questionnaire and few others employ interviews to collect data. Similar studies on adoption of POS have employed a cross-sectional research design (Adeoti and Oshotimehin, 2011).

The population of the study consisted of all Small and Medium Enterprise (SMEs) who are the main users or adopters of POS in Lagos state and the collaborative survey conducted by Small and Medium Enterprises Development Agencies of Nigeria and National Bureau of Statistics in 2013, put the population at 11,663 in Lagos state. The total copies of questionnaire distributed was 2,059 and 1587 were returned representing about 77.1% of response rate.

Pilot study was conducted using small segments of the sample in order to confirm the validity and reliability of the instrument. The Cronbach's alpha coefficients for the constructs are 0.727 for adoption of POS and 0.719 for consumer motivation and 0.758 for POS security, showing the reliability of the instrument while the instrument was subjected to content validity - expert opinion validity as used by Osuagwu (2004). The analysis of the study was conducted using descriptive and inferential statistics done through correlation and regression analysis. Specifically; Pearson Product Moment Correlation was used to measure the relationship between the study variables.

5. Data Analysis, Results and Discussion of Findings

The table below represents the respondents' responses from the administered questionnaire.

S /	Variables	SA	Α	FA	FD	D	S
Ν							D
1	Ease of recognition of	349	450	48	10	-	-
	POS device motivates its	40.7%	52.5%	5.6%	1.2	-	-
	adoption by consumer				%		
2	Consumer perceived	461	355	31	10	I	-
	usefulness of POS will	53.8%	41.4%	3.6%	1.2	-	-
	motivates its adoption				%		
3	Perceived adequate	493	321	43	-	-	-
	security in POS will	57.5%	37.5%	5.0%	-	-	-
	motivates its adoption by						
	consumer						
4	Consumer perceived ease	451	399	7	-	-	-
	of use of POS enhances its	52.6%	46.6%	0.8%	-	-	-
~	adoption	0.67	10.1	= -			
5	Perceived low cost of	367	434	56	-	-	-
	POS motivates its	42.8%	50.6%	6.6%	-	-	-
	adoption	220	170	20	10		
6	Self-satisfaction in the use	339	470	38	10	-	-
	of POS motivates its	39.6%	54.8%	4.4%	1.2	-	-
_	continuous usage	0.17	10-		%		
7	Personal orientation and	367	437	53	-	-	-
	belief will encourage the	42.8%	51.0%	6.2%	-	-	-
0	use of POS	272					
8	Perceived compliance to	272	505	80	-	-	-
	norms from reference	31.7%	58.9%	9.4%	-	-	-
	group will enhance the						
0	use of POS	202	277	07			
9	Perceived enjoyment of	595 45.00/	5//	8/	-	-	-
	POS WIII motivates its	45.9%	44.0%	10.1	-	-	-
	adoption			%			

Table 1. Respondents' responses to consumer motivation

Source: Field Survey, 2015. Output from SPSS

Table 1 shows responses by respondents in the questionnaire distributed and given as follows:

Statement 1 to 9 shows that majority of the respondents representing over 98% agreed that perceived ease of use, perceived usefulness, low cost of POS, ease of recognition of the POS, self-satisfaction of use of POS and others are important motivators to adopt POS in selected SMEs in Lagos state. Similarly, they also agreed that when would be adopters perceived a device as having adequate security, they would be motivated to its adoption.

S /	Variables	SA	Α	FA	FD	D	S
Ν							D
1	Experience is an important	832	647	86	22	-	-
	influence in adoption of	57.8%	37.5	4.0	0.8	-	-
	POS in an organisation.		%	%	%		
2	Innovativeness influences	854	657	57	19	-	-
	the adoption of POS in an	58.9%	37.8	2.6	0.7	-	-
	organisation.		%	%	%		
3	Availability of	1112	422	53	-	-	-
	infrastructure enhances	74.2%	23.5	2.4	-	-	-
	adoption of POS in an		%	%			
	organisation.						
4	Perceived Ease of use of	835	740	12	-	-	-
	POS influences its	57.2%	42.2	0.5	_	-	-
	adoption		%	%			
5	Perceived usefulness of	679	803	105	-	-	-
	POS influences its	47.9%	47.2	4.9	-	-	-
	adoption		%	%			
6	Ease of communicating the	628	870	70	19	-	-
	benefits of POS influences	39.6%	54.8	4.4	1.2	-	-
	its adoption in an		%	%	%		
	organisation						
7	Skill requirements of users	679	809	99	-	-	-
	of POS influences its	47.8%	47.5	4.7	-	-	-
	adoption		%	%			
8	Customer motivations will	892	584	111	-	-	-
	enhance the adoption of	61.4%	33.5	5.1	-	-	-
	POS in an organisation		%	%			
9	Government and	728	698	161	-	-	-
	regulations can enhance	51.4%	41.0	7.6	-	-	-
	the adoption of POS in an		%	%			
	organisation						

Table 2. Respondents' responses on Adoption of POS

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10	Security of POS will	1051	439	97	-	-	-
	enhanced the adoption of	70.9%	24.7	4.4	-	-	-
	POS in an organisation		%	%			
11	Customer Trust on POS	597	895	95	-	-	-
	will enhance its adoption	44.5%	55.5	4.7	-	-	-
	in an organisation		%	%			
12	Information quality	562	790	235	-	-	-
	obtained from the use of	40.8%	47.8	11.4	-	-	-
	POS will enhance its		%	%			
	adoption						

Source: Field survey, 2016

The response from participating respondents in Table 2 shows the following: It is also noteworthy from the above table from Statement 1 to 12 that majority agreed with the assertion that experience, innovativeness, availability of infrastructure, ease of use of POS, perceived usefulness of POS, ability to communicate the benefits of POS to its users, skill requirements, motivation, government and regulations, security of POS, customer trust, and quality of information generated from POS enhances its adoption of selected business organisations in Lagos. Comparing the interpretation of the responses in Table 1 and Table 2, it shows that customer trust enhances the adoption of POS in an organisation.

Fable 3. Pearson Product Correlation for consumer motivation and adoption
of POS of selected business organisations in Lagos state

		Adoption of POS in an	Consumer motivation
		Organisation	
Adoption of	Pearson Correlation	1	.429**
POS in	Sig. (2-tailed)		.000
Organisation	Ν	1587	1587
Consumer	Pearson Correlation	.429**	1
Consumer	Sig. (2-tailed)	.000	
mouvation	Ν	1587	1587
Correlation is	significant at the 0.0	1 level (2-tailed	I). Source: Field
	survey,	2016	

Table 3 shows the significant relationship between customer trust and adoption of POS in an organisation. The correlation coefficient (r) of customer trust to adoption of POS in an organization is .429 and the significance level is 0.01

(p < .01). The null hypothesis was then rejected concluding that consumer motivation on POS has a significant relationship on adoption of POS in Lagos.

S/ N	Variables	SA	Α	FA	FD	D	SD
1	Data security will	350	988	144	51	54	-
	enhance security	26.7	62.7	7.3%	1.9%	1.4	-
	capability of POS	%	%			%	
2	Software security will	389	900	276	-	-	22
	aid POS security	29.3	56.5	13.9	-	-	0.3
		%	%	%			%
3	Ability to secure	525	918	119	3	22	-
	critical data in POS	38.1	55.5	5.8%	0.1%	0.5	-
	enhances its security	%	%			%	
	capability.						
4	Security across	656	714	173	22	-	22
	communication	47.5	43.1	8.4%	0.8%	-	0.3
	network will	%	%				%
	necessarily leads to						
5	Developed accurity of	616	076	72			22
5	Physical security of POS will oncourage its	44.1	<u>870</u> 52.2	75	-	-	0.2
	adoption	44.1	32.2 04	5.5%	-	-	0.5
6	Different levers of	70 922	70 606	117	10		70
0	Different layers of	023 59.1	25.7	5 50/	19	-	0.2
	POS usage	J8.1 0/	55.7 04	5.5%	0.7%	-	0.5
7	There is high level of	⁷⁰ 576	70 836	00	10	10	70 38
	confidentiality in POS	363	527	6.2%	1.2%	17	$\frac{36}{24}$
	confidentiality in 1 05	30.3 %	52.7 %	0.270	1.2/0	1.2 %	2.4
8	Non-disclosure of	675	741	168	3	- 70	70
0	personal information in	42.5	467	10.6	0.2%	_	_
	POS will enhance its	%	%	%	0.270		
	security.	70	/0	/0			
9	Availability of superior	549	592	246	181	-	19
	anti-hackers software to	42.2	37.9	12.6	7.0%		0.2
	protect the network will	%	%	%			%
	enhance POS security						
	capability.						

Table 4. Respondents' responses on POS securit	JS security	POS	on l	responses	pondents'	Res	le 4.	l'ab	Ί
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Source: Field survey, 2016

Table 4 shows responses by respondents as follows:

Statement 1 through to 9 also shows that majority of the respondents agreed that data security on POS, software security, securing critical data in POS, security across communication network, physical security of POS, securing layers across network, high level of confidentiality in POS, non-disclosure of personal information in POS, availability of superior anti-hackers software to protect the network will enhance POS security of selected business organisations in Lagos.

Comparing the interpretation of the responses in Table 4 and Table 2 clearly shows that POS security has a positive relationship with adoption of POS of selected business organisations in Lagos.

Table 5. Tearson Troduct Correlation for TOS security								
		Adoption of POS in an Organisation	POS security					
Adoption of POS	Pearson Correlation	1	.437**					
in	Sig. (2-tailed)		.000					
Organisation	Ν	1587	1587					
POS security	Pearson Correlation	.437**	1					
	Sig. (2-tailed)	.000						
	Ν	1587	1587					
Correlation is significant at the 0.01 level (2-tailed). Source: Field								
survey, 2016								

Table 5. Pearson Product Correlation for POS security

Table 5 shows the significant relationship between POS security and adoption of POS in an organisation. The correlation coefficient (r) of security of POS to adoption of POS in an organisation is .437 and the significance level is 0.01 (p<.01). The null hypothesis was therefore rejected concluding that POS security has a positive and significant relationship on adoption of POS of selected business organisations in Lagos.

6 Conclusions and Recommendation

Based on the research analysis, hypotheses testing and interpretation of results it was observed that consumer motivation and POS security has positive relationship with the adoption of POS of selected SMEs in Lagos state.

6.1 Conclusion

In conclusion the result of the analysis of this study shows the importance of the adoption of POS of selected SMEs in Lagos state. Aside stressing the importance of consumer motivation which was identified as an important element of the

requirements for adoption of POS of selected SMEs in Lagos state, adequate security must be provided. The choice of POS which is a device for electronic payments systems was also to reduce the risk involved in carrying cash and the attendant consequences. So also is the reduction of cost of cash printings.

6.2 Recommendations

The importance of consumer motivation as a panacea for adoption of POS cannot be overemphasized and therefore the following recommendations are made based on findings in this study.

Operators are encouraged to keep improving on the security of POS as this is found to have a positive and significant relationship with adoption of POS. This will engender customers' confidence in the use of POS.

It is recommended to operators and other stakeholders in this sector to ensure that users are motivated to adopt POS. This can be done by ensuring the cost of deployment is put at minimal level hence motivates based on costs. Similarly, adequate enlightenment be made on its usefulness and ease of use as this would motivates and encourage its adoption.

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HIV Frequency in the Surgical Environment of Bamako: Case of the General Surgery Department Chu Gabriel Toure of Mali

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Abstract: HIV infection constitutes a major Public Health problem in Mali. Our preliminary study on this infection is retrospective, covering a period of 12 years (1999-2012). This study is to demonstrate the real existence of HIV in the Malian surgical milieu, especially in patients operated, more precisely in the epidemiological context. Our study group of 36patients operated had a predominance of the female sex (58.3 %), male sex (41.7%) for an average age of 32 years. The age range of 16-45 years was more represented. Among our patients 88.1% of our patients were origin from the centre province urban (Bamako and provinces of Mali). For the 25734 patients that had surgery, 447% were tested for HIV infection giving a screening percentage of 1.7%, 36 seropositive patients were counted, giving a prevalence of 8%. Indications of surgery: diffuse peritonitis (19.44%), infections proctology (22.22%), appendicitis (11.11%). Complications post operatively: infections, sepsis and peritonitis post operatively.

The mortality had of 8.33%. Further studies on HIV infection and surgery will be carried out on the clinical, therapeutic scale, to enable us to measure the real impact of this infection in the Malian surgical milieu.

Keywords: VIH SIDA, General Surgery, Hospital Gabriel TOURE.

Introduction

AIDS is the ultimate phase of human immunodeficiency virus infection (HLV 1 and HLV 2). Abbreviation for acquired immunodeficiency syndrome. HLV 1 and 2 destroy some white blood cells, T4, or CD4 lymphocytes, which are the active basis of anti-infective immunity.

The number of people living (adults and children) infected with HLV is estimated by the World Health Organization (W.H.O.) at about 40 million at the end of the year 2004 (they were 22.6 million in 1996), of which more than 26 million live On the African continent. The number of new cases of HLV infection in the year 2004 is estimated at 5 million: 4.3 million adults (including 2 million women) and 510 000 subjects under 15 years of age; 95 per cent of them reside in a developing country. The number of deaths in the world since the onset of the epidemic would amount to 3.1 million in 2004. [1].

In France, the estimated number of people living with AIDS is between 25 000 and 27 000 (2004); The total number of deaths since the onset of the epidemic is estimated to be close to 33 000; The number of people living with HIV for HLV is in the range of 100 000 in 2004 [1]. Sub-Saharan Africa remains one of the most severely affected regions with nearly one in 20 adults (4.9%) Living with HIV [2]. In Mali, the prevalence of HIV/AIDS was estimated, in 2012-2013 to 1.1 per cent in the adult population, representing 76 000 people living with HIV/AIDS [3].

The incidence of seropositivity in patients with surgery is steadily increasing [3]. The quality of life of the HIV-infected population has improved significantly in recent years. As a result, clinical limitations in the surgical treatment of HIV-infected patients undergoing any type of surgical intervention are increasing. All times the data available. The diagnostic method in the surgical environment is based on the positivity of a screening test, on the basis of suspicions or signs accompanying the disease and on the other hand of the appearance of so-called opportunistic diseases and postoperative complications which are manifested by suppurations of the operative site in HIV-positive patients [4].

The surgical indications are multiple indicating the heterogeneities of the pathologies operated [4], the number of CD4 and the Seremie. Since the discovery
of HIV, many publications have been published on the subject but those dealing with his relationship with surgery are the least numerous.

In Africa, few publications have been made in this area. In Mali no studies on AIDS in the surgical environment are available.

This preliminary, descriptive and analytical study proposes to identify the impact of HIV/AIDS in the surgical environment at the General Surgery Department of the Gabriel Toure hospital.

Patients and Methods

This work is a retrospective study performed in the General Surgery Department of Dr. Gabriel Touré. Gabriel Touré Teaching Hospital is a third level hospital structure in the health services scale in Mali. This study concerned patients admitted from January 1999 to December 2012. Included were any HIV-positive patient known or diagnosed during hospitalization and having a surgical pathology.

Variables Studied

Age, weight, CD4 T cell count, viral load, frequency of occurrence of opportunistic infections, mortality and morbidity rates, sex, occupation, reasons for consultation and surgical techniques. Serological HIV tests whose criteria for positivity were based on the detection of serum anti-HIV antibody in the blood with the Eliza test and Western Blot confirmation tests.

Results

1-Overall frequency: For 12 years, the General Surgery Department of CHU Gabriel Touré operated 25,734 patients, 447 of whom were tested for HIV, a screening rate of 1.7%. Of the 447 patients tested, 36 were HIV-positive, representing a seroprevalence of 8% (Table 1).

Year	Number of Interventions	Number of HIV Screeners	Number of HIV positive people
1999-2005	11588	122(1.05%)	7(5.7%)
2006-2012	14146	325(2.3%)	29(8.90%)
Total	25734	447(1.7%)	36(8)

The average age of patients was 32, with extremes of 16 to 70 years. The age group of 16-45 years was the most represented 52.7%. Our series included 58.3% of female patients and 41.7% of male patients. The sex ratio was 0.71 (21 women

for 15 men). 88.1% of our patients lived in urban areas and 11.9% in rural areas. Housewives constituted the most represented social group with 25%. 58.2% of the patients were married.

The sexual way was the mode of contamination in 72.2%. Mother-to-child transmission and drug abuse have not been detected in our patients. The emergency recruitment method was the most frequent 55.6% of cases. Of the 36 patients, 10 were already known to be HIV-positive (Table 2).

Serology was requested by surgeons in 26 cases (72.2%). In 22.3% of cases, we noted the existence of at least one surgical antecedent. No previous surgical history was found in 77.7% of patients. In medical history 10 patients were known to be HIV-positive before surgery (Table 2).

Medical history	Frequency	%
Any	14	38.88
Transfusion	3	8.33
hepatic abscess	1	2.8
HIV	10	27.8
Fever in the long run	5	13.88
TB confinement	3	8.33
Total	36	100.0

Table 2. Medical History

72.2% of our patients were classified as ASA1. The fever was found in 87.3%, vomiting in 61.1%. 3 patients had Kaposi's sarcoma. Diarrhea was found in 30.5% of cases.

The clinical stage II of the World Health Organization was the most represented 55.5%. HIV1 was the most represented serotype, 83.3%. The blood count was abnormal in 20 patients. The anomalies were: - anemia (20 cases). It was severe in 2 patients (7.8g / dl and 5.2g / dl hemoglobin), associated with microcytosis in 2 patients, and hypochromia in 1 case. - Hyperleukocytosis (3 cases), leukopenia (4 cases), lymphocytosis (3 cases), thrombocytopenia (3 cases). 36.1% of our patients had a CD4 count of 200-500 mm³.

CD4 count below 200 / ml was observed in 5 patients. In 10 patients, its value was between 200 and 400 / ml. 5.5% of patients had a viral load of between 10,000-100,000 copies. Generalized peritonitis, anal fistula and anal abscess were the most diagnosed pathologies at 66.6%. Tuberculosis was the most common co-infection, at 11.1%. Digestive candidiasis was the most common opportunistic

infection 11.1%. Fistulectomy was the most common surgical technique, 19.4%. The patients were operated without screening and therefore without treatment in 33.3% of cases (Table 3).

Operated	Frequency	%
Operated without screening/ Treatment	12	33.3
Operated SP not put Under ARV	10	28
Operated SP put under ARV	14	39
Total	36	100.0

Table 3. The type of patients operated

Surgical site infection was more common in Clinical II than in Clinical I with 17% versus 6% (Table 4).

Table 4. Surgical Site Infection (SSI) and WITO chincal stage			
	Presence of SSI	Absence of SSI	Total
Grade			
Grade I	2(6%)	20(55%)	22
Grade II	6(17%)	8(22%)	14
Total	8	28	36

Table 4. Surgical Site Infection (SSI) and WHO clinical stage

Table 5. Postoperative Peritonitis (POP) and CD4 Count

PPO	Presence of POP	Absence of POP	Total
CD4			
CD4 (500-350) mm ³	0	26(100%)	26
CD4<200/mm ³	2(100%)	8(80%)	10
Total	2	34	36

Table 6. SSI and Type of Surgery

SSI	Presence of SSI	Absence of SSI	Total
Type of Surgery			
Clean surgery	3(37,5%)	2(7.2%)	5
Dirty surgery	5(62,5%)	26(92.8%)	31
Total	8	28	36

Discussion

The prevalence of HIV infection in the Malian adult population was 1.1% in 2012-2013 according to the National High Council for AIDS Control [3]. Our hospital frequency of 3 patients per year is not different from that reported by the Senegalese series [9].

Table 7. Hospital Frequency and Authors		
Authors	Staff / duration	
Dieng, Senegal 2005 [5]	61/10years	
Odimba, Zambia 2008 [6]	192/12months	
Johanet, 1991 French [7]	255/8years	
Doumgba, Centrafrique 2006 [8]	207/12 months	
Spallanzani, Italy [6]	305/12 months	
Our study 2012	36/12years	

The age group most infected with HIV in the Malian population varies between 15-49 years according to the demographic and health survey (EDSV 2012-2013).

The average age found in our series is 36 years. This age corresponds to that of the young adult in whom sexual activity is presumed to be important [3]

According to the UN AIDS report 2012, women are more infected than men in sub-Saharan Africa [2]. In our series the women were the most numerous. This could be related to the fact that women's natural anatomic predispositions to a higher risk of HIV transmission, gender inequality and sexual violence. The city is an economic and political urban area in which the majority of human activities are concentrated [10]. Several authors [11; 8; 6] reported that the HIV/AIDS epidemic is much more frequently encountered in urban areas. The same is the same in our series 86.1% of our patients lived in an urban environment. All categories of activities may be affected by HIV/AIDS infection [9]. However the housewives were the most represented in our series. This could be explained by polygamy.

In Africa, the most common mode of contamination of HIV AIDS is the sexual mode according to UNAIDS with a contamination rate of more than 90% [2]. It has been the main factor of contamination in our patients. According to UN AIDS [2] and the World Health Organization [3], serotype HIV1 is the most common. The HIV2 is endemic in West and Central Africa but very rarely found elsewhere in the world [2]. The most experienced serotype in our series was the HIV1. Surgical pathologies that occur in AIDS patients most often occur in an emergency context [9]. The vast majority of the patients encountered in our series were received in an emergency. HIV AIDS infection is manifested by symptoms that vary depending on the stage of the disease. The General signs most frequently encountered during AIDS are the alteration of the general condition, anorexia and weight loss [2]. Fever, anorexia, weight loss were the most observed signs in our series. Headache; diarrhoea, vomiting, muscle and abdominal pain are the functional signs very often encountered during HIV [2]. Vomiting and abdominal

pain were the signs frequently found in our series. We found 83.3% of abdominal CONTRACTURE.

HIV-AIDS immunosuppression promotes infections of all kinds [6]. However, proctological infections (anal suppurations and fistula) were the most frequent in our series as well as in the Senegalese and European series [5; 9] and range from 23% to 57.4%. The frequency of anorectal pathologies, well documented in the West in the series with predominantly male homosexuals, is difficult to explain in our context where these practices are still taboo and therefore unavoated. Postoperative morbidity is defined by the occurrence of postoperative complications besides death in a study population during a specified period [12]. Infections of the surgical site, post-operative peritonitis, and septic shock were the main postoperative morbidity found in our series and that of the African and European series [11; 9] with a frequency ranging from 9.5% to 24.6%. However, the rate of infection of the surgical site complicating surgeries appears to be significantly elevated among HIV-positive and especially untreated patients [8]. Peri-operative mortality is a function of the duration of symptoms, immunosuppression (decrease in the rate of certain cells, CD4 lymphocytes), the general condition of the patient, and the surgical gesture practiced [9]. Our three (03) deceased patients: two (02) patients reported a State of septic shock associated with a major alteration of the General State to post-operative j2 and pulmonary embolism in (01) patient who was known diabetic and obese with a BMI at 35 to J7 post Operating. The average length of hospitalization depends on the therapeutic modality and the occurrence of complications [9]. The average length of hospitalization was 8j in our series.

Conclusion

HIV infection is a public health problem in Mali. The Association human immunodeficiency virus and surgical pathologies is common in Mali. Patients are most often received in an emergency context for acute abdomen. The specific antiretroviral treatment and improvement of certain indicators (CD4, Viremia) before and after surgery would help to reduce the risk of peri-operative morbidity and mortality in patients.

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Increased Apoptosis Index in Cochlear Fibroblasts Diabetic Rat Model (A Pilot Study)

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Abstract: Diabetes Mellitus (DM) is a metabolic disease characterized by an increase in blood sugar level due to a disruption in insulin secretion, function, or both. This study aimed to evaluate the Apoptotic Index on the cochlear lateral wall of the diabetic rat models. This experimental study used 32 male *Rattus norvegicus* divided into a control group and a intervention group which received streptozotocin (STZ) injection. Rats were terminated on the fifth day and the Apoptotic Index was measured by the TUNNEL test. Rats in the intervention group showed a significant increase in the Apoptotic Index (P < 0.05) compared to the control group.

Keywords: Apoptosis, diabetes, streptozotocin, cochlea.

1. Background

The association between Diabetes Mellitus (DM) and sensorineural hearing loss has been studied for more than a century. Cochlear histopathology study in diabetic animals has proven the thickening of the capillary basement membrane, the loss of outer and inner hair cells, the atrophy of spiral ganglion cell, and the atrophy of vascular striae (Fukushima *et al.*, 2005).

Poor neurodegenerative damage in DM patients can include increased apoptosis, oxidative damage, and intracellular calcium excitotoxicity (Frisina *et al.*, 2006).

Apoptosis is a defence mechanism against damage, loss of function, and cell aging. Some of its mechanisms can be induced in cells by extrinsic signals and intrinsic signals due to cellular stress. The sensitivity varies depending on several factors, such as pro-and anti-apoptotic proteins, the stage of cell cycle, and the degree of stimulus. Proapoptotic protein consists of Bcl-2 and bcl-XL proteins, while antiapoptotic proteins consist of Bad, Bax, and Bid. In regard to cytosolic action, Bcl-2 protein is often found as a cellular sensor or stress prevention (Oever *et al.*, 2010).

This study is a pilot study to evaluate the effect of hyperglycaemia on the incidence of apoptosis in the fibroblast cells of the lateral cochlear wall. Prior study has found that there is an increase in Apoptosis Index in fibroblast cells of the lateral cochlear wall in ototoxic rat models injected with intratymphanic gentamycin (Haryuna *et al.*, 2018), decreased SOD expression in fibroblast of lateral cochlear wall in diabetic rat models observed in other study (Haryuna *et al.*, 2017).

From study conducted by Xueqin *et al.*, it was stated that pathological changes in the auditory system in chronic diabetes may predict the occurrence of apoptosis and autophagy in spiral ganglion cells and nucleus neurons toxicity in the cochlea (Xueqin *et al.*, 2017).

Study on the lateral cochlear wall is still scarce and this motivated us to conduct a study on the Apoptosis Index in the lateral cochlear fibroblasts cells of diabetic rat models which subsequently became the basis for further research in efforts to prevent and treat DM-related hearing loss.

2. Materials and Methods

This study used a randomized post test only control group laboratory experimental design. The rat used were male *Rattus norvegicus* with a mean weight of 150-250 grams. There was a total of 32 rats included in this study equally distributed between the control group and the intervention group.

The taken samples were rats in the same strain, homogeneous, and bred in the Biochemistry Laboratory, Faculty of Medicine, Airlangga University with adequate lighting was served, food was given ad libitum, relative humidity between $55\% \pm 15\%$ and room temperature between 20° C to 26° C.

The control group was given a single injection of Citrate Buffer. The intervention group was injected with streptozotocin (Streptozotocin Bioworld, USA) 12 mg intraperitoneal single dose. DM was defined as a blood sugar level of more than 200 mg/dl (ADA, 2016). All rats were terminated on day 5. Rats were terminated and temporal bone necropsy was taken from the rat's head. Samples were collected and fixed with 10% formalin buffer solution and decalcified with EDTA

for 4 weeks. Samples were tested in the laboratory of Pathology Anatomy to assess the Apoptosis Index by TUNNEL assay in lateral wall of cochlear fibroblasts.

TUNNEL Assay

Samples were examined with TUNNEL assay to assess Apoptosis Index using TREVIGEN (TACS 2 TdT-DAB In Situ Apoptosis Detection Kit). Apoptosis was characterized by a brown cell nucleus measured under 40x magnification using the Olympus CX21 microscope with Panasonic Lumix G3. Calculations were carried out by a pathologist and a researcher in a double-blind method.

Statistical Analysis

Data were analyzed using T-test with IBM SPSS Statistics with a significance level of 5%.

3. Results

Apoptotic Index

In figure 1, group B was given Streptozotocin injection and showed a higher Apoptotic Index compared to group A (control); the TUNEL method assay showed fragmentation of DNA in brown cell nuclei.



Figure 1. Apoptotic Index (40x magnification): (A) Group A; (B) Group B

The red arrows show apoptosis in the nucleus of cochlear fibroblasts characterized by brown colour.

As shown in figure 2, the mean value of the Apoptotic Index in the cochlear lateral fibroblasts of the diabetic rat models appears higher in group B.



Figure 2. The mean value of Apoptotic Index of cochlear lateral fibroblasts of the diabetic rat models

Table 1 shows a significant difference (P < 0.05) between the control group compared to the diabetic rat model group.

Table 1. Results of the 1-test for Apoptotic findex		
Group	Mean difference ± Standard deviation	P value
A	7,69±1,302	0,001*
B 5,94±1,340 0,001*		
*Statistically significant		

 Table 1. Results of the T-test for Apoptotic Index

4. Discussion

Intraperitonial streptozotocin injection doses were given based on previous studies stating that single streptozotocin doses of 40 to 60 mg/kg can be given intraperitoneally to cause toxic effects and trigger DM after 6 hours of administration (Szkudelski, 2001). In this study, we gave intraperitoneal streptozotocin doses of 60 mg/kgbw with rat body weight ranging from 150-250 mg. In recent years, the number of in vitro studies has provided evidence that hyperglycaemia can induce endothelial cell apoptosis and extensively increase. These mechanisms include oxidative stress, increased intracellular Ca2⁺, mitochondrial dysfunction known as the mitochondrial apoptotic pathway, alteration in intracellular fatty acid metabolism, mitogen-activated protein kinase (MAPK) signaling pathway, and impaired phosphorylation activation of protein kinase Akt (Oever *et al.*, 2010).

There are two main pathways that cause apoptosis, 'extrinsic pathways' (death induction receptors) and 'intrinsic pathways' (Bcl-2-regulation or mitochondria). The extrinsic pathway is mediated by cell death receptors such as Fas or TNFR, which are a series of signals that cause activation of the caspase and apoptosis. Intrinsic pathways are often activated by stress cells such as growth factors, chemotherapy drugs, and exposure to perforin and granzyme cytotoxic granule constituents. The intrinsic pathway is regulated by an equilibrium between pro-and anti-apoptotic members of the Bcl-2 family proteins (Thomas, *et al.*, 2009).

The initial cellular response to high glucose is ROS which induces rapid apoptotic cell death. It is known that high diacylglycerol induces endothelial apoptosis through activation of the Bax-Caspase protease pathway. The apoptosis effector is known as the family of intracellular cysteine proteases namely caspase. The characteristics of apoptosis in regard to caspase are alteration in mitochondrial function characterized by a decrease in electrochemical gradients through the mitochondrial membrane and the release of cytochrome c mitochondria into the cytoplasm, and are inhibited by the presence of Bcl-XL in these organelles. Translocation of pro-apoptosis Bax protein into the mitochondrial membrane is accompanied by a significant increase in caspase-3 and caspase-9 activity (Frances *et al.*, 2013).

Functional defects and decreased pancreatic beta cells contribute to failure of pancreatic beta cells in type 2 DM. Apoptosis detected by TUNNEL staining is the most common thing in pancreatic beta cell death in type 2 DM. In some experimental animals, glucose can also induce beta cell apoptosis. High glucose exposure over a long period of time results in an increase in Bid regulation from BH3, Bad, and a decrease in Bcl-xL (Thomas *et al.*, 2009). In this pilot study, we have demonstrated an increase in the Apoptotic Index in the lateral wall of cochlear fibroblasts, where the comparison between the control group and intervention group showed a significant result (P < 0.05). This result is consistent with Zheng *et al.*, 2018 which showed a significant increase in the Apoptotic Index in the Apoptotic Index in cardiomyocytes in streptozotocin-induced diabetic rat models compared to the control group (Zheng *et al.*, 2018).

5. Conclusion

This study showed a significant increase in the Apoptosis Index in the cochlear lateral wall fibroblasts of diabetic rat models compared with controls.

Conflict of Interest

The authors declare that there is no conflict of interest in regard to the publication of this paper.

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Investigation of Phytochemical, Physicochemical and Essential Free Fatty Acid (MCFAs) from Virgin Coconut (*Coconucifera* Linn) Oil and Their Antimicrobial Activities

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Abstract: Antibiotic resistance has become a worldwide problem for treating infections caused by numerous organisms. Antimicrobial super power of MCFAs (Lauric Acid) are effectively kill many disease causing microorganisms. Virgin Coconut Oil is the riches source of MCFA (90%). Therefore, the main aim of this work is to prepare MCFAs from Virgin Coconut Oil and to assess its antimicrobial properties. In this research work, Coconucifera Linn (Coconut) was collected from Yankin Township, Yangon Division, Myanmar. In the present research work, according to the preliminary phytochemical investigation, alkaloids, terpenoids, flavonoids, saponins, glycosides, tannins, $\dot{\alpha}$ -amino acids were found to be present in Virgin Coconut Oil. Virgin Coconut Oil (VCO) was found to be 21%, moisture content 0.003%, pH 5.3, iodine value 14.2, saponification value 345, acid value 0.03 mg KOH/g, viscosity 45 cp, color intensity-1.14, peroxide value 0.0014 meg/kg and specific gravity 0.8730. Elemental analysis of VCO was carried out via EDXRF method, indicates the presence of calcium, iron, copper and zinc in VCO. Fatty acid profile of VCO by GC-MS analysis was (C6:0) 2.75%, (C8:0) 20.83%, (C10:0) 18.32%, (C12:0) 33.75% and (C14:0) 23.19%. MCFAs of VCO have strongly antimicrobial activity were Gram-positive (Staphylococcus aureus, Bacillus cereus), Gramnegative (Escherichia coli (ATCC), Proteus morgana, Klebsiella aeruginosa, Pseudomonas aeruginosa) and Yeast (Candida albicans).

Keywords: *Coconucifera* Linn, antimicrobial activity, Physicochemical analysis, Elemental analysis.

Introduction

Coconut (*Cocosnucifera* Linn) is classified as a "functional food" as it provides many health benefits beyond its nutritional content. Coconut is highly nutritious and rich in fiber, vitamins, and minerals. It provides a nutritious source of meat, juice, milk, and oil. On many islands coconut is a staple in the diet and provides the majority of the food eaten. Nearly one third of the world's population depends on coconut to some degree for their food and their economy. Coconut oil is of special interest because it possesses healing properties far beyond that of any other dietary oil and is extensively used in traditional medicine among Asian and Pacific populations. Pacific Islanders consider coconut oil to be the cure for all illness. The coconut palm is so highly valued by them as both a source of food and medicine. Only recently has modern medical science unlocked the secrets to coconut's amazing healing powers.

In traditional medicine around the world coconut is used to treat a wide variety of health problems including the following: abscesses, asthma, baldness, bronchitis, bruises, burns, colds, constipation, cough, dropsy, dysentery, earache, fever, flu, gingivitis, gonorrhea, irregular or painful menstruation, jaundice, kidney stones, lice, malnutrition, nausea, rash, scabies, scurvy, skin infections, sore throat, swelling, syphilis, toothache, tuberculosis, tumors, typhoid, ulcers, upset stomach, weakness, and wounds. Coconut oil is one of the primary natural products produced from dry fruit (copra) of coconut (*Cocosnurifera* Linn). Different methods produce different types of coconut oil that their properties are little varied. Desiccated coconut and coconut cream contained about 69 % of coconut oil. Full coconut milk is approximately 24 % of oil. Coconut oil is a colorless to pale brownish yellow oil with a melting point ranging from 23 to 26 °C. It does not become rancid (oxidation) easily [1].

Coconut oil was once mistakenly believed to be unhealthy because of its high saturated fat content, it is now known that the fat in coconut oil is a unique and different from most all other fats and possesses many health giving properties. It is now gaining long overdue recognition as a nutritious health food .Virgin coconut oil (VCO) seemed to be the purest form of coconut oil, water white in color, contains natural vitamin E and with very low free fatty acid content and low peroxide value. It has a mild to intense fresh coconut aroma. VCO may be defined as the naturally processed [1], chemically-free and additive-free product from fresh coconut meat or its derivative (coconut milk and coconut milk residue) which has not undergone any further chemical processing after extraction [10].

Fats varying in fatty acid chain lengths are metabolized differently [3]. Mediumchain triglycerides (MCT) differ from long-chain triglycerides (LCT) in that they are easier to digest and are absorbed, and oxidized faster than LCT fats. MCT are absorbed directly into the portal circulation and transported to the liver for rapid oxidation [3] and then enter mitochondria. LCT, however, are transported via chylomicrons into the lymphatic system, allowing for extensive uptake into adipose tissue. Rapid metabolism of MCT may increase energy expenditure (EE), decrease their deposition into adipose tissue and result in faster satiety. In addition, MCTs decrease protein catabolism in hyper-catabolic states, raise thyroid function and do not form esters with cholesterol. Most animal studies have also demonstrated that the greater EE with medium chain fatty acids (MCFA) relative to long-chain fatty acids (LCFA) results in less body weight gain and decreased size of fat depots after several months of consumption.

Furthermore, both animal and human trials suggest a greater satiating effect of MCT compared with LCT. Due to their ability to increase EE and make faster satiety, MCT facilitate weight control when included in the diet as a replacement for fats containing LCT [3]. Although long-chain fats have a kilocalorie values of 9.0 per gram, medium-chain triglycerides (MCT) fats have ~10% less (8.3 kilocalorie/gram).MCTs are mainly utilized as a nutritional supplement for patients suffering from mal absorption caused by intestinal resection and as a component in infant formula [11].

MCT are broken down almost immediately by enzymes in the saliva and gastric juice so that pancreatic fat digesting enzymes are not even essential. MCFAs are of a smaller particle size compared to LCFAs thus requiring less energy and fewer enzymes for absorption, placing less strain on the digestive system. Especially people who cannot digest fats (such as people with cystic fibrosis) can and will thrive on coconut oil. In addition, they also used as a solvent or a carrier of lipophilic nutrients or drugs, such as vitamin K and phospholipid. Studies have also shown MCFA provide protection against carcinogenic compounds and fail to raise cholesterol levels [8].

MCFAs have several distinguished characteristics, such as high oxidative stability, low melting point and viscosity, and high solubility in water. MCFA's burn three times more calories for six hours after a meal than LCFA's. MCTs have specific application in the field of foods, pharmaceuticals and cosmetics.

Medium chain mono glycerides are ideal solvent for aromatics, steroids, dyes and perfume bases. A mixture of medium chain mono glyceride and di glyceride was found to be an effective solvent for dissolving cholesterol gallstones in humans [9]. The antimicrobial effects of the FAs and MGs are additive, and total concentration is critical for inactivating viruses [5, 6, 7].

Materials and Methods Collection of Sample

Coconuts (*Cocosnucifera* Linn) were collected for the present research. The sample was collected from Yankin Township, Yangon Division, Myanmar. The collected sample was identified in Department of Botany, University of Yangon.

Chemicals

All chemicals used in this work were from British Drug House Chemical Ltd., Poole, England. All standard solutions and other diluted solutions throughout the experimental runs were prepared by using distilled water.

In all the investigations the recommended methods and standard procedures involving both conventional and modern techniques were employed [12]. Lipase (*Candida rugosa*) purchased from Sigma (Aldrich Chemical Co.) was used. All other chemicals and reagents used were of analytical grade.

Preparation of Virgin Coconut Oil

Extraction of Virgin Coconut Oil was observed by Cold Pressed Method. Mature coconuts were de husked the shell with a sharp knife or a scraper. The shredded meat was pressed at room temperature to get coconut milk and filtered through a cheese cloth to remove the impurities.

The coconut milk was separated into four layer parts by centrifugal method [1]. Virgin coconut oil at the top, cream layer at the second, skim milk in third and shredded meat (solid) at the bottom were collected. Water like color of virgin coconut oil was separated from top layer by decanting.

Preliminary Phytochemical analysis

Qualitative phytochemical analyses were performed in Preliminary Phytochemical analysis were performed in extraction of Virgin Coconut Oil .preliminary phytochemical test were carried out according to determine the presence of phytochemicals the alkaloid, α -amino acids, flavonoids, phenolic compounds, glycosides, and saponins as described by standard procedure.

Proximate analysis

The physicochemical properties of VCO were investigated for Moisture (%), pH, Iodine value, Saponification value, Acid value, Viscosity, Color density, Peroxide value, and Specific gravity according to the standard methods [2] and [4]. Elemental analysis of VCO was carried out via EDXRF method.

Enzymatic Hydrolysis of Virgin Coconut Oil

Virgin coconut oil (100 g) was taken in a 250 ml stoppered Erlenmeyer flask and water (60 % by weight of neutral glycerides) containing lipase powder was added. The mixture was magnetically stirred at 35 ± 2 °C. The degree of hydrolysis was monitored by determining the amount of free fatty acid liberated by titration method during hydrolysis time. After reaction completed, the oil layer and water layer containing enzyme and glycerol were separated by centrifugation.

Isolation of Short Chain Fatty Acid

The hydrolysate (100 mL) was subjected to steam distillation under atmospheric pressure. All parts of glass distillation equipment including steam inlet, steam outlet and thermometer pocket adapter were fitted well. The steam carried volatile fatty acids and was collected as the distillate (F_I).

Isolation of Medium Chain Fatty Acids from Residual Fatty Acids (FII)

The residual fatty acids from the steam distillation were fractionally distilled. The distillate that collected at (100-140 °C) under 4 mm Hg pressure mainly contained medium chain fatty acids (MCFAs). The distillate as fractions (F_{II}) and residual fractions (LCFA) (R) were then weighed and the yields were calculated on the basis of VCO.

Test Organism

The antibacterial activity of the test samples (VCO, FA fractions and glycerides) was determined by the agar disc diffusion technique. The microorganisms used for testing antimicrobial activity were Gram positive (*Staphylococcus aureus Bacillus cereus*), Gram-negative (*Escherichia coli* (ATCC), *Proteus morgana*, *Klebsiella aeruginosa*, *Pseudomonas aeruginosa*) and Yeast (*Candida albicans*).

Preparation of inoculum

A few colonies of the organism to be tested were inoculated into the triple sugar iron agar and incubated at 37 °C for 24 hours. A few colonies of the organism from triple sugar iron agar were introduced into the triplicate soy broth and incubated for 3 hours at 37 °C to obtain the bacterial suspension of moderate cloudiness. This contained approximately 105 to 107 organisms per m L.

Antimicrobial Activity Testing

The antibacterial activity of the test samples (VCO, FA fractions) was determined by the agar disc diffusion technique. Screening was done by the use of impregnated paper disc (6 mm). These discs were sterilized by autoclaving and followed by heating at 60 °C for 1 hour. It was then impregnated with concentrated sample ($20 \mu g$ /disc) and allowed to dry at 42 °C in an oven.

The bacterial suspension from triplicate soy broth was streaked evenly in three plane onto only the surface of the triplicate soy agar plates with sterile cotton swab. After the inoculums had allowed drying for minutes, the dried discs impregnated with test sample were placed on the agar with a flamed forceps and gently pressed down to ensure proper contact. A control discs impregnated with solvent only and with clinical drug (tetracycline) were also included. After inoculation, the plates were incubated immediately or within 30 minutes.

After overnight incubation at 37°C, the diameters of inhibition zone including 6 mm discs were measured by dial calipers.

Results and Discussion

Virgin coconut oil was extracted from freshly harvested mature coconut by cold press method. It is a unique production process; from harvesting of coconut final up to VCO, is within 24 hours and this important factor ensures optimal retention of the coconuts natural flavor, natural vitamin E and micronutrient. No heat was used in this process and no fermentation occurred during the process.

High process temperature and bacterial contamination of the coconut meat before oil extraction cause the yellow color of the coconut oil. Therefore, for the coconut oil to be categorized as virgin, its color should be water white. In the preliminary phytochemical investigation, alkaloids, terpenoids, flavonoids, saponins, glycosides, tannins, $\dot{\alpha}$ -amino acids were found to be present in Virgin Coconut Oil. The physicochemical properties of VCO was summarized in Table 1.

Elemental analysis of VCO was carried out via EDXRF spectrum that showed in Table 2. Fatty acid profile of VCO was investigated by GC-MS and the gas chromatogram was shown in Figure 1. Identification of GC peak was made by comparison of their mass spectra on both columns with those stored in NIST 02 and Wiley 275 Libraries or with mass spectra from literature. Component relative concentrations were calculated based on GC peak areas without using correction factors.

The retention time, relative concentration (% area) and identification of each GC peaks are summarized in Table 3. As represented in table, VCO was found to be rich in medium chain fatty acids (MCFAs) that got some special importance, as they provide a quick source of energy for infants and stressed adults. MCFAs have several distinguished characteristics, such as high oxidative stability, low melting point and viscosity, and high solubility in water.

Table 3 also presents the % fatty acid of coconut oils found in literature. Not all the coconut oils have the same in quality, and do not all provide the same health benefits. Gas chromatographic separation of VCO provided five major medium chain fatty acids (MCFAs) as shown in Figure 1.These five prominent peaks were eluted at retention times (Rt) of 11.62, 15.22, 18.22, 20.91, and 23.44 min.

The most prominent peak at 20.91 was corresponded to lauric acid (C 12:0) methyl ester. In its mass spectrum, peaks at m/z 214 (M+), 171 (M-COMe) (base peak) and 183 (M-OMe) were observed. This m/z 171 peak was also observed as

molecular ion peak in the MS of compound at Rt 20.89 min, indicating that compound at Rt 20.89 was resulted from the cleavage of the compound at Rt 20.91. Therefore, both peaks were corresponded to lauric acid present in VCO. After thoroughly analysis peaks in GC were identified. Enzymatic hydrolysis of VCO was made free fatty acids and glycerol. Enzyme was used from Sigma-Aldrich (0.4% *Candida rugosa* lipase). During enzymic hydrolysis, formation of FFA was shown in Table 4. At 11 hour 98.1% of FFA released from VCO. The liberation of FFA formed against hydrolysis time in Figure 3.

The hydrolyzed oil after removal of glycerol layer was subjected to steam distillation. Steam volatile fraction (F-I) was found to be rich in SCFAs, C 8:0 and C 10:0. Remaining oil was then fractional distilled under reduced pressure to provide fraction II (F-II) that was rich in MCFAs especially lauric acid. Residual oil (R) consisted mainly of LCFAs as shown in figure 3, 4 and 5. The yields of all isolated fractions were calculated on the basis of VCO and reported in Table 5, 6 and 7.

It can be noticed from the table that total yield of isolated free fatty acids were dependent on the enzyme used during hydrolysis. In addition, Enzyme provided yield of MCFAs (54.6 %).Antimicrobial activity of different fatty acid fractions and glycerides derived from VCO were screened for their antimicrobial activity using agar disc diffusion method as shown in figure 6 and samples tested for antimicrobial activity are shown in Table 8, 9 and 10.

Conclusion

The yield of virgin coconut oil (VCO) extracted from freshly harvested mature coconut by cold press method and the yield was 21 %.VCO has moisture content, 0.03 %; pH, 5.3; iodine value, 14.21, saponification value. 345, acid value, 0.03 mg KOH/g; viscosity, 45 cp; color density,-1.14; peroxide value, 0.0014 meq/kg; and specific gravity. 0.8730. Fatty acid profile of VCO was caproic acid (C 6:0), 3.75 %; caprylic (C 8:0), 20.83 %; capric acid, (C 10:0), 18.32 %; lauric acid (C 12:0), 33.75 %; and myristic acid (C 14:0), 23.19 % and Lauric acid content of 66.45 % of total MCFAs. *S. aureus, P. morganii*, and *S. flexneri* were found to be sensitive to test samples.

All samples except VCO strongly inhibited *S. aureus* with inhibition zone diameter ranging 15-20 mm. These samples also effective against Gram-negative bacteria as, *P. morganii* and *S. flexneri* with 13-21 mm inhibition zone diameter. MIC of all fractions against *S. aureusand S. flexneri* were <1.714 μ g/mL to inhibit the microorganism. For this reason, virgin coconut oil is becoming known as "The Healthiest Oil on Earth" The coconut palm is so highly valued by them as both a

source of food and medicine. Only recently has modern medical science unlocked the secrets to coconut's amazing healing powers.

No.	Properties	Results
1.	Moisture (%)	0.03
2.	pH	5.3
3.	Iodine value	14.21
4.	Saponification value	345.02
5.	Acid value (mg KOH/g)	0.031
6.	Viscosity (cp)	45
7.	Color density	-1.14
8.	Peroxide value (meq/kg)	0.0014
9.	Specific gravity	0.8730

 Table 1. Physicochemical Properties of Virgin Coconut Oil

Table 2. Quantitative Result of Some Element in	Virgin Coconut Oil by
EDXRF method	

Element	Result (mg/mL)
Ca	64.737
Fe	57.944
Cu	40.783
Zn	33.604

Table 3.	Fatty	Acid Profil	e of Virgin	Coconut	Oil based	on GC-MS	Analysis
			· · · -				

Rt	Identification of Fatty Acid	Relative	Content
(min)		Concentration	(%)
		(%)	
		Present work	Literature
11.62	Caproic acid (hexanoic acid) C	3.75	0.1-0.4
	6:0		
15.22	Caprylic (octanoic acid) C 8:0	20.83	3.0-10.0
18.22	Capric acid (decanoic acid) C	18.32	5.0-9.0
	10:0		
20.91	Lauric acid (dodecacanoic acid)	33.75	50.0-56.4
	12:0		
23.44	Myristic acid (tetradecanoic acid)	23.19	15.0-21.0
	14:0		



Figure 1. Gas chromatogram showing the fatty acids profile of virgin coconut oil

17.50

19.50

21.50

23.50

15.50

13.50

11.50

Hydrolyzed Coconut Oil by using Lipases				
Reaction Time (hour)	Free Fatty Acid (%)			
1	21.00			
2	32.25			
3	44.50			
4	53.25			
5	58.50			
6	72.11			
7	84.75			
8	93.95			
9	96.75			
10	98.00			
11	98.21			

Table 4. Yield of Isolated Free Fatty Acid Fractions from Enzymatic Juch 4 C **0:1** L

Time

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Reaction Time (Hour)

Figure 2. % of FFA Vs enzymic hydrolysis time of coconut oil by using Lipases



Figure 3. Gas chromatogram showing fatty acid profile of fraction F_I (isolated as steam distillate) from hydrolyzed VCO catalyzed by Enzyme

Figure 4. Gas chromatogram showing fatty acid profile of fraction F_{II} (isolated from fractional distillation) of Hydrolyzed VCO

Figure 5. Gas chromatogram showing fatty acid profile of residue (R) after removal of F_I and F_{II} from fractional distillation of hydrolyzed VCO

	Hydrolyzed Virgin Coconut Oil (according to GCMS)				
R _t (min)	Identification of Fatty Acid	Formula	% Area(F-I)		
17.21	Octanoic acid	$C_8H_{16}O_2$	28.46		
19.37	Decanoic acid	$C_{10}H_{20}O_2$	19.23		
22.03	Dodecanoic acid, methyl ester (lauric) methyl ester	$C_{13}H_{26}O_2$	36.92		
23.06	Dodecanoic acid, propyl ester (lauric) propyl ester	$C_{15}H_{30}O_2$	0.76		
23.58	Tetradecanoic acid, methyl ester (mystric) methyl ester	C ₁₅ H ₃₀ O ₂	3.07		
24.53	Tetradecanoic acid	$C_{14}H_{28}O_2$	11.53		

Table 5. Fatty Acid Profile of Steam Distillate isolated from Enzymatic Hydrolyzed Virgin Coconut Oil (according to GCMS)

Table 6. Fatty Acid Profile of Fractional Distillate isolated from Enzymatic Hydrolyzed Virgin Coconut Oil (according to GCMS)

Rt (min)	Identification of Fatty Acid	Formula	% Area F- II
17.60	Octanoic acid	$C_8H_{16}O_2$	2.27
19.23	Decanoic acid	$C_{10}H_{20}O_2$	23.64
21.92	Dodecanoic acid (lauric acid)	$C_{12}H_{26}O_2$	66.45
23.58	Tetradecanoic acid, methyl ester	$C_{15}H_{30}O_2$	4.27
24.53	Tetradecaonic acid	$C_{14}H_{28}O_2$	2.84

Rt (min)	Identification of Fatty Acid	Formula	% Area(R)
20.99	Dodecanoic acid, methyl ester (lauric acid) methyl ester	$C_{13}H_{26}O_2$	31.01
21.95	Dodecanoic acid (lauric acid)	$C_{12}H_{24}O_2$	31.27
23.04	Dodecanoic acid, propyl ester(lauric acid) propyl ester	$C_{15}H_{30}O_2$	1.28
23.60	Tetradecanoic acid, methyl ester	$C_{15}H_{30}O_2$	19.30
24.56	Tetradecanoic acid	$C_{14}H_{28}O_2$	17.11

Table 7. Fatty Acid Profile of Residue after Removal of F-I and F-II from Enzymatic Hydrolyzed Virgin Coconut Oil (according to GCMS)





(a)

(b)



a = *Staphylococcus aureus;* b = *Proteus morganii;* c = *Shigella flexneri* Control C-1= Ciprofloracin; Control C-2 = Tetracycline; Control C-3 = Ofloxacin

 F_{I} = stream distillate of virgin coconut oil (MCFA) F_{II} =Fractional distillate of virgin coconut oil (Lauric acid) R =Residue of virgin coconut oil

Figure 6 (a) (b) (c). Evaluation on Antimicrobial Activity of Free Fatty Acid Fractions Isolated from Hydrolysate of Coconut Oil by lipase Enzyme Agar well ~ 7 mm

Table 8. Antibacterial activities of Free Fatty Acids Fractions Isolated fromHydrolysate of Coconut Oil

No	Organisms tested	Diameter of inhibition zone (mm)		
		F-I	F-II	R
1	Staphylococcus aureus	17	17	15
2	Proteus morganii	15	17	10
3	Shigella flexneri	20	20	15

Table 9. Inhibition Zone diameter Vs Concentration for Various Free Fatty Acid Fractions of Hydrolysate of Coconut Oil

No.	Bacterial Strain	Dia	meter o Zone	f Inhibit (mm)	tion
		VCO	F-I	F-II	R
1.	Staphylococcus aureus	-	17	17	15
2.	Proteus morganic	-	15	17	10
3.	Shigella flexneri	-	20	20	15

Table 10. Minimum Inhibitory Concentration (MIC) for Free Fatty AcidFractions of Hydrolysate of Coconut Oil

Bacterial Strain	MIC value (µg/mL)			
Ductorial Strain	F-I(s)	F-II(s)	R(s)	
Staphylococcus Aureus	<1.714	<1.714	<1.714	
Proteus morganic	13.770	<1.714	27.540	
Shigella flexneri	<1.714	<1.714	<1.714	

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Student Services of SDSSU Higher Education: An Evaluation Review

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Abstract: This research study ultimately aims to determine the levels of student services of Surigao del Sur State University (SDSSU)-Tagbina Campus, Philippines. To ascertain the significant differences among the responses of the respondents, the One way Analysis of Variance (ANOVA) was employed and the Post-hoc comparison using T-test. A sample size of 307 by means of a stratified random sampling is used. Findings revealed a high level of services to all areas as perceived by the respondents. No significant difference was unveiled when these services were grouped according to the respondents' sexual identities or gender. Evidently, a significant difference was uncovered to all services provided to the students when they were classified according to their respective programs. The findings of this study are notable to the higher education institutions (private or public) and the administration as students are one of the dynamic players in the organization. The attainment of the organizational goals and objectives of the academic sectors does not only rest in the hands of the management but more so in the hands of the students being the customers in the market who "walk the talk" of the institution's character.

Keywords: student services, higher education institution, management, state university.

1. Introduction

Tertiary education is one of the fundamental academic pursuits of students. Higher Education Institutions (HEI's) in the Philippines provide students with a lot of developmental activities, learning opportunities and various student services in order for them to stay and remain in the next couple of years until they earn their diplomas which significantly carries the name of the tertiary institution itself. Hasan *et al.*, (2008) assert that in today's stiff competition, higher education institutions have to be more innovative in attracting and retaining students should they remain competitive in the academic industry.

This is true as universities whether in public or private institutions have undergone massive educational campaigns (Yooyen *et al.*, 2011) in order for them to maintain or enhance their levels of competitiveness. Hitt *et al.*, cited by Ciobanu (2013) argued that support to students and its services rendered help improve the quality of learning experiences in the quest of their academic endeavors. Other than the quality of teaching, the authors also added that service systems and support to students are the most essential factors in the quality assurance of the educational system. In his study, Haugen cited by Ciobanu (2013) contends that while some universities do some extra efforts to support the needs of the students outside their respective classrooms, still a lot of these academic institutions fail to address the ever rapid changing learning environment where student expectations, accessibility on the use of services and technology substantiate costs which yield a huge impact.

However, a gap streamlines between what students perceive and the reality of what students actually live through with the prevailing services of most universities. Because of constant pressures in the dynamic change of the curricular system among the educational institutions in the Philippines, it is in this endeavor that Surigao del Sur State University (SDSSU)-Tagbina Campus unceasingly search for improved quality services to the students beyond the boundaries of the classrooms. As a forerunner in the tertiary education of the region, SDSSU seeks to form individuals who can later become productive citizens of the country. As mandated by the Commission of Higher Education (CHED), SDSSU has to provide a set of student centered activities and services in support of academic instruction to facilitate holistic student development for building (CMO No. 21, 2006). University services include nation admission/enrollment services, co-curricular activities, medical services, sports development program, office of the student affairs and services, guidance services, library services, internet and computer laboratory services.

1.1 Objective of the Study

This research paper investigated in determining the levels of various student services of SDSSU-Tagbina Campus as perceived by the higher education students. Specifically, it sought to:

a) identify the demographic profile of the respondents in terms of their programs enrolled, gender, and religious affiliation;

b) describe the levels of admission/enrollment services, co-curricular activities, medical services, sports development program, student affairs and services, guidance services, library services, internet and computer laboratory services as perceived by the students;

c) determine the significant differences in the admission/enrollment services, cocurricular activities, medical services, sports development program, student affairs and services, guidance services, library services, internet and computer laboratory services when grouped according to gender; and

d) determine the significant differences in the responses of the respondents in terms of the admission/enrollment services, co-curricular activities, medical services, sports development program, student affairs and services, guidance services, library services, internet and computer laboratory services when grouped according to their respective programs.

2. Literature Review

In our society today, the academic environment is indeed competitive where a lot of students have a number of options to choose from and determinants that draw educational institutions from keeping them to transfer have to be profoundly considered in order to secure its competitive advantage (Dhaqane and Afrah, 2016). This is so true in the study of Schuller, Rašticova, and Konečny (2013) wherein the most contemporary issue brought by the universities in diverse parts of the world as evidenced by quite a number of researches is the quality of services offered. In order to gain its competitive advantage (Sherifi, 2015), higher education institutions must consider themselves as "profit-making" (Beaumont, 2012) or "business-like" (Stoltenberg, 2011) organizations much likely operating in the dynamic market place. Rudge (2014) also added tertiary education sectors have posed a lot of challenges such as a decrease of enrollment, increase of costs and competition. Because of these issues, educational institutions have to consider all these foreseen issues a major concern of their priorities from academic to social programs. With the services provided these aid students in the completion of their academic pursuits. It is a mandate of the Philippine constitution that access to quality education provided by the Higher Education Institutions (HEI's) has to be carried out within the bounds of law and other legal undertakings that optimizes every citizen's right to education provided by these learning institutions considering the academic freedom they hold onto (Carillo, 2017).

The Higher Education Act of 1994 mandates the Commission on Higher Education (CHED) to adopt and promulgate the enhanced policies and guidelines in relation to student affairs and services which the Higher Education Institutions (HEI's) have to adhere from. This is to foster a holistic approach in the student affairs and services as well as meet the minimum requirements as mandated by the Commission on Higher Education where quality education is of utmost priority (CMO No. 9, 2013). The student affairs and services refer to various services and programs catered by private and state universities and colleges that address the non-academic experiences of students to achieve holistic student

development (CMO No. 21, 2006). The Surigao del Sur State University (SDSSU), formerly known as Surigao del Sur Polytechnic State College, is the only state-run institution in the province of Surigao del Sur, Philippines. Its general mandate is to provide advanced education, higher technological, professional instruction and training in trade, fishery, agriculture, science, education, commerce, engineering, forestry, nautical courses and other related fields.

The university has six satellite campuses namely, SDSSU Cantilan Campus, SDSSU Cagwait Campus, SDSSU San Miguel Campus, SDSSU Lianga Campus, SDSSU Bislig Campus and SDSSU Tagbina Campus. All of these campuses are situated in the province of Surigao del Sur. The main campus, SDSSU Tandag, is situated the heart of Tandag City, the provincial city of Surigao del Sur (SDSSU Code, 2012). The unceasing search for quality excellence in the aspect of education of SDSSU has brought significant change in the administration, faculty and students as the institution is welcomed by the International Organization for Standardization (ISO) as duly ISO certified 9001-2015 by the National Quality Assurance Firm (NQA) firm in February, 2019. According to his research, some academic institutions (Ntabathia, 2013) which submitted for ISO certifications have received benefits from these quality systems. As the precursor in the Outcomes-Based Education (OBE) among other schools in the province of Surigao del Sur, SDSSU undeniably conforms to quality excellence (SDSSU MTDP, 2015), going beyond the borders of the province to wit;

Vision: A leading "Glocal" University with widened academic perspectives that focus on attaining food security, supporting poverty alleviation, developing renewable energy, and conserving natural environment.

Mission: SDSSU shall provide competency-based higher education training driven by relevant and responsive instruction, research, extension and sustainable resource management.

Quality Policy: The Surigao del Sur State University commits itself to produce highly motivated, globally competitive and morally upright human resource through the delivery of transformative and quality higher education that conforms to international standards driven by excellent instruction, relevant researches, sustainable extension, and production services.

Together with our stakeholders, we shall endeavor for continual improvement of our quality management system in consonance with statutory and regulatory requirements for clients and industry satisfaction for quality of life.

2.1 Hypothesis

The null hypotheses at 0.05 level of significance was formulated and investigated under the following.

1. There is no significant difference in the admission/enrollment services, cocurricular activities, medical services, sports development program, office of the student affairs and services, guidance services, library services, internet and computer laboratory services when grouped according to gender.

2. There is no significant difference in the responses of the respondents in terms of the admission/enrollment services, co-curricular activities, medical services, sports development program, student affairs and services, guidance services, library services, internet and computer laboratory services when grouped according to their respective programs.

2.2 Theoretical Framework

The students are the key players in the academic industry. The student development theory is one of the many pillars in various studies of student development. The student development theory is subdivided into other distinct types of theories namely the psychosocial, cognitive-structural, personenvironment interactive, and humanistic-existential (Baumann, 2010; Long, 2012). Of those theories notably recognized by the student affairs scholars, this study corresponds from Astin's Theory of Student Involvement in 1984 where it falls under the Person-Environment Interactive. Astin (1984) purports that student involvement mainly pertains to the students' amount of "physical and psychological energy" (p. 518) dedicated to their academic pursuits in the higher education. Respectively, Astin also asserts that students with high involvement in school utilize their time in campus, dedicate their efforts in studying to a greater extent, participate proactively in various student activities and campus organizations. More so, students also socialize with other students as well as to the teaching personnel.

3. Methods

In an effort to collect pertinent data relative to the purpose of the study, the study utilized a quantitative research design with the use of the Likert scale in rating the levels of admission/enrollment services, co-curricular activities, medical services, sports development program, student affairs and services, guidance services, library services, internet and computer laboratory services. With the prescribed research design which is quantitative in nature, samples are selected on the basis of the characteristic of the population itself (Kumar, Talib and Ramayah, 2017) and where these judgments or behavioral aspects are considered (Serrano and Palad, 2016); notwithstanding, on the nature of the phenomena (Serrano, 2016).

A questionnaire written in English language adopted from the Office of the Student Affairs and Services was employed. This questionnaire had been consistently used all throughout the campuses of the university over the past years to date. Moreover, some questions were modified to conform to the standards of the Accrediting Agency of Chartered Colleges and Universities (AACCUP), a duly renowned accrediting agency duly recognized by the Commission on Higher Education, of which SDSSU is an active member for almost a decade.

Knowing the characteristic of the population and the appropriate number of respondents, stratified sampling technique was employed. Stratified sampling is a technique (Sirug, 2015) wherein the population is subdivided into subgroups or known as strata (stratum) where members are randomly drawn for every subgroup or stratum. The entire population is heterogeneous (Singh and Masuku, 2014) and dividing the population into a number of groups becomes strata which are homogeneous in nature and randomly sampled. The use of stratified random sampling (Nickolas, 2017) seems to be an appropriate method when the population is distributed into small groups. Population is then segregated into various strata and samples are randomly undertaken according to the fraction of the population based on the identified stratum. Further, cases of the identified stratum must have the same distinctiveness. In this study, the total population of SDSSU Tagbina Campus for the second semester academic year 2018-209 was 1,319. Using the Slovin's formula, the sample size generated a result of 307 with five percent margin of error. Presented in Table 1 is the population of the higher education students for the second semester academic year 2018-2019.

SDSSU Tagbina Campus (Program Offering)	Total	Percentage of Distribution (%)	Sample Size
Bachelor of Elementary Education	93	7	21
Bachelor of Secondary Education	152	12	37
Bachelor of Science in Business Administration	242	18	55
Bachelor of Agricultural Technology	588	45	138
Bachelor of Science in Hospitality Management	86	6	19
Bachelor of Science in Computer Science	158	12	37
	1,319	100%	307

Table 1. Population of the Higher Education Students of SDSSU TagbinaCampus for the Second Semester Academic Year 2018-2019

In order to determine the levels of student services, statistical tools which were appropriate in the analysis of data were employed. To uncover the various levels of student services, statistical mean was utilized. When grouped according to gender, the researcher made use of the T-test for independence. This was to determine how significantly different were the responses of the respondents regardless of which program they belonged. Further, to determine the significant differences in the responses of the respondents in terms of the admission/enrollment services, co-curricular activities, medical services, sports development program, student affairs and services, guidance services, library services, internet and computer laboratory services, the researcher made use of the One Way Analysis of Variance (ANOVA). To further refine the statements in the questionnaire, the revised instrument was subjected for reliability analysis to a sample of thirty students who were not the main respondents of the study; these were the graduating students from the BSBA program who were having their onthe-job training the time this study was conducted. As to the internal consistency, all cases generated to 0.885 using the Cronbach's Alpha in which the questionnaire proved to be acceptable. In rating the levels of student services in this study, the use of the four-point Likert scale was utilized.

Range of	Descriptive	Interpretation
Mean	Level	
3.50 - 4.00	Very High	This means that the items in the student
		services are always manifested.
2.50 - 3.49	High	This means that the items in the student
		services are occasionally manifested.
1.50 - 2.49	Low	This means that the items in the student
		services are seldom manifested.
1.00 - 1.49	Very Low	This means that the items in the student
		services are not manifested at all.

3.1 Ethical Consideration

A number of ethical principles the researcher took into consideration when performing dissertation research. This guided the researcher in the conduct of his study during face to face contact with the respondents. Research scholars are sometimes precautious as to (Smith, 2003) how these ethical dilemmas are accorded relative to their academic pursuits. Such research enthusiasts are challenged given the substantial ethical requirements. Considerable amount of professionalism and the demonstration of ethical standards taking initiatives in producing quality research are necessary conditions in order to acknowledge commendable authorship. The researcher, being the faculty member of the university, subjected his research endeavor and a research proposal was made notified by the Program Chair recommended by the Research Head and duly approved by the Office of the Campus Director. A furnished copy of the research proposal was also given to the Head of the Student Affairs and Services for acknowledgement. The research proposal underwent a thorough review by the Technical Working Group (TWG) to ensure that all activities undertaken by the researcher during the conduct of his research were accorded to the principles governing research ethics. As an inclusion to the study, the respondents were all the college students from first year to fourth year who were bona fide enrollees for the second semester of academic year 2018-2019.

The fourth year students of the BSBA program formed part of the exclusion criteria since they were on their work integrated learning exposure outside the school during the time this study was conducted. After the approval of the proposal, preparations were made in the conduct of his study. The program chairpersons of the different colleges were given a copy of the letter duly approved by the campus director citing the researcher's intent. The researcher asked the assistance of the selected faculty members of the different colleges being the contact persons explaining to them the relevance of the study, distributing and retrieving back the questionnaires. Questionnaires were given to the respondents during their vacant time so as not to disrupt their classes. The selected faculty members also observed research ethical principles. Consent forms were also given to the respondents explaining to them their rights as participants of the study.

4. Results and Discussions

4.1 Demographic Profile of the Respondents

Shown in Table 1 is the demographic profile of the respondents. Respondents come from various programs offered by the university. Three hundred seven (307) students from various year levels accepted their voluntary participation as respondents in the conduct of this study. These respondents currently take up Bachelor of Elementary Education (BEEd), Bachelor of Secondary Education (BSEd), Bachelor of Science in Business Administration (BSBA), Bachelor of Agricultural Technology (BAT), Bachelor of Science in Hospitality Management (BSHM), and Bachelor of Science in Computer Science (BSCS).

The most number of respondents come from the BAT program comprising of about forty-five percent or 138 representing the entire sample size. Male respondents comprise forty-five percent or 139 and the female ones comprise fifty-five percent or 168. In terms of the religious affiliation, majority of the respondents come from the Roman Catholic believers of about sixty-four percent or 198.
A large disparity is observed as this is seconded by the Born Again Christian believers contributing to nineteen percent or fifty-seven of them representing the entire sample size.

Program	Frequency	Percent
Bachelor of Elementary Education	21	7%
(BEEd)		
Bachelor of Secondary Education	37	12%
(BSEd)		
Bachelor of Science in Business	55	18%
Administration (BSBA)		
Bachelor of Agricultural Technology	138	45%
(BAT)		
Bachelor of Science in Hospitality	10	6%
Management (BSHM)	19	070
Bachelor of Science in Computer	37	12%
Science (BSCS)		
Total	307	100%
Gender		
Male	139	45%
Female	168	55%
Total	307	100%
Religious Affiliation		
Roman Catholic	198	64%
Seventh Day Adventist	22	7%
Iglesia ni Cristo	14	5%
Salvatoris	6	2%
United Church of Christ in the	5	1.6%
Philippines		
Jehova's Witnesses	5	1.6%
Others (Born Again Christian)	57	19%
Total	307	100%

Table 1. Demographic Profile of the Respondents

4.2 Summary on the Level of Student Services

Presented in Table 2 is the summary on the level of various services of the university perceived by the students. As depicted in the table, the overall standard deviation (0.73) is less than 1.0, relatively a distinctive characteristic for a 4 point Likert Scale. This by some means demonstrate a consistency of responses among the respondents.

The overall mean on the level of student services as perceived by the respondents is 2.66 indicating a *high* level of remark. This implies that the services offered to students are occasionally manifested. Looking into the spectrum, the library services generated the highest mean of 2.87. Subsequently, the admission/enrollment services, the OSAS, guidance services, medical services, the sports development program, and the co-curricular activities fall in the same mean range earning a *high* descriptive level, too.

The internet and computer laboratory services got the lowest mean score of 2.19 having a *low* descriptive level as perceived by the students from various programs of the university. This is not surprising as the campus seemingly faces a lot of efforts because of the insufficient number of computers, poor internet access, and poor ventilation. Though services were occasionally manifested as depicted in the findings, it still did not fully meet the expectations of the students. These findings validate the study of Khatibi (2013). Although the concentration of his research dealt much on student satisfaction, results revealed that the services rendered by the Payame Noor University were not able to meet the students' expectations since they vary from one another including their motivations and abilities (Maejo, Pirani and Mujtaba, 2011). Similarly, though the extent of implementation and level of students' satisfaction in terms of the student welfare programs and student development programs and services of DMMMSU are both highly implemented, the study of Eisma (2015) also revealed that there is a need to improve further on the student services to achieve a very high level of satisfaction.

Student Services	SD	Mean	Descriptive	Rank
			Level	
Admission / Enrollment	0.67	2.83	High	2
Services				
Co-curricular Activities	0.78	2.57	High	7
Medical Services	0.73	2.69	High	5
Sports Development	0.71	2.63	High	6
Program				
Office of the Student Affairs	0.70	2.78	High	3
and Services (OSAS)				
Guidance Services	0.72	2.70	High	4
Library Services	0.74	2.87	High	1
Internet and Computer	0.77	2.19	Low	8
Laboratory Services				
Total	0.73	2.66	High	

 Table 2. Summary on the Level of Student Services

4.3 T-test Comparison of the Student Services when grouped according to Gender

The responses of the respondents in relation to various services offered when grouped according to gender are exhibited in Table 3. Among the students from various programs (N=307), findings reveal that there is no statistically significant difference between the male respondents and the female respondents where p > 0.05 (assuming equal variance), CI .95.

Thus, the study accepts the null hypothesis that there is no significant difference in the admission/enrollment services, co-curricular activities, medical services, sports development program, student affairs and services, guidance services, library services, internet and computer laboratory services when grouped according to gender.

This simply means that regardless of their sexual identities, male and female respondents have the same feelings toward the various student services. This study is in parallel with Alegado (1997) as findings revealed that gender was not statistically significant in the awareness, usage and satisfaction of selected student services.

Services	Gender	Ν	Mean	SD	t	Sig.
Admission	Male	139	2.96	0.77	0.11	0.01
	Female	168	2.97	0.63	-0.11	0.91
Co-	Male	139	2.70	0.89		
curricular					-0.91	0.36
	Female	168	2.79	0.75		
Medical	Male	139	2.82	0.85	1 1 2	0.27
	Female	168	2.92	0.74	-1.12	0.27
Sports	Male	139	2.74	0.90	0.81	0.42
	Female	168	2.81	0.74	-0.81	
OSAS	Male	139	2.88	0.84	1 20	0.20
	Female	168	3.00	0.72	-1.20	0.20
Guidance	Male	139	2.83	0.80	0.92	0.41
	Female	168	2.91	0.72	-0.85	0.41
Library	Male	139	2.93	0.78	0.72	0.47
	Female	168	2.99	0.64	-0.75	0.47
Internet	Male	139	2.34	0.82	0.17	0.96
	Female	168	2.35	0.80	-0.17	0.00

Table 3. T-test Comparison of the Student Services when grouped accordingto Gender

4.4 ANOVA on the differences among the responses of the respondents in terms of the Admission/Enrollment Services

Exhibited in Table 4 is the significant difference among the responses of the respondents by program regarding the admission/enrollment services. A one-way between groups analysis of variance was carried out to investigate the impact of the services offered by the university as perceived by the students across the programs. These students are grouped according to the program where they belong namely, the BEEd, BSEd, BSBA, BAT, BSHM, and the BSCS.

A significant difference is uncovered in terms of the admission/enrollment services among the six programs F(5, 301) = 35.719, p < 0.05. Having reached its statistical significance, the actual difference in mean scores between groups comes to a small effect. The effect size, calculated using eta squared is 0.37. Posthoc comparison using T-test analysis assuming equal variances revealed that the mean score for the BEEd (M = 1.55; SD = 0.83) is significantly different when paired with the students of the BSEd (M = 2.80; SD = 0.76), BSBA (M = 3.38; SD = 0.58), BAT (M = 2.97; SD = 0.79), BSHM (M = 3.00; SD = 0.50), and the BSCS (M = 3.26; SD = 0.55). The responses of the students also generate a significant difference between the BSEd and the BSBA, BSEd and BSCS, BSBA and BAT, BSBA and BSHM.

Table 4. ANOVA on the differences among the responses of the respond	lents
in terms of the Admission/Enrollment Services	

Source of Variation	SS	df	MS	F	Sig
Between Groups	55.667	5	11.133	35.719	0.000
Within Groups	93.821	301	0.312		
Total	149.488	306			

4.5 ANOVA on the differences among the responses of the respondents in terms of the Co-Curricular Activities

The significant difference among the responses of the respondents according to their programs regarding the co-curricular activities is shown in Table 5. Similarly, a one-way between groups analysis of variance was employed to investigate the impact of the services offered. As such, a significant difference occurred in terms of the co-curricular activities for the six programs F(5, 301) = 27.750, p < 0.05. Having reached its statistical significance, the actual difference in mean scores between groups comes only on a small effect. The effect size, calculated using eta squared is 0.31. Post-hoc comparison using T-test analysis assuming equal variances revealed that the mean score for the BEEd (M = 1.27; SD = 0.68) is significantly different when paired with the students of the BSEd (M = 2.39; SD = 0.89), BSBA (M = 3.19; SD = 0.61), BAT (M = 2.84; SD = 0.61)

0.87), BSHM (M = 2.71; SD = 0.88), and the BSCS (M = 2.99; SD = 0.77). Further, significant differences when paired with BSED and BSBA, BSEd and BAT, BSEd and BSCS, BSBA and BAT, BSBA and BSHM are also uncovered.

Table 5. ANOVA on the differences among the responses of the respondents
in terms of the Co-Curricular Services

Source of Variation	SS	df	MS	F	Sig
Between Groups	64.642	5	12.928	27.750	0.000
Within Groups	140.233	301	0.466		
Total	204.875	306			

4.6 ANOVA on the differences among the responses of the respondents in terms of the Medical Services

Depicted in Table 6 are the significant differences of the respondents according to their programs regarding the medical services. To investigate the impact of the services of students, the researcher utilized the one-way between groups analysis of variance. Notably, a significant difference is evident in terms of the medical services among the six programs F(5, 301) = 38.971, p < 0.05. With the profound statistical significance, its actual difference in mean scores between groups falls to a small effect. The effect size, calculated using eta squared is 0.39. In comparison with, the Post-hoc using T-test analysis assuming equal variances is utilized which reveals that the mean score for the BEEd (M = 1.29; SD = 0.69) is significantly different when paired with the students of the BSEd (M = 2.57; SD = 0.86), BSBA (M = 3.32; SD = 0.59), BAT (M = 2.93; SD = 0.80), BSHM (M = 2.70; SD = 0.80), and the BSCS (M = 3.31; SD = 0.65). Additionally, there are significant differences occurred on the responses of the students when paired with BSED and BSBA, BSEd and BSCS, BSBA and BAT, BSBA and BSHM, BAT and BSCS, and BSHM and BSCS.

Table 6	ANOV	A on	the diffe	erences an	10ng t	he respo	nses of tl	ne respo	ndents
in terms of the Medical Services									

Source of Variation	SS	df	MS	F	Sig
Between Groups	75.038	5	15.008	38.971	0.000
Within Groups	115.915	301	0.385		
Total	190.954	306			

4.7 ANOVA on the differences among the responses of the respondents in terms of the Sports Development Program

The significant differences of the respondents' responses in terms of the sports development program are exemplified in Table 7. To examine closely on its

implication, a one-way between groups analysis of variance was employed by the researcher. Undoubtedly, a significant difference seems to be apparent in terms of the sports development program where F(5, 301) = 31.973, p < 0.05 across all programs. Valuing its statistical significance, a small effect occurs in the actual difference in mean scores between groups. This was calculated using eta squared that generated its effect size to 0.35. The Post-hoc using T-test analysis assuming equal variances is utilized for possible association between groups. Findings revealed that the mean score for the BEEd (M = 1.29; SD = 0.67) is significantly different when paired with the students of the BSEd (M = 2.27; SD = 0.81), BSBA (M = 3.11; SD = 0.57), BAT (M = 2.88; SD = 0.84), BSHM (M = 3.12; SD = 0.68), and the BSCS (M = 3.09; SD = 0.67). Other than those groups mentioned significant differences are also found between BSED and BSBA, BSEd and BAT, BSEd and BSHM, BSEd and BSCS.

 Table 7. ANOVA on the differences among the responses of the respondents in terms of the Sports Development Program

Source of Variation	SS	df	MS	F	Sig
Between Groups	69.566	5	13.913	31.97	0.000
				3	
Within Groups	130.982	301	0.435		
Total	200.548	306			

4.8 ANOVA on the differences among the responses of the respondents in the Office of the Student Affairs and Services

Shown in Table 8 is the significant difference of the respondents' responses in the office of the student affairs and services. To verify its significance level, a one-way between groups analysis of variance was employed. It is undeniable that a significant difference substantially proves across all programs in the office of the student affairs and services where F(5, 301) = 39.041, p < 0.05. Its statistical significance rests to a small effect in the actual difference of the mean scores between groups. This was calculated using eta squared that generated its effect size to 0.39.

For possible association between groups citing its significant level, Post-hoc using T-test analysis assuming equal variances is utilized. Results show that the mean score for the BEEd (M = 1.37; SD = 0.64) is significantly different when paired with the students of the BSEd (M = 2.61; SD = 0.87), BSBA (M = 3.40; SD = 0.56), BAT (M = 2.99; SD = 0.75), BSHM (M = 3.05; SD = 0.78), and the BSCS (M = 3.28; SD = 0.62). Some of the groups when paired with each other also generate a remarkable significant level. These include the BSEd and BSBA, BSEd and BAT, BSEd and BSCS, BSBA and BAT.

in the Office of the Student Affairs and Services								
Source of Variation	SS	df	MS	F	Sig			
Between Groups	72.542	5	14.508	39.041	0.000			
Within Groups	111.857	301	0.372					
Total	184.399	306						

 Table 8. ANOVA on the differences among the responses of the respondents in the Office of the Student Affairs and Services

4.9 ANOVA on the differences among the responses of the respondents in terms of the Guidance Services

The significant differences among the responses of the respondents in terms of the guidance services are shown in Table 8. In like manner, a one-way between groups analysis of variance was employed to look into upon which groups differ their responses in one way or another. A revealing observation is occurred that substantiates its significant difference in the guidance services F (5, 301) = 31.950, p < 0.05. Considering the statistical significance of the study, the actual difference in mean scores between groups comes to a small effect. The effect size, calculated using eta squared is 0.34.

Post-hoc comparison using T-test analysis assuming equal variances revealed that the mean score for the BEEd (M = 1.40; SD = 0.84) is significantly different when paired with the students of the BSEd (M = 2.59; SD = 0.75), BSBA (M = 3.16; SD = 0.61), BAT (M = 2.95; SD = 0.74), BSHM (M = 2.82; SD = 0.73), and the BSCS (M = 3.30; SD = 0.62). Moreover, more paired groups reveal a statistical significant difference with each other; BSEd and BSBA, BSEd and BAT, BSEd and BSCS, BAT and BSCS.

Table 9. ANOVA on the differences among the responses of the respondents									
in terms of the Guidance Services									
	Source of Variation	22	df	MS	F	Sig			

Source of Variation	SS	df	MS	F	Sig
Between Groups	60.731	5	12.146	31.950	0.000
Within Groups	114.428	301	0.381		
Total	175.159	306			

4.10 ANOVA on the differences among the responses of the respondents in terms of the Library Services

As can be gleaned in Table 10, the significant differences of the respondents in terms of their experiences in the use of the library services prove to be evident. The researcher utilized the one-way between groups analysis of variance to have an in depth examination how library services influenced their perceived responses. This yields a notable result as a significant difference exists in terms of

the library services among the six programs F(5, 301) = 18.194, p < 0.05. The actual difference in mean scores between groups lies only a small effect as the effect size generated an eta squared of 0.23.

Comparative results using the Post-hoc T-test analysis assuming equal variances reveals that the mean score for the BEEd (M = 1.93; SD = 1.02) is significantly different when paired with the students of the BSEd (M = 2.70; SD = 0.94), BSBA (M = 3.31; SD = 0.59), BAT (M = 2.97; SD = 0.79), BSHM (M = 3.03; SD = 0.58), and the BSCS (M = 3.27; SD = 0.55). More importantly, significant differences are also found on the responses of the students when paired with BSED and BSBA, BSEd and BSCS, BSBA and BAT.

 Table 10. ANOVA on the differences among the responses of the respondents in terms of the Library Services

Source of Variation	SS	df	MS	F	Sig
Between Groups	35.135	5	7.027	18.194	0.000
Within Groups	116.255	301	0.386		
Total	151.391	306			

4.11 ANOVA on the differences among the responses of the respondents in terms of the Internet and Computer Laboratory Services

Given a picture of the significant difference of the respondents' responses in the use of the internet and computer laboratory services is illustrated in Table 11. To test whether or not a significance level exists, the researcher makes use of the one-way between groups analysis of variance. Findings unquestionably resulted to such significant difference across all programs in as far as the internet and computer laboratory services are concerned where F(5, 301) = 17.525, p < 0.05.

The eta squared was calculated at 0.23 having regarded a small effect size in the actual difference of the mean scores between groups considering its statistical significance. The revealing significance level prompts the researcher to utilize the Post-hoc using T-test analysis assuming equal variances for possible association as to which groups differ one from the other.

Results show that the mean score for the BEEd (M = 1.27; SD = 0.65) is significantly different when paired with the students of the BSEd (M = 1.78; SD = 0.68), BSBA (M = 2.61; SD = 0.71), BAT (M = 2.48; SD = 0.96), BSHM (M = 2.38; SD = 0.93), and the BSCS (M = 2.63; SD = 0.71). BSEd and BSBA have also shown significant differences with each other. Further, BSEd and BAT, BSEd and BSHM, BSEd and BSCS groups show the same statistical differences.

in terms of the internet and Computer Services						
Source of Variation	SS	df	MS	F	Sig	
Between Groups	44.966	5	8.993	17.525	0.000	
Within Groups	154.463	301	0.513			
Total	199.430	306				

 Table 11. ANOVA on the differences among the responses of the respondents in terms of the Internet and Computer Services

5. Conclusion

The findings of this study provide theoretical and practical implications in the academic sectors nowadays most particularly by virtue of Republic Act No. 10931 or the Universal Access to Quality Tertiary Education Act. This implies further that State Universities and Colleges (SUCs), based upon the implementing rules and regulations shall cover the tuition and other fees of all students who opt to enroll their tertiary education. The number of students from the Bachelor of Agricultural Technology program accounts forty-five percent or 138 in the total number of respondents. There are more female than male respondents comprising fifty-five percent as the subject of the study.

Roman Catholic believers dominate the religious affiliation of about 198 or close to sixty-four percent. Generally, the level of student services as perceived by the respondents is high. No significant difference was found in all the student services when grouped according to their sexual identities. However, significant differences were unveiled on all student services when classified according to the various programs of the respondents. Summing it up, the findings support Astin's theory of student involvement as a theoretical ground in this study. As Astin posits in one of his postulates, that students have varying degrees of involvement in various objects as well as time differences.

6. Recommendation

The Surigao del Sur State University, the premier university in the province of Surigao del Sur, has undoubtedly exerted a lot of efforts in providing valuable services more than what students desire for. As education is a never ending process so as the need to constantly ensure that student services are well addressed with the varying needs of the students. The periodic evaluation of student services gauges its way in deliberating issues and concerns in order to foster relationship within the academic community. The high level of student services at SDSSU Tagbina Campus manifests that these services are observed occasionally and have not fully met the expectations of the students. The school administration may revisit existing policy guidelines and provisions as to the implementation of the enrollment services, and guidance services. The Office of the Student Affairs and Services (OSAS) may also conduct a review on implementing rules and policy reviews governing student development and services programs including but not limited to co-curricular and extracurricular activities. The student services program is an investment (Alegado, 1997) for the higher education institutions that the administration has to work together for proper implementation and monitoring. In the same vein, the school administration may revisit policies and guidelines as to the welfare of the faculty members who serve as club moderators/advisers in various sports, sociocultural and campus-based organizations who deserve due recognition in their efforts of strengthening the skills, abilities and talents of students. Allocation of resources and periodic upgrade of facilities and equipment are highly recommended to the medical, library, internet and computer laboratory services. With this, considerable amount of efforts are needed for SDSSU Tagbina Campus administration to achieve a very high level of student services. Since the present study focuses on the varying levels of student services; hence, an in-depth examination of service quality in relation to student satisfaction is highly proposed.

7. Practical Implication

With the full implementation of the Republic Act 10931 at the time of this study, the SDSSU system, a state-run institution, sees handful opportunities in support of its vision especially that the influx of freshmen, transfer students and the lifelong learners may take place. The administration of the university has to strengthen their concerted efforts to provide quality services to the students in its optimum level as competition among the state universities have become wider due to the prevailing law on the universal access to quality education. Nevertheless, the findings of this study are noteworthy for the administration to continuously conduct regular assessment and review as to the magnitude of the services offered to the students. This also prepares the management of SDSSU Tagbina Campus for future challenges especially that quality management systems in the academic sectors are indispensable. Equally important, these findings aid in the program and policy reviews of the administration as the university conforms to quality standards on student affairs and services as a recognized academic institution by the Accrediting Agency of Chartered Colleges and Universities (AACCUP) and as an official affiliate of the ISO 9001-2015 duly certified by the National Quality Assurance Firm. On the whole, realizing its vision as a "glocal" university, SDSSU unceasingly goes beyond borders in its capacity to transform lives through suitable education to all ages. Its thrust is attuned to the ongoing internationalization of the academic industry as Philippines like any other Asian countries welcomes globalization in the new millennium.

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