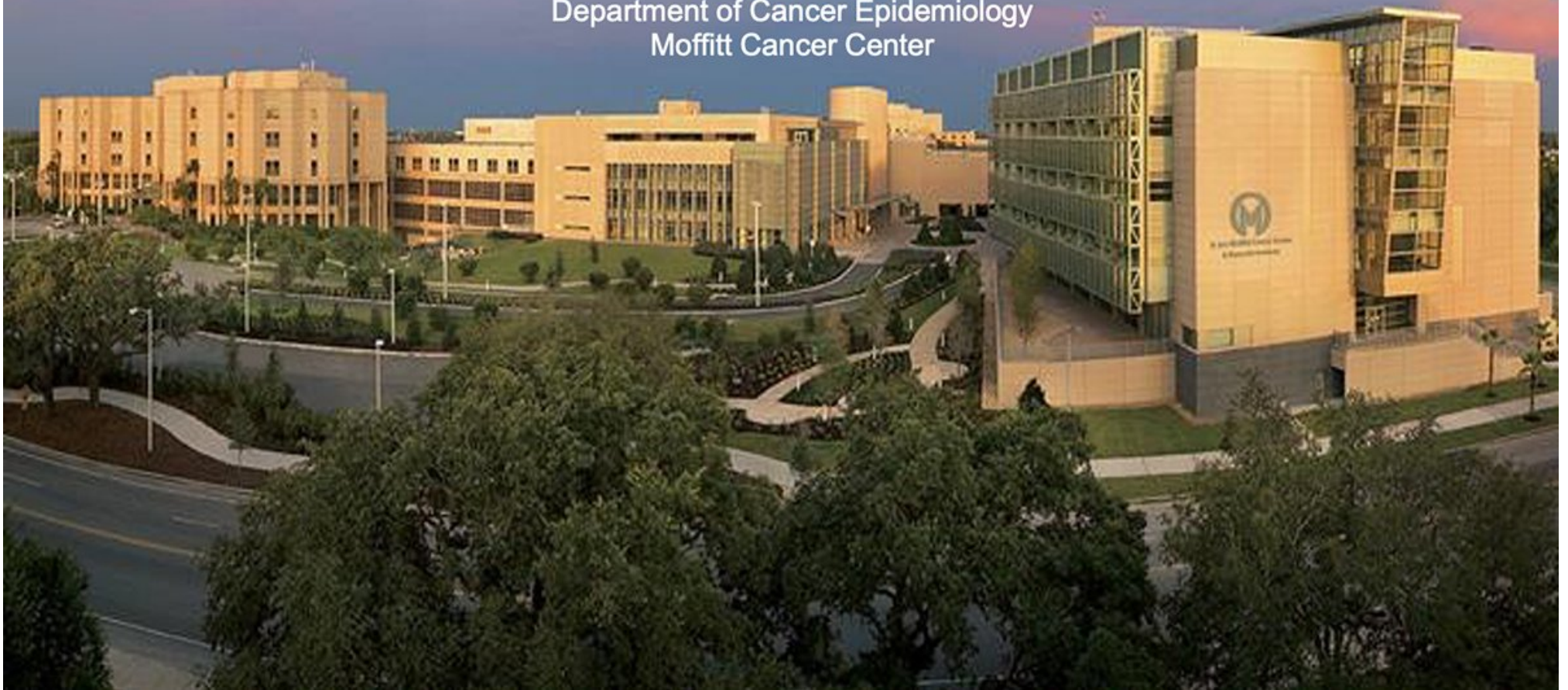
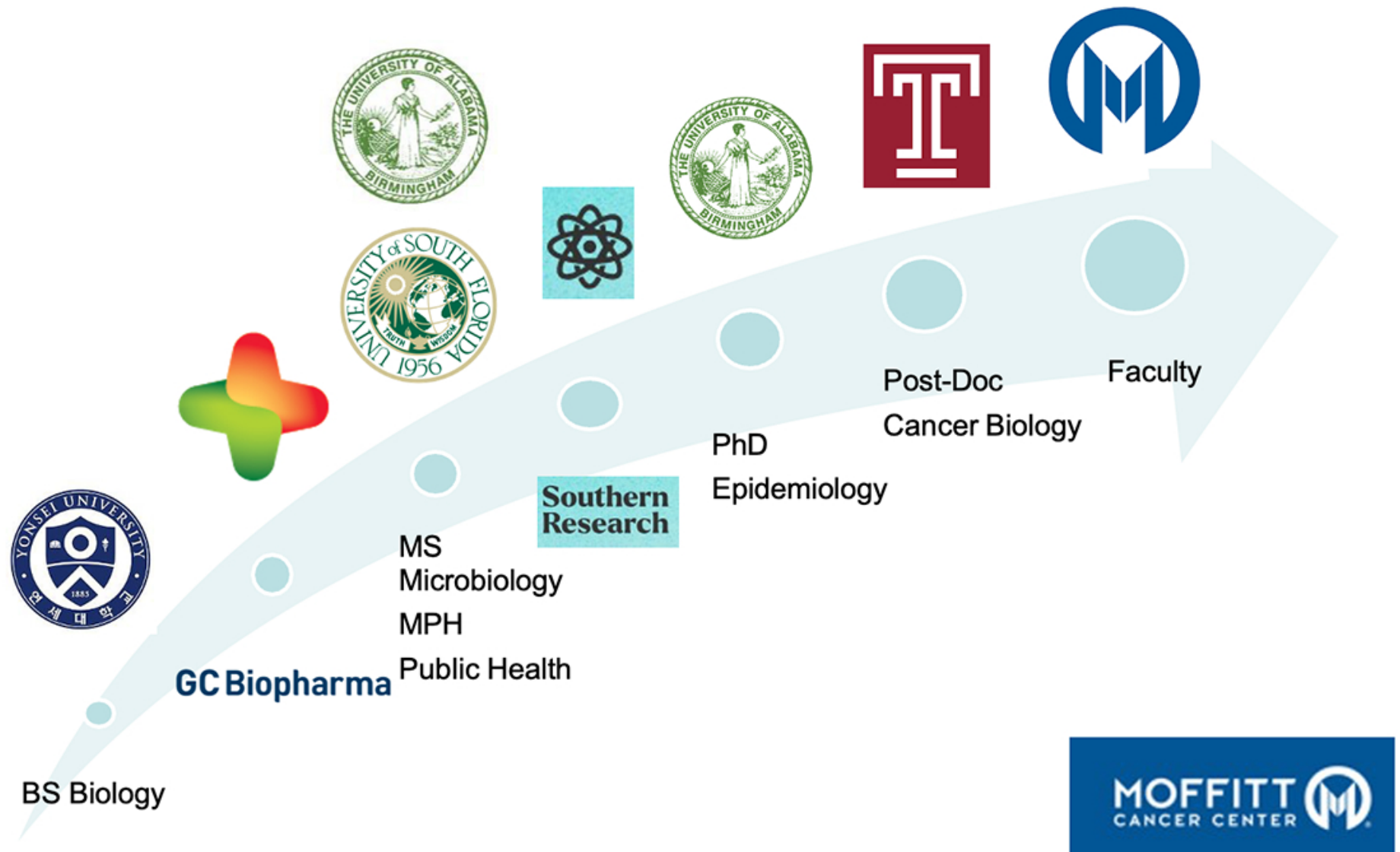


AIC (Anti-Orbital Ionic Calcium) Effect on Bone Mineral Density

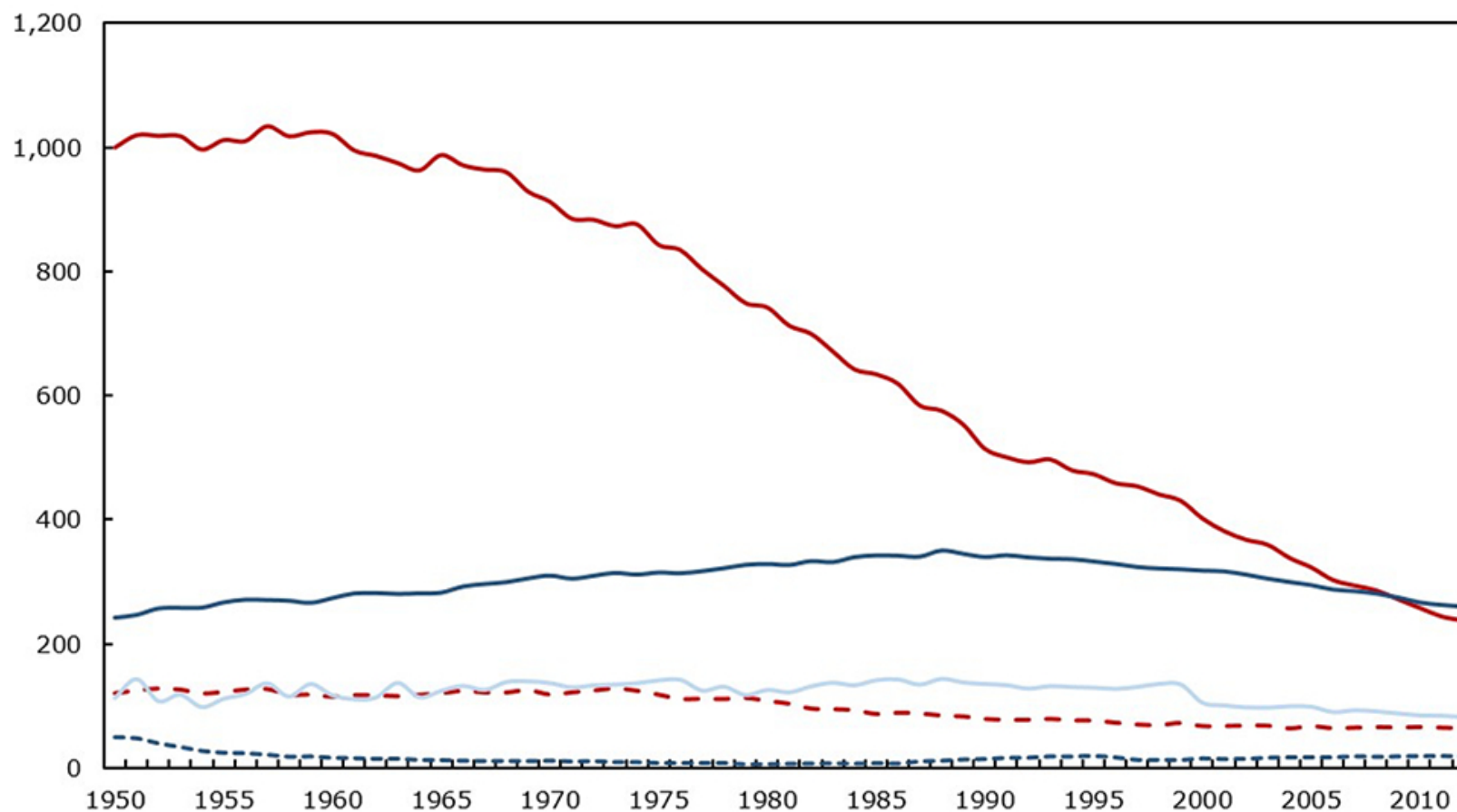
March 21, 2025

Jong Y. Park, PhD, MPH, MS.
Senior Member
Department of Cancer Epidemiology
Moffitt Cancer Center





Changes in the Death Rates by Causes



Year: Death rates (all causes)
1950: 1,831.5
2012: 843.4

Cancer Incidence and mortality rates

US Cancer new Cases (2024)

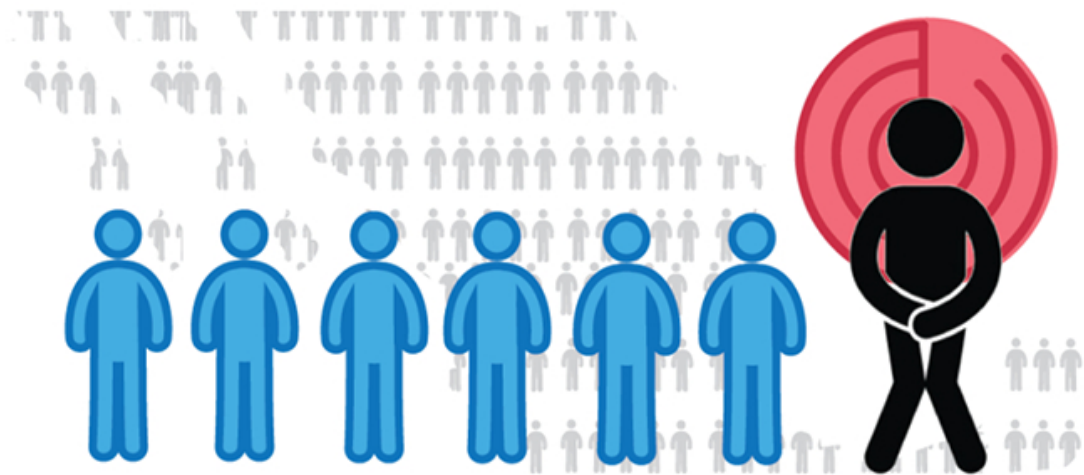
Male		
Prostate	299,010	29%
Lung & bronchus	116,310	11%
Colon & rectum	81,540	8%
Urinary bladder	63,070	6%
Melanoma of the skin	59,170	6%
Kidney & renal pelvis	52,380	5%
Non-Hodgkin lymphoma	44,590	4%
Oral cavity & pharynx	41,510	4%
Leukemia	36,450	4%
Pancreas	34,530	3%
All sites	1,029,080	



US Cancer Deaths (2024)

Male		
Lung & bronchus	65,790	20%
Prostate	35,250	11%
Colon & rectum	28,700	9%
Pancreas	27,270	8%
Liver & intrahepatic bile duct	19,120	6%
Leukemia	13,640	4%
Esophagus	12,880	4%
Urinary bladder	12,290	4%
Non-Hodgkin lymphoma	11,780	4%
Brain & other nervous system	10,690	3%
All sites	322,800	

Prostate Cancer

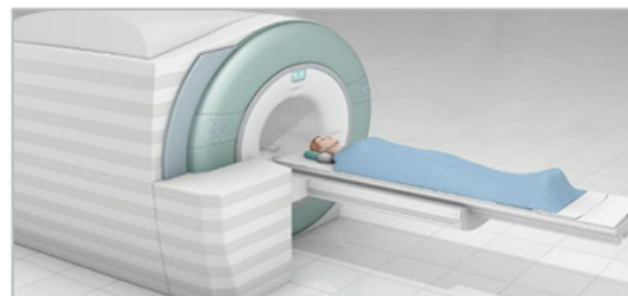


Detection & Diagnosis

PSA

DRE

MRI



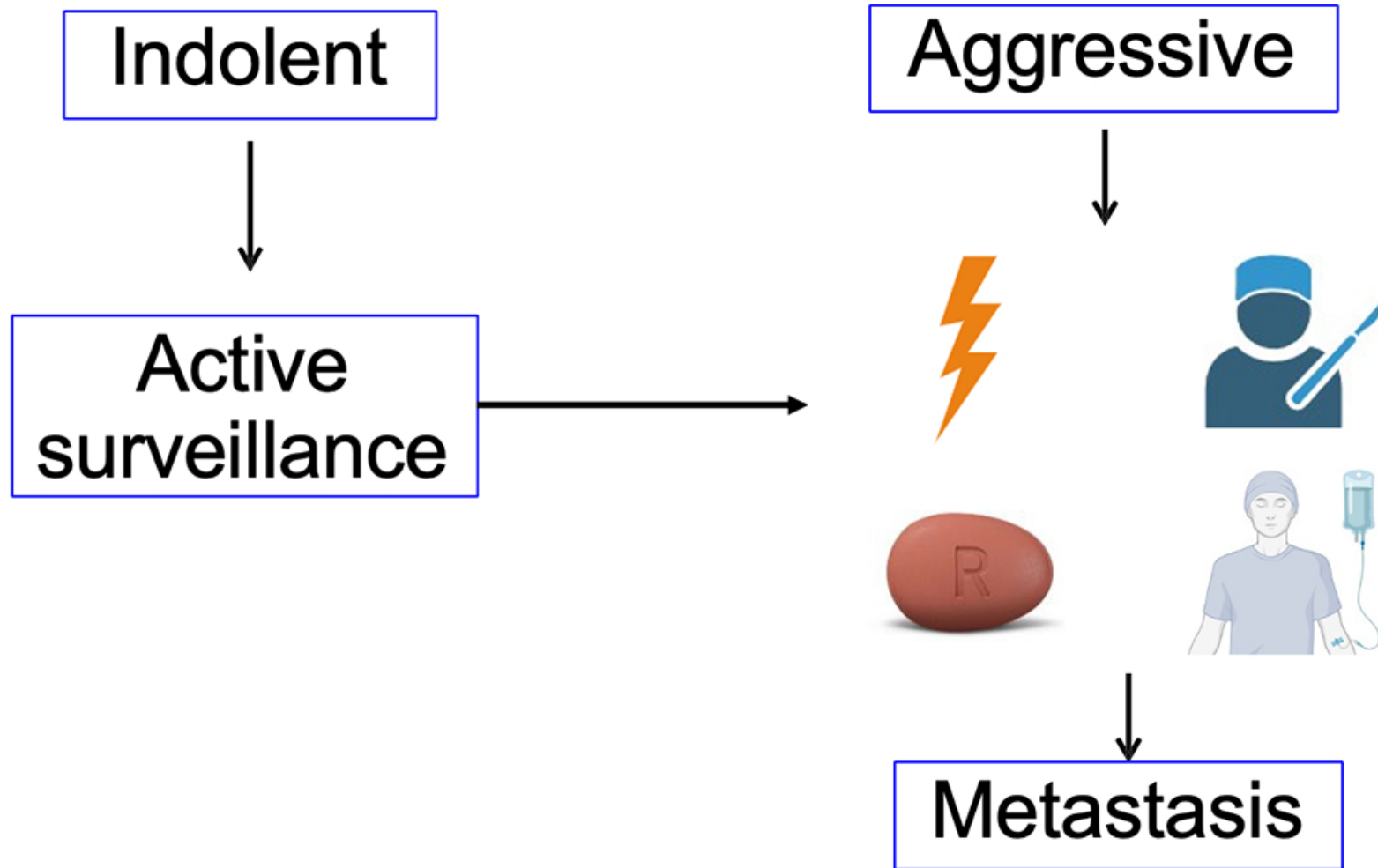
Biopsy

Prostate Cancer

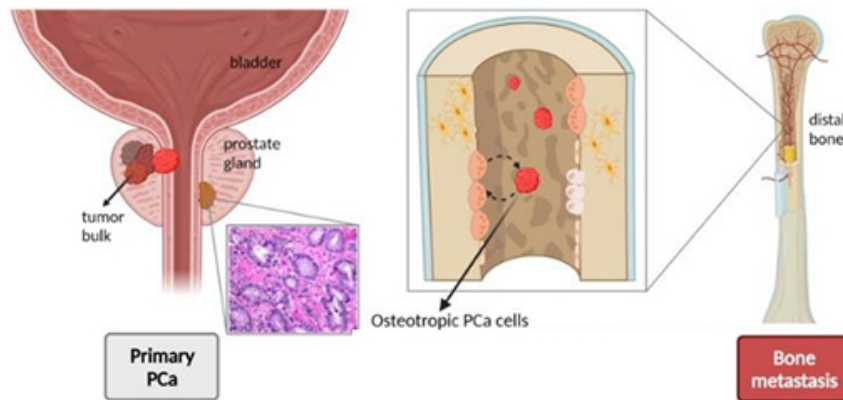
Trends in Five-year Relative Cancer Survival Rates (%)

	1975-77	1995-97	2012-18
All sites	49	63	68
Breast (female)	75	87	91
Colon & rectum	50	61	65
Leukemia	34	48	66
Lung & bronchus	12	15	23
Melanoma of the skin	82	91	94
Non-Hodgkin lymphoma	47	56	74
Ovary	36	43	50
Pancreas	3	4	12
Prostate	68	97	97
Urinary bladder	72	80	77
Uterine cervix	69	73	67
Uterine corpus	87	84	81

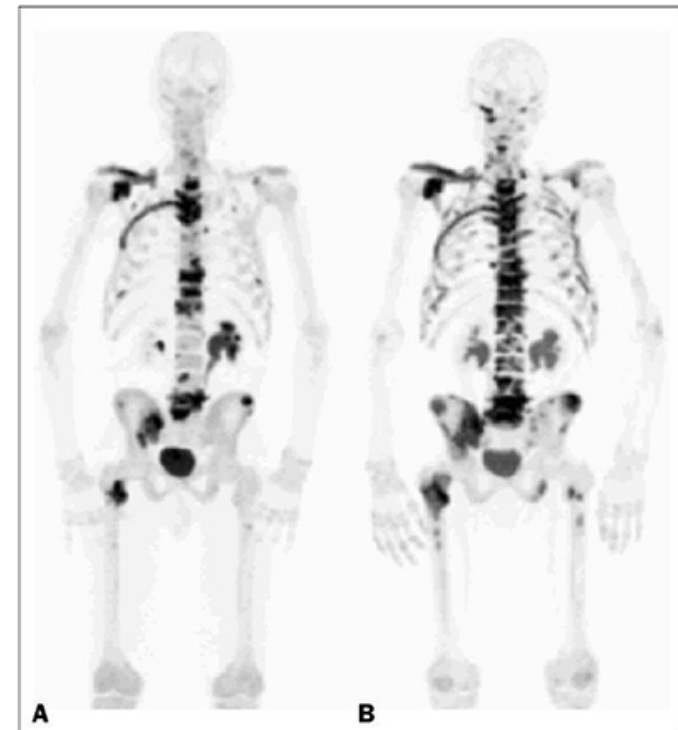
Prostate Cancer treatment



Prostate Cancer metastasis

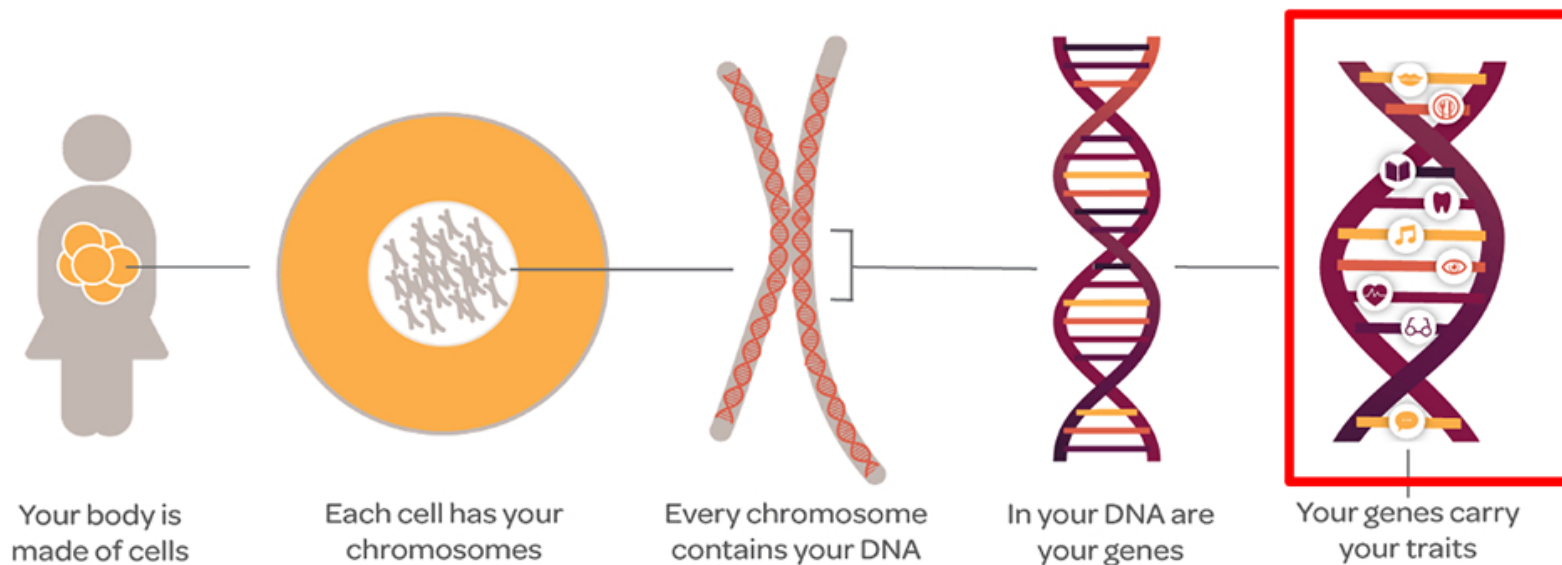


90% metastasis on bone

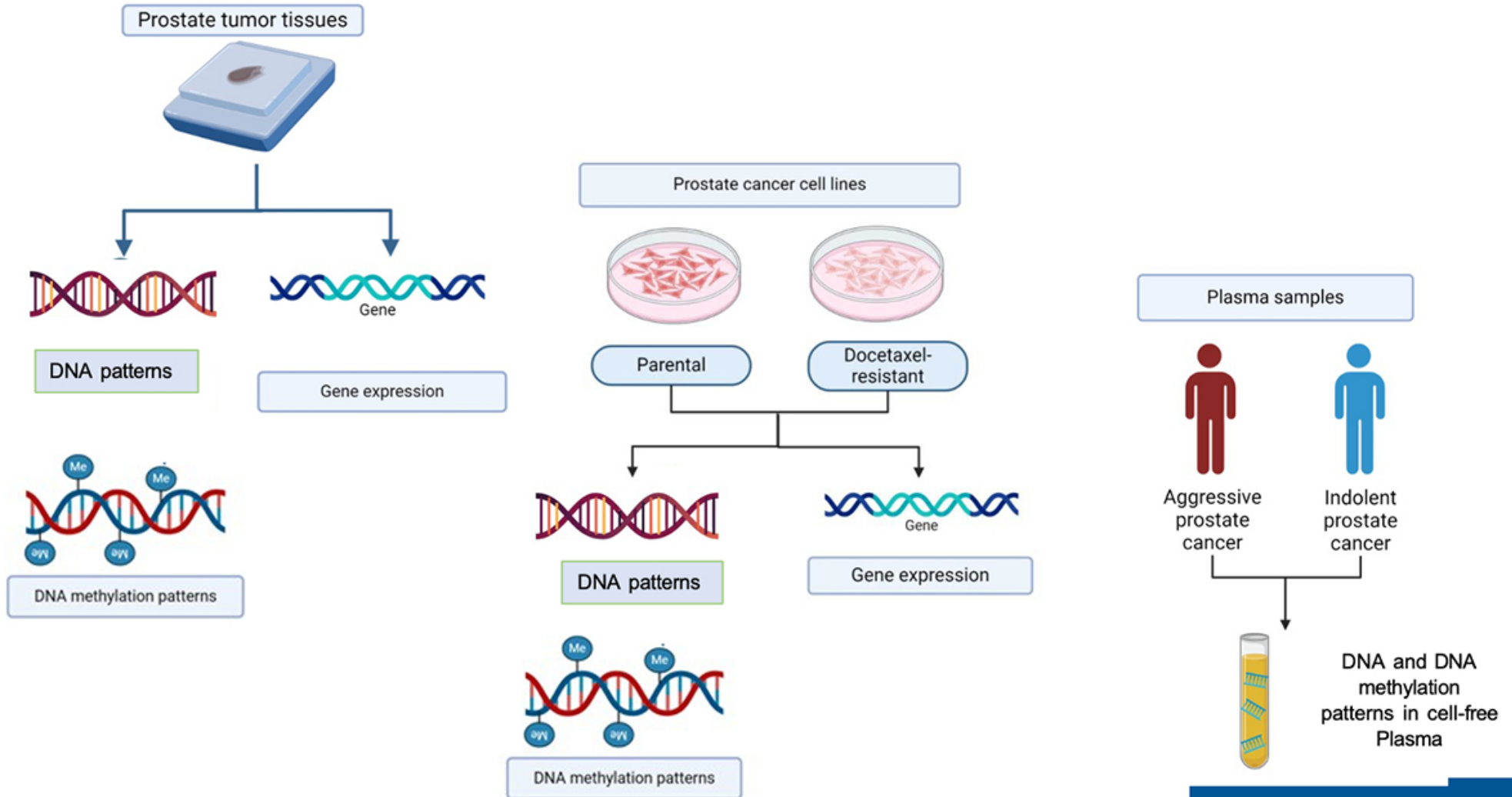


Research

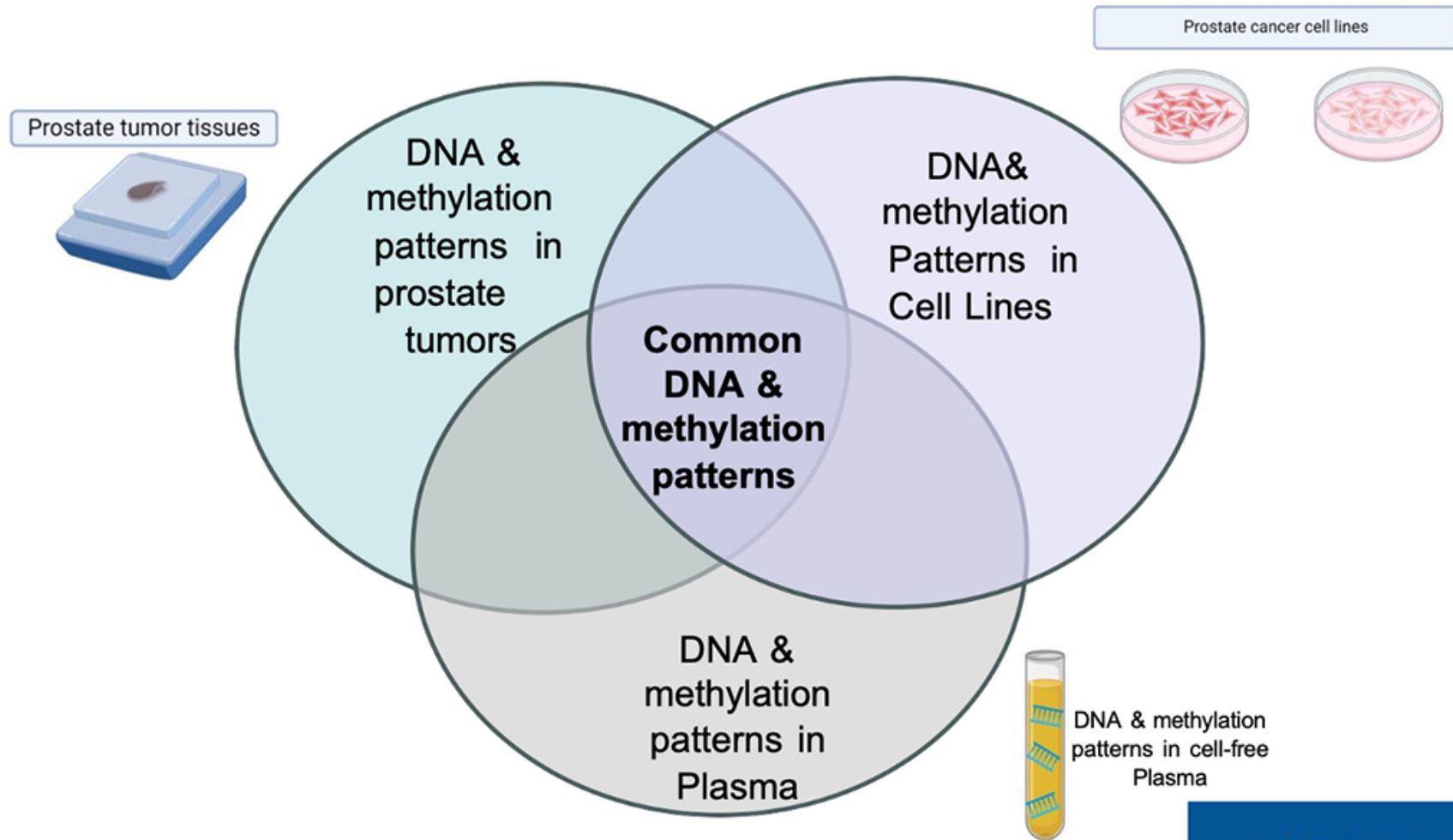
Goal: To identify biomarkers for lethal prostate cancer.



Research



Results



Collaboration between Moffitt, CBHI, and ACRI



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DSA between Moffitt and CBHI

Contract Name		Linked Contracts	Initiate New Workflow	Expires in 1088 days
Data Use/Share Agreement - CALCIUM AND BONE HEALTH INSTITUTE - CTb9e19				

Organization	Moffitt Cancer Center	Primary Other Party	CALCIUM AND BONE HEALTH INSTITUTE
Contract Categories	Research	Contract Locations	E Institute (Parent) - H. Lee Moffitt Cancer Center and Research Institute, Inc.
Contract Type	Data Use/Share Agreement		S All Moffitt Cancer Center Campuses
Contract Description	Bidirectional DSA for de-identified questionnaire data and bone density data from 117 participants in bone density research program. PI: Jong Park		D Epidemiology & Genetics

[Summary](#) [Custom Fields](#) [Documents](#) [Attachments](#) [Critical Dates](#) [Assets](#) [Workflow Activity](#) [Contract History](#)

Key Terms

Effective Date	Expiration Date	Auto Renewal	Renewal Term Months
Mar 7th 2025	Mar 6th 2028	No	

Evergreen	Renewal Times	Renewal Notice Days
No		

Original Term

End Date: 3 years after the Start Date

Total Cohort

Symptoms	Frequency	Percent
Normal	1227	41.5
Osteopenia	1004	34.0
Osteoporosis	725	24.5
Total	2956	100

Symptoms	Female	%	Male	%	Total	%
Normal	718	36.9	509	50.3	1227	41.5
Osteopenia	633	32.6	371	36.7	1004	34.0
Osteoporosis	593	30.5	132	13.0	725	24.5
Total	1944		1012		2956	

Total Cohort

Age group	Female		Male		Total	
<10	8	0.4%	6	0.6%	14	0.5%
10	10	0.5%	18	1.8%	28	0.9%
20	111	5.7%	44	4.3%	155	5.2%
30	134	6.9%	65	6.4%	199	6.7%
40	391	20.1%	146	14.4%	537	18.2%
50	590	30.3%	305	30.1%	895	30.3%
60	420	21.6%	233	23.0%	653	22.1%
70	222	11.4%	141	13.9%	363	12.3%
80	58	3.0%	54	5.3%	112	3.8%
Total	1944	100%	1012	100%	2956	100%

Bone Mineral Density by T-score

T-score is used in Dual-Energy X-ray Absorptiometry (DEXA) scans to assess bone mineral density (BMD) and diagnose osteoporosis.

T-Score Interpretation:

T-Score	Bone Health Status
≥ -1.0	Normal
-1.0 to -2.5	Osteopenia
≤ -2.5	Osteoporosis

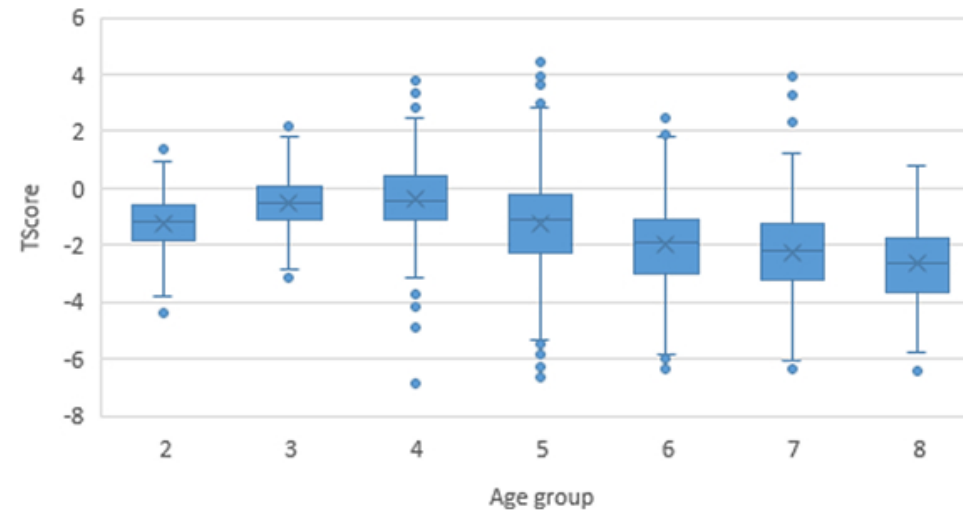
T-score by Age group

Age group	N	Mean	Std. Deviation	Minimum	Maximum
20	154	-1.23	1.07	-4.37	1.53
30	199	-0.49	0.94	-3.12	2.48
40	537	-0.37	1.33	-6.85	4.03
50	895	-1.23	1.58	-6.61	4.43
60	653	-1.97	1.48	-6.36	2.44
70	363	-2.25	1.55	-6.32	3.91
80	112	-2.66	1.49	-6.46	0.76
Total	2913	-1.37	1.61	-6.85	4.43

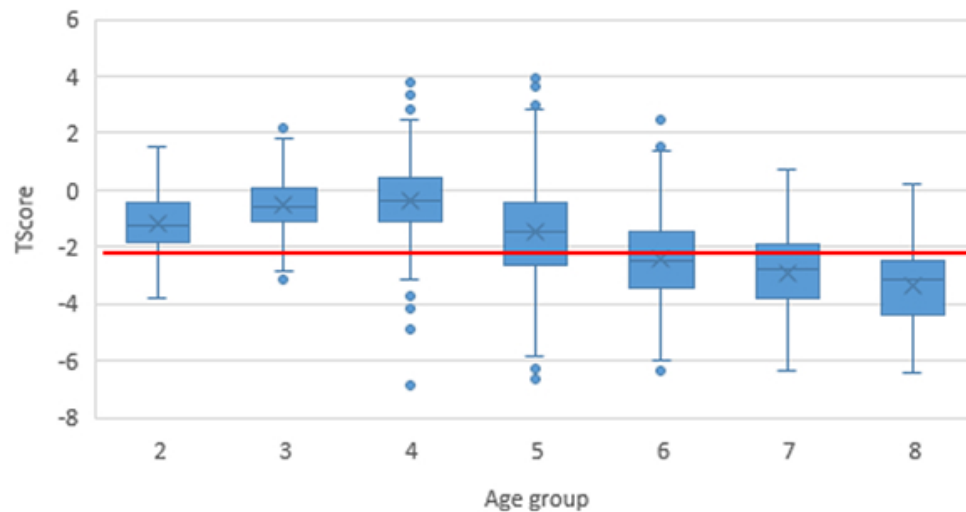
P<0.0001

T-score by Age group

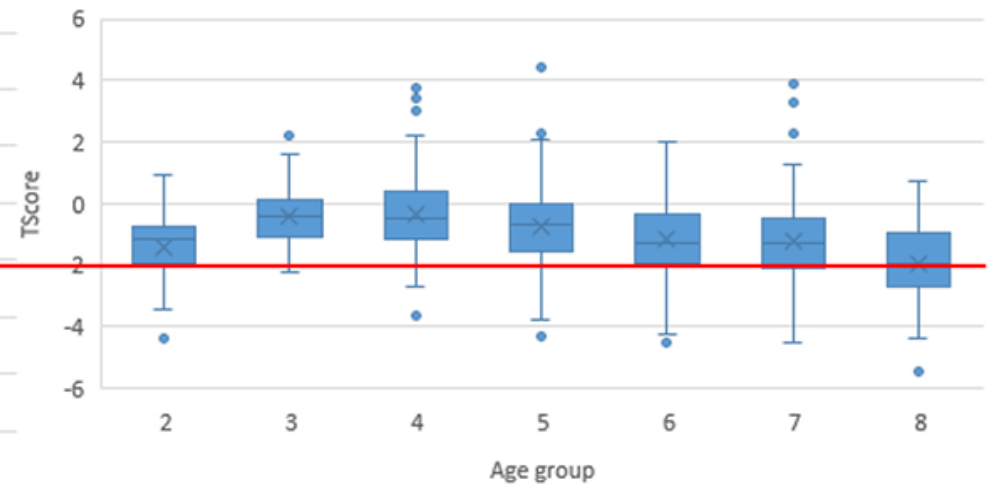
Simple Boxplot of TScore by Age group



Simple Boxplot of TScore by Age group (Female)



Simple Boxplot of TScore by Age group (Male)



Bone Mineral Density

Z-Score in Bone Mineral Density Studies (DEXA Scan)

A **Z-score** measures how a person's **bone mineral density (BMD)** compares to the average BMD of **people of the same age, sex, and ethnicity**.

Interpretation of Z-Scores in Bone Health

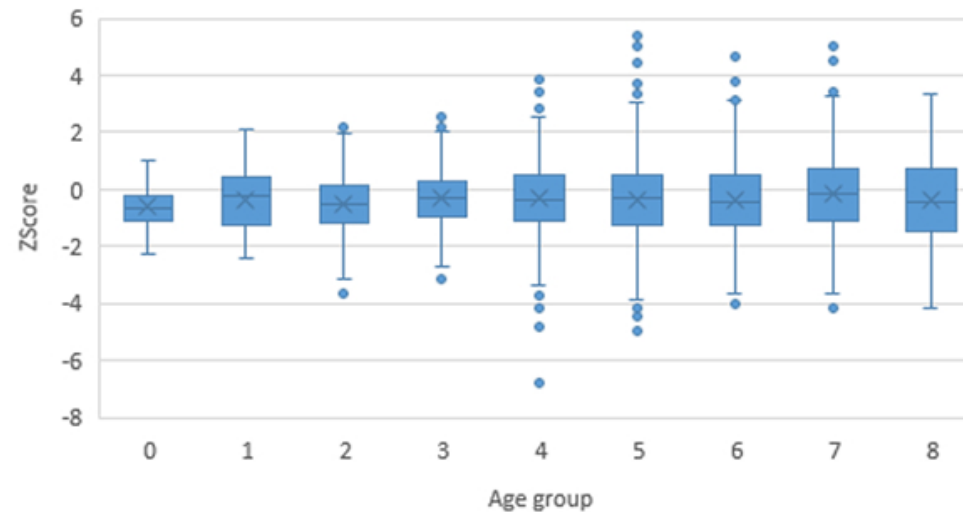
Z-Score	Bone Health Status
> -1.0	Normal bone mineral density for age
-1.0 to -2.0	Below-average bone mineral density
< -2.0	Significantly low bone mineral density

Z-score by age group

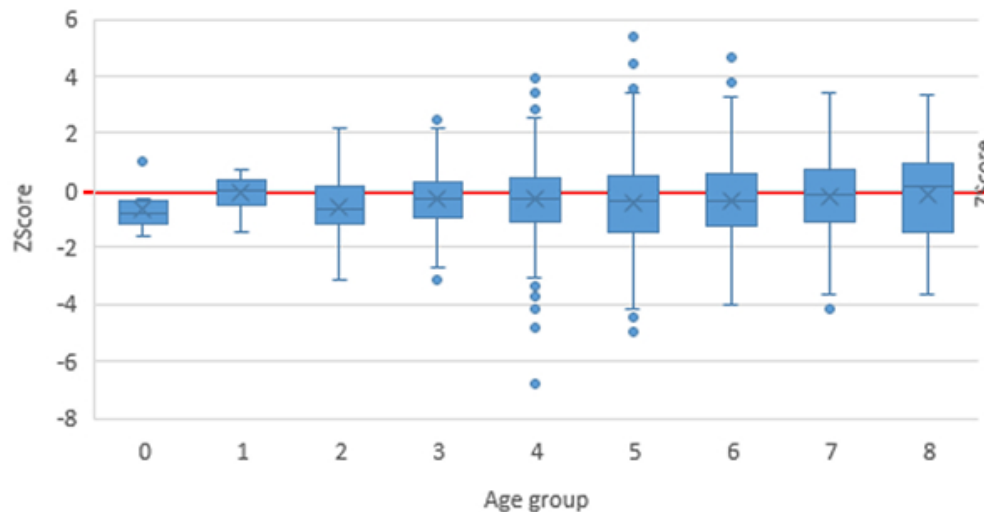
Age	N	Mean	Std. Deviation	Minimum	Maximum	
0	14	-0.63	0.82	-2.3	1	P=0.218
1	28	-0.38	1.12	-2.4	2.1	
2	155	-0.53	1.04	-3.7	2.1	
3	199	-0.29	0.94	-3.1	2.6	
4	537	-0.30	1.33	-6.8	4.1	
5	895	-0.36	1.45	-4.9	5.4	
6	653	-0.38	1.35	-4	4.6	
7	363	-0.17	1.34	-4.1	5.1	
8	102	-0.38	1.43	-4.1	3.3	
Total	2946	-0.34	1.34	-6.8	5.4	

Z-score by Age group

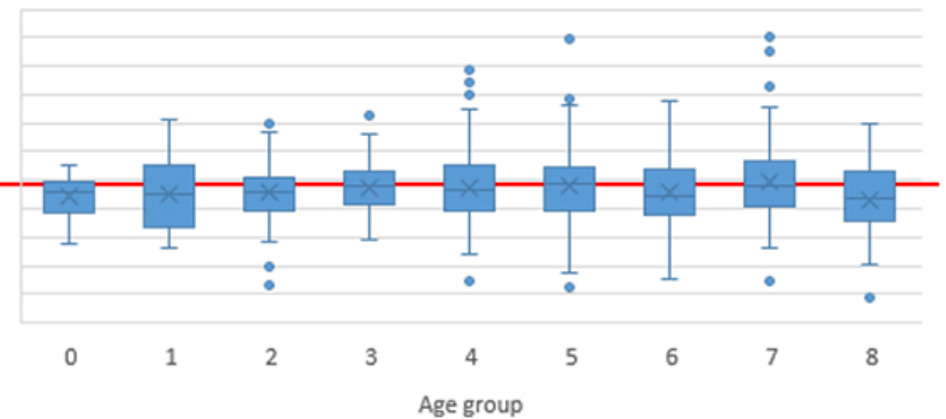
Simple Boxplot of ZScore by Age group



Simple Boxplot of ZScore by Age group (Female)



Simple Boxplot of ZScore by Age group (Male)



SOS

SOS in bone mineral density study

ChatGPT said:

Speed of Sound (SOS) in Bone Mineral Density Studies

Speed of Sound (SOS) is a parameter measured in **quantitative ultrasound (QUS)** bone mineral density tests. It assesses **bone quality, strength, and density** by measuring the speed at which an ultrasound wave travels through bone.

Normal SOS Values (Average Ranges)

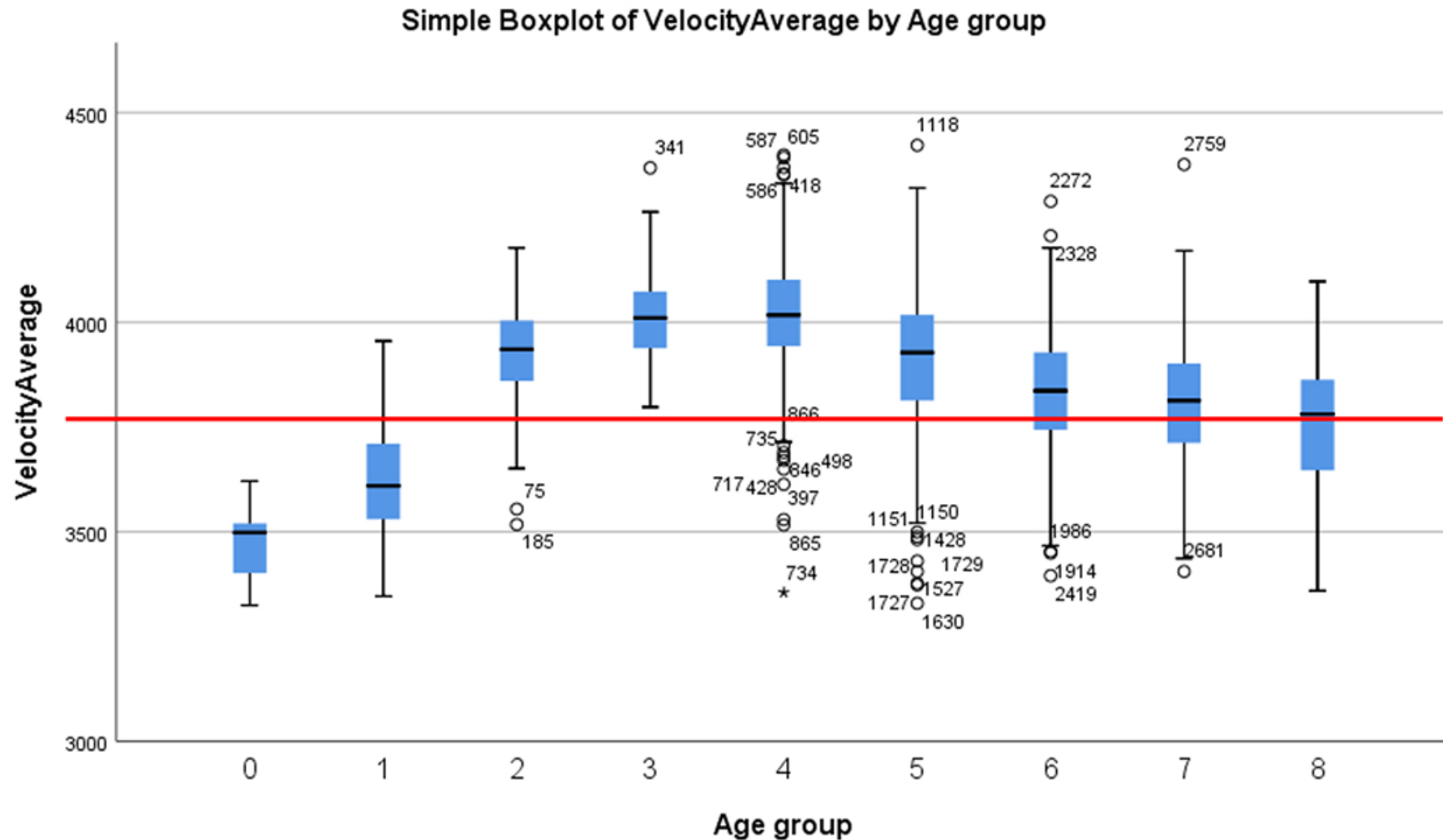
SOS values vary based on the **measurement site (heel, tibia, radius, phalanges)**, age, sex, and ethnicity. Below are general reference ranges:

Normal Bone Mineral Density:	SOS $\geq$ 3,950 m/s
Osteopenia:	SOS 3,800 – 3,950 m/s
Osteoporosis:	SOS $\leq$ 3,800 m/s

SOS by age group

Age group	N	Mean	Std. Deviation	Minimum	Maximum	
0	14	3473.57	90.12	3324	3621	P=0.0001
1	28	3636.00	155.57	3346	3955	
2	155	3931.52	117.96	3517	4177	
3	199	4011.54	99.54	3797	4368	
4	537	4017.51	132.69	3355	4399	
5	895	3915.84	158.42	3329	4422	
6	653	3834.08	142.64	3395	4288	
7	363	3807.44	146.29	3405	4376	
8	112	3765.84	148.32	3359	4097	
Total	2956	3899.77	167.52	3324	4422	

SOS by age group



AIC trial cohort (n=135)

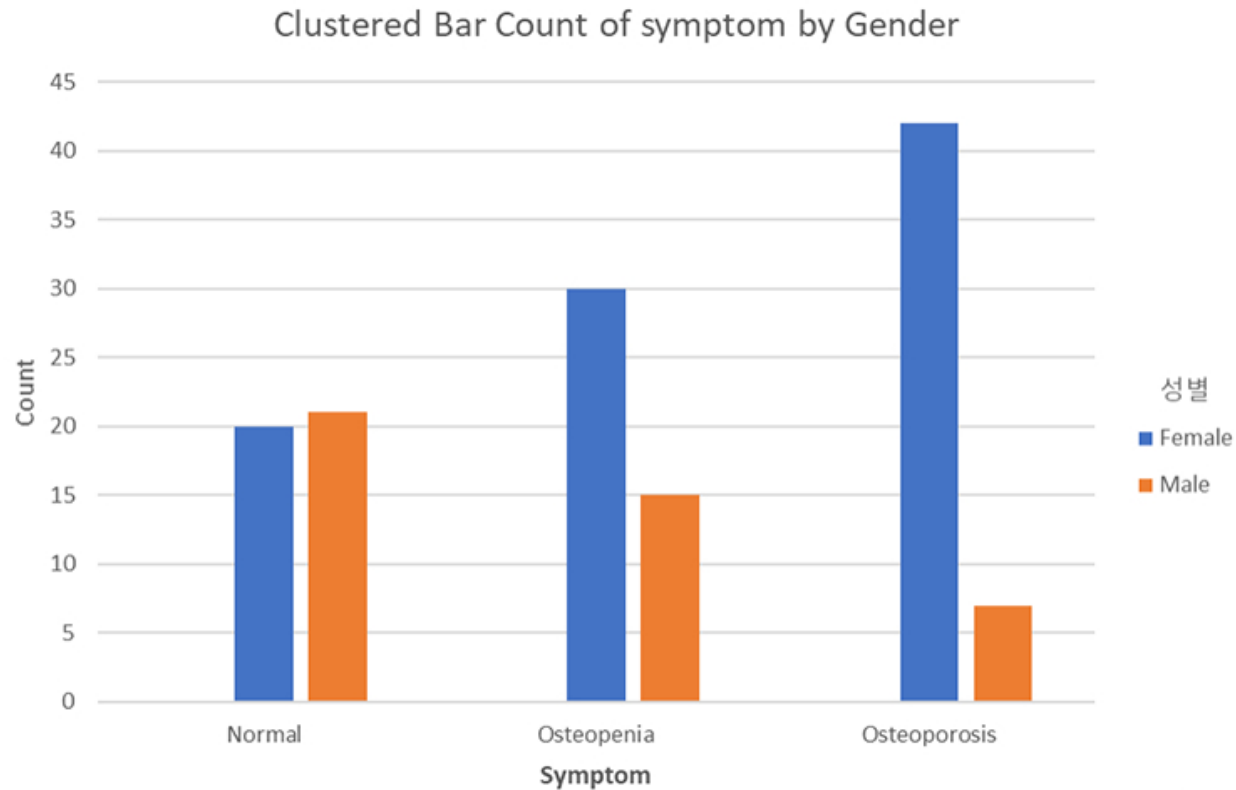
Symptoms	Frequency	
Normal	41	30.4%
Osteopenia	45	33.3%
Osteoporosis	49	36.3%
Total	135	100%

Gender	Frequency	
Female	92	68.1%
Male	43	31.9%
Total	135	100%

Age group	Frequency	Percent
20	4	3.0%
30	4	3.0%
40	17	12.6%
50	51	37.8%
60	40	29.6%
70	18	13.3%
80	1	0.7%
Total	135	100%

AIC trial cohort (n=135)

Symptom	Gender		Total
	Female	Male	
Normal	20 (21.7%)	21 (48.8%)	41 (30.4%)
Osteopenia	30 (32.6%)	15 (34.9%)	45 (33.3%)
Osteoporosis	42 (45.7%)	07 (16.3%)	49 (36.3%)
Total	92 (68.1%)	43 (31.9%)	135



Effect of AIC

T-score

		N	Mean	Std. Deviation	P
Normal	Before	41	1.21	0.09	0.055
	After	41	1.25	0.15	
Osteopenia	Before	44	1.00	0.05	0.0001
	After	44	1.11	0.15	
Osteoporosis	Before	50	0.80	0.08	0.0001
	After	50	0.90	0.14	

Effect of AIC

BD change

Symptoms	N	Mean	Std. Deviation	Minimum	Maximum
Normal	64	13.7%	14.2%	-14.9%	56.6%
Osteopenia	42	8.3%	14.1%	-28.3%	45.5%
Osteoporosis	29	1.4%	13.7%	-25.2%	30.6%
Total	135	9.4%	14.8%	-28.3%	56.6%

P=0.001

		N	Mean	SD	Minimum	Maximum
Female	Normal	34	10.6%	11.2%	-14.9%	37.9%
	Osteopenia	33	8.9%	15.0%	-28.3%	45.5%
	Osteoporosis	25	2.6%	14.1%	-25.2%	30.6%
	Total	92	7.8%	13.7%	-28.3%	45.5%
Male	Normal	30	17.3%	16.4%	-6.0%	56.6%
	Osteopenia	9	6.1%	10.7%	-10.8%	20.9%
	Osteoporosis	4	-6.3%	7.2%	-15.6%	0.5%
	Total	43	12.7%	16.4%	-15.6%	56.6%

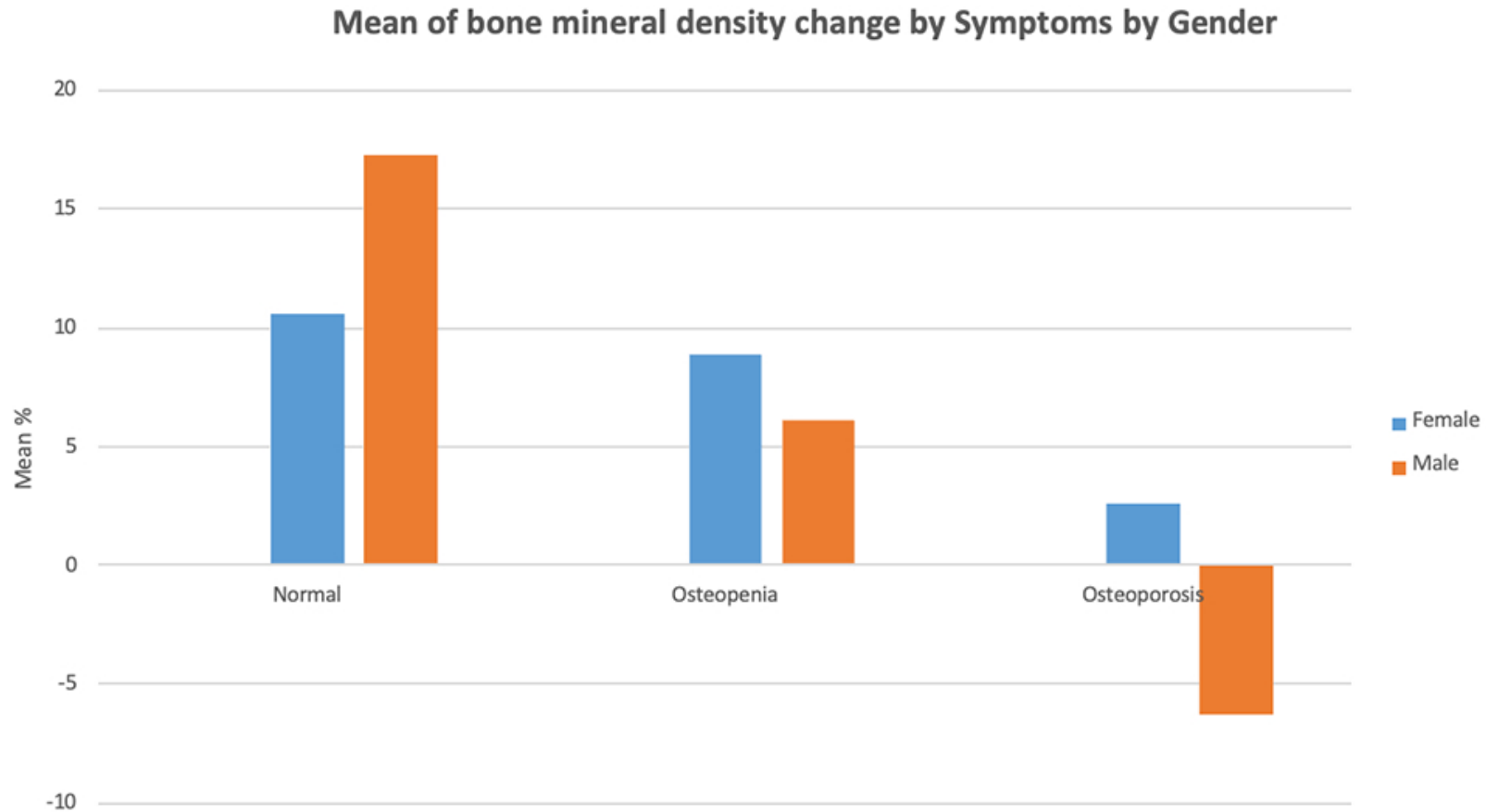
P=0.07

P=0.008



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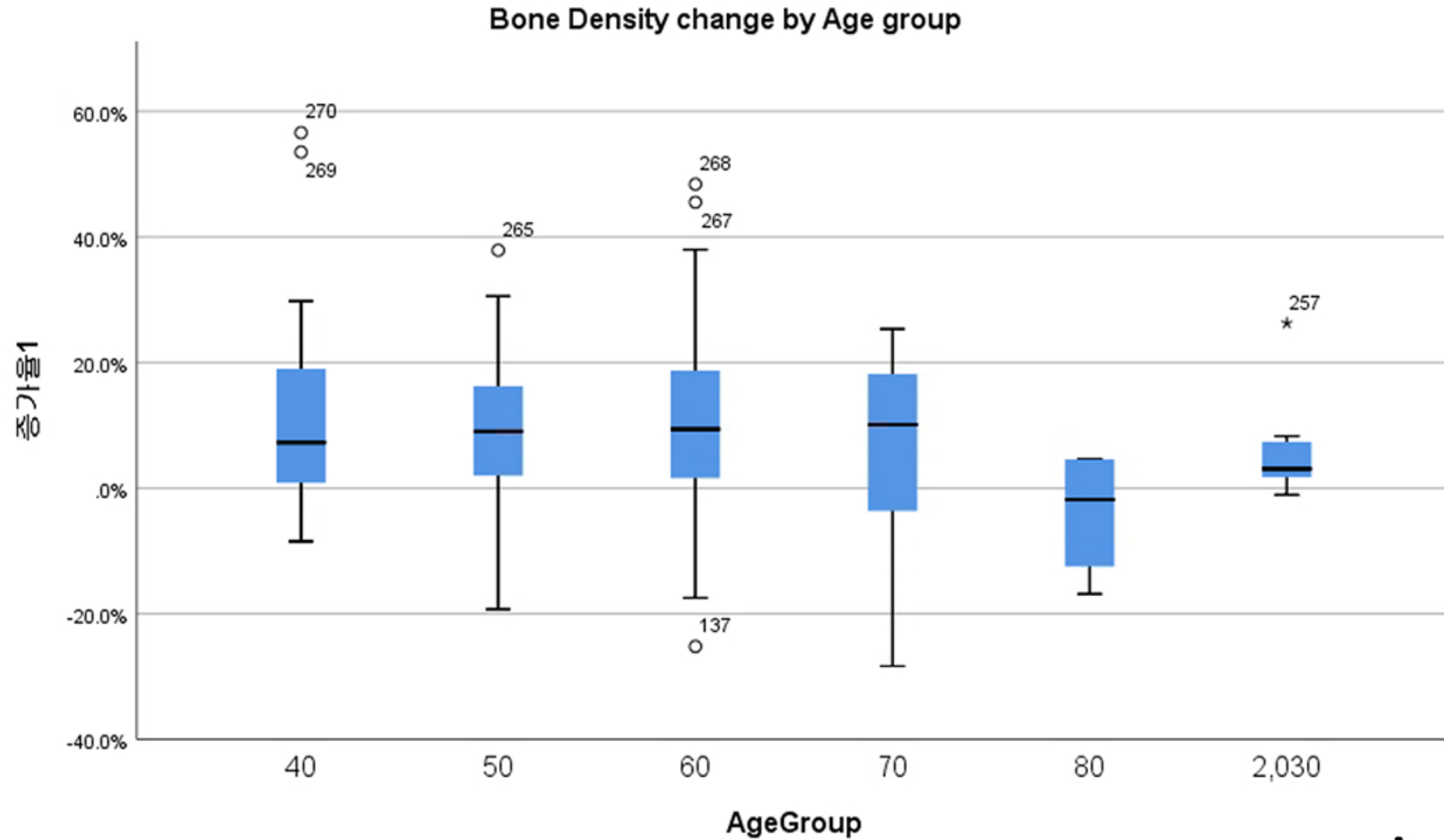
Effect of AIC by symptoms



Effect of AIC

Bone mineral density change					
Age group	N	Mean	Std. Deviation	Minimum	Maximum
20-30	8	6.2%	8.6%	-1.1%	26.3%
40	14	14.2%	20.0%	-8.5%	56.6%
50	48	9.3%	11.4%	-19.3%	37.9%
60	44	11.0%	16.6%	-25.2%	48.4%
70	17	5.8%	15.2%	-28.3%	25.3%
80	4	-4.0%	10.5%	-16.9%	04.7%
Total	135	9.4%	14.8%	-28.3%	56.6%

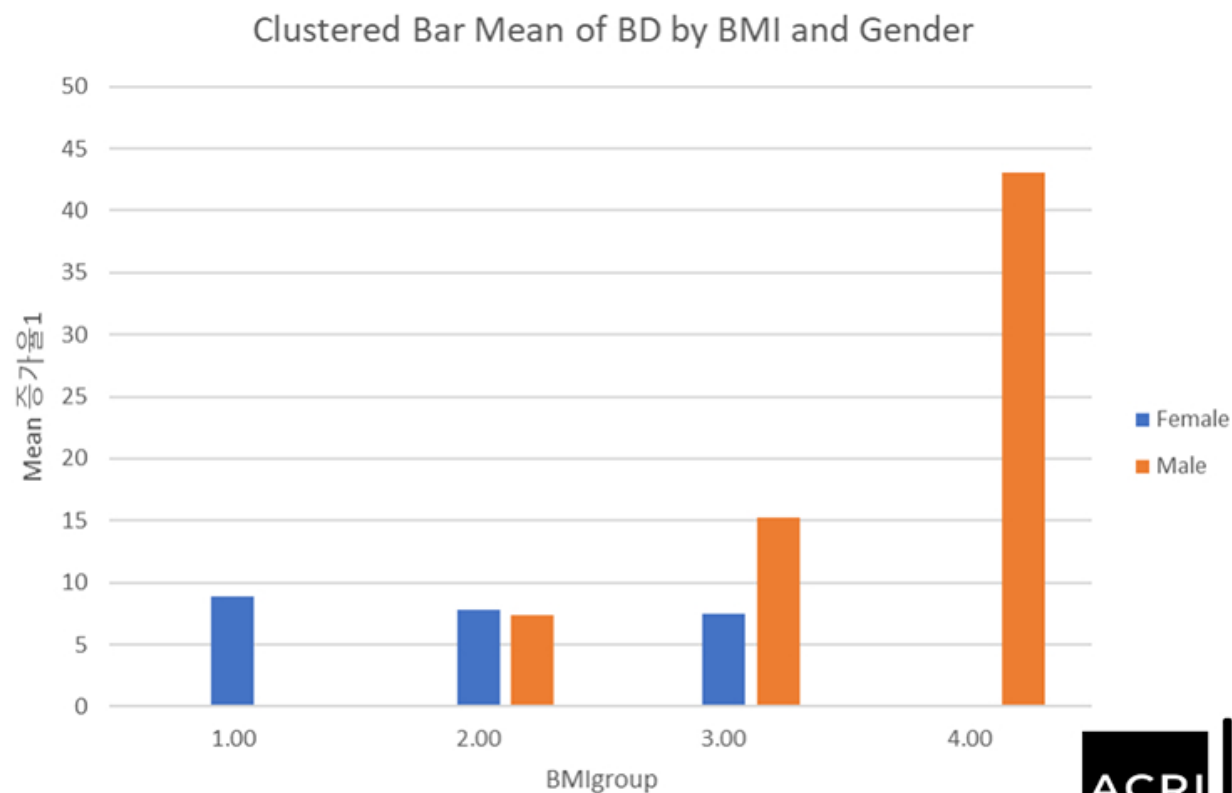
Effect of AIC



Effect of AIC by BMI

BMI	N	Mean	Std. Deviation	Minimum	Maximum
Under WT	8	8.88%	12.21%	-0.10%	37.90%
Normal WT	90	7.71%	14.32%	-28.30%	45.50%
Over WT	30	12.42%	14.67%	-4.70%	53.50%
Obesity	2	43.09%	19.08%	29.60%	56.60%
Total	130	9.41%	14.92%	-28.30%	56.60%

P=0.005



Risk Factors for Osteoporosis



Risk Factors for Osteoporosis



Factors affecting SAC efficiency

Symptoms	Normal, Osteopenia, Osteoporosis
Age	Under 80
Gender	M (normal), F (Osteopenia)
Race	
BMI	Overweight
Family History	
Genetic factors	
Body size	
Calcium & Vitamin D	
Exercise	
Smoking	
Alcohol	
Poor nutrition	
Chronic Diseases	

Acknowledgements

Moffitt Cancer Center

Kosj Yamoah, MD. PhD

Julio Pow-Sang, MD

Jasreman Dhillon, MD.

Clement Gwede, PhD

Park's Lab

Hyun Park, MS

Chelsea Aggor

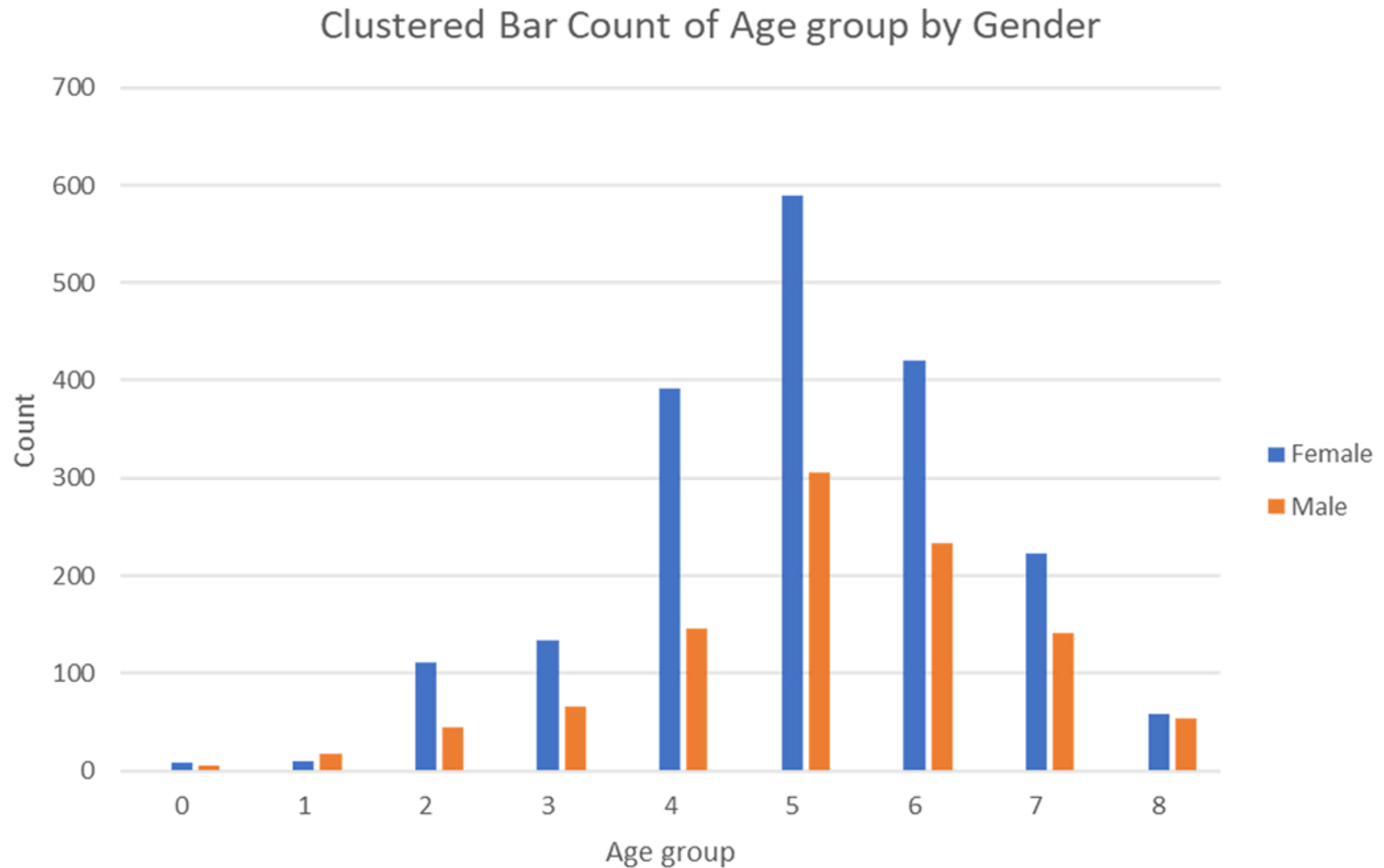
Kala Jamison, BS

Jenna Damonte, MS

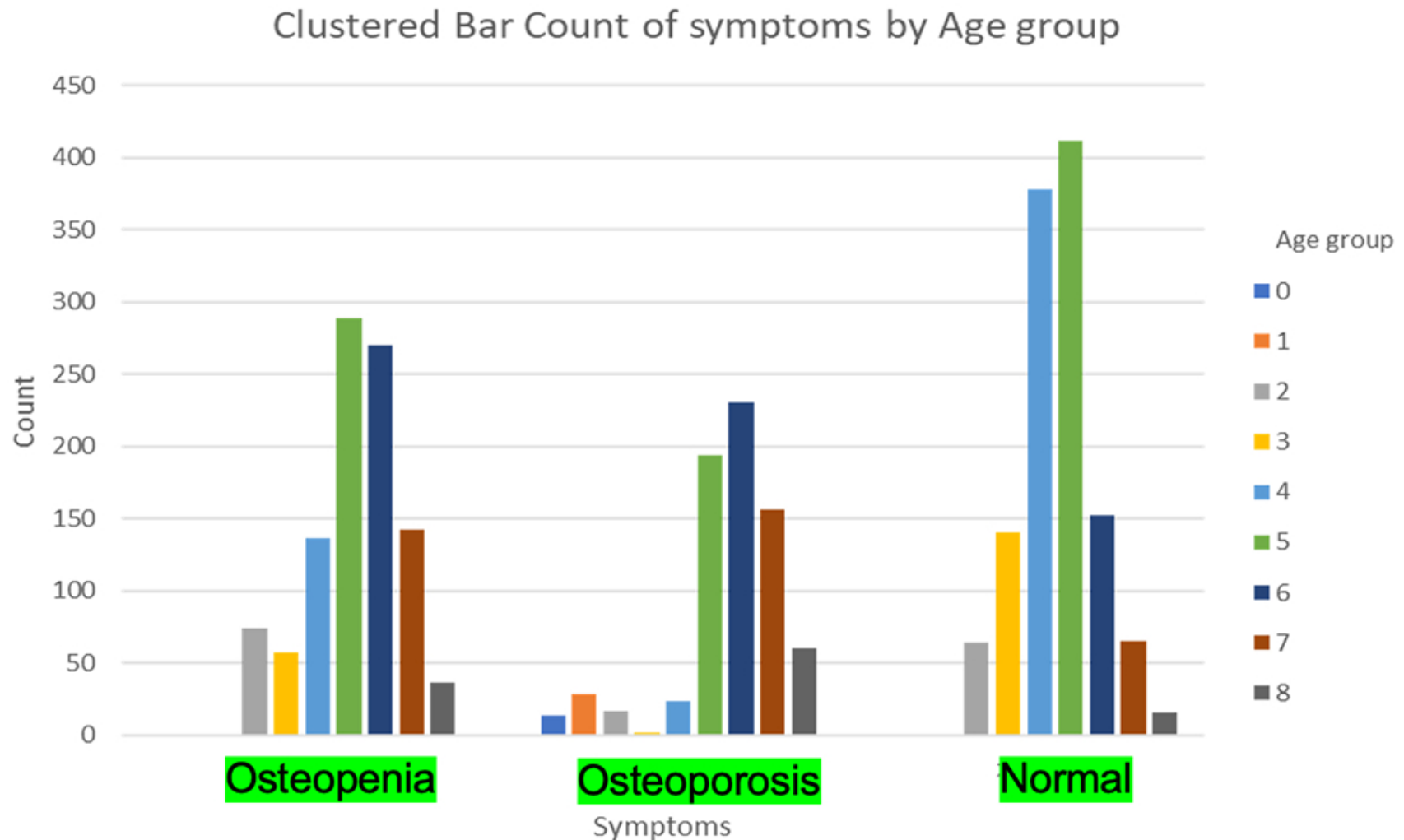
Carmen Benson, BS



Age group by Gender



Symptoms by Age group



Total Cohort

Age group			Female	%	Male	%	Total
	0	Osteoporosis	8	100	6	100	14
		Total	8		6		14
	1	Osteoporosis	10	100	18	100	28
		Total	10		18		28
2	Normal		47	42.3	17	38.6	64
		Osteopenia	53	47.7	21	47.7	74
		Osteoporosis	11	9.9	6	13.6	17
		Total	111		44		155
3	Normal		92	68.7	48	73.8	140
		Osteopenia	40	29.9	17	26.2	57
		Osteoporosis	2	1.5	0	0	2
		Total	134		65		199
4	Normal		275	70.3	103	70.5	378
		Osteopenia	98	25.1	38	26	136
		Osteoporosis	18	4.6	5	3.4	23
		Total	391		146		537
5	Normal		230	39	182	59.7	412
		Osteopenia	194	32.9	95	31.1	289
		Osteoporosis	166	28.1	28	9.2	194
		Total	590		305		895
6	Normal		61	14.5	91	39.1	152
		Osteopenia	157	37.4	113	48.5	270
		Osteoporosis	202	48.1	29	12.4	231
		Total	420		233		653
7	Normal		11	5	54	38.3	65
		Osteopenia	78	35.1	64	45.4	142
		Osteoporosis	133	59.9	23	16.3	156
		Total	222		141		363
8	Normal		2	3.4	14	25.9	16
		Osteopenia	13	22.4	23	42.6	36
		Osteoporosis	43	74.1	17	31.5	60
		Total	58		54		112
Total	Osteopenia		633	32.6	371	36.7	1004
		Osteoporosis	593	30.5	132	13	725
	Normal		718	36.9	509	50.3	1227
		Total	1944		1012		2956