

New 2010 WHO Standards (5th Edition) for the Evaluation of Human Semen

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Introduction

- About 1 out of 15 couples at reproductive age experience difficulty conceiving
- Both men and women are more or less equally affected
- Men are solely responsible for the difficulty in 20-25% of the time, and are involved in 20-25% of the time along with their female partners¹

Introduction

- The prevalence of male subfertility/infertility is similar to that of Type 1 and 2 diabetes combined²
- Semen analysis is the cornerstone for evaluating men for subfertility or infertility
- However, the test has been shown to be ineffective in reliably predicting the fertility status of men

Reasons for the Low Predictive Power of Semen Analysis

- Lack of technology to precisely assess a subset of sperm capable of inducing term pregnancies (associate the numbers with the function)
- Inherent variability in semen parameters among men
- Relying on reference thresholds (“normal values”) proven to be inadequate tools and standards for distinguishing fertile from infertile men

- Valid reference ranges can improve the value of semen analysis but this has been hampered by the shortcomings of technology and the inherent variability in semen quality among men
- During past 65 years 3 key studies have been carried out for establishing or validating reference ranges for major semen parameters

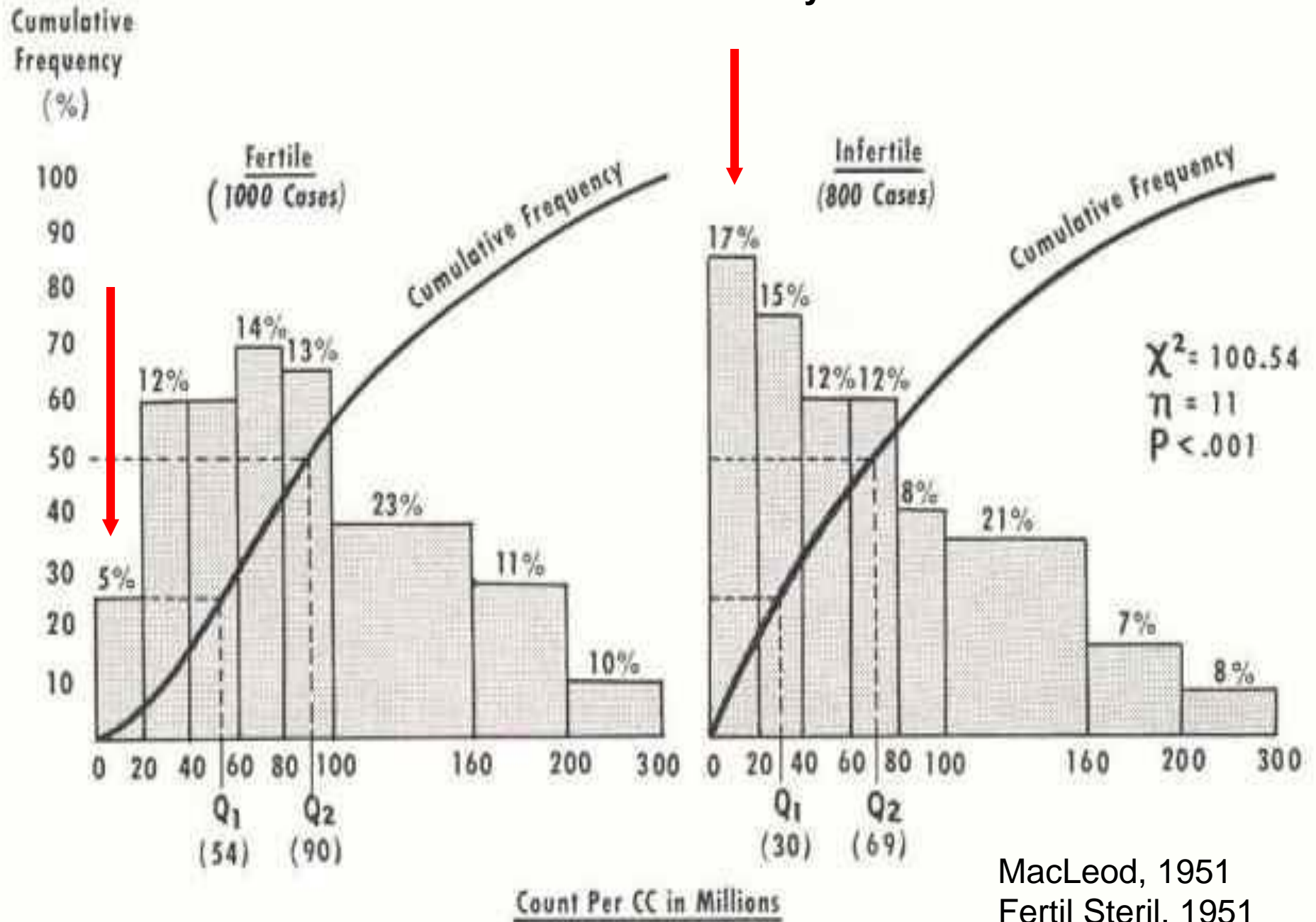
Major Studies To Establish or Validate Reference Limits for Semen Parameters From 1951 to 1980 to 1991 to 2010

- MacLeod Study, (1951-1953)
- Guzick et al study, (1991)
 - mainly to assess if MacLeod/WHO reference ranges as well as morphology based on Strict Criteria were able to distinguish fertile from subfertile men
- WHO, 5th edition, (2010)
 - Exception: sperm morphology, revised several times

John Macleod Study³

- 1000 men, wives pregnant
- 800 “infertile” men
- Collection: Masturbation or coitus interruptus (withdrawal)
- One semen/man
- Exception: When fertile men had low quality semen, a second sample was collected
- Motility/morphology evaluations: Blindly, by a single person
- Sperm motility assessed within 5 hours or less

MacLeod's Study



MacLeod, 1951
Fertil Steril, 1951

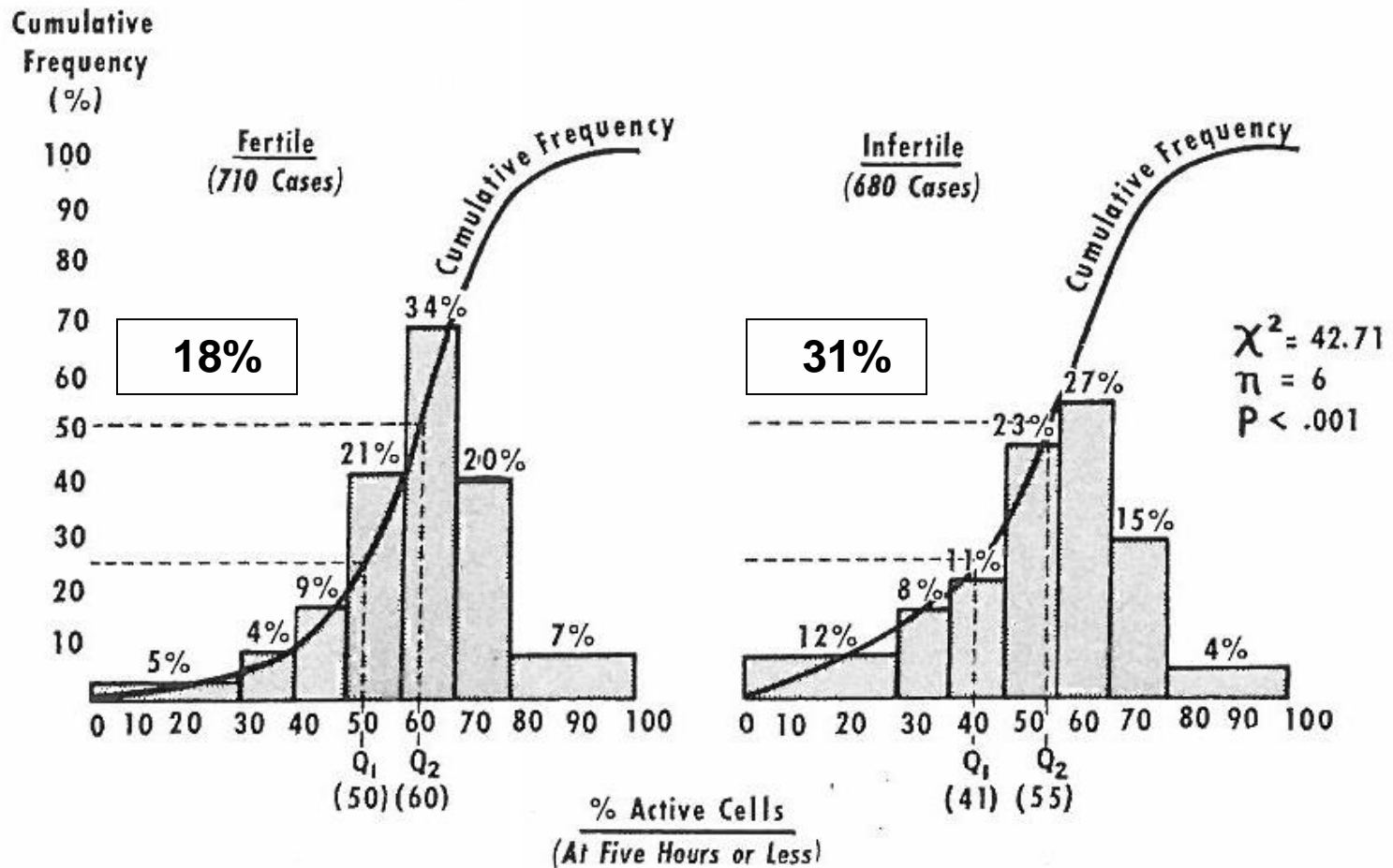


FIGURE 7. Relative frequency distributions of “per cent active” spermatozoa in semen of 1000 fertile men and of 800 men in “infertile” marriage.

MacLeod, Fertil Steril, 1951

No difference in semen volume and morphology between the 2 groups

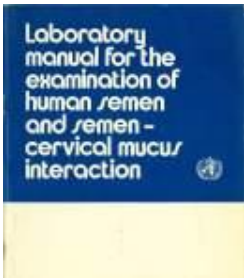
Major Issues With MacLeod's Study

- Coitus interruptus
- Only one sample per person
- Exception given to the fertile group
- Motility assessment: up to 5 hrs. post collection
- Fertility not clearly defined in both populations
- Inadequate statistical methods
- Morphological evaluations: highly subjective

- Nevertheless, the data from John MacLeod's study and a few other investigators were used to establish the “normal values” (reference ranges) for major semen parameters in the 1st edition (1980) of the WHO manual for the examination of human semen and cervical mucus

1st (1980) WHO Standards for Major Semen Parameters

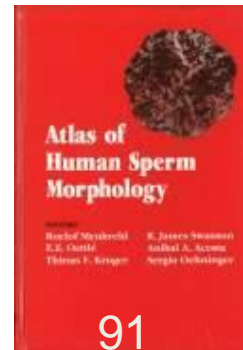
Parameter	“Normal”	1987, 1992, 1999
Semen Volume (mL)	≥ 2 mL (2-5 mL)	Same
Sperm Concentration ($\times 10^6$)	$\geq 20 \times 10^6$ (-200)	Same
Sperm Motility (% progressive)	$\geq 50\%$	Same
Sperm Morphology (% normal forms)	$\geq 80.5\%$	$\geq 50\%$, $\geq 30\%$, $\geq 15\%$
Sperm Viability (% viable)	$\geq 50\%$	Same



WHO 1st 1980

Normal Morphology

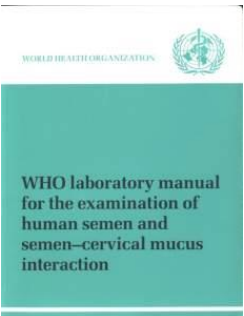
Normal: $\geq 80.5\%$



Strict Criteria

Normal Morphology

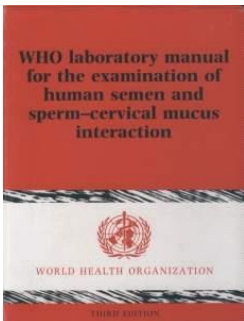
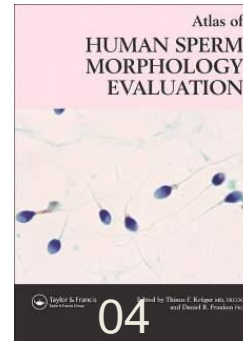
Normal: $\geq 14\%$



WHO 2nd 1987

Normal Morphology

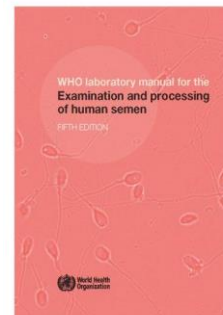
Normal: $\geq 50\%$



WHO 3rd 1992

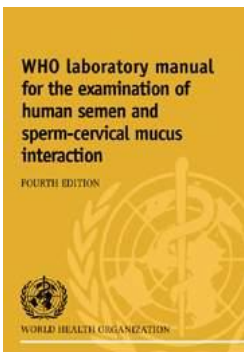
Normal Morphology

Normal: $\geq 30\%$



WHO 5th 2010

Normal Morphology **4%**



WHO 4th 1999

Normal Morphology

Normal: $\geq 15\%$

“Data from assisted reproductive technology programs suggest that, as sperm morphology falls below 15% normal forms using the methods and definitions described in this manual, the fertilization rate in vitro decreases.”

Guzick's Study

- Guzick et al revisited the value of WHO reference ranges by studying samples from 696 fertile and 765 subfertile men at 9 sites across the US (New Eng J Med, 1991)
- The authors used Classification-And-Regression-Tree (CART) analysis to establish the threshold values for fertility and subfertility and used ROC curve to assess the relative value of these parameters in distinguishing between fertile and subfertile men

Positive Aspects of Guzick's Study

- The fertile population was better defined
- Two semen samples per individual were obtained for the study and tested in a timely fashion
- The status of the female partners were more clearly defined
- Valid statistical methods were utilized to evaluate the data

Questionable Aspects of Guzick's Study

- The fertile population was not as uniformly defined (recent up to 2 years)
- The subfertile population was not truly subfertile/infertile
- Possible unknown female factors
- Abstinence between the 2 semen samples varied significantly, 2 of 6 samples for infertile
- Testicular output was not assessed
- The age of men varied significantly

TABLE 2. FERTILE, INDETERMINATE, AND SUBFERTILE RANGES FOR SPERM MEASUREMENTS FROM CLASSIFICATION-AND-REGRESSION-TREE ANALYSIS AND CORRESPONDING ODDS RATIOS FOR INFERTILITY.*

VARIABLE	SEMEN MEASUREMENT		
	CONCENTRATION	MOTILITY	MORPHOLOGY
	$\times 10^{-6}/\text{ml}$	%	% normal
Fertile range	>48.0	>63	>12
Indeterminate range	13.5–48.0	32–63	9–12
Univariate odds ratio for infertility (95% CI)	1.5 (1.2–1.8)	1.7 (1.5–2.2)	1.8 (1.4–2.4)
Subfertile range	<13.5	<32	<9
Univariate odds ratio for infertility (95% CI)	5.3 (3.3–8.3)	5.6 (3.5–8.3)	3.8 (3.0–5.0)

*CI denotes confidence interval.

Guzick et al, 1991

TABLE 3. ODDS RATIOS FOR INFERTILITY FOR COMBINATIONS OF SPERM MEASUREMENTS.*

SPERM MEASUREMENT RANGE			ODDS RATIO (95% CI)
MORPHOLOGIC FEATURES	MOTILITY	CONCENTRATION	
Fertile	Fertile	Fertile	1.0
Subfertile	Fertile	Fertile	2.9 (2.2–3.7)
Fertile	Subfertile	Fertile	2.5 (1.6–4.2)
Fertile	Fertile	Subfertile	2.2 (1.3–3.6)
Subfertile	Subfertile	Fertile	7.2 (4.3–12.2)
Subfertile	Fertile	Subfertile	6.3 (3.8–10.3)
Fertile	Subfertile	Subfertile	5.5 (3.0–10.2)
Subfertile	Subfertile	Subfertile	15.8 (8.7–29.0)

2010 WHO Criteria For Semen Analysis

- Up to 2010, for nearly 60 years the reference values used for basic semen parameters were from the threshold established by MacLeod
- The exception was for sperm morphology that revised several time until 2010 guidelines were published

2010 WHO Criteria For Semen Analysis

- Data from 4 different populations (+)
- A total of 4500 men from 14 countries in 4 continents (+/-)
 - Men who fathered children within the previous 12 months (time-to-pregnancy, TTP, of ≤ 12 months) (+)
 - Men of unknown fertility (UNSCR, unscreened, from general population) (+)
 - Fertile men (NOTTP, no report of when they fathered children) (+)
 - Men who were screened and chosen if normozoospermic (SCR, based on 1999, WHO standards) (+)

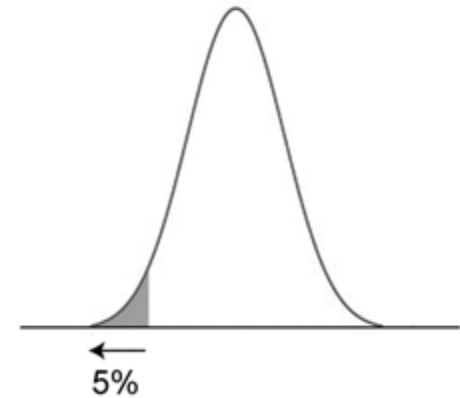
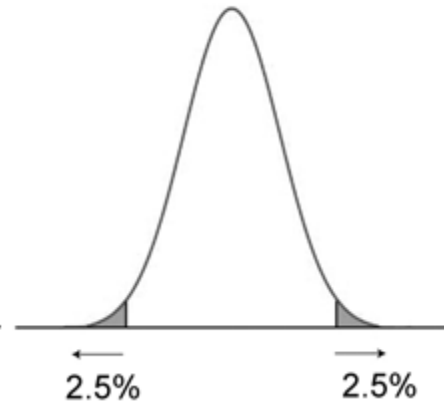
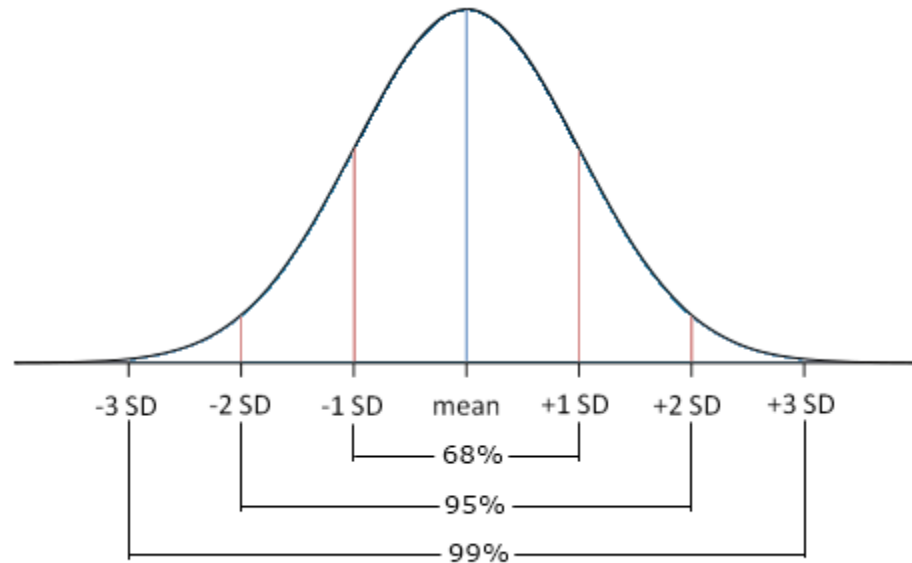
2010 WHO Criteria For Semen Analysis

- Rather than calculating the mean and the upper and lower limits for various semen parameters obtained from the TTP ≤ 12 months, one-sided 5th centile was used as the lower threshold (normal values) for major semen parameters
- 95% confidence intervals (CI) was calculated from the remaining 5%

Why 5th Centile, What is Centile?

A

B

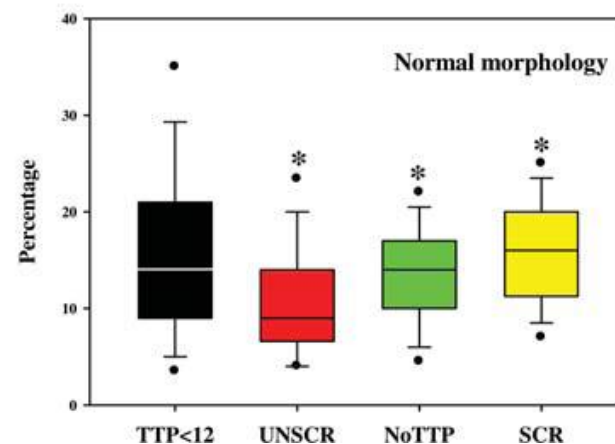
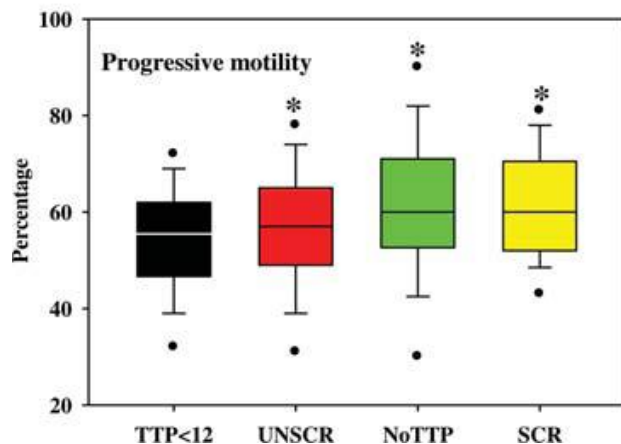
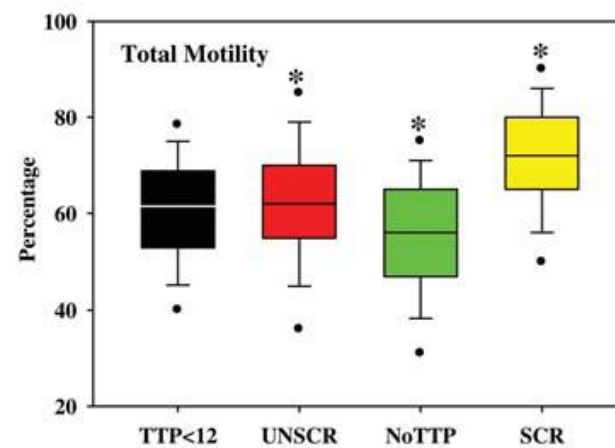
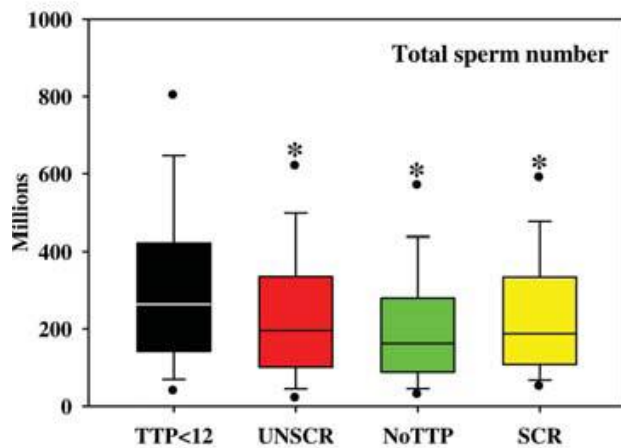
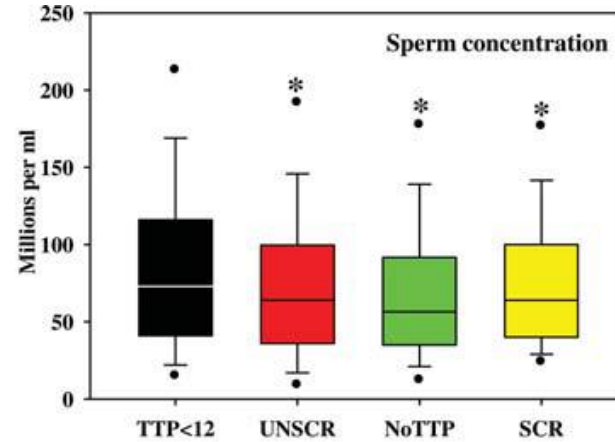
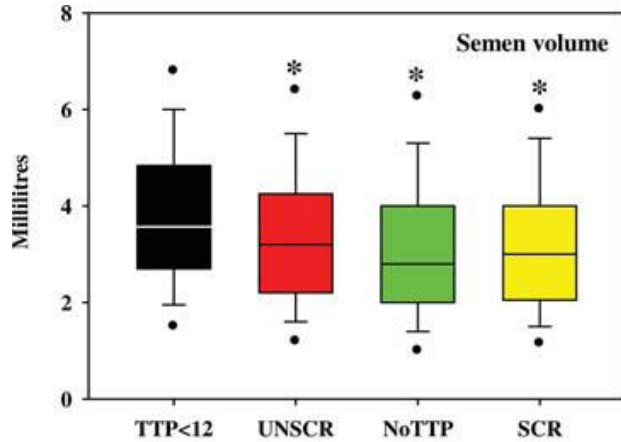


Google Image

Boyd, Asian J Androl, 2010

2010 WHO Criteria For Semen Analysis

- Lower 5th centile thresholds established from one of the 4 groups, a group of men who fathered children during the previous 12 month prior ($TTP \leq 12$ months) to the submission of semen samples for analysis
- 1953 semen samples from 5 studies in 8 counties in 3 continents.
- The other 3 groups were evaluated for comparison with this group



Comparison of Reference Values

	Macleod/WHO 1st-4th Editions	Guzick et al 1991 (Fertile)	Guzick et al 1991 (subfert.)	Men with a TTP of ≤12 months
Semen Vol. (95% CI)	≥2 mL (2-5)	—	—	1.5 mL (1.4-1.7)
Sperm Conc. (95% CI)	≥20 x 10 ⁶ /mL (20-200)	>48 x 10 ⁶ /mL	<13.5x 10 ⁶ /mL	15 x 10 ⁶ /mL (12-16)
Total Sperm Per Ejaculate	—	—	—	39 x 10 ⁶ /mL (33-46)
Sperm Total Motility	—	>63%	—	40% (38-42%)
Sperm Prog. Motility	≥50%	—	<32%	32% (31-34%)
Morphology (normal forms)	≥80.5%	>12%	<9%	4% (3-4%)

95% CI were calculated from the remaining 5%

Table A1.2 Distribution of values for semen parameters from men whose partners became pregnant within 12 months of discontinuing contraceptive use

Parameter (units)	N	Centile								
		2.5	5	10	25	50	75	90	95	97.5
Semen volume (ml)	1941	1.2	1.5	2.0	2.7	3.7	4.8	6.0	6.8	7.6
Total sperm number (10 ⁶ per ejaculate)	1859	23	39	69	142	255	422	647	802	928
Sperm concentration (10 ⁶ per ml)	1859	9	15	22	41	73	116	169	213	259
Total motility (PR+NP, %)	1781	34	40	45	53	61	69	75	78	81
Progressive motility (PR,%)	1780	28	32	39	47	55	62	69	72	75
Non-progressive motility (NP, %)	1778	1	1	2	3	5	9	15	18	22
Immotile spermatozoa (IM, %)	1863	19	22	25	31	39	46	54	59	65
Vitality (%)	428	53	58	64	72	79	84	88	91	92
Normal forms (%)	1851	3	4	5.5	9	15	24.5	36	44	48

Comments About the New 2010 Standards

- The semen samples were not collected exclusively for the purpose of establishing the guidelines.
- The data from the semen samples from these men were collected for the purpose of establishing the standards/reference values

Comments About the New 2010 WHO Standards

- Adequate number of men from 4 different populations compared. No infertile group.
- Men with TTP \leq 12 months adequate
- Abstinence too broad
- One sample (the first) from each man was included to relate the results to interindividual variation. However, limiting the data to one sample per person removes the intraindividual variations from calculations

Comments About the New 2010 WHO Standards

- Different temperature settings were used to evaluate semen samples
- Various sperm counting chambers and methods were used
- Calculating output/hr. or /24 or 48 hr. better
- From the data and the threshold, still remains difficult to assess the likelihood of pregnancy
- Success for various centiles should have been found

Comments About the New 2010 WHO Standards

- Focus should be shifted from traditional reference values to decision limits, likelihood ratios. Reference values have not been proven valuable for many years and their values based on the 2010 guidelines remain to be proven
- Better: The rate of producing “ideal” spermatozoa (i.e., motility, morphology, DNA, devoid of undesirable genetic markers capable of fertilization and maintenance of pregnancy)

Comments About the New 2010 WHO Standards

- This number and rate (of ideal sperm production) we must also include the factors related to the female partner to come up with a reliable likelihood of pregnancy

Comments About the New 2010 WHO Standards

- Rather than flagging the results as low or abnormal, it is better to compare them with the centiles obtained from the reference population
- The centile table available from WHO 5th edition manual is a resource which needs to be kept handy by the laboratorians and the ordering healthcare providers

What Do You Need to Do to Perform a Semen Analysis Based on 2010 WHO Standards?

- Measure/report volume to tenth of an mL
- Measure/report sperm concentration as usual
- Assess/report total and progressive motility
- Determine/report total sperm per ejaculate
- Determine/report morphology based on Strict Criteria
- Have all 2010 WHO lower thresholds and 95% confidence intervals, CI, in your report
- Flag abnormal or low if lower than 95% CI

- Examples of Semen Analysis Reports Based on WHO 2010 Guidelines

ANDROLOGY LABORATORY

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Laboratory Director
Mahmood Morshed, Ph.D., HCLD(ABB)

Clinical Director:
Sergio Oehninger, M.D., Ph.D.

WHO 5 -Basic Semen Analysis Report

Referring Physician:	Test Date:
Patient:	Spouse:
Patient SSN:	Spouse SSN:
Medical Record Number:	Medical Record Number:
Specimen Number:	Date of Last Emission:
Time Collected:	Location of Collection: Collection Room
Time Analyzed:	Collection Complete (Y/N): Yes
	If no, the loss was from ___ 1 st , ___ middle, ___ last part
Collection Method: MASTURBATION	Counting Chamber: Makler

PARAMETER	RESULT	WHO 2010 LOWER REFERENCE LIMIT (95% CI)
SEMEN DATA		
Volume		1.5 mL (1.4-1.7 mL)
Odor	Spermine	Spermine
Color	Whitish	Whitish, Gray, Opalescent
Viscosity	Normal	Normal
Liquefaction	Complete	Complete in 30 minutes
pH		Basic ≥ 7.2
Agglutination	None	None
Round Cells	$\times 10^6/\text{mL}$	< 1 million/mL semen
Neutrophils	$\times 10^6/\text{mL}$	< 1 million/mL semen

SPERM DATA (Computer Assisted)		Number of Sperm Analyzed:
Concentration	$\times 10^6/\text{mL}$	15 million/mL (12-16 million/mL)
Total Sperm Count/Ejaculate	$\times 10^6$	39 million (33-46 million)
Total Percent Motility (progressive + non-progressive)	%	40% (38%-42%)
Progressive Motility	%	32% (31%-34%)
Rapid: Medium: Slow:		Limits have not been established
Motile Sperm/Ejaculate	$\times 10^6$	Lower Limit not established
Total Progressively Motile/Ejaculate		Lower Limit not established
Progressive Velocity	$\mu\text{m/s}$	≥ 25 micrometers/second
Mean Linearity	%	35-79% Circular to Straight Line
Motility Index		≥ 10 (% motile x mean velocity)
Viability (eosin)	%	$\geq 58\%$ (55%-63%)
Comments: Sperm concentration and motility have been checked twice.		

MORPHOLOGY DATA (Strict Criteria)		Number of Sperm Analyzed:
Normal Sperm:*	%	Midpiece Defect: %
Small Head:	%	Tail Defects/Coiled: %
Large Head:	%	Duplicate Form: %
Round Head:	%	Cytoplasmic Droplet: %
Tapered Head:	%	Amorphous Head: %
		100%
Slightly abnormal: %		Coiled Tail, Normal Head: _____

Morphology Lower Threshold:

*Lower Threshold for Morphologically Normal Sperm: 4%
95% Confidence Interval (CI): 3-4%

WHO 5 -Basic Semen Analysis Report

Referring Physician:		Test Date:	
Patient:		Spouse:	
Patient SSN:		Spouse SSN:	
Medical Record Number:		Medical Record Number:	
Specimen Number:		Date of Last Emission:	
Time Collected:		Location of Collection:	
Time Analyzed:		Collection Complete (Y/N): Yes	
Collection Method: MASTURBATION		If no, the loss was from ___ 1 st , ___ middle, ___ last part	
Incubation and reading temperatures: 37 C		Counting Chamber: Makler	

PARAMETER	RESULT	WHO 2010 LOWER REFERENCE LIMIT (95% CI)
SEMEN DATA		
Volume		1.5 mL (1.4-1.7 mL)
Odor	Spermine	Spermine
Color	Whitish	Whitish, Gray, Opalescent
Viscosity	Normal	Normal
Liquefaction	Complete	Complete in 30 minutes
pH		Basic ≥ 7.2
Agglutination	None	None
Round Cells	x10 ⁶ /mL	< 1 million/mL semen
Neutrophils	x10 ⁶ /mL	< 1 million/mL semen

SPERM DATA (Computer Assisted)		Number of Sperm Analyzed:
Concentration	x10 ⁶ /mL	15 million/mL (12-16 million/mL)
Total Sperm Count/Ejaculate	x10 ⁶	39 million (33-46 million)
Total Percent Motility (progressive + non-progressive)	%	40% (38%-42%)
Progressive Motility	%	32% (31%-34%)
Rapid: Medium: Slow:		Limits have not been established
Motile Sperm/Ejaculate	x10 ⁶	Lower Limit not established
Total Progressively Motile/Ejaculate		Lower Limit not established
Progressive Velocity	μm/s	≥ 25 micrometers/second
Mean Linearity	%	35-79% Circular to Straight Line
Motility Index		≥ 10 (% motile x mean velocity)
Viability (eosin)	%	≥ 58% (55%-63%)
Comments: Sperm concentration and motility have been checked twice.		

MORPHOLOGY DATA (Strict Criteria)		Number of Sperm Analyzed:
Normal Sperm:*	%	Midpiece Defect: %
Small Head:	%	Tail Defects/Coiled: %
Large Head:	%	Duplicate Form: %
Round Head:	%	Cytoplasmic Droplet: %
Tapered Head:	%	Amorphous Head: %
		100%
Slightly abnormal: %		Coiled Tail, Normal Head: _____
Morphology Lower Threshold:		
<ul style="list-style-type: none"> *Lower Threshold for Morphologically Normal Sperm: 4% 		
95% Confidence Interval (CI): 3-4%		

Referring Physician: [REDACTED] , MD	Test Date: 03/26/2014
Patient: [REDACTED]	Spouse:
Patient SSN: [REDACTED]	Spouse SSN: --
Patient DOB: [REDACTED]	Spouse DOB:
Medical Record Number: [REDACTED]	Medical Record Number:
Specimen Number: [REDACTED]	Date of Last Emission: 03/24/2014
Time Collected: 11:12	Location of Collection: Collection Room
Time Analyzed: 11:30	Collection Complete (Y/N): Yes
Collection Method: Masturbation	Counting Chamber: Makler

PARAMETER	RESULT	WHO 2010 LOWER REFERENCE LIMIT (95% CI)
SEMEN DATA		
Volume	1.6	1.5 mL (1.4 - 1.7 mL)
Odor	Spermine	Spermine
Color	Opalescent	Whitish, Gray, Opalescent
Viscosity	Slight	Normal
Liquefaction	Complete	Complete in 30 minutes
pH	8.5	Basic \geq 7.2
Agglutination	None	None
Round Cells	< 1 million/mL semen	< 1 million/mL semen
Neutrophils	< 1 million/mL semen	< 1 million/mL semen

SPERM DATA (Computer Assisted)		Number Of Sperm Analyzed	342
Concentration	15.2 x 10 ⁶ /mL	15 million/mL (12-16 million/mL)	
Total Sperm Count/Ejaculate	24.3 x 10 ⁶ *Low	39 million (33-46 million)	
Total Percent Motility (progressive + non-progressive)	54.6%	40% (38-42%)	
Progressive Motility	22.9% *Low	32% (31-34%)	
Rapid: 18 % Medium: 4 % Slow: 1 %		Limits have not been established	
Motile Sperm Ejaculate	13.3 x 10 ⁶	Lower Limit not established	
Total Progressively Motile/Ejaculate	5.6 x 10 ⁶	Lower Limit not established	
Average Path Velocity	59.3 μ m/s	\geq 25 micrometers/second	
Mean Linearity	32%	35-79% Circular to Straight Line	
Motility Index	32.4	\geq 10 (%motile x mean velocity)	
Viability (eosin)	84.1	\geq 58% (55-63%)	
Comments: Sperm concentration and motility have been checked twice.			

MORPHOLOGY DATA (Strict Criteria)		Number of Sperm Analyzed	200
Normal Sperm:*	3.0%	Midpiece Defect	0.0%
Small Head	0.0%	Tail Defects Coiled	2.5%
Large Head	0.0%	Duplicate Form	3.5%
Round Head	0.0%	Cytoplasmic Droplet	1.0%
Tapered Head	0.0%	Amorphous Head	90.0%
			100.0%
Slightly Abnormal	2.5%	Coiled Tail Normal Head	0.0%

*Lower Limit for Morphologically Normal Sperm: 4%
95% Confidence Interval (CI): 3-4%

Quality Semen Analysis

- Volume
- Sperm Concentration
- Sperm Motility
- Sperm Morphology



A Hemacytometer

Sperm Counting Chambers

The Makler chamber is one of the most commonly used chamber in andrology laboratories.



Sperm Counting Chambers

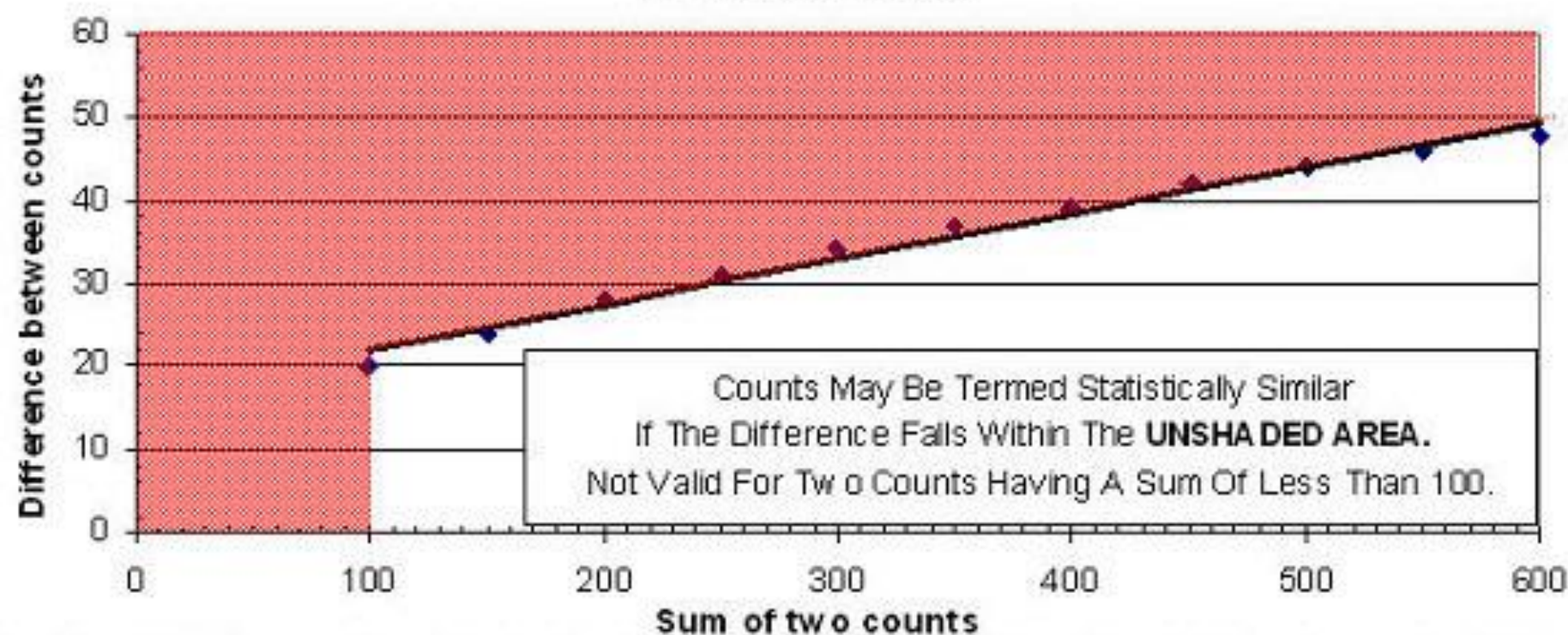
Other chambers used are Microcell and Cell-VU. These are fixed cover slip chambers.

MicroCell



Approximate 95%CI
Differences Between Two Counts

$$y = 0.0551x + 16.445$$

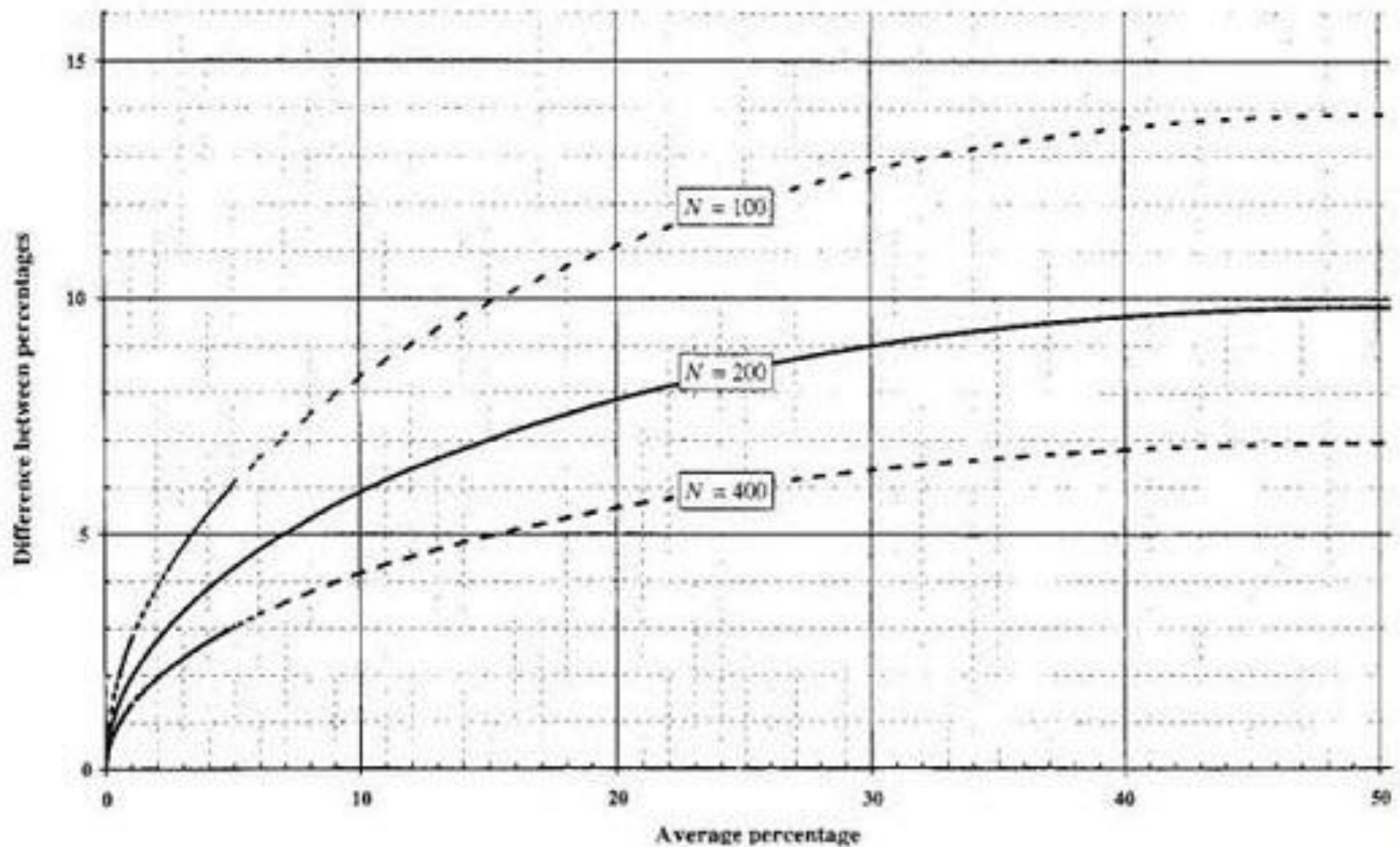


Adapted from: WHO Laboratory Manual for the Examination of Human Semen and Sperm-Cervical Mucus Interaction, 4th Ed .
Cambridge University Press, Pg 117 . 1999 .

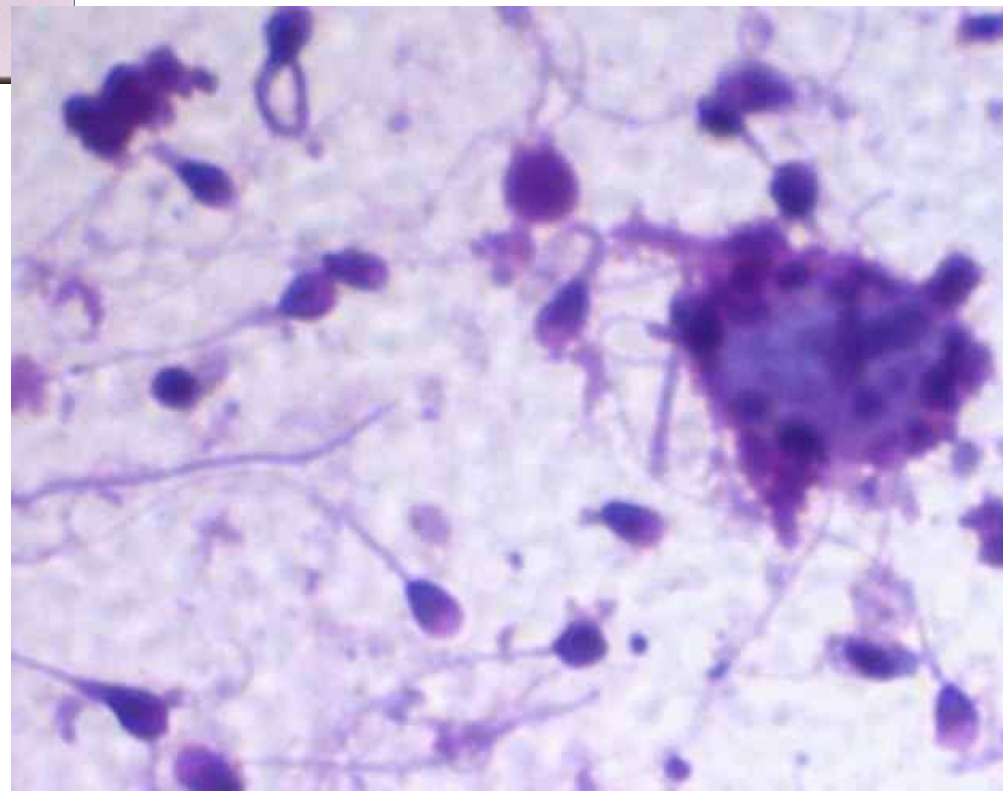
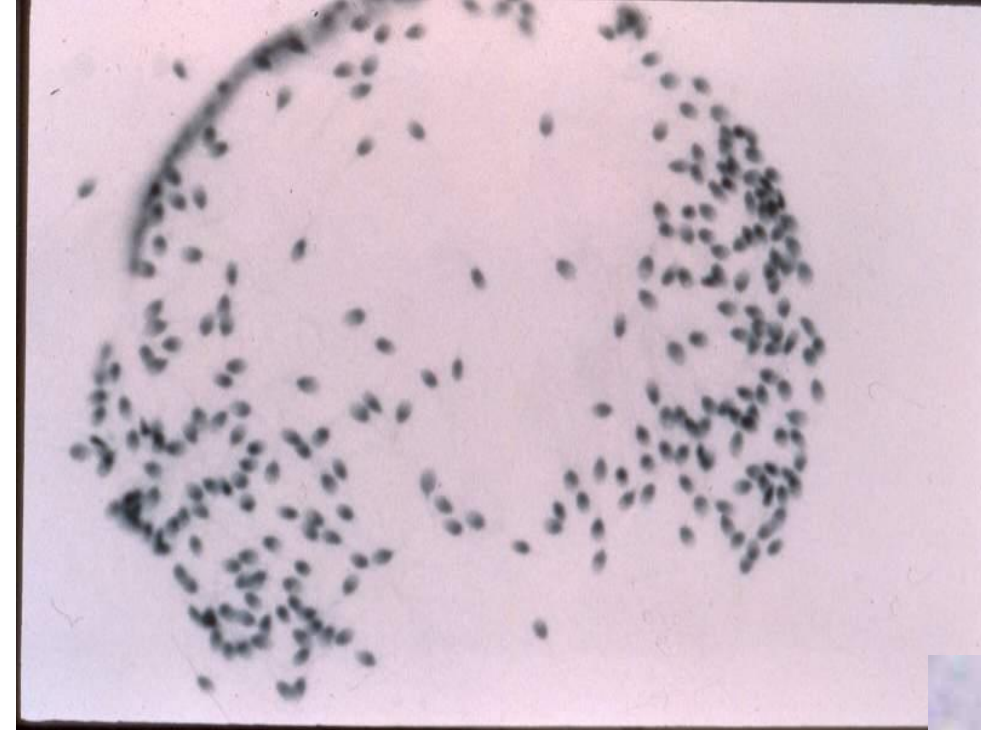
Alternatively, you can use the following tables in this and the next slide to assess maximum allowable difference between 2 readings of sperm count

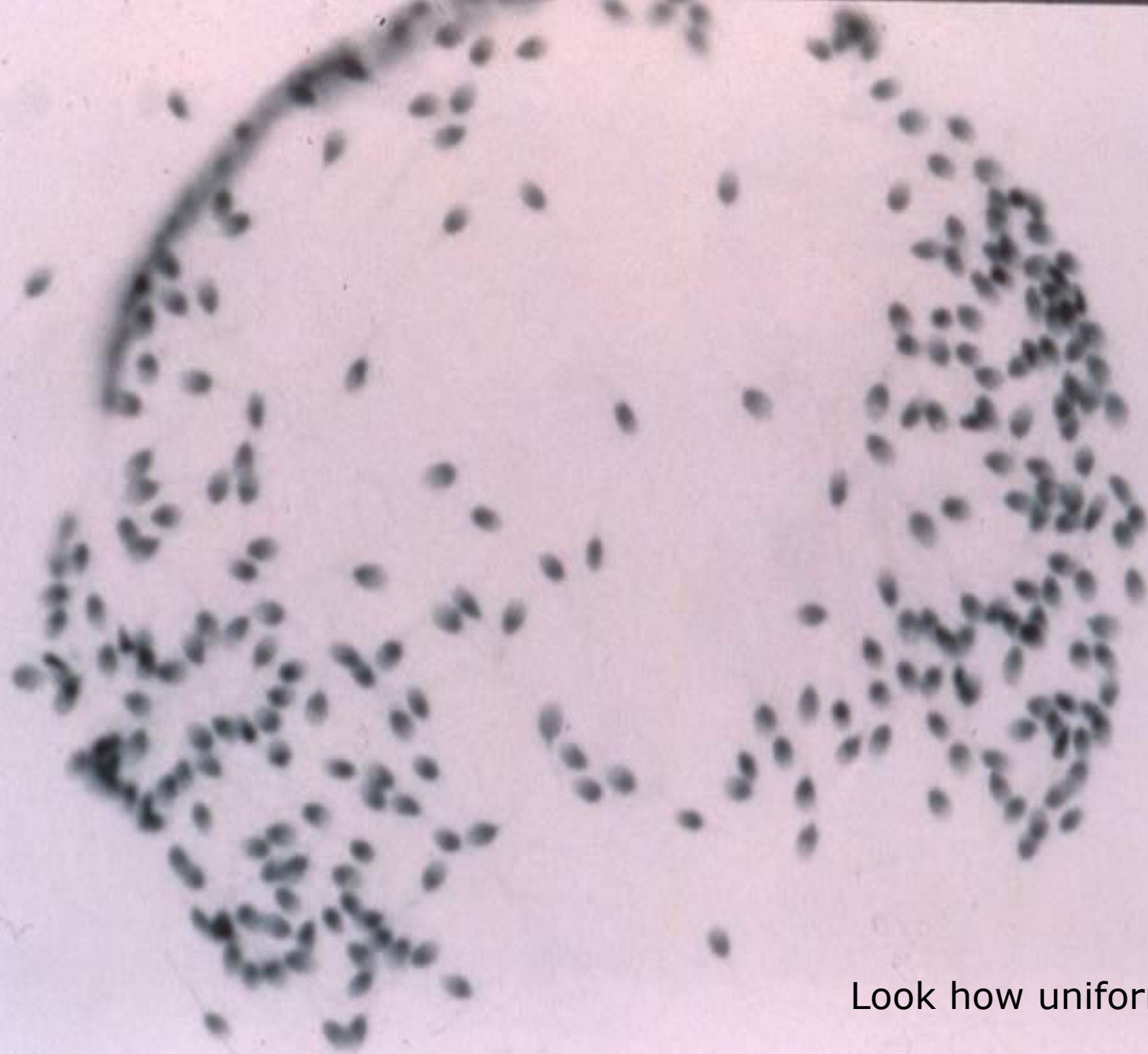
Column A	Column B
Sum of Two Counts	Maximum Difference Between Two Counts
100	22
110	23
120	23
130	24
140	24
150	25
160	25
170	26

Column A	Column B
Sum of Two Counts	Maximum Difference Between Two Counts
180	26
190	27
200	27
210	28
220	29
230	29
240	30
250	30
260	31
270	31
280	32
290	32
300	33

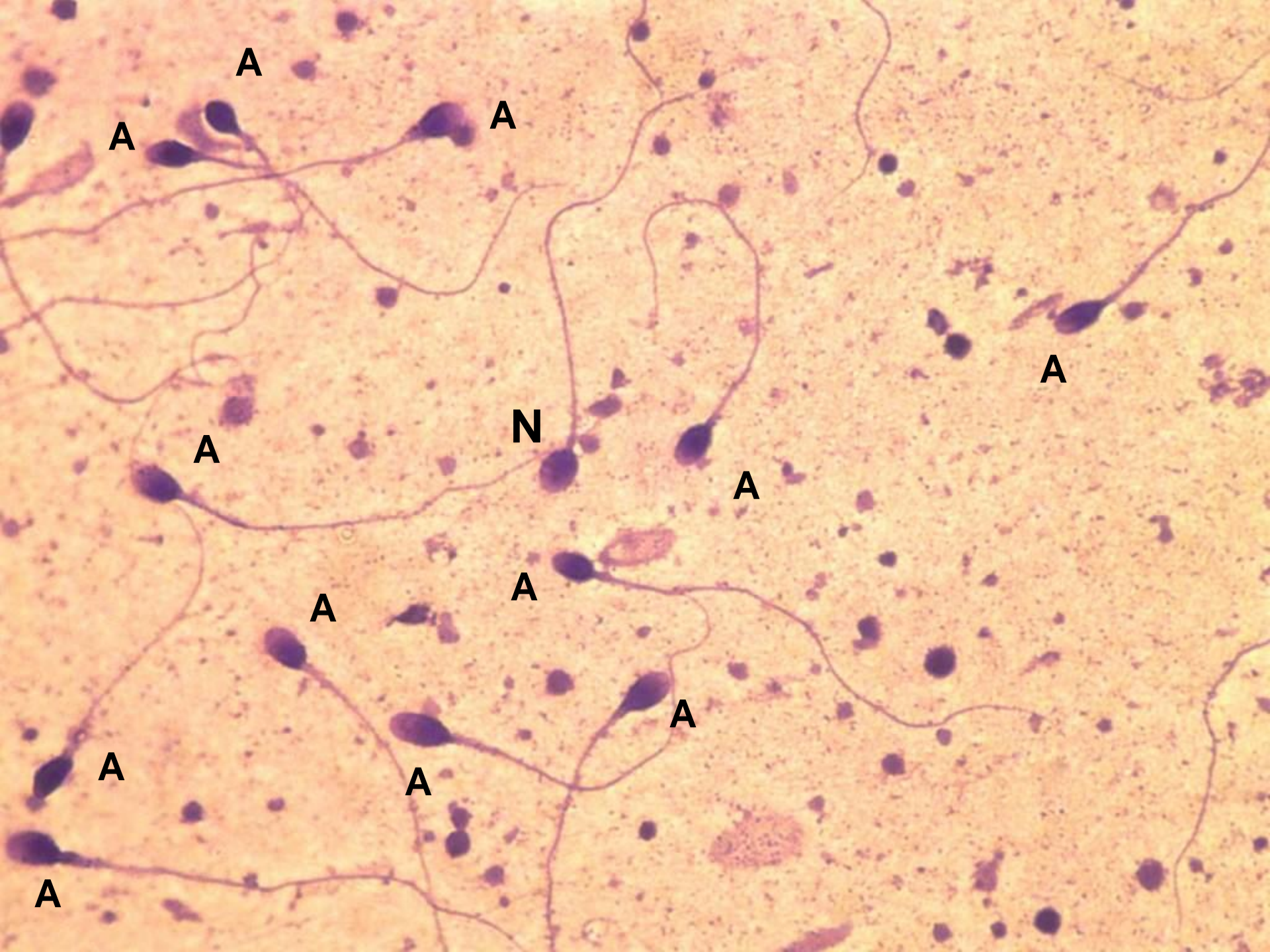


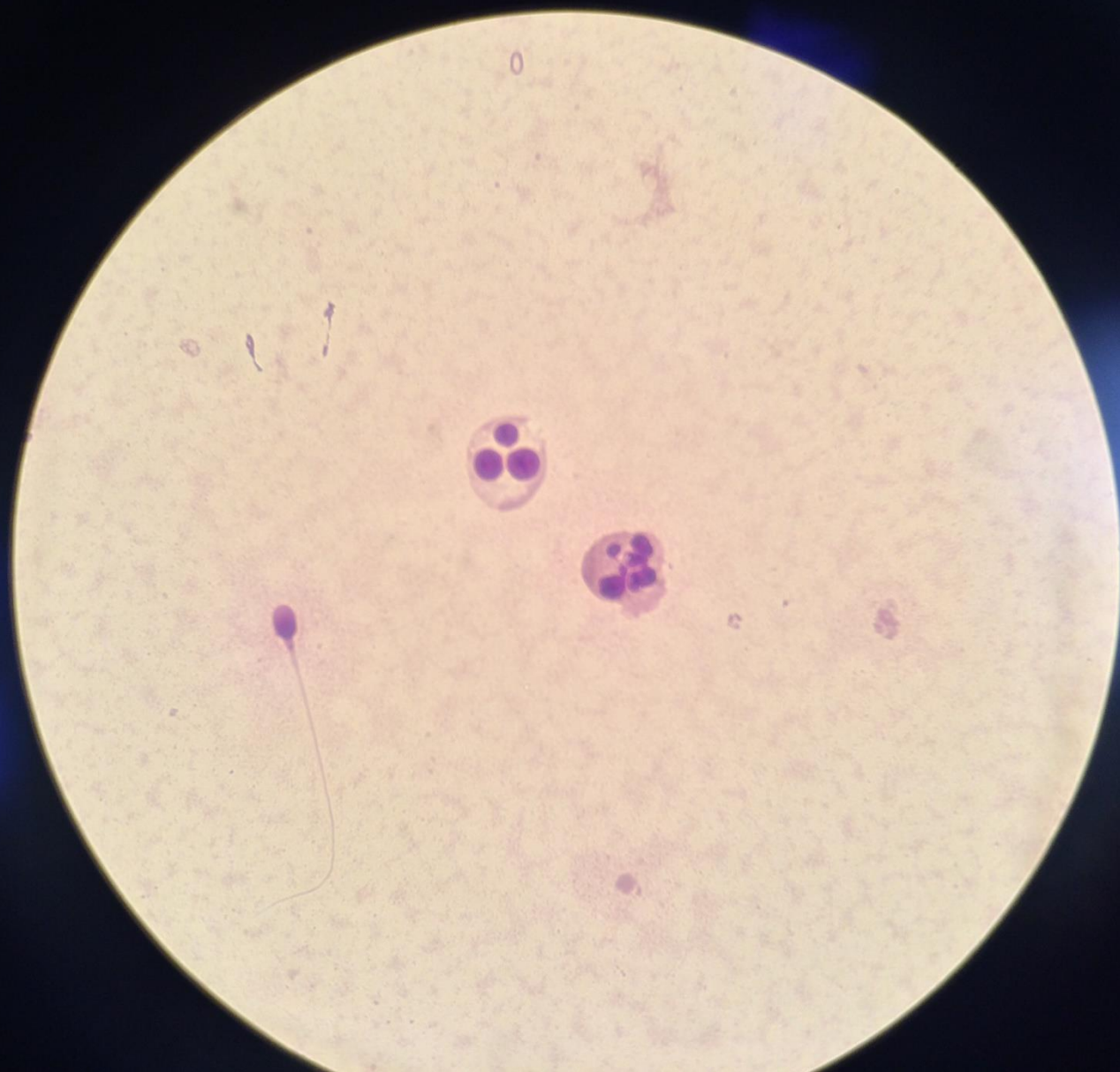
WHO Manual for the Evaluation of Human Semen and Cervical Mucus, 1999





Look how uniform sperm are





Basic Semen Analysis Report

Referring Physician: Sergio Oehninger, MD

Test Date: 09/14/2007

Patient: [REDACTED]

Spouse: [REDACTED]

Patient SSN: [REDACTED]

Spouse SSN: [REDACTED]

Patient DOB: [REDACTED]

Spouse DOB: [REDACTED]

Medical Record Number: [REDACTED]

Medical Record Number: [REDACTED]

Specimen Number: 1

Date of Last Emission: 09/12/2007

Time Collected: [REDACTED]

Location of Collection: Home

Time Analyzed: 08:32

Collection Method: Masturbation

Collection Complete (Y/N): Yes

PARAMETER	RESULT	REFERENCE RANGE
SEMEN DATA		
Volume	1.7	2.0 - 5.0 ml
Odor	Spermine	Spermine
Color	Opalescent	Whitish, Gray, Opalescent
Viscosity	Slight	Normal
Liquefaction	Complete	Complete in 30 minutes
pH	8.3	Basic ≥ 7.6
Agglutination	None	None
Round Cells	0.1 million/mL	≤ 1 million/mL semen
Neutrophils	≤ 1 million/mL semen	≤ 1 million/mL semen

Comments: No sperm observed during the initial evaluation with 2 counting chambers. Detailed evaluation below.

Semen Analysis Results: The semen was concentrated to 35 μ L, 30 μ L of which was used for wet mount evaluation with no sperm observed. The remaining 5 μ L was used to prepare a stained smear with no sperm observed.

The supernate was concentrated to 20 μ L, all of which was used for wet mount evaluation with no sperm observed.

SUMMARY

NO SPERM WAS OBSERVED.

Basic Semen Analysis Report

Sergio Oehninger, M.D.

Referring Physician: Sergio Oehninger, MD

Test Date: 03/17/2004

Patient:

Spouse:

Patient SSN:

Spouse SSN:

Patient DOB:

Spouse DOB:

Specimen Number: 1

Date of Last Emission: 03/13/2004

Time Collected:

Location of Collection: Collection Room

Time Analyzed:

Collection Method: Masturbation

Collection Complete (Y/N): Yes

PARAMETER	RESULT	REFERENCE RANGE
SEMEN DATA		
Volume	0.6	2-5 mL
Odor	Spermine	Spermine
Color	Opalescent	Whitish, Gray, Opalescent
Viscosity	Normal	Normal
Liquefaction	Complete	Complete in 30 minutes
pH	6.8	Basic ≥ 7.6
Agglutination	None	None
Round Cells	0.5 million/mL	≤ 1 million/mL semen
Neutrophils	≤ 1 million/mL semen	≤ 1 million/mL semen

Comments: No sperm observed during the initial evaluation with two makler chambers.

Semen Analysis Results: The semen was concentrated to 30 μ L, with 25 μ L used for wet mount evaluation with no sperm observed. The remaining 5 μ L was used to prepare a stained smear with no sperm observed.

The supernate was concentrated to 20 μ L, all of which was used for wet mount evaluation with no sperm observed.

SUMMARY

NO SPERM OBSERVED.

SEMEN MICROBIOLOGY RESULTS

Specimen Type: Semen

Ureaplasma urealyticum: Negative

Colony Growth: Moderate growth on blood agar.

Concluding Remarks

- Semen analysis continues to be the primary test for evaluating men who have difficulty fathering children
- However, the test in the format that currently is performed it should not be used for the purpose of predicting the fertility of a man
- It can be used to determine the degree of difficulty one may have fathering a child

Concluding Remarks

- We must switch our emphasis from looking the parameters such as mean, median, or traditional measures expressing confidence in correctness of the value for a given sample or information for a male based on 2-5 samples collected over 1-3 weeks that have not been proven reliable for more than 80 years to attributes which may prove more useful

» Amman, personal communication

Concluding Remarks

- Attributes such as the number of sperm with motilities, morphologies , DNA content and other characteristics necessary for successful fertilization and term pregnancy in a semen sample produced within a specific time period (sperm output/hour) may prove more beneficial

Concluding Remarks

- Timing of abstinence must strictly be enforced (testicular output overlap of data)

END