Research Square

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Accuracy of Visually Estimated Blood Loss in the Operating Room: A Simulation Study

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Abstract

Background: Visually estimated blood loss (VEBL) is the most widely used method for assessing intraoperative hemorrhage yet is highly subjective and inaccurate. Prior studies have focused predominantly on surgeons and anesthesiologists; data on broader OR personnel are limited. We evaluated VEBL accuracy across a multidisciplinary OR cohort and examined whether provider title, department, and years of experience predict estimation performance.

Methods: Fifty-five OR personnel, including attending surgeons, surgical residents, anesthesiologists, anesthesia residents, CRNAs, SRNAs, and OR/PACU nurses, estimated blood volume at 8 stations displaying surgical materials prepared with diluted expired pRBCs (actual volumes 20–300 mL). Correct estimation was defined as within ±15% of actual volume. Groups were compared by title, department, and experience (<10 vs ≥10 years) using chi-square tests and ANOVA.

Results: Correct estimation rates were low across all stations (range: 3.6%–27.3%), with overestimation as the predominant error. Station 3 (300 mL, irrigation-contaminated suction canister) showed the most extreme bias (96.4% overestimated). Station 4 (225 mL, chux pad) was uniquely dominated by underestimation (70.9%). Small-volume stations (Stations 7 and 8, 20 mL each) had correct estimate rates of 12.7% and 9.1%.

By provider title, mean estimates differed significantly at Stations 7 and 8 (p=0.018, p=0.030): attending physicians estimated closest to actual while RNs and CRNAs/SRNAs overestimated substantially. Categorical accuracy differed significantly at Stations 4 and 6 (p=0.015, p=0.003); at Station 6, RNs overestimated 78.6% of cases (7.1% correct) while attending physicians did not overestimate at all. At Station 4, underestimation was most pronounced among residents (88.0%).

By department, mean estimates differed significantly at Stations 5 and 6 (p=0.037, p=0.021), and categorical accuracy differed at Stations 4, 5, and 6 (p=0.045, p=0.003, p=0.0003). PACU nurses showed the highest overestimation rates at Stations 5 (92.3%) and 6 (84.6%); the Anesthesia Team achieved the highest correct rate at Station 6 (39.3%).

Conclusions: VEBL accuracy is universally low, with systematic error patterns varying by volume, material type, irrigation contamination, and provider role. These findings identify targetable gaps for simulation-based training, with priority for nursing staff and trainees who demonstrated the greatest systematic bias.

Background

Visually estimated blood loss (VEBL) is the most widely used method for assessing intraoperative blood loss, routinely performed by surgeons and anesthesiologists[1]. This technique involves evaluating blood present on surgical sponges, drapes, the operating room floor, and within suction canisters. Despite its ubiquity, VEBL is highly subjective and often fails to accurately reflect actual blood loss[2].

In a meta-analysis by Gerdessen et al., VEBL demonstrated the lowest correlation with reference methods such as gravimetric or colorimetric techniques[3]. Similarly, Rothermel and Lipman found that 95% of OR personnel had greater than 25% error in at least one simulated VEBL scenario, and only 27% showed

consistent over- or underestimation[4]. In a retrospective analysis by Howe et al., VEBL exhibited low correlation with calculated blood loss based on perioperative hemoglobin changes ($r = 0.189$, $p = 0.008$)[5]. Meiser et al. also reported significant discrepancies in simulated VEBL, with a trend toward overestimating diluted blood and underestimating fully saturated sponges[6].

Estimation accuracy also appears to depend on the material on which blood is assessed. Piekarski et al. demonstrated that among 53 anesthesia providers, the median VEBL was significantly higher when blood was displayed on white sponges (250 mL) compared to green sponges (150 mL), despite the actual blood volume being 103 mL for both[7].

Another major limitation of VEBL is declining accuracy as blood loss increases. Ram et al. found that estimation accuracy deteriorated significantly when blood loss exceeded 500 mL[8]. In a simulation by Kollberg et al., underestimation increased with larger blood volumes, and OR personnel miscalculated blood loss by a median of 30% regardless of profession, experience, or self-assessed ability[1]. Sosa et al. and Anya et al. similarly reported that discrepancies between VEBL and actual blood loss widened with increasing volume in obstetric settings[9,10]. Thomas et al. further noted that the presence of irrigation fluid, lymph, or bile complicates visual estimation and contributes to inaccuracy[11].

Studies consistently show that VEBL tends to underestimate blood loss. In a meta-analysis of 26 studies, Tran et al. found VEBL consistently reported lower values than formula-based methods, highlighting the need for standardized assessment protocols[12]. Kadri et al. demonstrated a 30% underestimation by VEBL compared to gravimetric methods in a postpartum cohort[13], and Budair et al. found that both orthopedic surgeons and anesthesiologists significantly underestimated intraoperative blood loss in hip fracture surgery[14].

Conversely, VEBL can also lead to overestimation. Guinn et al. showed in a randomized controlled trial that anesthesiologists overestimated mean blood loss by 40% during spinal surgeries, attributing this to the inability to visually assess hemoglobin concentration in serosanguineous fluid[15]. Gerdessen et al. reported a median VEBL of 500 mL among anesthesiologists compared to a reference value of 281.5 mL[16], and Zajak et al. similarly found overestimation by both surgeons and anesthesiologists during abdominal surgery compared to spectrophotometric measurements[17].

Despite these limitations, VEBL remains valuable for its simplicity and real-time feedback, which facilitates prompt decision-making regarding hemodynamic status and transfusion needs. Given that intraoperative blood loss is associated with increased risk of postoperative complications, mortality, and reduced quality of life[18,19], VEBL retains practical utility. More accurate methods such as formula-based calculations, gravimetric techniques, and non-invasive hemoglobin monitoring exist but are often time-consuming or impractical in urgent situations. Training interventions have been shown to improve VEBL accuracy, with visual reference aids and structured training programs yielding measurable improvements[20,21].

This study evaluated VEBL accuracy across a broad range of OR personnel and examined whether provider title, department, or years of experience are associated with estimation accuracy. Unlike prior work focused primarily on surgeons and anesthesiologists, we included a wider range of roles and incorporated materials

spanning suction canisters, absorbent pads, and irrigation-contaminated scenarios to better reflect real-world intraoperative conditions.

Methods

This study was deemed exempt from full review by the Temple University Institutional Review Board. OR personnel were recruited from a single academic institution. Eight stations depicting simulated blood loss scenarios were assembled in a curtained area of the PACU. Eligible participants included attending surgeons and surgical residents, attending anesthesiologists and anesthesia residents, CRNAs and student CRNAs (SRNAs), OR and PACU nurses (RNs). Participants were recruited as they passed through the OR in the course of their regular duties. Only one participant occupied the station area at a time. Fifty-five participants enrolled (see Table 1 for demographic breakdown). Each participant independently estimated blood loss in milliliters at sequential stations. Stations displayed bloodied surgical equipment as it might be encountered intraoperatively: Ray-Tec sponges, lap sponges, absorbent pad, chux pads, a sponge collection bag, and a suction canister (see Fig. 1 for the complete station list and Fig. 2 for representative figure photographs). Participants recorded their estimates on an individual questionnaire that also captured professional title, affiliated department, and years of experience in the department (see Fig. 3 for the questionnaire).

Blood used to prepare the stations was obtained from expired packed red blood cells provided by the hospital blood bank. To improve visual realism, the blood was diluted with normal saline to match the mean hemoglobin (12.3 g/dL) and hematocrit (36.9%) of surgical patients at our institution over the study period (October 2022–November 2023; see Fig. 4 for dilution method). Station 3 represented a scenario of blood mixed with irrigation fluid in a suction canister; the actual blood content was 300 mL. All other stations displayed blood on absorbent materials without additional fluids.

Correct estimates were defined as values within ± 15% of the actual volume at each station (Table 2 shows ranges for each station).

Participants were grouped by professional title (RNs, Residents, CRNAs/SRNAs, Attending) and by department (Surgical Team, PACU, Anesthesia Team [ANES]). The total cohort was fifty-five. A secondary analysis dichotomized participants by years of experience (< 10 years vs. ≥10 years). For continuous outcomes, group differences were assessed using one-way ANOVA (three or more groups) or independent t-tests (two groups). Categorical outcomes (correct/over/underestimate distributions) were analyzed using chi-square tests. Statistical significance was set at $p < 0.05$. All analyses were performed using standard statistical software.

Table 1
Participant demographics by professional title

	DEMOGRAPHICS		
	Overall (%)	**≥ 10 YOE**	**< 10 YOE**
TITLE, N (%)			
Attending	9 (16.4%)	6 (31.6%)	3 (8.6%)
CRNA/SRNA	7 (12.7%)	5 (26.3%)	2 (5.7%)
Resident	25 (45.5%)	0 (0.0%)	25 (69.4%)
RN	14 (25.5%)	8 (42.1%)	6 (16.7%)
Total	**55**	**19**	**36**
DEPARTMENT, N (%)*			
Anes	28 (52.8%)	11 (57.9%)	17 (50.0%)
PACU	13 (24.5%)	7 (36.8%)	6 (17.6%)
Surgical Team	12 (22.6%)	1 (5.3%)	11 (32.4%)
Total	**53**	**19**	**34**

*** 2 participants did not identify their department (n = 53 for department data).**

Figure 4. Dilution of Expired Blood Products

$$_{pre}\text{Hct} \times (_{pre}\text{Vol}) / _{post}\text{Hct} = _{post}\text{vol}$$

Table 2
Overall Accuracy by Station (n = 55)

Station	Material	Actual Volume	Correct, n (%)	Underestimate, n (%)	Overestimate, n (%)
1	Sponge Collection Bag	300 mL	2 (3.6%)	21 (38.2%)	32 (58.2%)
2	Absorbent Pad	150 mL	4 (7.3%)	18 (32.7%)	33 (60.0%)
3†	Suction Canister	300 mL	0 (0.0%)	2 (3.6%)	53 (96.4%)
4‡	Chux Pad	225 mL	0 (0.0%)	39 (70.9%)	16 (29.1%)
5	Ray-Tec Sponge	50 mL	4 (7.3%)	20 (36.4%)	31 (56.4%)
6	Ray-Tec Sponge	100 mL	15 (27.3%)	20 (36.4%)	20 (36.4%)
7	4×4 Lap Sponge	20 mL	7 (12.7%)	11 (20.0%)	37 (67.3%)
8	4×4 Lap Sponge	20 mL	5 (9.1%)	18 (32.7%)	32 (58.2%)

Correct estimate defined as within ± 15% of actual volume.

† Station 3: suction canister with irrigation fluid contamination; actual blood content 300 mL.

‡ Station 4: underestimation was the dominant error (70.9% overall); 0% correct reflects absence of accurate estimates, not absence of overestimation.

Table 3
Overestimation Frequency by Station, Provider Title, Department, and Experience

Station	Provider Title				Department			Experience (years)	
	RN (n = 14)	Resident (n = 25)	C/SRNA (n = 7)	Attending (n = 9)	Surgical (n = 12)	PACU (n = 13)	Anes (n = 28)	< 10 year (n = 36)	≥ 10 year (n = 19)
1	57.1%	60.0%	57.1%	55.6%	50.0%	61.5%	64.3%	61.1%	52.6%
2	71.4%	44.0%	**85.7%**	66.7%	41.7%	**76.9%**	64.3%	55.6%	73.7%
3†	*92.9%*	*96.0%*	*100%*	*100%*	*100%*	*92.3%*	*96.4%*	*97.2%*	*94.7%*
4‡	*50.0%*	*12.0%*	*28.6%*	*44.4%*	*8.3%*	*53.8%*	*28.6%*	*22.2%*	*42.1%*
5	**85.7%**	44.0%	71.4%	33.3%	16.7%	**92.3%**	57.1%	55.6%	57.9%
6	**78.6%**	24.0%	42.9%	0.0%	8.3%	**84.6%**	25.0%	33.3%	42.1%
7	**85.7%**	64.0%	71.4%	44.4%	58.3%	**92.3%**	60.7%	69.4%	63.2%
8	71.4%	52.0%	71.4%	44.4%	41.7%	**76.9%**	57.1%	52.8%	68.4%

Values represent percentage of participants within each subgroup who overestimated blood loss at that station.

Bold = subgroup overestimation ≥ 75%. Italics = special-case stations (see footnotes †‡).

Overall count of participants: n = 55. Department analysis: n = 53 (2 participants did not identify department).

† Station 3: suction canister with irrigation fluid contamination; actual blood content 300 mL.

‡ Station 4: underestimation was the dominant error overall; overestimation rates shown for completeness.

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Results

Overall Accuracy

Across all 8 stations, correct estimation rates were low, ranging from 3.6% (Station 1) to 27.3% (Station 6). Overestimation was the predominant error at most stations. The most extreme bias occurred at Station 3 (300

mL blood in a suction canister with irrigation fluid), where 96.4% of participants overestimated the actual blood content, likely reflecting the difficulty of distinguishing blood from irrigation fluid when the total volume is large. At Station 1 (300 mL, sponge collection bag), 58.2% of participants overestimated and 38.2% underestimated, with only 3.6% accurate. In contrast, Station 4 (225 mL, chux pad) was dominated by underestimation (70.9%), with only 29.1% overestimating. The two lowest-volume stations, Stations 7 and 8 (each 20 mL), were also challenging: overestimation rates were 67.3% and 58.2% respectively, with correct estimate rates of only 12.7% and 9.1%.

By Provider Title

Participants were grouped by professional titles: RNs (n = 14), Residents (n = 25), CRNAs/SRNAs (n = 7), and Attending Physicians (n = 9). Attendings had significantly more years of experience on average (mean 20.7 years) compared to the other groups (mean range 2–14 years; $p < 0.0001$). Mean estimates differed significantly across title groups at Station 7 ($p = 0.018$) and Station 8 ($p = 0.030$). Attending physicians gave the lowest mean estimates at these stations: 29.2 ± 16.5 mL at Station 7 and 20.9 ± 10.6 mL at Station 8, the closest to actual among all groups. RNs and CRNAs/SRNAs estimated substantially higher at both stations (RN means: 75.4 ± 56.6 mL and 66.8 ± 68.2 mL; CRNA/SRNA means: 87.1 ± 70.4 mL and 72.1 ± 60.8 mL).

Categorical accuracy differed significantly by title at Station 4 (225 mL; $p = 0.015$) and Station 6 (100 mL; $p = 0.003$). At Station 6, RNs overestimated in 78.6% of cases (7.1% correct), while attending physicians did not overestimate at all (most were correct or underestimated). At Station 4, underestimation predominated across all groups but was especially pronounced among residents (88.0%), while RNs were more evenly split.

By Department

Participants were grouped by department: Surgical Team (n = 12), PACU Nurses (n = 13), and Anesthesia Team (n = 28). The three departments differed significantly in years of experience ($p = 0.045$), with PACU nurses being the most experienced on average (median ~ 15 years) and the Surgical Team having the fewest years (median ~ 3–5 years).

Significant differences in mean estimates were found at Station 5 (50 mL; ANOVA $p = 0.037$) and Station 6 (100 mL; $p = 0.021$). At Station 5, the Surgical Team gave the highest mean estimates (112.7 ± 43.4 mL), followed by the Anesthesia Team (81.7 ± 93.9 mL) and PACU nurses (35.4 ± 27.0 mL). At Station 6, the Surgical Team again estimated highest (187.7 ± 81.8 mL) while PACU nurses estimated lowest (70.4 ± 49.8 mL), with the Anesthesia Team intermediate (116.4 ± 125.8 mL).

Estimation accuracy patterns differed significantly by department at Station 4 ($p = 0.045$), Station 5 ($p = 0.003$), and Station 6 ($p = 0.0003$). At Station 5 (50 mL), 92.3% of PACU nurses overestimated versus only 16.7% of the Surgical Team (75.0% of whom underestimated). At Station 6 (100 mL), 84.6% of PACU nurses overestimated while 66.7% of the Surgical Team underestimated. At Station 6, the Anesthesia Team achieved the highest correct estimate rate (39.3%), versus 25.0% for the Surgical Team and 7.7% for PACU nurses.

By Years of Experience

Participants were dichotomized into those with < 10 years of experience (n = 36; mean 2.5 ± 1.9 years) and those with ≥ 10 years (n = 19; mean 20.9 ± 8.8 years). By design, these groups also differed in title composition: all residents fell in the < 10-year group, while most attendings and CRNAs/SRNAs were in the ≥ 10-year group ($p < 0.0001$). Departments also differed, with PACU nurses more concentrated in the ≥ 10-year group and the Surgical Team more represented in the < 10-year group ($p = 0.036$).

More experienced providers gave significantly higher mean estimates at Station 8 (70.1 ± 67.8 mL vs. 31.3 ± 26.9 mL; $p = 0.026$). A similar trend was observed at Station 7, where the ≥ 10-year group estimated roughly double the volume of the < 10-year group (76.6 ± 66.0 mL vs. 43.5 ± 29.4 mL; $p = 0.049$). At all other stations, mean estimates did not differ significantly by experience group. Despite these differences in raw estimates, the distribution of correct, over-, and underestimate categories did not differ significantly between the two experience groups at any station (all $p > 0.1$).

Discussion

This study confirms that VEBL is highly inaccurate across a broad range of OR personnel, with substantial errors at every station. While prior research has focused on surgeons and anesthesiologists, our study extends these findings to include OR nurses and PACU staff, revealing important differences in the direction and magnitude of error across provider groups.

The dominant pattern across most stations was overestimation, which is consistent with prior work showing that visual cues can exaggerate the perceived volume of blood[6,7]. This was most striking at Station 3, where 96.4% of participants overestimated. Because Station 3 displayed blood mixed with irrigation fluid in a suction canister, the expanded total fluid volume likely amplified the perceived blood content, a finding that echoes Thomas et al., who reported that non-blood fluids in the operative field significantly complicate visual estimation[11]. This underscores the difficulty of estimating blood loss when non-blood fluids are present and suggests clinicians should exercise particular caution, and where possible, avoid sole reliance on VEBL when significant irrigation has been used.

The pronounced overestimation at low-volume stations (Stations 7 and 8, 20 mL each) is also clinically noteworthy. A small volume of blood can appear strikingly red on white surgical sponges, and our findings support the theory that visual contrast inflates perceived volume. Piekarski et al. previously demonstrated that sponge color alone significantly affects estimation[7], and our results suggest that diluted blood on absorbent white material produces a similar perceptual amplification. Attending physicians gave mean estimates closest to true volume at these stations, likely reflecting accumulated experience with how small blood volumes appear in practice.

Station 4 was a notable exception: 70.9% of participants underestimated the 225 mL blood volume displayed on the chux pad. This pattern suggests that when blood is distributed across a large surface area, perceived volume may be systematically underestimated, a finding consistent with Meiser et al.[6], who reported that fully saturated sponges tend to be underestimated. The high underestimation rate among residents (88%) at this station may reflect inexperience with interpreting heavily soaked chux pads.

Provider-specific differences in accuracy were observed across multiple stations. Attending physicians and the Anesthesia Team generally performed better than RNs and PACU nurses at several stations, particularly those involving low volumes or Ray-Tec sponges. These findings suggest that anesthesia providers may be more familiar with tracking blood in suction canisters and small-volume scenarios, while PACU nurses, despite being the most experienced group overall, may have less intraoperative exposure to visual blood loss estimation. This underscores that general clinical experience does not substitute for role-specific estimation practice.

Although more experienced providers (≥ 10 years) gave higher absolute estimates at the low-volume stations, neither accuracy nor estimation at higher-volume stations differed by experience. This finding suggests that experience may refine certain aspects of visual estimation (e.g., recognition of small volumes) without broadly improving overall accuracy, a pattern that highlights the importance of targeted, scenario-based training rather than passive accumulation of clinical years.

Clinical Implications

The inaccuracies identified in this study carry meaningful clinical consequences. Overestimation of blood loss can prompt unnecessary transfusions or premature case termination, while underestimation can delay resuscitation of a hemorrhaging patient. Our findings argue against sole reliance on VEBL for high-stakes intraoperative decisions; however, this is not always feasible given the need for rapid decision-making in the OR. Clinicians should maintain a high index of suspicion when irrigation fluid is present and resist over-interpreting small blood stains on light-colored materials.

Our results provide actionable targets for education. The patterns of overestimation at low volumes and in irrigation-contaminated fields are reproducible findings that could be directly incorporated into simulation-based curricula. Formal VEBL training programs using quantified examples of blood on representative materials have been shown to improve accuracy[20,21], and our data support prioritizing such training for trainees and nursing staff, who showed the greatest systematic biases.

Limitations

Several limitations of this study warrant consideration. First, the simulation environment does not fully replicate the intraoperative context. Real surgeries involve dynamic, ongoing bleeding, clinical decision pressure, poor lighting, and distractions that could affect performance differently than a controlled station exercise. Second, our single-institution sample of 55 participants may limit generalizability; different hospitals, training programs, and patient populations could yield different results. Third, the use of expired packed red blood cells diluted with saline, while designed to standardize blood appearance, approximates but does not perfectly replicate the color and consistency of fresh intraoperative blood, which can vary with oxygenation and clotting. Fourth, the stations used static rather than actively bleeding displays, which may underestimate the challenges of real-time estimation. Finally, the ± 15% correct estimation threshold, while clinically reasonable, introduces some arbitrariness. A 10–15% error may have different practical significance

depending on the clinical context and baseline volume. These limitations highlight the need for prospective validation of our findings in real operative settings.

A sixth limitation concerns confounding between provider title, department, and years of experience. These three variables are structurally interrelated by study design: all residents fell in the < 10-year group, most attendings and CRNAs/SRNAs in the ≥ 10-year group, and PACU nurses were disproportionately experienced relative to the Surgical Team. Significant differences in experience composition were confirmed across both title ($p < 0.0001$) and department ($p = 0.036$) groups. This collinearity means that observed differences by title or department may partly reflect underlying differences in experience, and vice versa. These analyses should therefore be interpreted as descriptive rather than causally separating the independent contributions of role, training environment, and accumulated experience.

Future Directions

Future work should evaluate VEBL accuracy during live surgeries, using objective measurement methods (e.g., gravimetric or photometric) as concurrent reference standards. Intervention studies testing whether structured training programs, such as scenario-based exercises with quantitative feedback, can reduce systematic biases are also needed. Our findings suggest that training efforts should specifically address the tendency to overestimate in irrigation-contaminated fields and to overestimate small volumes on white absorbent materials.

Advances in artificial intelligence offer a promising avenue for reducing reliance on subjective visual estimation. Machine learning models trained on images of bloodied surgical materials could potentially provide real-time, objective blood loss quantification at the point of care. Development and validation of such tools, trained on representative datasets encompassing the range of materials, volumes, and contamination scenarios, represents a meaningful research priority. Integration with existing OR imaging infrastructure may ultimately allow automated VEBL assistance that supplements, and in some settings replaces, provider estimation for routine cases.

Conclusions

VEBL accuracy is low across all OR personnel, with overestimation as the predominant error at most stations. The direction of error varies systematically with volume, material type, the presence of irrigation fluid, and provider role. Despite these limitations, VEBL remains an indispensable real-time tool in the rapidly evolving operative environment, where the speed and simplicity of visual estimation are frequently irreplaceable. These results reinforce the need for structured, scenario-specific VEBL training for OR personnel at all experience levels, particularly trainees and nursing staff, who demonstrated the greatest systematic bias, and support caution in using VEBL as the sole basis for high-stakes intraoperative decisions.

Abbreviations

ANES
Anesthesia team
ANOVA

Analysis of variance
CRNA
Certified registered nurse anesthetist
Hct
Hematocrit
OR
Operating room
PACU
Post-Anesthesia Care Unit
pRBCs
Packed red blood cells
RN
Registered nurse
SRNA
Student nurse anesthetist
VEBL
Visually estimated blood loss
YOE
Years of experience

Declarations

Ethics approval and consent to participate

This study was deemed exempt from full review by the Temple University Institutional Review Board. Informed consent was waived given the study's exempt status.

Consent for publication

Not applicable.

Competing Interests

Authors declare no competing interests.

Funding

None.

Author Contribution

JP contributed to conceptualization, methodology, investigation, and resources, and prepared Figures 1, 2, and 3. DF and EH contributed to validation, project administration, and supervision. ZH performed the formal

statistical analysis. SL contributed to writing of the original draft, writing review and editing, and data curation, and prepared Figure 4 and Tables 2 and 3. All authors read and approved the final manuscript.

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Availability of data and materials

The dataset generated and analyzed during the study are not publicly available due to potential identifiability of participants given the small sample size, but are available from the corresponding author on reasonable request.

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Figures

Station	Bloodied surgical product	Actual Volume (mL)	Underestimate	Correct Range (mL)	Overestimate
Station 1	Sponge Collection Bag	300	< 255	[255, 345]	> 345
Station 2	Absorbent Pad	150	< 127.5	[127.5, 172.5]	> 172.5
Station 3*	Suction Canister	300	< 255	[255, 345]	> 345
Station 4	Chux Pad	225	< 191.25	[191.25, 258.75]	> 258.75
Station 5	Ray-Tec Sponge	50	< 42.5	[42.5, 57.5]	> 57.5
Station 6	Ray-Tec Sponge	100	< 85	[85, 115]	> 115
Station 7	4×4 Lap Sponge	20	< 17	[17, 23]	> 23
Station 8	4×4 Lap Sponge	20	< 17	[17, 23]	> 23

Figure 1

Station list with correct range of estimated blood loss

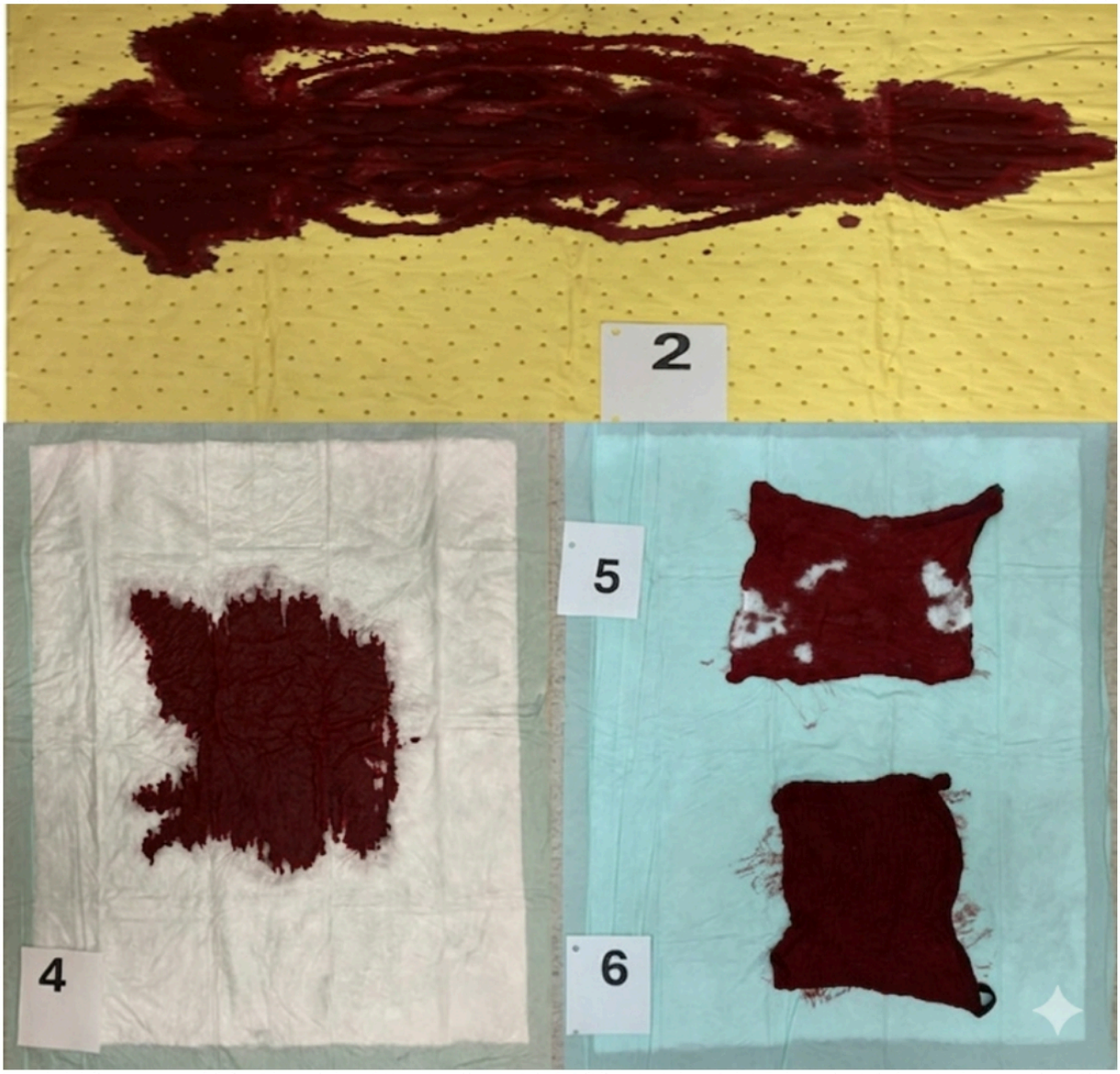
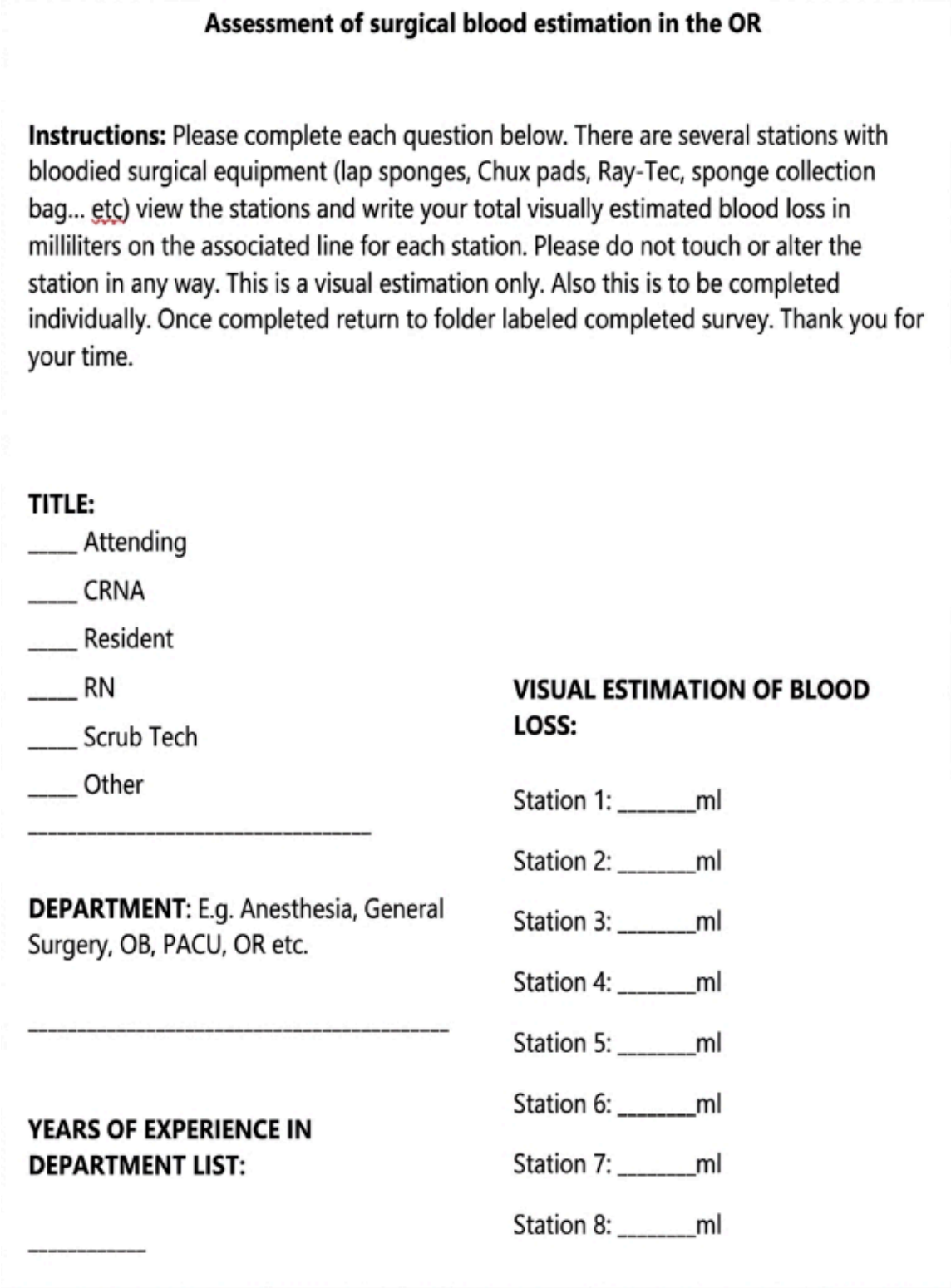


Figure 2

Stations 2, 4, 5, and 6

$$_{pre}Hct \times (_{pre}Vol) / {}_{post}Hct = {}_{post}vol$$

Figure 3



Assessment of surgical blood estimation in the OR

Instructions: Please complete each question below. There are several stations with bloodied surgical equipment (lap sponges, Chux pads, Ray-Tec, sponge collection bag... etc) view the stations and write your total visually estimated blood loss in milliliters on the associated line for each station. Please do not touch or alter the station in any way. This is a visual estimation only. Also this is to be completed individually. Once completed return to folder labeled completed survey. Thank you for your time.

TITLE:

____ Attending

____ CRNA

____ Resident

____ RN

____ Scrub Tech

____ Other

_____

DEPARTMENT: E.g. Anesthesia, General Surgery, OB, PACU, OR etc.

_____

YEARS OF EXPERIENCE IN DEPARTMENT LIST:

_____

VISUAL ESTIMATION OF BLOOD LOSS:

Station 1: _____ml

Station 2: _____ml

Station 3: _____ml

Station 4: _____ml

Station 5: _____ml

Station 6: _____ml

Station 7: _____ml

Station 8: _____ml

Figure 4

Participant Questionnaire

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- VEBLData.docx