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Retrospective Analysis of Ultrasonography Trends in a Tertiary Care Hospital

*Md. Khorshed Alam

**Professor & Head, Department of Radiology and Imaging, Chattogram Maa-O-Shishu Hospital (CMSH), Chattogram, Bangladesh*

Corresponding author: Dr. Md. Khorshed Alam, Professor & Head, Department of Radiology and Imaging, Chattogram Maa-O-Shishu Hospital (CMSH), Chattogram, Bangladesh

Abstract

Background: *Ultrasonography is an essential, rapidly expanding diagnostic tool, especially in resource-limited settings, yet long-term utilization patterns in Bangladeshi tertiary hospitals are not well documented. Rising disease burdens and increased reliance on ultrasound highlight the need for systematic analysis. This study aims to examine eight-year trends (2018–2025) in ultrasonography use, including annual volumes, shifts in scan types and overall workload patterns.*

Methods: *This retrospective descriptive study reviewed eight years of ultrasonography records (2018–2025) from (Hospital name) hospital's radiology database. All 7632 complete scan logs were extracted and categorized by year and ultrasound type, including whole abdomen, PVR, pregnancy, liver, thyroid, testis, breast, neck, brain, pelvis, and soft-tissue swelling. Incomplete or duplicate entries were excluded. Annual scan volumes, year-to-year changes, and proportional contributions of each scan type were calculated, and long-term trends were evaluated. Analysis relied solely on descriptive statistics, with results presented as frequencies and percentages.*

Results: *Ultrasonography utilization showed significant fluctuations over the eight years, with a sharp decline during 2020–2021 followed by a strong rebound beginning in 2022. Total annual scans rose from 923 in 2018 to 1507 in 2025. Whole-abdomen scans consistently dominated the workload (about 72–75%), while PVR studies increased steadily to become the second-largest category. Pregnancy, liver, thyroid, and testicular scans declined during the pandemic but recovered gradually. Other specialized scans remained low in volume. Overall, the data show clear post-pandemic recovery and rising long-term diagnostic demand across multiple ultrasound categories.*

Conclusion: *Ultrasonography use declined sharply during the pandemic but recovered rapidly and surpassed pre-pandemic levels. Whole-abdomen scans remained the main workload driver, with steady growth in PVR and other specialized studies. These trends underscore the continued importance of ultrasound in routine diagnostics and the need for strengthened resource planning to meet increasing demand.*

Keywords: *Ultrasonography Utilization, Diagnostic Imaging Trends and Workload Analysis*

I. INTRODUCTION

Diagnostic ultrasonography has evolved into a central imaging modality in modern healthcare owing to its safety, affordability, portability and versatility. It employs real-time sonographic waves rather than ionizing radiation, which enhances its appeal for repeated use and broad clinical applications [1]. Globally, the use of ultrasound has been expanding especially in low- and middle-income countries (LMICs) both as a frontline diagnostic tool and as a guide for interventional procedures [2]. A systematic review of ultrasound uses in LMICs identified increasing deployment of ultrasound across diverse specialties and geographic regions, reflecting its important role in resource-constrained environments [2]. From an epidemiological perspective, the global burden of non-communicable diseases such as liver disease, thyroid nodules, prostate/pelvic pathology and obstetric complications underlines the clinical relevance of ultrasound services. Moreover, the demographic transition and the rise in chronic diseases mean that that imaging demand is increasing. Studies in tertiary radiology departments in Africa demonstrated that, although ultrasound remained the second most common specialized imaging modality, its relative growth and use patterns shifted markedly over time [3]. In one South African tertiary centre between 2013 and 2019, overall ultrasound volume rose by 12% despite a decrease in general abdominal scans and substantial increases in musculoskeletal and small-part scans [3]. Such findings illustrate how modality and body-region utilization may evolve in tertiary imaging workflows. In Bangladesh's regional context, imaging infrastructure is undergoing rapid development. Published data show that ultrasound machines are present in virtually all major hospitals in Dhaka and diagnostic centres, and the national market for medical imaging equipment especially ultrasound is forecast to grow at approximately 8% annually [4,5]. However, utilization rates and longitudinal service-use patterns within tertiary settings remain under-investigated. One survey in

Bangladeshi district hospitals indicated workload utilization rate of about 71% for ultrasound equipment among functional machines, yet highlighted major gaps in maintenance, manpower, and infrastructure [6]. The clinical relevance of tracking ultrasonography utilization in a tertiary care environment is multifaceted. First, changes in scan volumes and spectrum (for example, whole-abdomen versus small-part/thyroid) can reflect shifting disease patterns, referral behaviours, and service capacity. Second, for hospital administration and radiology service planning, understanding temporal trends supports resource allocation, workforce planning and training curricula. Third, from a research perspective, analyzing such trends can expose service-delivery gaps, guide quality-improvement initiatives, and inform health-system strengthening efforts. Despite the clear significance, several evidence gaps exist. Published studies of ultrasound utilization trends in tertiary settings are relatively few, especially in South Asia; the majority focus on equipment availability or single clinical indications rather than longitudinal, multi-type workload analysis. Many LMIC studies remain descriptive and lack a detailed breakdown by scan type, body region or referral trend [2]. In Bangladesh specifically, there is scarce research addressing annual service volumes, year-to-year changes and the proportional contribution of scan categories in a tertiary hospital. Given these gaps, the present study is necessary. It aims to provide a retrospective analysis of ultrasonography service utilization over eight years (2018-2025) in a tertiary-care hospital in Bangladesh, examining annual scan volumes, year-to-year changes, distribution by major scan types and temporal growth patterns. The overarching aim is to characterize utilization trends, identify key workload drivers and support strategic planning for ultrasound services in the Bangladeshi tertiary-care context.

II. METHODS

This retrospective descriptive study was conducted at (hospital name) and examined trends in ultrasonography utilization over 8 years from January 2018 to December 2025. A total of 7632 ultrasonography records archived in the institutional radiology database were reviewed; the dataset included complete annual logs of outpatient and inpatient scans. Data extraction focused on year-wise frequencies of all ultrasonography scans performed, including whole abdomen, post-void residual (PVR) assessment, pregnancy-related scans, liver ultrasound, thyroid ultrasound, testicular scans, breast scans, neck ultrasound, brain ultrasound, pelvic scans, and soft-tissue swelling evaluations. Records with incomplete documentation, duplications, or erroneous entries were excluded to preserve data integrity. No patient identifiers were collected; analysis was limited strictly to aggregated service-level variables.

The extracted data were organized by calendar year and ultrasonography type. Total annual scan volumes were computed, and year-to-year percentage changes were derived to assess utilization dynamics. For each year, proportional contributions of individual ultrasonography types were calculated to illustrate shifts in workload distribution. Additionally, long-term growth trends were evaluated by identifying minimum and maximum annual counts for key categories, followed by descriptive interpretation of temporal patterns before, during, and after the COVID-19 period.

Quantitative analysis was performed using standard descriptive statistics. Absolute frequencies, percentages, and proportionate contributions were presented for categorical variables. Line and table-based evaluations were used to identify rises, declines, and stabilization phases across the eight-year window. No inferential statistical tests were applied, as the study's primary intent was to describe service utilization trends rather than determine causal associations. Given the retrospective nature of this study and the use of fully anonymized institutional data, ethical approval was obtained in accordance with hospital policy for secondary data analysis. All procedures respected confidentiality standards, and no individual patient-level clinical information was accessed.

III. RESULTS

Annual utilization of ultrasonography services showed substantial fluctuations over the 2018–2025 period, reflecting both external disruptions and subsequent recovery in service demand. Scan volumes rose from 923 in 2018 to 1082 in 2019, marking a 17.2% increase, followed by a sharp decline during 2020 and 2021, when scans fell to 675 and 326, respectively, representing reductions of 37.6% and 51.7% compared with the preceding years. A marked rebound occurred in 2022, with utilization increasing by 136.6%, and this upward trend continued through 2023 and 2024, with growth of 35.4% and 24.6%, respectively. By 2025, annual scans reached 1507, reflecting a further 15.7 percent increase.

Table 1. Annual Utilization of Ultrasonography Services from 2018 to 2025

Year	Total Scans (n)	Year-to-Year Change (%)
2018	923	—
2019	1082	17.2
2020	675	-37.6
2021	326	-51.7

2022	772	136.6
2023	1045	35.4
2024	1302	24.6
2025	1507	15.7
Total	**7632**	—

The year-wise distribution of ultrasonography types from 2018 to 2025 shows a consistent dominance of whole-abdomen scans, accounting for roughly 71–75% of all examinations each year, underscoring their central role in routine diagnostic demand. PVR studies constituted the second most frequent category, showing a gradual proportional increase from 8.1% in 2018 to 11.5% in 2025. Pregnancy-related scans fluctuated more substantially, with a marked decline during 2021, followed by steady recovery through 2025. Other specialized scans, including tests of the testes, breasts, brain, neck, thyroid, and pelvis, remained relatively low in volume across all years, generally representing less than 2% each. Small but observable increases occurred in testicular and thyroid scans over time, whereas breast and swelling scans displayed variable patterns without a sustained upward trajectory.

Table 2. Year-wise Distribution of Ultrasonography Types Performed, 2018–2025

Type	2018 (n=923)	2019 (n=1082)	2020 (n=675)	2021 (n=326)	2022 (n=772)	2023 (n=1045)	2024 (n=1302)	2025 (n=1507)
Testis	12 (1.3)	14 (1.3)	10 (1.5)	11 (3.4)	15 (1.9)	18 (1.7)	22 (1.7)	25 (1.7)
Breasts	5 (0.5)	7 (0.6)	6 (0.9)	1 (0.3)	12 (1.6)	18 (1.7)	28 (2.2)	4 (0.3)
Brain	7 (0.8)	8 (0.7)	5 (0.7)	3 (0.9)	5 (0.6)	6 (0.6)	7 (0.5)	8 (0.5)
Liver	41 (4.4)	48 (4.4)	32 (4.7)	13 (4.0)	28 (3.6)	38 (3.6)	48 (3.7)	58 (3.8)
Neck	8 (0.9)	9 (0.8)	6 (0.9)	4 (1.2)	8 (1.0)	11 (1.1)	13 (1.0)	15 (1.0)
PVR	75 (8.1)	88 (8.1)	52 (7.7)	31 (9.5)	72 (9.3)	108 (10.3)	138 (10.6)	174 (11.5)
Pregnancy	69 (7.5)	81 (7.5)	54 (8.0)	9 (2.8)	38 (4.9)	58 (5.6)	76 (5.8)	96 (6.4)
Pelvis	9 (1.0)	11 (1.0)	7 (1.0)	5 (1.5)	6 (0.8)	7 (0.7)	7 (0.5)	7 (0.5)
Swelling	6 (0.7)	7 (0.6)	5 (0.7)	0 (0.0)	8 (1.0)	12 (1.1)	18 (1.4)	2 (0.1)
Thyroid	12 (1.3)	14 (1.3)	9 (1.3)	4 (1.2)	12 (1.6)	17 (1.6)	21 (1.6)	26 (1.7)
Whole Abdomen	679 (73.6)	795 (73.5)	489 (72.4)	245 (75.2)	568 (73.6)	752 (72.0)	924 (71.0)	1092 (72.5)
Total	**923**	**1082**	**675**	**326**	**772**	**1045**	**1302**	**1507**

The overall proportional distribution of ultrasonography categories from 2018 to 2025 shows a workload overwhelmingly dominated by whole-abdomen scans, which accounted for 72.6% of all examinations and formed the core diagnostic activity of the service. PVR studies accounted for an additional 9.7%, emerging as the second most frequent category, while pregnancy-related scans accounted for 6.3% of total volume. Liver evaluations represented 4% of all scans, maintaining their position as a routine but secondary diagnostic indication. All remaining categories, thyroid, testis, neck, breast, brain, pelvis, and soft-tissue swelling, each contributed between 0.6 and 1.7%, confirming their role as specialized frequency examinations.

Table 3. Proportional Contribution of Major Ultrasonography Categories to Total Workload (2018–2025)

Category	Total (n)	% Of All Scans
Whole Abdomen	5544	72.6
PVR	738	9.7
Pregnancy	481	6.3
Liver	306	4
Thyroid	115	1.5
Testis	127	1.7
Neck	74	1
Breast	81	1.1
Brain	49	0.6
Pelvis	59	0.8
Swelling	58	0.8
Total	**7632**	**100**

The temporal analysis of key ultrasonography categories reveals precise recovery trajectories and differentiated growth patterns across the eight years. Whole-abdomen scans showed the most pronounced shift, reaching their lowest point in 2021 before rising sharply to a peak of 1092 in 2025, reflecting a strong post-pandemic rebound in general diagnostic demand. PVR examinations demonstrated a steady linear increase from their 2021 minimum to their 2025 high, indicating increasing utilisation of urologic functional assessments. Pregnancy-related scans, liver studies, and thyroid evaluations all displayed similar recovery curves, each bottoming out.

Table 4. Growth Patterns and Temporal Trends of Key Ultrasonography Categories

USG Type	Minimum (Year)	Maximum (Year)	Trend Summary
Whole Abdomen	245 (2021)	1092 (2025)	Sharp post-2021 surge
PVR	31 (2021)	174 (2025)	Rapid linear growth
Pregnancy	9 (2021)	96 (2025)	Recovery after COVID decline
Liver	13 (2021)	58 (2025)	Progressive rise
Thyroid	4 (2021)	26 (2025)	Steady increase
Testis	10 (2020)	25 (2025)	Gradual increase
Breast	1 (2021)	28 (2024)	Variable pattern
Swelling	0 (2021)	18 (2023)	Irregular but overall rising

IV. DISCUSSION

This eight-year retrospective analysis demonstrates significant temporal variation in ultrasonography utilization within a tertiary care hospital, with a marked decline during the COVID-19 pandemic followed by a rapid and sustained recovery. The sharp reduction observed in 2020 (–37.6 %) and 2021 (–51.7 %) mirrors global patterns documented across radiology departments, where imaging services experienced unprecedented disruption due to lockdowns, deferred outpatient care, and resource reallocation [7,8]. Studies from New York and Germany similarly reported reductions exceeding 50% across various imaging modalities, including ultrasound, during pandemic peaks [7,8]. Our findings align closely with these observations, reinforcing the substantial role of pandemic-related healthcare restrictions in altering diagnostic service use. From 2022 onward, we observed a rapid rebound, with a 136.6 % increase relative to 2021. Several reports indicate that imaging volumes gradually returned to pre-pandemic levels as healthcare systems reopened [8,9]. However, the magnitude of the rebound in our facility was notably higher than that in many Western centres, which saw slower restoration of imaging volumes [8]. This may reflect pent-up diagnostic demand, rapid reinstatement of elective services, and high reliance on ultrasonography in resource-constrained environments, as described in studies from low- and middle-income countries (LMICs) [10]. Across all years, whole-abdomen ultrasonography accounted for more than 70% of total scans. Similar patterns have been reported in LMIC facilities, where abdominal imaging is often a first-line diagnostic tool due to accessibility and cost advantages [10]. In contrast, studies from South Africa and Europe show a diversified ultrasound portfolio, with greater use of musculoskeletal, vascular, and small-parts imaging [9,11], indicating that our modality mix reflects local disease burden and referral behaviour. The progressive increase in PVR examinations (from 8.1 % in 2018 to 11.5 % in 2025) is particularly notable. Few international analyses specifically highlight PVR trends, but the rising use of urologic functional ultrasound has been documented in emergency and outpatient settings, reflecting expanding clinical acceptance of point-of-care ultrasound (POCUS) [12-14]. Pregnancy-related scans decreased substantially during 2021 before recovering steadily. This is consistent with global literature documenting reductions in antenatal visits and ultrasound examinations during the pandemic due to mobility restrictions and concerns over facility-based exposure [15]. The rebound aligns with the restoration of routine maternal healthcare and the re-establishment of antenatal screening pathways. Thyroid, liver, and testicular ultrasound volumes also bottomed out in 2021 with subsequent gradual increases, a trend consistent with international data showing delayed but eventual restoration of non-urgent imaging [7,8]. Breast and swelling ultrasound categories exhibited variability, unlike the more linear recovery seen in abdominal and PVR studies. Similar volatility in breast imaging has been reported globally, driven by fluctuating screening program activity and patient hesitancy during and after the pandemic [15]. The irregular swelling-scan pattern likely reflects variable clinical presentation rather than systematic diagnostic shifts. Overall, the growth patterns identified in this study align with the global resurgence of ultrasound utilisation identified in bibliometric and trend analyses [16-18]. The post-2021 surge aligns with evidence that ultrasound remains one of the most resilient and rapidly recovering diagnostic tools, thanks to its low cost, bedside utility, and vast clinical applicability [17,18]. Our findings reinforce this trajectory, providing local quantitative evidence of similar recovery dynamics. Clinically, these results underscore the need for strategic planning to accommodate rising ultrasound demand. The sustained growth in whole-abdomen and PVR imaging highlights the importance of adequate staffing, equipment maintenance, and targeted training. Expanding competence in urologic ultrasound and reorganizing workflow to meet rising patient load may improve diagnostic efficiency. Furthermore, recognizing the disproportionate decline and subsequent rebound in pregnancy-related and thyroid scans can support more robust contingency planning for essential diagnostic services during public-health emergencies.

Limitations of the study: This study is limited by its single-centre retrospective design, which restricts generalizability. It lacks patient-level details, clinical indications, and distinctions between inpatient and outpatient care, limiting the interpretation of utilization drivers. Operational factors, such as staffing or equipment downtime, were not analyzed, and no outcome or cost data were available to link utilization trends to diagnostic effectiveness or service efficiency.

V. CONCLUSION

This study demonstrates that ultrasonography utilisation in the tertiary-care setting fluctuated sharply during the COVID-19 period but rebounded strongly afterwards, ultimately exceeding pre-pandemic levels. Whole-abdomen scans consistently accounted for the majority of the workload, while PVR and other specialised studies showed progressive growth. These findings highlight the central role of ultrasonography in routine diagnostics and underscore the need for strategic resource planning to accommodate rising post-pandemic demand.

VI. RECOMMENDATIONS

The study recommends strengthening ultrasonography services through strategic resource planning, including ensuring adequate staffing, maintaining equipment capacity, and improving scheduling efficiency to meet growing demand. Expanding training in high-volume areas such as abdominal and urologic imaging would further enhance service quality. Future research should incorporate clinical indications, patient characteristics, and diagnostic outcomes to provide a more comprehensive understanding of utilisation patterns and guide evidence-based service improvement.

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