

Prevalence and Evolution of Fat Atrophy and Fat Deposition in a Cohort of HIV-Infected Men and Women



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Objectives



- **Define Fat Atrophy (FA) and Fat Deposition (FD) using anthropometrics that are applicable to clinical settings**
- **Determine the prevalence of FA among non-wasted and FD among non-overweight/non-obese**
- **Identify demographic, clinical and laboratory correlates of FA & FD**
- **Evaluate the evolution of FA and FD over one year of follow-up**

Background for Lipodystrophy

- **HIV- associated Lipodystrophy Syndrome (HALS) - 4 syndromes**
- **1) Fat deposition (FD) - visceral**
- **2) Fat atrophy (FA) - subcutaneous**
- **3) Hyperlipidemia - cholesterol and triglycerides**
- **4) Glucose intolerance - elevated insulin, abnormal glucose tolerance**

- **Risk factors for HALS**
- **PI use/duration: Assoc. with fat deposition, ↑ lipids & glucose intolerance**
- **NRTI use (D4T) /duration: Associated with FA & ? mitochondrial toxicity**
- **Increased Age**
- **Severity &/or duration of HIV infection, prolonged, advanced HIV**
- **Greater change in viral load or CD4 count with therapy**
- **Gender, ethnicity (? Caucasians)**
- **Premorbid body weight, weight change, low BMI (FA), high BMI (FD)**

Nutrition for Healthy Living Cohort (NFHL)



- **Longitudinal study of nutritional aspects of HIV disease among HIV-positive adult men and women**
- **Clinical, laboratory, and nutritional data collected semi-annually**
- **n = 375 with ≥ 1 waist to hip ratio measurement**
- **Between Nov 1998 and August 2001**

Measurement of Anthropometrics

- **Measurements by trained, monitored personnel**
- **Body mass index (BMI) = weight/ height² (kg/m²)**
- **Triceps skinfold on back of arm (mm)**
- **Waist to hip ratio**
 - At natural waist indentation, end of normal expiration**
 - Without clothing, tape measure, light contact with skin**

Definition of Fat Atrophy (FA)

**Among non-wasted only
(BMI \geq 20 kg/m²)**

Fat Atrophy (FA+)

■ triceps skin fold < 10% of norms for sex and age

No Fat atrophy (FA-)

■ triceps skin fold \geq 10% of norms for sex and age

Definition of Fat Deposition

**Among non-overweight and non-obese only
(BMI < 28 kg/m²)**

Fat Deposition (FD+)

- waist-hip ratio > 0.95 for men and > 0.90 for women

No Fat Deposition (FD-)

- waist-hip ratio < 0.95 for men and < 0.90 for women

Definition of Mixed Syndrome (Mixed)

**Among normal BMI only
(BMI \geq 20 kg/m² and $<$ 28 kg/m²)**

Mixed Syndrome (FA+ and FD+)

- waist-hip ratio $>$ 0.90 for women and $>$ 0.95 for men
and
- triceps skinfold $<$ 10% on norms for age and sex

No Mixed Syndrome (No mixed)




- waist-hip ratio $<$ 0.90 for women and $<$ 0.95 for men
and/or
- triceps skinfold $>$ 10% on norms for age and sex

Definition of Evolution of FA, FD and Mixed

Among participants with 2 waist-hip ratio measurements 10-12 months apart

Time 0

~ One year later

- | | | |
|----------------------------|--|-------------------------------|
| 1. FA+ vs. FA- |  | FA+ vs. FA- vs. wasted |
| 2. FD+ vs. FD- |  | FD+ vs. FD- vs. obese |
| 3. Mixed+ vs. other |  | Mixed+ vs. other |

Predictors



Demographics

Current antiretrovirals

Any HAART use

HAART use with protease inhibitors (HAART-PI)

Non-nucleoside reverse transcriptase inhibitors (NNRTI)

D4T

Duration of HAART use

Symptoms last 30 days (diarrhea, loss of appetite)

Laboratory

CD4 (current, lowest, highest minus lowest ever), CD8, HIV viral load

(current, highest minus lowest ever), triglycerides, albumin

Caloric intake (3 day food record),

Resting energy expenditure (REE)

General health (0-3 scale)

Statistical Analysis

Correlates of FA and FD - Cross-sectional

- **Bivariate *** **Kruskal-Wallis test, Fisher's exact test**
- **Multivariate **** **Logistic regression (outcome= FA or FD)**

Evolution of FA, FD, Mixed

- **Percent change in FA, FD or Mixed over 1 year**

* **Non-missings on demographics, triceps skinfold, waist-hip ratio, CD4, CD8, HAART**

* * **Complete case analysis**

Characteristics of Cohort Men (n=261) and Women (n=114)

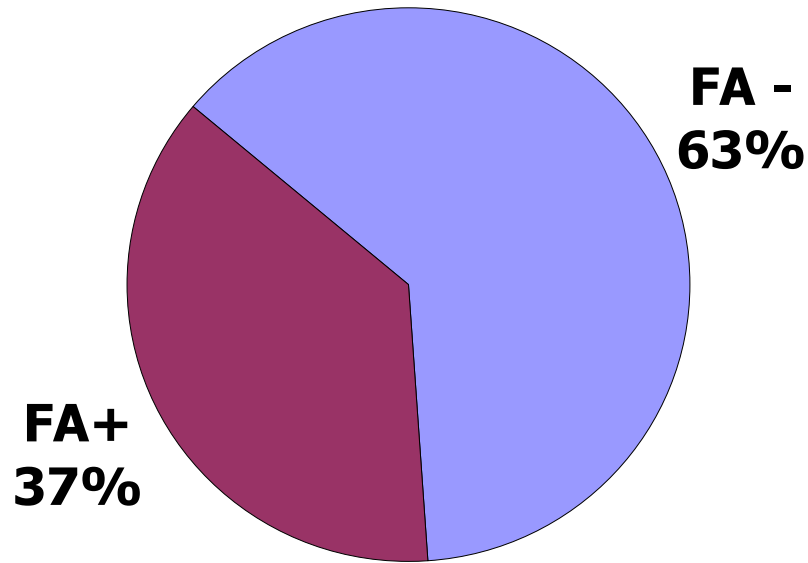
| Characteristic | | Men | Women |
|--------------------------|-------------------------|-------------|-------------|
| | | % | % |
| Race | White | 67.4 | 36.8 |
| | African American | 21.1 | 47.4 |
| | Other | 11.5 | 15.8 |
| Impoverished | | 42.9 | 75.4 |
| Symptoms | Diarrhea | 47.7 | 61.1 |
| Current treatment | Any HAART | 73.9 | 62.3 |
| | HAART-NNRTI | 8.0 | 17.3 |
| | HAART-PI | 65.9 | 45.0 |
| | D4T | 43.3 | 36.8 |
| BMI | <20 | 7.3 | 12.3 |
| | 20-27.9 | 70.5 | 56.1 |
| | ≥ 28 | 22.1 | 31.5 |

Characteristics of cohort

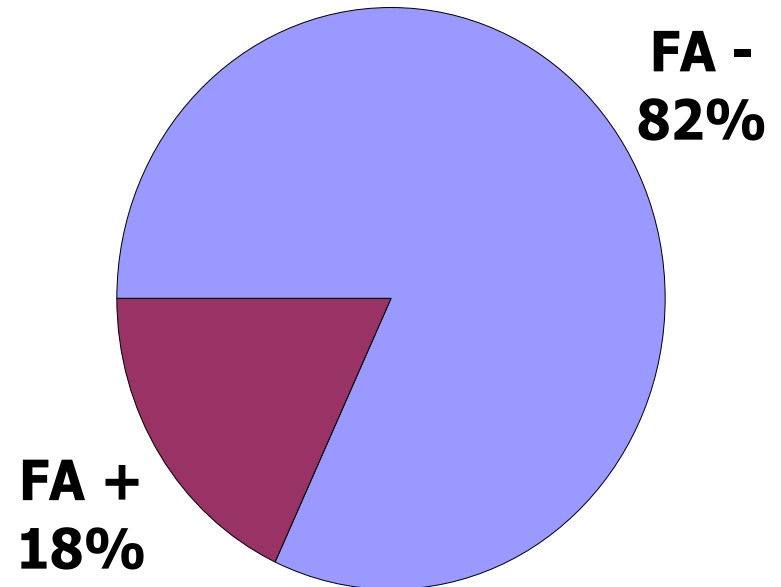
Men (n=261) and Women (n=114)

| Characteristic | Men | Women |
|--|--------|--------|
| | Median | Median |
| Age (years) | 42.6 | 38.9 |
| Years known HIV+ | 8.5 | 7.7 |
| Duration of HAART use (months) | 18.1 | 12.0 |
| Triglycerides (mg/dL) | 174 | 128 |
| Albumin (gm/dL) | 4.3 | 4.0 |
| CD4 count (cells/mm ³) | 383 | 501 |
| Lowest CD4 count (cells/mm ³) | 257 | 321 |
| Highest minus lowest CD4 (cells/mm ³) | 178 | 161 |
| HIV viral load (log ₁₀) | 3.1 | 2.3 |
| Highest minus lowest viral load (log ₁₀) | 1.1 | 0.7 |
| Caloric intake/ body weight (kcal/day/kg) | 37.4 | 31.7 |
| Caloric expenditure (kcal/day/kg) | 33.0 | 31.8 |
| REE/kg (kcal/day/kg) | 25.8 | 25.6 |
| General health | 3 | 3 |

Prevalence of Fat Atrophy among BMI \geq 20

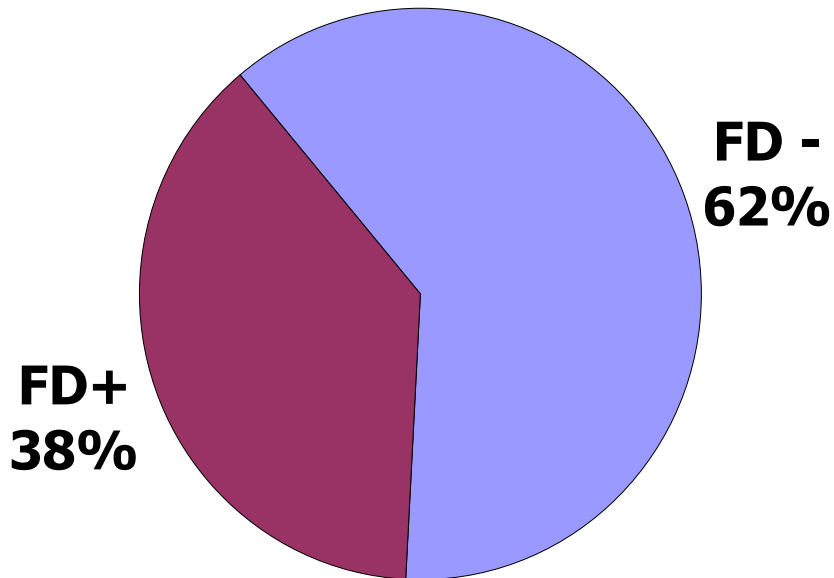


Men (n= 242)

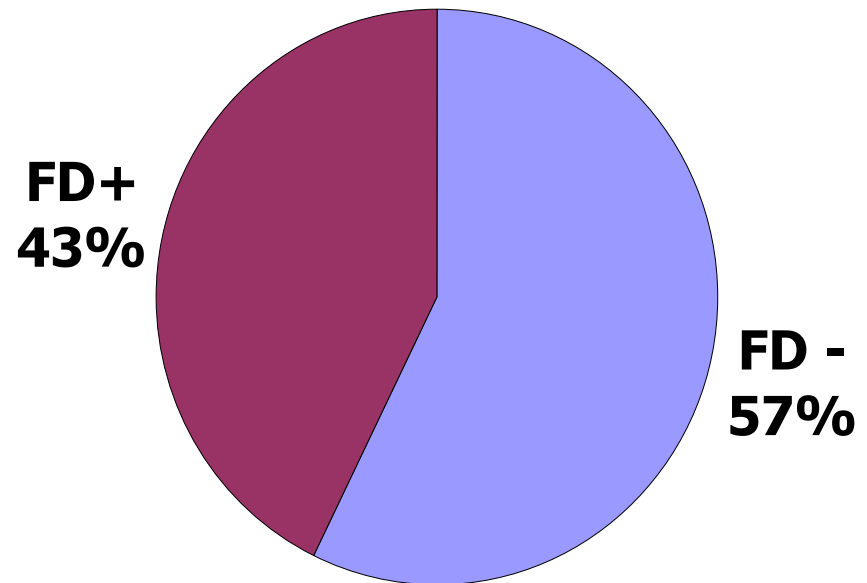


Women (n=100)

Prevalence of Fat Deposition among BMI < 28

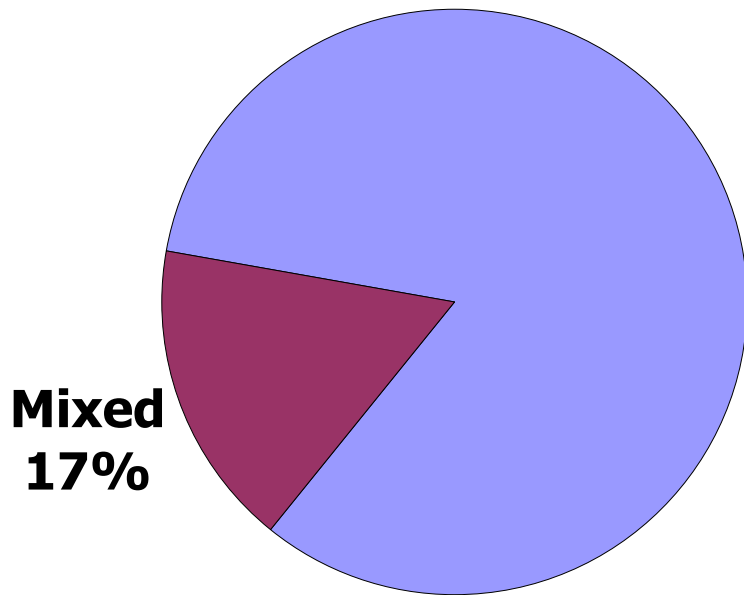


Men (n=203)

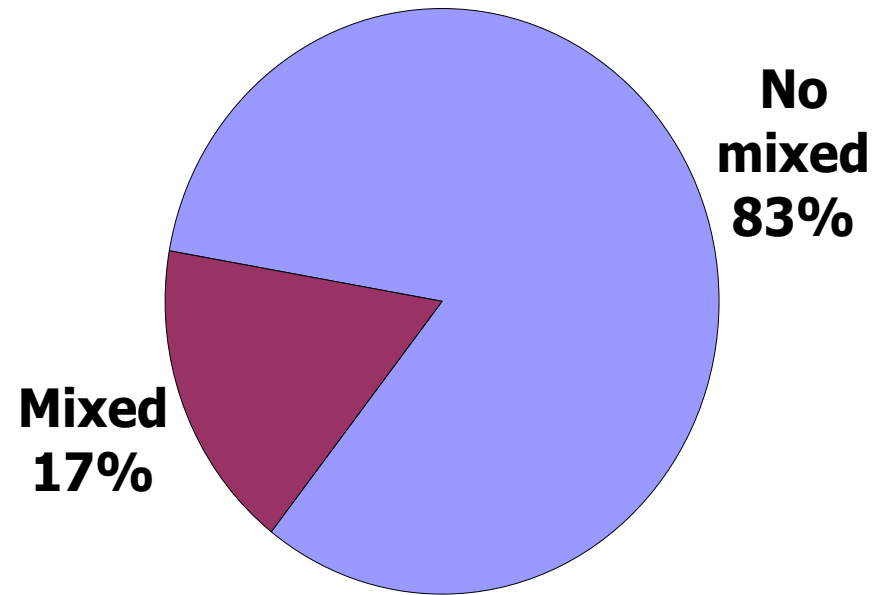


Women (n=77)

Prevalence of Mixed Syndrome among BMI 20- 27.9



Men (n= 184)



Women (n=64)

Men - Predictors of Fat Atrophy

Multivariate analysis

| Characteristic | Adjusted Odds Ratio | 95% CI | P |
|---|---------------------|------------|-------|
| Diarrhea in last 30 days | 2.0 | 1.04, 3.8 | 0.04 |
| Current D4T use | 2.1 | 1.1, 4.0 | 0.02 |
| Increased caloric intake (kcal/day/kg) | 1.03 | 1.01, 1.06 | 0.01 |
| Increased REE (kcal/day/kg) | 1.2 | 1.04, 1.3 | 0.008 |
| Decreased general health | 0.7 | 0.5, 0.9 | 0.02 |

Women -Predictors of Fat Atrophy

Multivariate analysis

| Characteristic | Adjusted Odds Ratio | 95% CI | P |
|-----------------------------------|------------------------|------------|-------|
| Increased HAART duration (mos) | 1.0 | 0.996, 1.1 | 0.07 |
| Increased REE (kcal/day/kg) | 1.3 | 1.1, 1.5 | 0.007 |

Men - Predictors of Fat Deposition

Multivariate analysis

| Characteristic | Adjusted Odds Ratio | 95% CI | P |
|---|---------------------|------------|--------|
| Race | | | |
| White | 1.0 | Ref. | |
| African American | 0.09 | 0.02, 0.3 | 0.0004 |
| Other | 0.8 | 0.3, 2.1 | 0.60 |
| Current HAART use | 4.1 | 1.6, 10.4 | 0.003 |
| Increased age (years) | 1.1 | 1.01, 1.1 | 0.01 |
| Greater change in CD4 | 1.1 | 0.99, 1.2 | 0.08 |
| Decreased caloric intake (kcal/day/kg) | 0.96 | 0.93, 0.99 | 0.02 |

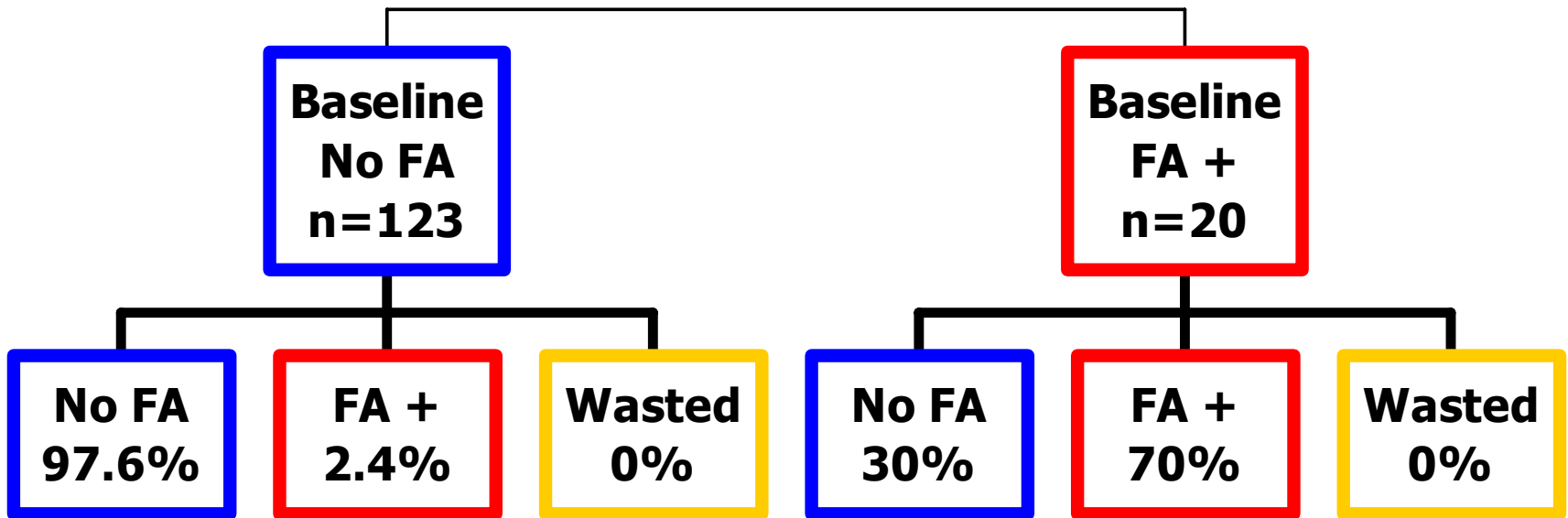
Women - Predictors of Fat Deposition

Multivariate analysis

| Characteristic | Adjusted Odds Ratio | 95% CI | P |
|---|---------------------|------------|-------|
| Increased age (years) | 1.1 | 0.98, 1.2 | 0.12 |
| Increased years known HIV+ | 1.3 | 1.1, 1.5 | 0.009 |
| Greater change in CD4 | 1.2 | 0.97, 1.4 | 0.09 |
| Decreased caloric intake (kcal/day/kg) | 0.94 | 0.89, 0.99 | 0.02 |

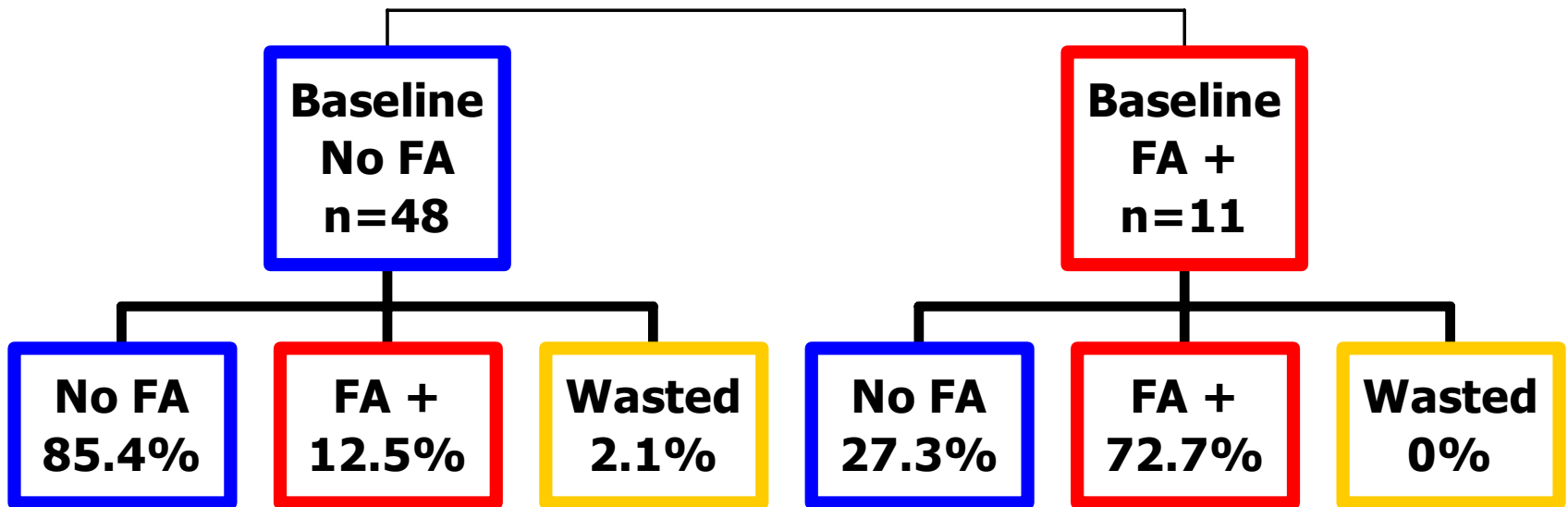
Evolution of Fat Atrophy (FA) over one year - Men

Men (n=143)

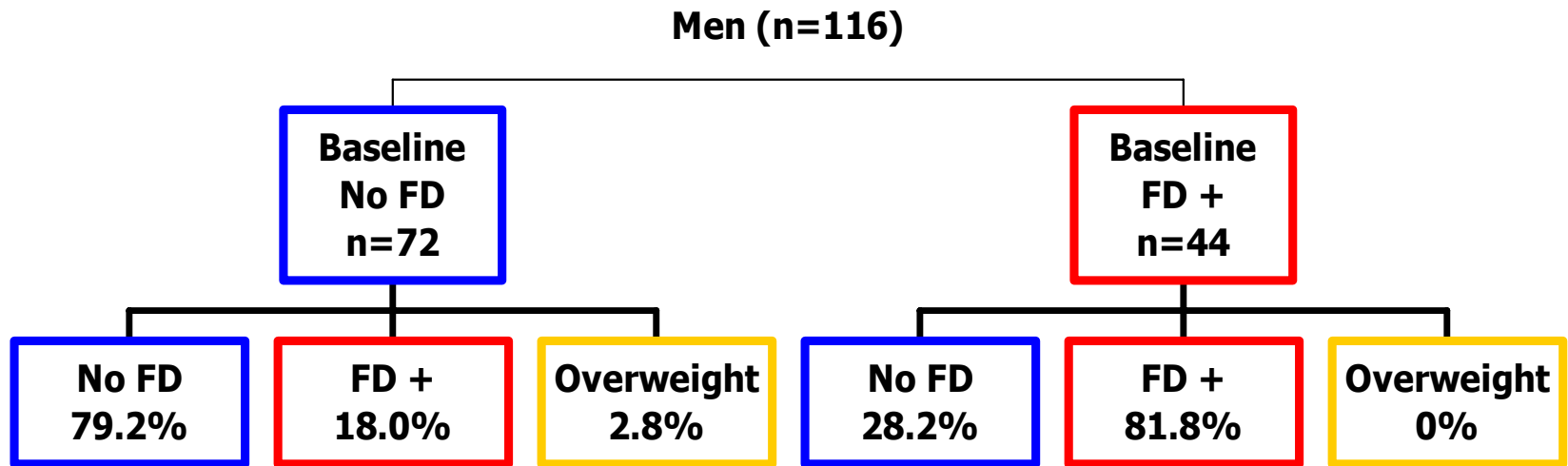


Evolution of Fat Atrophy (FA) over one year - Women

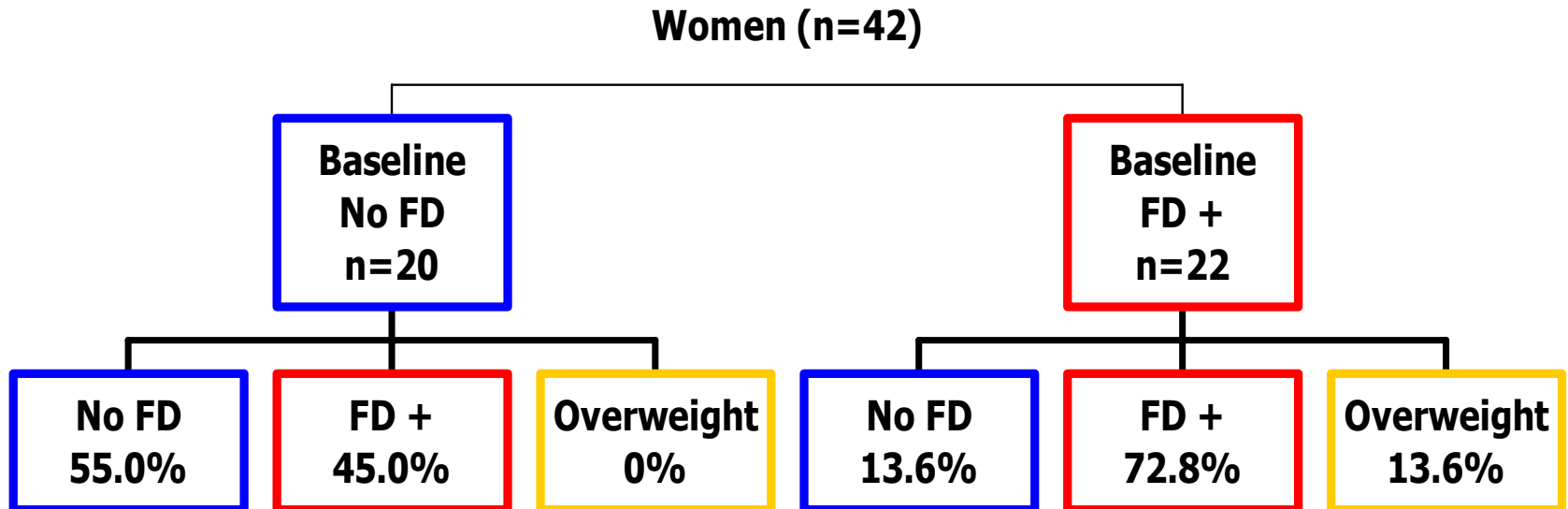
Women (n=60)



Evolution of Fat Deposition (FD) over one year - Men

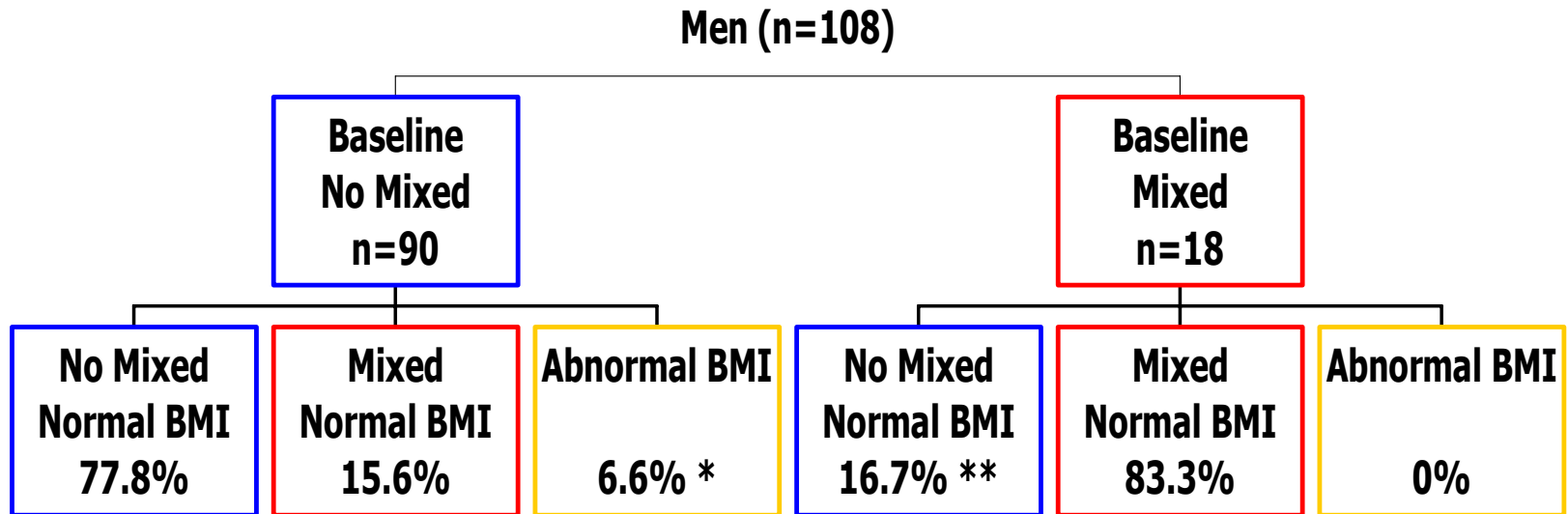


Evolution of Fat Deposition (FD) over one year - Women



Evolution of Mixed Syndrome (Mixed) over one year - Men

Among BMI 20-27.9 at baseline

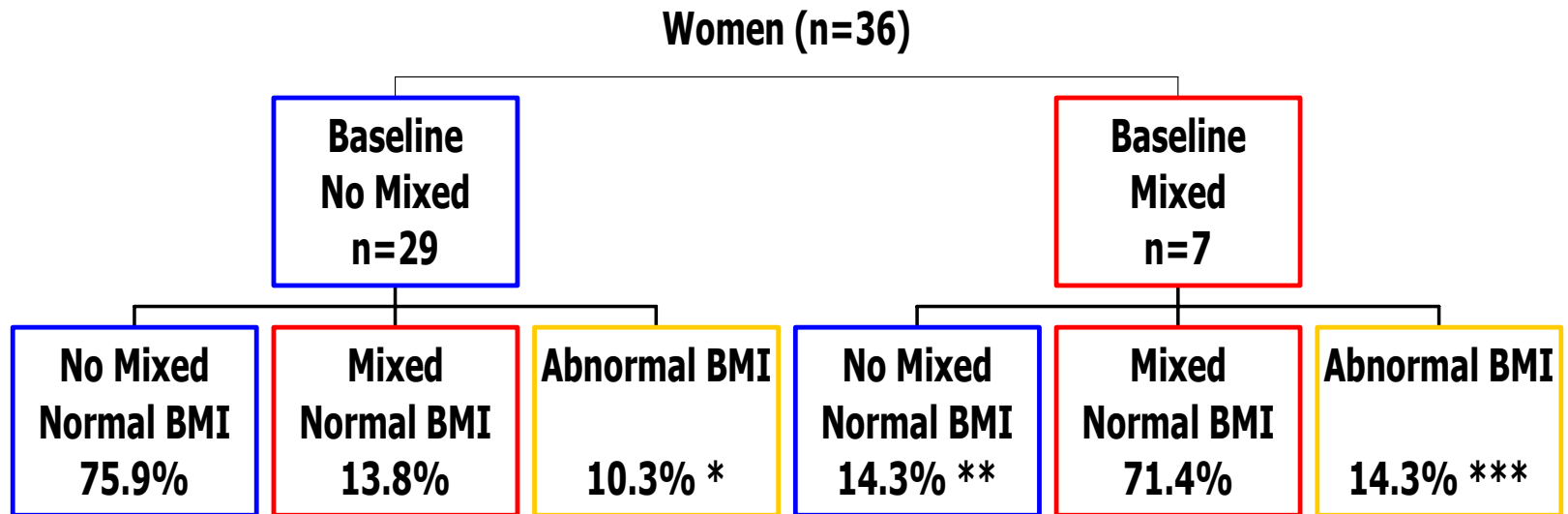


* Wasted 4.4%, Overweight 2.2%

** FA only 11.1%, FD only 5.6%

Evolution of Mixed Syndrome (Mixed) over one year - Women

Among BMI 20-27.9 at baseline



* Wasted 3.4%, Overweight 6.9%

** FD only 14.3%

*** Obese 14.3%

Summary



- FA and FD occur equally often in men and 17% have both.
- In women, FD is more common than FA and 17% have both.
- Over 70% of both men and women maintain FA, FD and mixed over one year.
- Fewer than 20% of men or women develop FA or mixed over one year. More women (45%) than men develop FD (18%).

- The common factors associated with FA in men and women are ART treatment (D4T in men and HAART duration in women) and increased REE.
- In men, FD was most highly associated with HAART and Caucasian race.
- Both men and women with versus without FD were older, had a greater change in CD4 cells and decreased caloric intake.

Conclusions



- Simple measures of lipodystrophy, such as anthropometrics, that are useful in a clinical setting can aid clinicians in the diagnosis of lipodystrophy.
- Anthropometric measures of FA and FD should be compared and validated with other measures of lipodystrophy such as DEXA and CT scans.