SUBCLINICAL HYPOTHYROID

MANAGING PATIENTS USING RESTING METABOLIC RATE AND BRACHIORADIALIS REFLEXOMETRY

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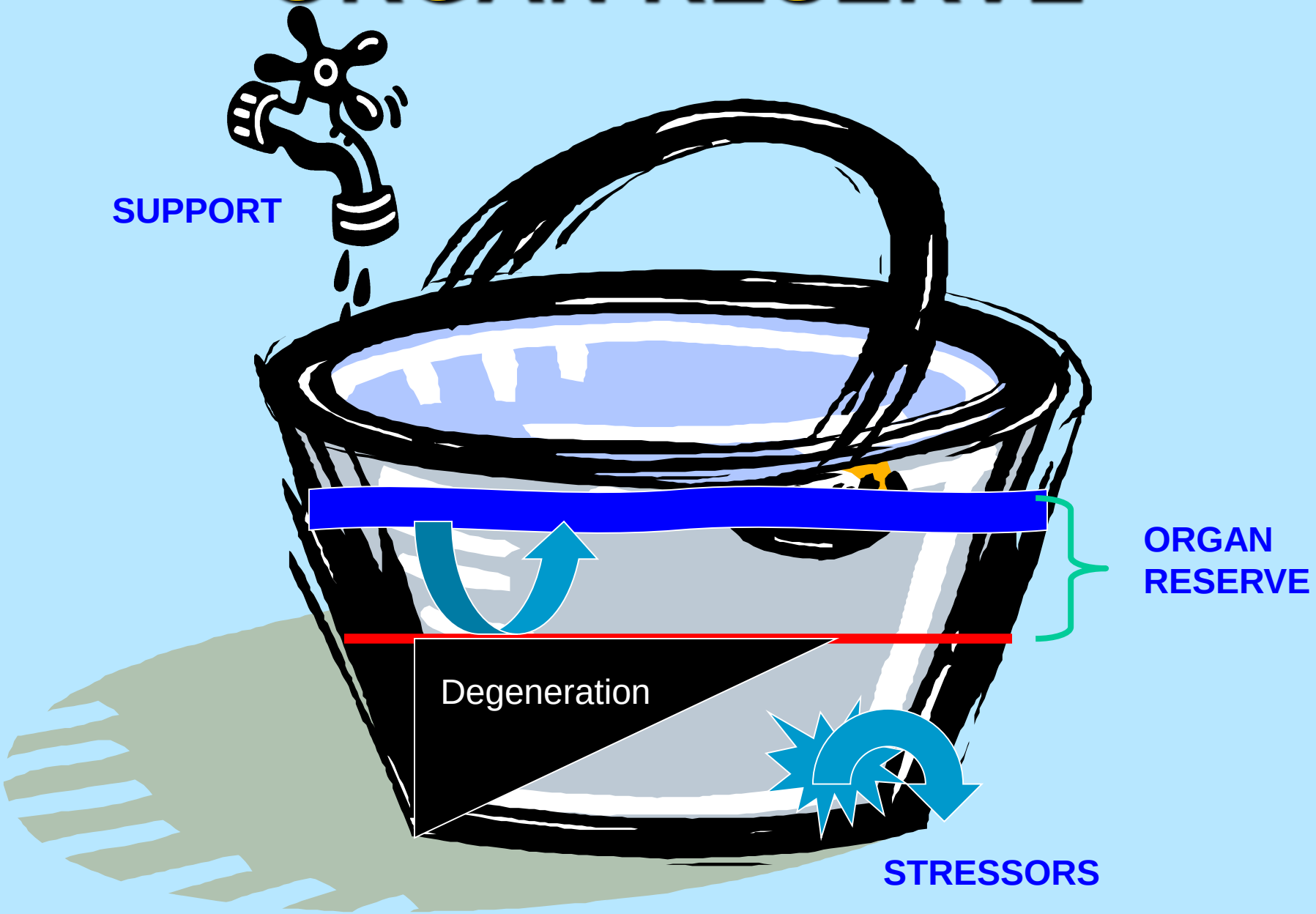
GENERAL CONSIDERATIONS

- MUST WORK FOR HUMANS TO FUNCTION
  - ABSORPTION AND ASSIMILATION
  - DETOXIFICATION AND ELIMINATION
  - REGULATION
- STRESS IMPACTS ALL OF THESE BUT THE MOST PROFOUND AND IMMEDIATE EFFECT IS ON REGULATION
  - ADRENAL AND THYROID GLANDS ARE THE MOST STRESS LABILE
- ADRENAL AND THYROID INTERACT IN REGULATING
  - WEIGHT
  - ENERGY
  - BLOOD SUGAR
  - BLOOD FATS
  - NEUROTRANSMITTERS
  - SEX HORMONES
  - INFLAMMATION
  - IMMUNE FUNCTION

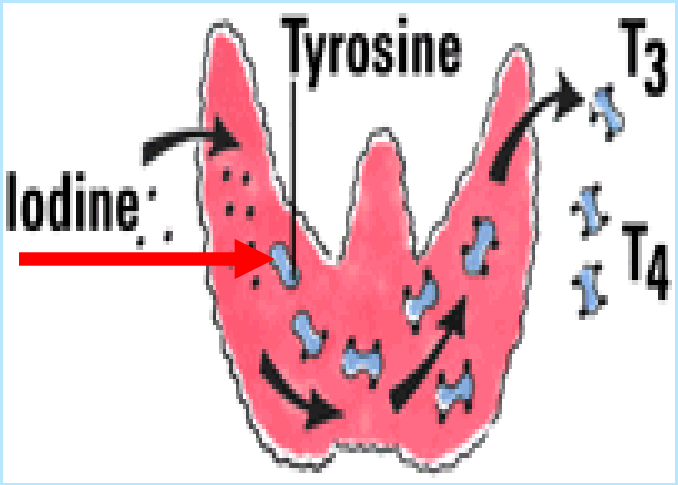
ORGAN RESERVE



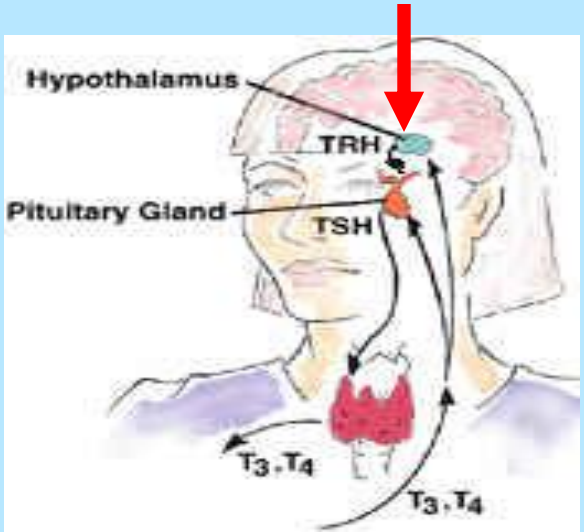
Thyroid Feedback Regulation

The thyroid gland uses

L-Tyrosine and **Iodine** to make T4, the storage form of thyroid hormone and T3 the active form



The production of thyroid hormone is controlled by a feedback loop. When there is not enough receptor site activity in the hypothalamus, TRH is elaborated which stimulates the anterior pituitary to make TSH, which then stimulates the thyroid to make more T3 and T4.



SUBCLINICAL HYPOTHYROID

- **SYMPTOMS COMPATIBLE WITH HYPOTHYROID (≥ 12 on Symptom Survey)**
- **LOW BBT (≤ 97.5° F axillary)**
- **SLOW REFLEXES (≥ 137 msecs)**
- **LOWER RMR**
- **NORMAL TO SLIGHTLY HIGH TSH**
- **NORMAL FREE T3, FREE T4**
- **NORMAL T3U, T4, T7**
- **PREVALENCE UNKNOWN (8-30%)**

CARDIOVASCULAR RISK

- **INCREASED**
  - SERUM LIPIDS
  - HOMOCYSTEINE
  - C-REACTIVE PROTEIN
  - CORONARY HEART DISEASE
  - HYPERTENSION
  - ISCHEMIC HEART DISEASE
  - ENDOTHELIAL DAMAGE
  - COAGUABILITY
  - PERIPHERAL ARTERY DISEASE
- **DECREASED**
  - STROKE VOLUME
  - CARDIAC OUTPUT

MARKERS OF SUDDEN DEATH RISK

DIABETES RISK

- DISRUPTION OF GLP-1 SIGNALLING
- DECREASED THYROID FUNCTION UP TO 18 HOURS AFTER HYPOGLYCEMIC EPISODES
- ASSOCIATED WITH INSULIN RESISTANCE

INCREASED

- HOMA AND TRIG/HDL
- DYSGLYCEMIA
- OBESITY

ARTHRITIS & INFLAMMATION

- INCREASED RATES OF HASHIMOTO'S
- INCREASED EUTHYROID SICK RISK
- RA PATIENTS WITH SUBCLINICAL HYPOTHYROID HAD DYSFUNCTIONS OF GLUCOSE METABOLISM AND INSULIN RESISTANCE

NEURO-PSYCHOLOGICAL RISK

INCREASED

- HOFFMAN'S SYNDROME
  - WEAKNESS AND STIFFNESS
- DUPUYTREN'S CONTRACTURE
- CARPAL TUNNEL SYNDROME
- POLYMYOSITIS-LIKE SYNDROME
- PARKINSONS
- HEARING LOSS
- ANXIETY AND DEPRESSION
- 1.97 RELATIVE RISK OF COGNITIVE DECLINE (ALZHEIMER'S)

BONE RISK

INCREASED

- **BONE RESORPTION IN HYPERTHYROID**
  - URINARY PYRIDINOLINE
  - URINARY DEOXYPYRIDINOLINE
  - URINARY CALCIUM
  - SERUM TELOPEPTIDES
- **NO CALCIUM METABOLISM PROBLEMS IN HYPOTHYROID**
  - CALCIUM BINDS THYROID

(TAKE THYROID AT LEAST 45 MINS AWAY FROM CALCIUM)

PREGNANCY

- FERTILITY ISSUES
- 3 FOLD INCREASE IN PLACENTA PREVIA
- 2 FOLD INCREASE IN PREMATURE DELIVERY
- MAY AFFECT MENTATION IN OFFSPRING
  - NOT WELL STUDIED

FACTORS AFFECTING THYROID FUNCTION

- PERIPHERAL CONVERSION OF T4 TO T3
  - HEPATIC, RENAL, MITOCHONDRIAL FUNCTION
  - DECREASED 5'D-1
    - INHIBITED BY IL-1, IL-6
- TOXIC MATERIALS
  - LEAD, MERCURY
  - PCB
  - FUNGICIDES, ORGANO-CHLORINE INSECTICIDES
- DRUGS
    - AMIODORONE, ANTI-CONVULSANTS, SALSALATE, LITHIUM
- MITOCHONDRIAL PROTEIN LEAKAGE
  - UNCOUPLING PROTEIN 3
- CYTOKINES
  - NF-KAPPA-B
  - TNF-ALPHA
  - IL-1 ALPHA/BETA
- EUTHYROID SICK SYNDROME IMPAIRS FUNCTION UP TO 60 DAYS FOLLOWING ACUTE SEVERE ILLNESS

DISTRIBUTION OF THYROID

Organ Distribution of T_3 and T_4

In humans, the extra thyroidal pool of T_3 and T_4 is distributed as follows:

Table

Organ	T_4	T_3
Liver & Kidney	33%	5-7%
Skin, muscle, brain	44%	75%
Plasma	22%	18%

DECREASED CONVERSION

Peripheral conversion of $T_4 \rightarrow T_3$ is reduced by:

1. Carbohydrate intake restriction
2. Chronic illness
3. Hypothyroidism
4. Increased glucocorticoids-or high stress states
5. Estrogens
6. Deficits in tissue cofactors
7. $\mathcal{B}$-Blockers

REVERSE T3 (RT3)

	T_4	T_3	rT_3	Remarks
mean serum concentration ng/ml	80	1.4	.25	serum T_4 is 60x more abundant than T_3
body distribution volume (L)	10	38	90	T_4 is mostly confined to vascular space
production rates mg/day	88	30	28	T_3 distributes in vascular and ECF space
% derived from T_4	-	>80	>95	rT_3 distributes in total body

The ratio in the gland of $T_4/T_3 = 10$

Vasoactive Intestinal Peptide and Thyroid Function

- **VIP exerts action through 2 receptors VPAC1 and VPAC2**
  - **VPAC1 receptors are in liver, breast, kidney, prostate, ureter, bladder, pancreatic ducts, GI mucosa, lung, thyroid, adipose tissue, lymphoid tissue, and adrenal medulla.**
  - **VPAC2 receptors are in blood vessels, smooth muscles, the basal part of mucosal epithelium in colon, lung, and vasculature of kidney, adrenal medulla and retina. Also present in thyroid follicular cells and acinar cells of the pancreas.**
- **In hypothyroid, there was a 2-fold increase in all peptides derived from VIP, found in the gastric fundus**
- **In hypothyroid significant increases of pituitary VIP**
- **VIP modulates T3 and T4 (decreases) in any inflammation**

DE-IODINASES

Bianco AC, Salvatore D, et al. Biochemistry, cellular and molecular biology, and physiological roles of the iodothyronine selenodeiodinases. Endocr Rev. 2002 Feb;23(1):38-89.

Type	Tissues	Site	Substrate Preference	Inhibitors
D1	Liver, Kidneys, Thyroid	**Plasma membra**	rT3, T4, T3	**PTU, T4+, IL1, IL6, TNFα**
D2	**Thyrotrophs, Hypothalamus, Skeletal Muscle, Heart, Thyroid**	Endo. Retic	T4, rT3	**Iopanoate, T4+, T3+**
D3	**Brain, Placenta, Pregnant Uterus, Skin**	**Sub Plasma Memb**	T3, T4	**Iopanoate, Dexamethasone**

T4 to T3 CONVERSION

ACTION ON METABOLISM

Thyroid Receptor Phenotypes

Alkemade A, Vujist CL, et al. Thyroid hormone receptor expression in the human hypothalamus and anterior pituitary. J Clin Endocrinol Metab. 2005 Feb;90(2):904-12.

TYPE	TISSUES
TRβ2	Pituitary Thyrotrophs
TRβ1	Liver, Kidney T4 to T3 Conversion
TRα1	Skin, Muscle, Heart Brown Fat
TRα2	Brain Action on Metabolism Hypothalamus (inhibitory)

TSH- REGULATION

MAY NOT REPRESENT METABOLIC DEMAND

TISSUE	ACTION	RECEPTOR	DE-IODINASE
HYPOTHALAMUS BRAIN (action on metabolism)	TRH	TR-α2	D2, D3
THYROTROPHS (Pituitary)	TSH	TR-β2	D2
THYROID (T4, T3 production)	T4, T3	TR-β2 ?	D1, D2
LIVER KIDNEYS (T4 to T3 conversion)	T3	TR-β1	D1
SKELETAL MUSCLES HEART		TR-α1	D2

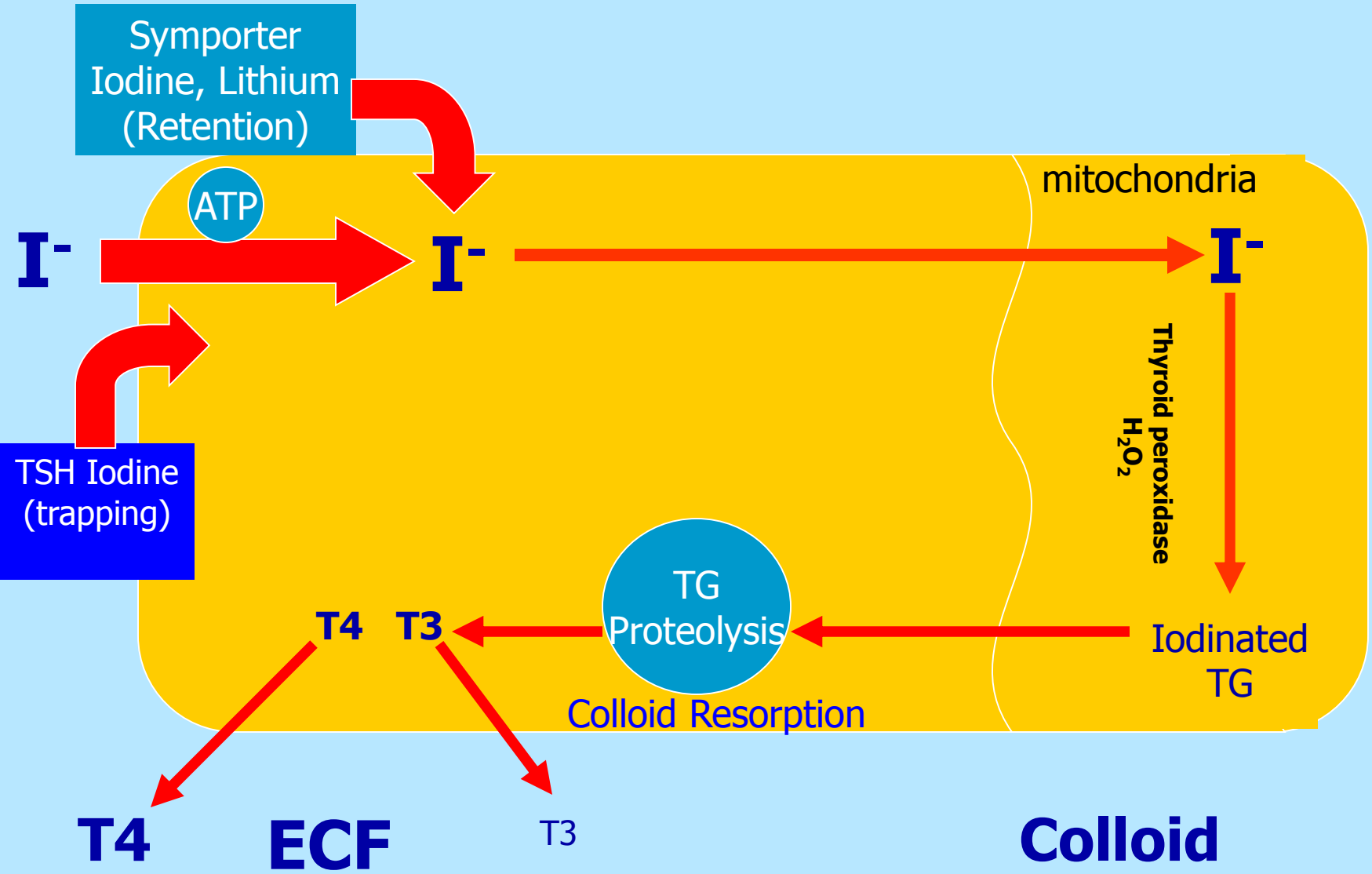
NUTRIENTS AND THYROID

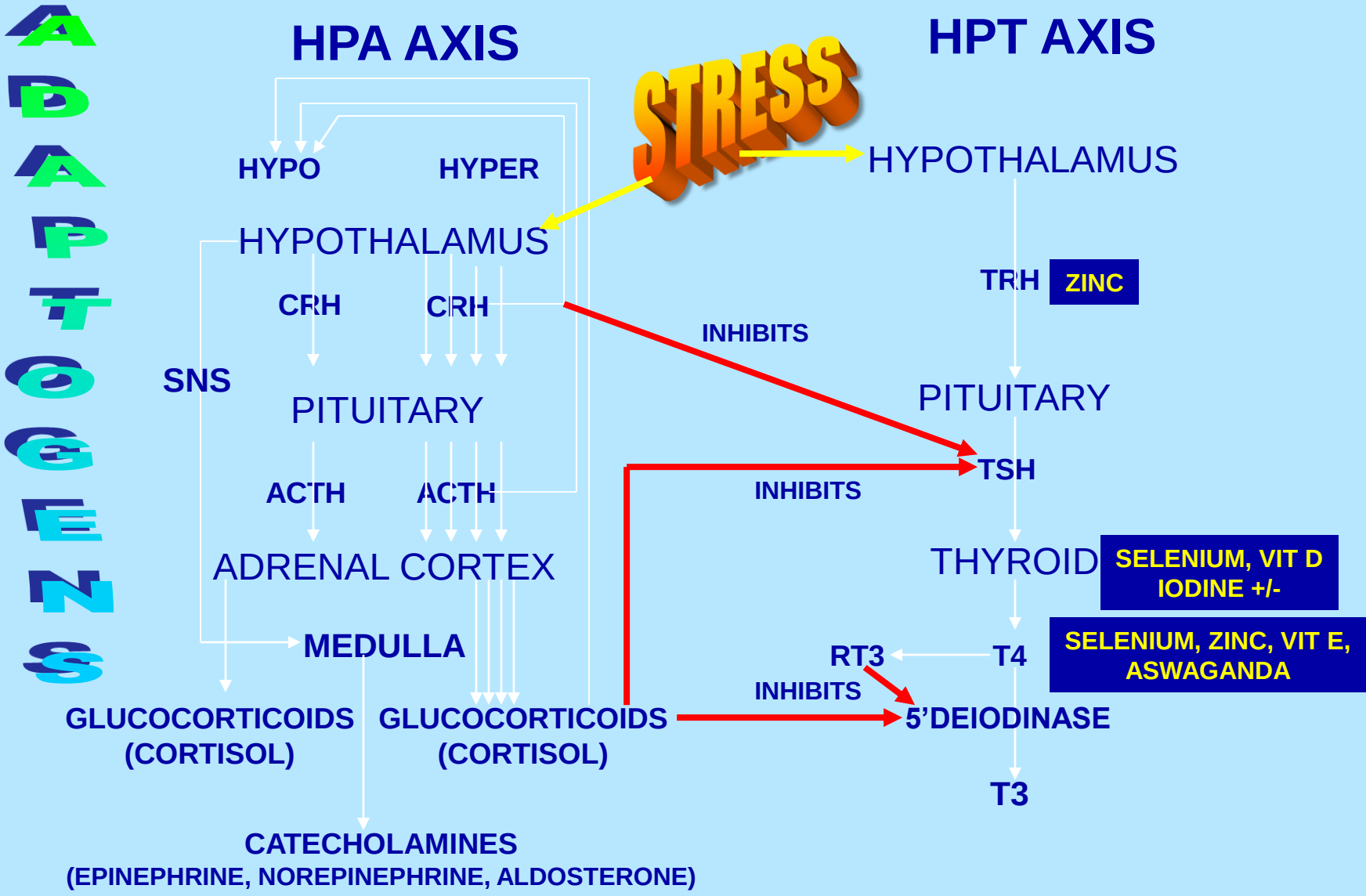
- SELENIUM
  - IMPROVES FUNCTION DECREASES RECOVERY TIME IN EUTHYROID SICK SYNDROME
- IRON AND ZINC
  - INCREASE THYROID FUNCTION IN IRON/ZINC DEFICIENT
  - NO EFFECT IN IRON/ZINC SUFFICIENT
- CALCIUM
  - INHIBITS ABSORPTION
- ALPHA-TOCOPHEROL
  - NO EFFECT
- KELP AND ALL IODINE
  - HELPFUL IN IODINE DEFICIENT
  - DOSE DEPENDENT DECREASE IN THYROID FUNCTION IF IODINE SUFFICIENT
- L-CARNITINE DECREASES THYROID FUNCTION
  - PREVENTS THYROID HORMONE ENTRY INTO NUCLEUS OF CELLS
- High Soy intake inhibits thyroid function
  - Ipriflavone helps bone resorption but does not increase cancer risk

Lithium and Thyroid Function

- Enters thyrocyte via the Na^+/I^- Symporter
- Concentrated in thyroid gland to 3-4 times serum levels
- Increases intra-thyroidal iodine content
- Inhibits coupling of iodotyrosine residues
- Decreases colloid droplet formation
- Inhibits microtubule formation
- Inhibits thyroid hormone secretion
- Blocks iodine release from thyroid gland
- Treats hyperthyroid in people allergic to iodine

Iodine Uptake and Retention





Hypercortisolemia Inhibits Thyroid Function

Influence of Other Hormones on Thyroid Activity

STRONG THYROID STIMULATORS	MILD THYROID STIMULATORS	STRONG THYROID INHIBITORS	MILD THYROID INHIBITORS
Growth Hormone IGF-1 Testosterone Other Androgens	**DHEA Androstenedione Melatonin Progesterone Cortisol at physiologic doses**	**ORAL ESTROGENS OF ANY TYPE**	Transdermal or injectable Estradiol, Cortisol in small doses
Insulin In patients with insulin deficiency	Erythropoietin (hypothetical)	Cortisol and other Glucocorticoids at high doses	Insulin In patients with insulin resistance

HERTOGHE, T; The Hormone Handbook. International Medical Books Surrey, UK, 2006, p88.

Hypothyroid Causes Adrenal Dysfunction

- Results in hypersecretion of CRH and AVP from hypothalamus
- Significantly increased pituitary content of VIP
- ↓ Adrenal weight, ↓ Corticosterone
- ↑ACTH, CRH, AVP

Tohei A. Studies on the functional relationship between thyroid, adrenal and gonadal hormones. J Reprod Dev 2004 Feb;50(1):9-20.

MEASUREMENTS OF THYROID FUNCTION

SERUM MEASUREMENTS

- What's on the shelves at the pharmacy
- TSH INSENSITIVE WHEN APPROACHING NORMAL

PHYSIOLOGIC MEASUREMENTS

- What you took home from the pharmacy

- BODY MASS INDEX
  - CORRELATION WITH RESTING METABOLIC RATE
- BASAL BODY TEMPERATURES
  - IDENTIFY SUBCLINICAL HYPOTHYROID
  - TOO SLOW TO RESPOND TO TREATMENT
- RESTING METABOLIC RATE
  - SOME ARTIFACTS
    - CONGESTION
    - REACTIVE AIRWAY DISEASE
    - ASTHMA OR OTHER COPD
- REFLEXES
  - ACHILLES, BRACHIORADIALIS, STAPEDIAL
  - NO ARTIFACTS UNLESS NERVE DAMAGE

METHODOLOGY

- **ENTRY CRITERIA**
  - **BBT<97.5^0 F AXILLARY AVERAGE (BRODA BARNES)**
- **BASELINE MEASUREMENT AND THIRTY DAY TREATMENT INTERVALS**
  - **SYMPTOM SURVEY**
  - **BODY MASS INDEX**
  - **RESTING METABOLIC RATE (oxygen consumption)**
  - **BRACHIORADIALIS REFLEXOMETRY (mean of 4)**
  - **TSH,T3U, T4, T7**
    - **ADDED FREE T3, FREE T4**
    - **SOME HAD**
      - **MICROSOMAL (TPO) AB**
      - **THYROGLOBULIN AB**
      - **REVERSE T3**
      - **THYROTROPIN RELEASING HORMONE**
  - **LIPIDS**
    - **CHOLESTEROL**
    - **LDL**
    - **HDL**
    - **TRIGLYCERIDES**

RESTING METABOLIC RATE MEASUREMENT VIA OXYGEN CONSUMPTION


PROTO-TYPE BRACHIORADIALIS REFLEXOMETRY SYSTEM

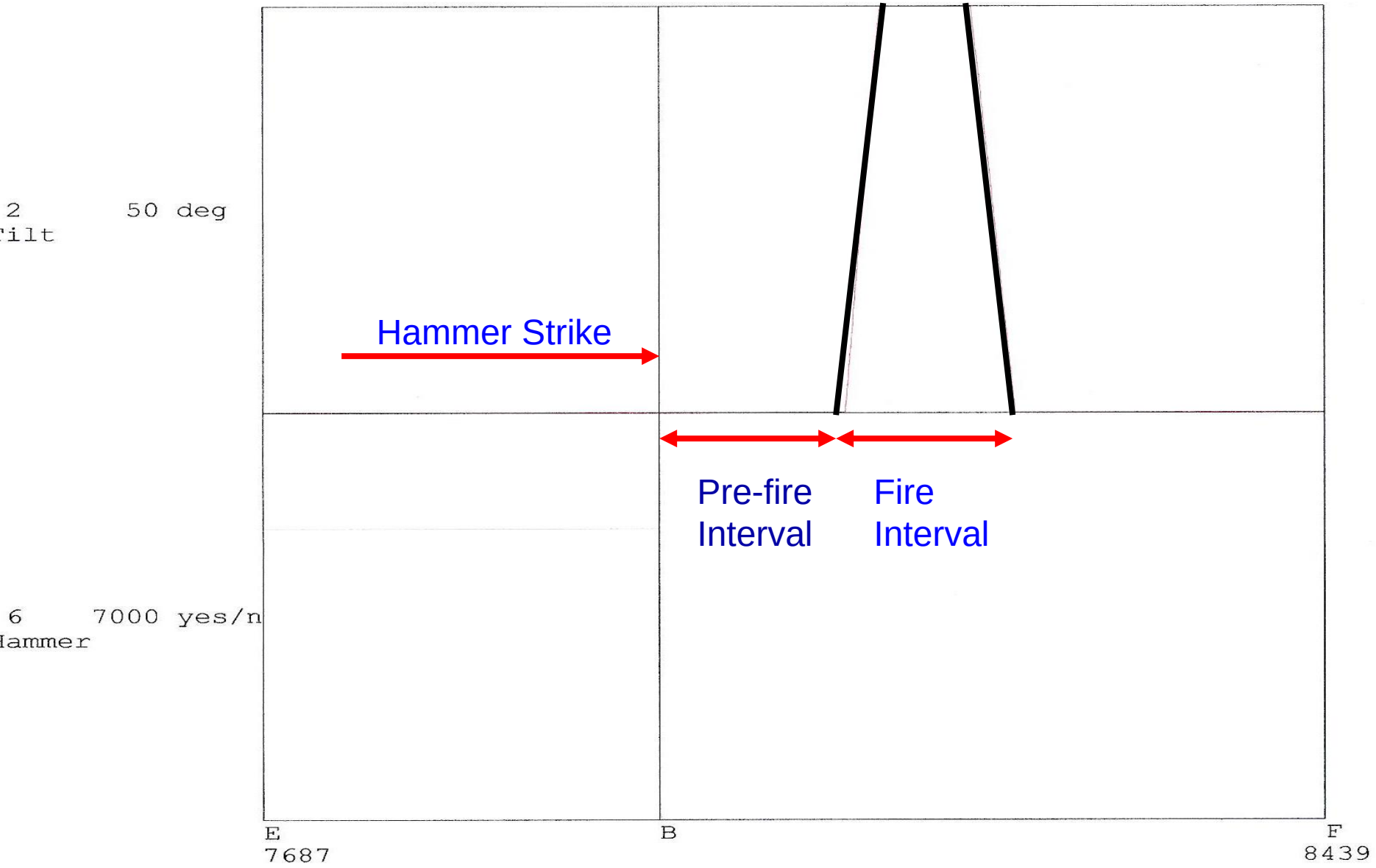

INCLUDES
COMPUTER
Hammer
Link
Inclinator

Test: Reflex Arc

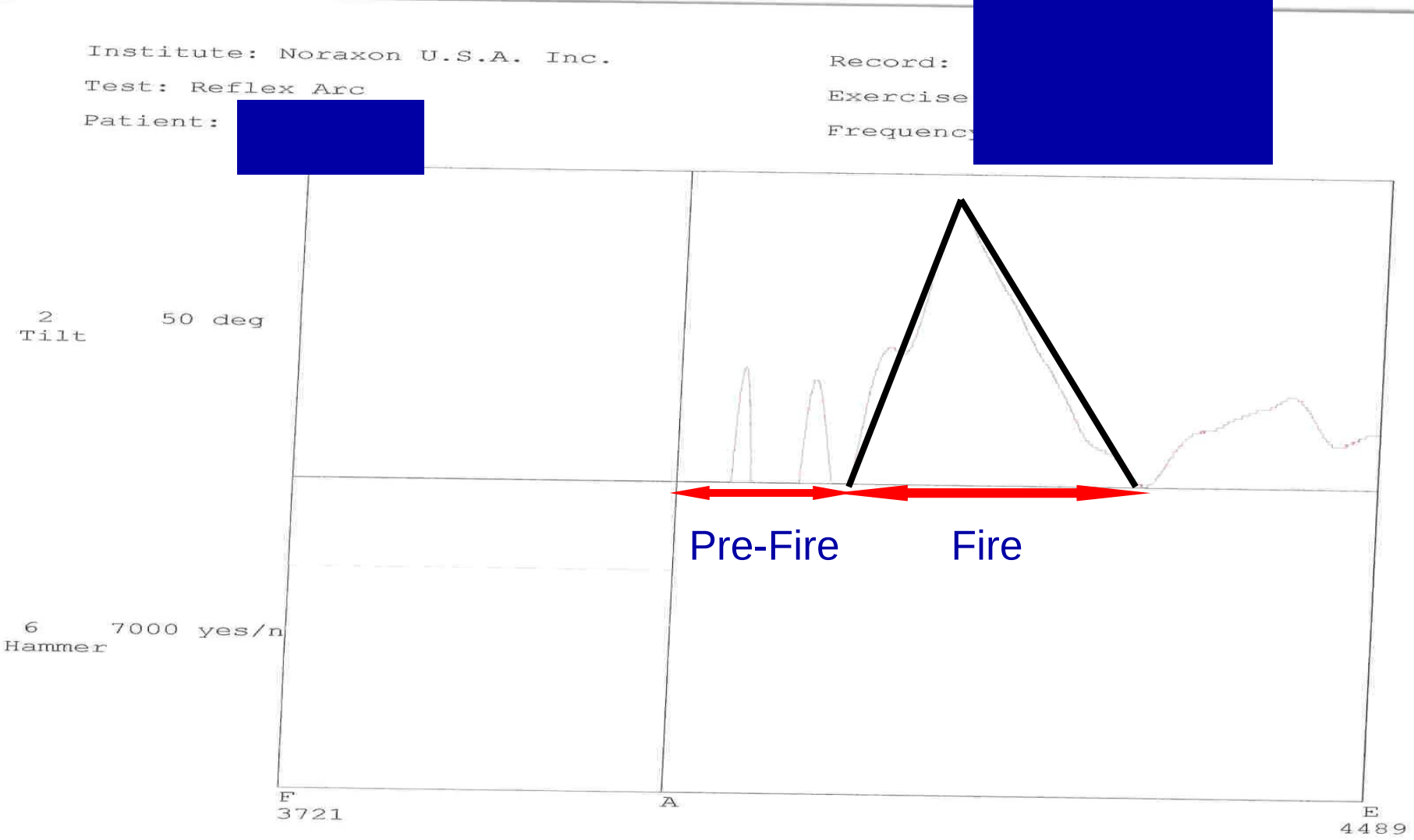
Patient:

Exercise:

Frequency: 2000 Hz



Euthyroid



HYPOTHYROID

Institute: [redacted]

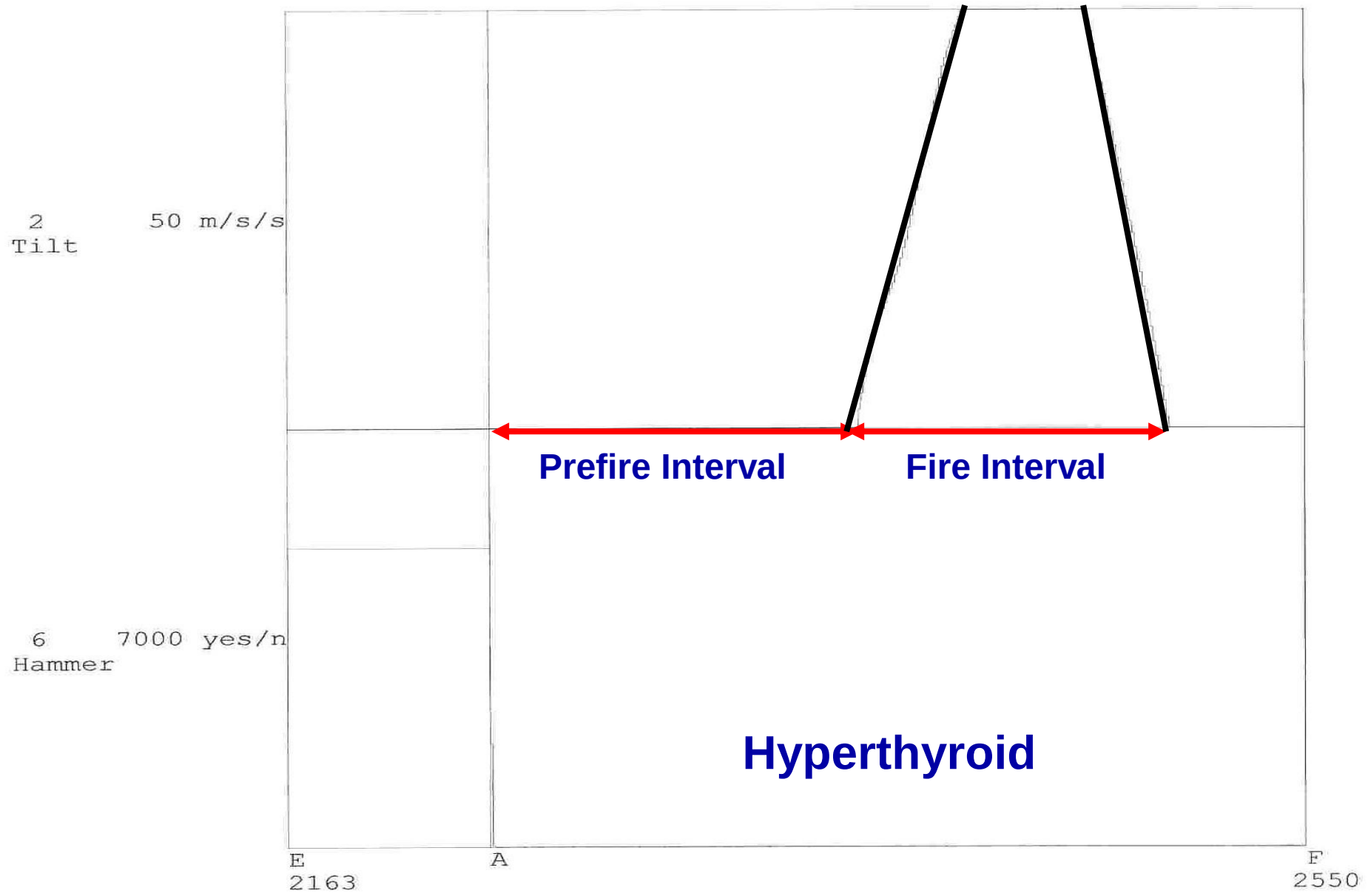
Test: Reflex Study

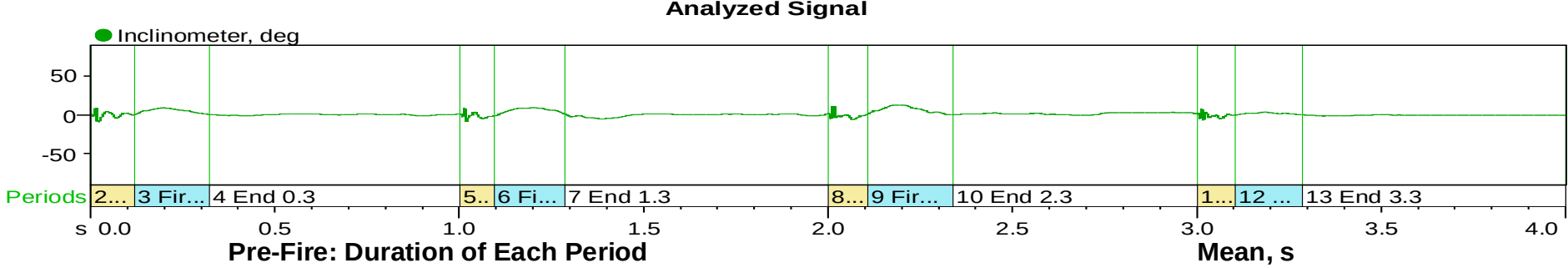
Patient [redacted]

Record: [redacted]

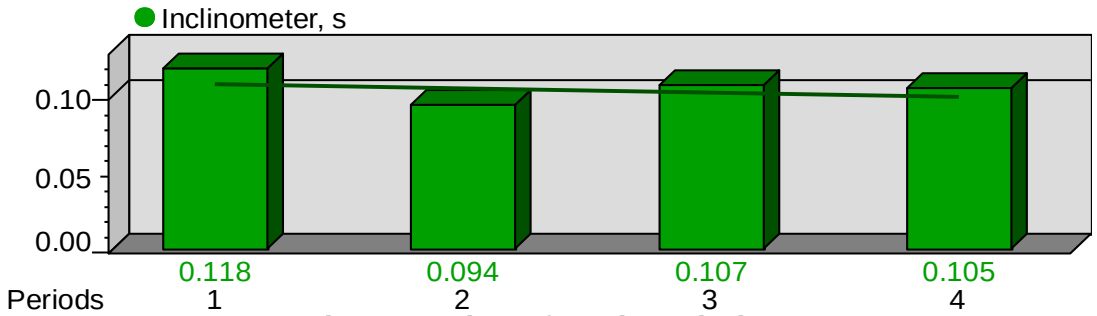
Exercise

Frequenc

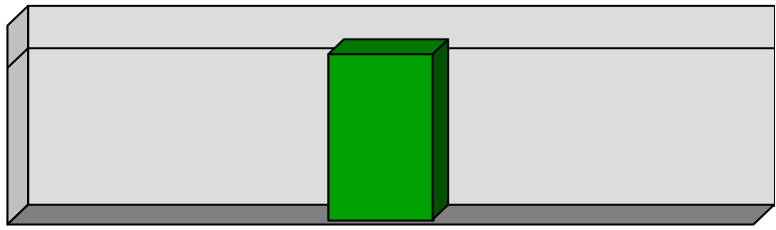




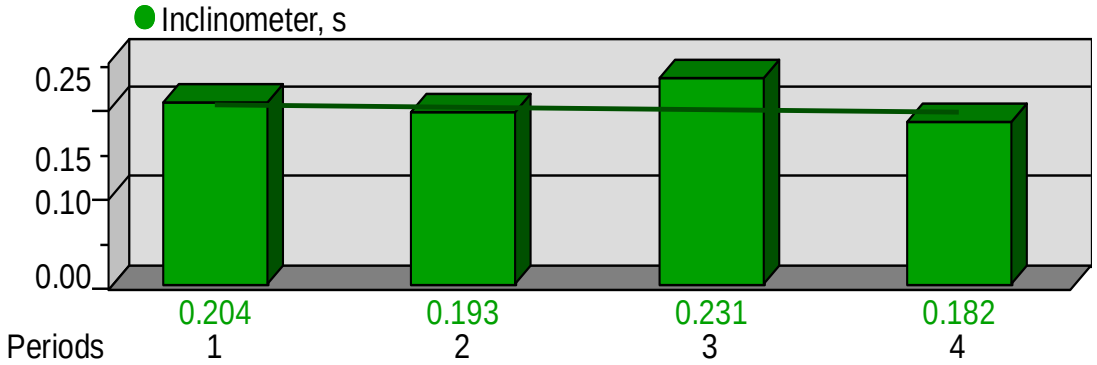
Pre-Fire: Duration of Each Period



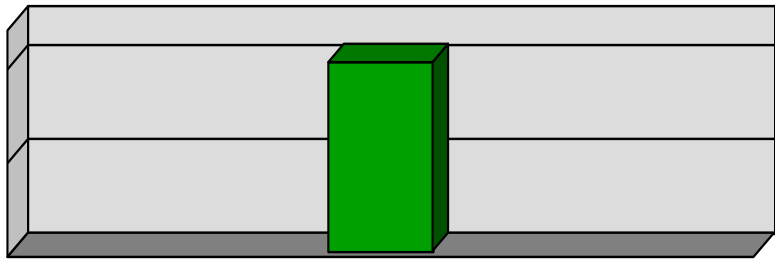
Mean, s



Fire: Duration of Each Period

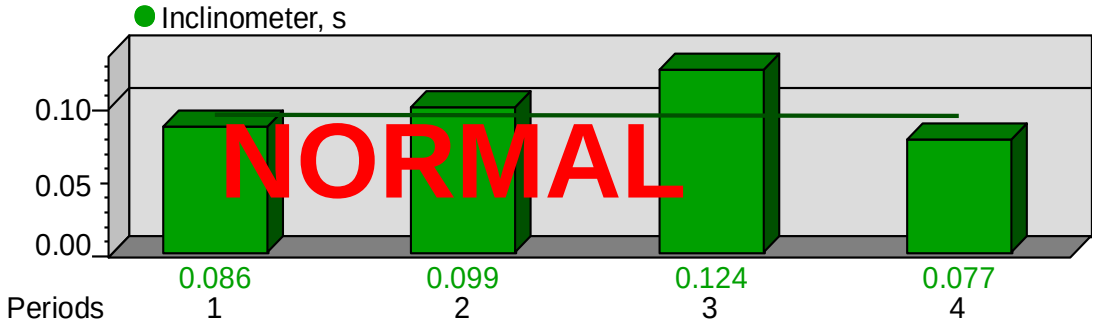


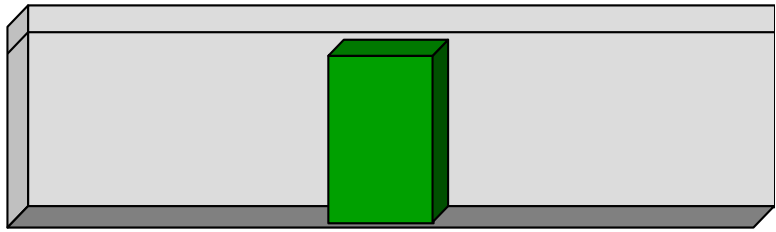
Mean, s

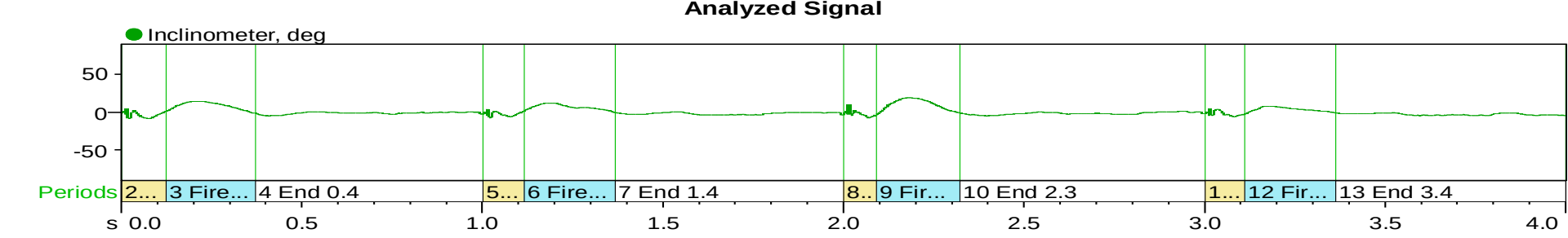


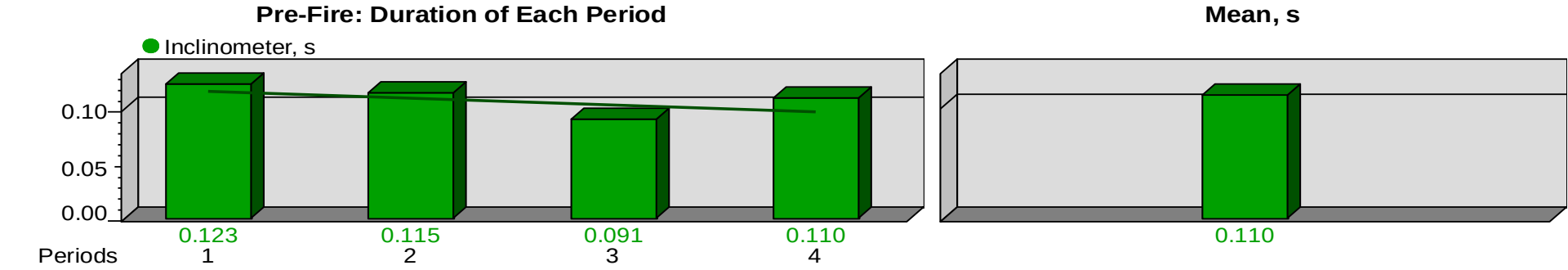
Fire Minus Pre-Fire of Each Period

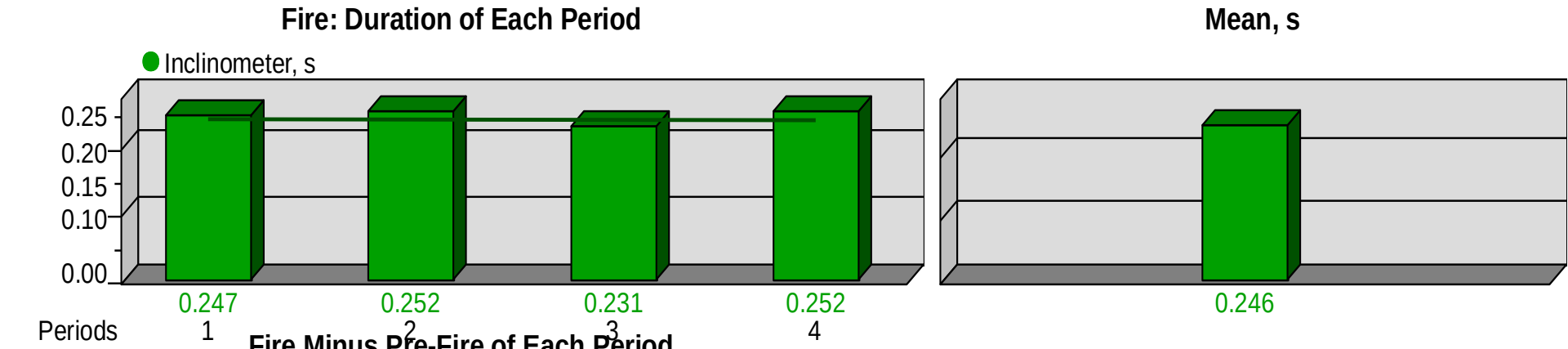
NORMAL = .052 to 0.137 SECS

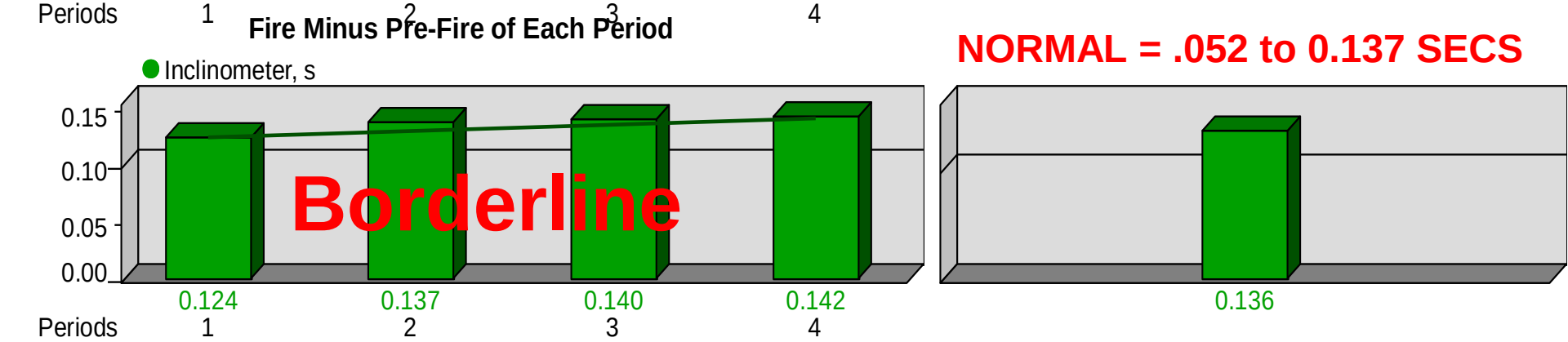





Analyzed Signal
Inclinometer, deg
50
0
-50
Periods
2...
3 Fire...
4 End 0.4
5...
6 Fire...
7 End 1.4
8..
9 Fir...
10 End 2.3
1...
12 Fir...
13 End 3.4
s 0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0

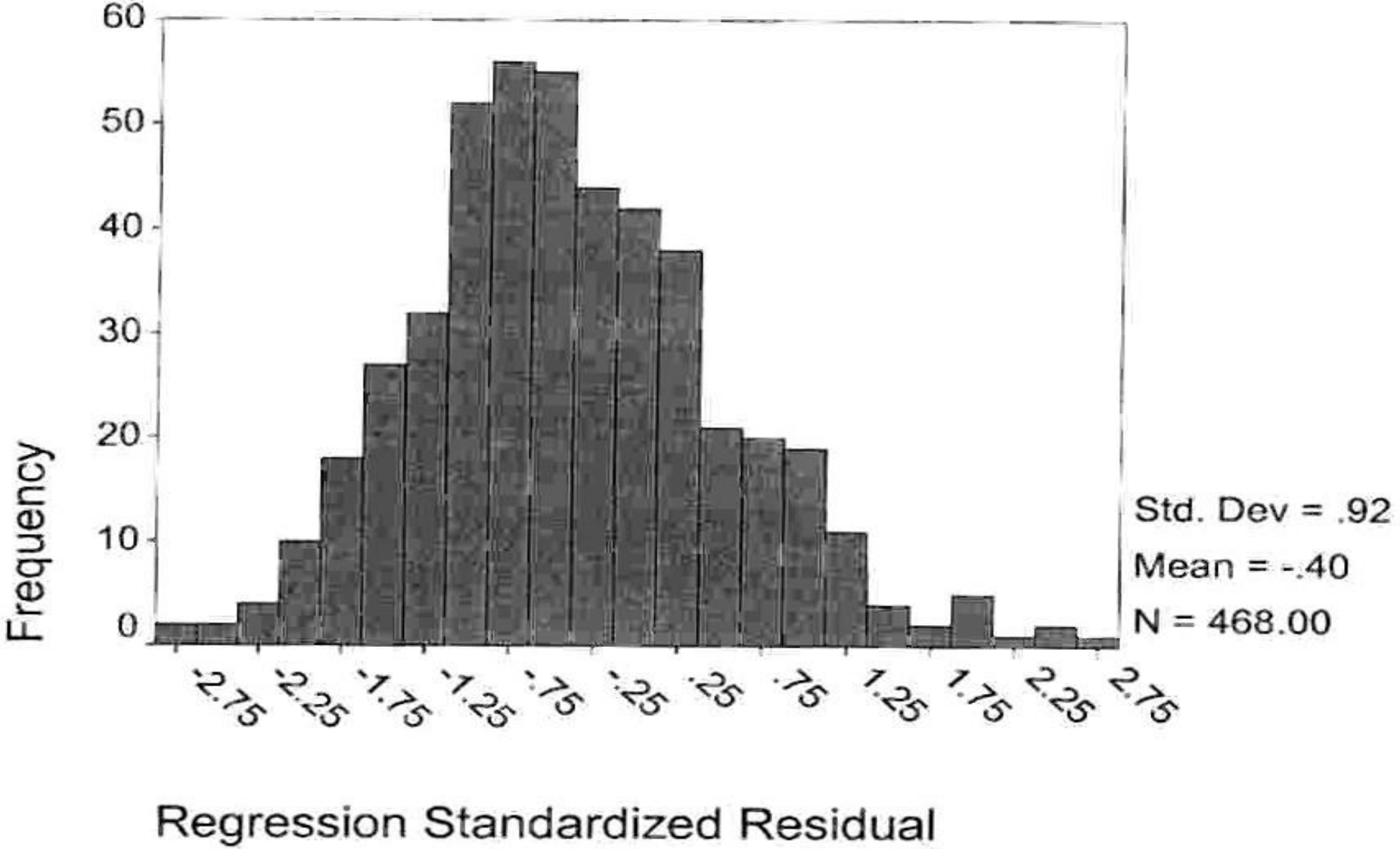

Pre-Fire: Duration of Each Period
Mean, s
Inclinometer, s
0.10
0.05
0.00
0.123
0.115
0.091
0.110
Periods
1
2
3
4
0.110


Fire: Duration of Each Period
Mean, s
Inclinometer, s
0.25
0.20
0.15
0.10
0.00
0.247
0.252
0.231
0.252
Periods
1
2
3
4
0.246

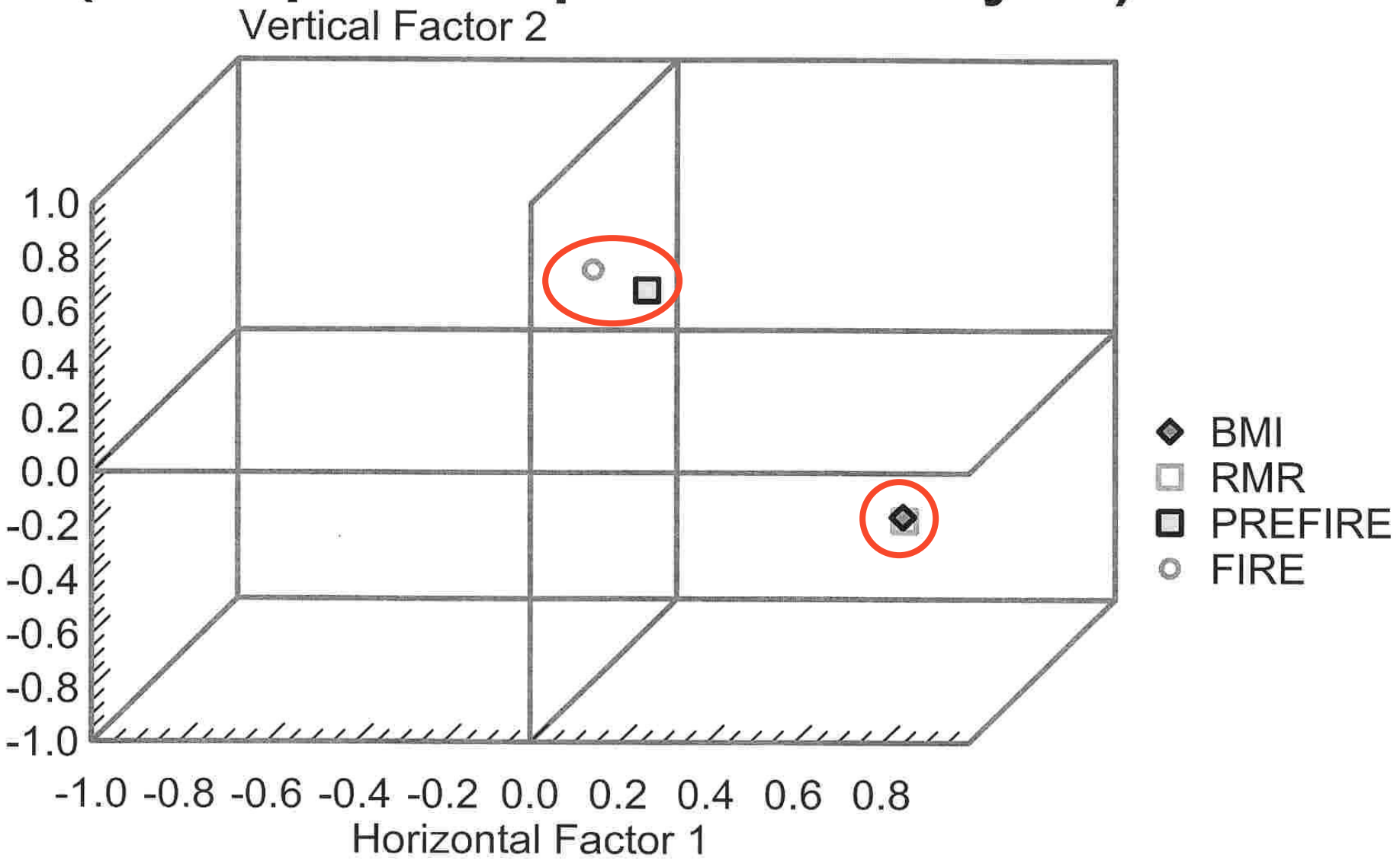

Fire Minus Pre-Fire of Each Period
NORMAL = .052 to 0.137 SECS
Inclinometer, s
0.15
0.10
0.05
0.00
Borderline
0.124
0.137
0.140
0.142
Periods
1
2
3
4
0.136

Histogram of Unselected Cases

Dependent Variable: RMR



Factor Loadings - Unrotated Solution (Principal Components Analysis)



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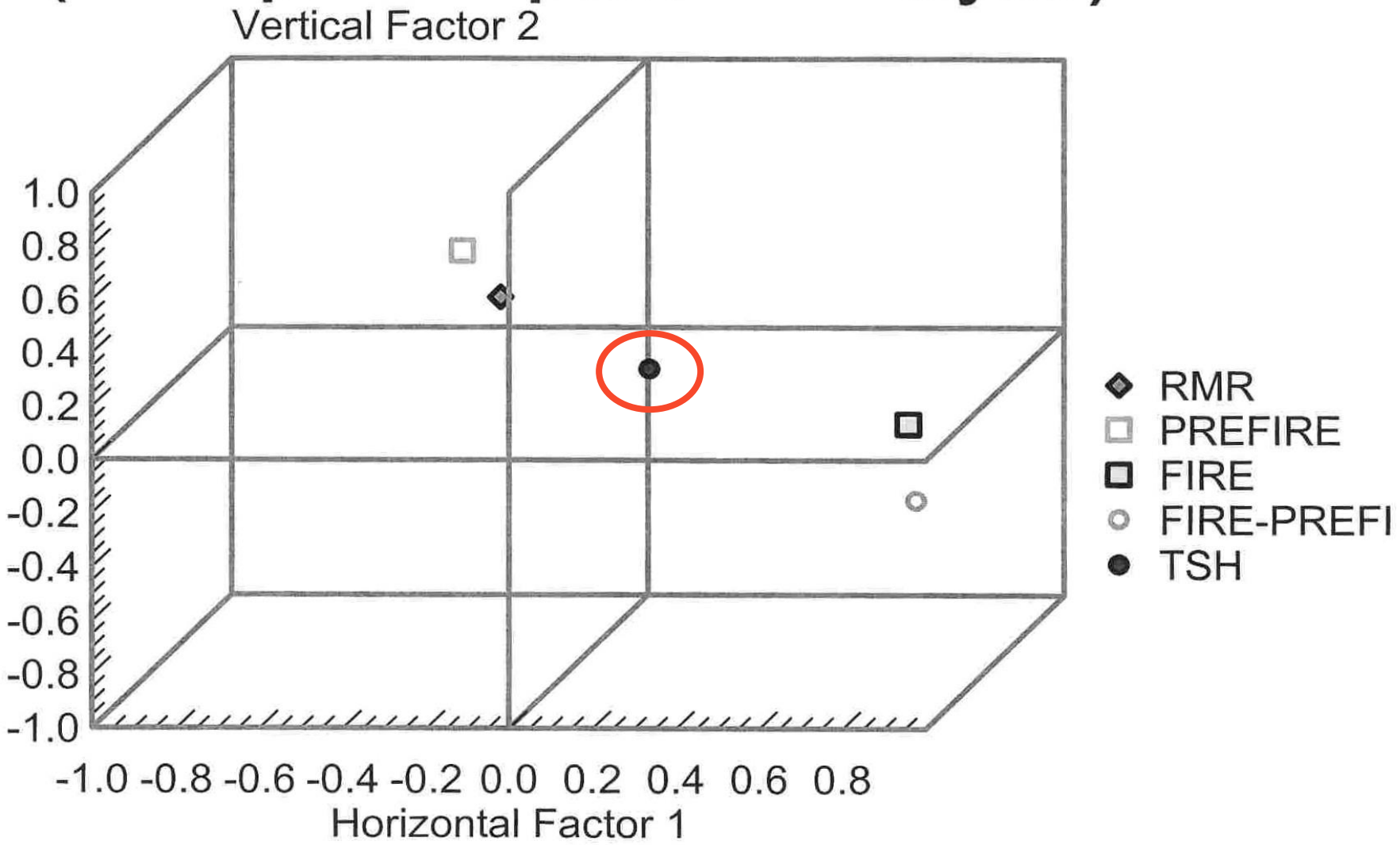
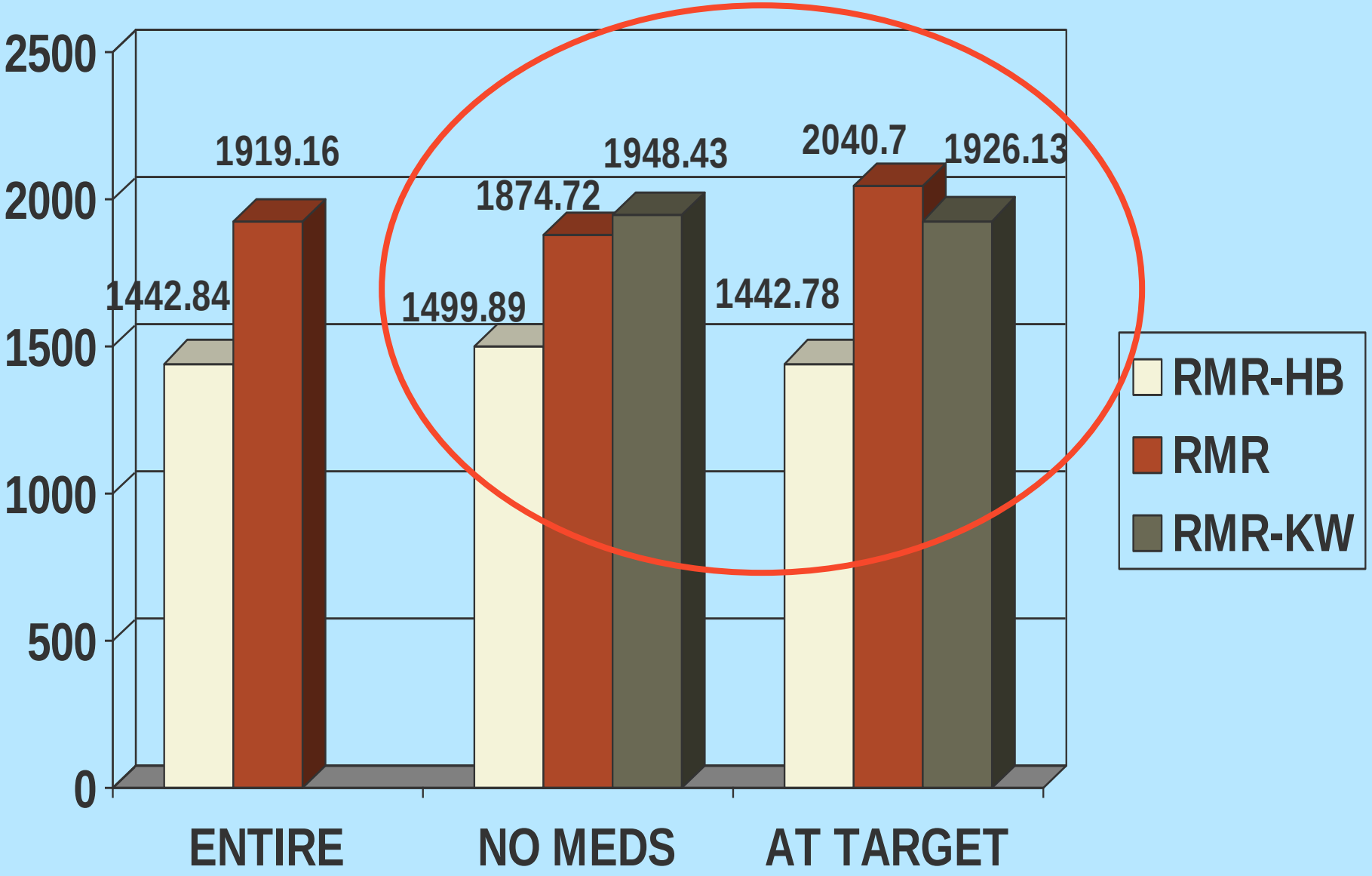


KAIL-WATERS EQUATION

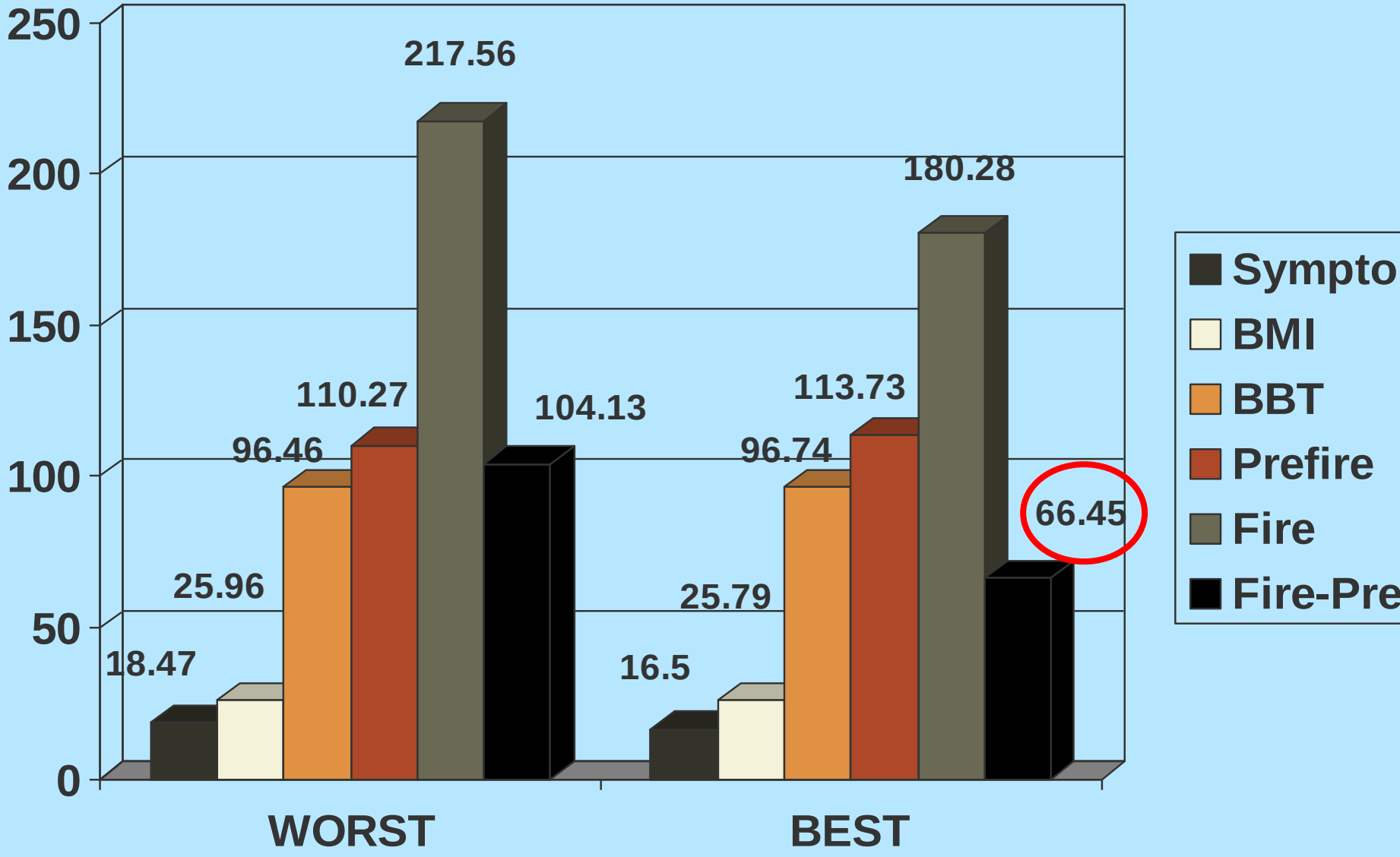
RMR = 2307.62 + [-7.53(CM)] + [27.09(KG)] + [-42.59(BMI)] + [-45.47(PREFIRE)] + [45.85(FIRE)] + [-46.27(FIRE-PREFIRE)]

PREDICTED vs MEASURED RMR



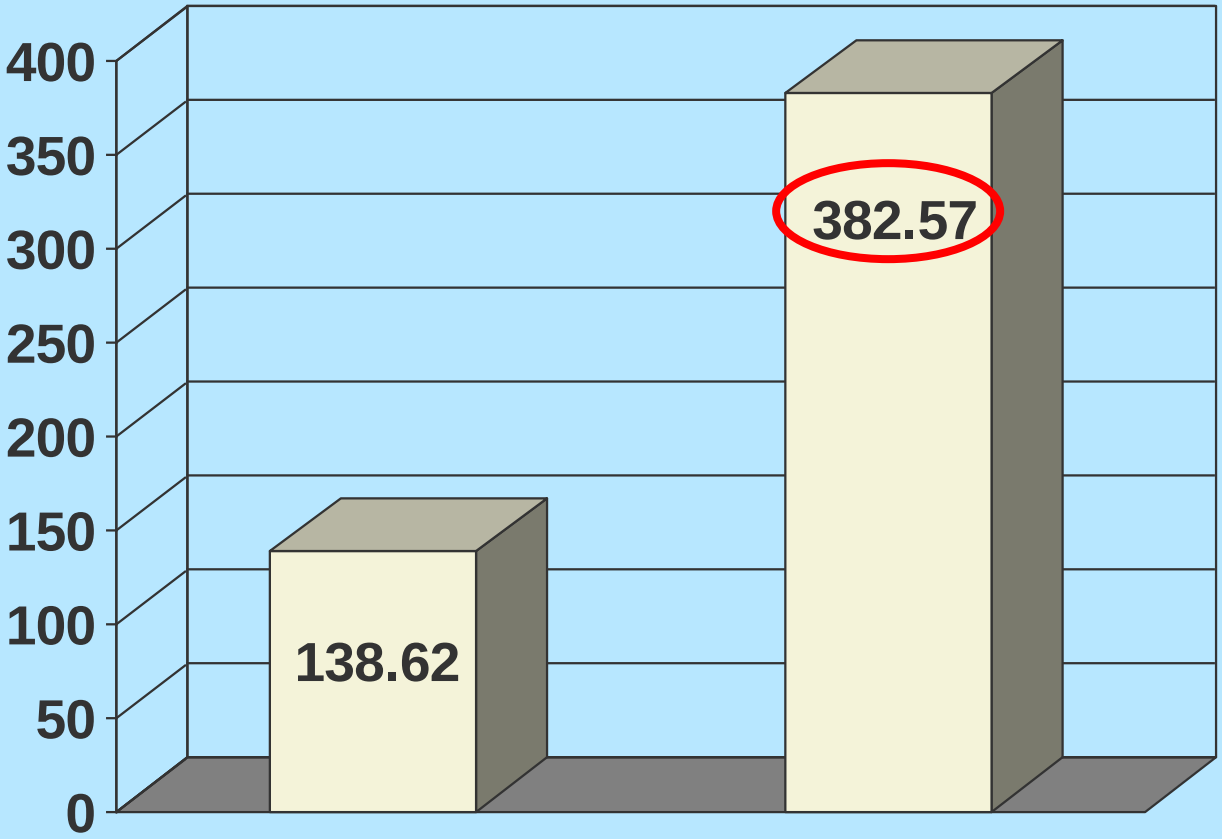
WORST TO BEST

1st Cohort



WHY TSH DOES NOT IDENTIFY THOSE AT RISK !!!

TSH gets too low before adequate effect (↑RMR)

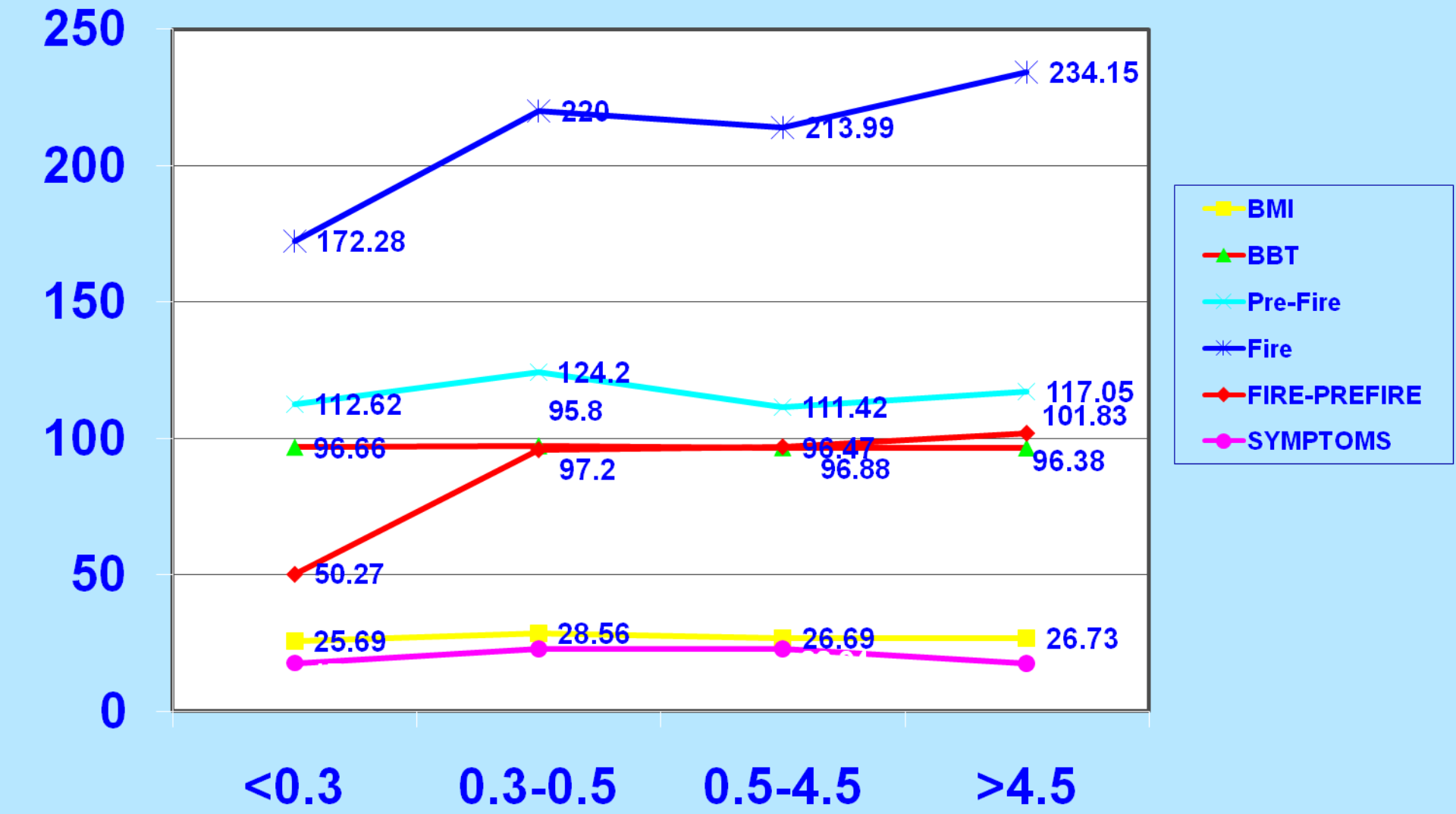


Patients that became normal by reflexes and symptoms had a mean RMR increase of about 400 kcals

N=100

TSH <0.3

FIRE-PREFIRE<66



TSH

<0.3 n = 109
0.3-0.5 n = 5
0.5-4.5 n = 146
>4.5 n = 22

PREDICTABILITY OF BRACHIORADIALIS REFLEX TESTING

179 in Subpopulation on No Medication	Normals	Hypothyroid (+)	Euthyroid (-)
Resting Metabolic Rate	≥ 2000 kcals.	117	58
Brachio-Radialis Reflex	Fire-Prefire ≤ 66 msecs.	123	57

PREDICTABILITY OF BRACHIORADIALIS REFLEX TESTING

	Gold Standard RMR (+)	**Gold Standard RMR (-)**
BR Test (+)	True Positives (117)	False Positives (6)
BR Test (-)	False Negatives (1)	True Negatives (58)

SENSITIVITY

Sensitivity is the proportion of those that are hypothyroid that are correctly diagnosed.

It is expressed as:

$$\frac{\text{True Positives}}{\text{True Positives + False Negatives}} = \frac{117}{117 + 1} = 0.992$$

SPECIFICITY

Specificity is the proportion of those that are euthyroid that were correctly identified.

It is expressed as:

$$\frac{\text{True Negatives}}{\text{True Negatives + False Positives}} = \frac{58}{58 + 6} = 0.906$$

PREDICTIVE VALUE of POSITIVE TEST

Predictive Value of a Positive Test is the proportion of those with a positive test that are hypothyroid.

It is expressed as:

$$\frac{\text{True Positives}}{\text{True positives + False Positives}} = \frac{117}{117+6} = 0.951$$

PREDICTIVE VALUE of NEGATIVE TEST

Predictive Value of a Negative Test is considered the proportion of those with a negative test who are euthyroid:

It is expressed as:

$$\frac{\textbf{True Negatives}}{\textbf{False Negatives + True Negatives}} = \frac{\textbf{58}}{\textbf{1 + 58}} = \textbf{0.983}$$

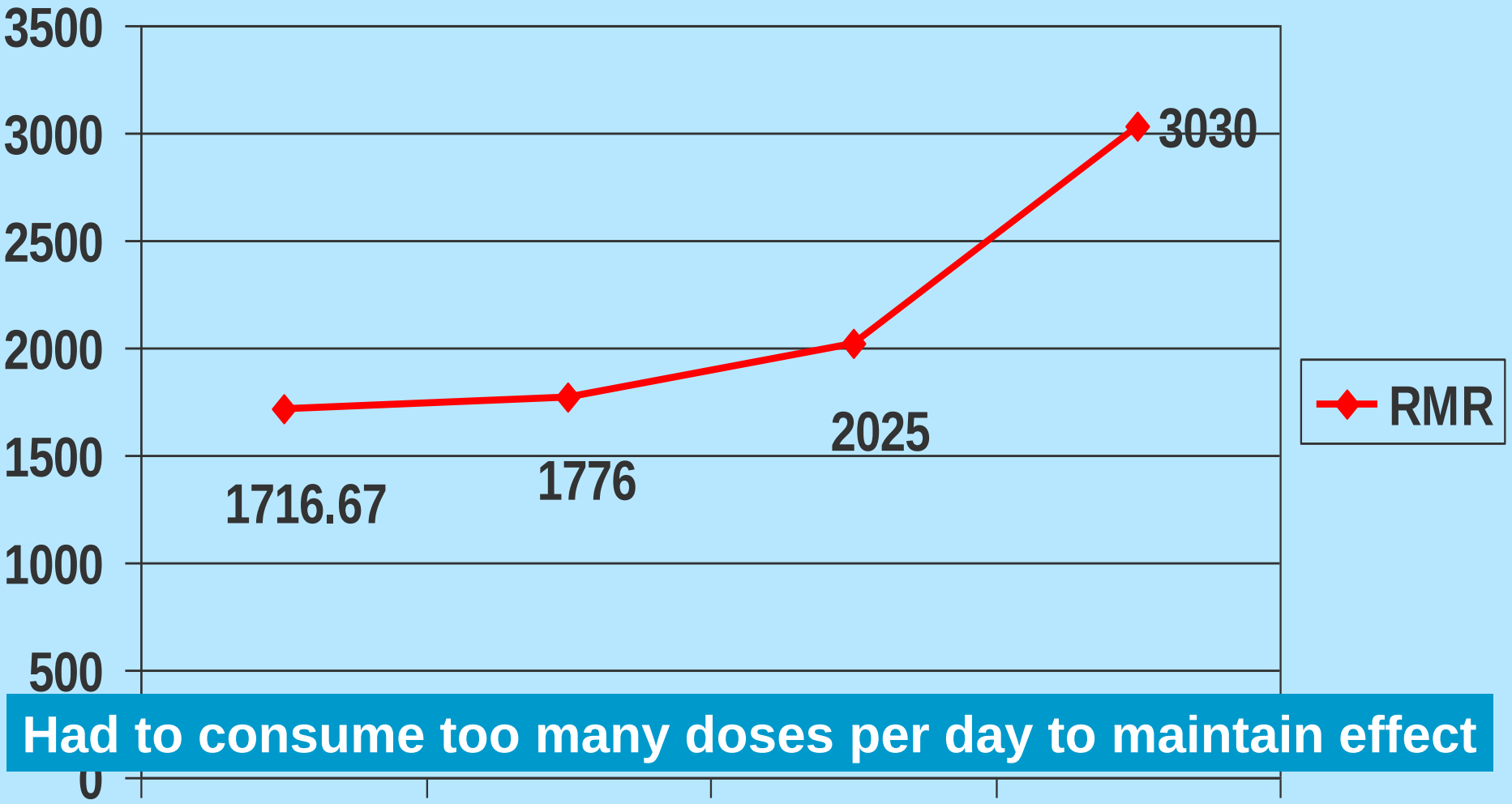
HOW TO OPTIMIZE THYROID ACTIVITY AND TREATMENT

	WHAT TO DO	WHAT TO AVOID
DIET	1500-2500 CAL/DAY ORGANIC PALEOLITHIC FOODS IRON RICH FOODS HERTOGHE, T; The Hormone Handbook. International Medical Books Surrey, UK, 2006, p87.	LOW CALORIE, LOW FAT DIETS SKIPPING MEALS INDUSTRIALIZED FOODS ALCOHOL, VINEGAR CAFFEINE EXCESS ANIMAL PROTEIN FIBER RICH CEREALS
SLEEP	SLEEP SUFFICIENTLY 6-9 HRS/NIGHT	SLEEP DEPRIVATION
STRESS	SOME STRESS MANAGEMENT TECHNIQUE	PROLONGED STRESS EXCESSIVE PHYSICAL ACTIVITY

OTC THYROID AGENTS

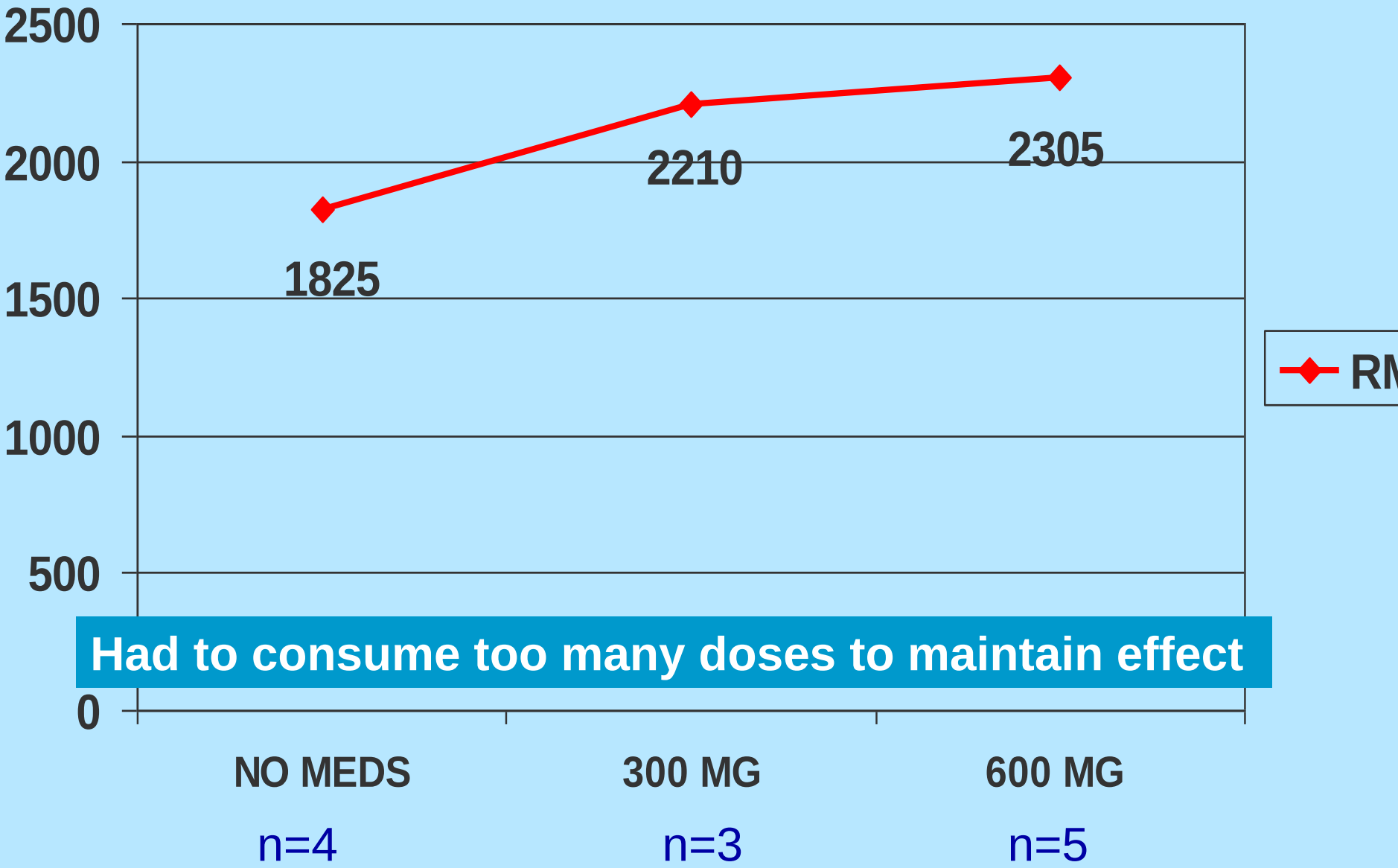
AGENT	CONTENTS
HOMEOPATHIC THYROID STIMULATOR	THYROID 5C, NATIVE GOLD 8X, BLACK CURRANT BUDS 1DH, BLOODTWIG DOGBERRY BUDS 1 DH, SWEET ALMOND BUDS 1DH, ETHANOL, GLYCERIN, WATER
OTC THYROID TISSUE	NEW ZEALAND SHEEP THYROID TISSUE, RICE POWDER, DI-CALCIUM PHOSPHATE, GELATIN
OTC THYROID TISSUE PLUS CO-FACTORS	NEW ZEALAND BOVINE THYROID, L-TYROSINE, ANTERIOR PITUITARY, L-ASPARTIC ACID, IRIS VERSICOLOR, KELP

HOMEO AND RMR

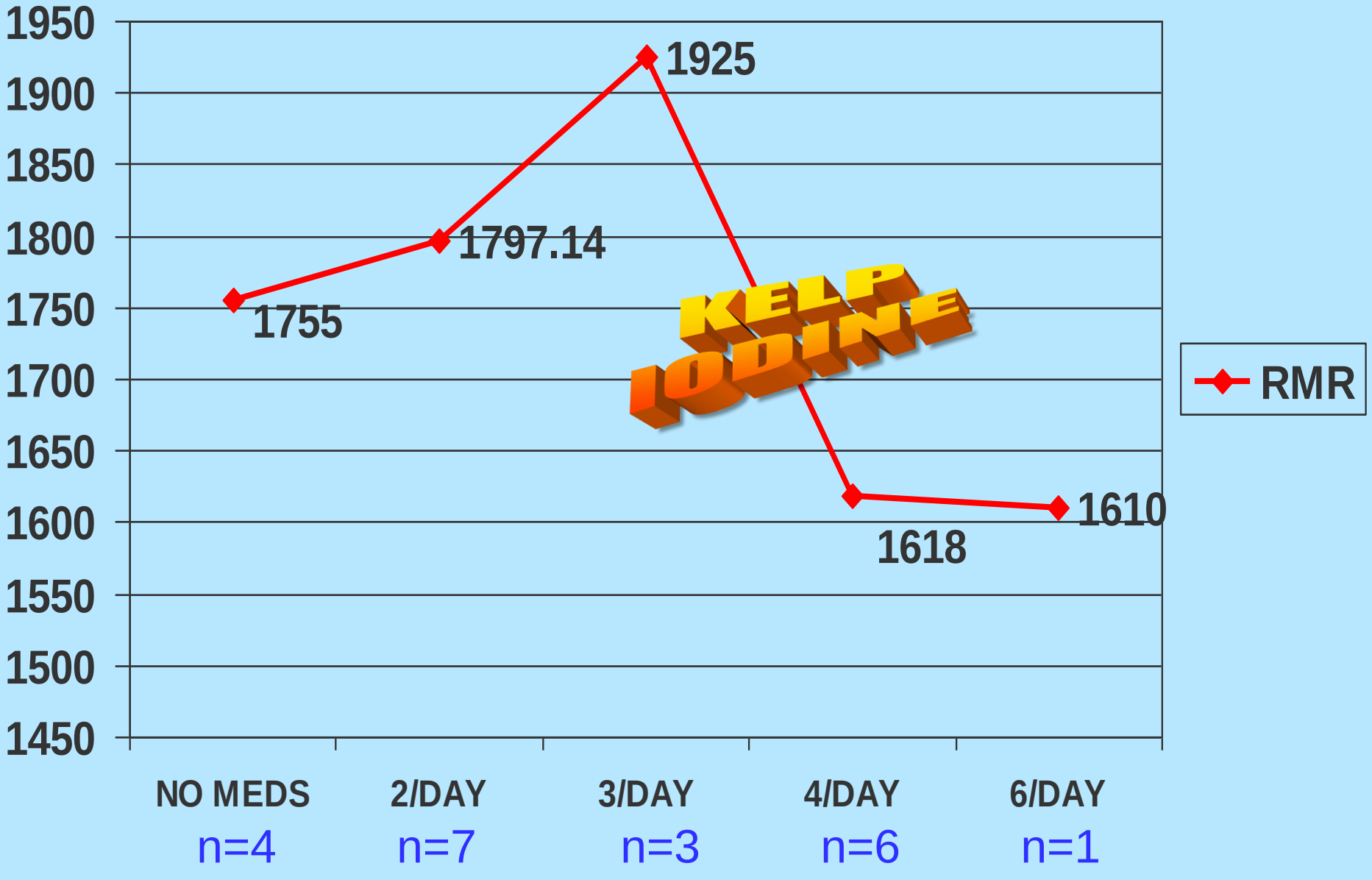


Had to consume too many doses per day to maintain effect

OTC THYROID AND RMR



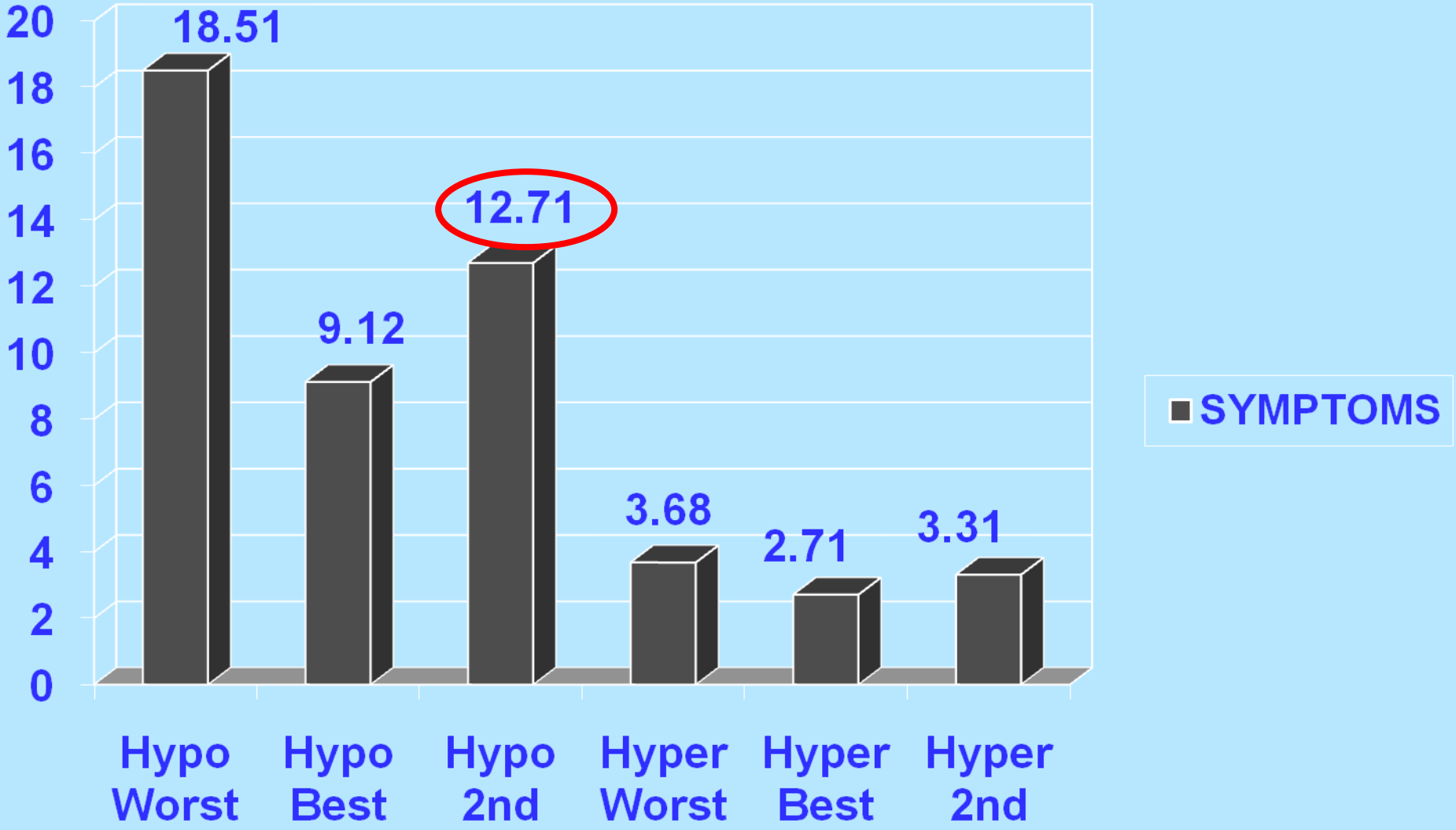
TISSUE AND COFACTORS AND RMR



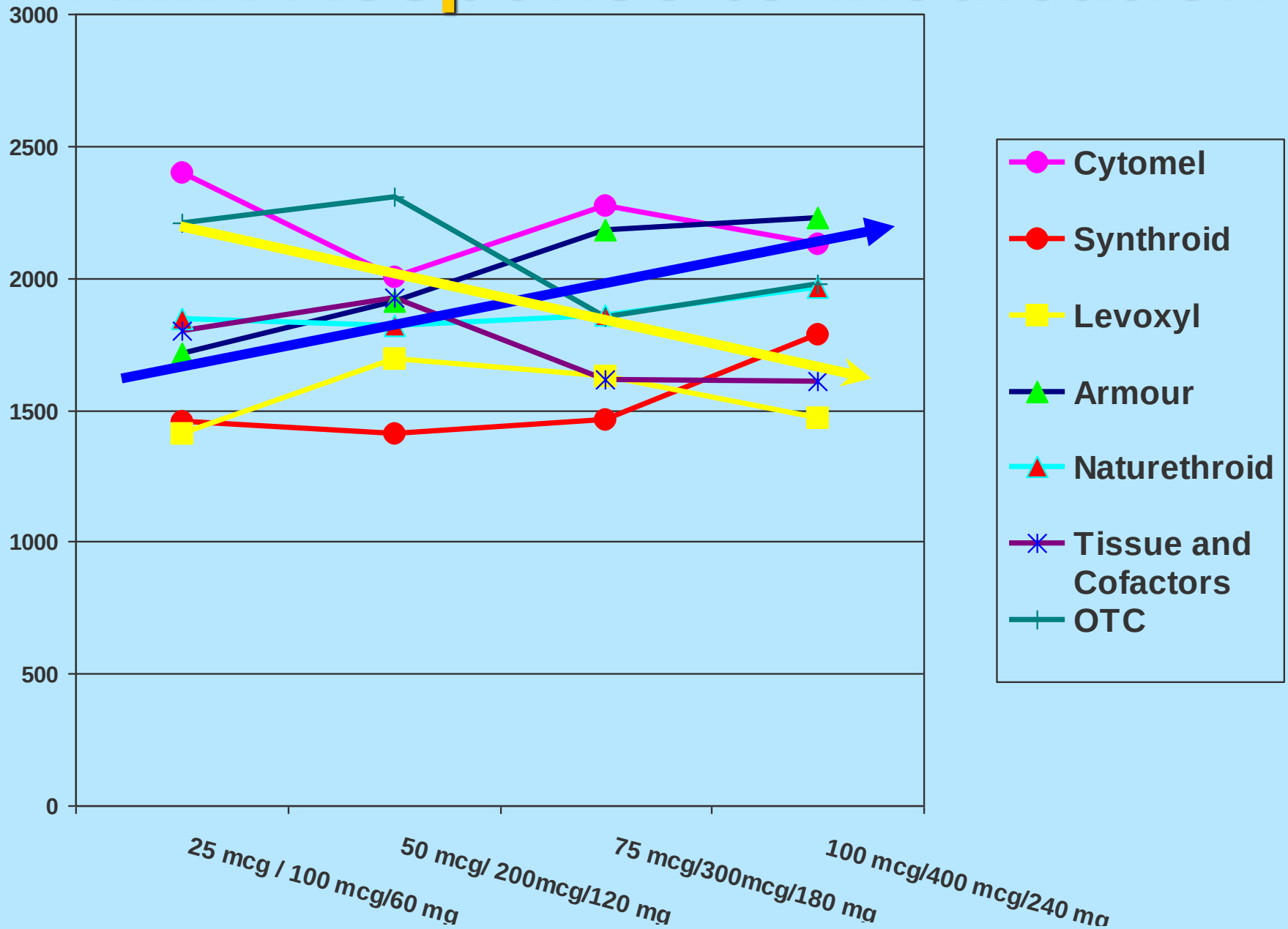
RX THYROID PREPARATIONS

AGENT	EQUIVALENT DOSE	½ LIFE	ADDITIVES
CYTOMEL	25 MCG	1.4 DAYS	CALCIUM SULFITE, GELATIN, STARCH, STEARIC ACID, SUCROSE, TALC
SYNTHROID	0.1 MG	6-7 DAYS	ACACIA, SUGAR, CORN STARCH, LACTOSE, MAGNESIUM STEARATE, POVIDONE, TALC
DESSICATED 38 mcg T4 9 mcg T3	1 GRAIN 60 MG	3-7 DAYS	CALCIUM STEARATE, DEXTROSE, MICROCRYSTALLINE CELLULOSE, SODIUM STARCH GLYCOLATE, OPODY WHITE

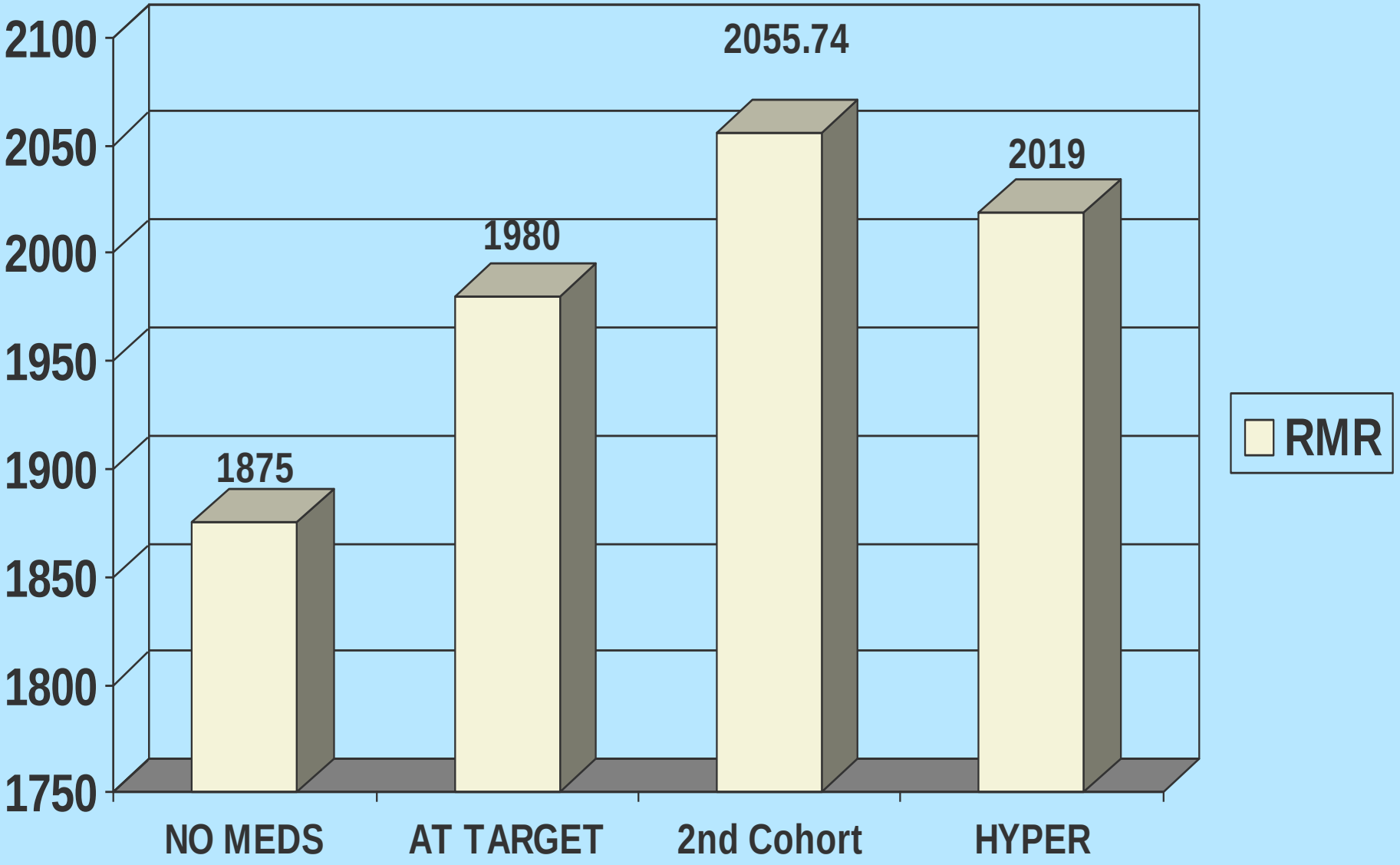
SYMPTOM SCORE
WORST TO BEST



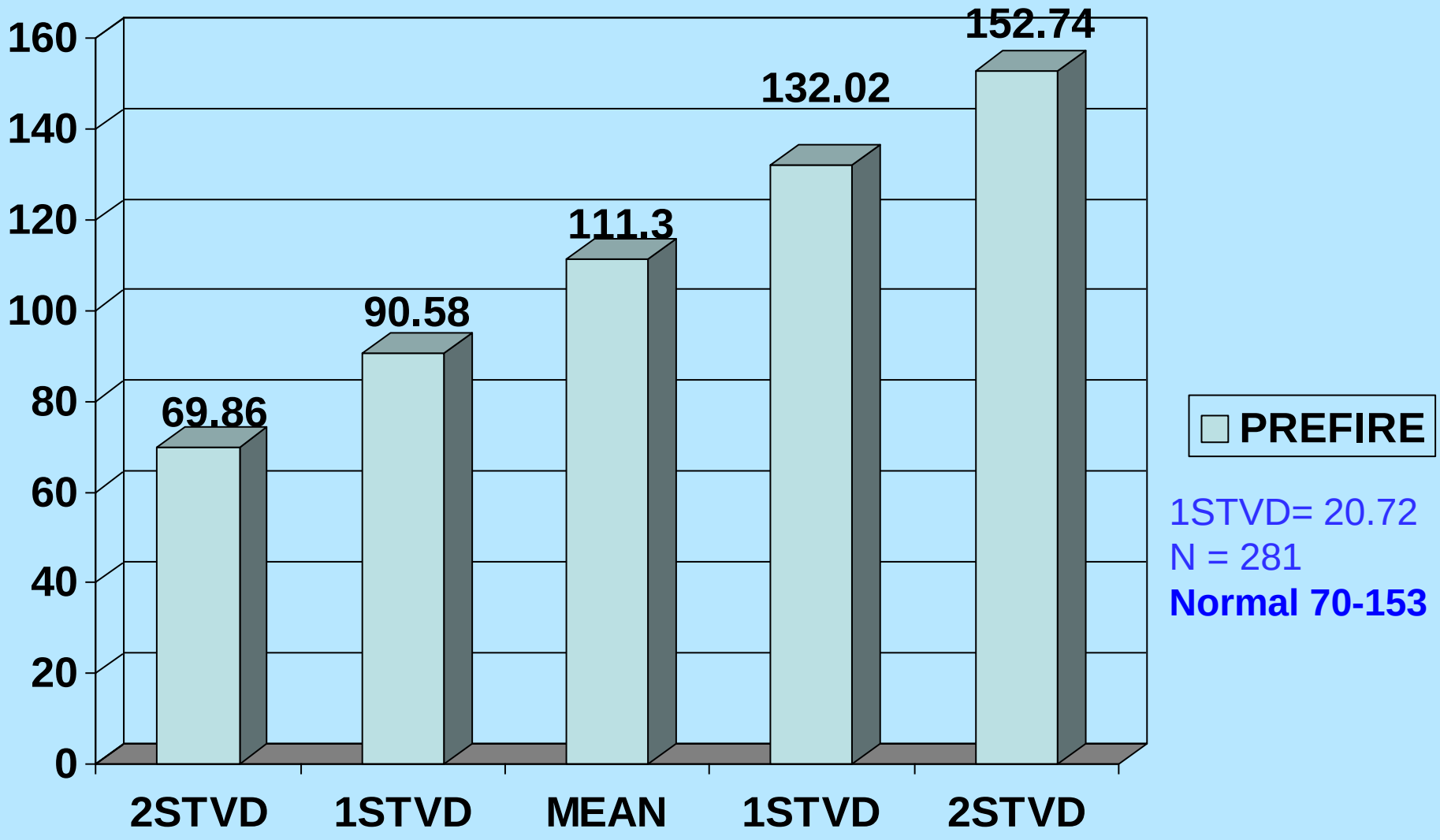
RMR Response to Medication



RMR

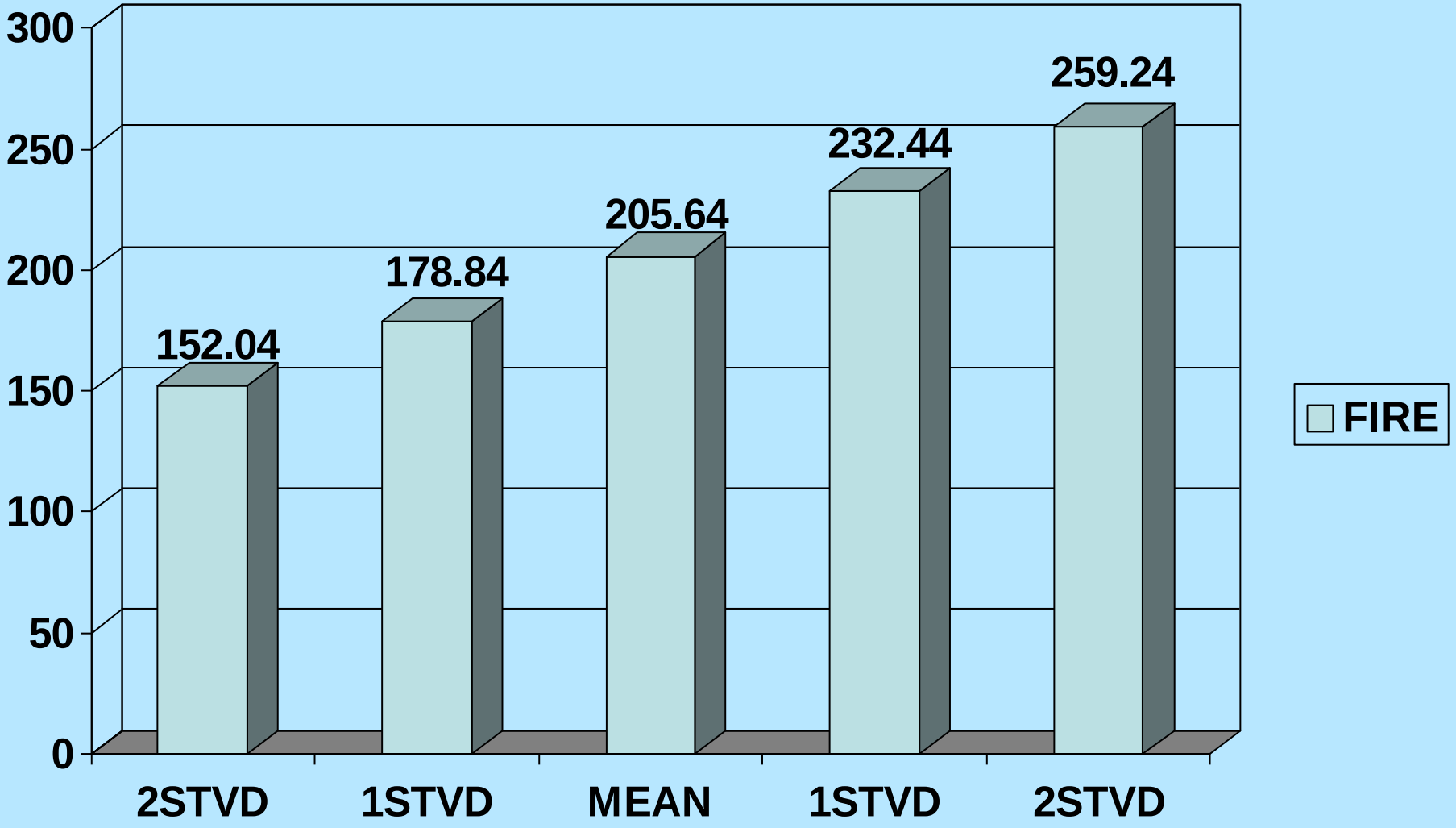

2100
2050
2000
1950
1900
1850
1800
1750
1875
1980
2055.74
2019
NO MEDS
AT TARGET
2nd Cohort
HYPER
RMR

PREFIRE NORMAL

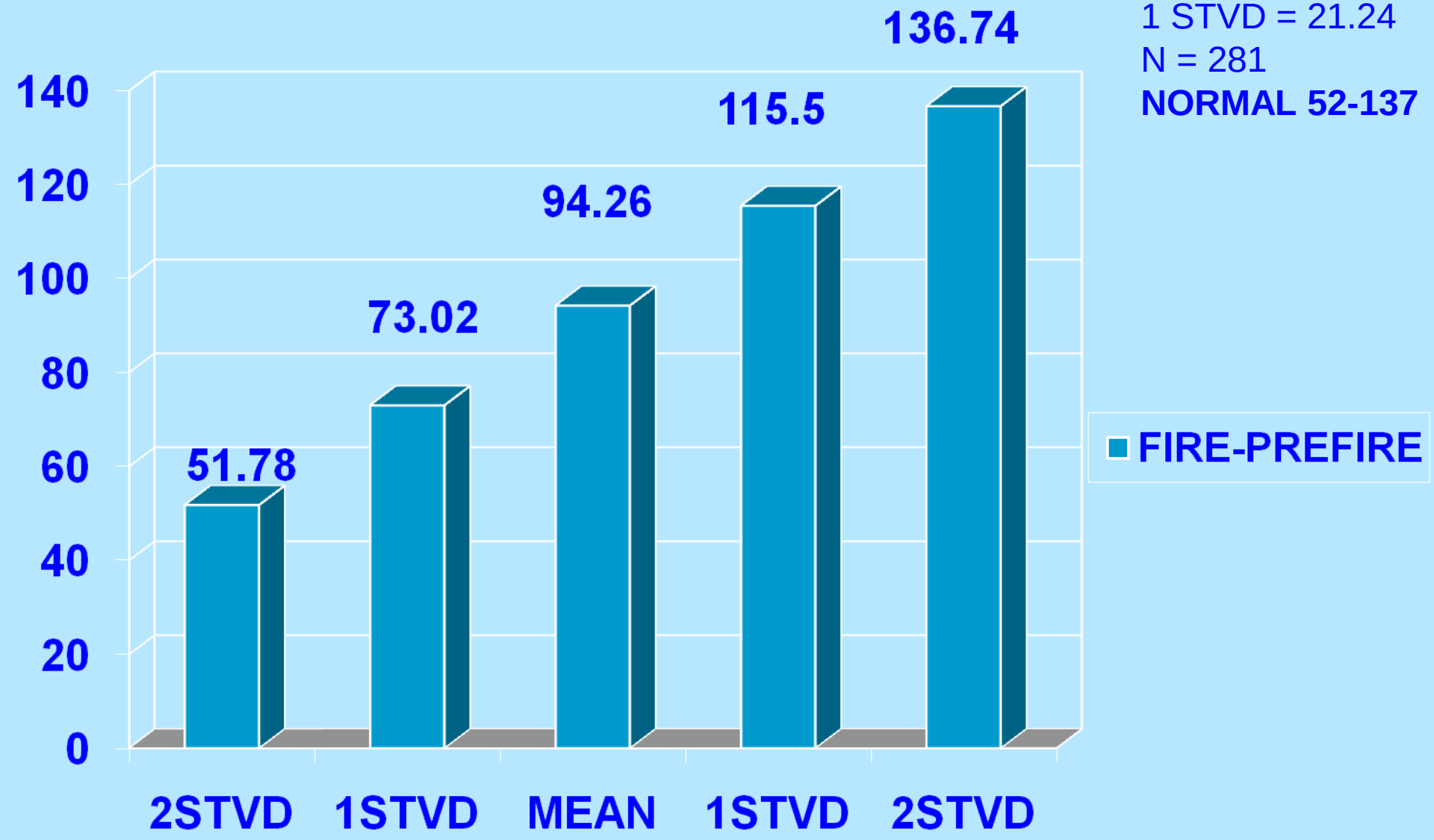


FIRE NORMAL

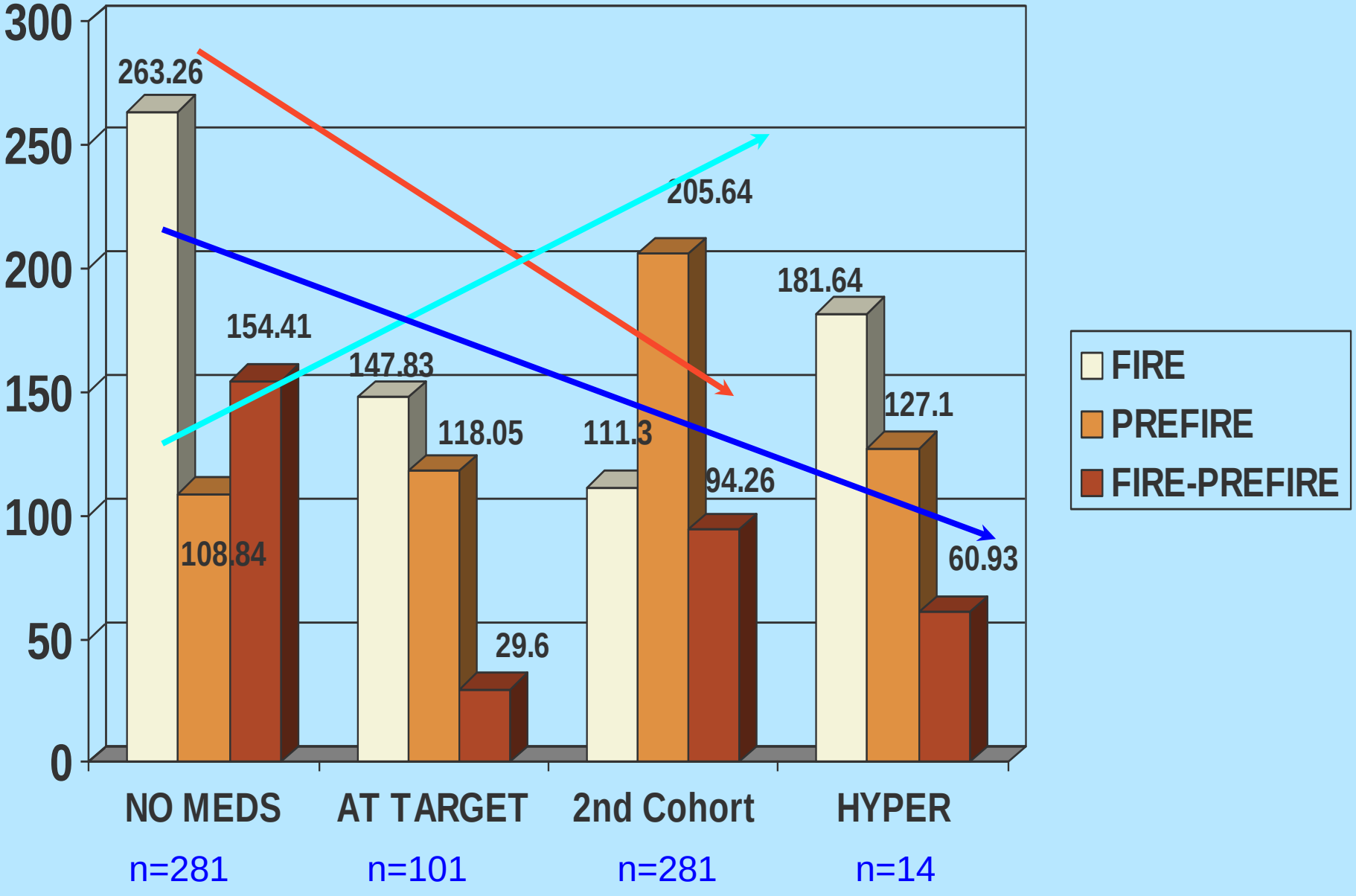
1 STVD = 26.80
N = 281
NORMAL 152-259



FIRE-PREFIRE NORMAL

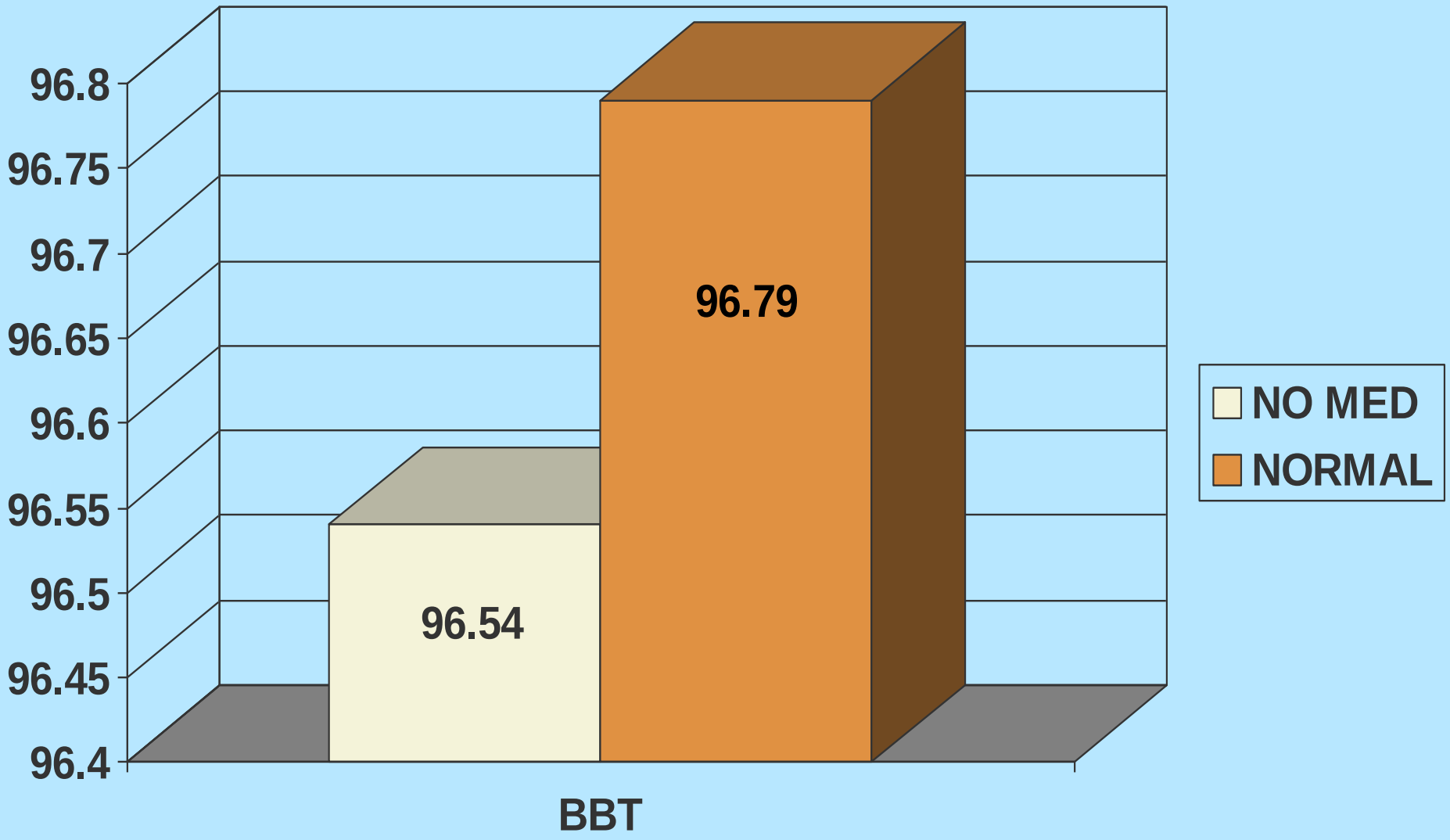


REFLEX PARAMETERS



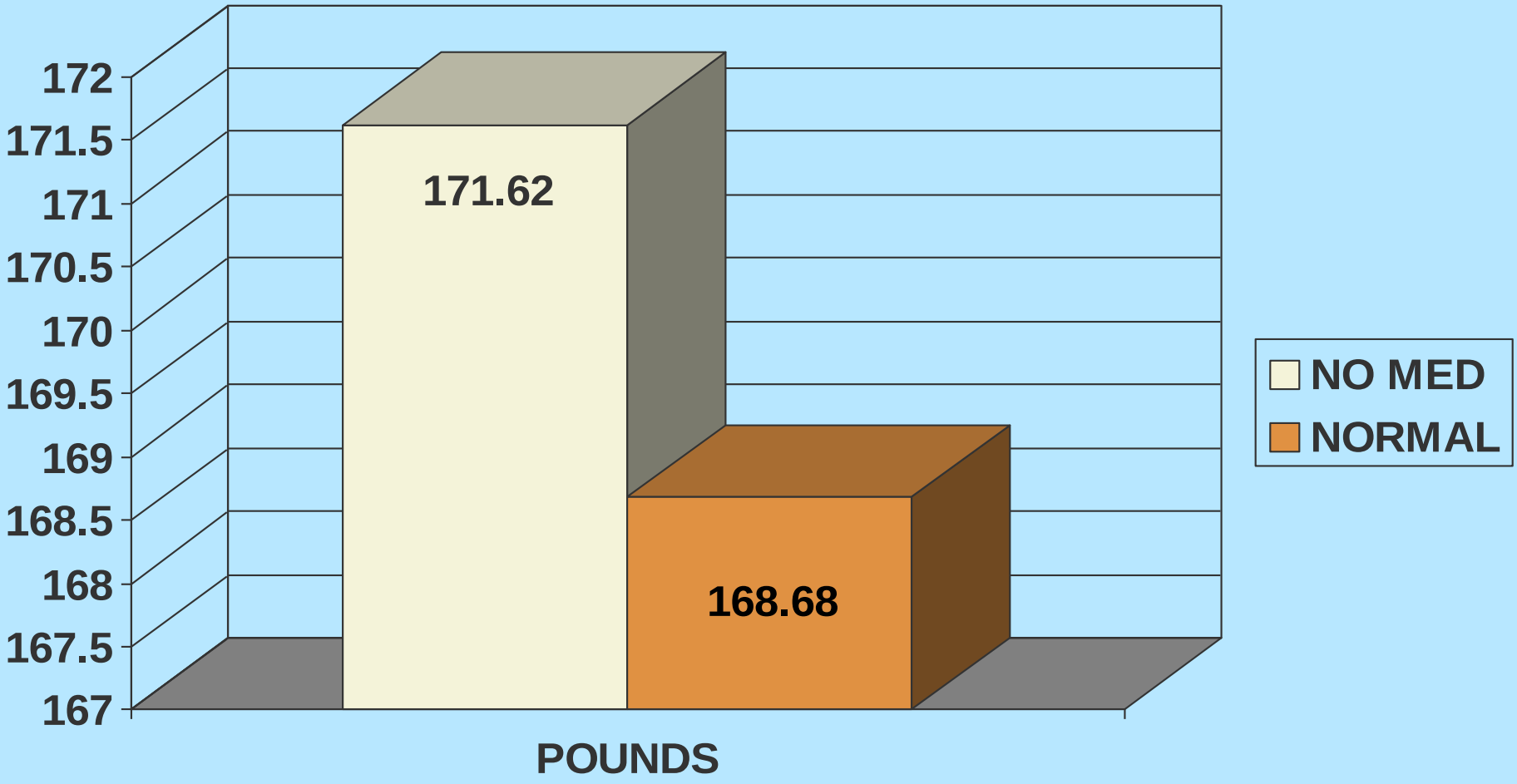
CHANGE IN BBT

2nd Cohort



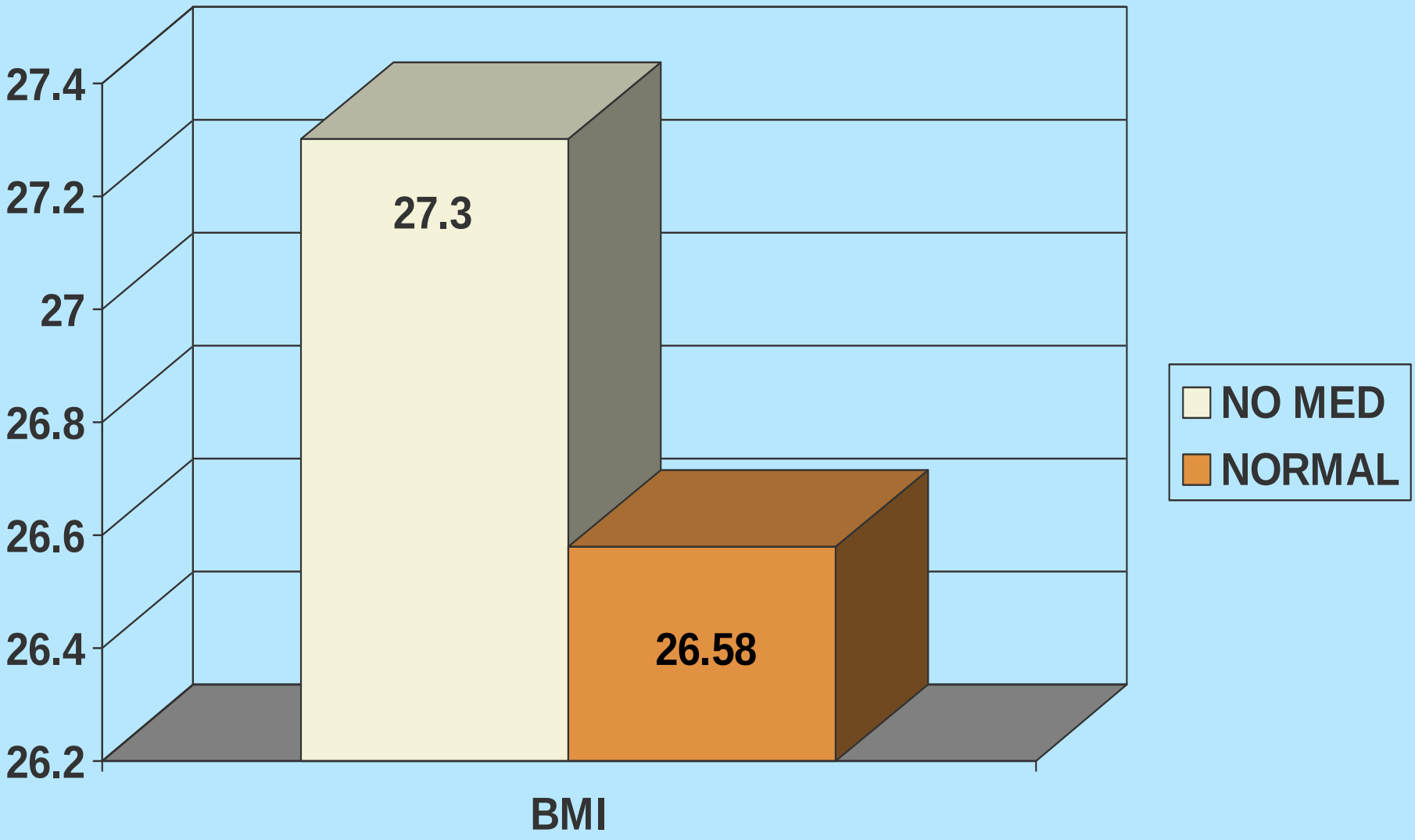
CHANGE IN WEIGHT

2nd Cohort



CHANGE IN BMI

2nd Cohort



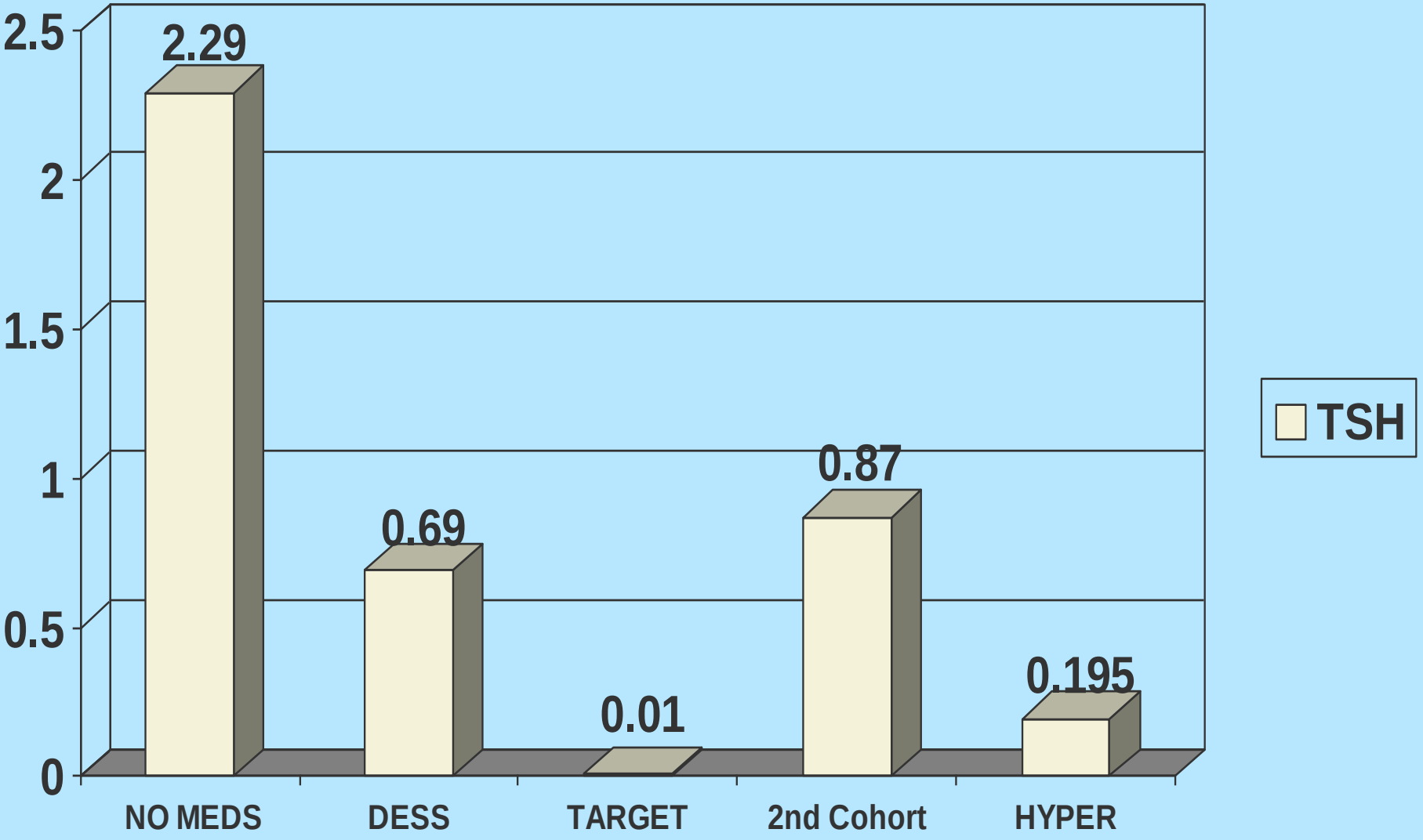
HYPERTHYROID SIGNS

PALPITATIONS	6:815	0.7%
TACHYCARDIA	4:815	0.4%
SHAKEY/HYPER	2:815	0.2%
HAIR LOSS	1:815	0.1%
HYPERTENSION	1:815	0.1%
TOTAL	14:815	1.7%

SONORA QUEST NORMALS

TEST	LOW END NORMAL	HIGH END NORMAL
TSH	0.45	4.5
T3U	23.4	42.7
T4	4.5	12.5
T7	1.2	4.3
FREE T3	1.8	5.4
FREE T4	0.8	1.9

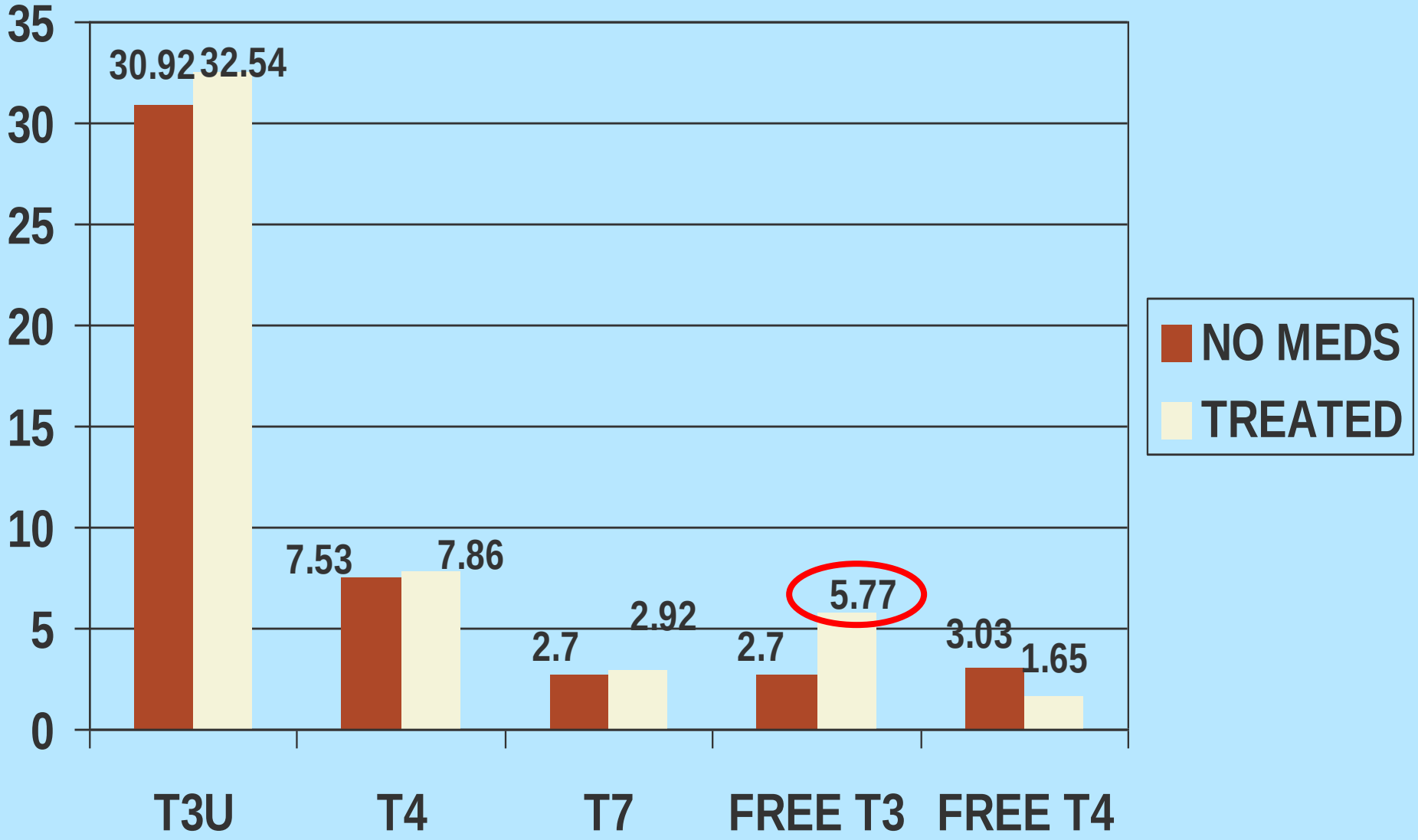
TSH



≤ 66 msecs 52-137 msecs

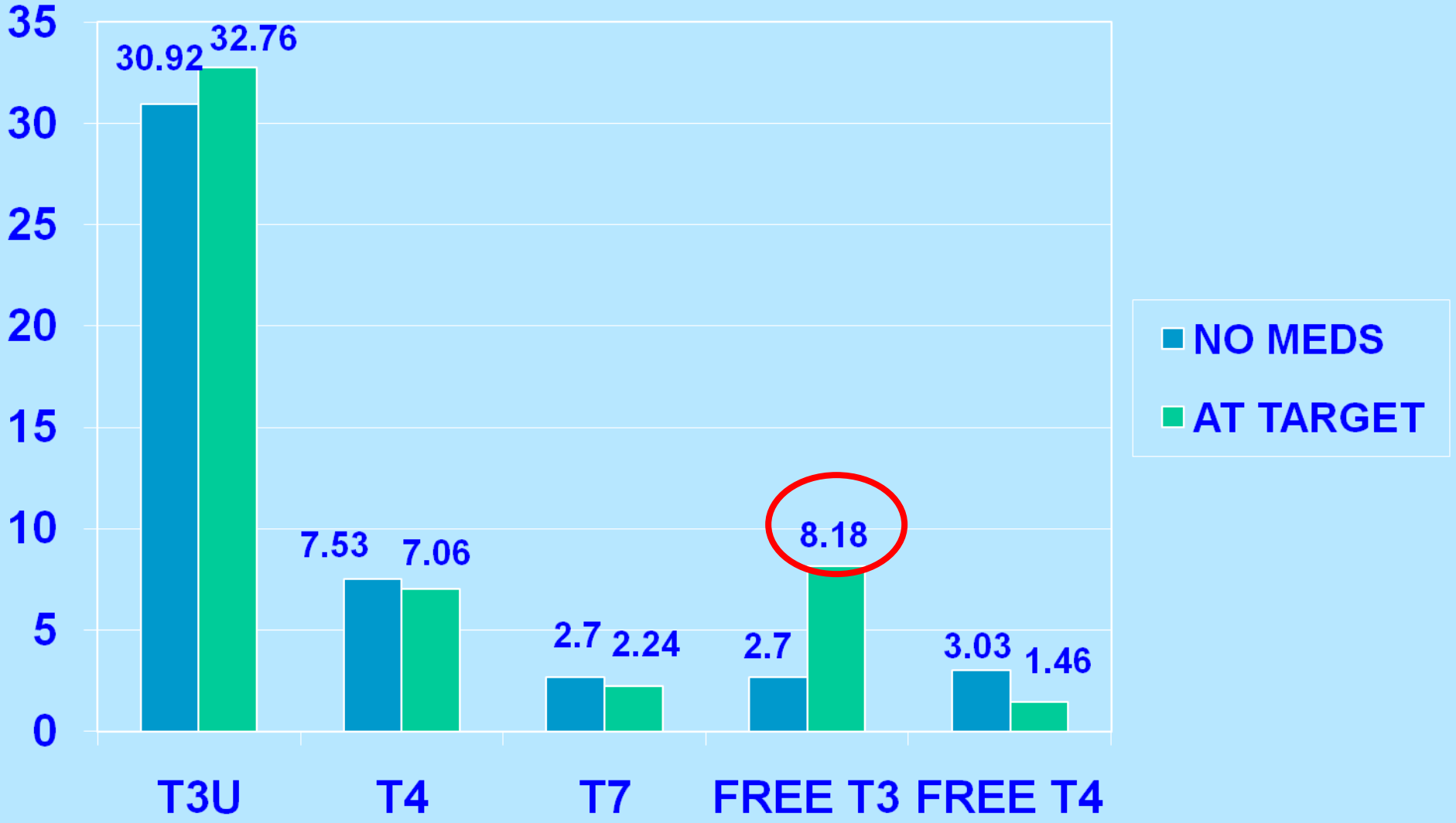
AT TARGET

(FIRE-PREFIRE<66)

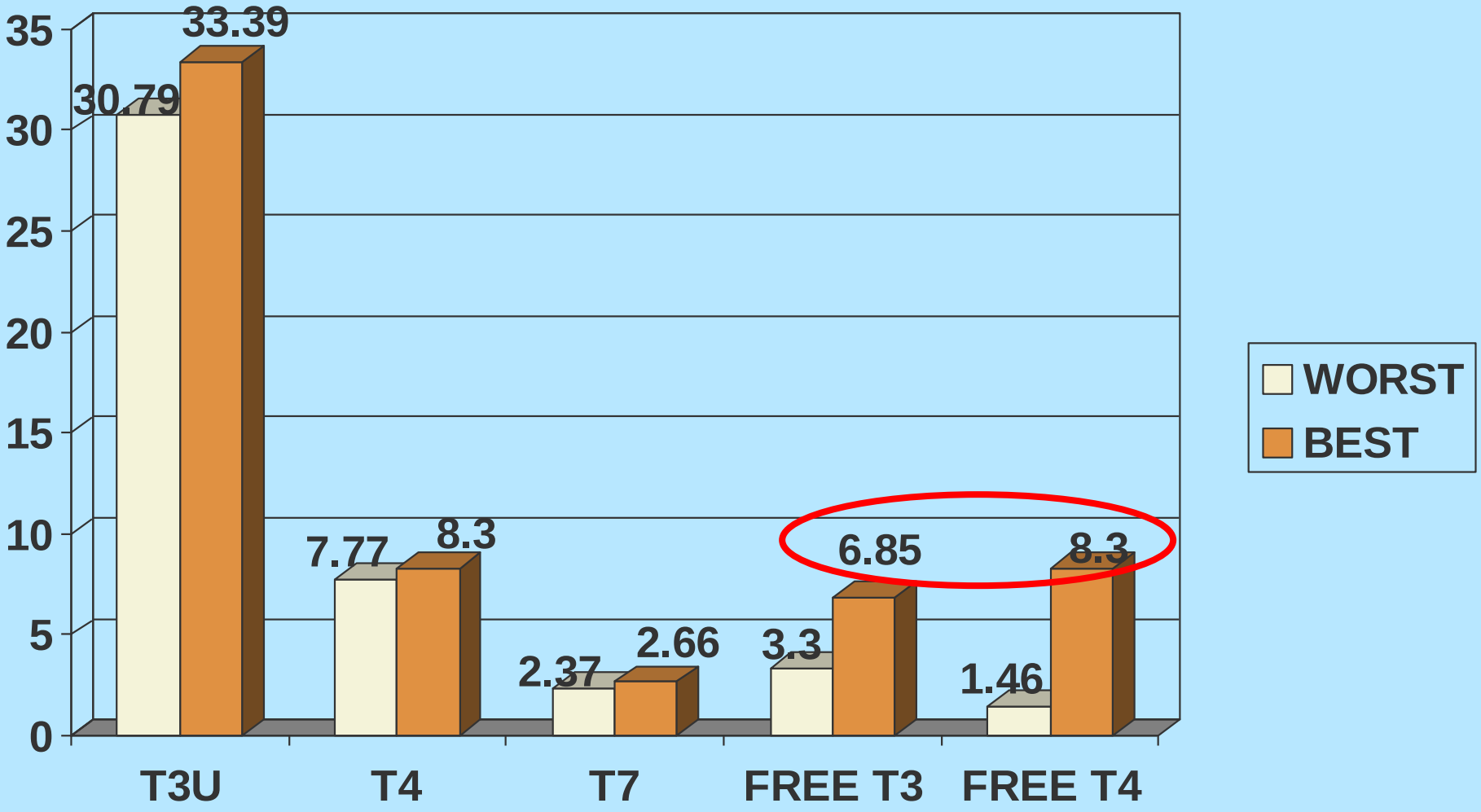


AT TARGET

(RMR CHANGE > 355)

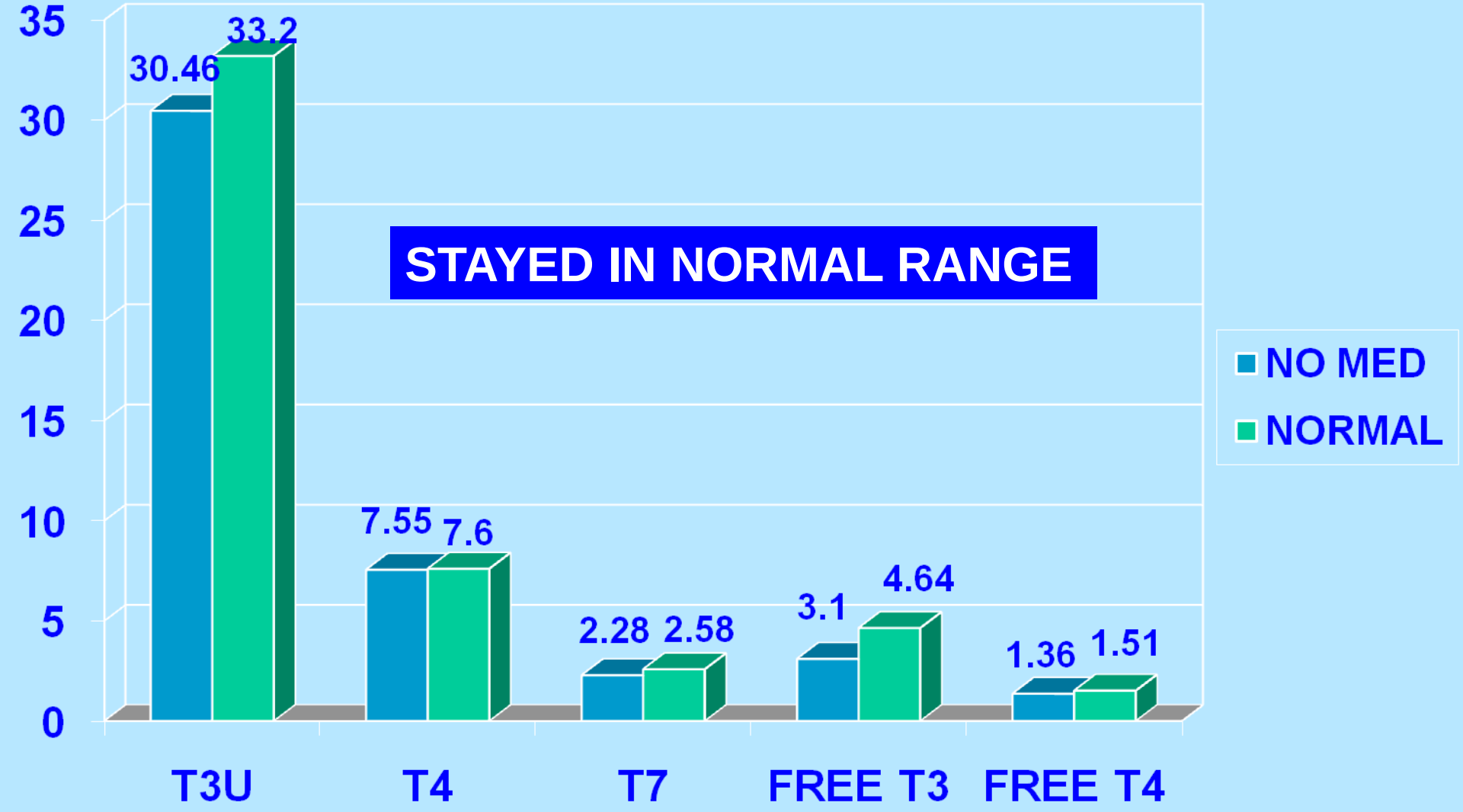


DESSICATED THYROID AND SERUM THYROID HORMONES

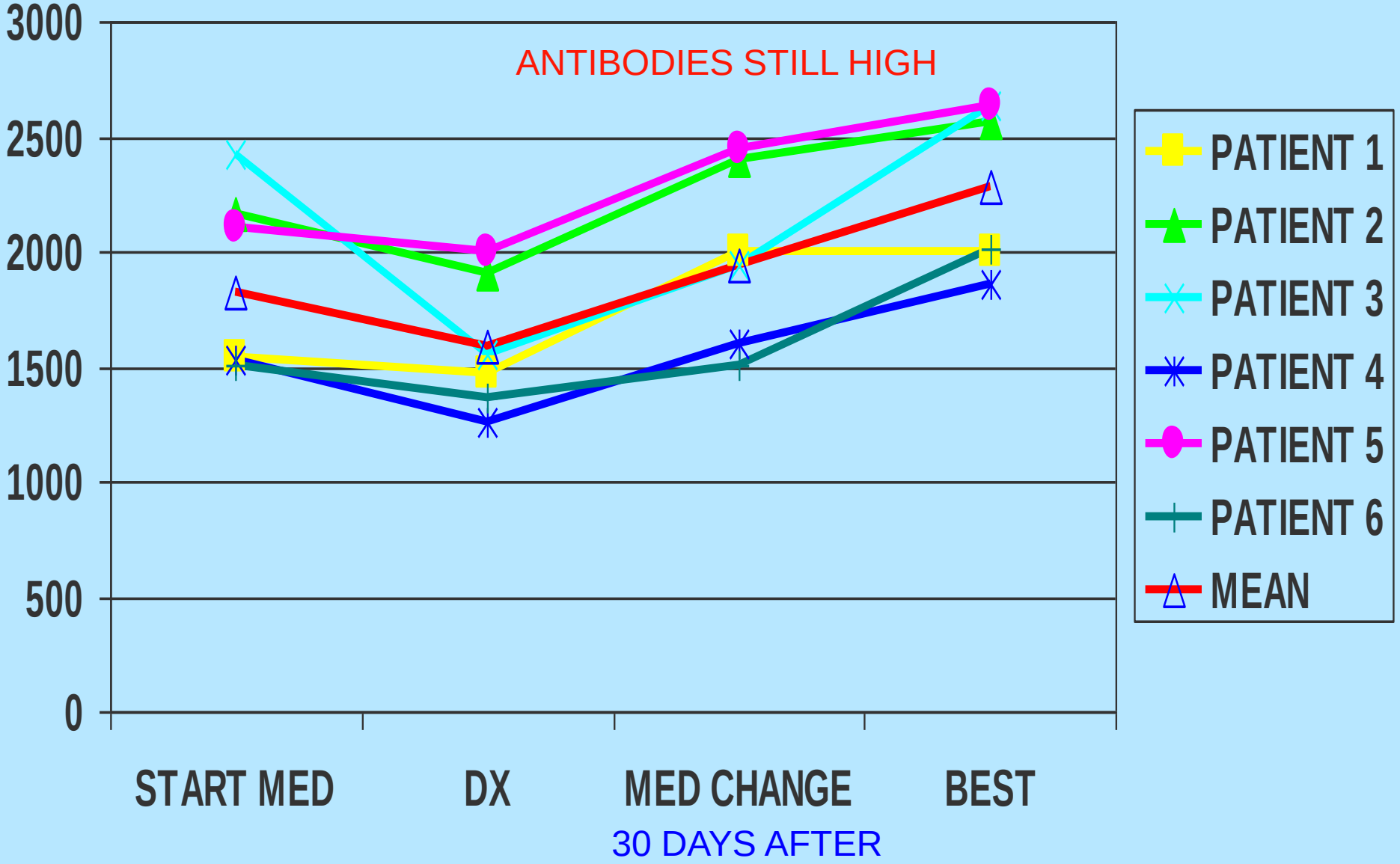


CHANGE IN SERUM HORMONES

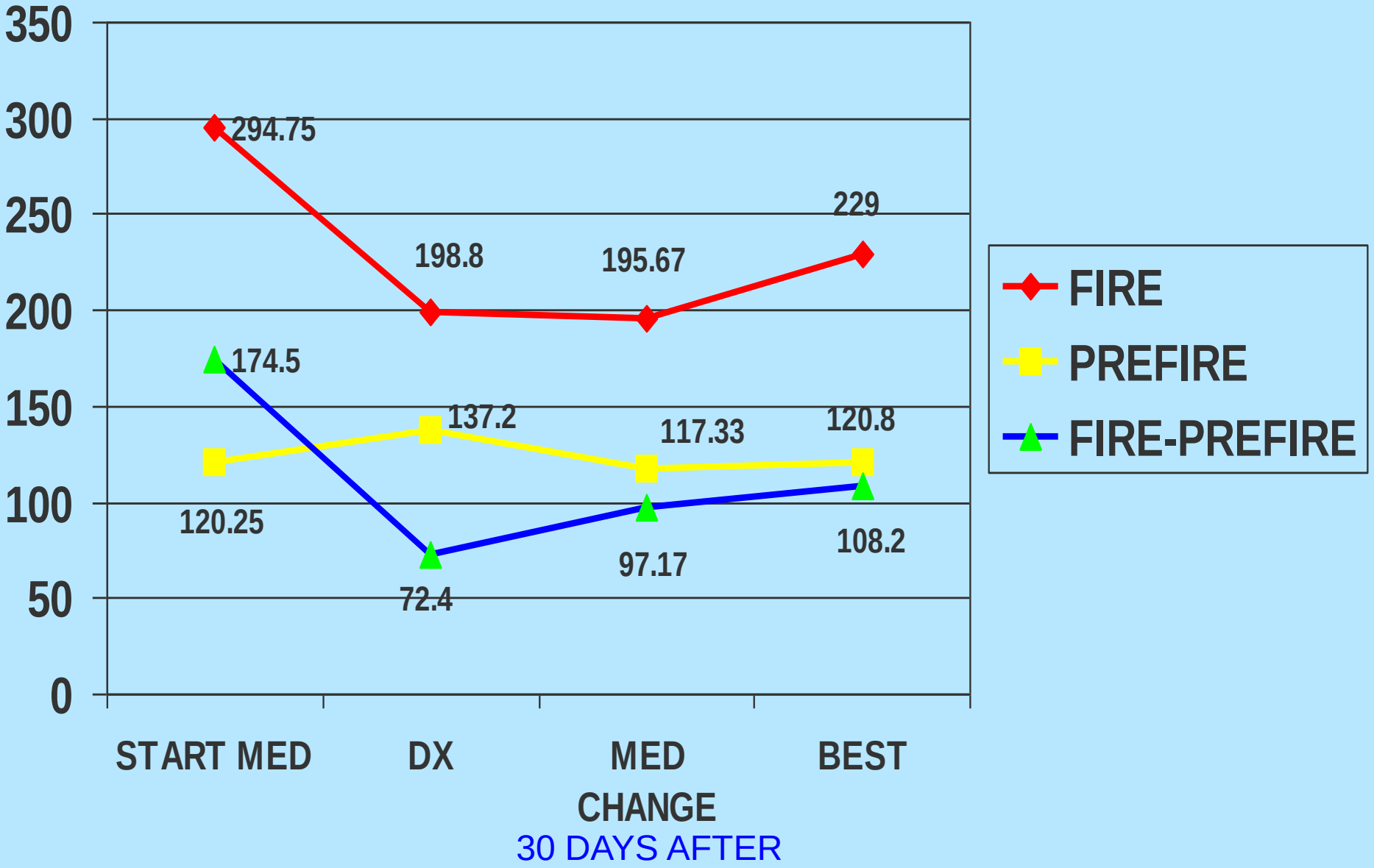
2nd Cohort



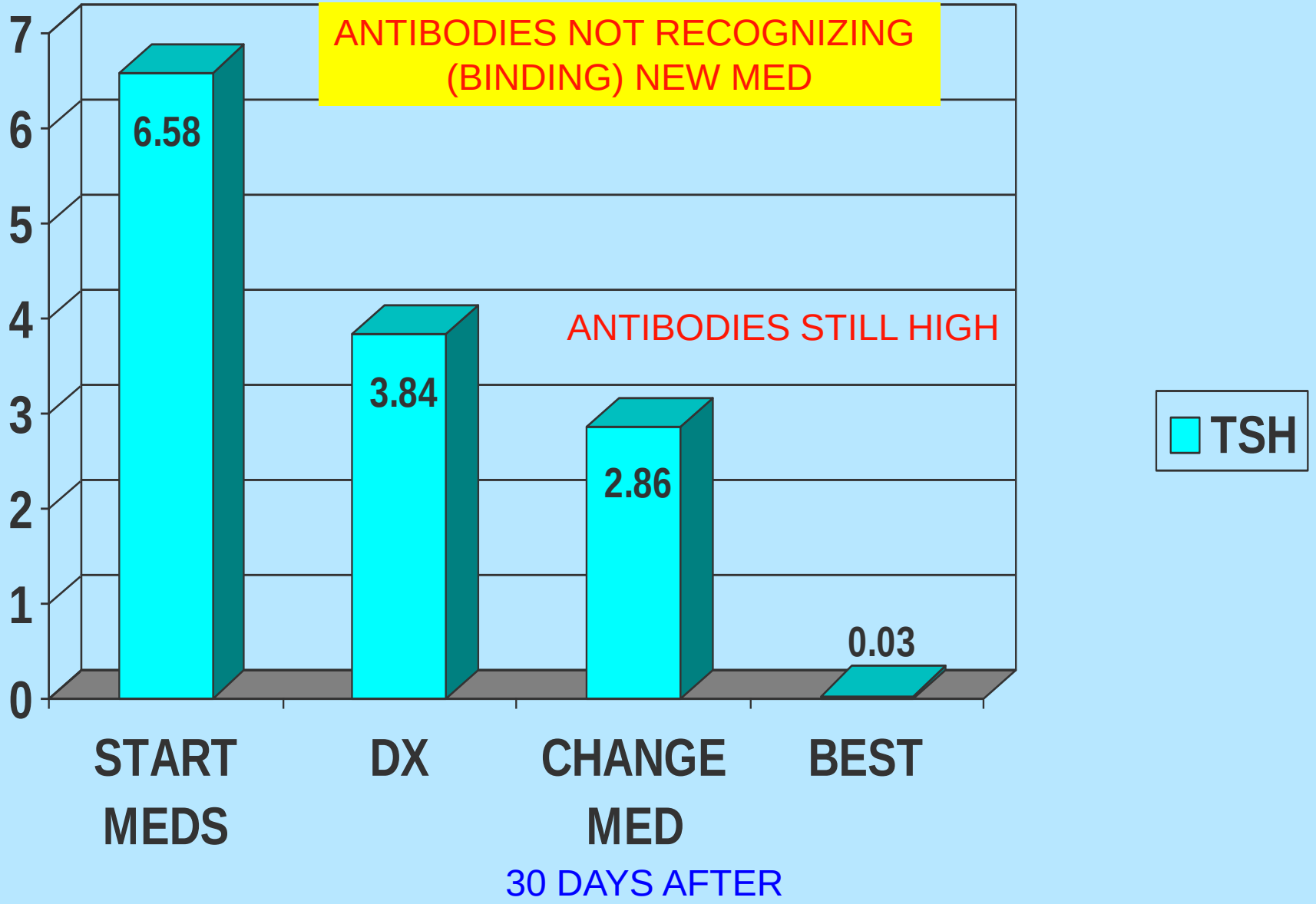
HASHIMOTO'S AND RMR



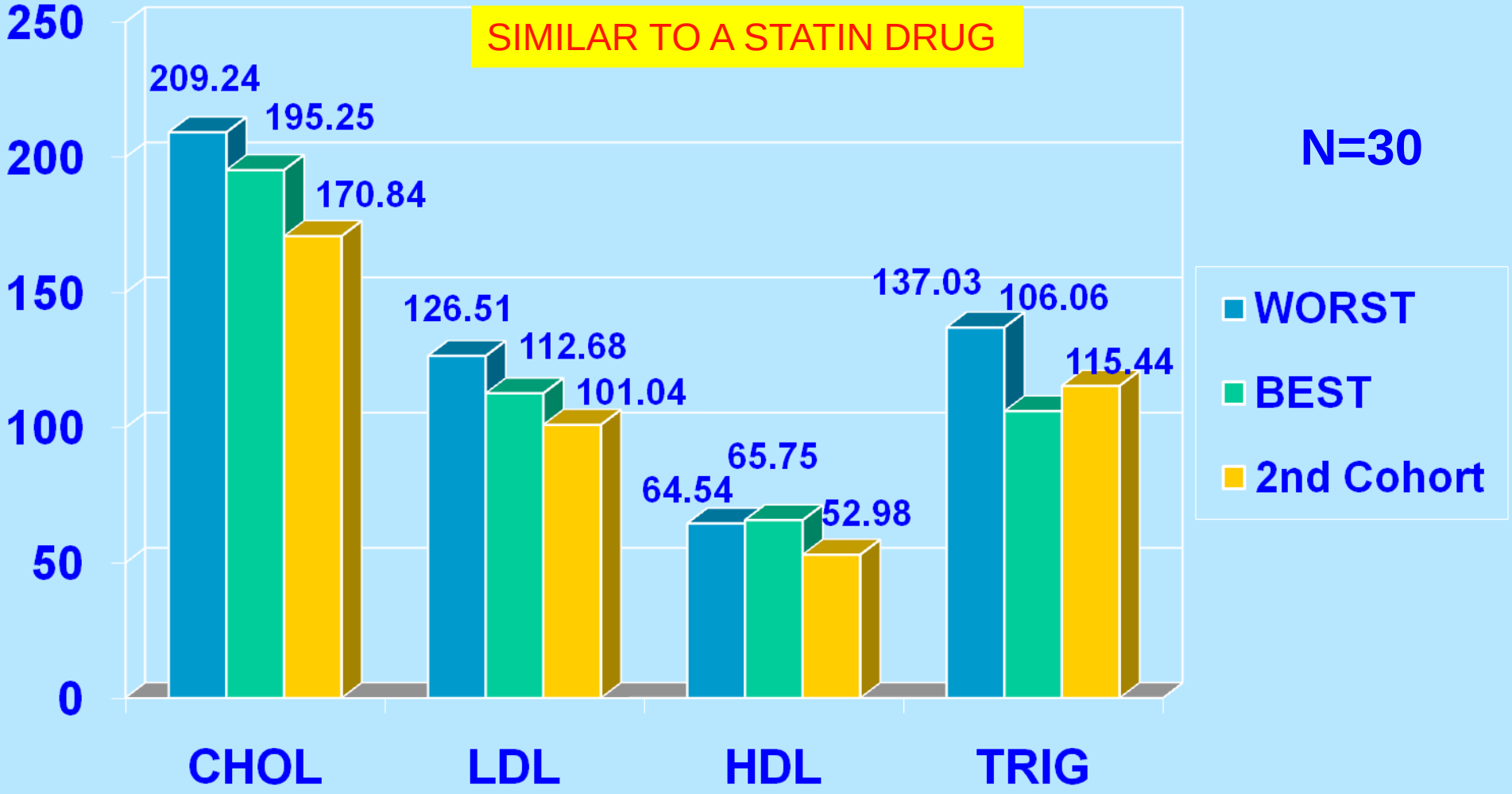
REFLEXES AND HASHIMOTO'S



HASHIMOTO'S AND TSH



THYROID EFFECTS ON SERUM LIPIDS



ADAPTING THYROID DOSE TO ENVIRONMENT

DOSE	INCREASE DOSE (5-20% MORE)	LOWER DOSE (5-20% LESS)
CONDITIONS	INSUFFICIENT EFFECTS	EXCESSIVE EFFECTS
	WINTER	SUMMER
	IN THE MOUNTAINS	AT THE BEACH
	EXERCISING A LOT	EXCESSIVE STRESS
	HIGH PROTEIN DIET	LOW PROTEIN DIET
	LOW VEGGIE/FRUIT DIET	HIGH VEGGIE/FRUIT DIET
	LOW CALORIE DIET	CAFFEINATED DRINKS
	BETA BLOCKERS	UNTREATED CORTISOL DEFICIENCY
	ORAL ESTROGEN	ANDROGENS IN WOMEN
	SLEEP DEPRIVATION	GROWTH HORMONE TREATMENT
	SITUATIONS REQUIRING MENTAL ALERTNESS	INSULIN TREATMENT

HERTOGHE, T; The Hormone Handbook. International Medical Books Surrey, UK, 2006, p89.

COST OF THYROID MEDS

PHARMACY 30 day supply	ARMOUR 120 mg	SYNTHROID 200 mcg	CYTOMEL 50 mcg
WALGREENS	$13.79	$28.19	$46.49
OSCO	$21.69	$39.00	$75.00
K-MART	$15.97	$29.69	$48.97
COSTCO	$10.19	$21.17	$41.89
AVERAGE	$15.41	$29.51	$53.09

Many on synthetic thyroid require both T3 and T4

Combination Therapy $82.60 for 30 day supply

THYROID MYTHS

- **DOES SUBCLINCAL HYPOTHYROID NEED TO BE TREATED ?**
  - **HEALTH RISK IS HUGE IF UNTREATED**
- **IS TSH THE BEST CLINICAL MARKER ?**
  - **INSENSITIVE NEAR NORMAL**
    - **GETS TOO SMALL BEFORE FULL CLINICAL EFFECT**
  - **RECEPTOR ACTIVITY DOESN'T REFLECT METABOLIC DEMAND**
- **IS IODINE GOOD FOR THYROID FUNCTION ?**
  - **DECREASES THYROID FUNCTION IF NOT DEFICIENT**
- **ARE SYNTHETIC THYROID MEDS MORE PRECISE AND MORE SCIENTIFIC THAN NATURAL ?**
  - **NATURAL THYROID IS BIOIDENTICAL, U.S.P. AND HAS $\geq$ EFFECT**
  - **HALF-LIFE IS LONG IN MOST THYROID MEDS**
  - **MOST PEOPLE END UP ON 2 SYNTHETIC MEDS**
    - **IF SYNTHROID ALONE CAN'T CONVERT T4 TO T3**
    - **IF CYTOMEL ALONE T4 GOES TO ZERO**