Effectiveness of an Iron subsidy program in improving hemoglobin values End Stage Kidney Disease hemodialysis patients (Abstract No.1371)

Yusuke Ozawa[4], Tze Ting Luo[2], Nor Majidah Mustaffa Kamal[5], Kuen Koh Pao[7], Mathew Patrick Williams[3], Rosnawati Yahya[6], **Li Ping Tan[1]**

[1]Department of Nephrology, Davita Malaysia, Malaysia
[2]Department of Quality, Davita, Malaysia
[3]Department of Management, Davita, Malaysia
[4]Department of Quality, DaVita, Malaysia
[5]Department of Operations, Davita, Malaysia
[6]Department of Nephrology, General Hospital Kuala Lumpur, Malaysia
[7]Department of Finance, Davita, Malaysia

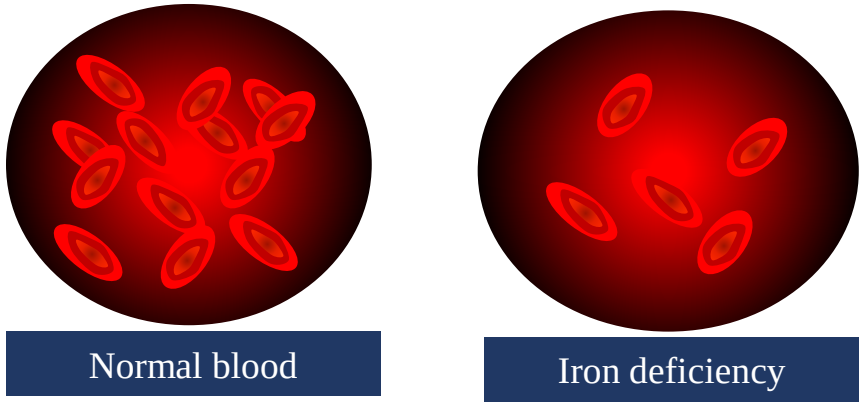
Introduction

Anemia is an important marker of cardiovascular morbidity and mortality in haemodialysis patients. Maintaining an adequate level of haemoglobin requires adequate erythrocyte stimulating agent (ESA) as well as ensuring proper stores of iron. In our practice, intravenous iron is often not provided due to cost, resulting in lower than targeted haemoglobin results.

Adjusted hazard ratio mortality of HD patients (1996-2016)*1

Factors	n	Hazard ratio	95% CI	P-value
Hemoglobin*(g/dL)*				
<10	31171	1.649	(1.614, 1.685)	<0.001
10-<12	39712	1		
>=12	3942	0.749	(0.713, 0.787)	<0.001

- Malaysian NRR (National Renal Registry) 2016.
- According to the report, HR is high if HB < 10*g/dL*



Normal blood | Iron deficiency

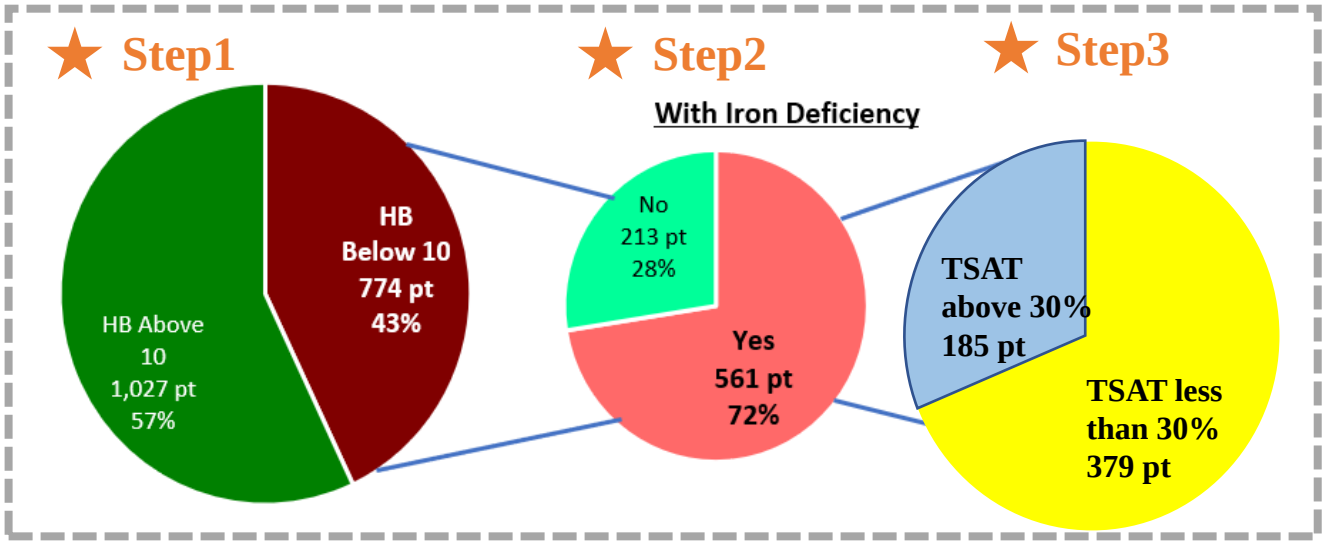
- Iron deficiency prevents the production of haemoglobin*2.
- Low Haemoglobin results in shortness of breath*3 and other symptoms like frequent headaches etc,.

*1: 24th Report of the Malaysian Dialysis and Transplant Registry 2016, Malaysian National Renal Registry
*2: Jeffery L. Miller, Iron Deficiency Anemia: A Common and Curable Disease. *Cold Spring Harb Perspect Med*, 2013 ,3(7), a011866
*3: Black MM, Quigg AM, Hurley KM, Pepper MR 2011. Iron deficiency and iron-deficiency anemia in the first two years of life: Strategies to prevent loss of developmental potential. *Nutr Rev* 69: S64–S70

Method – Selection of Patients

We surmise that provision of iron at a subsidized rate would help in lowering rates of anemia. We have selected patients as target for giving iron. The Selection requirements is : 1.) HB less than 10, 2) Iron Deficiency, 3) TSAT less than 30%.

Patient Selection requirements for the project



- **Step1**: Check HB level of 1,801 patients and select 774 pts whose HB below 10.
- **Step2**: Identify 561 patients who don't have enough iron.
- **Step3**: Select 379 patients whose TSAT level is less than 30%

Patient's Characteristic

Factors		Rate%(# of patients)
Age	<40	16%(223)
	40-65	62%(79)
	65<	16%(59)
Gender	Male	49%(178)
	Female	51%(183)
Ave. HB (*g/dL*)		8.7(379)
Ave. TSAT (%)		23.7(379)
Ave. Ferritin		370(379)

Method – Intervention & Data Monitoring

Intravenous iron sucrose, 100mg weekly during haemodialysis for total of 10 doses delivering a total of 1000mg to 379 patients who matched our requirements. We monitor the project progress by using format below. Also, we assess effecti veness of the impact on HB, Ferritin, TSAT level for 3 monthly basis.

Intervention

1. Planned to give intravenous iron sucrose at 100mg weekly for 10 doses for 379patients.

Data monitoring

1. Blood test monitoring on monthly basis (HB), three monthly basis (Ferritin, TSAT)
2. Monthly monitoring for number of EPO given
3. Checking on project progress by using Project Observation Template

Project Observation Template

Name	Sponsor name	Hb level	Tsat level	Course completed (answer comple te / in progress / Not started)	Remarks (please comment why IV iron Not given)	How many dose prescribed by NIC (e.g. 10dose/week x 10weeks)	How many dose given	First date of giving first Dose	End date of last dose	Blood Cancer (Answer Y es or No)	Allergic reaction (Answer Y es or No)
Patient A	Sponsor A										
Patient B	Sponsor B										

Result

379 patients were identified as meeting the criteria but only 287 patients were analysed. Patients were excluded due to death, refusal of continuation after single dose of iron, allergic reactions and transferring to different dialysis centr es.

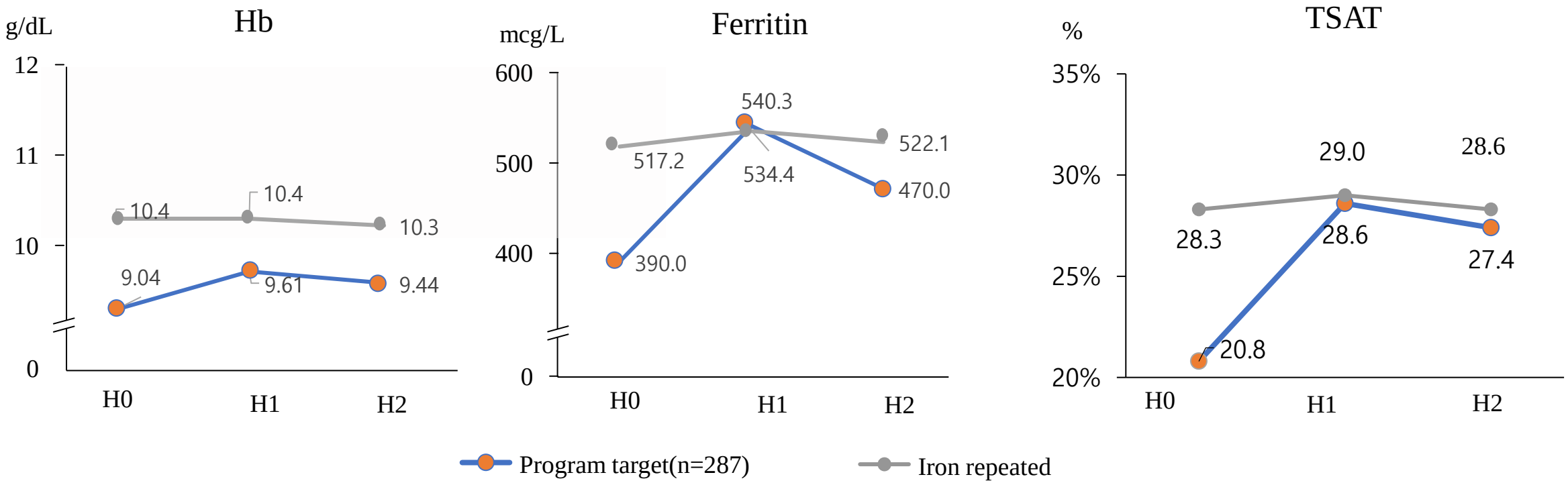
Patient's project progress

Patient's Characteristic

Factors		Rate%(# of patients)
Age	<40	17%(47)
	40-65	69%(172)
	65<	22%(60)
Gender	Male	48%(117)
	Female	52%(129)
Ave. HB (*g/dL*)		9.0(287)
Ave.TSAT (%)		20.5(287)
Ave.Ferr		390(287)

Result

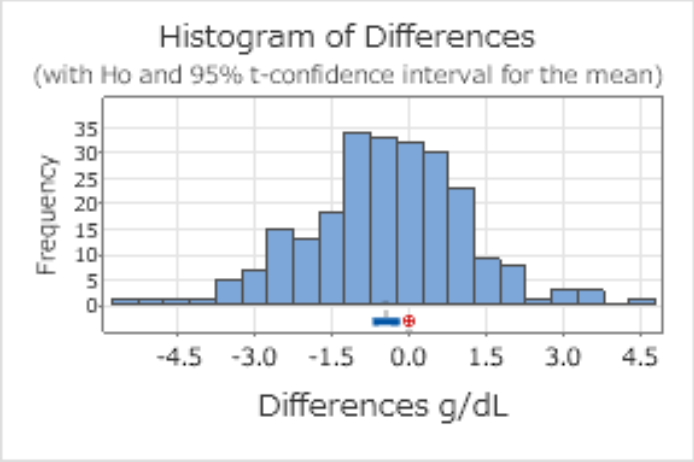
At the end of the program, despite varying iron provision, average ferritin levels had increased from 390mcg/L to 470 mcg/L while haemoglobin levels increased from 9.0 to 9.4g/dL. average iron saturation had increased from 20.8% to 27.4%.

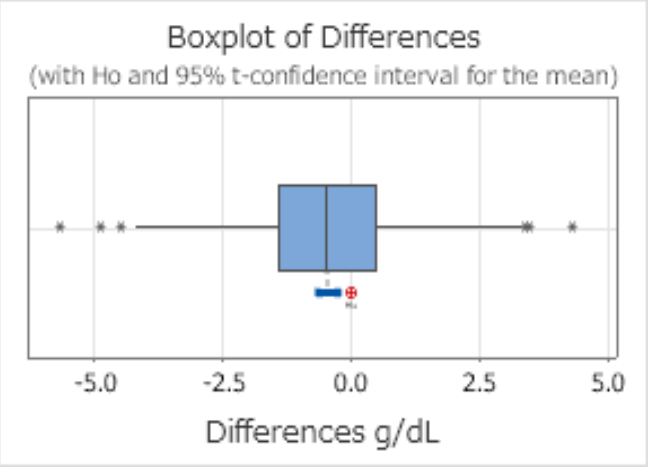


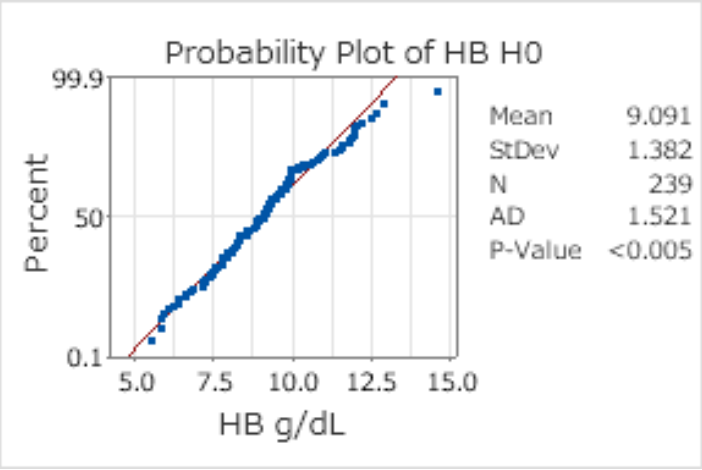
H0: -3 months after the start of the project , H1: 3-6 months after the start of the project, H2; 6-9 months after the start of the project

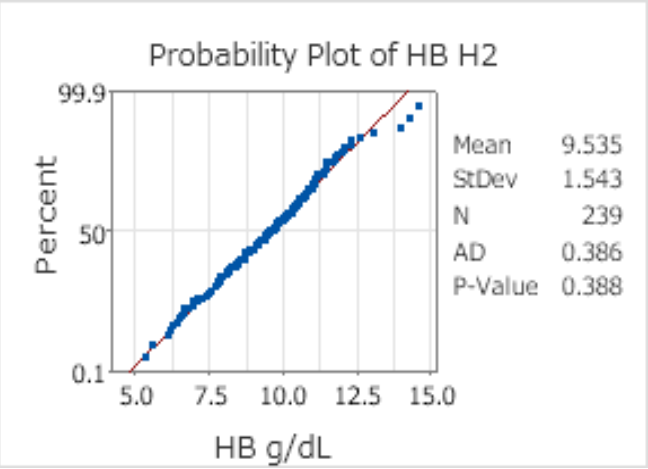
Result

As the paired T-Test results, significant differences were observed in HB level before and after this project.









Paired T-Test Results

Descriptive Statistics

Sample	N	Mean g/dL	StDev	SE Mean
HB H0	239	9.0908	1.3820	0.0894
HB H2	239	9.5351	1.5427	0.0998

Estimation for Paired Difference

Mean	StDev	SE Mean	95% CI for μ_difference
-0.4444	1.5318	0.0991	(-0.6395, -0.2492)

μ_difference: population mean of (HB H0 - HB H2)

T Test

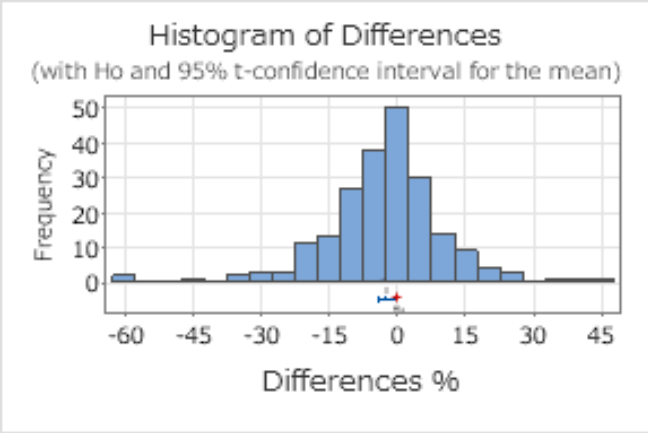
Null hypothesis H_0: μ_difference = 0

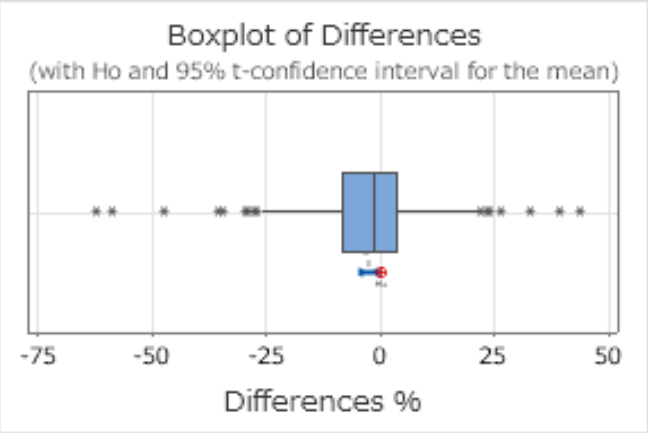
Alternative hypothesis H_1: μ_difference ≠ 0

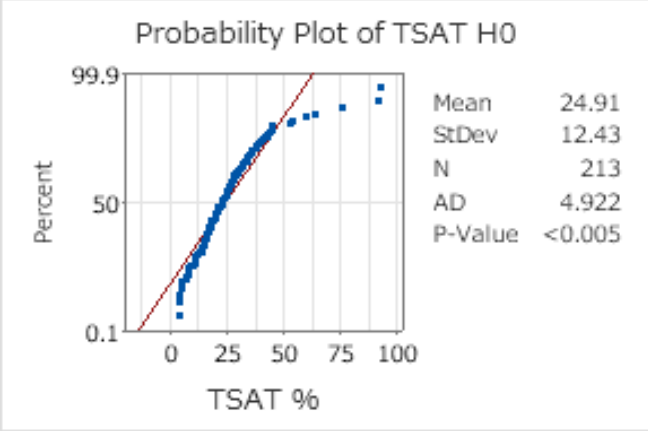
T-Value	P-Value
-4.48	**0.000**

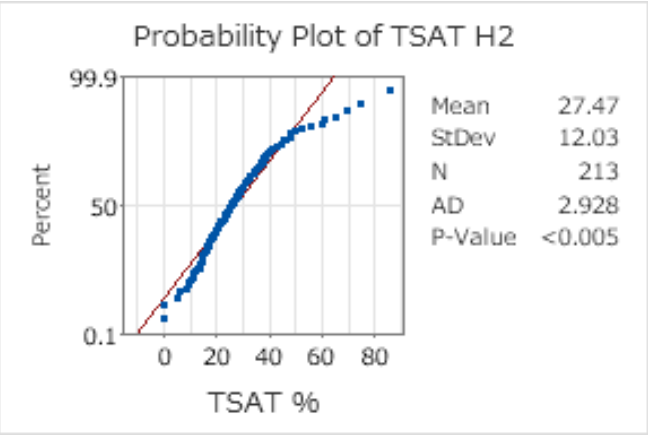
Result

As the paired T-Test results, significant differences were observed in TSAT level before and after this project









Paired T-Test Results

Descriptive Statistics

Sample	N	Mean %	StDev	SE Mean
TSATH0	213	24.908	12.431	0.852
TSATH2	213	27.474	12.033	0.825

Estimation for Paired Difference

Mean	StDev	SE Mean	95% CI for μ_difference
-2.566	13.351	0.915	(-4.369, -0.763)

μ_difference: population mean of (TSATH0 - TSATH2)

T Test

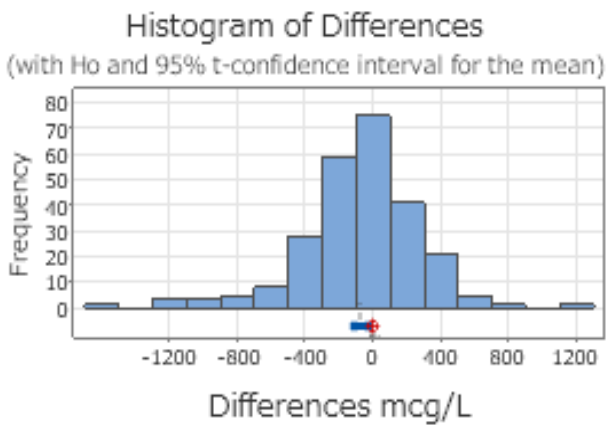
Null hypothesis H_0: μ_difference = 0

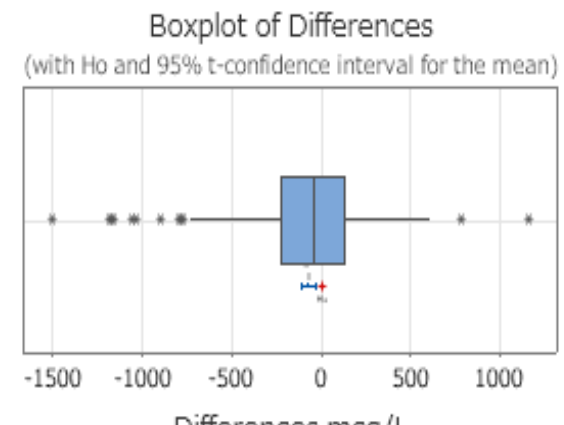
Alternative hypothesis H_1: μ_difference ≠ 0

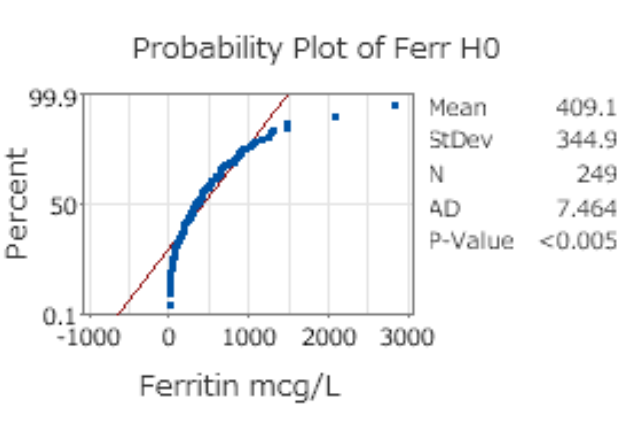
T-Value	P-Value
-2.81	**0.004**

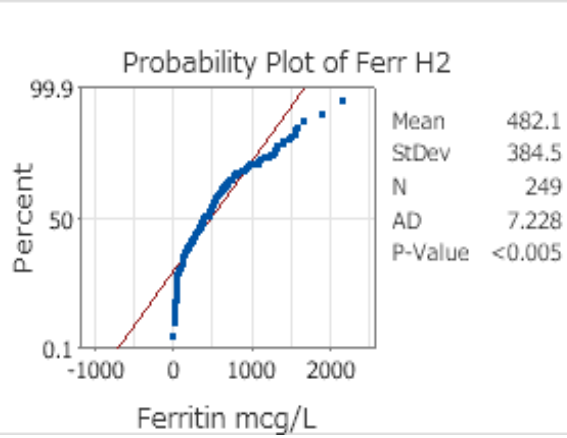
Result

As the paired T-Test results, significant differences were observed in Ferritin level before and after this project









Paired T-Test Results

Descriptive Statistics

Sample	N	Mean mcg/L	StDev	SE Mean
Ferr H0	249	409.1	344.9	21.9
Ferr H2	249	482.1	384.5	24.4

Estimation for Paired Difference

Mean	StDev	SE Mean	95% CI for μ difference
-73.1	333.7	21.1	(-114.7, -31.4)

μ_difference: population mean of (Ferr H0 - Ferr H2)

T Test

Null hypothesis H_0: μ_difference = 0

Alternative hypothesis H_1: μ_difference ≠ 0

T-Value	P-Value
-3.46	**0.001**

Study

Through this effort, improvements in HB, Ferritin, and TSAT due to Iron were observed. We aim to improve reproducibility by increasing the number of samples.

Benefit

- This validation was conducted on approximately 300 subjects and was able to monitor the improvement of blood test items due to Iron.
- By monitoring blood test results for approximately six months, we were able to verify the continued effectiveness of Iron.

Weakness

- Small sample size
- Frequency of blood testing is 3 months and testing frequency needs to be improved.

Conclusion

Iron delivery can effectively improve haemoglobin levels. Iron can be delivered in a variety of prescriptions and still achieve increases in haemoglobin. When cost is not a constraint, the take up rate for iron is high. Sur prisingly, the increase is iron is not mirrored by a similar magnitude of increase in haemoglobin

Reference

*1: 24th Report of the Malaysian Dialysis and Transplant Registry 2016, Malaysian National Renal Registry

*2:Jeffery L. Miller, Iron Deficiency Anemia: A Common and Curable Disease. *Cold Spring Harb Perspect Med,* 2013 ,3(7), a011866

*3: Black MM, Quigg AM, Hurley KM, Pepper MR 2011. Iron deficiency and iron-deficiency anemia in the first two years of life: Strategies to prevent loss of developmental potential. *Nutr Rev* 69: S64–S70

*4: Alleyne M, Horne MK, Miller JL 2008. Individualized treatment for iron-deficiency anemia in adults. *Am J Med* 121: 943–948