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ORIGINAL RESEARCH

An Audit of Turnaround Time in Histopathology: A Comparative Study of Two Years in a Teaching Health Facility

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Abstract

Background: Pathology laboratory turnaround time (TAT) is an important quality indicator of laboratory performance. Delay in the issuance of reports contributes to prolonged patients' treatment-waiting time, decreases satisfaction, and increases patient morbidity and the cost of treatment.

Aim: To evaluate the TAT in the Histopathology Unit of the Department of Morbid Anatomy and Histopathology of a Nigerian teaching hospital and compare the findings with those of similar studies elsewhere.

Methods: This was a retrospective descriptive study of all the consecutive surgical samples received in the Department of Morbid Anatomy and Histopathology of Ladoke Akintola University of Technology Teaching Hospital, Ogbomoso, Nigeria, in the years 2016 and 2021. In determining the TAT, specimen handling as a process was divided into four stages: grossing time, tissue processing time, reporting time, and transcription time.

Results: The mean TAT for 2016 and 2021 were 15.23±10.05 days and 18.10±9.61 days, respectively. In 2016 and 2021, respectively, 57.0% and 43.6% of cases were grossed, processed with slides reported, and results typed, corrected, and signed within 14 days. There was no significant linear relationship between TAT for 2016 and 2021($r = 0.018$ and $p = 0.685$).

Conclusion: The tasks of grossing specimens, reporting slides and verification of results were major contributors to TAT, with tissue processing also playing a significant role. These findings underscore the importance of proper funding and implementation of a quality management system to optimise workflow in histopathology.

Keywords: Audit, Grossing, Laboratory specimen, Laboratory reporting, Tissue processing, Transcription, Turnaround Time.

Introduction

Pathology laboratory turnaround time (TAT) is the time between receiving a specimen in the laboratory and when the report is ready for collection or dispatch. Timeliness in delivering histopathology reports is essential as it enables physicians to make patient healthcare decisions efficiently. [1, 2] There are varying perspectives on the importance of the timeliness of pathology reports. Laboratories usually focus on the accuracy of reports as being the most vital outcome of the laboratory process. In contrast, users of laboratory services often place a premium on the timeliness of laboratory reports as the most significant yardstick of quality. [1]

TAT is also viewed as the sum of the various complex and interwoven laboratory, technical, clerical, and human interpretive processes that eventuate in the final diagnostic report. [1,2] The delay in issuance of laboratory reports contributes to prolonged patients' treatment-waiting time, decreases satisfaction, and increases patient morbidity and cost of treatment. [3] Pathology practice in developing countries has reportedly been characterised by systematic delay in processing and reporting. This is due to a chronic shortage of pathologists in the region. [4] In a study conducted at the Queen Elizabeth's Central Hospital in Malawi, a median TAT of 31 days was observed for 544 suspected cancer patients. [5] In University College Hospital, Ibadan, the mean TAT for all samples studied by Ajani *et al.* was 22 days (±10 days). [2]

Besides the shortage of pathologists, a poor laboratory management system also significantly affects the timeliness of laboratory reports. A poor laboratory management system may contribute to fixation problems, poor tissue processing and staining, delayed reporting, transcription errors, and poor maintenance of laboratory equipment, among others. [5-7]

This study aimed to evaluate the TAT in the Histopathology Unit of the Department of Morbid Anatomy and Histopathology of a Nigerian Teaching Hospital, comparing the findings with those of similar studies and measuring them against international standards. [8-10] The study compared the TAT of 2016 with that of 2021, which was to measure the laboratory performance over the years, with a view to identifying factors that affected TAT in this period. The study also served as an audit to promote good laboratory practice. These two years were intentionally selected to represent distinct time points—2016 serving as the baseline period before widespread doctor resignations and a prolonged phase of industrial harmony over poor remuneration, and 2021 reflecting a period marked by a significant reduction in medical staff within the department. This non-consecutive year design allowed for a more robust assessment of long-term trends and the impact of structural and workforce changes.

Methods

Study design

This was a retrospective descriptive study of 500 consecutive surgical samples received at the Department of Morbid Anatomy and Histopathology of Ladoke Akintola University of Technology Teaching Hospital, Ogbomoso, Nigeria, in the years 2016 and 2021.

Ethical considerations

Permission to conduct this study was obtained from the Ethical Review Committee of the health facility with the protocol number LTH/OGB/EC/2023/443. This study was also conducted in compliance with the guidelines of the Helsinki Declaration on biomedical research on human subjects. All the data obtained was stored in a personal password-protected computer, thereby maintaining the confidentiality of the identity of the patients and their personal health information.

Data collection

Necessary information, such as dates, type of specimen, and histopathology diagnosis, was extracted from the department records. The tissue samples were categorised into small to intermediate and large-sized to complex samples. The small samples included, but were not limited to, endoscopic gastrointestinal biopsies and needle biopsies of the liver, breast, and prostate. Samples such as bone, mastectomy, colectomy, and hysterectomy were categorised as large-sized and complex samples. Specimen handling as a process was divided into four stages: reception and grossing by pathologists, tissue processing by technical staff, reporting by pathologists, and transcription by clerical staff. The first stage is the grossing time (T1), which refers to the time (in days) between the reception of the specimen and the moment grossing was completed. This is followed by the processing time (T2), which was the time between the completion of grossing of a tissue and the submission of histological slides for reporting. The reporting time (T3) is the period of reporting. It is defined as the interval between the submission of histopathology slides to a pathologist and the time the written report was sent out for typing or transcription. Finally, the transcription (T4) time is the period during which the reports were typed, proofread, printed, and eventually signed. All times were consecutive calendar days, including the weekends.

Data analysis

The data obtained was analysed using Microsoft Excel and Statistical Package for the Social Sciences (SPSS) Software (IBM, SPSS Statistics for Windows, Version 23.0). Calculation of mean and standard deviation was done. Chi-squared test and Pearson correlation were used to test the relationships between categorical variables, and continuous datasets. A p-value less than 0.05 was considered to indicate statistical significance.

Results

The mean number of days for grossing time, tissue processing time, reporting time, transcription time, and TAT for 2016 was 1.19±1.32, 4.97±4.72, 4.69 ±4.69, 4.38 ± 7.38, and 15.23±10.05 days, respectively. The mean number of days for grossing time, tissue processing time, reporting time, transcription time, and TAT for 2021 was, respectively, 3.12±3.68, 5.29±4.85, 6.50±7.00, 3.20±2.22, and 18.10±9.61 days. The ranges were 2 to 79 and 6 to 95 days for 2016 and 2021, respectively. There was no statistically significant difference in TAT between the two periods (r = 0.018 and p = 0.685 (Table I). In 68.2% of cases, the results were available for collection within 14 days in 2016 compared to 47.6% of cases within 14 days in 2021 (Table II).

Out of 500 specimens reviewed in 2016, gynaecological specimens accounted for 26.6% (n = 133), followed by breast specimens (93; 18.6%), and gastrointestinal specimens (81; 16.2%). In 2021, breast, gynaecological and gastrointestinal specimens accounted for 120 (24.0%), 103 (20.6%) and 108 (21.6%) of the 500 specimens reviewed (Table III).

Table I: Distribution of components of TAT of histopathology specimens in 2016 and 2021

Year	*Number*	*GT*	*PS*	*RT*	*TT*	*TAT*
2016	500	1.19±1.32	4.97±4.72	4.69±4.69	4.38±7.38	15.23±0.05
2021	500	3.12±3.68	5.29±4.85	6.50±7.00	3.20±2.22	18.10±9.61

Paired T-test (TAT): r = 0.018, *P*-value = 0.685

GT - Grossing time, PS - Tissue processing time, RT - Reporting time, TT - Transcription time

Table II: Comparison of total TAT for 2016 and 2021

Turnaround time	*2016*	*2021*
0 to 7 days	56 (11.2)	2 (4.0)
8 to 14 days	285 (57.0)	218 (43.6)
15 to 21 days	71 (14.2)	168 (33.6)
More than 21 days	88 (17.6)	112 (22.4)
Total	500 (100.0)	500 (100.0)

Table III: Frequencies according to organ system, specimen size and diagnostic category

	2016		*2021*	
	Frequency	*Percentage*	*Frequency*	*Percentage*
Organ systems				
Breast	93	18.6	120	24
Bone and soft tissue	41	8.2	29	5.8
Gynaecological	133	26.6	103	20.6
Gastrointestinal	81	16.2	108	21.6
Lymphoreticular	22	4.4	10	2
Head and neck	29	5.8	40	8
Skin	27	5.4	23	4.6
Urological	74	14.8	67	13.4
Specimen size				
Small	357	71.4	372	74.4
Large	143	28.6	128	25.6
Diagnostic category				
Neoplastic lesion	246	49.2	276	55.2
Non-neoplastic lesion	254	50.8	224	44.8
Total	**500**	**100.0**	**500**	**100.0**

Within 0 to 14 days, 70% and 45.8% of reports for breast specimens were ready for collection in 2016 and 2021, respectively. In 2016, 61.7% and 75.3% of gynaecological and gastrointestinal specimens were grossed, processed with slides reported, and results typed and signed within 0 to 14 days. In 2021, 37.9% and 45.4% of gynaecological and gastrointestinal specimens were grossed, processed with slides reported and results typed and signed within 0 to 14 days. There was no significant association between the nature of the specimen and TAT, with p-values of

0.481 and 0.463, respectively, for 2016 and 2021. (Table IV)

Table IV: Distribution of TAT according to organ systems, specimen size and diagnostic category

	2016			*2021*		
	0 to 7	***8 to 14 days***	***>14 days***	***0 to 7***	***8 to 14 days***	***>14 days***
Organ system						
Breast	13 (14.0)	52 (55.9)	28 (30.1)	2 (1.7)	53 (44.2)	65 (54.2)
Bone and soft tissue	5 (12.2)	25 (61.0)	11 (26.8)	0 (0.0)	13 (44.8)	16 (55.2)
Gynaecological	8 (6.0)	74 (55.6)	51 (38.3)	0 (0.0)	39 (37.9)	64 (62.1)
Gastrointestinal	12 (14.8)	49 (60.5)	20 (24.7)	0 (0.0)	49 (45.4)	59 (54.6)
Haematopathology	2 (9.1)	13 (59.1)	7 (31.8)	0 (0.0)	6 (60.0)	4 (40.0)
Head and neck	8 (27.6)	12 (41.4)	9 (31.0)	0 (0.0)	21 (52.5)	19 (47.5)
Skin	1 (3.7)	16 (59.3)	10 (37.0)	0 (0.0)	6 (26.1)	17 (73.9)
Urological	7 (9.5)	44 (59.5)	23 (31.1)	0 (0.0)	31 (46.3)	36 (53.7)
p-value			*0.481*			*0.463*
Specimen size						
Small	41 (11.5)	217 (60.8)	99 (27.7)	2 (0.5)	170 (45.7)	200 (53.8)
Large	15 (10.5)	68 (47.6)	60 (42.0)	0 (0.0)	48 (37.5)	80 (62.5)
p-value			*0.018*			*0.099*
Diagnostic categories						
Neoplastic lesion	29 (11.8)	132 (53.7)	85 (34.6)	0 (0.0)	131 (47.5)	145 (52.5)
Non-neoplastic lesion	27 (10.6)	153 (60.2)	74 (29.1)	2 (0.9)	87 (38.8)	135 (60.3)
Total	**56 (11.2)**	**285 (57.0)**	**159 (31.8)**	**0 (0.0)**	**220 (44.0)**	**280 (56.0)**
p-value			***0.063***			***0.092***

A total of 71.4% of the specimens were small to intermediate-sized, while large to complex specimens accounted for 28.6% in 2016. In 2021, a total of 74.4% of the specimens were small to intermediate-sized, while large to complex specimens accounted for 25.6% (Table III). In 2016 and 2021, respectively, the results of 72.3% and 46.2% of small to intermediate-sized specimens were ready for collection within 0-14 days. In 2016 and 2021, respectively, the results of 58.0% and 37.5% of large to complex specimens were ready for collection within 0-14 days. There was a significant association between the sizes of the specimens and TAT (p = 0.018) in 2016 but there was no significant association between the size of the specimen and TAT (p = 0.099) in 2021 (Table IV).

Tumours were diagnosed in 42.2% and 55.2% of all the specimens reviewed in 2016 and 2021, respectively (Table III). In 2016 and 2021, respectively, 65.4 % and 47.5% of tumour cases were grossed, processed with slides, reported, and results typed and signed within 0 to 14 days. There was no significant association between the nature of the specimen and TAT, with p-values of 0.063 and 0.092 in 2016 and 2021, respectively (Table IV).

Discussion

Turnaround time in the laboratory is an integral component of a quality management system. In this study, the ranges were 2 to 79 days for 2016 and 6 to 95 days for 2021, respectively. Our findings were higher than 2-15days, 3-18days, and 3-59 days reported in Lahore (Pakistan), Jos (Nigeria), and Eldoret (Kenya), respectively. [3,11,12] Similarly, the mean of TAT was 15.23±10.05 and 18.10±9.61days for 2016 and 2021 respectively. Our findings were higher than 5.6 days (Lahore, Pakistan) and 7.5 days (Jos, Nigeria), but similar to 16.2±10.20 days in Kenya. [3,11,12] This prolonged turnaround time in our centre can be attributed to multiple factors, including recurrent industrial actions due to poor remuneration, the absence of a structured quality management system, and the emigration of pathologists and residents to other centres within the country and overseas. The non-availability of residents at the facility was also due to a lack of accreditation for training in pathology by training regulatory authorities. Our findings were also lower than those of 31 days and 22 days recorded in Queen Elizabeth's Central Hospital, Malawi, and the University College Hospital, Ibadan, respectively. [2, 5] Variations in the workload and service structure may explain this relatively lower TAT. Also, unlike our centre, some of the compared institutions function as dedicated oncology centres and laboratories that serve cancer centres, which are known to have longer TAT. [5]

A review of the literature showed huge disparity in TAT between developed and developing nations. [4] The College of American Pathologists recommended that TAT for routine surgical biopsies should be no longer than 2 days TAT for routine surgical biopsies. [8] According to the guidelines of the Royal College of Pathologists, it was recommended in 2013 that the percentage of diagnostic biopsies reported, confirmed, and authorised within 7 days of biopsy should be 80 per cent. In 2014, the threshold was pegged at 90 per cent. The Royal College of Pathologists of Ireland also prescribed a target of 80% of histopathology cases to be completed by day 5. [10] In our centre, only 11.2 per cent and 4.0 per cent of histopathology reports were released within seven days in 2016 and 2021, respectively, which is significantly lower than the recommended standards. [8-10] Also, 68.2 per cent and 44 per cent were reported within 14 days in 2016 and 2021, respectively. Our findings were in disparity with what was obtained in Uyo, Nigeria, where 15.2 per cent, 70.6 per cent, and 96.4 per cent of cases were reported within 7, 10, and 14 days, respectively. [13] Similarly, in Jos, Nigeria, 20.80 per cent, 54.80 per cent, 73.20 per cent, and 92.40 per cent of cases were reported within three, six, eight, and 11 days, respectively. [3] This further reflects a vast disparity between TAT in developed and developing countries due to systemic limitations in human resources, infrastructure, and workflow optimisation. [6, 8-10,14,15]

In the present study, the mean number of days for grossing time, tissue processing time, reporting time and transcription time in 2016 were 1.19, 4.9, 4.69, and 4.38 days, respectively, while the mean number of days for grossing time, tissue processing time, reporting time and transcription time for 2021 were 3.12, 5.29, 6.50, and 3.20, respectively. Our findings exceeded those obtained in Jos, with reported mean times of 1.6, 3.5, 1.9, and 1.1 days for grossing, processing, reporting, and transcription, respectively.[3] However, our findings were lower than histological processing, reporting, and transcription time of 1.5, 5.9,9.1 and 5.6 days obtained in a study by Ajani *et al.* at the University College Hospital, Ibadan. [2] Grossing time in our study was higher than that obtained in Jos and Ibadan in both periods covered in our study. This could be attributed to the shortage of resident doctors in our centre, which was more apparent in 2021. In 2016, the

department had six resident doctors and two full-time equivalent (FTE) consultant histopathologists, while in 2021, there was just one resident doctor and one FTE consultant. Interestingly, TAT was longer in 2021 compared to 2016. The prolonged TAT observed in 2021 can be attributed not only to a shortage of consultant pathologists but also to the non-availability of resident doctors, as the department was not accredited for residency training in pathology hence, experienced poor staff retention. These challenges have been further worsened by the ongoing mass emigration of doctors and other healthcare professionals seeking better opportunities overseas. This exodus has significantly reduced the availability of trained pathology personnel and negatively impacted indices of laboratory performance.

Also, tissue processing contributed to 32.6 per cent and 29.2 per cent of the total TAT in 2016 and 2021, respectively. Our findings were closer to what was obtained by Ajani *et al*. who reported that tissue processing contributed to 27 per cent of TAT. [2] However, our findings were lower than what was obtained in Jos, where tissue processing consumed 35.5 per cent of TAT. [3] In our centre, medical laboratory scientists and technicians were primarily responsible for the tissue processing phase. Although the department had two tissue processors, only one was functional at any given time. Occasionally, both processors became faulty simultaneously, compounding delays. Furthermore, technical issues such as the need for re-grossing and re-cutting of tissue sections also contributed to extended TATs. Capacity building and further training may help in overcoming these non-conformity events. [13]

Reporting of slides by pathologists, added approximately 31 per cent and 24.6 per cent to the duration of TAT in 2016 and 2021, respectively. Our finding was lower than the report from Ibadan (41 per cent) but was within the same range as obtained in Jos (27.7 per cent). [2, 3] Reporting time is primarily influenced by hierarchical reporting because of the number of doctors that may need to examine the cases, especially in teaching hospitals. In our centre, the residents would first report the slides, pass them to the consultant pathologists who would review and sign out the results.

This responsibility of training pathology residents, coupled with other roles of overseeing laboratory services and holding academic positions in the universities, can increase the workloads of pathologists, which could affect laboratory performance. [14 - 16] Also, in some cases, there were periodic intra-departmental conference meetings to finalise some diagnoses and teach resident doctors. In addition, the lack of multi-headed and projecting microscopes made intra-departmental consultation and training of residents difficult, which inadvertently contributed to prolonged TAT in this audit. Transcription of results also contributed to 28.8 per cent and 17.7 per cent of the total TAT in 2016 and 2021, respectively. Our findings were similar to what Ajani *et al.* reported that transcription contributed to 25 per cent of TAT. A study in Jos also observed that transcription consumed 19.3 per cent of TAT. [3] Transcription time is the time involved in typing, correcting and signing out of reports. [3] The secretarial staff and the pathologist are involved in this phase. Utilising a laboratory information system can facilitate the transcription process and reduce the time required for results verification in a paper-based system. A Laboratory Information System (LIS) is a software-based laboratory information management system that helps manage and track laboratory data, samples, and testing results. It is used in healthcare facilities to manage laboratories, including ordering of tests, grossing of specimens, tissue processing and reporting of results. [17,18] The size of specimens may

determine histopathology TAT depending on departmental policy. [19]

In this present study, we observed a significant association between the size of the specimen and TAT in 2016 unlike in 2021, indicating that there was a decline in laboratory performance over the years. Despite this, the sizes of specimens may contribute to TAT. However, Ajani *et al.* argued that other factors were responsible for the prolonged TAT. A similar observation was made in Uyo. [13] In advanced laboratories, small-sized specimens, especially endoscopic and trucut biopsies, are prioritised and handled as emergencies with a view to establishing a quick diagnosis. In contrast, large and complex specimens require more time for ~~a~~dequate fixation or special handling, like decalcification, before embedding in paraffin. [8,9,10,19]

Furthermore, the type of tissues had no significant association with TAT. In 2016 and 2021, respectively, gynaecological and breast specimens accounted for most of the cases handled. In our centre, all specimens were processed in the same way, and there was a departmental policy of overnight fixation with emphasis on specimens like breast, gastrointestinal tract, urological and gynaecological specimens. Studies have shown that overnight fixation of specimens was associated with prolonged TAT. [19,20] Furthermore, the wait for special stains and deeper sections in the liver, renal, gastric, and bone marrow biopsies may prolong TAT.

Other factors that may determine TAT are the histological diagnosis. In our study, we found that there was no significant association between histological diagnosis and TAT. Our findings were in contrast with what was obtained in Uyo, where a substantial association between TAT and pathologic diagnosis was noted. [13] Literature review also shows that cancer diagnoses were known to cause increased TAT, and laboratories that served cancer centres were known to have longer TAT. [5]

Our research has shown that laboratory performance declined within the study periods, as measured by the turnaround time (TAT), which is a key monitor and indicator of the overall quality of the laboratory service and is considered a critical element of quality due to its impact on the clinical management of patients. [21] Evidently, there is a gap between TAT in developed and developing nations, and this is due to the non-availability of national or local guidelines on quality management systems in histopathology. [4,22,23] Other factors described in literature as contributing factors to prolonged TATs include inter-professional competition, poorly structured quality assurance programs, inadequate infrastructures, and poor funding of laboratories. [4.16,22]

To mitigate prolonged turnaround time and declining laboratory performance, we recommend the implementation of a national quality management system in histopathology laboratories to ensure consistent standards, set TAT targets and facilitate regular audits. [24,25] Furthermore, TAT targets should be reviewed at periodic departmental quality assurance meetings. The targets that were not achieved should be discussed and reviewed. Restoration and strengthening of residency training programs are essential to ensure continuous human resources development in the field. Improving remuneration and working conditions for pathologists and laboratory staff is crucial to enhancing job satisfaction and reducing attrition. Strategic measures should be put in place to curb the effects of the excessive emigration of doctors, and these include career advancement opportunities, retention bonuses, and bilateral agreements for temporary placements abroad. There is also a need for more advocacy by medical bodies to canvass for proper funding of pathology services by hospital managements and governments at all levels.

Conclusion

The tasks of grossing specimens, reporting slides, and verification of results were major contributors to prolonged TAT, with tissue processing also playing a significant role. These findings underscore the importance of implementing a quality management system to optimise workflow in histopathology. Adequate funding of pathology services and capacity building for both pathologists and technical staff are required to achieve the desired optimization of workflow. In addition, regular quality assurance meetings to constantly evaluate and audit laboratory processes would help reduce TAT and ensure good service delivery.

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