Is gender based dose analysis in CT worthwhile ?

Mike Holubinka
CTUG, Birmingham
October 2019

Working together To drive excellence in care for our patients and communities

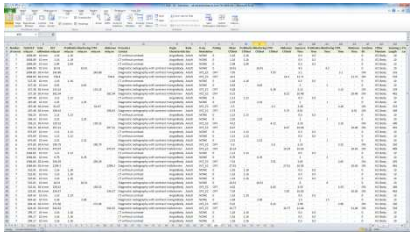
The motivation:

NDRLs & LDRLs
Optimisation
National survey (PHE-IPEM)
Might be interesting

Source data:

4x Siemens CT
Two NHS Trusts
CareAnalytics

Trust A:
January 2018 to June 2019
Trust B:
February to November 2018



The analysis:

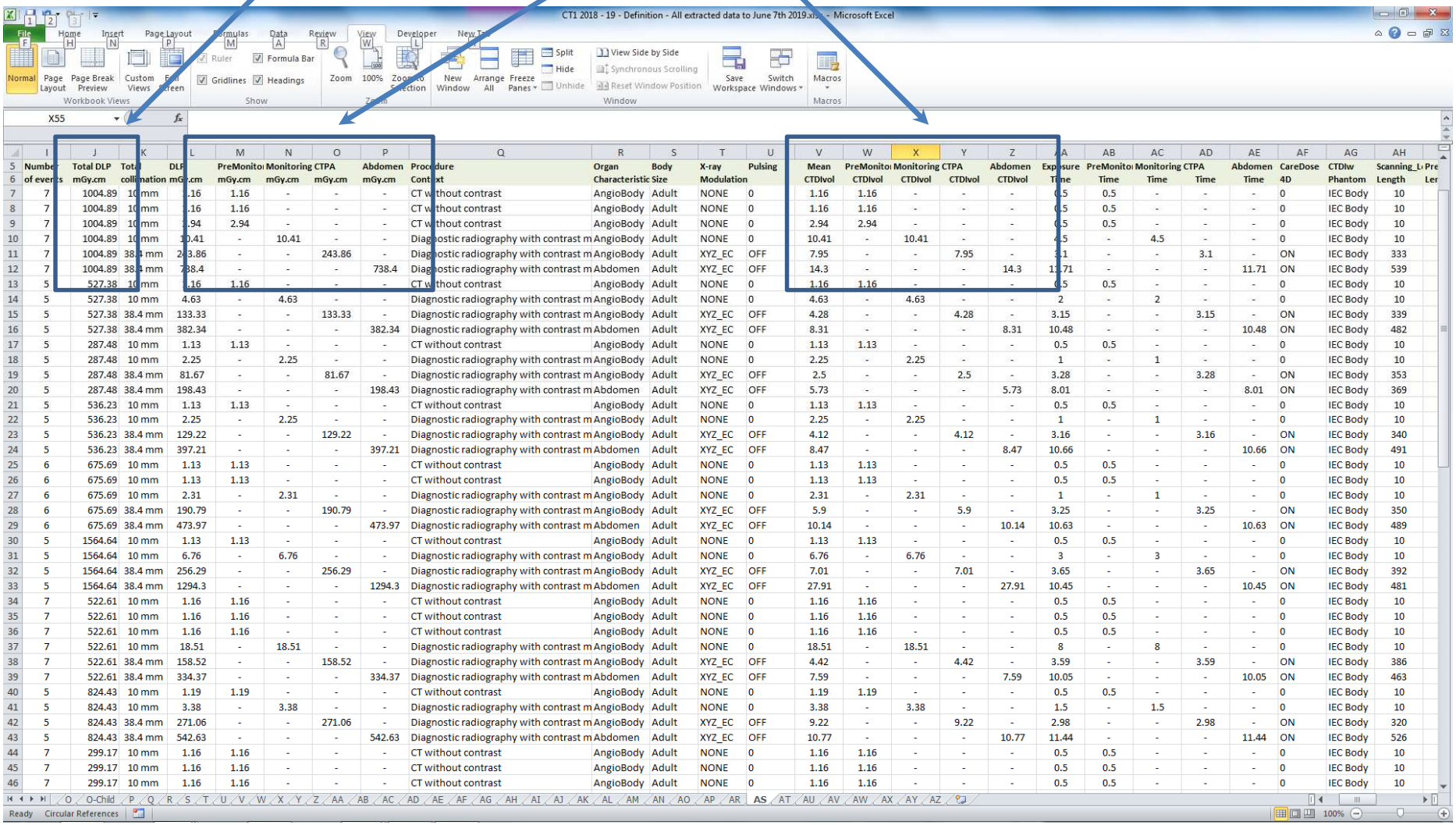
- **Bottom up – protocol based analysis**
- **All adult patients**
- **Studies with at least 20 patients**
- **Unknown weight & body habitus**
- **Off-protocol variants excluded**
- **Composition of protocols examined**
- **Medians for DLP, CTDIvol, scan length**

The questions:

- How do metrics compare with NDRLs ?
- Comparisons between scanners ?
- **Do metrics vary with gender?**

Protocols & protocol components

Totals and protocol components analysed separately



	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH
5	Number	Total DLP	Total	DLP	PreMonitor	Monitoring	CTPA	Abdomen	Procedure	Organ	Body	X-ray	Pulsing	Mean	PreMonitor	Monitoring	CTPA	Abdomen	Exposure	PreMonitor	Monitoring	CTPA	Abdomen	CareDose	CTDIw	Scanning_L
6	of events	mGy.cm	collimation	mGy.cm	mGy.cm	mGy.cm	mGy.cm	mGy.cm	Context	Characteristic	Size	Modulation		CTDIvol	CTDIvol	CTDIvol	CTDIvol	CTDIvol	Time	Time	Time	Time	Time	4D	Phantom	Length
7	7	1004.89	10 mm	1.16	1.16	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.16	1.16	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
8	7	1004.89	10 mm	1.16	1.16	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.16	1.16	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
9	7	1004.89	10 mm	2.94	2.94	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	2.94	2.94	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
10	7	1004.89	10 mm	10.41	-	10.41	-	-	Diagnostic radiography with contrast m	AngioBody	Adult	NONE	0	10.41	-	10.41	-	-	4.5	-	4.5	-	-	0	IEC Body	10
11	7	1004.89	38.4 mm	243.86	-	-	243.86	-	Diagnostic radiography with contrast m	AngioBody	Adult	XYZ_EC	OFF	7.95	-	-	7.95	-	3.1	-	-	3.1	-	ON	IEC Body	333
12	7	1004.89	38.4 mm	738.4	-	-	-	738.4	Diagnostic radiography with contrast m	Abdomen	Adult	XYZ_EC	OFF	14.3	-	-	-	14.3	11.71	-	-	-	11.71	ON	IEC Body	539
13	5	527.38	10 mm	1.16	1.16	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.16	1.16	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
14	5	527.38	10 mm	4.63	-	4.63	-	-	Diagnostic radiography with contrast m	AngioBody	Adult	NONE	0	4.63	-	4.63	-	-	2	-	2	-	-	0	IEC Body	10
15	5	527.38	38.4 mm	133.33	-	-	133.33	-	Diagnostic radiography with contrast m	AngioBody	Adult	XYZ_EC	OFF	4.28	-	-	4.28	-	3.15	-	-	3.15	-	ON	IEC Body	339
16	5	527.38	38.4 mm	382.34	-	-	-	382.34	Diagnostic radiography with contrast m	Abdomen	Adult	XYZ_EC	OFF	8.31	-	-	-	8.31	10.48	-	-	-	10.48	ON	IEC Body	482
17	5	287.48	10 mm	1.13	1.13	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.13	1.13	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
18	5	287.48	10 mm	2.25	-	2.25	-	-	Diagnostic radiography with contrast m	AngioBody	Adult	NONE	0	2.25	-	2.25	-	-	1	-	1	-	-	0	IEC Body	10
19	5	287.48	38.4 mm	81.67	-	-	81.67	-	Diagnostic radiography with contrast m	AngioBody	Adult	XYZ_EC	OFF	2.5	-	-	2.5	-	3.28	-	-	3.28	-	ON	IEC Body	353
20	5	287.48	38.4 mm	198.43	-	-	-	198.43	Diagnostic radiography with contrast m	Abdomen	Adult	XYZ_EC	OFF	5.73	-	-	-	5.73	8.01	-	-	-	8.01	ON	IEC Body	369
21	5	536.23	10 mm	1.13	1.13	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.13	1.13	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
22	5	536.23	10 mm	2.25	-	2.25	-	-	Diagnostic radiography with contrast m	AngioBody	Adult	NONE	0	2.25	-	2.25	-	-	1	-	1	-	-	0	IEC Body	10
23	5	536.23	38.4 mm	129.22	-	-	129.22	-	Diagnostic radiography with contrast m	AngioBody	Adult	XYZ_EC	OFF	4.12	-	-	4.12	-	3.16	-	-	3.16	-	ON	IEC Body	340
24	5	536.23	38.4 mm	397.21	-	-	-	397.21	Diagnostic radiography with contrast m	Abdomen	Adult	XYZ_EC	OFF	8.47	-	-	-	8.47	10.66	-	-	-	10.66	ON	IEC Body	491
25	6	675.69	10 mm	1.13	1.13	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.13	1.13	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
26	6	675.69	10 mm	1.13	1.13	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.13	1.13	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
27	6	675.69	10 mm	2.31	-	2.31	-	-	Diagnostic radiography with contrast m	AngioBody	Adult	NONE	0	2.31	-	2.31	-	-	1	-	1	-	-	0	IEC Body	10
28	6	675.69	38.4 mm	190.79	-	-	190.79	-	Diagnostic radiography with contrast m	AngioBody	Adult	XYZ_EC	OFF	5.9	-	-	5.9	-	3.25	-	-	3.25	-	ON	IEC Body	350
29	6	675.69	38.4 mm	473.97	-	-	-	473.97	Diagnostic radiography with contrast m	Abdomen	Adult	XYZ_EC	OFF	10.14	-	-	-	10.14	10.63	-	-	-	10.63	ON	IEC Body	489
30	5	1564.64	10 mm	1.13	1.13	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.13	1.13	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
31	5	1564.64	10 mm	6.76	-	6.76	-	-	Diagnostic radiography with contrast m	AngioBody	Adult	NONE	0	6.76	-	6.76	-	-	3	-	3	-	-	0	IEC Body	10
32	5	1564.64	38.4 mm	256.29	-	-	256.29	-	Diagnostic radiography with contrast m	AngioBody	Adult	XYZ_EC	OFF	7.01	-	-	7.01	-	3.65	-	-	3.65	-	ON	IEC Body	392
33	5	1564.64	38.4 mm	1294.3	-	-	-	1294.3	Diagnostic radiography with contrast m	Abdomen	Adult	XYZ_EC	OFF	27.91	-	-	-	27.91	10.45	-	-	-	10.45	ON	IEC Body	481
34	7	522.61	10 mm	1.16	1.16	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.16	1.16	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
35	7	522.61	10 mm	1.16	1.16	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.16	1.16	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
36	7	522.61	10 mm	1.16	1.16	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.16	1.16	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
37	7	522.61	10 mm	18.51	-	18.51	-	-	Diagnostic radiography with contrast m	AngioBody	Adult	NONE	0	18.51	-	18.51	-	-	8	-	8	-	-	0	IEC Body	10
38	7	522.61	38.4 mm	158.52	-	-	158.52	-	Diagnostic radiography with contrast m	AngioBody	Adult	XYZ_EC	OFF	4.42	-	-	4.42	-	3.59	-	-	3.59	-	ON	IEC Body	386
39	7	522.61	38.4 mm	334.37	-	-	-	334.37	Diagnostic radiography with contrast m	Abdomen	Adult	XYZ_EC	OFF	7.59	-	-	-	7.59	10.05	-	-	-	10.05	ON	IEC Body	463
40	5	824.43	10 mm	1.19	1.19	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.19	1.19	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
41	5	824.43	10 mm	3.38	-	3.38	-	-	Diagnostic radiography with contrast m	AngioBody	Adult	NONE	0	3.38	-	3.38	-	-	1.5	-	1.5	-	-	0	IEC Body	10
42	5	824.43	38.4 mm	271.06	-	-	271.06	-	Diagnostic radiography with contrast m	AngioBody	Adult	XYZ_EC	OFF	9.22	-	-	9.22	-	2.98	-	-	2.98	-	ON	IEC Body	320
43	5	824.43	38.4 mm	542.63	-	-	-	542.63	Diagnostic radiography with contrast m	Abdomen	Adult	XYZ_EC	OFF	10.77	-	-	-	10.77	11.44	-	-	-	11.44	ON	IEC Body	526
44	7	299.17	10 mm	1.16	1.16	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.16	1.16	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
45	7	299.17	10 mm	1.16	1.16	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.16	1.16	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10
46	7	299.17	10 mm	1.16	1.16	-	-	-	CT without contrast	AngioBody	Adult	NONE	0	1.16	1.16	-	-	-	0.5	0.5	-	-	-	0	IEC Body	10

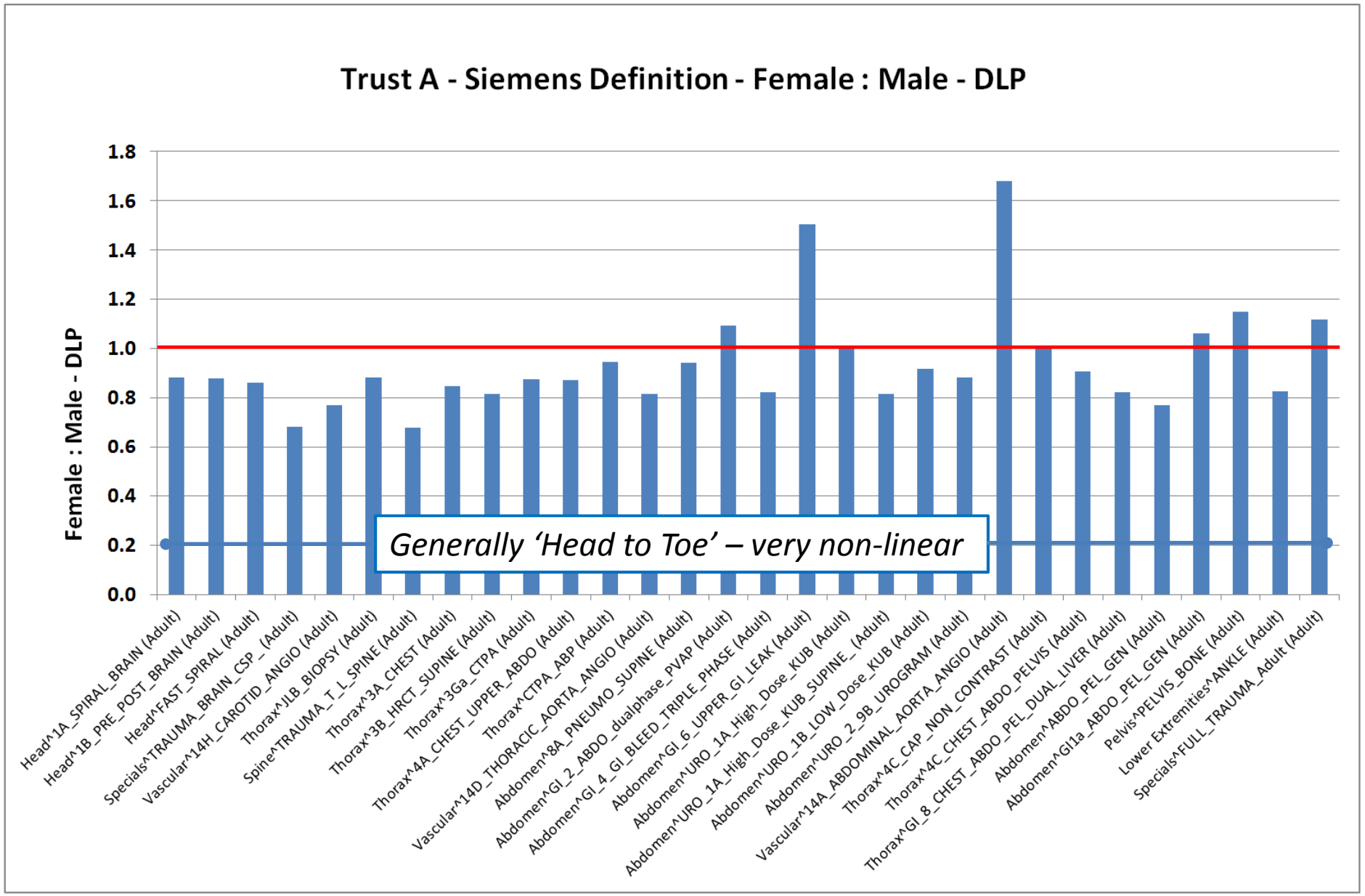
Summary stats:

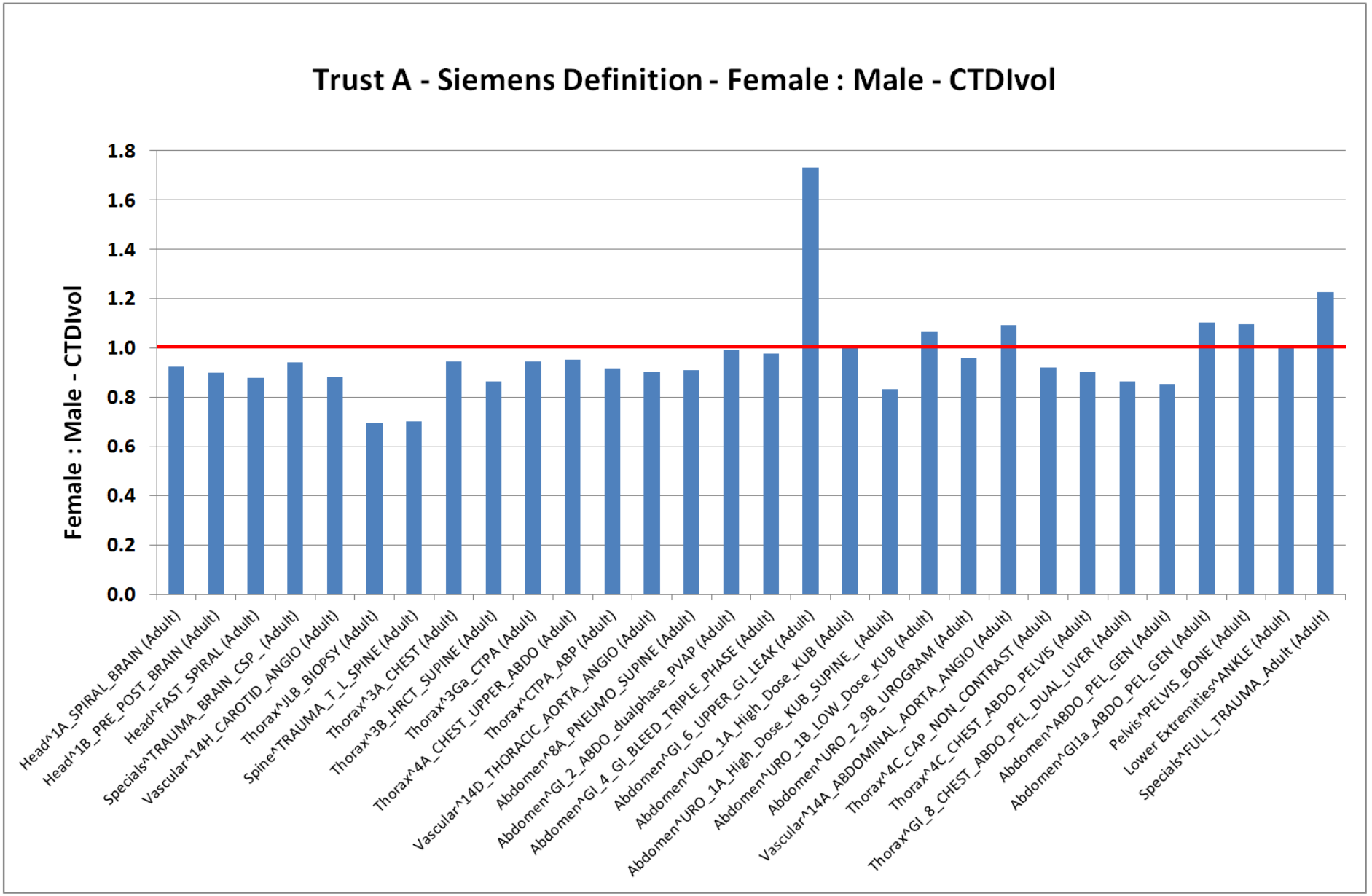
Trust	Scanner	Reported Protocols	Patients	Males	Females	*Other** Protocols*
A	Definition AS+	30	4244	2081	2163	*23 (+67)*
	Sensation S40	37	4970	2399	2571	*21 (+52)*
B	Definition Flash	17	1840	945	895	*6 (+72)*
	Definition AS+	18	1819	864	955	*10 (+40)*

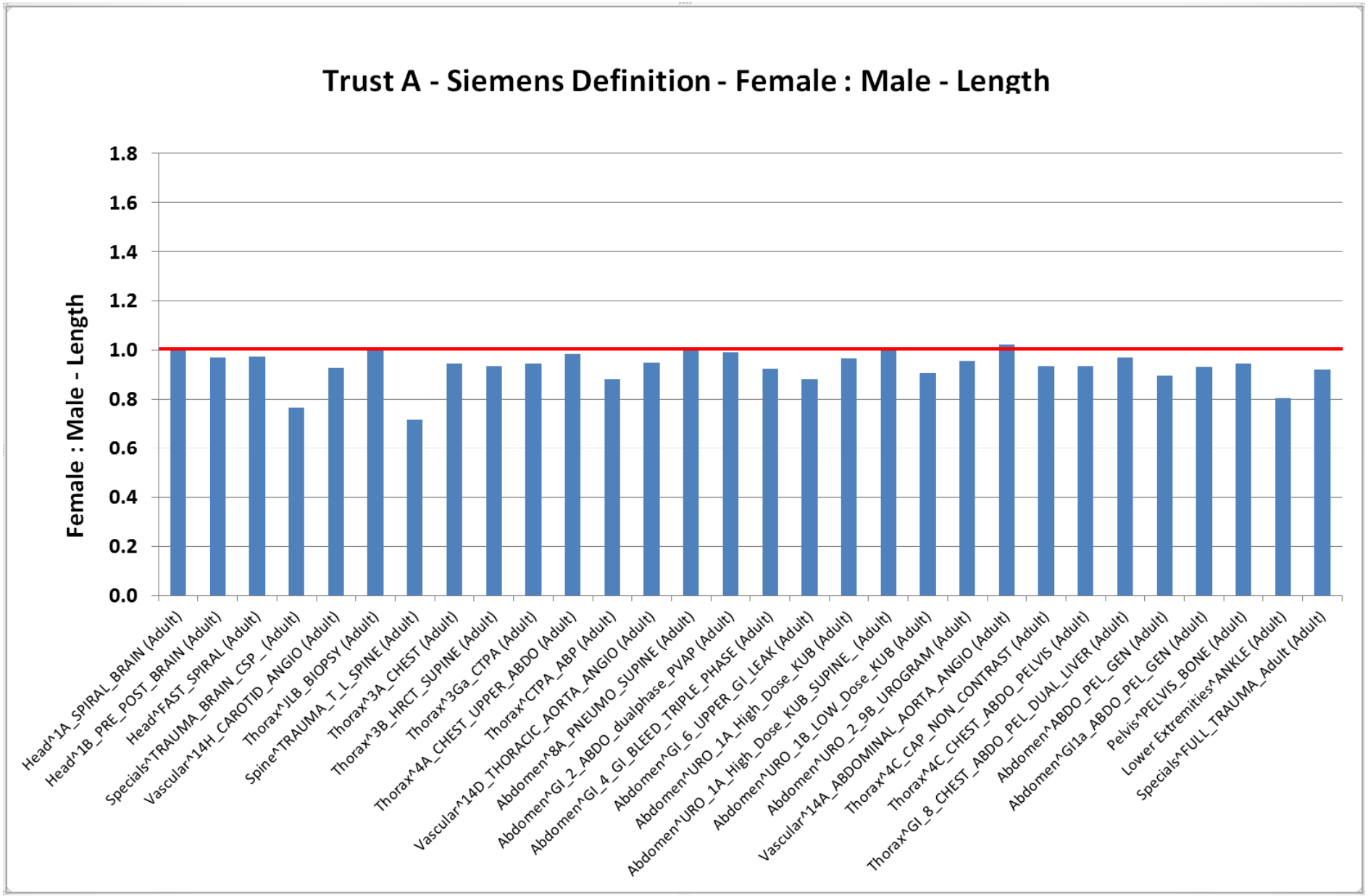
**Other protocols:
Combined gender <15 patients (<10 patients)

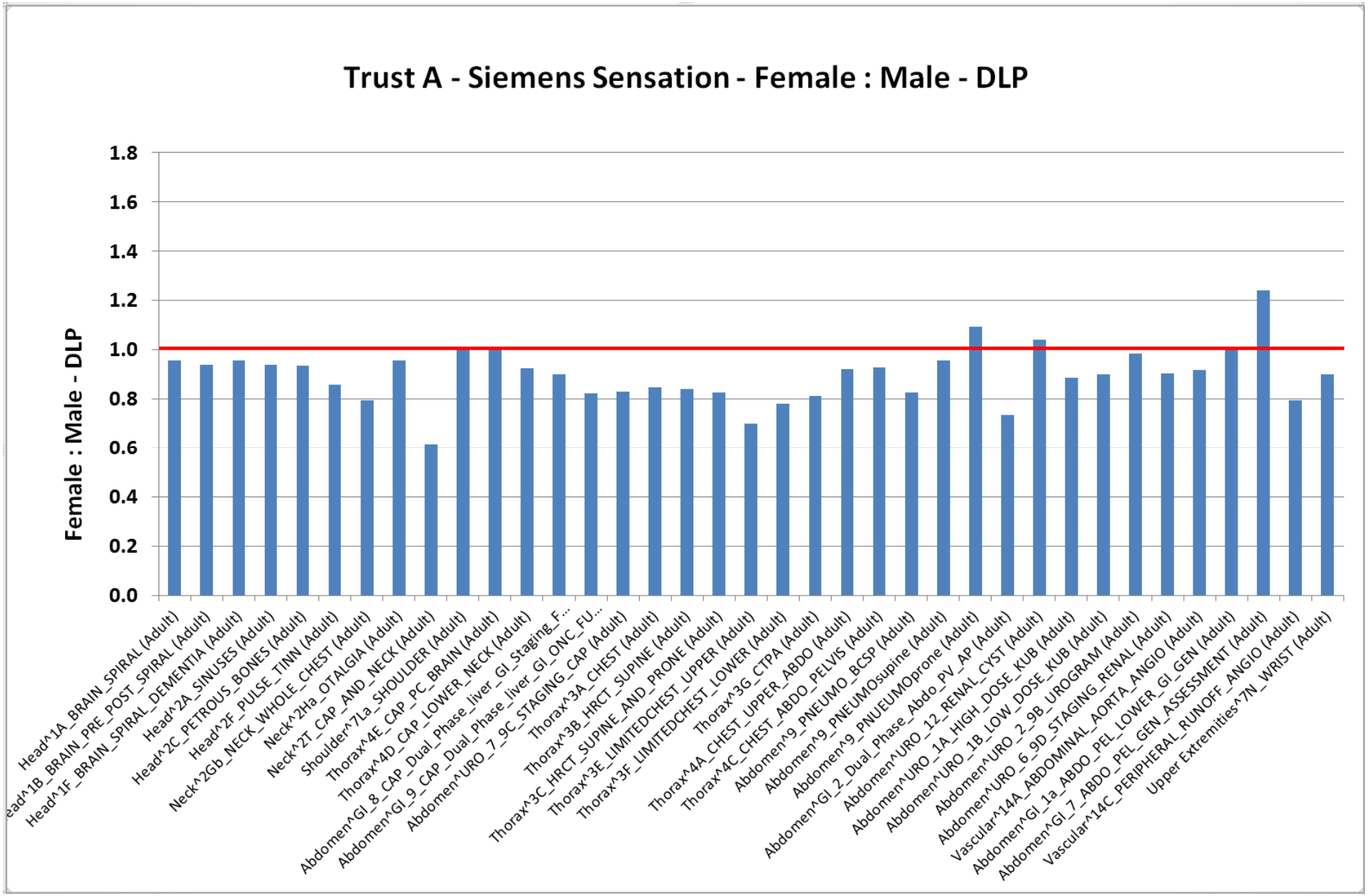
How to present the dose metrics and gender ?

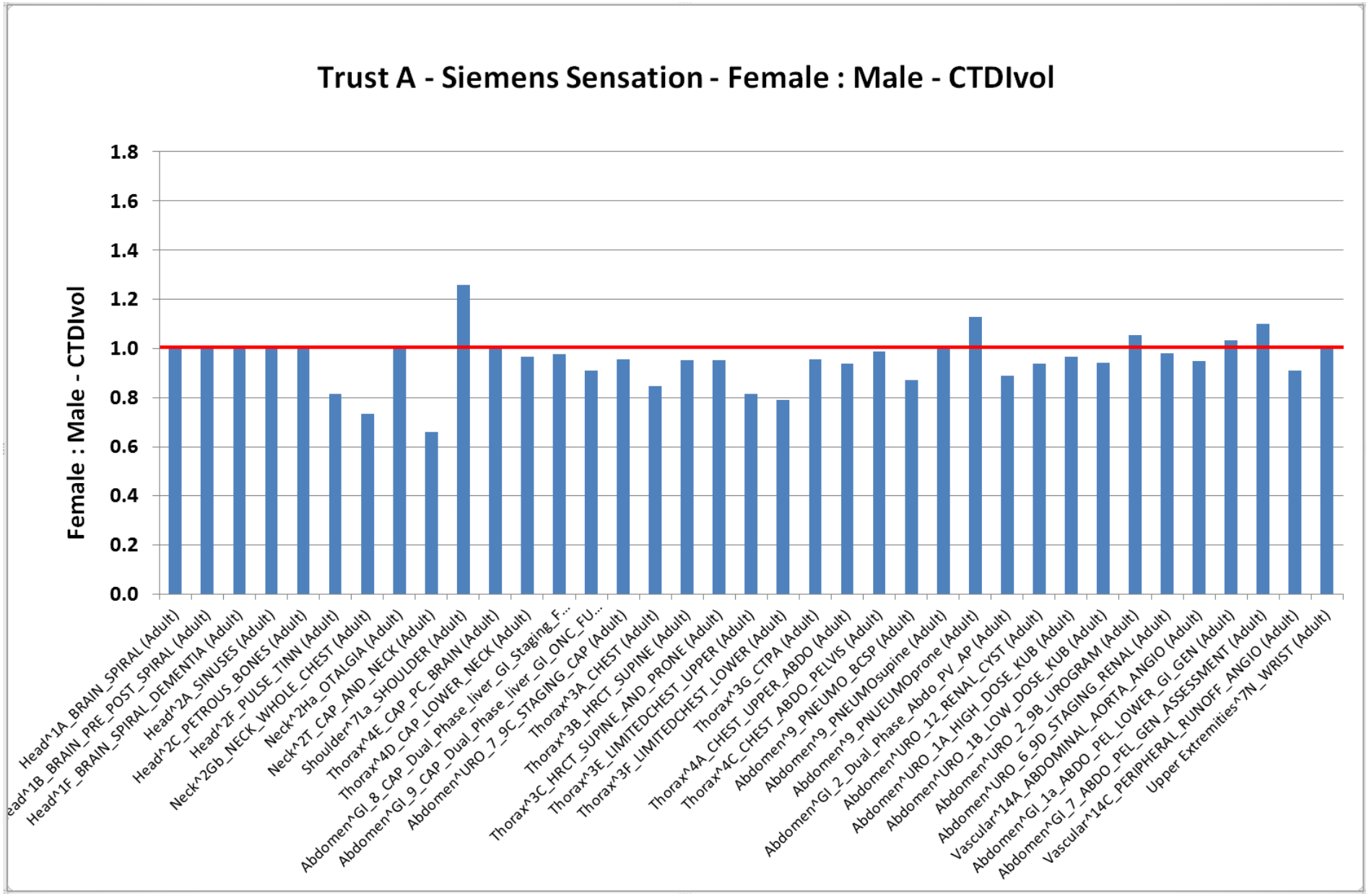
- All reported studies by scanner
- Female : Male ratio of the metric median
- DLP
- CTDIvol
- Scan length

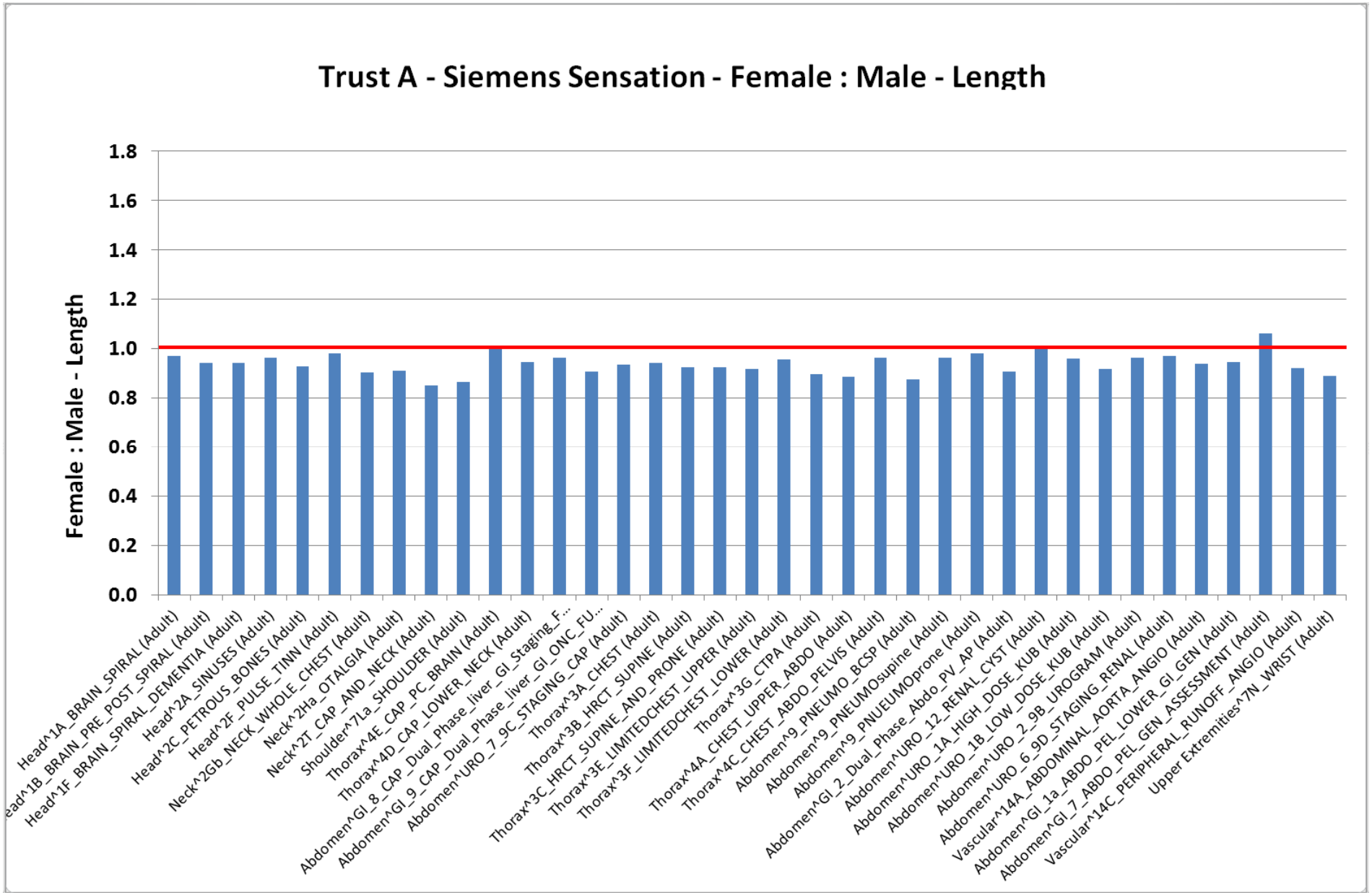

Trust A - Siemens Definition - Female : Male - DLP
Female : Male - DLP
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Generally 'Head to Toe' – very non-linear
Head^1A_SPIRAL_BRAIN (Adult)
Head^1B_PRE_POST_BRAIN (Adult)
Head^FAST_SPIRAL (Adult)
Specials^TRAUMA_BRAIN_CSP _ (Adult)
Vascular^14H_CAROTID_ANGIO (Adult)
Thorax^JLB_BIOPSY (Adult)
Spine^TRAUMA_T_L_SPINE (Adult)
Thorax^3A_CHEST (Adult)
Thorax^3B_HRCT_SUPINE (Adult)
Thorax^3Ga_CTPA (Adult)
Thorax^4A_CHEST_UPPER_ABDO (Adult)
Thorax^CTPA_ABP (Adult)
Vascular^14D_THORACIC_AORTA_ANGIO (Adult)
Abdomen^8A_PNEUMO_SUPINE (Adult)
Abdomen^GI_2_ABDO_dualphase_PVAP (Adult)
Abdomen^GI_4_GI_BLEED_TRIPLE_PHASE (Adult)
Abdomen^GI_6_UPPER_GI_LEAK (Adult)
Abdomen^URO_1A_High_Dose_KUB (Adult)
Abdomen^URO_1A_High_Dose_KUB_SUPINE_ (Adult)
Abdomen^URO_1B_LOW_Dose_KUB (Adult)
Abdomen^URO_2_9B_UROGRAM (Adult)
Vascular^14A_ABDOMINAL_AORTA_ANGIO (Adult)
Thorax^4C_CAP_NON_CONTRAST (Adult)
Thorax^4C_CHEST_ABDO_PELVIS (Adult)
Thorax^GI_8_CHEST_ABDO_PEL_DUAL_LIVER (Adult)
Abdomen^ABDO_PEL_GEN (Adult)
Abdomen^GI1a_ABDO_PEL_GEN (Adult)
Pelvis^PELVIS_BONE (Adult)
Lower Extremities^ANKLE (Adult)
Specials^FULL_TRAUMA_Adult (Adult)

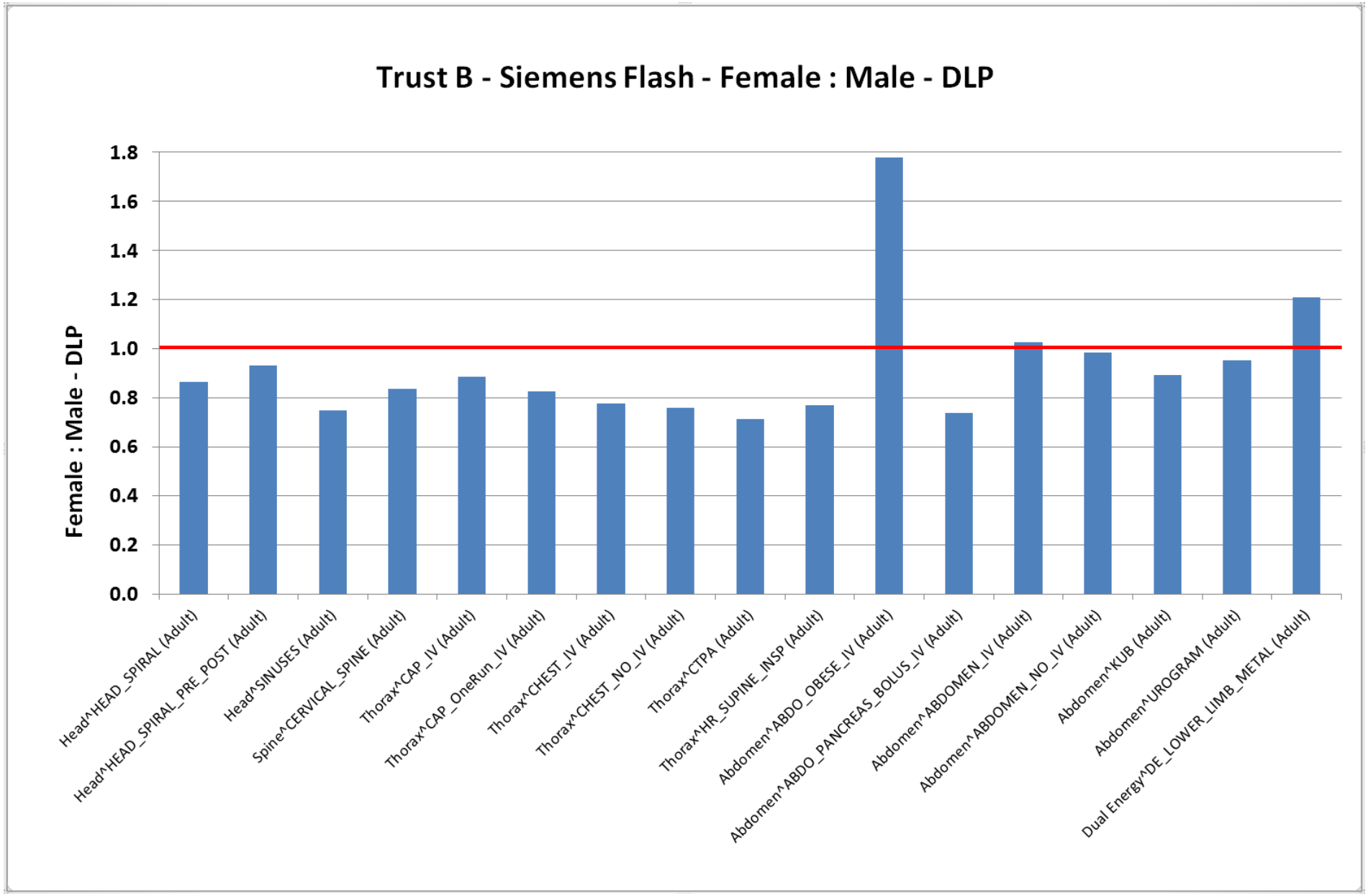

Trust A - Siemens Definition - Female : Male - CTDIvol
Female : Male - CTDIvol
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Head^1A_SPIRAL_BRAIN (Adult)
Head^1B_PRE_POST_BRAIN (Adult)
Head^FAST_SPIRAL (Adult)
Specials^TRAUMA_BRAIN_CSP _ (Adult)
Vascular^14H_CAROTID_ANGIO (Adult)
Thorax^1LB_BIOPSY (Adult)
Spine^TRAUMA_T_L_SPINE (Adult)
Thorax^3A_CHEST (Adult)
Thorax^3B_HRCT_SUPINE (Adult)
Thorax^3Ga_CTPA (Adult)
Thorax^4A_CHEST_UPPER_ABDO (Adult)
Thorax^CTPA_ABP (Adult)
Vascular^14D_THORACIC_AORTA_ANGIO (Adult)
Abdomen^8A_PNEUMO_SUPINE (Adult)
Abdomen^GI_2_ABDO_dualphase_PVAP (Adult)
Abdomen^GI_4_GI_BLEED_TRIPLE_PHASE (Adult)
Abdomen^GI_6_UPPER_GI_LEAK (Adult)
Abdomen^URO_1A_High_Dose_KUB (Adult)
Abdomen^URO_1A_High_Dose_KUB_SUPINE_ (Adult)
Abdomen^URO_1B_LOW_Dose_KUB (Adult)
Abdomen^URO_2_9B_UROGRAM (Adult)
Vascular^14A_ABDOMINAL_AORTA_ANGIO (Adult)
Thorax^4C_CAP_NON_CONTRAST (Adult)
Thorax^4C_CHEST_ABDO_PELVIS (Adult)
Abdomen^ABDO_PEL_DUAL_LIVER (Adult)
Abdomen^ABDO_PEL_GEN (Adult)
Abdomen^GI1a_ABDO_PEL_GEN (Adult)
Pelvis^PELVIS_BONE (Adult)
Lower Extremities^ANKLE (Adult)
Specials^FULL_TRAUMA_Adult (Adult)
Thorax^GI_8_CHEST_ABDO_PEL_DUAL_LIVER (Adult)

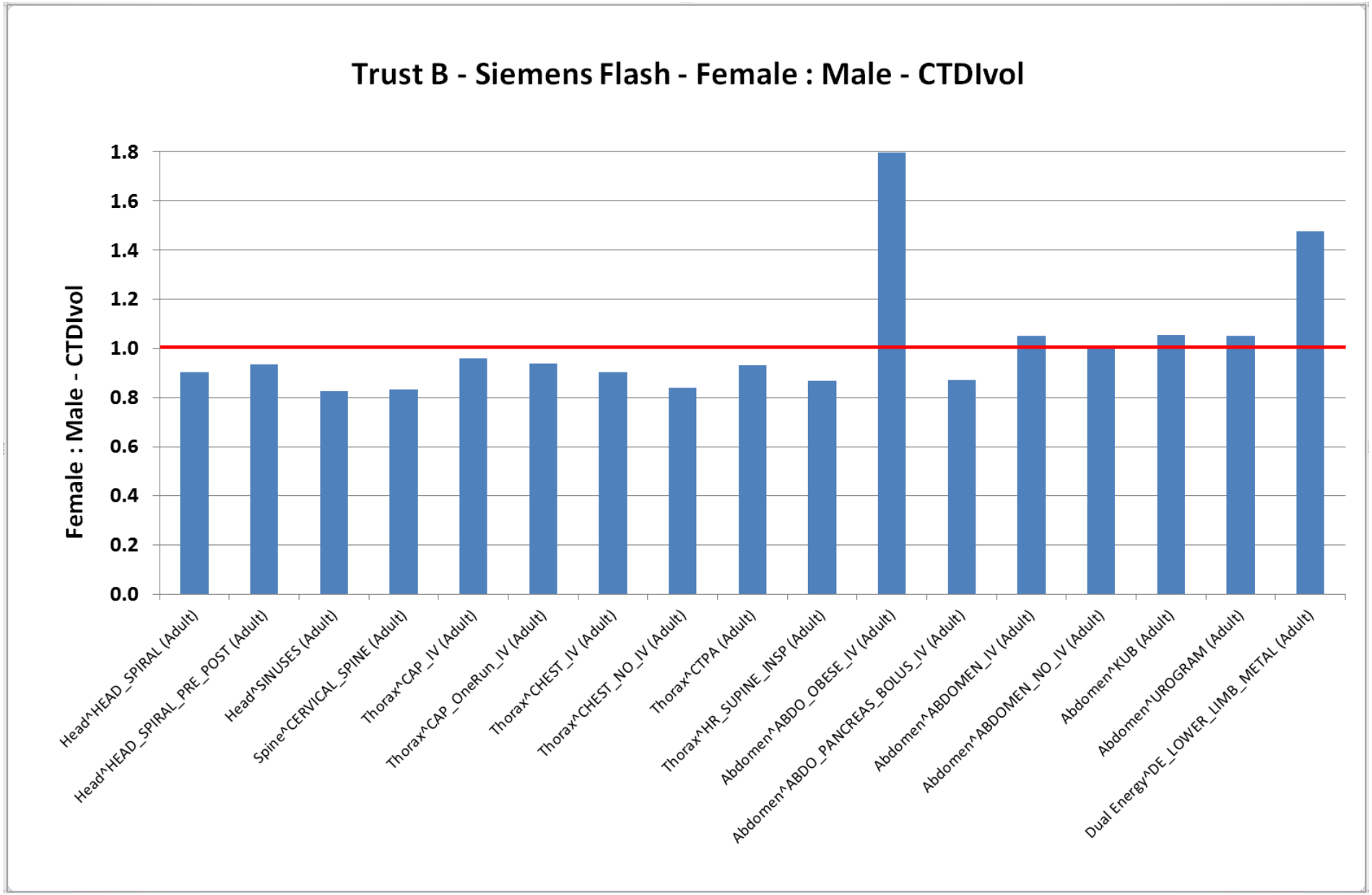

Trust A - Siemens Definition - Female : Male - Length
Female : Male - Length
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Head^1A_SPIRAL_BRAIN (Adult)
Head^1B_PRE_POST_BRAIN (Adult)
Head^FAST_SPIRAL (Adult)
Specials^TRAUMA_BRAIN_CSP _ (Adult)
Vascular^14H_CAROTID_ANGIO (Adult)
Thorax^1LB_BIOPSY (Adult)
Spine^TRAUMA_T_L_SPINE (Adult)
Thorax^3A_CHEST (Adult)
Thorax^3B_HRCT_SUPINE (Adult)
Thorax^3Ga_CTPA (Adult)
Thorax^4A_CHEST_UPPER_ABDO (Adult)
Thorax^CTPA_ABP (Adult)
Vascular^14D_THORACIC_AORTA_ANGIO (Adult)
Abdomen^8A_PNEUMO_SUPINE (Adult)
Abdomen^GI_2_ABDO_dualphase_PVAP (Adult)
Abdomen^GI_4_GI_BLEED_TRIPLE_PHASE (Adult)
Abdomen^GI_6_UPPER_GI_LEAK (Adult)
Abdomen^URO_1A_High_Dose_KUB (Adult)
Abdomen^URO_1A_High_Dose_KUB_SUPINE_ (Adult)
Abdomen^URO_1B_LOW_Dose_KUB (Adult)
Abdomen^URO_2_9B_UROGRAM (Adult)
Vascular^14A_ABDOMINAL_AORTA_ANGIO (Adult)
Thorax^4C_CAP_NON_CONTRAST (Adult)
Thorax^4C_CHEST_ABDO_PELVIS (Adult)
Thorax^4C_CHEST_ABDO_PEL_DUAL_LIVER (Adult)
Abdomen^ABDO_PEL_GEN (Adult)
Abdomen^GI1a_ABDO_PEL_GEN (Adult)
Pelvis^PELVIS_BONE (Adult)
Lower Extremities^ANKLE (Adult)
Specials^FULL_TRAUMA_Adult (Adult)

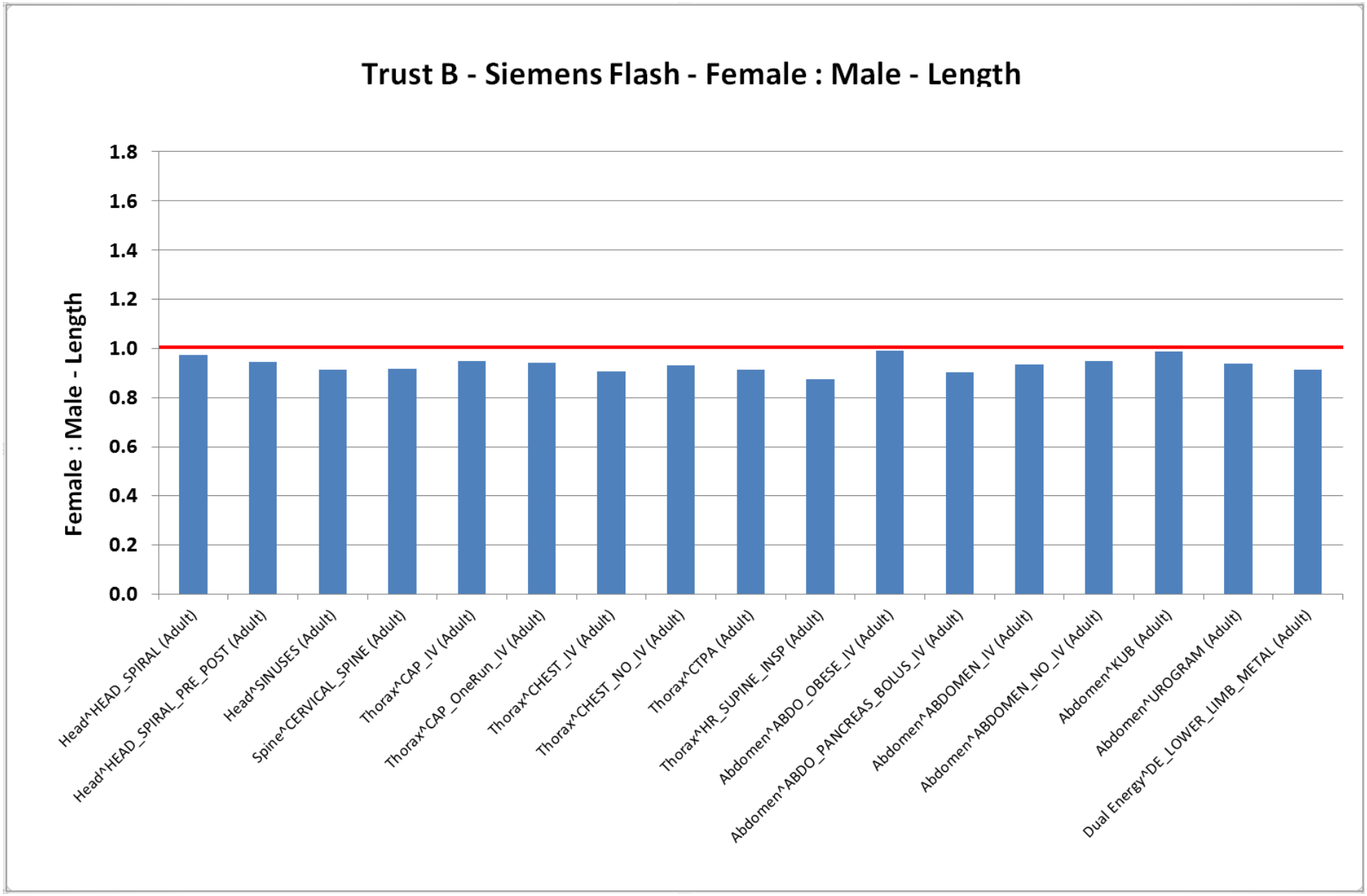

Trust A - Siemens Sensation - Female : Male - DLP
Female : Male - DLP
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Head^1A_BRAIN_SPIRAL (Adult)
ead^1B_BRAIN_PRE_POST_SPIRAL (Adult)
Head^1F_BRAIN_SPIRAL_DEMENTIA (Adult)
Head^2A_SINUSES (Adult)
Head^2C_PETROUS_BONES (Adult)
Head^2F_PULSE_TINN (Adult)
Neck^2Gb_NECK_WHOLE_CHEST (Adult)
Neck^2Ha_OTALGIA (Adult)
Neck^2T_CAP_AND_NECK (Adult)
Shoulder^7La_SHOULDER (Adult)
Thorax^4E_CAP_PC_BRAIN (Adult)
Thorax^4D_CAP_LOWER_NECK (Adult)
Abdomen^GI_8_CAP_Dual_Phase_liver_GI_Staging_F...
Abdomen^GI_9_CAP_Dual_Phase_liver_GI_ONC_FU...
Abdomen^URO_7_9C_STAGING_CAP (Adult)
Thorax^3A_CHEST (Adult)
Thorax^3B_HRCT_SUPINE (Adult)
Thorax^3C_HRCT_SUPINE_AND_PRONE (Adult)
Thorax^3E_LIMITEDCHEST_UPPER (Adult)
Thorax^3F_LIMITEDCHEST_LOWER (Adult)
Thorax^3G_CTPA (Adult)
Thorax^4A_CHEST_UPPER_ABDO (Adult)
Thorax^4C_CHEST_ABDO_PELVIS (Adult)
Abdomen^9_PNEUMO_BCSP (Adult)
Abdomen^9_PNEUMOsupine (Adult)
Abdomen^9_PNEUMOprone (Adult)
Abdomen^GI_2_Dual_Phase_Abdo_PV_AP (Adult)
Abdomen^URO_12_RENAL_CYST (Adult)
Abdomen^URO_1A_HIGH_DOSE_KUB (Adult)
Abdomen^URO_1B_LOW_DOSE_KUB (Adult)
Abdomen^URO_2_9B_UROGRAM (Adult)
Abdomen^URO_6_9D_STAGING_RENAL (Adult)
Vascular^14A_ABDOMINAL_AORTA_ANGIO (Adult)
Abdomen^GI_1a_ABDO_PEL_LOWER_GI_GEN (Adult)
Abdomen^GI_7_ABDO_PEL_GEN_ASSESSMENT (Adult)
Vascular^14C_PERIPHERAL_RUNOFF_ANGIO (Adult)
Upper Extremities^7N_WRIST (Adult)

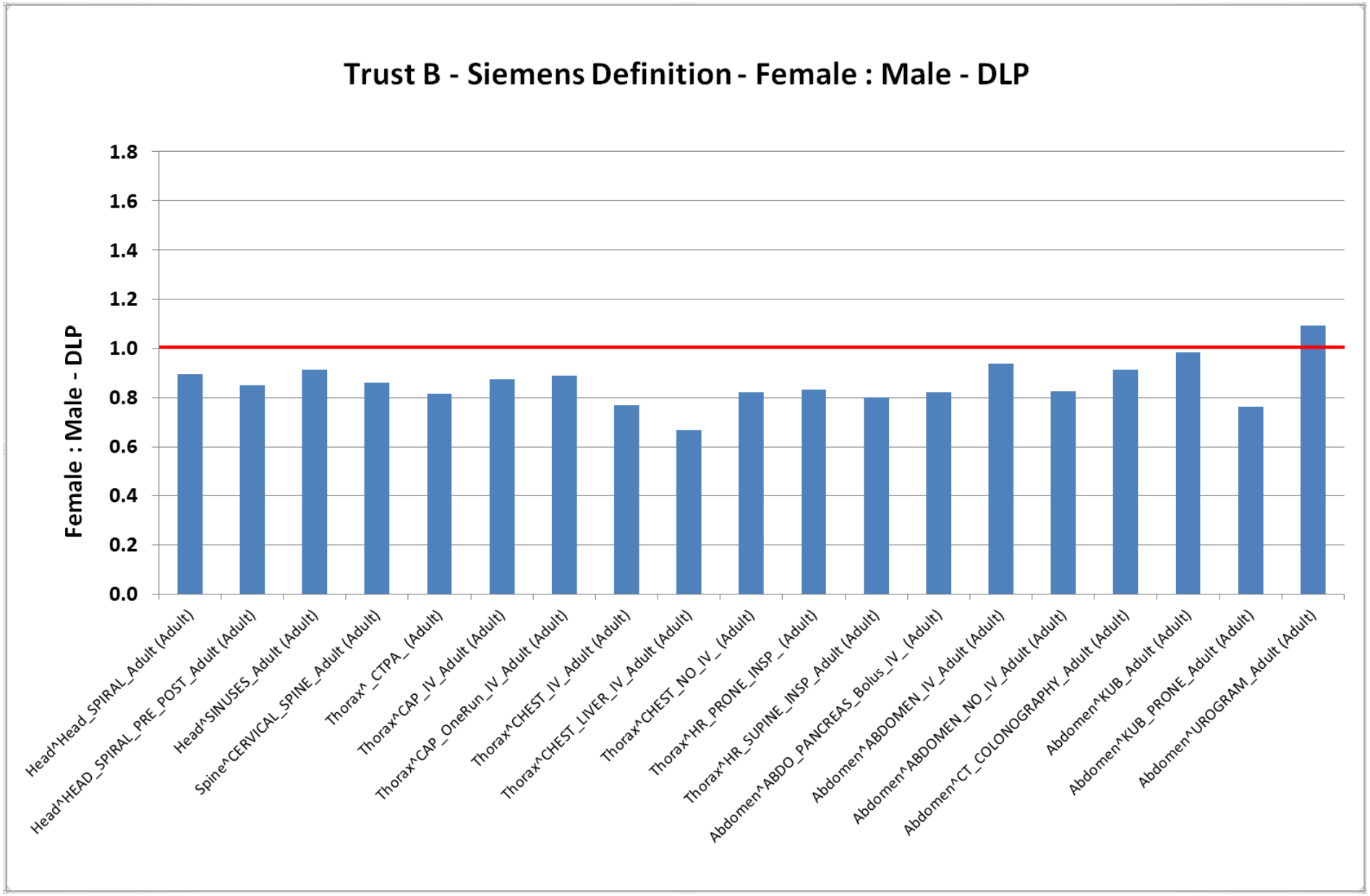

Trust A - Siemens Sensation - Female : Male - CTDIvol
Female : Male - CTDIvol
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
ead^1B_BRAIN_PRE_POST_SPIRAL (Adult)
Head^1A_BRAIN_SPIRAL (Adult)
Head^1F_BRAIN_SPIRAL_DEMENTIA (Adult)
Head^2A_SINUSES (Adult)
Head^2C_PETROUS_BONES (Adult)
Head^2F_PULSE_TINN (Adult)
Neck^2Gb_NECK_WHOLE_CHEST (Adult)
Neck^2Ha_OTALGIA (Adult)
Neck^2T_CAP_AND_NECK (Adult)
Shoulder^7La_SHOULDER (Adult)
Thorax^4E_CAP_PC_BRAIN (Adult)
Thorax^4D_CAP_LOWER_NECK (Adult)
Abdomen^GI_8_CAP_Dual_Phase_liver_GI_Staging_F...
Abdomen^GI_9_CAP_Dual_Phase_liver_GI_ONC_FU...
Abdomen^URO_7_9C_STAGING_CAP (Adult)
Thorax^3A_CHEST (Adult)
Thorax^3B_HRCT_SUPINE (Adult)
Thorax^3C_HRCT_SUPINE_AND_PRONE (Adult)
Thorax^3E_LIMITEDCHEST_UPPER (Adult)
Thorax^3F_LIMITEDCHEST_LOWER (Adult)
Thorax^3G_CTPA (Adult)
Thorax^4A_CHEST_UPPER_ABDO_PELVIS (Adult)
Thorax^4C_CHEST_ABDO_PELVIS (Adult)
Abdomen^9_PNEUMO_BCSP (Adult)
Abdomen^9_PNEUMOsupine (Adult)
Abdomen^9_PNEUMOprone (Adult)
Abdomen^GI_2_Dual_Phase_Abdo_PV_AP (Adult)
Abdomen^URO_12_RENAL_CYST (Adult)
Abdomen^URO_1A_HIGH_DOSE_KUB (Adult)
Abdomen^URO_1B_LOW_DOSE_KUB (Adult)
Abdomen^URO_2_9B_UROGRAM (Adult)
Abdomen^URO_6_9D_STAGING_RENAL (Adult)
Vascular^14A_ABDOMINAL_AORTA_ANGIO (Adult)
Abdomen^GI_1a_ABDO_PEL_LOWER_GI_GEN (Adult)
Abdomen^GI_7_ABDO_PEL_GEN_ASSESSMENT (Adult)
Vascular^14C_PERIPHERAL_RUNOFF_ANGIO (Adult)
Upper Extremities^7N_WRIST (Adult)

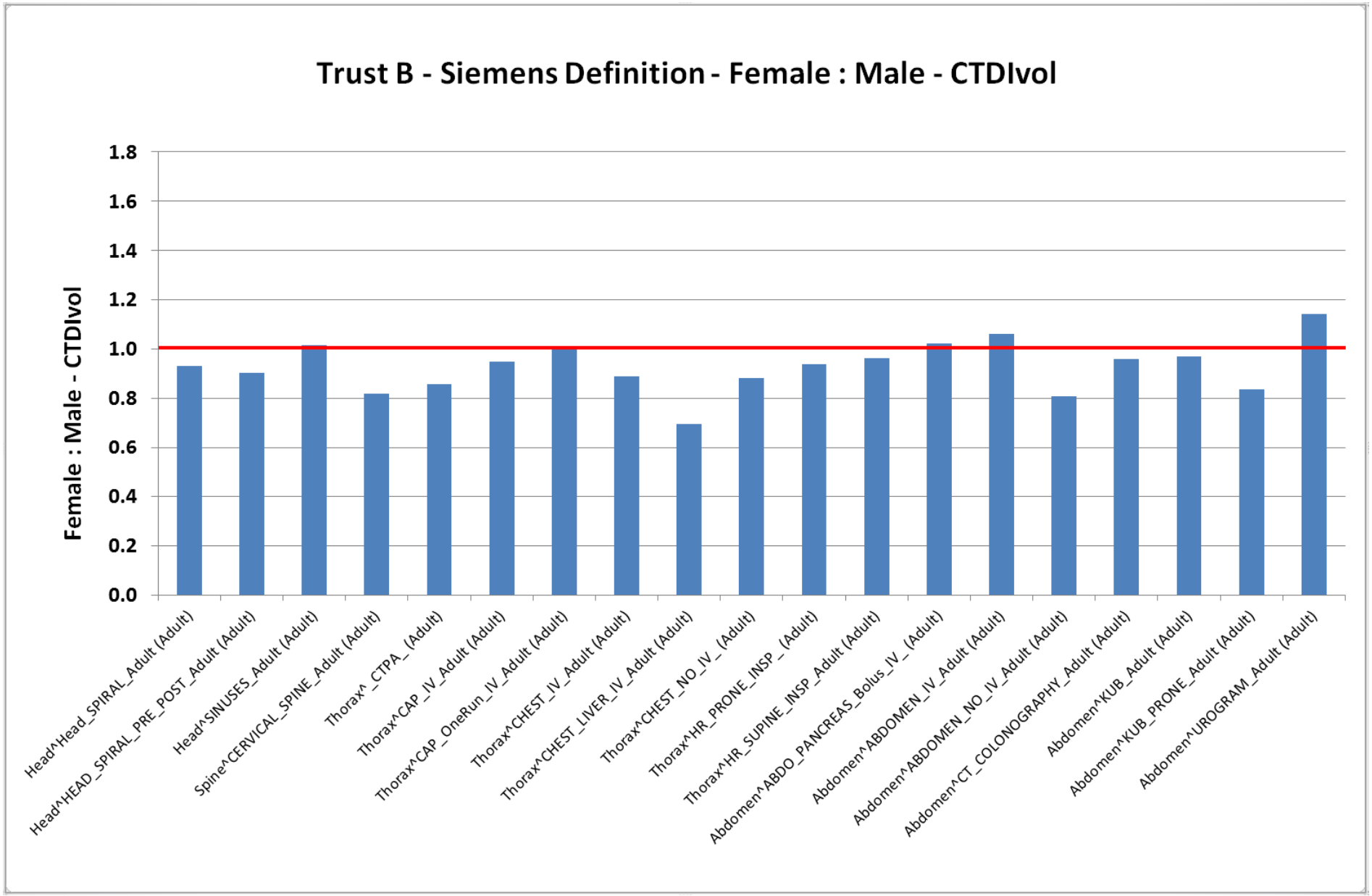

Trust A - Siemens Sensation - Female : Male - Length
Female : Male - Length
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Head^1A_BRAIN_SPIRAL (Adult)
ead^1B_BRAIN_PRE_POST_SPIRAL (Adult)
Head^1F_BRAIN_SPIRAL_DEMENTIA (Adult)
Head^2A_SINUSES (Adult)
Head^2C_PETROUS_BONES (Adult)
Head^2F_PULSE_TINN (Adult)
Neck^2Gb_NECK_WHOLE_CHEST (Adult)
Neck^2Ha_OTALGIA (Adult)
Neck^2T_CAP_AND_NECK (Adult)
Shoulder^7La_SHOULDER (Adult)
Thorax^4E_CAP_PC_BRAIN (Adult)
Thorax^4D_CAP_LOWER_NECK (Adult)
Abdomen^GI_8_CAP_Dual_Phase_liver_GI_Staging_F...
Abdomen^GI_9_CAP_Dual_Phase_liver_GI_ONC_FU...
Abdomen^URO_7_9C_STAGING_CAP (Adult)
Thorax^3A_CHEST (Adult)
Thorax^3B_HRCT_SUPINE (Adult)
Thorax^3C_HRCT_SUPINE_AND_PRONE (Adult)
Thorax^3E_LIMITEDCHEST_UPPER (Adult)
Thorax^3F_LIMITEDCHEST_LOWER (Adult)
Thorax^3G_CTPA (Adult)
Thorax^4A_CHEST_UPPER_ABDO_PELVIS (Adult)
Thorax^4C_CHEST_ABDO_PELVIS (Adult)
Abdomen^9_PNEUMO_BCSP (Adult)
Abdomen^9_PNEUMOsupine (Adult)
Abdomen^9_PNEUMOprone (Adult)
Abdomen^GI_2_Dual_Phase_Abdo_PV_AP (Adult)
Abdomen^URO_12_RENAL_CYST (Adult)
Abdomen^URO_1A_HIGH_DOSE_KUB (Adult)
Abdomen^URO_1B_LOW_DOSE_KUB (Adult)
Abdomen^URO_2_9B_UROGRAM (Adult)
Abdomen^URO_6_9D_STAGING_RENAL (Adult)
Vascular^14A_ABDOMINAL_AORTA_ANGIO (Adult)
Abdomen^GI_1a_ABDO_PEL_LOWER_GI_GEN (Adult)
Abdomen^GI_7_ABDO_PEL_GEN_ASSESSMENT (Adult)
Vascular^14C_PERIPHERAL_RUNOFF_ANGIO (Adult)
Upper Extremities^7N_WRIST (Adult)

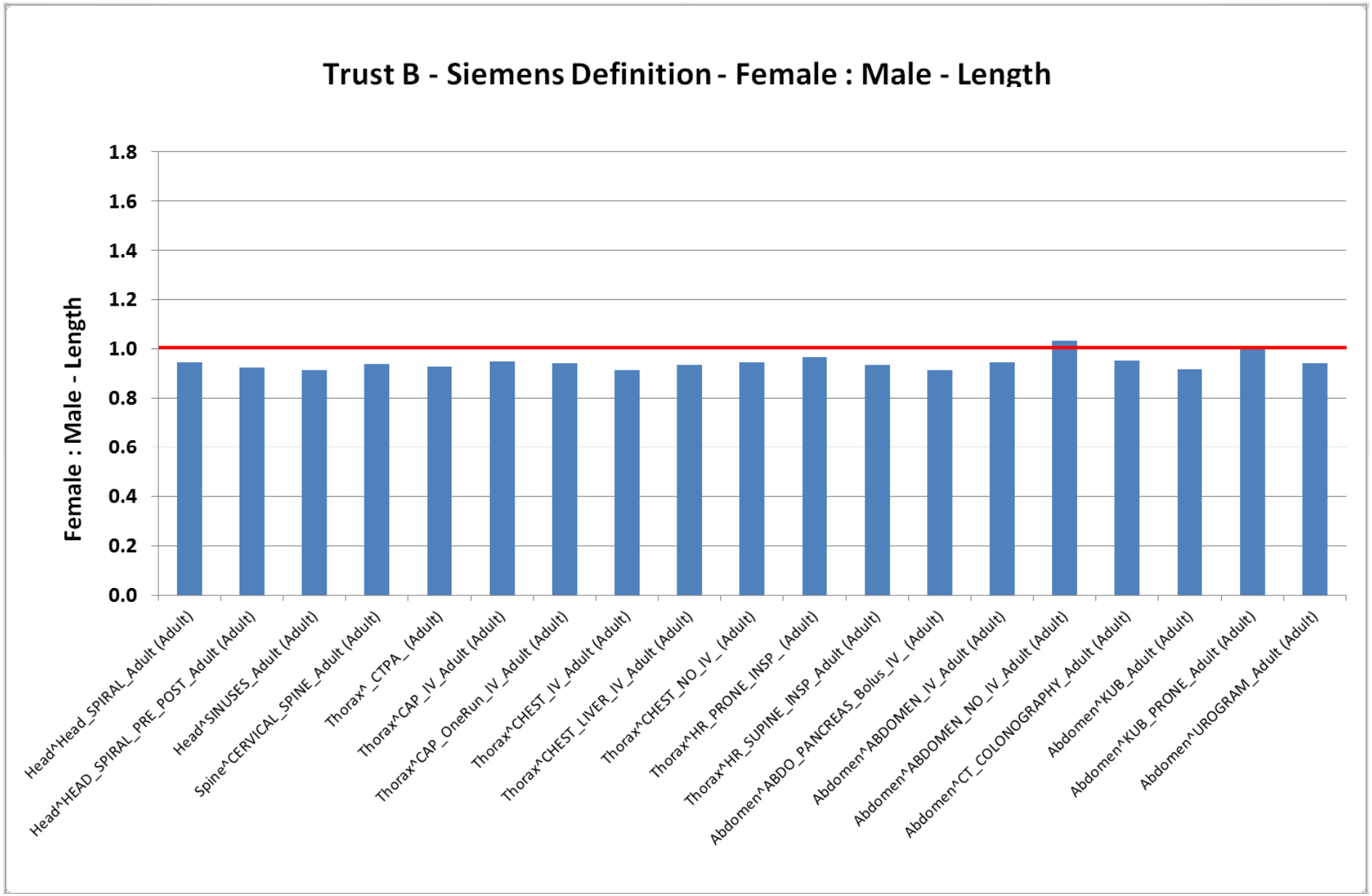

Trust B - Siemens Flash - Female : Male - DLP
Female : Male - DLP
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Head^HEAD_SPIRAL (Adult)
Head^HEAD_SPIRAL_PRE_POST (Adult)
Head^SINUSES (Adult)
Spine^CERVICAL_SPINE (Adult)
Thorax^CAP_IV (Adult)
Thorax^CAP_OneRun_IV (Adult)
Thorax^CHEST_IV (Adult)
Thorax^CHEST_NO_IV (Adult)
Thorax^CTPA (Adult)
Thorax^HR_SUPINE_INSP (Adult)
Abdomen^ABDO_OBESE_IV (Adult)
Abdomen^ABDO_PANCREAS_BOLUS_IV (Adult)
Abdomen^ABDOMEN_IV (Adult)
Abdomen^ABDOMEN_NO_IV (Adult)
Abdomen^KUB (Adult)
Abdomen^UROGRAM (Adult)
Dual Energy^DE_LOWER_LIMB_METAL (Adult)


Trust B - Siemens Flash - Female : Male - CTDIvol
Female : Male - CTDIvol
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Head^HEAD_SPIRAL (Adult)
Head^HEAD_SPIRAL_PRE_POST (Adult)
Head^SINUSES (Adult)
Spine^CERVICAL_SPINE (Adult)
Thorax^CAP_IV (Adult)
Thorax^CAP_OneRun_IV (Adult)
Thorax^CHEST_IV (Adult)
Thorax^CHEST_NO_IV (Adult)
Thorax^CTPA (Adult)
Thorax^HR_SUPINE_INSP (Adult)
Abdomen^ABDO_OBESE_IV (Adult)
Abdomen^ABDO_PANCREAS_BOLUS_IV (Adult)
Abdomen^ABDOMEN_IV (Adult)
Abdomen^ABDOMEN_NO_IV (Adult)
Abdomen^KUB (Adult)
Abdomen^UROGRAM (Adult)
Dual Energy^DE_LOWER_LIMB_METAL (Adult)


Trust B - Siemens Flash - Female : Male - Length
Female : Male - Length
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Head^HEAD_SPIRAL (Adult)
Head^HEAD_SPIRAL_PRE_POST (Adult)
Head^SINUSES (Adult)
Spine^CERVICAL_SPINE (Adult)
Thorax^CAP_IV (Adult)
Thorax^CAP_OneRun_IV (Adult)
Thorax^CHEST_IV (Adult)
Thorax^CHEST_NO_IV (Adult)
Thorax^CTPA (Adult)
Thorax^HR_SUPINE_INSP (Adult)
Abdomen^ABDO_OBESE_IV (Adult)
Abdomen^ABDO_PANCREAS_BOLUS_IV (Adult)
Abdomen^ABDOMEN_IV (Adult)
Abdomen^ABDOMEN_NO_IV (Adult)
Abdomen^KUB (Adult)
Abdomen^UROGRAM (Adult)
Dual Energy^DE_LOWER_LIMB_METAL (Adult)


Trust B - Siemens Definition - Female : Male - DLP
Female : Male - DLP
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Head^Head_SPIRAL_Adult (Adult)
Head^HEAD_SPIRAL_PRE_POST_Adult (Adult)
Head^SINUSES_Adult (Adult)
Spine^CERVICAL_SPINE_Adult (Adult)
Thorax^_CTPA_ (Adult)
Thorax^CAP_IV_Adult (Adult)
Thorax^CAP_OneRun_IV_Adult (Adult)
Thorax^CHEST_IV_Adult (Adult)
Thorax^CHEST_LIVER_IV_Adult (Adult)
Thorax^CHEST_NO_IV_ (Adult)
Thorax^HR_PRONE_INSP_ (Adult)
Thorax^HR_SUPINE_INSP_Adult (Adult)
Abdomen^ABDO_PANCREAS_Bolus_IV_ (Adult)
Abdomen^ABDOMEN_IV_Adult (Adult)
Abdomen^ABDOMEN_NO_IV_Adult (Adult)
Abdomen^CT_COLONOGRAPHY_Adult (Adult)
Abdomen^KUB_Adult (Adult)
Abdomen^KUB_PRONE_Adult (Adult)
Abdomen^UROGRAM_Adult (Adult)


Trust B - Siemens Definition - Female : Male - CTDIvol
Female : Male - CTDIvol
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Head^Head_SPIRAL_Adult (Adult)
Head^HEAD_SPIRAL_PRE_POST_Adult (Adult)
Head^SINUSES_Adult (Adult)
Spine^CERVICAL_SPINE_Adult (Adult)
Thorax^_CTPA_(Adult)
Thorax^CAP_IV_Adult (Adult)
Thorax^CAP_OneRun_IV_Adult (Adult)
Thorax^CHEST_IV_Adult (Adult)
Thorax^CHEST_LIVER_IV_Adult (Adult)
Thorax^CHEST_NO_IV_(Adult)
Thorax^HR_PRONE_INSP_(Adult)
Thorax^HR_SUPINE_INSP_Adult (Adult)
Abdomen^ABDO_PANCREAS_Bolus_IV_(Adult)
Abdomen^ABDOMEN_IV_Adult (Adult)
Abdomen^ABDOMEN_NO_IV_Adult (Adult)
Abdomen^CT_COLONOGRAPHY_Adult (Adult)
Abdomen^KUB_Adult (Adult)
Abdomen^KUB_PRONE_Adult (Adult)
Abdomen^UROGRAM_Adult (Adult)


Trust B - Siemens Definition - Female : Male - Length
Female : Male - Length
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Head^Head_SPIRAL_Adult (Adult)
Head^HEAD_SPIRAL_PRE_POST_Adult (Adult)
Head^SINUSES_Adult (Adult)
Spine^CERVICAL_SPINE_Adult (Adult)
Thorax^_CTPA_ (Adult)
Thorax^CAP_IV_Adult (Adult)
Thorax^CAP_OneRun_IV_Adult (Adult)
Thorax^CHEST_IV_Adult (Adult)
Thorax^CHEST_LIVER_IV_Adult (Adult)
Thorax^CHEST_NO_IV_ (Adult)
Thorax^HR_PRONE_INSP_ (Adult)
Thorax^HR_SUPINE_INSP_Adult (Adult)
Abdomen^ABDO_PANCREAS_Bolus_IV_ (Adult)
Abdomen^ABDOMEN_IV_Adult (Adult)
Abdomen^ABDOMEN_NO_IV_Adult (Adult)
Abdomen^CT_COLONOGRAPHY_Adult (Adult)
Abdomen^KUB_Adult (Adult)
Abdomen^KUB_PRONE_Adult (Adult)
Abdomen^UROGRAM_Adult (Adult)

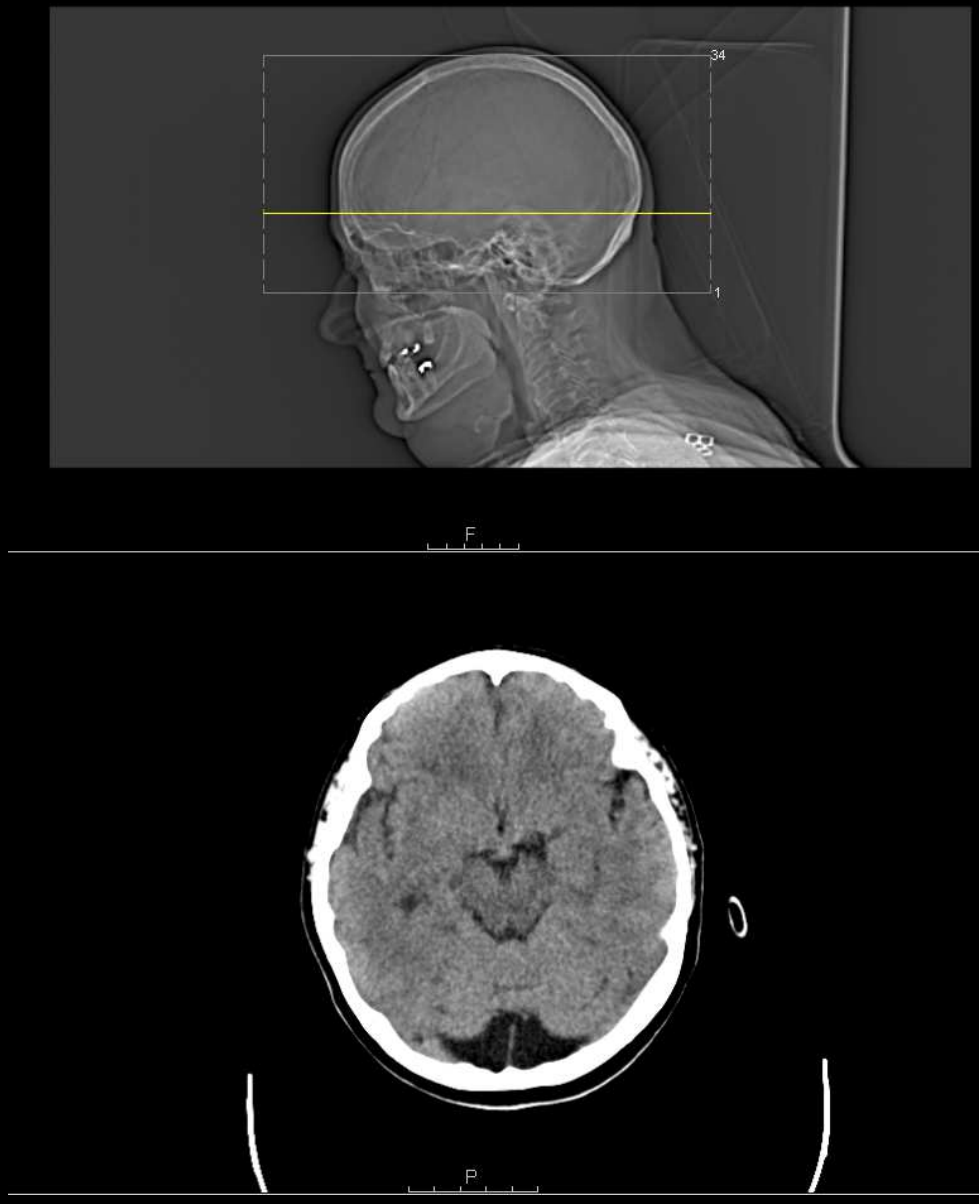
General observations:

- Study DLP approximately 10-20% lower for females
- Combined effect of lower CTDIvol and shorter scan length
- Across all four scanners on both sites
- Some exceptions with much higher dose metric ratios

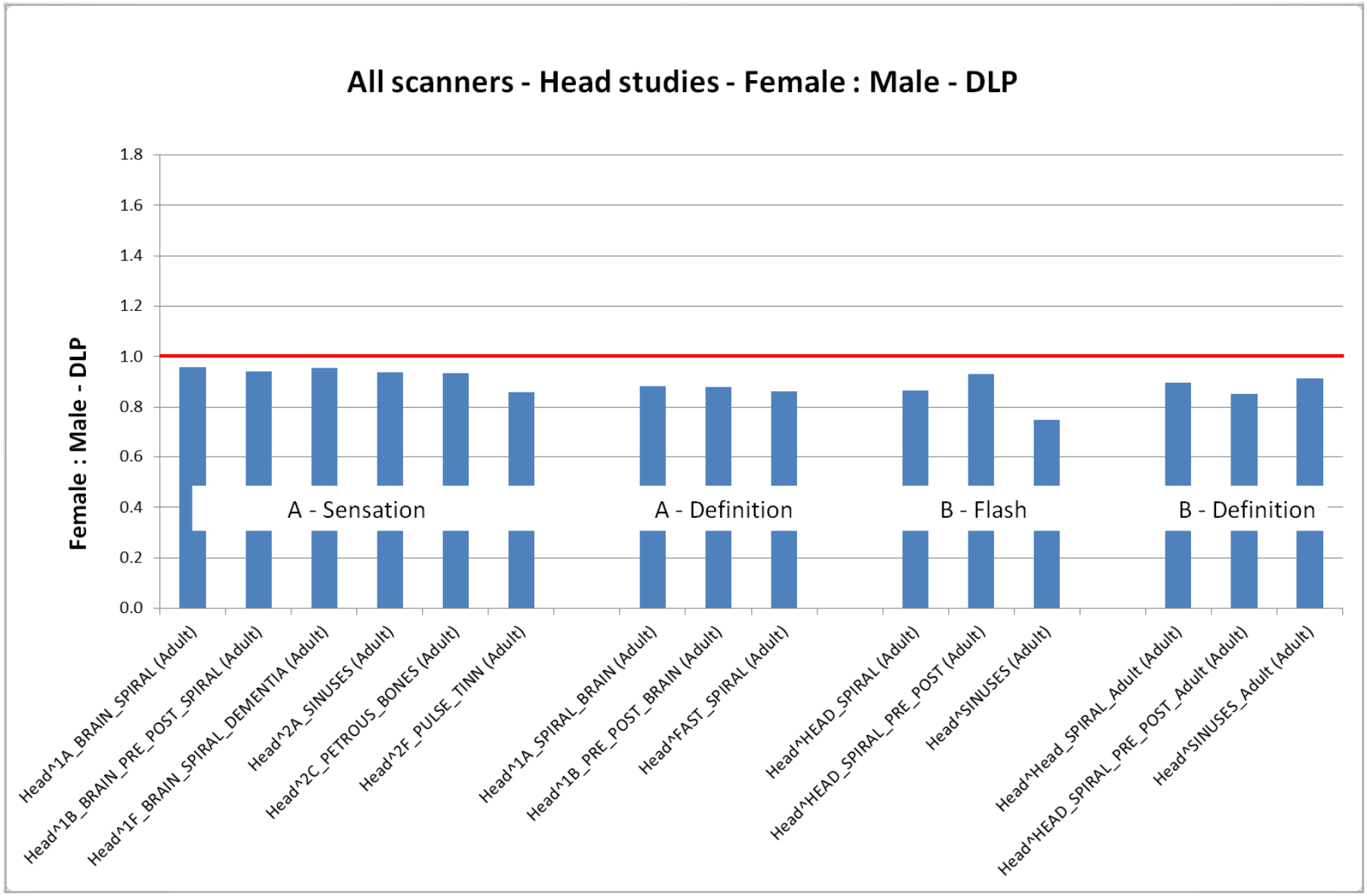
Caveats:

- Some studies with no differences between genders
- Study sample median for examined population
- No attempt to select patients by weight or habitus

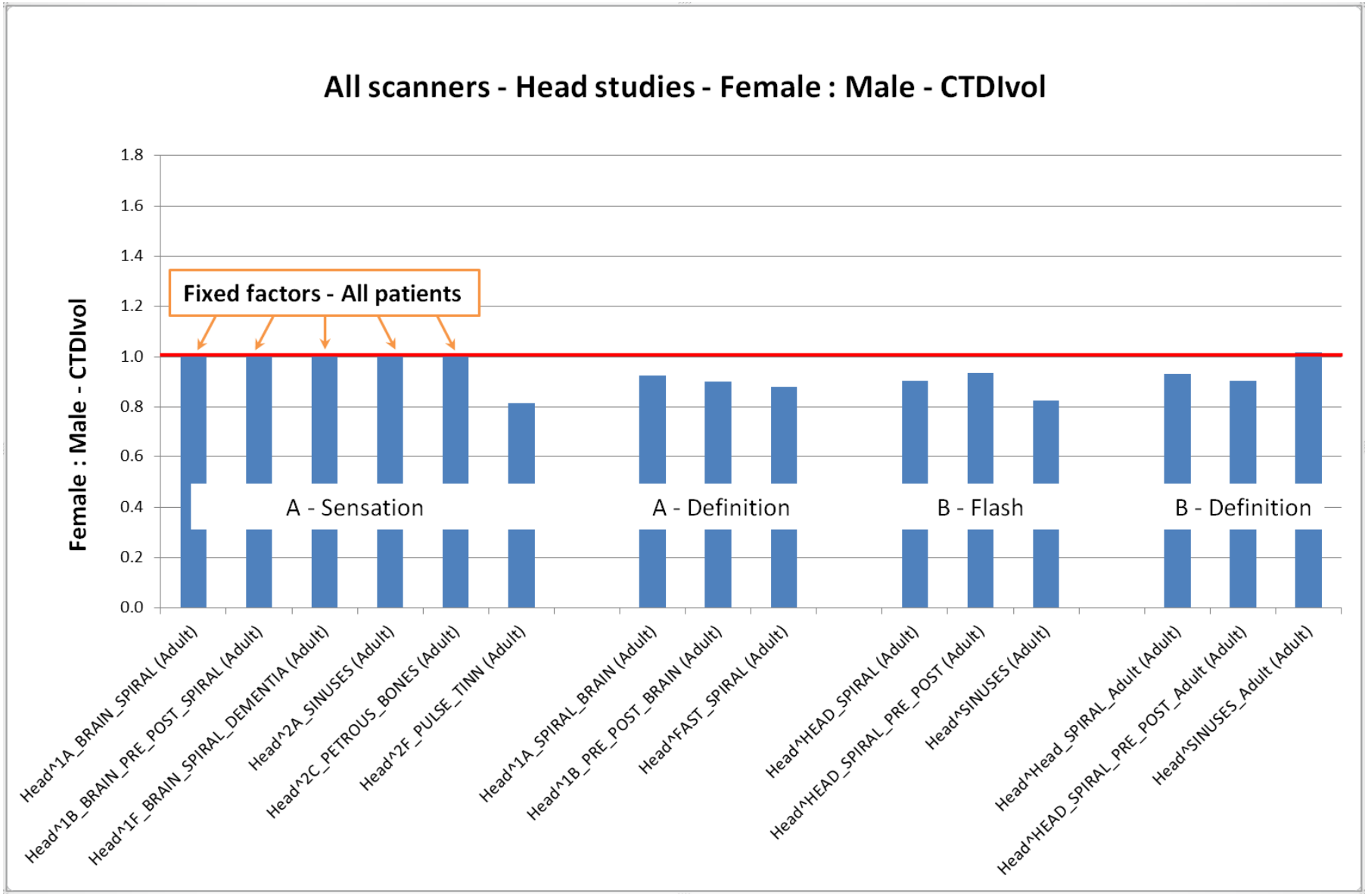
Case 1: Trust A - Siemens Sensation Heads



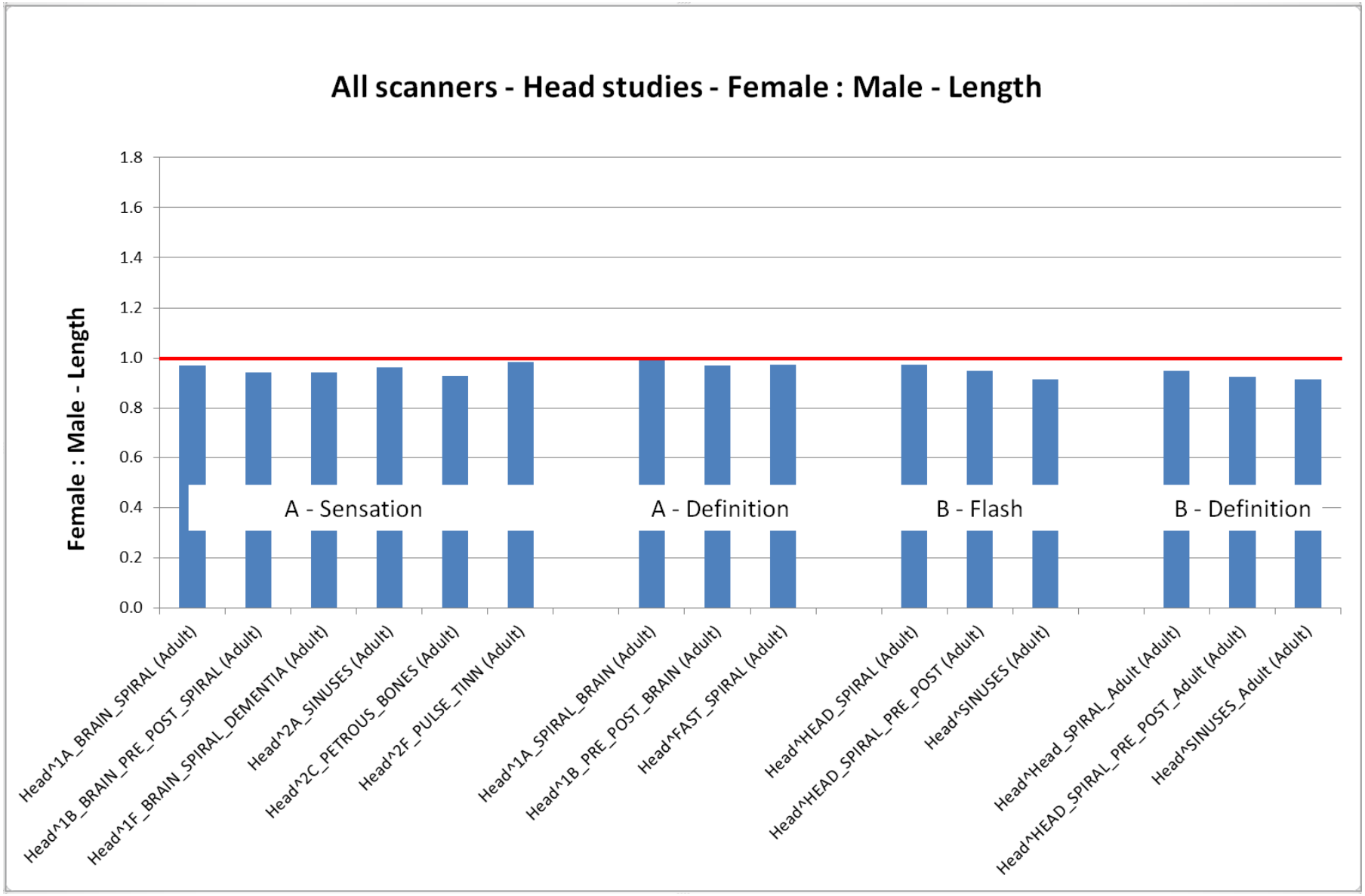
Case 1: Trust A - Siemens Sensation Heads



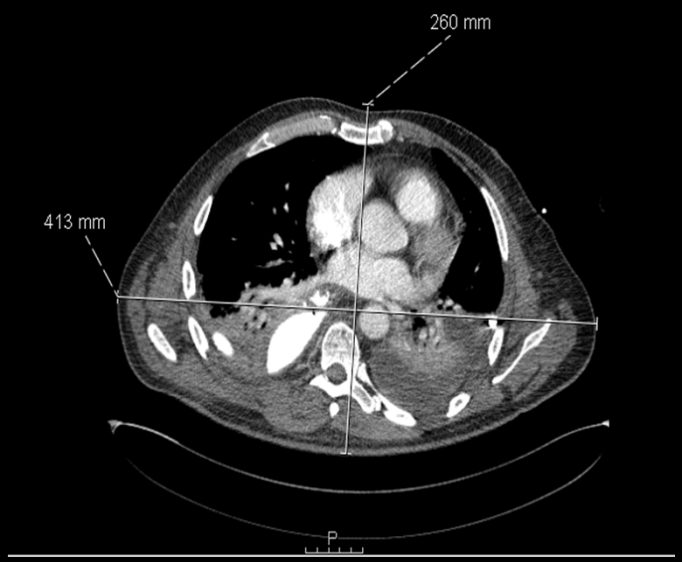
Case 1: Trust A - Siemens Sensation Heads



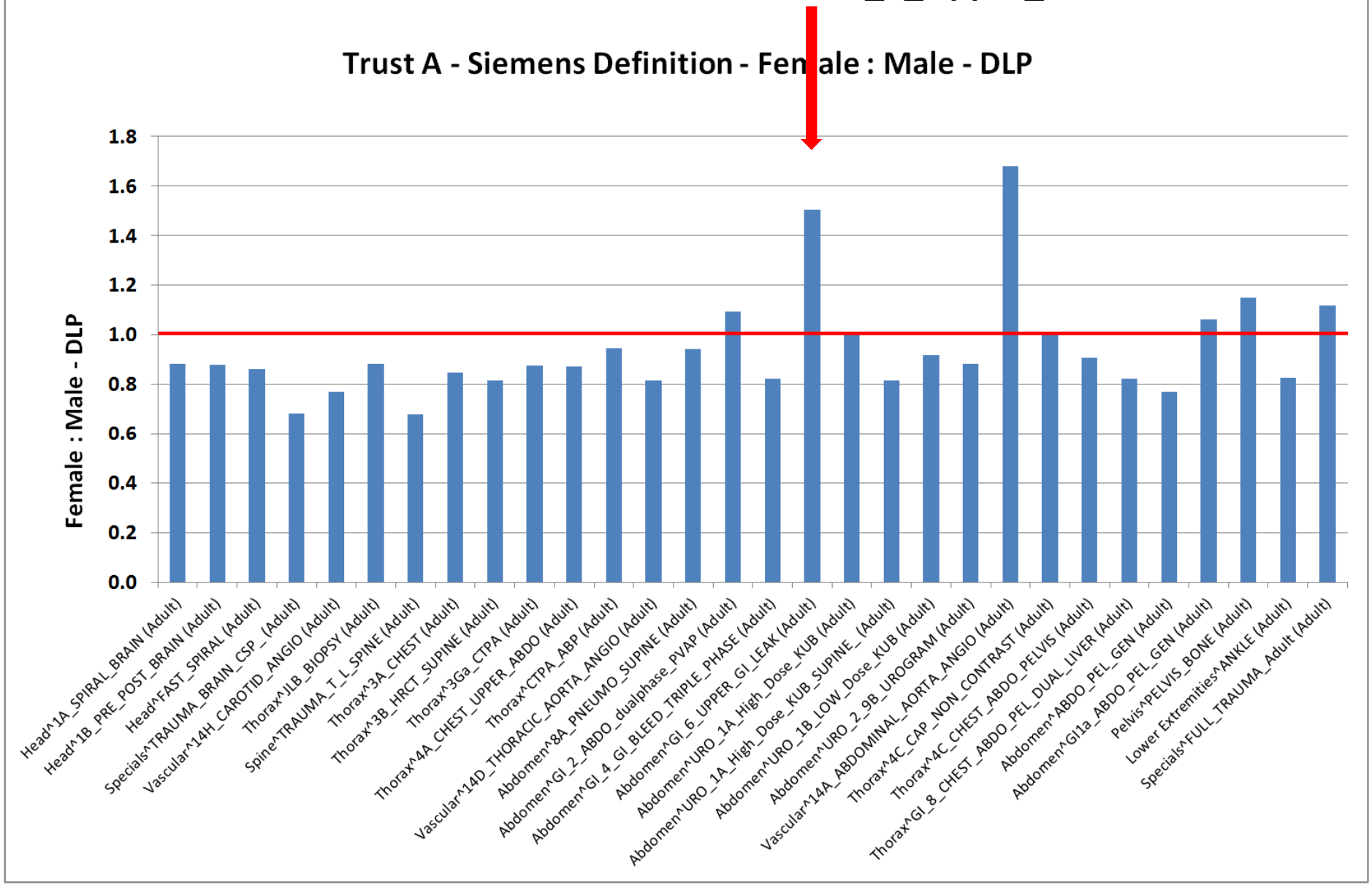
Case 1: Trust A - Siemens Sensation Heads



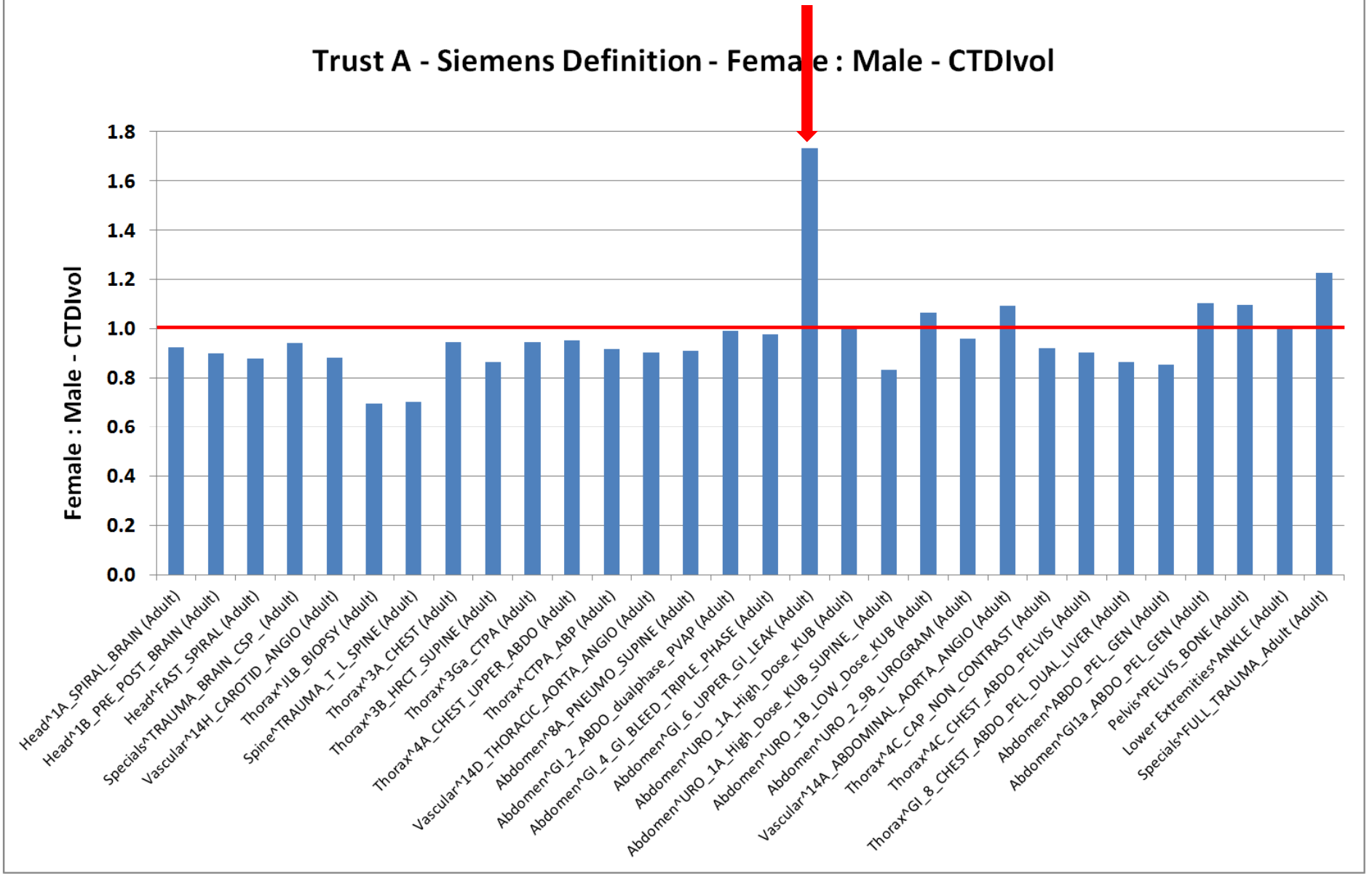
Case 2: Trust A Siemens Definition – Abdomen^GI_6_Upper_GI Leak



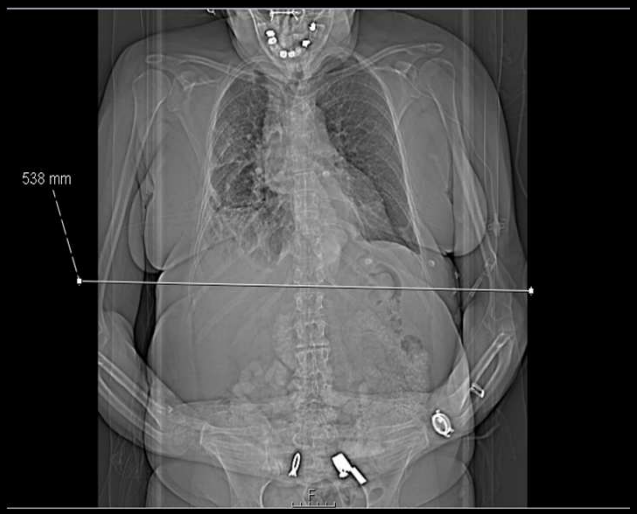
Case 2: Trust A Siemens Definition – Abdomen^GI_6_Upper_GI Leak

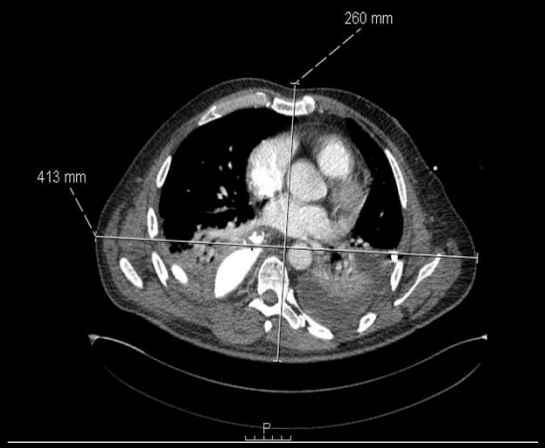


Case 2: Trust A Siemens Definition – Abdomen^GI_6_Upper_GI Leak



Case 2: Trust A Siemens Definition – Abdomen^GI_6_Upper_GI Leak





Male

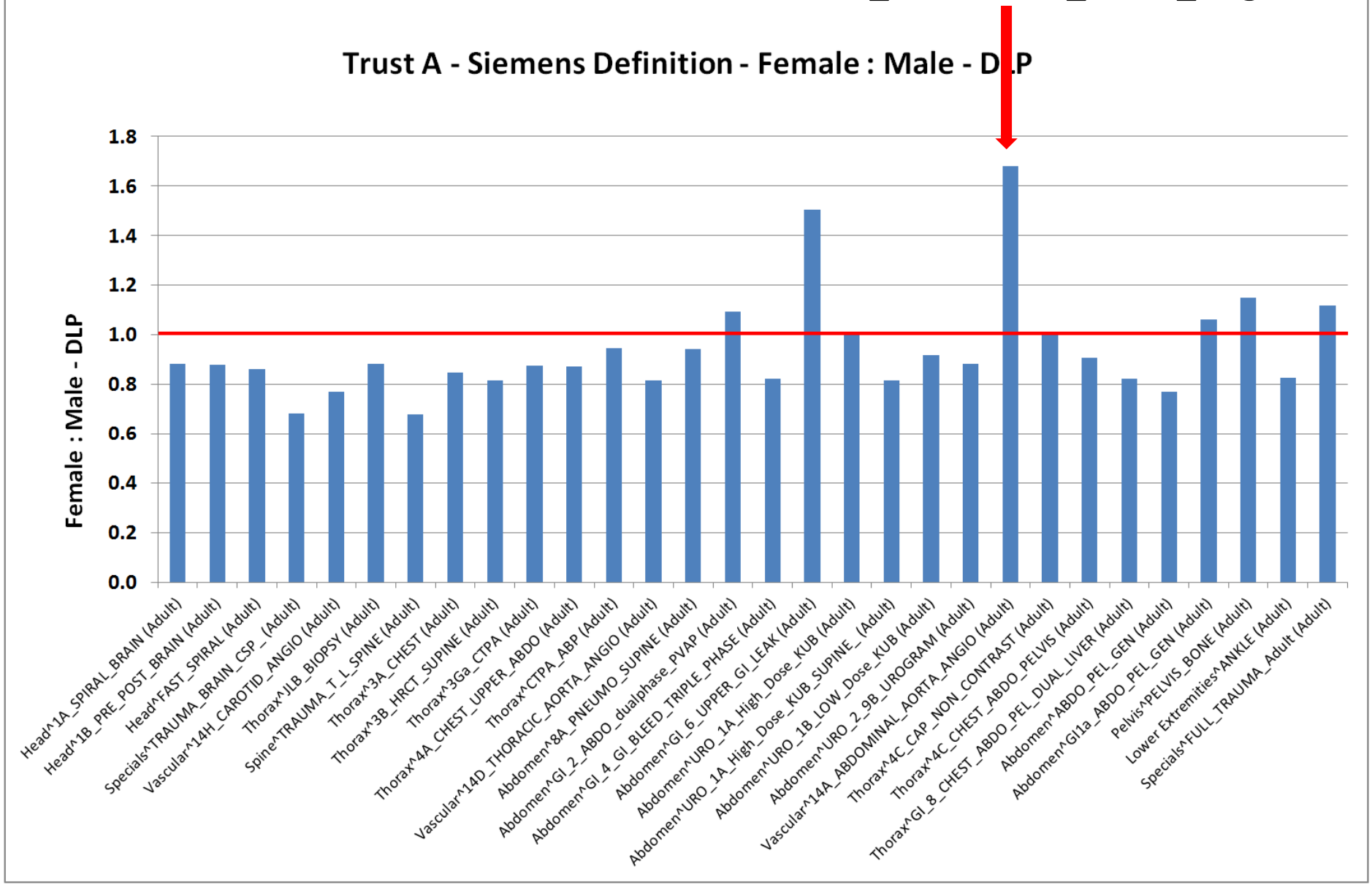
Female

2/3rds of females scanned arms down

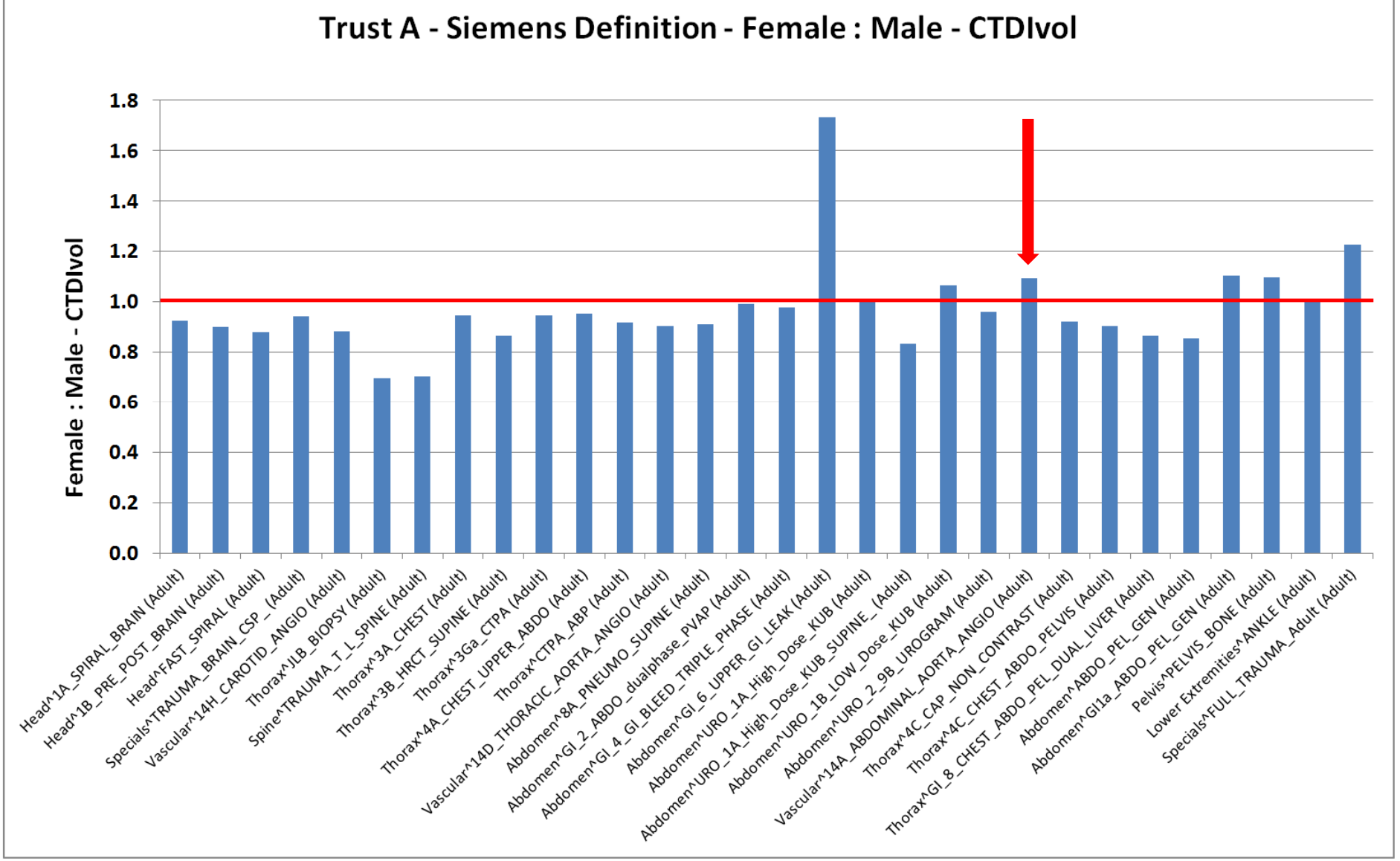
Topogram and axial reference images of male and female 'median patients'

Case 3: Trust A Siemens Definition – Vascular^14A_Abdominal_Aorta_Angio

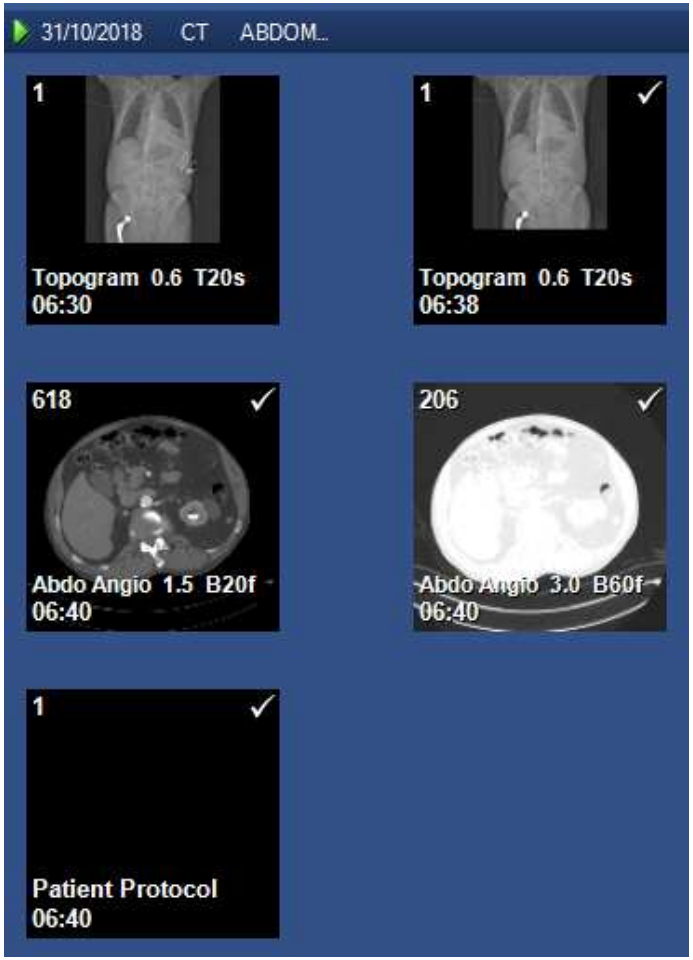
Case 3: Trust A Siemens Definition – Vascular^14A_Abdominal_Aorta_Angio



Case 3: Trust A Siemens Definition – Vascular^14A_Abdominal_Aorta_Angio

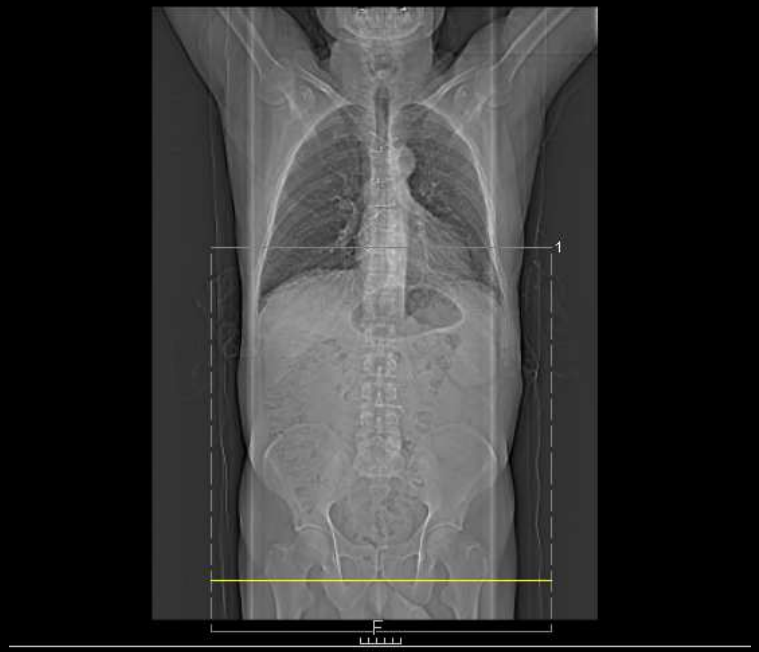


Case 3: Trust A Siemens Definition – Vascular^14A_Abdominal_Aorta_Angio

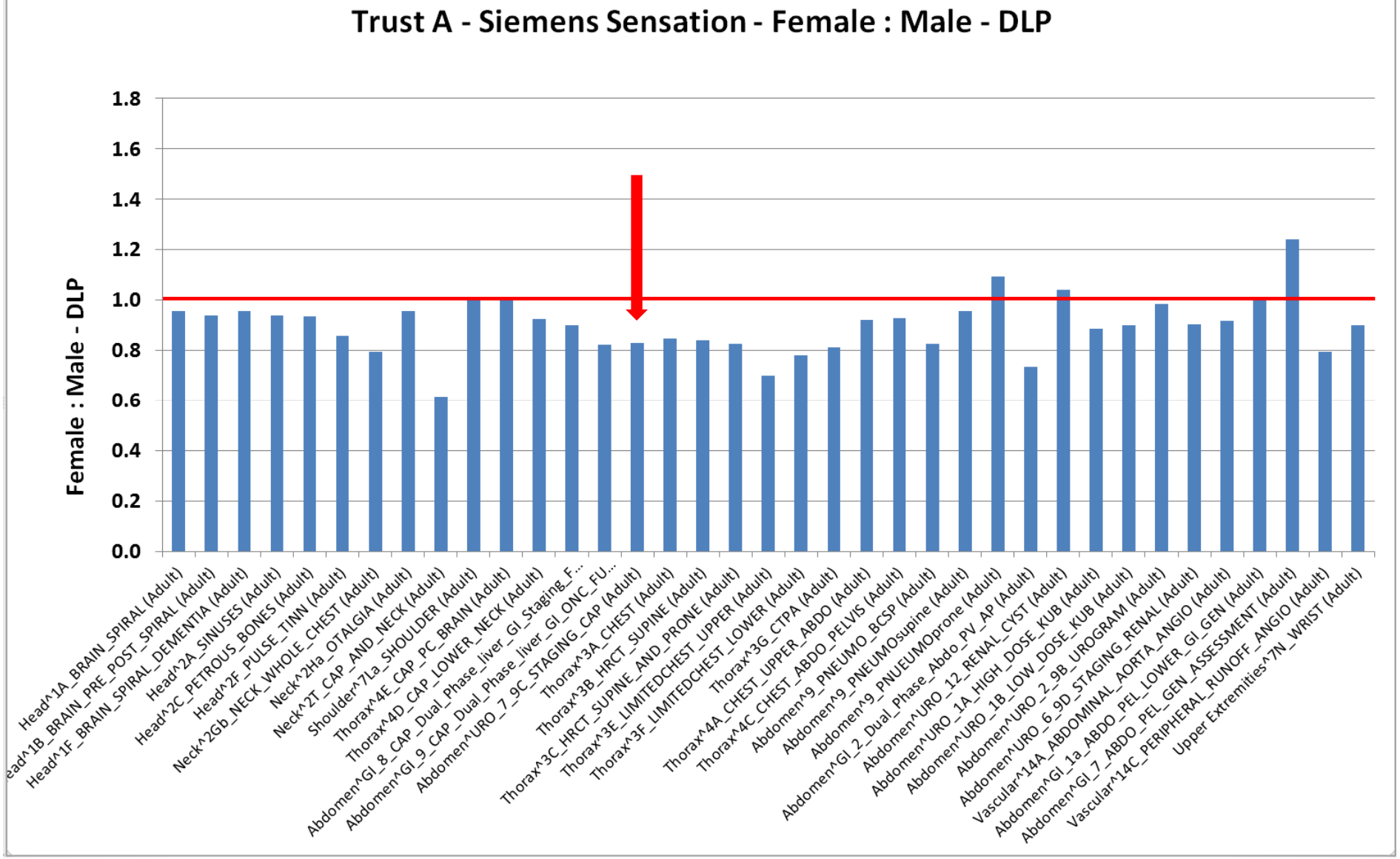


I in 4 females had an additional spiral Abdomen scan (off-protocol variant ?)

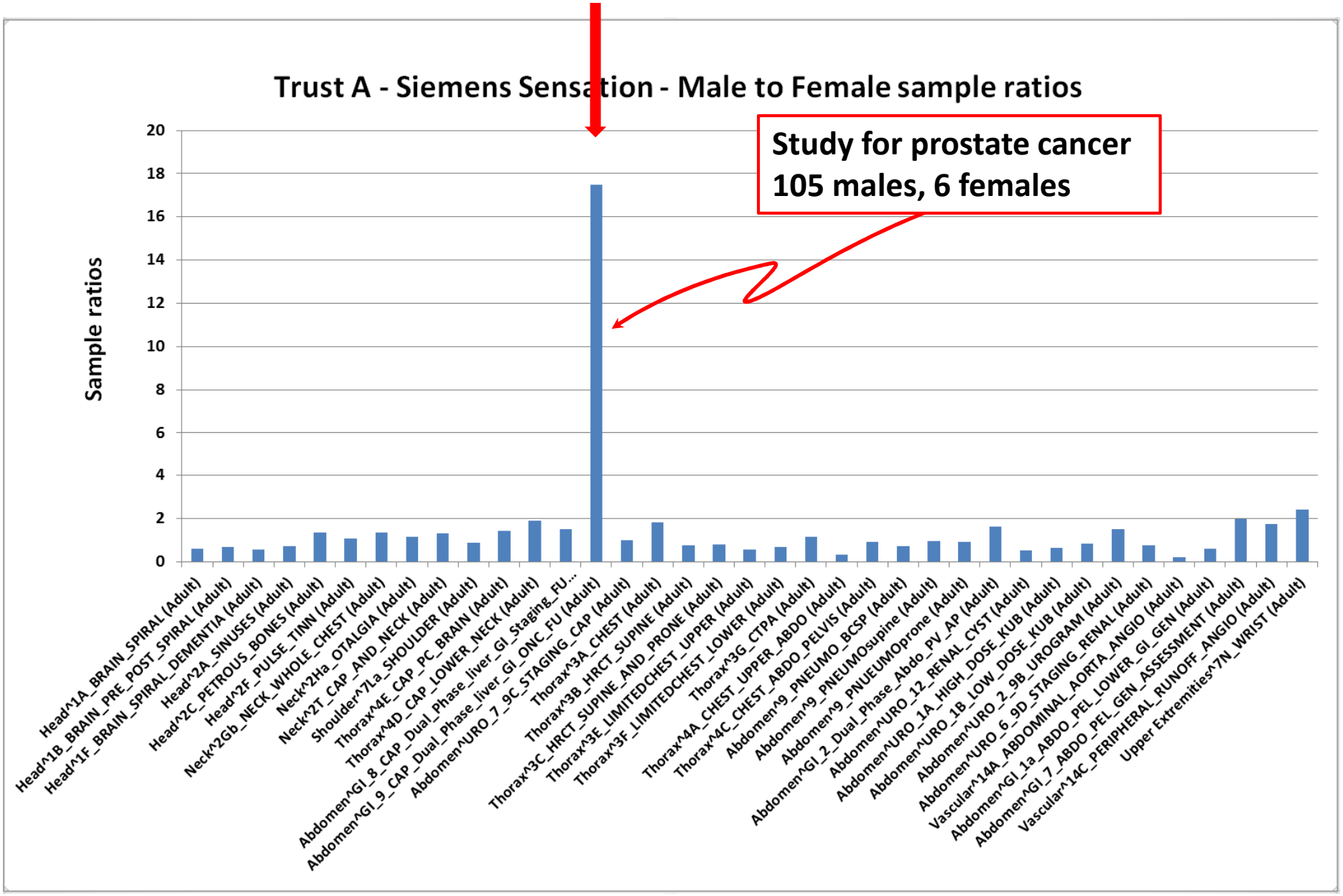
Case 4: Trust A Siemens Sensation – Adbomen^Uro_7_9C_Staging_CAP

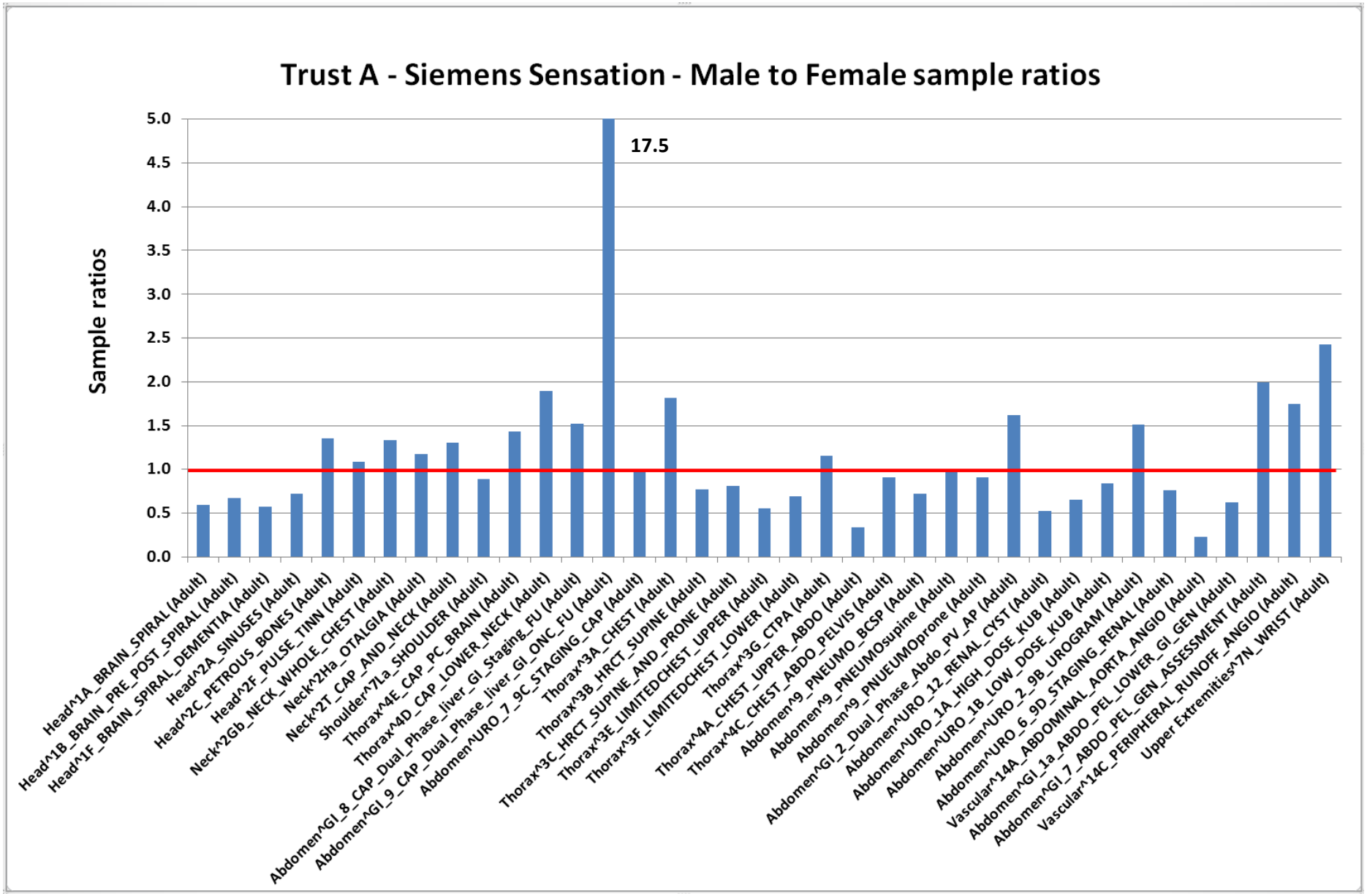


Case 4: Trust A Siemens Sensation – Adbomen^Uro_7_9C_Staging_CAP



Case 4: Trust A Siemens Sensation – Adbomen^Uro_7_9C_Staging_CAP




Trust A - Siemens Sensation - Male to Female sample ratios
Sample ratios
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
17.5
Head^1A_BRAIN_SPIRAL (Adult)
Head^1B_BRAIN_PRE_POST_SPIRAL (Adult)
Head^1F_BRAIN_SPIRAL_DEMENTIA (Adult)
Head^2A_SINUSES (Adult)
Head^2C_PETROUS_BONES (Adult)
Head^2F_PULSE_TINN (Adult)
Neck^2Gb_NECK_WHOLE_CHEST (Adult)
Neck^2Ha_OTALGIA (Adult)
Neck^2T_CAP_AND_NECK (Adult)
Shoulder^7La_SHOULDER (Adult)
Thorax^4E_CAP_PC_BRAIN (Adult)
Thorax^4D_CAP_LOWER_NECK (Adult)
Abdomen^GI_8_CAP_Dual_Phase_liver_GI_Staging_FU (Adult)
Abdomen^GI_9_CAP_Dual_Phase_liver_GI_ONC_FU (Adult)
Abdomen^URO_7_9C_STAGING_CAP (Adult)
Thorax^3C_HRCT_SUPINE_AND_PRONE (Adult)
Thorax^3A_CHEST (Adult)
Thorax^3B_HRCT_SUPINE (Adult)
Thorax^3E_LIMITEDCHEST_UPPER (Adult)
Thorax^3F_LIMITEDCHEST_LOWER (Adult)
Thorax^3G_CTPA (Adult)
Thorax^4A_CHEST_UPPER_ABDO (Adult)
Thorax^4C_CHEST_ABDO_PELVIS (Adult)
Abdomen^9_PNEUMO_BCSP (Adult)
Abdomen^9_PNEUMOsupine (Adult)
Abdomen^9_PNEUMOprone (Adult)
Abdomen^GI_2_Dual_Phase_Abdo_PV_AP (Adult)
Abdomen^URO_12_RENAL_CYST (Adult)
Abdomen^URO_1A_HIGH_DOSE_KUB (Adult)
Abdomen^URO_1B_LOW_DOSE_KUB (Adult)
Abdomen^URO_2_9B_UROGRAM (Adult)
Abdomen^URO_6_9D_STAGING_RENAL (Adult)
Vascular^14A_ABDOMINAL_AORTA_ANGIO (Adult)
Abdomen^GI_1a_ABDO_PEL_LOWER_GI_GEN (Adult)
Abdomen^GI_7_ABDO_PEL_GEN_ASSESSMENT (Adult)
Vascular^14C_PERIPHERAL_RUNOFF_ANGIO (Adult)
Upper Extremities^7N_WRIST (Adult)

Summary

Gender based analysis;

- Useful additional tool in the optimisation toolbox ?
- Identify cases which depart from the norm ?
- Reveal ‘potential bias’ in dose metrics ?
- Illustrate potential improvements from changes in protocol ?
- Differences more significant according to AEC ?

If accept that gender influences audit metrics;

- Should samples be matched in preparation for analysis ?
- Knowing M & F dose metrics may be helpful with future results ?
- Knowing M:F ratios may be helpful in interpreting future results ?

Thank you for listening

CTUG, Birmingham
October 2019