

Difference in Self-Reported Adherence on Different Recall Intervals over Time between Males and Females in **MACH14** Study

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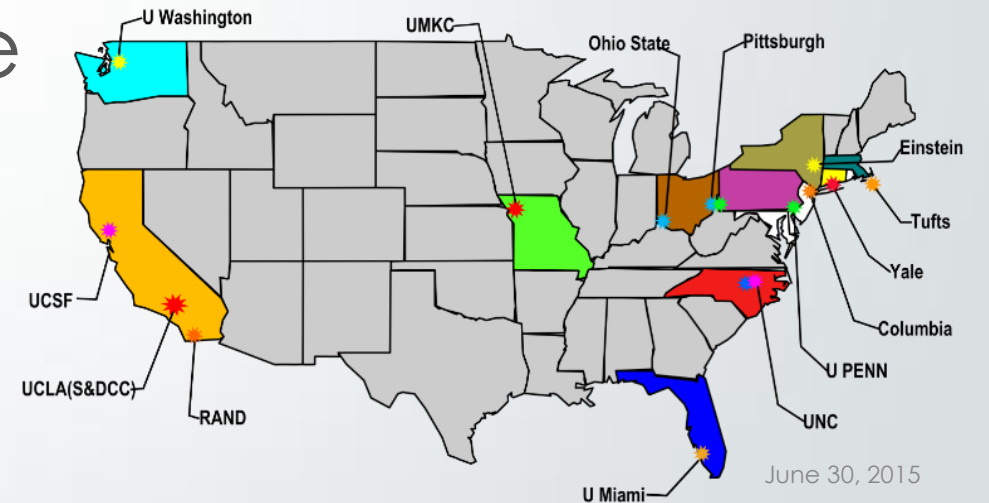
Outline

- ➔ Background
- ➔ IRT model
- ➔ Results
- ➔ Discussion/Limitation

Background

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- Item Response Theory (IRT) for Health Outcome
- MACH14 project
- Self-Reported Adherence



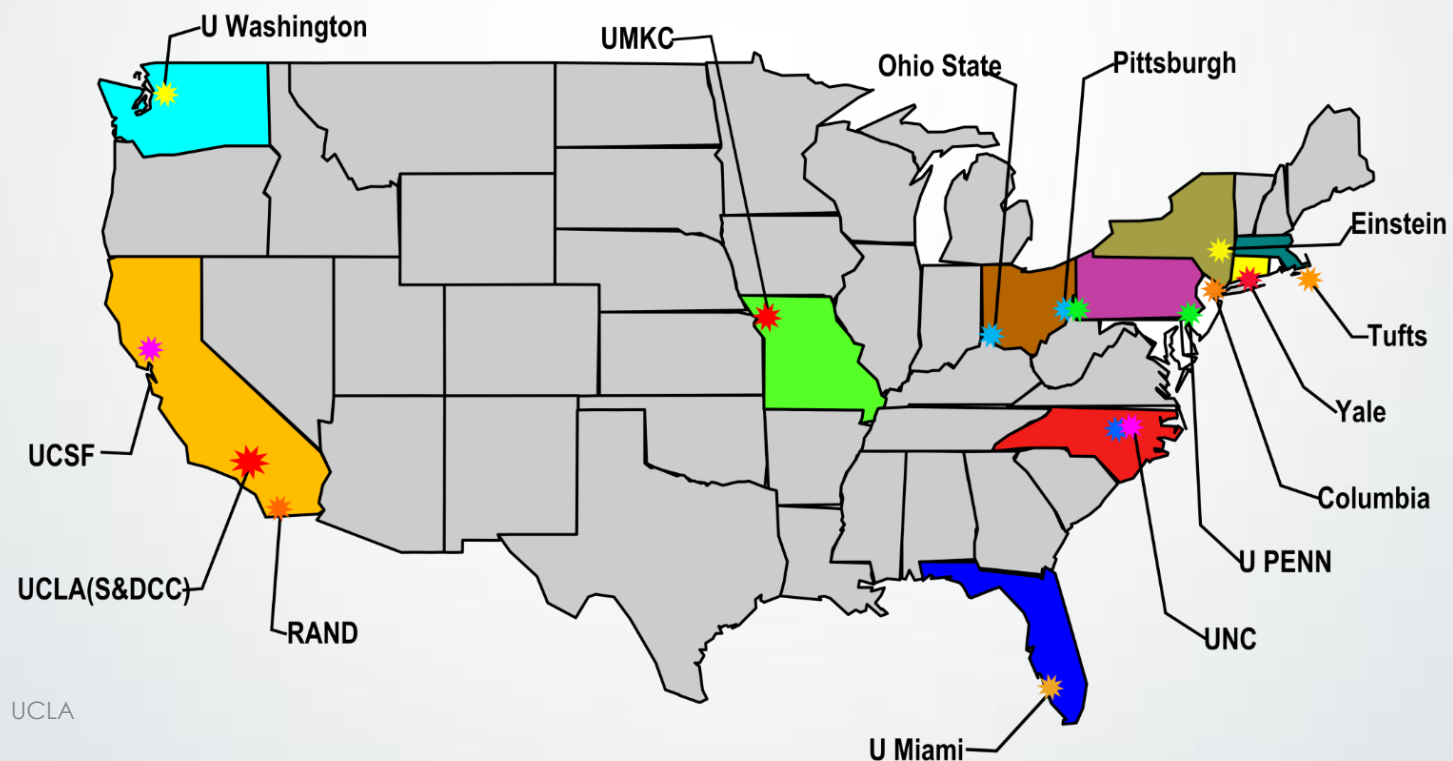
Item Response Theory (IRT)

- ➔ **IRT was first proposed in psychometrics**
 - ➔ Widely used in education
 - ➔ Relate **latent trait(s)** to the probability of responses
- ➔ **IRT-based models have become increasingly popular in**
 - ➔ Health outcomes
 - ➔ Quality-of-life research
 - ➔ Clinical research
- ➔ **Item residuals** when using the same instruments over time



Data

- ➔ **MACH14** study----a Multi-site Adherence Collaboration in HIV among 14 universities/institutes in the U.S.

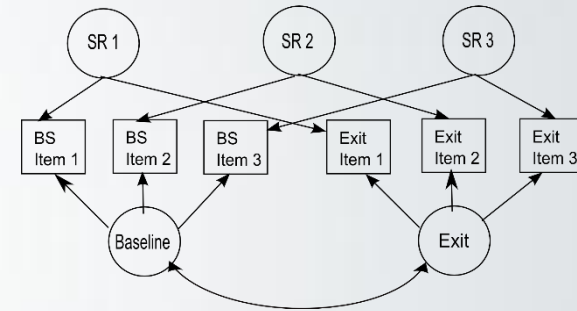


Self-reported adherence

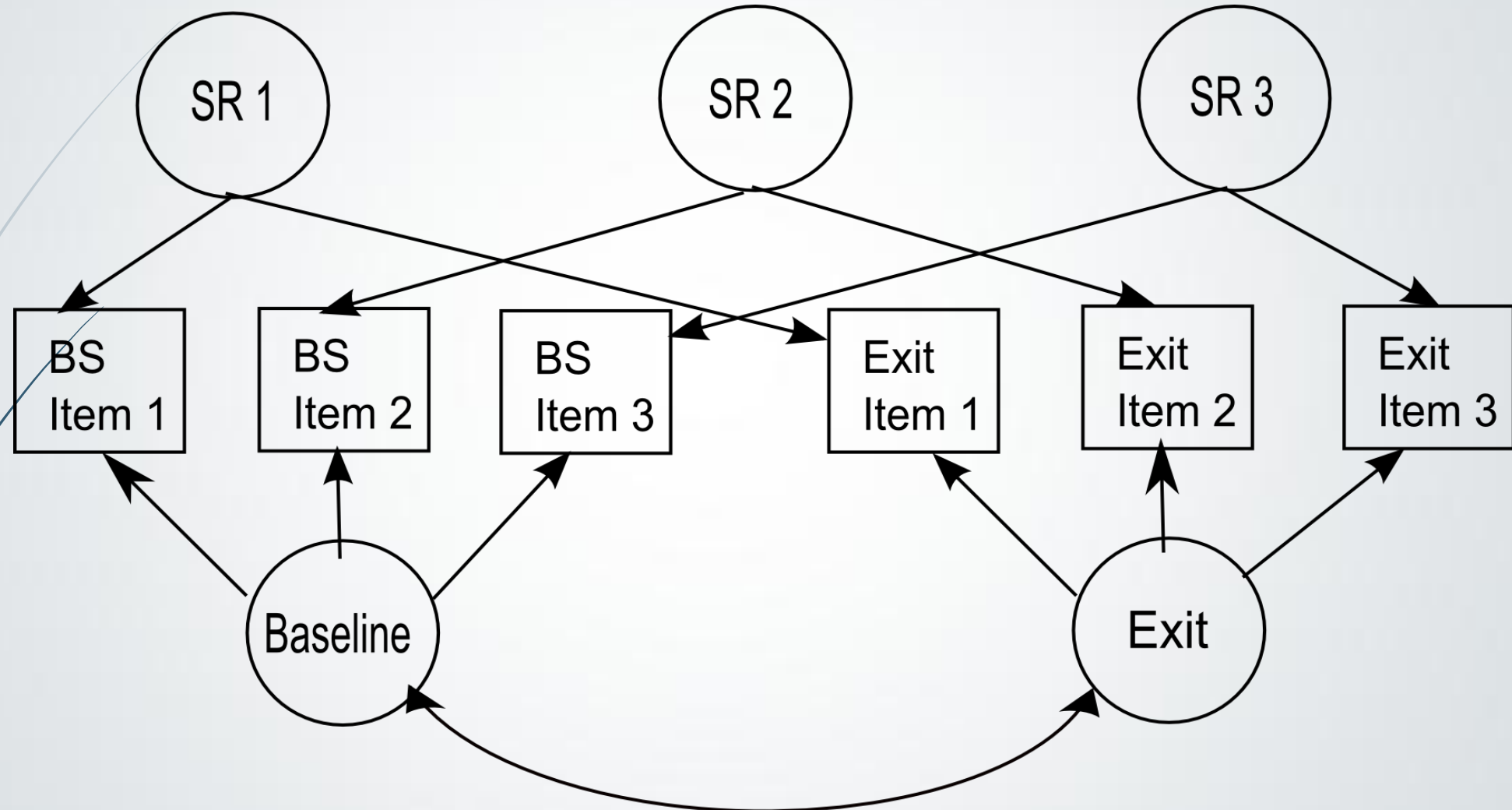
- ➔ Self – reported adherence with different recall intervals
 - ➔ One day
 - ➔ Two days
 - ➔ Three days
- ➔ Ordinal response created at baseline and exit:
 - ➔ 0 – with less than 50%
 - ➔ 1 – 50% - 85%
 - ➔ 2 - >85% - perfect adherence

Method

- Two-tier Item Factor Analysis Model
 - Missing observations
 - Clustering observations
 - By gender



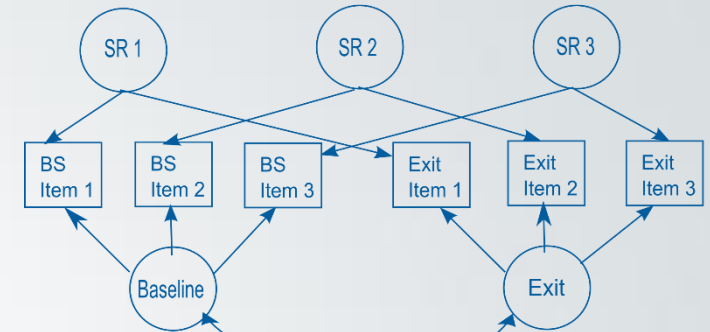
Two-tier model for longitudinal data



Additional problems

- ➔ Missing is coded as “-9”
- ➔ Clustered observations within each study
- ➔ Compare the difference between genders

Assumptions of the model



- ➔ The latent variables are normally distributed.
- ➔ Primary latent variables can be correlated
- ➔ The components of specific dimensions (adherence at different recall intervals) are mutually orthogonal.
- ➔ The primary dimension and the specific dimensions are orthogonal.
- ➔ The item responses are independent after the influence of latent variables are removed.

Results

- Latent trait estimation
- flexMIRT



Some basic characteristics of the sample

Male

➔ N = 1108

➔ Mean Age = 41.3 ± 8.3

Female

➔ N = 484

➔ Mean Age = 41.2 ± 7.7



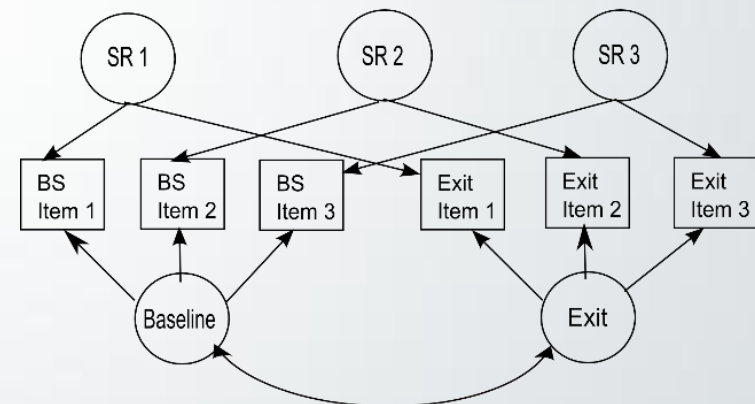
Variable	N	Mean \pm Std	Mean \pm Std	N	Mean \pm Std	Mean \pm Std
BS item 1	1067	0.93 ± 0.23	1.84 ± 0.5	478	0.89 ± 0.27	1.75 ± 0.59
BS item 2	1003	0.93 ± 0.23	1.83 ± 0.5	426	0.9 ± 0.27	1.76 ± 0.59
BS item 3	998	0.92 ± 0.24	1.82 ± 0.52	424	0.89 ± 0.28	1.76 ± 0.59
Ex item 1	1052	0.91 ± 0.26	1.8 ± 0.56	470	0.86 ± 0.31	1.68 ± 0.67
Ex item 2	986	0.91 ± 0.26	1.79 ± 0.56	421	0.89 ± 0.29	1.74 ± 0.62
Ex item 3	987	0.91 ± 0.26	1.81 ± 0.54	422	0.89 ± 0.28	1.76 ± 0.6

Overall estimation

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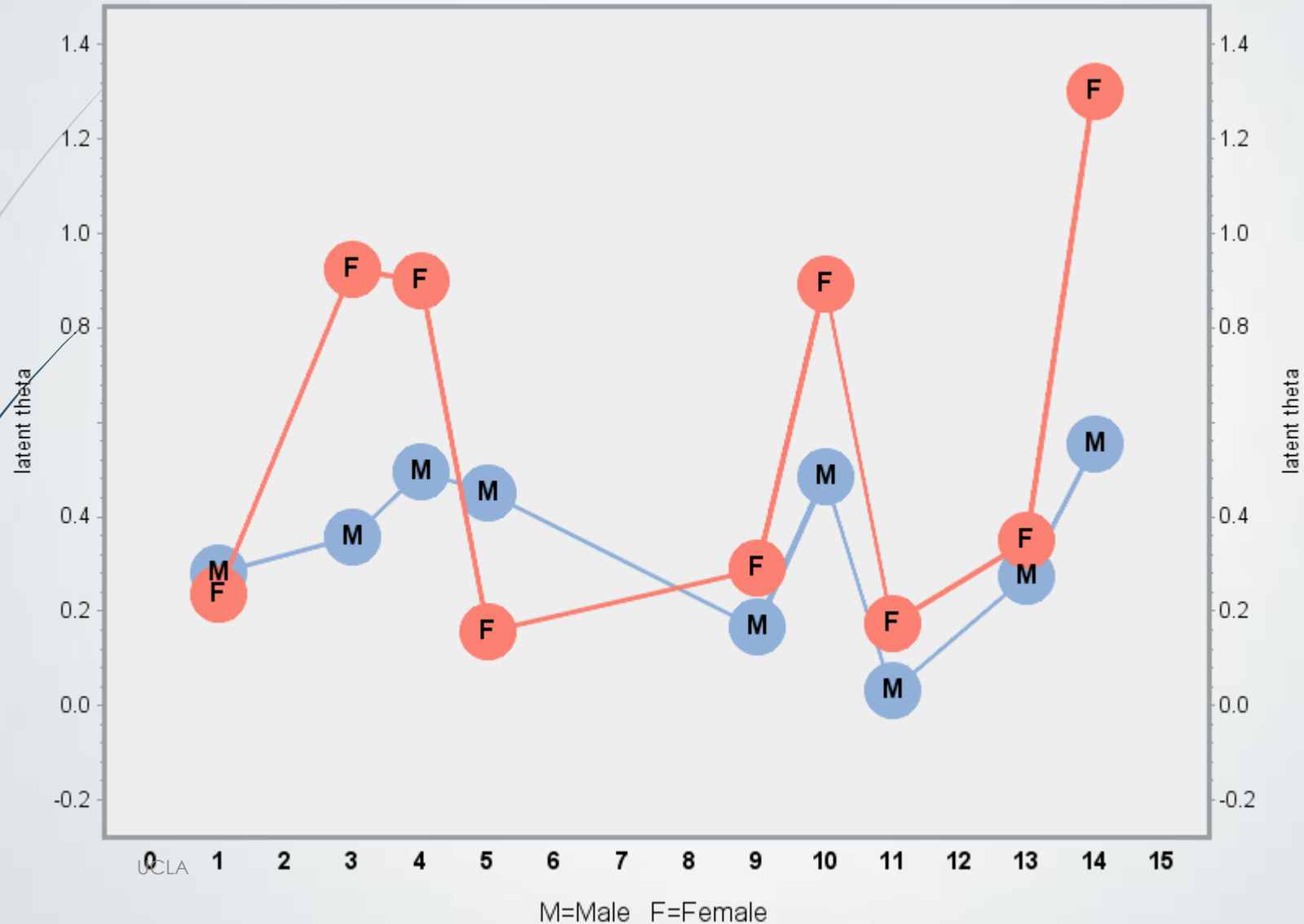
Item	a1	a2	a3	a4	a5	c1	c2
1	6.28	0	3.3	0	0	10.57	8.02
2	30.35	0	0	12.28	0	45.49	35.82
3	7.62	0	0	0	2.99	12.01	9.45
4	0	6.28	3.3	0	0	10.57	8.02
5	0	30.35	0	12.28	0	45.49	35.82
6	0	7.62	0	0	2.99	12.01	9.45

	mu1	mu2	mu3	mu4	mu5
	0	-0.01	0	0	0
Theta1	Theta2	Theta3	Theta4	Theta5	
1	0.78	1.11			
0	0	1			
0	0	0	1		
0	UCLA	0	0	1	



Clustered within study

Latent Site Estimation by Gender



By gender estimation – latent adherence

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Graded Items for Group 1: M $\theta_1 = 0, \theta_2 = 1.07, Var(\theta_2) = 1.7, COV(\theta_1, \theta_2) \approx 0$

Item	a 1	a 2	a 3	a 4	a 5	c 1	c 2
1	3	0	3.7	0	0	5.36	3.73
2	7.09	0	0	7.08	0	9.01	5.88
3	32.23	0	0	0	38.7	42.66	36.04
4	0	3	3.7	0	0	5.36	3.73
5	0	7.09	0	7.08	0	9.01	5.88
6	0	32.23	0	0	38.7	42.66	36.04

Graded Items for Group 2: F $\theta_1 = 0, \theta_2 = 1, Var(\theta_2) = 1.95, COV(\theta_1, \theta_2) \approx 0$

Item	a 1	a 2	a 3	a 4	a 5	c 1	c 2
1	32.12	0	43.24	0	0	44.45	23.33
2	28.86	0	0	41.97	0	42.36	23.03
3	2.35	0	0	0	4.09	5.09	3.25
4	0	32.12	43.24	0	0	44.45	23.33
5	0	28.86	0	41.97	0	42.36	23.03
6	UCLA	0	2.35	0	0	4.09	5.09

Conclusion

- ▶ The difficulty on report adherence based on different recall intervals between male and female
 - ▶ Male – 3 days recall
 - ▶ Female – 1 or 2 days recall
- ▶ Males have advantages in short-term memory



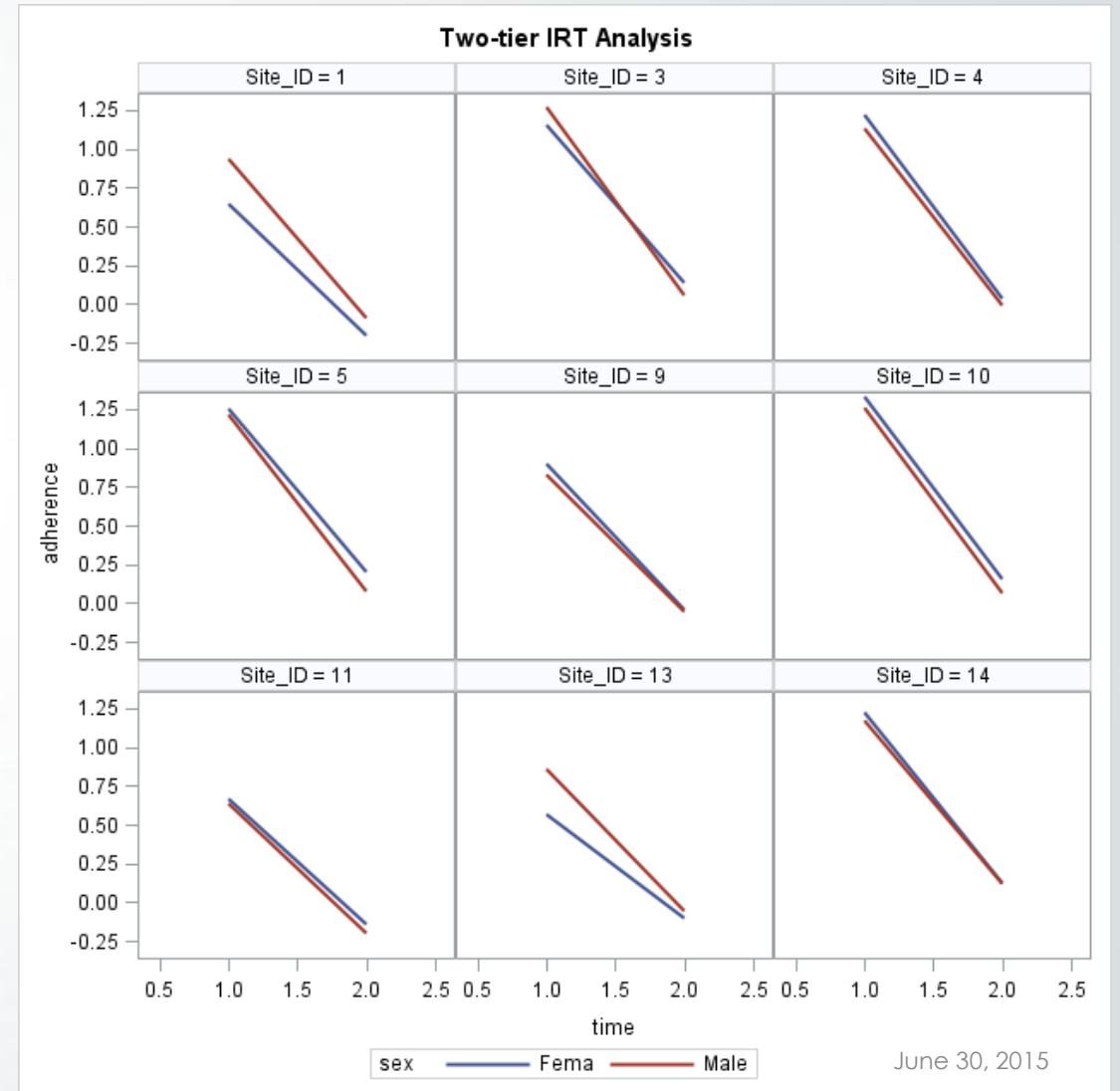
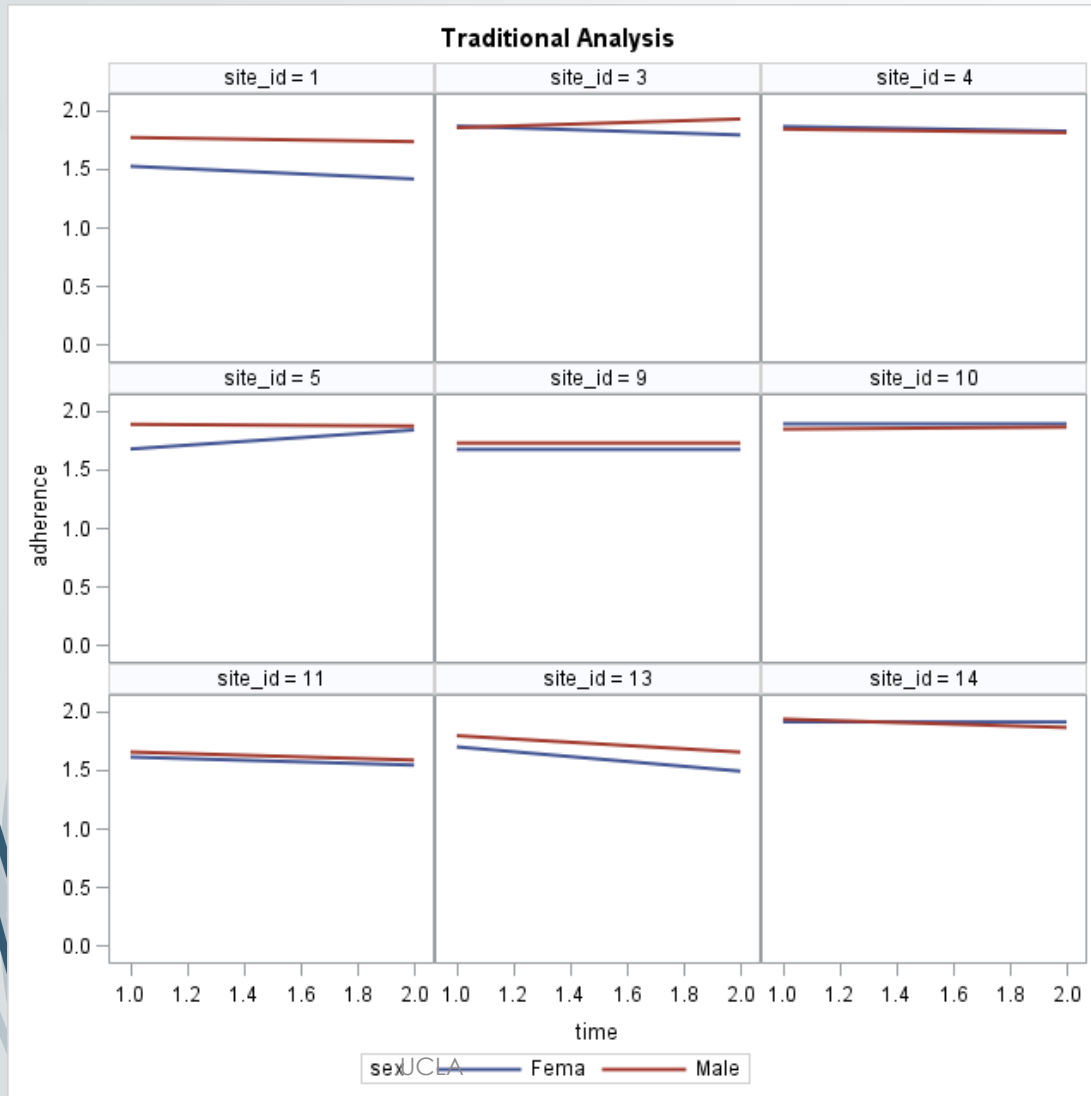
Discussion and Limitation

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- Discussion
- Limitation
- Future work

Compare with traditional analysis

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Discussion

- ➔ The computation speed
 - ➔ With and without cluster
 - ➔ Different OS
 - ➔ Assumptions

Limitation

- ➔ Missing is not at random
- ➔ No inference about the other covariates
 - ➔ Age
 - ➔ Substance abuse
 - ➔ Ethnicity

Possible Future Work

- ➔ MEMS data verification 
- ➔ Continuous outcome vs Ordinal response
- ➔ More than two longitudinal time points
- ➔ Multiple imputation techniques
- ➔ Violation of the assumptions

Key references

- ▶ Cai, L. (2010). A two-tier full-information item factor analysis model with applications. *Psychometrika*, 75(4), 581-612.
- ▶ Hays, R. D., Morales, L. S., & Reise, S. P. (2000). Item response theory and health outcomes measurement in the 21st century. *Med Care*, 38(9 Suppl), 1128-42.
- ▶ Liu, H., Wilson, I. B., Goggin, K., Reynolds, N., Simoni, J. M., Golin, C. E., . . . Remien, R. H. (2013). MACH14: a multi-site collaboration on ART adherence among 14 institutions. *AIDS and Behavior*, 17(1), 127-141.
- ▶ Wang, Y., Crane, H., & Liu, H. Conditional Maximum Likelihood Rasch Model in Data Harmonization. *In: 2014 JSM Proceedings, Nonparametric Statistics Section, Boston, MA: American Statistical Association. pp. 464-473.*

Acknowledgements

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