

ORIGINAL ARTICLE

Causes and Counter Measure Analysis of Inpatients Unqualified Clinical Specimens from 2015 to 2019

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SUMMARY

Background: To improve the quality of pre-analytical phase and provide targeted suggestions, this study analyzed factors causing unqualified clinical specimens in patients of the Department of Clinical Laboratory of Renmin Hospital of Wuhan University from 2015 to 2019.

Methods: Inpatient specimens from January 2015 to December 2019 were retrospectively analyzed. Unqualified specimens were identified by referring to the general principle of rejection. The analytical indicators included incidence rate of unqualified specimens and constituent ratio of reasons of unqualified specimens. These two indicators were analyzed according to the inpatient wards and types of specimens.

Results: From 2015 to 2019, 21,674 inpatient unqualified specimens were collected, the incidence rate of unqualified specimens was 0.22% (21,674/9,700,869), the number and rate of unqualified specimens decreased year by year. The main reasons of unqualified specimens were insufficient volume (29.67%, 6,430/21,674) and clotting (26.31%, 5,703/21,674). The number of unqualified specimens in the departments of cardiovascular, pediatrics, neurology, oncology, urinary surgery, and intensive care unit ranked the top each year. Clotting (39.29%, 5,682/14,462) was the main reason of unqualified blood specimens while insufficient volume (71.18%, 3,365/4,727) was for urine specimens. Wrong identification caused unqualified feces (62.65%, 728/1,162) and body fluid (40.74%, 539/1,323) specimens.

Conclusions: Clinical laboratory could make effective measures to improve pre-analytical quality by retrospectively analyzing data of unqualified specimens.

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Supplementary Table

Table S1. Statistics of the rate of the unqualified specimens for each inpatients wards.

Inpatient wards	Total number of specimens	Total number of unqualified specimens (The rate)	The quantity of specimens					The quantity of unqualified specimens (The rate)				
			2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
Cardiovascular Department	966,969	2,206 0.23%	152,540	159,289	34,569	213,653	306,918	636 0.42%	457 0.29%	400 0.30%	358 0.17%	355 0.12%
Intensive Care Unit	426,439	1,924 0.45%	60,588	85,831	101,261	81,556	97,203	556 0.92%	489 0.57%	385 0.38%	252 0.31%	242 0.25%
Pediatric Department	707,864	1,909 0.27%	94,21	98,102	104,507	185,089	225,445	612 0.65%	441 0.45%	275 0.26%	272 0.15%	309 0.14%
Neurology Department	699,634	1,899 0.27%	112,440	131,830	105,753	168,971	180,640	539 0.48%	427 0.32%	361 0.34%	302 0.18%	270 0.15%
Oncology Department	742,595	1,401 0.19%	101,467	121,660	134,685	179,332	205,451	339 0.33%	341 0.28%	279 0.21%	202 0.11%	240 0.12%
Respiratory Medicine	551,028	1,379 0.25%	71,619	97,342	109,557	114,214	158,296	404 0.56%	380 0.39%	236 0.22%	156 0.14%	203 0.13%
Urinary Surgery Department	484,395	1101 0.23%	87,014	88,119	99,175	97,970	112,117	308 0.35%	248 0.28%	184 0.19%	231 0.24%	130 0.12%
Nephrology Department	638,521	997 0.16%	91,036	96,764	103,824	164,314	182,583	248 0.27%	215 0.22%	134 0.13%	257 0.16%	143 0.08%
Orthopedics Department	312,864	843 0.27%	50,550	49,663	68,021	76,934	67,696	202 0.40%	185 0.37%	167 0.25%	181 0.24%	108 0.16%
Gastroenterology Department	330,068	834 0.25%	59,630	67,275	75,624	80,094	47,445	240 0.40%	190 0.28%	168 0.22%	166 0.21%	70 0.15%
Neonatology Department	149,491	779 0.52%		18,156	39,197	43,538	48,600		143 0.79%	205 0.52%	227 0.52%	204 0.42%
Gynecology Department	500,557	701 0.14%	112,767	104,466	106,138	96,863	80,323	233 0.21%	176 0.17%	104 0.10%	105 0.11%	83 0.10%
Otolaryngology Department	324,663	626 0.19%	45,865	43,063	58,880	43,560	133,295	175 0.38%	164 0.38%	108 0.18%	83 0.19%	96 0.07%
Hematology Department	203,525	580 0.28%	36,542	37,500	39,405	54,628	35,450	156 0.43%	144 0.38%	107 0.27%	93 0.17%	80 0.23%
Gastrointestinal Surgery Department	224,555	542 0.24%	20,722	39,276	50,095	61,095	53,367	70 0.34%	98 0.25%	138 0.28%	138 0.23%	98 0.18%

Table S1. Statistics of the rate of the unqualified specimens for each inpatients wards (continued).

Inpatient wards	Total number of specimens	Total number of unqualified specimens (The rate)	The quantity of specimens					The quantity of unqualified specimens (The rate)				
			2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
Thoracic Surgery Department	199,412	449 0.23%	26,763	29,670	39,377	39,935	63,667	112 0.42%	96 0.32%	75 0.19%	100 0.25%	66 0.10%
Ophthalmology Department	287,914	399 0.14%	53,237	48,388	108,560	61,665	16,064	83 0.16%	77 0.16%	72 0.07%	111 0.18%	56 0.35%
General Department	146,721	364 0.25%	47,597	57,825	41,299			64 0.13%	191 0.33%	109 0.26%		
Endocrinology Department	212,934	298 0.14%	26,049	25,066	29,444	47,243	85,132	40 0.15%	51 0.20%	40 0.14%	41 0.09%	126 0.15%
Thyroid and Breast Surgery Department	194,543	272 0.14%	33,140	31,519	3,920	49,173	49,791	62 0.19%	51 0.16%	40 0.13%	60 0.12%	59 0.12%
Hepatobiliary Surgery Department	124,468	271 0.22%	27,778	28,414	27,756	20,135	20,385	93 0.33%	62 0.22%	50 0.18%	31 0.15%	35 0.17%
Psychiatry Department	99,006	262 0.26%	20,173	17,938	26,631	23,715	10,549	54 0.27%	84 0.47%	63 0.24%	49 0.21%	12 0.11%
Physical Examination Center	128,378	253 0.20%	22,268	19,366	25,390	24,651	36,703	65 0.29%	68 0.35%	63 0.25%	36 0.15%	21 0.06%
Pancreatic Surgery Department	113,781	229 0.20%			10,240	33,604	69,937			35 0.34%	119 0.35%	75 0.11%
Obstetrics Department	215,796	207 0.10%		23,444	59,945	46,097	86,310		50 0.21%	30 0.05%	56 0.12%	71 0.08%
Infections Department	112,814	169 0.15%	22,110	16,785	25,093	21,958	26,868	43 0.19%	46 0.27%	27 0.11%	30 0.14%	23 0.09%
Traditional Chinese Medicine Department	53,935	167 0.31%	9,438	11,125	19,106	8,031	6,235	55 0.58%	52 0.47%	40 0.21%	15 0.19%	5 0.08%
Organ Transplantation Department	100,445	120 0.12%	8,757	14,901	20,112	29,288	27,387	13 0.15%	33 0.22%	30 0.15%	25 0.09%	19 0.07%
Dermatology Department	79,990	117 0.15%	13,657	11,985	17,870	17,595	18,883	44 0.32%	27 0.23%	27 0.15%	9 0.05%	10 0.05%
Psychological Department	75,775	100 0.13%	5,931	9,218	31,583	19,673	9,370	29 0.49%	11 0.12%	12 0.04%	42 0.21%	6 0.06%

Table 3. Statistics of the rate of the unqualified specimens for each inpatients wards (continued).

Inpatient wards	Total number of specimens	Total number of unqualified specimens (The rate)	The quantity of specimens					The quantity of unqualified specimens (The rate)				
			2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
Emergent Intensive Care Unit	73,766	86 0.12%	9,685	2,024	30,031	9,707	22,319	5	12	9	29	31 0.14%
Reproductive Medicine Center	92,692	70 0.08%	12,914	14,061	40,843	19,142	5,732	12	15	19	15	9 0.16%
Surgery Department	38,612	62 0.16%	2,279	6,494	18,808	2,343	8,688	11	21	26	3	1 0.01%
Interventional Ward	10,292	21 0.20%				3,284	7,008				15	6 0.09%
Rehabilitation Department	20,530	16 0.08%	3,480	3,429	3,643	2,043	7,935	2	8	2	1	3 0.04%
Nuclear Medicine Department	26,287	14 0.05%	6,497	2,977	12,613	4,200		5	1	2	6	
Pain Myouragement	1,618	3 0.19%					1,618					3 0.19%
Stomatology Department	5,530	3 0.05%	1,071	405	1,067	613	2,374	1	1	0	0	1 0.04%
General Medicine Ward	279	1 0.36%					279					1 0.36%
Emergency Department	5	0 0.00%		5					0			
Operating Room	71	0 0.00%		71					0			

Table S2. Detailed analysis for reasons of each inpatient ward unqualified specimens.

Reasons	The quantity of unqualified specimens				
	2015	2016	2017	2018	2019
Cardiovascular Department					
Insufficient volume	103	147	102	97	83
Clotting	143	80	77	58	92
Wrong identification	67	33	19	44	26
Hemolysis	96	82	92	75	66
Inappropriate container	52	35	24	15	10
Improper time of sampling or transfer	71	28	46	36	32
Lipid	31	18	7	3	12
Leaked or contaminated specimen	41	19	28	3	18
Unqualified specimens collected by patients themselves	32	13	4	15	12
Specimens with unqualified character or nature	0	2	1	6	1
Incorrect specimen type	0	0	0	6	3
Intensive Care Unit					
Insufficient volume	50	37	28	9	10
Clotting	174	180	223	204	148
Wrong identification	16	14	7	0	0
Hemolysis	90	70	61	39	66
Inappropriate container	49	43	21	0	3
Improper time of sampling or transfer	32	26	19	0	4
Lipid	124	99	18	0	4
Leaked or contaminated specimen	21	13	5	0	7
Unqualified specimens collected by patients themselves	0	3	0	0	0
Specimens with unqualified character or nature	0	4	3	0	0
Incorrect specimen type	0	0	0	0	0
Pediatrics Department					
Insufficient volume	227	111	93	53	51
Clotting	191	171	99	162	175
Wrong identification	32	26	16	13	5
Hemolysis	62	45	23	12	10
Inappropriate container	45	39	8	12	15
Improper time of sampling or transfer	25	15	17	0	15
Lipid	5	2	0	0	0
Leaked or contaminated specimen	14	17	10	9	12
Unqualified specimens collected by patients themselves	11	15	9	5	12
Specimens with unqualified character or nature	0	0	0	0	0
Incorrect specimen type	0	0	0	6	14

Table S2. Detailed analysis for reasons of each inpatient ward unqualified specimens (continued).

Reasons	The quantity of unqualified specimens				
	2015	2016	2017	2018	2019
Neurology Department					
Insufficient volume	176	125	123	114	86
Clotting	130	86	69	89	86
Wrong identification	43	53	36	12	15
Hemolysis	27	33	33	30	18
Inappropriate container	62	71	36	30	16
Improper time of sampling or transfer	66	28	34	15	13
Lipid	17	18	5	0	0
Leaked or contaminated specimen	13	13	25	6	21
Unqualified specimens collected by patients themselves	5	0	0	0	6
Specimens with unqualified character or nature	0	0	0	3	0
Incorrect specimen type	0	0	0	3	9
Oncology Department					
Insufficient volume	120	112	115	93	137
Clotting	55	44	55	52	44
Wrong identification	55	82	46	18	13
Hemolysis	11	14	11	15	17
Inappropriate container	57	60	31	6	4
Improper time of sampling or transfer	13	8	4	6	6
Lipid	9	6	2	0	0
Leaked or contaminated specimen	6	10	12	3	6
Unqualified specimens collected by patients themselves	13	5	2	6	8
Specimens with unqualified character or nature	0	0	1	0	0
Incorrect specimen type	0	0	0	3	5
Urology Surgery Department					
Insufficient volume	108	80	67	56	44
Clotting	44	30	31	62	18