

# Factors associated with variations in calculated free testosterone in men: Individual Participant Data meta-analyses on 20,631 participants

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## OBJECTIVE

Sociodemographic, lifestyle and medical variables influence total testosterone (T) and sex hormone-binding globulin (SHBG) concentrations. The relationship between these factors and "free" T remains unclear. We examined 21 sociodemographic, lifestyle and medical predictors influencing calculated free T (cFT) in community-dwelling men across ages.

## METHODOLOGY

Individual participant data (IPD) were provided by nine population cohorts. Factors associated with cFT were analyzed using two-stage random effects IPD meta-analyses. Covariates including age, body mass index (BMI), marital status, and education were incorporated across all models. Additionally, alcohol consumption, physical activity, and smoking were accounted for in models for lifestyle and medical variables.

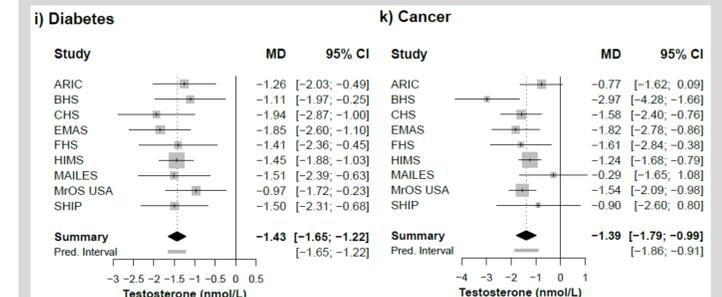
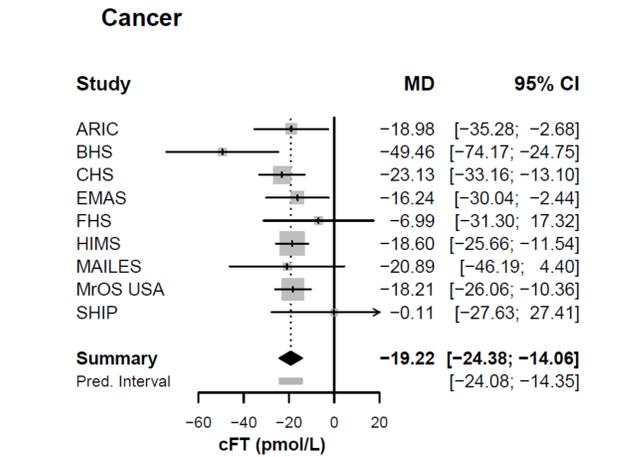
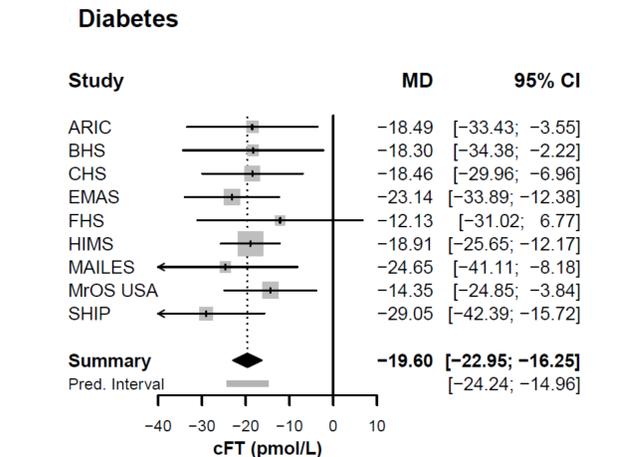
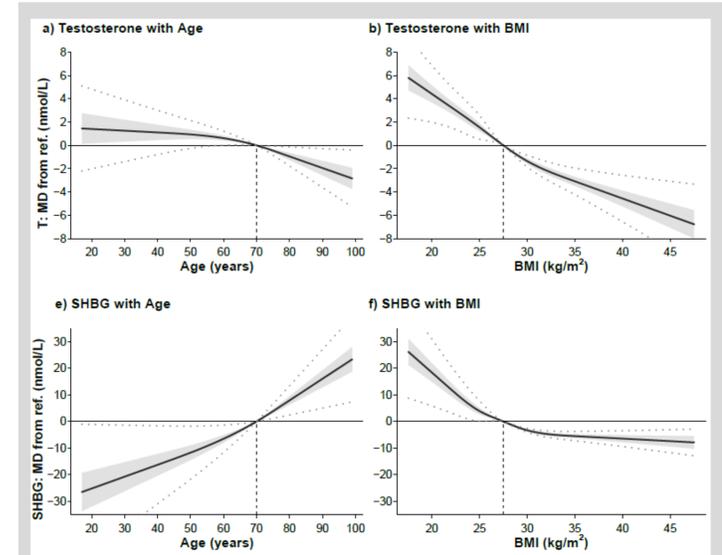
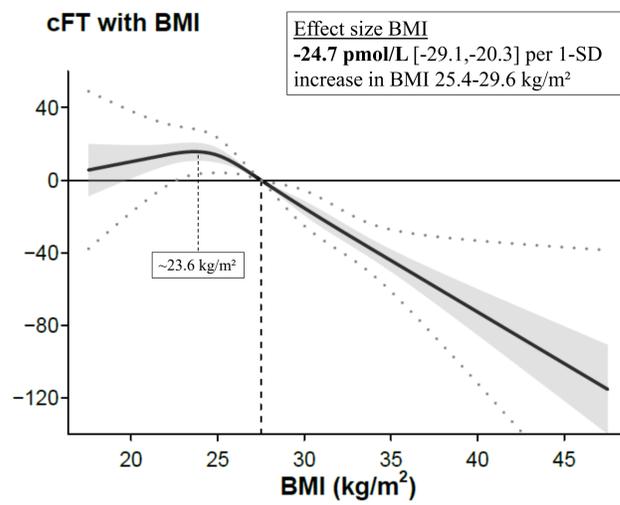
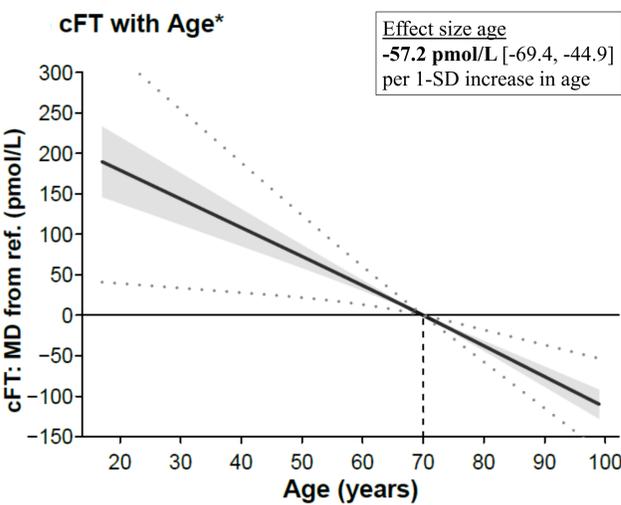
## STUDY DESIGN

- Cross-sectional analysis: Androgens in Men study (AIMS)[1]
- 20,631 participants
- Total T by LC-MS/MS
- SHBG by immunoassay
- cFT using the Vermeulen formula [2]

Study cohort	Participants	Median (25 <sup>th</sup> – 75 <sup>th</sup> percentile)				
		Age, y	BMI, kg/m <sup>2</sup>	cFT, pmol/L	Total T, nmol/L	SHBG, nmol/L
ARIC	1,392	63.0 (58.0 - 68.0)	27.7 (25.4 - 30.6)	262.9 (211.6 - 324.0)	13.1 (10.0 - 16.6)	32.7 (24.1 - 44.6)
BHS	2,017	49.9 (37.6 - 64.8)	26.2 (24.1 - 28.6)	290.7 (231.2 - 360.4)	13.0 (10.1 - 16.6)	27.2 (20.4 - 35.6)
CHS	1,123	76.0 (73.3 - 79.9)	26.4 (24.2 - 28.8)	174.3 (135.3 - 215.6)	12.7 (9.5 - 16.5)	58.5 (44.7 - 79.0)
EMAS	2,825	59.3 (50.2 - 69.3)	27.4 (24.9 - 30.0)	299.0 (246.7 - 359.5)	16.2 (12.6 - 20.4)	39.5 (29.2 - 52.3)
FHS	3,334	49.0 (39.0 - 59.0)	27.7 (25.2 - 30.5)	358.9 (273.3 - 476.7)	20.4 (15.7 - 26.2)	43.6 (30.7 - 60.4)
HIMS	4,037	76.0 (74.0 - 79.0)	26.3 (24.2 - 28.6)	223.0 (181.0 - 267.7)	12.4 (9.5 - 15.6)	39.6 (31.4 - 50.4)
MAILES	1,926	55.0 (46.0 - 64.0)	28.0 (25.4 - 30.7)	350.8 (285.2 - 431.2)	16.5 (12.8 - 20.7)	31.0 (23.8 - 41.0)
MrOS USA	1,984	73.0 (68.0 - 77.0)	27.0 (24.8 - 29.4)	221.4 (179.7 - 266.8)	13.5 (10.3 - 17.0)	46.0 (35.3 - 58.7)
SHIP	1,993	51.0 (38.0 - 64.0)	27.4 (25.0 - 30.0)	258.9 (203.7 - 329.4)	15.5 (12.0 - 19.6)	44.1 (32.8 - 58.1)

Summary attributes by study cohort at baseline.

## RESULTS



Associations of age, BMI, diabetes and cancer with total T and SHBG. AIMS Individual participant data meta-analyses. Previously published work from Marriott et al (2023). [3]

## CONCLUSION

Calculated free testosterone was most prominently associated with age and BMI. The linear, inverse association with age, non-linear association with BMI, and presence of diabetes, cancer and socio-demographic factors should be considered when using calculated free testosterone as a proxy for free testosterone.

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## REFERENCES

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- [2] A Vermeulen et al., J Clin Endocrinol Metab 84 (10), 3666 (1999).
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