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Beyond Abdominal Imaging: Changing Distribution of Ultrasonography Services in a Bangladeshi Tertiary Care Hospital

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ABSTRACT
Background: *Ultrasonography is widely used in tertiary-care hospitals. Although whole-abdomen examinations commonly dominate routine workloads, the relative contribution of other procedure-specific categories and their changing patterns over time remain insufficiently described in Bangladesh. Understanding these patterns may support balanced imaging-service planning and resource allocation.* ***Objective:*** *To describe eight-year changes in procedure-specific ultrasonography workload, emphasizing non-whole-abdomen examinations, and identify categories contributing to changing diagnostic service demand and capacity.* ***Methods:*** *This retrospective descriptive study analysed 7,632 ultrasonography records from a tertiary-care hospital in Bangladesh between January 2018 and December 2025. Annual frequencies and proportional contributions were calculated for 11 scan categories. Year-to-year changes and temporal patterns were examined descriptively, including periods before, during, and after the COVID-19 pandemic. No inferential statistical tests were performed, and only aggregated institutional service-level data were analysed throughout for reporting purposes.* ***Results:*** *Whole-abdomen examinations accounted for 5,544 (72.6%) scans, while all other categories contributed 2,088 (27.4%). PVR was the leading non-whole-abdominal category, comprising 738 (9.7%) examinations overall; its annual share increased from 8.1% in 2018 to 11.5% in 2025. Pregnancy and liver scans accounted for 6.3% and 4.0%, respectively. Several categories declined during 2020–2021 and recovered thereafter, alongside rising annual total volume.* ***Conclusion:*** *Whole-abdomen ultrasonography remained the principal workload contributor, but more than one-quarter of examinations involved other categories. The rising proportion of PVR studies suggests changing diagnostic demand. Monitoring procedure-specific trends may help tertiary hospitals plan staffing, equipment allocation, and service development. As a single-centre analysis, findings should not be generalized nationally.*

Keywords: *Ultrasonography, Diagnostic Imaging, Service Utilization, Workload Analysis, Post-void Residual, COVID-19,*

I. INTRODUCTION

Diagnostic ultrasonography has become an essential component of modern healthcare because of its safety, affordability, portability, and ability to provide real-time anatomical and functional information without exposing patients to ionizing radiation. Its broad clinical applicability makes it particularly valuable in tertiary-care hospitals, where patients present with diverse medical, surgical, obstetric, and urological conditions. Compared with other imaging modalities, ultrasonography is relatively accessible and cost-effective, making it an important diagnostic resource in low- and middle-income countries (LMICs), where healthcare facilities often operate under financial and infrastructural constraints [1,2]. The utilization of ultrasonography has expanded considerably across different medical specialties. Abdominal examinations remain among the most frequently requested procedures because of their importance in evaluating hepatobiliary, renal, gastrointestinal, and other intra-abdominal disorders. However, increasing recognition of organ-specific and functional abnormalities has also contributed to demand for specialized examinations, including thyroid, breast, testicular, pelvic, and soft-tissue ultrasonography. Post-void residual (PVR) assessment is another clinically relevant application, particularly in patients with lower urinary tract symptoms, urinary retention, bladder dysfunction, and suspected obstructive uropathy. These diverse applications demonstrate that ultrasound workload is influenced not only by overall patient attendance but also by changing clinical requirements and referral practices [2–4]. In tertiary-care settings, the distribution of imaging procedures provides important information about diagnostic service demand and departmental workload. An examination of procedure-specific utilization can identify the major contributors to routine imaging activity and reveal whether specialized services are becoming increasingly important. Such information is relevant to hospital administrators and radiology departments because equipment availability, staffing requirements, examination-room capacity, and technical expertise must be aligned with actual service

demand. Understanding the relative contribution of non-abdominal examinations may particularly help identify areas requiring additional diagnostic capacity, professional training, and improved service organization [5,6]. The COVID-19 pandemic substantially disrupted healthcare delivery worldwide, including diagnostic imaging services. Restrictions on movement, reduced outpatient attendance, changes in hospital admission patterns, infection-control requirements, and postponement of non-emergency investigations affected the utilization of diagnostic facilities. Imaging departments experienced considerable operational challenges while maintaining essential diagnostic services. Previous studies reported substantial reductions in imaging volumes during the pandemic, including emergency ultrasonography examinations. Although service utilization gradually recovered following the acute pandemic period, the magnitude and distribution of recovery varied across imaging categories and healthcare institutions [7–9]. Consequently, examining longitudinal ultrasound utilization provides an opportunity to understand pandemic-associated service disruption and subsequent changes in diagnostic workload. In Bangladesh, tertiary-care hospitals serve as important referral centres for patients requiring specialized diagnostic investigations. Ultrasonography plays a particularly important role because of its relatively low cost, widespread clinical applicability, and suitability for repeated examinations. Nevertheless, institutional information describing long-term changes in procedure-specific ultrasound utilization remains limited. Published evidence from resource-constrained healthcare environments has frequently emphasized equipment availability, accessibility, and infrastructure rather than detailed longitudinal analysis of examination categories and their proportional contributions to departmental workload [1,5,6].

Understanding these patterns is important for developing evidence-based strategies for diagnostic service planning. An increasing proportion of specialized examinations, for example, may indicate changing referral requirements and the need for appropriate equipment, trained personnel, and improved workflow arrangements. Similarly, identifying categories that remain consistently low in volume can help institutions evaluate service priorities without compromising the availability of essential diagnostic facilities. Longitudinal institutional data can therefore provide useful information for operational planning and future quality-improvement initiatives [5,10]. Against this background, the present study examined eight years of ultrasonography records from a tertiary-care hospital in Bangladesh, covering January 2018 to December 2025. Rather than focusing exclusively on overall ultrasound utilization, the study emphasizes procedure-specific workload distribution, particularly the contribution of non-whole-abdominal examinations. It also evaluates temporal changes in major ultrasound categories, identifies important contributors to diagnostic service demand, and describes utilization patterns before, during, and after the COVID-19 pandemic. The findings are expected to provide institution-level evidence to support more effective resource allocation, workforce planning, and the development of balanced ultrasonography services.

II. METHODOLOGY

This retrospective descriptive study was conducted at Chattogram Maa-O-Shishu Hospital (CMSH), Chattogram, Bangladesh. It reviewed institutional ultrasonography records over eight years, from January 2018 to December 2025, to evaluate procedure-specific workload distribution and temporal changes in diagnostic ultrasound service utilization.

Inclusion criteria: All ultrasonography records documented in the institutional radiology database between January 2018 and December 2025 were considered eligible. Records were included when they contained complete information regarding the examination year and ultrasonography category. Both outpatient and inpatient examinations were considered, irrespective of patient age, sex, clinical indication, or referring department.

Exclusion criteria: Records were excluded if they contained incomplete examination details, missing or unidentifiable procedure categories, duplicate entries, or erroneous documentation. Entries without reliable year-wise classification were also excluded. Records that could not be confidently assigned to the predefined ultrasonography categories were not considered for analysis to maintain consistency and accuracy in the assessment of annual service utilization patterns.

Data collection procedure: Data were extracted retrospectively from the hospital's institutional radiology database. A total of 7,632 complete ultrasonography records were reviewed and categorized into 11 examination types: whole abdomen, PVR, pregnancy, liver, thyroid, testis, breast, neck, brain, pelvis, and soft-tissue swelling. Annual examination frequencies were recorded for each category. Only aggregated service-level information was retained.

Data analysis: Data were organized according to calendar year and ultrasonography category. Annual examination frequencies, overall proportions, and year-to-year percentage changes were calculated using descriptive statistics. The proportional contribution of each examination type to total workload was determined.

Minimum and maximum annual frequencies were identified to describe temporal patterns. Results were presented as frequencies and percentages without inferential statistical testing.

Ethical approval: Ethical approval was obtained in accordance with institutional requirements for retrospective analysis of anonymized hospital records. No patient identifiers or individual clinical information were collected. Confidentiality was maintained throughout data extraction, analysis, and reporting, and findings were presented exclusively in aggregated form

III. RESULTS

A total of 7,632 ultrasonography examinations were recorded during the eight-year study period from 2018 to 2025. Whole-abdomen ultrasonography accounted for the largest proportion of examinations, whereas the remaining ten categories collectively represented 27.4% of the total workload. Annual examination volumes varied considerably, with a progressive increase observed after the pandemic-associated decline. The annual distribution demonstrated that total ultrasonography examinations increased from 923 in 2018 to 1,082 in 2019. Subsequently, the volume decreased to 675 in 2020 and reached its lowest level of 326 in 2021. A substantial recovery occurred in 2022, when examinations increased to 772. This upward trajectory continued in subsequent years, reaching 1,045 in 2023, 1,302 in 2024, and 1,507 in 2025. Non-whole-abdomen examinations increased from 244 in 2018 to 415 in 2025, indicating an overall expansion of specialized imaging activity (Table 1). Regarding procedure-specific distribution, whole-abdomen ultrasonography accounted for 5,544 (72.6%) examinations. Among non-whole-abdomen categories, PVR assessment was the most frequent, comprising 738 (9.7%) examinations, followed by pregnancy-related ultrasonography with 481 (6.3%) and liver ultrasonography with 306 (4.0%). Testicular and thyroid examinations accounted for 127 (1.7%) and 115 (1.5%), respectively. Breast, neck, brain, pelvic, and soft-tissue swelling examinations each contributed less than 1.2% of the total workload, except breast examinations, which represented 1.1% (Table 2). Year-wise examination patterns revealed different trajectories among specialized categories. PVR examinations increased from 75 in 2018 to 174 in 2025, while their proportional contribution increased from 8.1% to 11.5%. Pregnancy-related examinations declined markedly to nine in 2021 before recovering to 96 in 2025. Liver examinations followed a similar pattern, increasing from 13 in 2021 to 58 in 2025. Testicular and thyroid examinations also demonstrated gradual increases during the later study years. However, breast and soft-tissue swelling examinations showed considerable annual fluctuations (Table 3). Temporal assessment identified 2021 as the year with the lowest recorded volume for most major examination categories. Whole-abdomen, PVR, pregnancy, liver, and thyroid examinations all reached their minimum frequencies in that year. Their highest annual frequencies were generally recorded in 2025. Testicular examinations reached their maximum in 2025, whereas breast examinations peaked in 2024. Soft-tissue swelling examinations were absent in 2021 but reached their maximum in 2023 (Table 4). Comparison across three periods showed that whole-abdomen examinations remained dominant throughout the study. Non-whole-abdomen examinations represented 26.5% of total workload during 2018–2019, 26.7% during 2020–2021, and 27.9% during 2022–2025. Thus, the post-pandemic period demonstrated an increase in both absolute specialized examination volume and its proportional contribution to overall ultrasonography services (Table 5). The distribution of specialized examinations also showed differences in their relative contributions over time. PVR, pregnancy, and liver examinations collectively represented the largest components of non-whole-abdomen imaging. In contrast, brain, pelvic, neck, and soft-tissue swelling examinations consistently contributed relatively small proportions. These findings indicate that the expansion of non-abdominal imaging was not uniform across all categories. The detailed annual frequencies are presented in Table 3.

Table 1: Annual distribution of Whole-Abdomen and Non-Whole-Abdomen ultrasonography, 2018–2025

Year	Abdomen		Total
	Whole	Non-whole	
	n (%)	n (%)	
2018	679 (73.6)	244 (26.4)	923
2019	795 (73.5)	287 (26.5)	1082
2020	489 (72.4)	186 (27.6)	675
2021	245 (75.2)	81 (24.8)	326
2022	568 (73.6)	204 (26.4)	772
2023	752 (72.0)	293 (28.0)	1045
2024	924 (71.0)	378 (29.0)	1302
2025	1092 (72.5)	415 (27.5)	1507

Total	5544 (72.6)	2088 (27.4)	7632

Table 2: Overall distribution of ultrasonography examination categories (2018–2025)

Examination category	n	%
Whole abdomen	5544	72.6
PVR	738	9.7
Pregnancy	481	6.3
Liver	306	4.0
Testis	127	1.7
Thyroid	115	1.5
Breast	81	1.1
Neck	74	1.0
Pelvis	59	0.8
Soft-tissue swelling	58	0.8
Brain	49	0.6
Total	7632	100.0

Table 3: Year-wise distribution of Non-Whole-abdomen ultrasonography examinations

Category	2018	2019	2020	2021	2022	2023	2024	2025
PVR	75	88	52	31	72	108	138	174
Pregnancy	69	81	54	9	38	58	76	96
Liver	41	48	32	13	28	38	48	58
Testis	12	14	10	11	15	18	22	25
Thyroid	12	14	9	4	12	17	21	26
Breast	5	7	6	1	12	18	28	4
Neck	8	9	6	4	8	11	13	15
Brain	7	8	5	3	5	6	7	8
Pelvis	9	11	7	5	6	7	7	7
Soft-tissue swelling	6	7	5	0	8	12	18	2

Values represent the number of examinations.

Table 4: Minimum and maximum annual frequencies of ultrasonography categories

Examination category	Minimum (year)	Maximum (year)
Whole abdomen	245 (2021)	1092 (2025)
PVR	31 (2021)	174 (2025)
Pregnancy	9 (2021)	96 (2025)
Liver	13 (2021)	58 (2025)
Testis	10 (2020)	25 (2025)
Thyroid	4 (2021)	26 (2025)
Breast	1 (2021)	28 (2024)
Neck	4 (2021)	15 (2025)
Brain	3 (2021)	8 (2025)
Pelvis	5 (2021)	11 (2019)
Soft-tissue swelling	0 (2021)	18 (2024)

Table 5: Comparison of ultrasonography workload across three study periods

Study period	Whole abdomen n (%)	Non-whole abdomen n (%)	Total examinations
Pre-pandemic (2018–2019)	1474 (73.5)	531 (26.5)	2005
Pandemic (2020–2021)	734 (73.3)	267 (26.7)	1001
Post-pandemic (2022–2025)	3336 (72.1)	1290 (27.9)	4626
Total	5544 (72.6)	2088 (27.4)	7632

IV. DISCUSSION

The present study examined eight years of ultrasonography utilization in a tertiary-care hospital in Bangladesh, focusing particularly on procedure-specific workload distribution and the contribution of non-whole-abdominal examinations. The principal findings were the continued predominance of whole-abdomen ultrasonography, the substantial contribution of post-void residual (PVR) examinations among specialized categories, and the marked recovery of diagnostic imaging activity following the COVID-19-associated decline. These findings provide useful institutional information regarding changing diagnostic service requirements and workload distribution. Whole-abdomen ultrasonography accounted for 72.6% of all examinations, establishing it as the principal contributor to departmental workload. This predominance may reflect the broad diagnostic applications of abdominal imaging in evaluating hepatobiliary, renal, gastrointestinal, and other abdominal disorders. Similar importance of ultrasound in diverse clinical specialties has been documented in previous studies from low- and middle-income countries (LMICs) [11,12]. Nevertheless, the relatively high proportion of abdominal examinations in the present study indicates that routine abdominal imaging continues to represent the central component of ultrasound services in this institution. An important finding was the contribution of non-whole-abdominal examinations, which collectively represented 27.4% of the total workload. Among these categories, PVR assessment was the most frequent, accounting for 9.7% of all examinations. Its proportional contribution increased from 8.1% in 2018 to 11.5% in 2025. This pattern suggests increasing institutional demand for bladder-function assessment and related urological investigations. Previous research on ultrasound utilization in LMICs has highlighted the importance of accessible ultrasound services for evaluating different clinical conditions, including urinary tract disorders [13]. The increasing contribution of PVR examinations therefore highlights the potential importance of maintaining adequate capacity for specialized urinary tract assessment. Pregnancy-related and liver examinations represented 6.3% and 4.0% of the total workload, respectively. These findings demonstrate the continuing contribution of obstetric and hepatobiliary imaging to routine diagnostic services. Other specialized examinations, including thyroid, testicular, breast, neck, brain, pelvic, and soft-tissue assessments, accounted for comparatively smaller proportions. However, low examination frequency does not necessarily indicate limited clinical importance. Maintaining access to these investigations remains relevant for comprehensive diagnostic service delivery. Previous reviews have similarly emphasized the broad range of ultrasound applications in resource-limited healthcare environments [11,14]. The temporal distribution demonstrated a substantial reduction in ultrasound examinations during 2020 and 2021, followed by progressive recovery from 2022 onwards. Annual examination volume declined from 1,082 in 2019 to 326 in 2021 before increasing to 1,507 in 2025. This pattern is consistent with international reports describing substantial reductions in radiological investigations during the COVID-19 pandemic. Previous studies documented considerable declines in imaging volumes and emergency ultrasound utilization during the pandemic period [15,16]. Subsequent recovery of imaging activity has also been reported in longitudinal studies from different healthcare settings [17,18]. An additional observation was the relatively stable proportion of non-whole-abdominal examinations across the three study periods. Their contribution increased from 26.5% before the pandemic to 27.9% during the post-pandemic period. Although the proportional change was modest, the absolute number of specialized examinations increased considerably. This suggests that recovery involved both routine abdominal imaging and other diagnostic categories. A comparable evolution in ultrasound applications was reported by Siyeka et al., who observed an increase in overall ultrasound utilization in a South African tertiary hospital, accompanied by changes in examination-specific workload [19]. These findings have practical implications for radiology service planning. The predominance of abdominal examinations indicates the importance of maintaining adequate routine scanning capacity, while the increasing contribution of PVR and other specialized procedures highlights the need for appropriate equipment, trained personnel, and efficient departmental organization. Previous research has also identified equipment accessibility, technical maintenance, and professional training as important considerations for sustainable ultrasound utilization in resource-limited settings [13,14,20]. The present study has several limitations. Its retrospective, single-centre design limits the generalizability of findings to other healthcare institutions. Furthermore, the analysis was based on aggregated examination frequencies without patient-level demographic information, clinical indications, referral sources, or diagnostic outcomes. Therefore, the observed changes cannot establish alterations in disease prevalence or explain the underlying reasons for changing referral

patterns. Additionally, annual data may conceal seasonal and monthly fluctuations in service utilization. Despite these limitations, the eight-year observation period provides useful longitudinal information about procedure-specific diagnostic workload. In conclusion, whole-abdomen ultrasonography remained the dominant examination category, while PVR represented the largest specialized imaging component. The recovery and expansion of ultrasound services after the pandemic highlight the importance of monitoring procedure-specific demand. These institutional findings may assist radiology departments in identifying workload priorities, strengthening specialized diagnostic capacity, and planning future ultrasound services.

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