Roles of Clinical Pathologist in Rational Lab Use (RLU) of Buriram Hospital

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Data analysis of laboratory over-investigation in buriram hospital

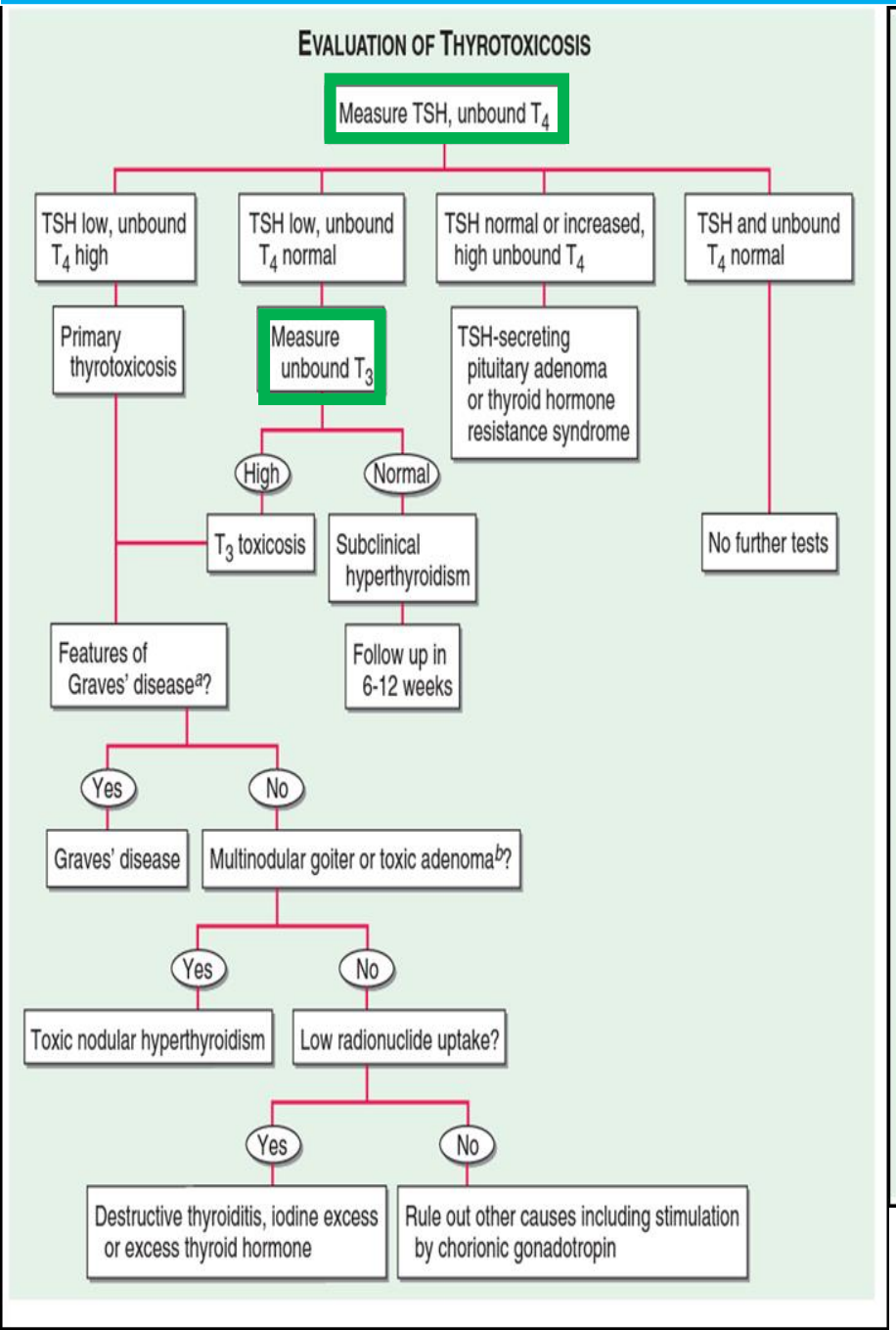
	Test	Details	Waste number of testing (average/year)	Waste cost budget (average/year, Baht)	Waste Nation price budget (average/year)	Waste time	
						/test	total
1.	FT3	14,479 data of TFT, only 1.2% (178) data were found high FT3 alone.	14,301	972,468	2,145,150	32 min.	318 Days
2.	Ferritin	44% of IPD patients , ferritin > normal range but %transferrin saturation < normal range (Ferritin is positive acute phase reactant ,increase with acute inflammation)	1023	132,990	317,130	11 min.	8 Days
3.	HbA1C	Re-testing less than 60 Days	2269	204,210	340,350	2 min.	3 Days
4.	HBsAg	Re-testing less than 30 Days	951	44,697	123,630	56 min.	37 Days
5.	Anti HCV	Re-testing less than 30 Days	512	53,504	153,600	46 min.	16 Days
6.	Hb typing	Re-testing less than 1 year	93	19,023	24,180	7 Days	7 Days
7.	Total protein	Total protein in the LFT re-testing less than 7 days	14,247	71,235	854,820	14 min.	138 Days
8.	Lipid profiles	Re-testing less than 60 Days	3,844	161,448	768,800	19 min.	50 Days
Total			37,240 Test	1,659,575 Baht	4,727,660 Baht	577 Days	

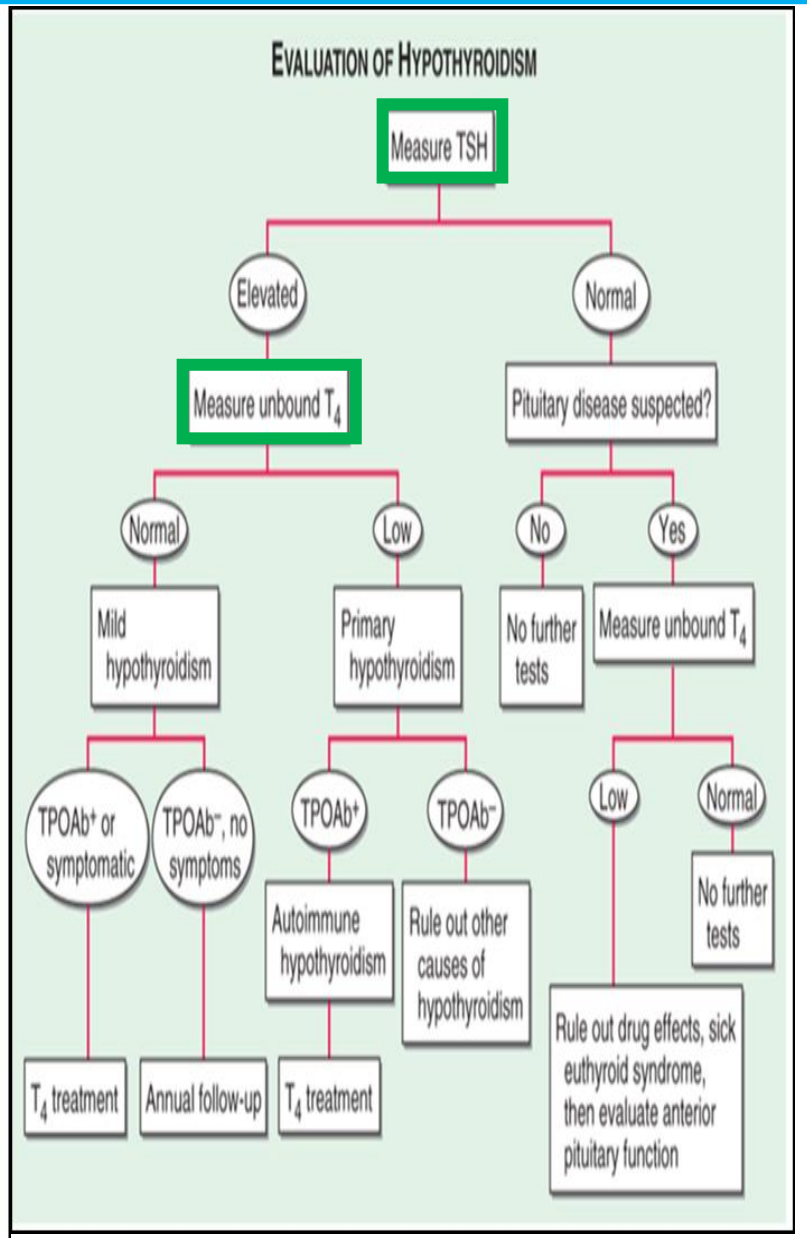
สรุป ผลการดำเนินการ

	Test	ข้อกำหนด	ข้อยกเว้น	การส่งที่ลดลง (เฉลี่ยต่อเดือน)	ต้นทุนลดลง (ต่อเดือน)	งบประมาณประเทศลดลง(ต่อเดือน)
1.	FT3	ตรวจ TSH, FT4 เบื้องต้นก่อน	ขอส่งเพิ่มเมื่อผล ไม่สอดคล้องกัน หรือใช้ติดตามการรักษา	642	43,656	96,300
2.	Ferritin	ผู้ป่วย IPD ไม่ส่งตรวจพร้อมกับ Iron study	ขอส่งเพิ่มได้กรณี โรคHemophagocytic LymphoHistiocytiosis หรือไม่มีไข้	84	10,920	26,040
3.	HbA1C	งดส่งซ้ำใน 60 วัน	หญิงตั้งครรภ์ ส่งซ้ำได้ 30 วัน	368	30,912	55,200
4.	HBsAg	งดส่งซ้ำใน 30 วัน	ส่งซ้ำกรณีผล inconclusive และแนะนำส่ง HBV viral load	44	2,200	5,720
5.	Anti HCV	งดส่งซ้ำใน 30 วัน	ส่งซ้ำกรณีผล inconclusive และแนะนำส่ง HBV viral load	76	7,980	22,800
6.	Hb typing	งดส่งซ้ำตลอดชีวิต หรือเคยได้รับ Pack red cell 3 เดือน	ส่งเพิ่มกรณีหาข้อมูลเก่าไม่พบ หรือ ผู้ป่วยอายุน้อยกว่า 2 ปี ที่ผลไม่ชัดเจน	8	1,680	2,080
7.	Total protein	งดส่งซ้ำใน 7 วัน	ส่งซ้ำกรณีติดตามการรักษาโรค multiple myeloma	1,382	6,910	82,920
8.	Lipid profiles	งดส่งซ้ำใน 60 วัน	ส่งซ้ำกรณีติดตามการรักษาโรค nephrotic syndrome หรือ severe hypertriglyceridemia	110	4,620	22,000
รวม				2,714 test	108,8788 บาท (**1,306,536** ต่อปี)	291,060 บาท (**3,756,720** ต่อปี)

Comparison of Budgets and Number of testing

	Test	Budget (per month, Thai Baht)		Number of testing (per month, Test)		Time (per month, Test)	
		no RLU	RLU	no RLU	RLU	no RLU	RLU
1	FT3	81,056	- 43,656	1,192	- 642	636 hr	- 342 hr
2	Ferritin	75,270	- 10,920	579	- 84	106 hr	- 15 hr
3	HbA1C	246,960	- 30,912	2,744	- 368	91 hr	- 12 hr
4	HBsAg	63,168	- 2,200	1,344	- 44	1,254 hr	- 41 hr
5	Anti HCV	116,865	- 7,980	1,113	- 76	853 hr	- 58 hr
6	Hb typing	24,395	- 1,680	119	- 8	7 Days	- 7 Days
7	Total protein in LFT	38,300	- 6,910	7,660	- 1,382	1,787 hr	- 322 hr
8	Lipid profile	13,454	- 22,000	3,844	- 110	1,218 hr	- 34 hr
Total		659,468 บาท	- 291,060 บาทต่อเดือน - ต้นทุน 1,306,536บาทต่อปี - งบประมาณประเทศ 3,756,720 ต่อปี	14,751	- 2,714 Test	97 Days 3 hr.	- 38 Days 11 hr





Harrison's Principles of Internal Medicine 3 ; 2018

Total data	14479	
FT3 and FT4 Toxicosis	589	4.07%
Isolated FT3 Toxicosis	178	1.23%
Isolated FT4 Toxicosis	674	4.66%

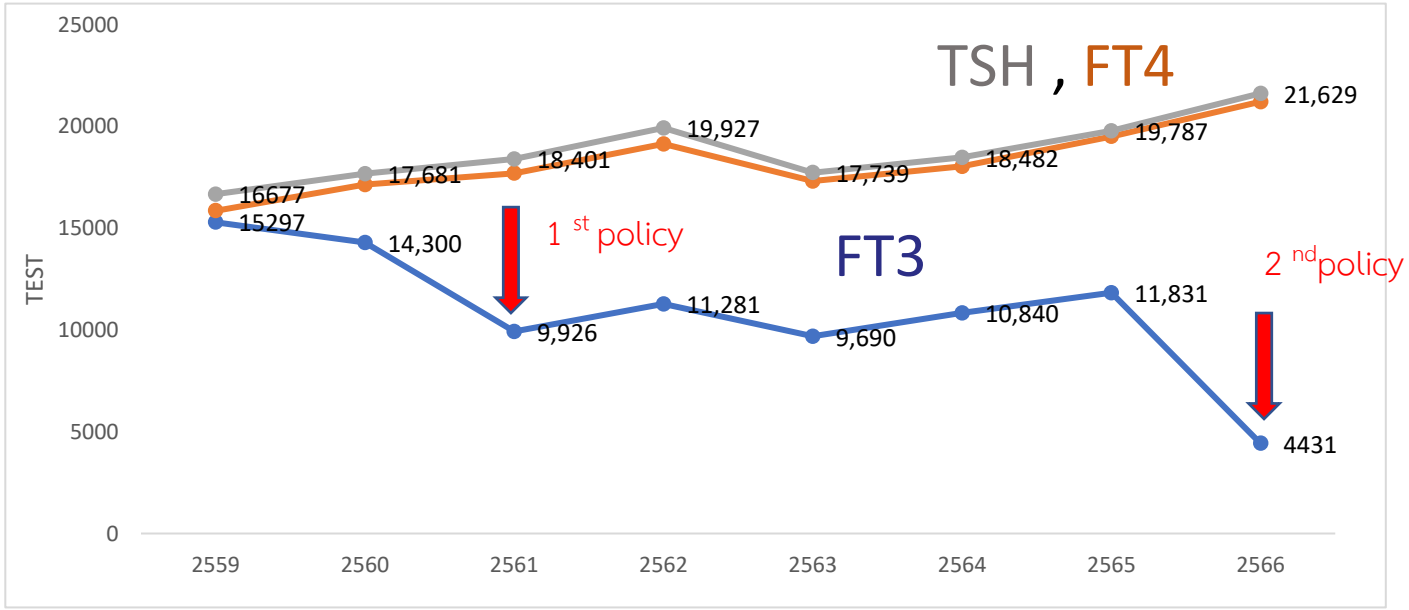
- From the analysis of FT4 and FT3 being examined at the same time 14,479 data in Buriram Hospital.
  - only 1.2% (178) data were found high FT3 alone.

Thyroid Function Test (TFT)

(TSH, FT4, ~~FT3~~)

- 1 st RLU of TFT policy (Start in 2018)

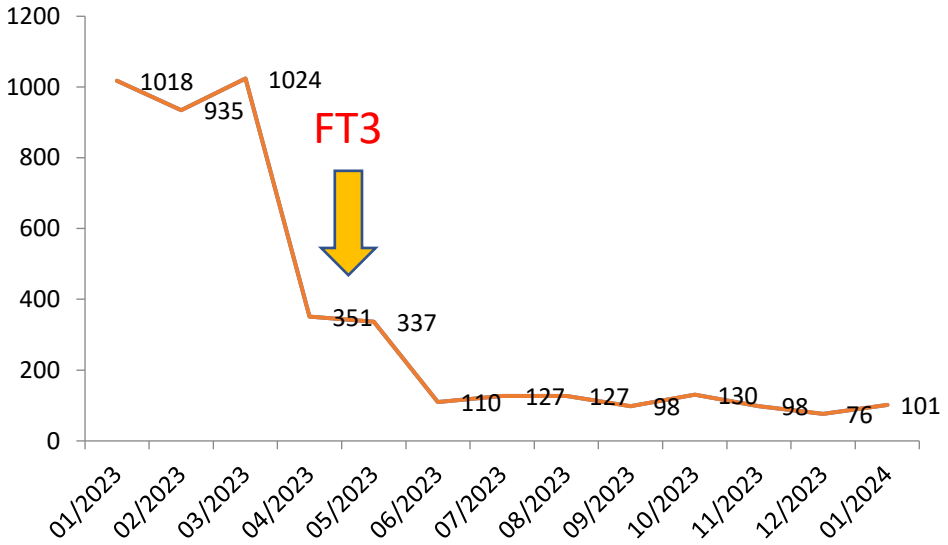
- If writing the abbreviation TFT - > only test for TSH, FT4
- Add FT3 later if unclear of boths TSH and FT4 results



Graph 1 shows the FT3, FT4 and TSH testing volumes between 2017 and 2022. After implementing the 1st RLU of FT3 policy in 2018, the FT3 testing volume was decreased.

- Save budgets for FT3 testing, at least = 522,512 baht per year (15,036 USD) , (7,684 test per year × cost 68 baht)

• 2nd RLU of FT3 policy



Graph 2 shows the FT3 testing volumes in 2023. After implementing the 2nd RLU of FT3 policy in April 2023, the FT3 testing volume has decreased more than last previous month.

- Start in April 2023
- Initial order of TSH, FT4, and FT3, only TSH and FT4 will be tested. If both results are unclear, such as low TSH, FT4 normal, or high TSH, FT4 normal, FT3 will be tests.
- Save budget for FT3 testing at least 43,656 baht per month (642 tests).

1. Ordering a test series (lab set)

1.2 Ferritin with Iron study

-> Ferritin

-> Iron study (not include ferritin)

%Transferrin satutation = serum iron/TIBC x 100

RLU of Ferritin with Iron study

CASE study

- Male 63 years admit in ward by acute gouty arthritis with microcytic anemia, Doctor test for Ferritin with Iron study
- Lab : low transferrin saturation (Iron study) but very high

Hb	**6.9**		
Hct	**21.5**		
MCV	**79.3**		
Serum Iron(SI)	**<10**	ug/dL	50 - 180
TIBC	**145.40**	ug/dL	250 - 450
UIBC	**136.4**		155-355
%Transferrin satu	**6**	%	15-55 (cut off<1
Ferritin	**1001.9**	ng/mL	23.09 - 336.20

Ferritin is positive acute phase reactant ,increase with acute inflammation

Acute-phase Reactants Synthesized in the Liver

Positive acute-phase reactants (concentrations increase with acute inflammation)
Immune-related Complement (C') Mannose-binding lectin (MBL) C-reactive protein (CRP) Orosomucoid (alpha-1 acid glycoprotein)
Antiproteases (antienzymes) Alpha-1 antitrypsin (A1-AT) Alpha-2 macroglobulin (A2M)
Antioxidants Ceruloplasmin
Coagulation factors Fibrinogen Factor VIII
Others Haptoglobin Serum amyloid A (SAA) Plasma fibronectin Lipopolysaccharide-binding protein (LBP) Ferritin
Negative acute-phase reactants (concentrations decrease with acute inflammation)
Retinol-binding protein (RBP) Transthyretin (TBPA) Albumin Transferrin

Source : Laboratory Medicine Diagnosis of Disease in Clinical Laboratory 2E

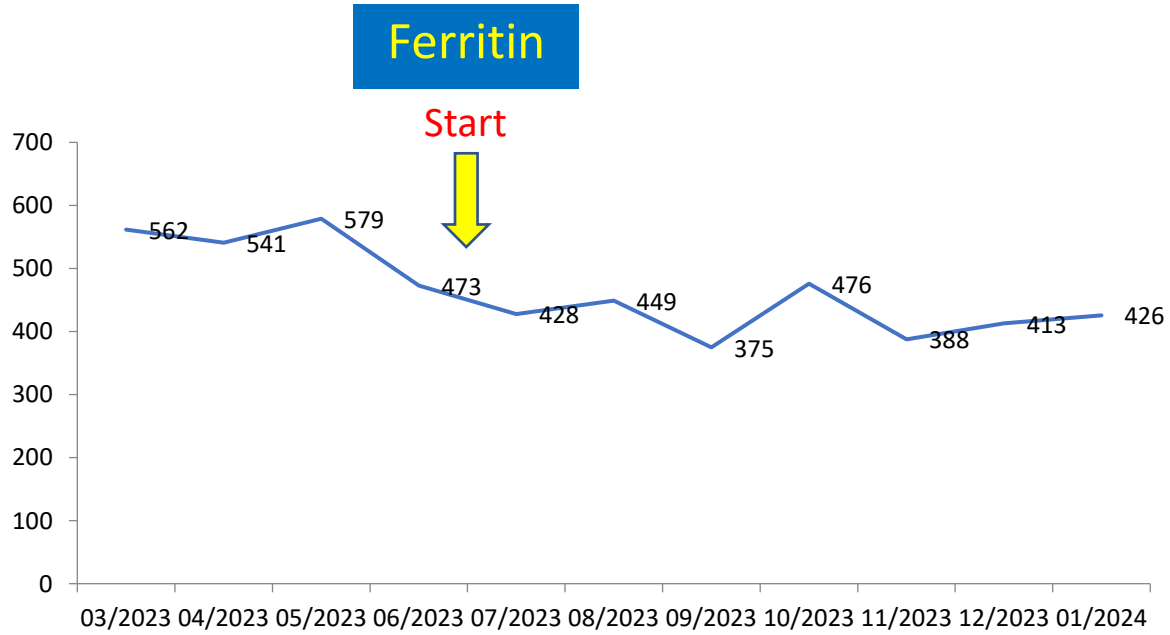
Analysis discordant results of ferritin with iron study (%transferin saturation)

%Transferrin saturation	2.00	Ferritin	18.50	Pneumonia, unspecified	IPD
%Transferrin saturation	2.00	Ferritin	66.50	Iron deficiency anaemia, uns	IPD
%Transferrin saturation	3.00	Ferritin	248.50	Osteomyelitis of vertebra: ce	IPD
%Transferrin saturation	3.00	Ferritin	18.30	Unilateral or unspecified ingui	IPD
%Transferrin saturation	3.00	Ferritin	28.70	Spinal stenosis: lumbar regior	IPD
%Transferrin saturation	3.00	Ferritin	17.10	Gastrointestinal haemorrhage	IPD
%Transferrin saturation	3.00	Ferritin	24.60	Gastric ulcer: acute with haer	IPD
%Transferrin saturation	3.00	Ferritin	57.00	Iron deficiency anaemia, uns	IPD
%Transferrin saturation	3.00	Ferritin	29.60	Fever, unspecified	IPD
%Transferrin saturation	3.00	Ferritin	18.20	Gastro-oesophageal laceratio	IPD
%Transferrin saturation	3.00	Ferritin	20.60	Gastrointestinal haemorrhage	IPD
%Transferrin saturation	3.00	Ferritin	17.50	Acute appendicitis with localiz	IPD
%Transferrin saturation	3.00	Ferritin	279.30	Cerebral infarction due to thr	IPD
%Transferrin saturation	3.00	Ferritin	18.20	Congestive heart failure	IPD
%Transferrin saturation	3.00	Ferritin	32.60	Cerebral infarction, unspecifie	IPD
%Transferrin saturation	3.00	Ferritin	450.10	Alcoholic cirrhosis of liver	IPD
%Transferrin saturation	3.00	Ferritin	44.10	Chronic kidney disease, stage	IPD
%Transferrin saturation	3.00	Ferritin	39.20	Cerebral infarction due to uns	IPD
%Transferrin saturation	4.00	Ferritin	12.70	Chronic ulcer of skin, not else	IPD
%Transferrin saturation	4.00	Ferritin	29.40	Chronic obstructive pulmonar	IPD
%Transferrin saturation	4.00	Ferritin	138.60	Gastroduodenitis, unspecified	IPD
%Transferrin saturation	4.00	Ferritin	30.10	Anaemia, unspecified	IPD
%Transferrin saturation	4.00	Ferritin	842.90	Acute and fulminating melioid	IPD
%Transferrin saturation	4.00	Ferritin	112.00	Iron deficiency anaemia, uns	IPD
%Transferrin saturation	4.00	Ferritin	121.10	Acute renal failure, unspecifie	IPD
%Transferrin saturation	4.00	Ferritin	93.80	Other viral pneumonia	IPD

In IPD patients with inflamation or infection (fever), patients with microcytic anemia should be test by only iron study (%transferin saturation) not including ferritin and add on ferritin later when used to diagnose Hemophagocytic LymphoHistiocytiosis (HLH)

- The data show there are 44%(1023 /2317) of IPD patients that ferritin higher than normal range (>11.0 ng/ml) but %transferin saturation below normal range (<15%) and Only 0.5% (11/2317) of IPD patients that %transferin saturation higher than normal range (>15%) but Ferritin below normal range (<11.0 ng/ml).

RLU of Ferritin with Iron study



Graph 3 shows ferritin test volumes In 2023. After implementing the RLU of Ferritin policy in June 2023, the ferritin testing volume was decreased.

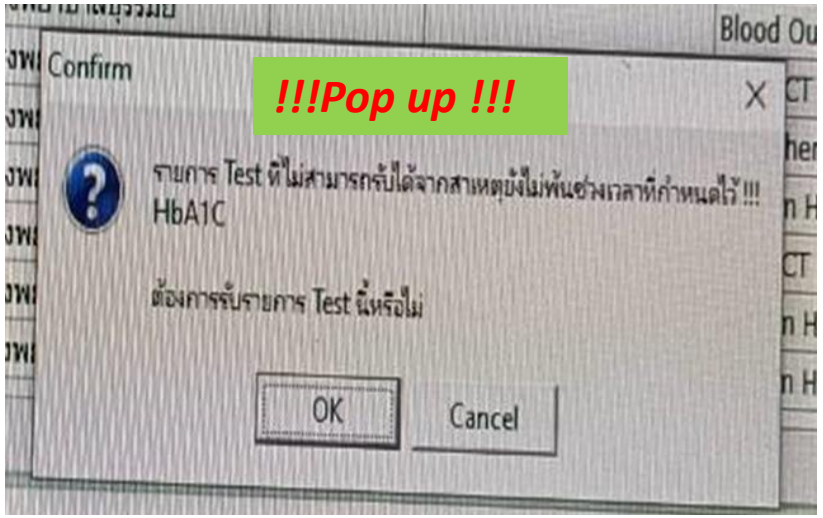
- Save budget for Ferritin testing, about 10,920 baht per mount (average 557 – 473 = 84, cost price 130 baht).

Inappropriate repetition of the same blood test

(Pop up warning)

7 days — Total protein in
Liver Funtion Test

30 days — HBsAg
Anti HCV



60 days — HbA1c
Lipid profile

10 years — Hb typing
HLA-B 1502, HLA-B 5801,
HLA-B 5701, HLA-B27

Once in a lifetime

สปสช แจ้งอัตราเหมาจ่าย 150 บาท ไม่เกิน 2 ครั้งต่อปี
ระยะเวลาห่างกันมากกว่า 3 เดือนในการส่งตรวจ HbA1cซ้ำ

หลักเกณฑ์ เงื่อนไข และแนวทางดำเนินการกรณี DMHT

ณ วันที่ 31 สิงหาคม 2565

กลุ่มเป้าหมาย ประชาชนสิทธิ UC

1. ผู้ป่วย DM Type 2 ทุกราย
2. HT เฉพาะรายใหม่

อัตราการจ่ายค่า Lab / รหัสโรคและรหัสหัตถการที่กำหนด

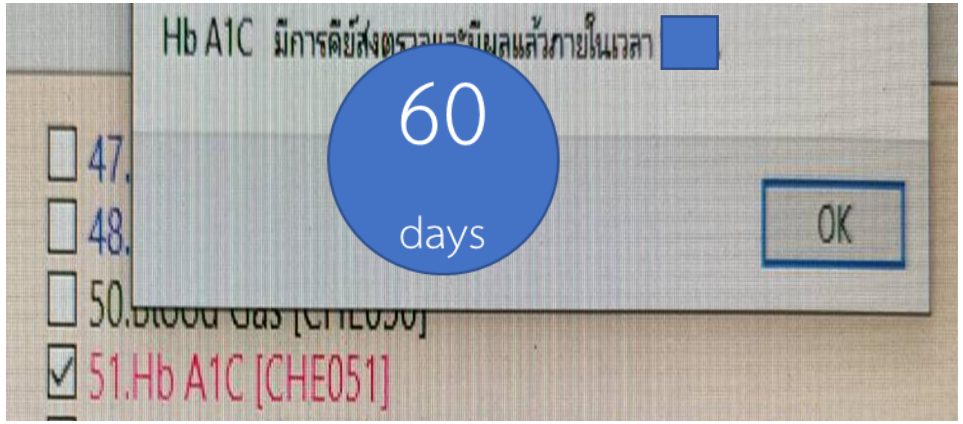
โรค	รหัสโรค	ชื่อ Lab	รหัสหัตถการ	อัตราจ่าย
DM type 2	E11 - E14	HbA1C	32401	เหมาจ่าย 150 บ./ครั้ง/ปี (ไม่เกิน 2 ครั้ง/ปี) (***ห่างกันมากกว่า 3 เดือน)
HT เฉพาะรายใหม่	I10 – I15	Potassium (K)	32103	จ่ายครั้งเดียว 40 บ.
		Creatinine(Cr)	32202	
DM +HT	E11 - E14 และ I10 – I15	HbA1C และหรือ K ,CR	32401 และหรือ 32103 , 32202	ครั้งแรกจ่าย 150 บาท + 40 บาท ครั้งที่ 2 จ่ายเฉพาะ HbA1C 150 บาท

จ่ายทุกหน่วยบริการในระบบ UC

****สปสช.อาจจะทบทวนอัตราจ่ายอีกครั้ง เปรียบเทียบกับรายการ Fee Schedule

RLU of HbA1C in Buriram hospital

- 1 st RLU HbA1C policy (Started in November 2022)
  - > pop up in 90 Days
- 2nd RLU HbA1C policy (Started in February 2023)
  - > pop up in 60 Days



HbA1C Pop up warning

Changes in HbA1c Level over a 12-Week Follow-up in Patients with Type 2 Diabetes following a Medication.

- The results of show that the HbA1c level 8 weeks after a change in medication was strongly predictive of HbA1c 12 weeks after the change in diabetes medication and that patients with HbA1c greater than 8.2% at 8 weeks did not achieve glycaemic control at 12 weeks.

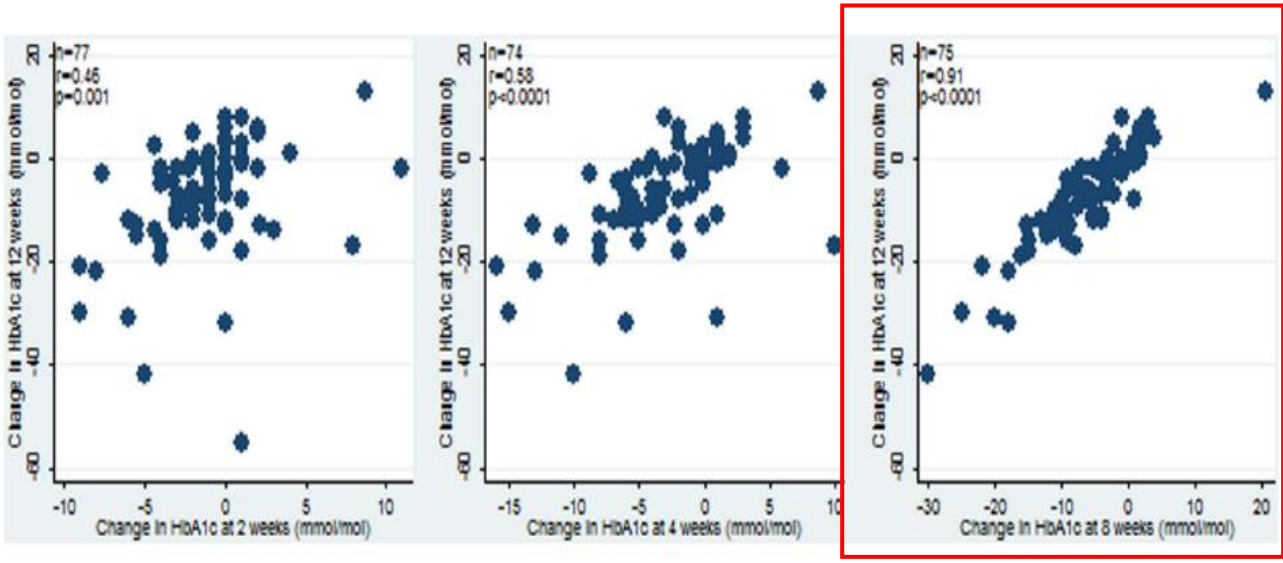


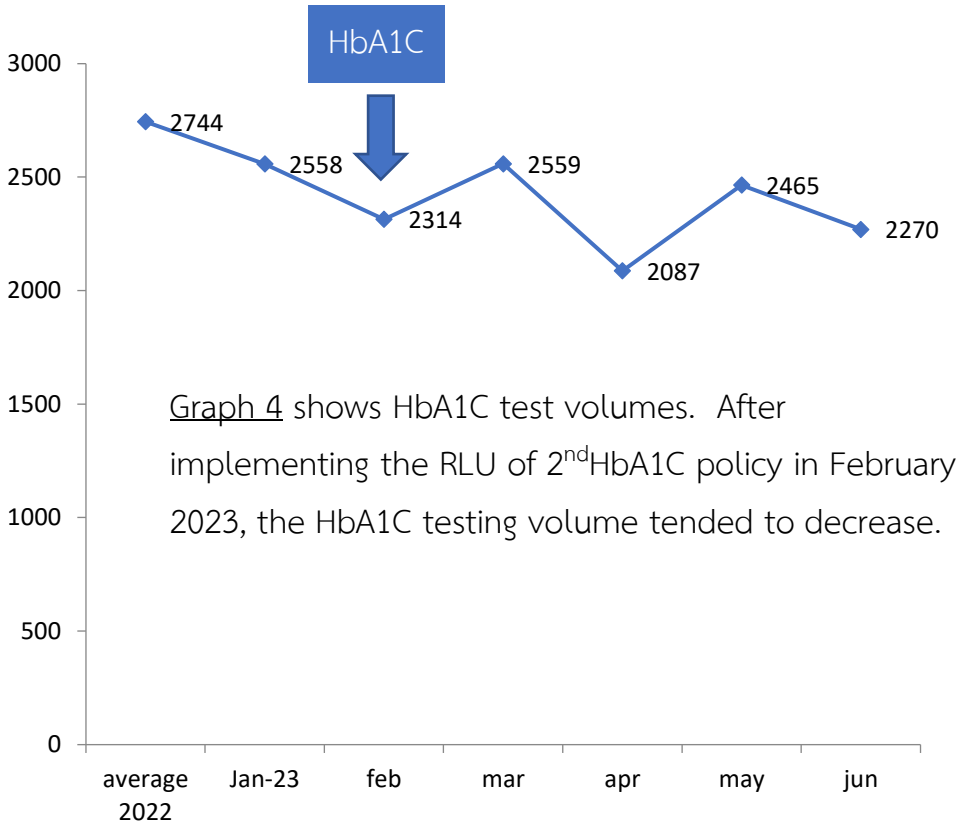
Figure 4. Correlation between 2 week, 4 week and 8 week HbA1c versus change in12 week HbA1c in mmol/mol.

Hirst JA, Stevens RJ, Farmer AJ (2014)

RLU of HbA1C in Buriram hospital

Analysis of HbA1c data with re-testing in 60 days (2021)

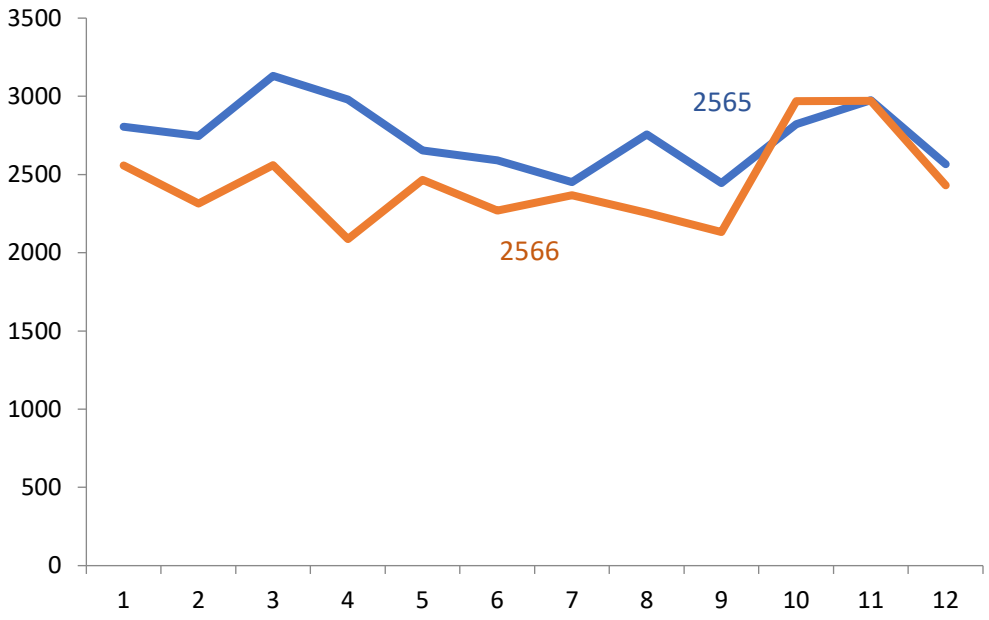
Repetition date (day)	Amount	Repetition date (day)	Amount	Repetition date (day)	Amount
1	120	21	39	41	29
2	38	22	22	42	76
3	21	23	26	43	32
4	24	24	18	44	25
5	25	25	25	45	17
6	25	26	26	46	22
7	33	27	41	47	12
8	25	28	189	48	23
9	25	29	21	49	72
10	29	30	32	50	27
11	27	31	17	51	25
12	27	32	20	52	14
13	30	33	31	53	19
14	47	34	33	54	34
15	30	35	84	55	44
16	26	36	21	56 8 weeks	277
17	25	37	23	57	43
18	24	38	24	58	25
19	20	39	24	59	18
20	38	40	30	60	30



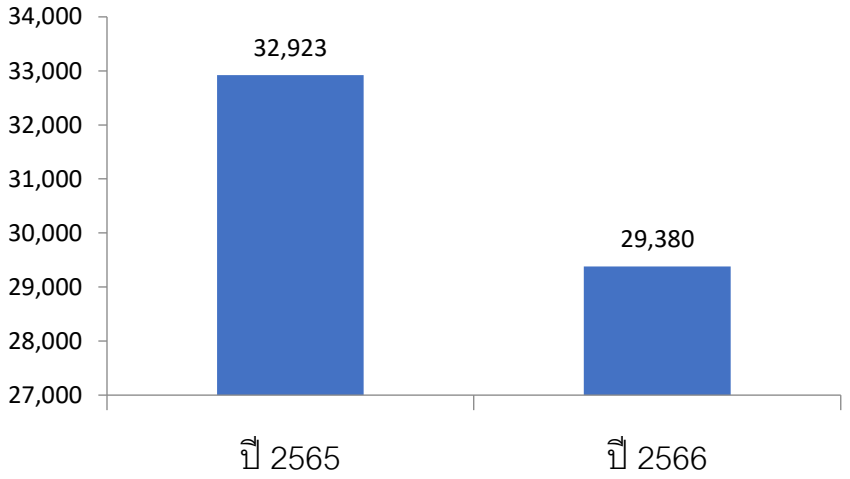
Graph 4 shows HbA1C test volumes. After implementing the RLU of 2nd HbA1C policy in February 2023, the HbA1C testing volume tended to decrease.

- The re-testing for HbA1c less than 60 days are 2269 test, 204,210 bath
- save the average budget about 30,912 baht/month. (368 tests/month)

RLU of HbA1C in Buriram hospital



ปี 2565	2806	2746	3131	2980	2653	2590	2452	2756	2446	2822	2975	2566
ปี 2566	2558	2314	2559	2087	2465	2270	2367	2256	2132	2969	2972	2431



ช่วงเวลา	ปริมาณการตรวจ	ส่วนต่าง	เฉลี่ยต่อเดือน
ม.ค. – ธ.ค. 2565	32,923		
ม.ค. – ธ.ค. 2566	29,380	- 3,543	-296

RLU of HbsAg and Anti HCV in Buriram hospital

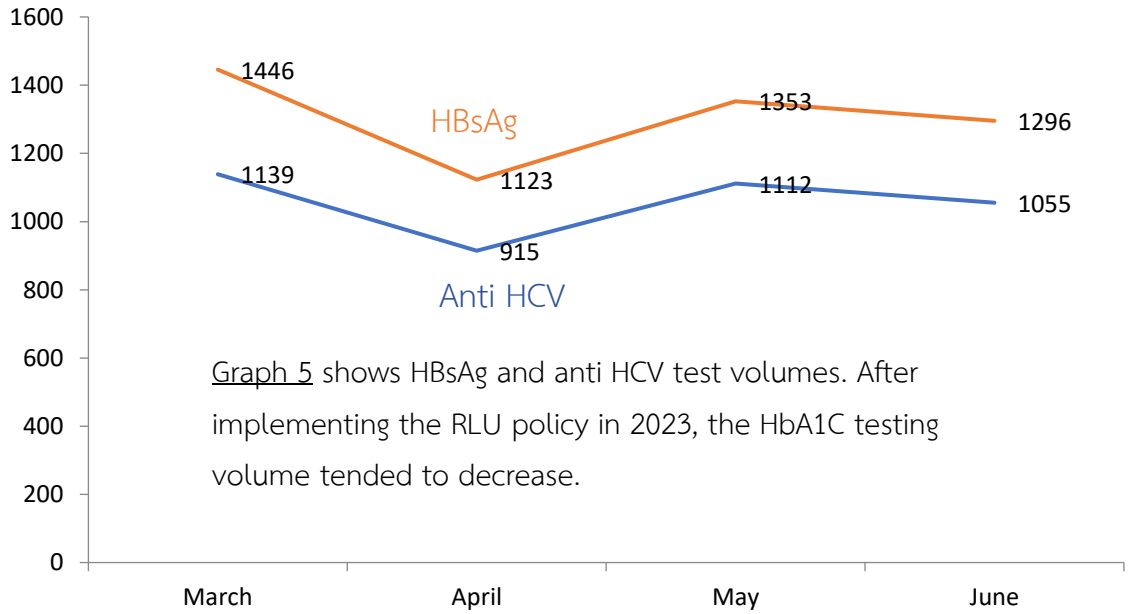
30 days

- Re-testing of HBsAg and Anti HCV founded 951 and 512 test in 30 days (2021) , waste of budget 44,697 and 53,504 bath/year
- If doctor requests re-testing of HBsAg or Anti HCV less than 30 days, advise to test for HBV or HCV viral load.

Diagnostic Window Period

Agent	Years	Screening assay[a]	Length of vDWP (days)[b]
HBV	2003-2006[c]	ChLIA (HBsAg)	42
	2007-2017	ID-NAT (HBV-DNA)	17
HCV	2003-2006[c]	44MP-NAT (HCV-RNA)	5[e]
	2007-2017	ID-NAT (HCV-RNA)	3

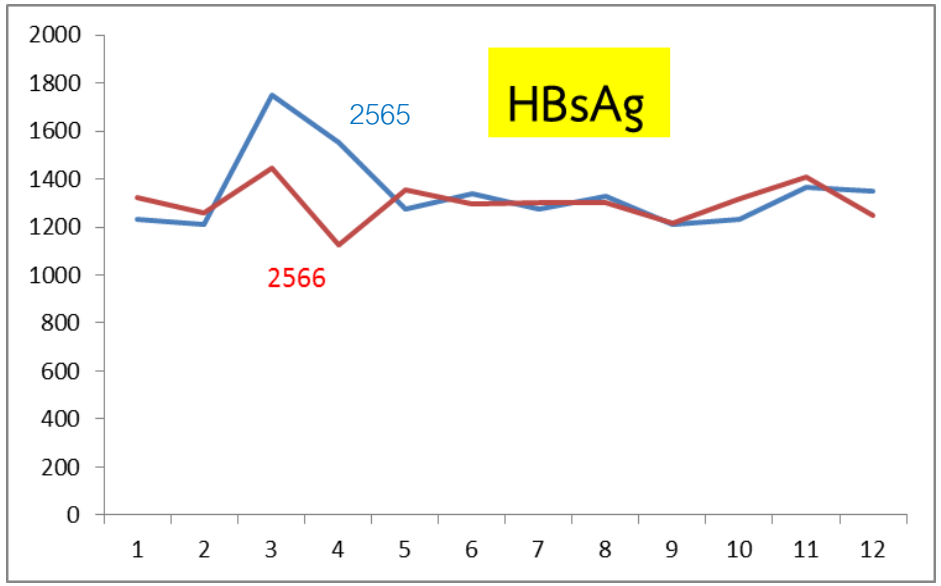
WHO technical report series; no. 1004. WHO Expert Committee on Biological Standardization. Geneva: World Health Organization; 2017. p. 163-96.

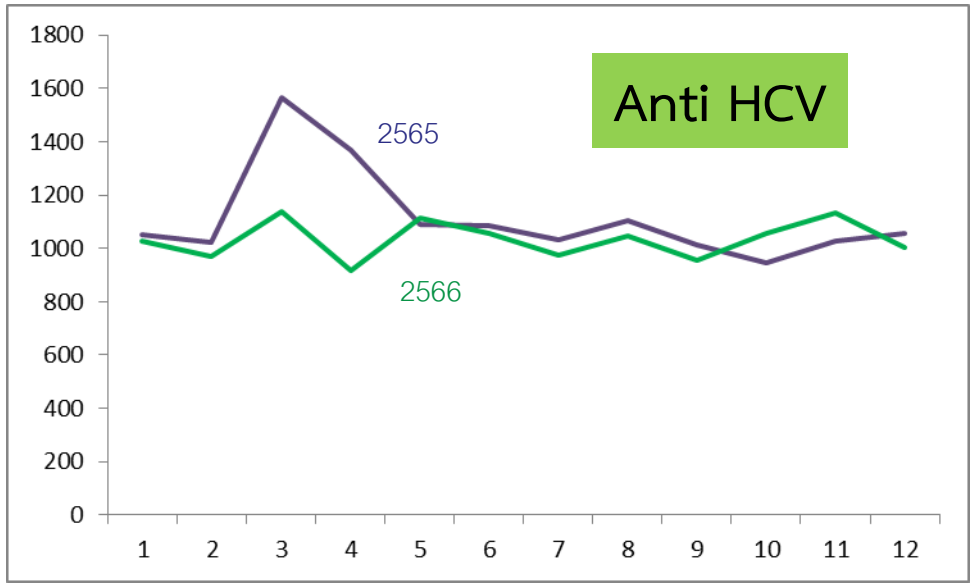


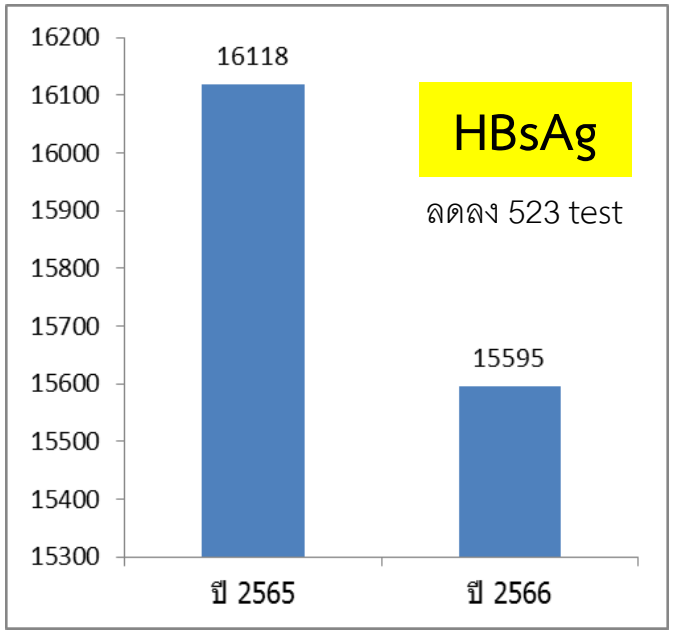
Graph 5 shows HBsAg and anti HCV test volumes. After implementing the RLU policy in 2023, the HbA1C testing volume tended to decrease.

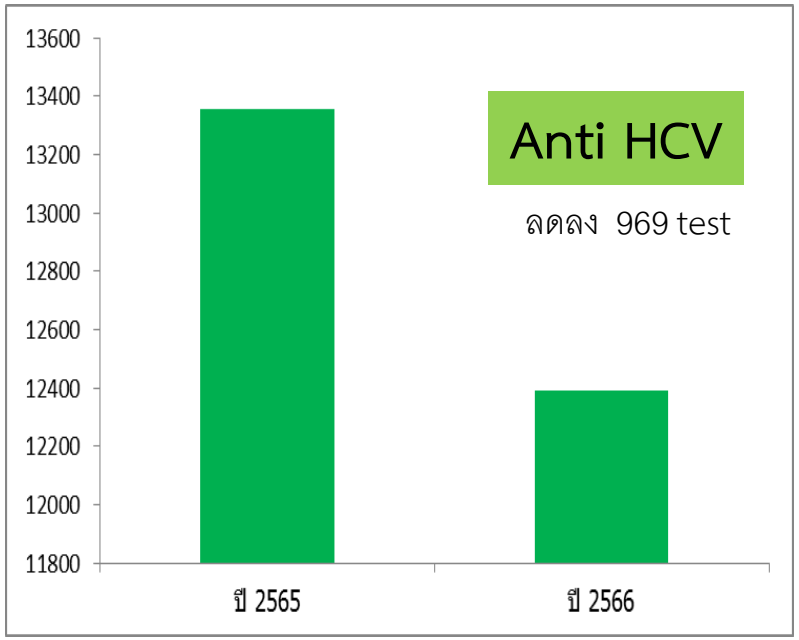
- The volumes of HBsAg and Anti HCV testing in 2023 was decreased about 44 and 76 cases per month, saving the budget of 2,200 and 7,980 baht/month.

RLU of HbsAg and Anti HCV in Buriram hospital









RLU of Hb typing

Once in a lifetime

- 924 re-testing Hb typing in 10 years, 190,224 baht.
- RLU Hb typing – Block Hb typing resend and patients who have previously received blood products in the last 3 months.
- Budget savings 9,040 baht in 9 mounts (43 cases)
- Other advantages:

- Doctors and patients can know the previous results faster from pop-ups warning sign without having to waste time on re-examination.

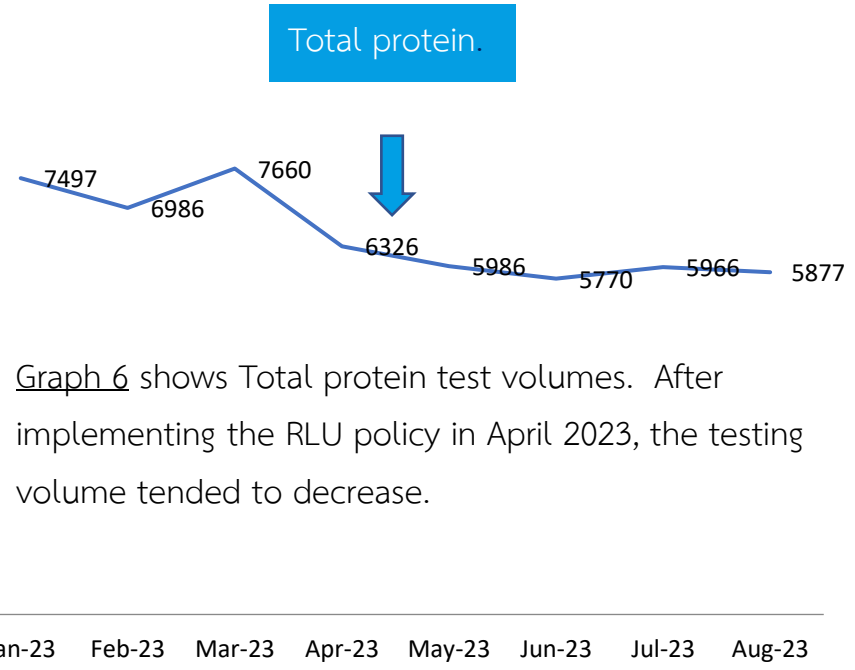
- Got the correct Hb typing result without contaminating donor blood from the blood transfusion.

Table : *show volumn re-testing of Hbtyping and previous blood transfusions patients in each mount.*

	Re-tesing	Received Blood product	Total
Nov-22 – Jan 24 (15 mounts)	34	29	63

RLU of Liver Funtion Test (LFT)

- LFT series are Total protein, Albumin, Globulin, Total bilirubin, Direct bilirubin, AST, ALT and ALP
- Gamma-Glutamyl Transferase (GGT) should not be in the LFT, order more when needed.
- In 2022, 14,247 LFT re-test in 7 days, 840,000 baht per year
- Total protein in the LFT may not require follow-up liver disease within 7 days except for the follow-up treatment of patients with multiple myeloma
- Avoid writing unnecessarily LFT series
- Total protein tends to decrease. Average 1,382 tests per month, value decreased by 6,910 baht per month.



Graph 6 shows Total protein test volumes. After implementing the RLU policy in April 2023, the testing volume tended to decrease.

ตารางแสดงจำนวน Total protein ที่ยับยั้งการส่งได้

เดือน / รายการ	พ.ค.-66	มิ.ย.-66	ก.ค.-66	ส.ค.-66	ก.ย.-66	ต.ค.-66	พ.ย.-66	ธ.ค.-66	ม.ค.-67	รวม
Total Protein	4	13	3	248	315	311	342	246	375	1857

60 days

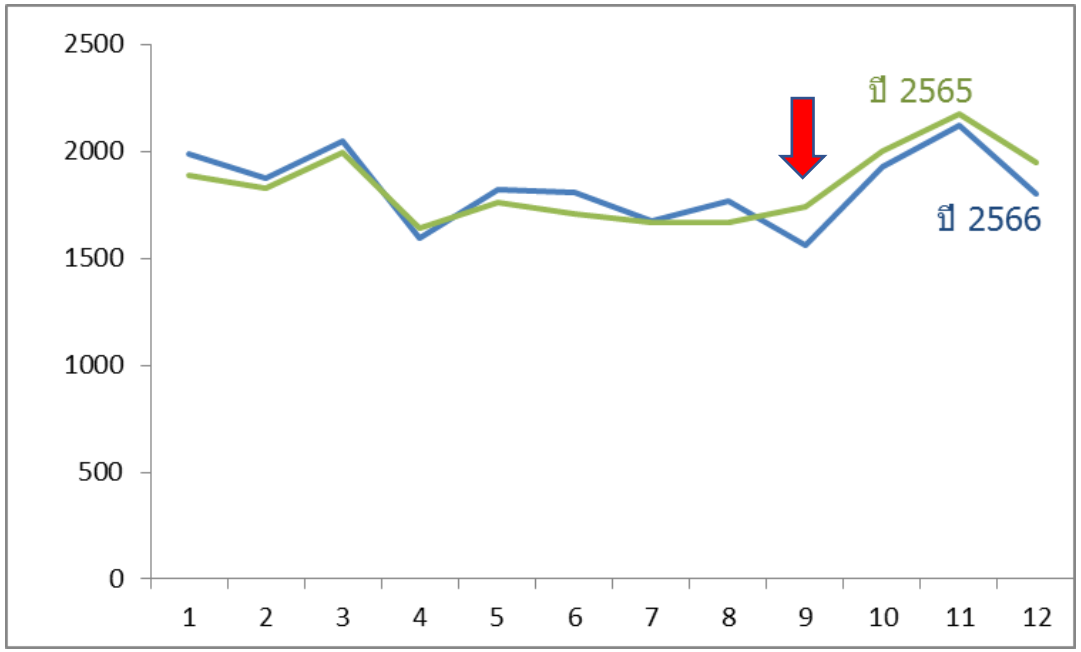
RLU of lipid profile

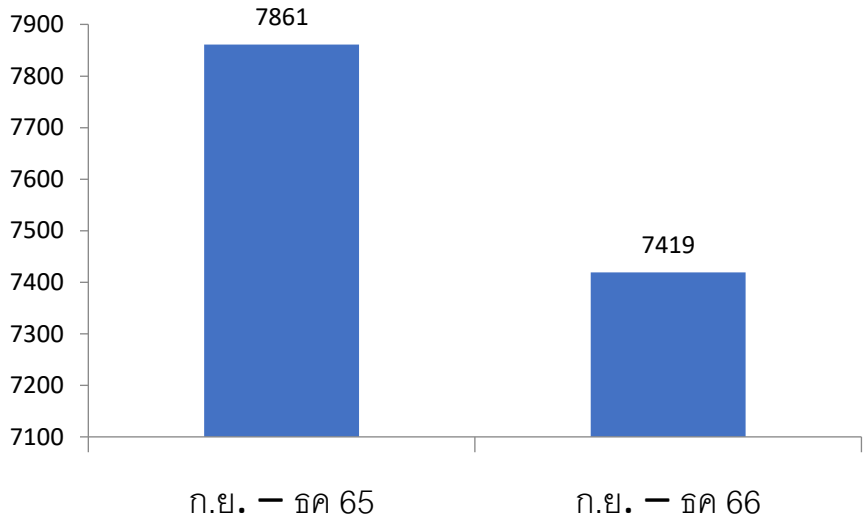
- Lipid profiles consist of cholesterol, triglyceride, HDL and calculated LDL
- In 2022, there were 3,844 lipid profiles were re-testing less than 90 days. with a value of 161,448 baht. (Cost 42 baht per profile)
- In August 2023, the agreement of the Laboratory committee, consist of medical specialists in many fields concluded that Lipid profile should not be re-testing within 60 days.
- If re-testing is required within 60 days, advise to test separate items such as only blood cholesterol (Cost 7 baht/test) for monitoring nephrotic syndrome or only blood triglyceride for severe hypertriglyceridemia (Cost 9 baht/test) or only direct LDL for severe high LDL cholesterol (Cost 29 baht/test) .

ผลการดำเนินการ เริ่ม ส.ค. 66

เดือน / รายการ	ก.ย.-66	ต.ค.-66	พ.ย.-66	ธ.ค.-66	ม.ค.-67	รวม
งด Cholesterol	18	9	22	13	10	72
งด Triglyceride	23	11	23	14	10	81

RLU of lipid profile





	ม.ค	ก.พ.	มี.ค.	เม.ย.	พ.ค.	มิ.ย.	ก.ค.	ส.ค	ก.ย.	ต.ค	พ.ย.	ธ.ค.
ปี 2566	1987	1872	2046	1597	1820	1805	1674	1767	1564	1931	2122	1802
ปี 2565	1891	1827	1995	1639	1761	1706	1669	1671	1739	2001	2173	1948

ช่วงเวลา	ปริมาณการตรวจ	ส่วนต่าง	เฉลี่ยต่อเดือน
ก.ย. – ธค 65	7861		
ก.ย. – ธค 66	7419	- 442	-110

< ความกล้าหาญสำคัญกว่าความสมบูรณ์แบบ >

Thank you!