

ARemind: A Personalized Prototype Cellular Phone Reminder System

Background

- Electronic reminder devices (ERD) have been identified as potential component of strategies to improve adherence¹
- Limited information on the effect(s) content of reminders may have on adherence & self-efficacy
- Aremind pilot project (N=8)²:
 - 75% of subjects supported feasibility & usefulness of cell technology
 - Content Preferences: mix of opinions, most favored ring tone but many interested in receiving diverse contents (weather, news, music..)

Objectives

- I. To evaluate the *feasability & content of dynamic personalized reminders (Aremind)* over a 6 week period

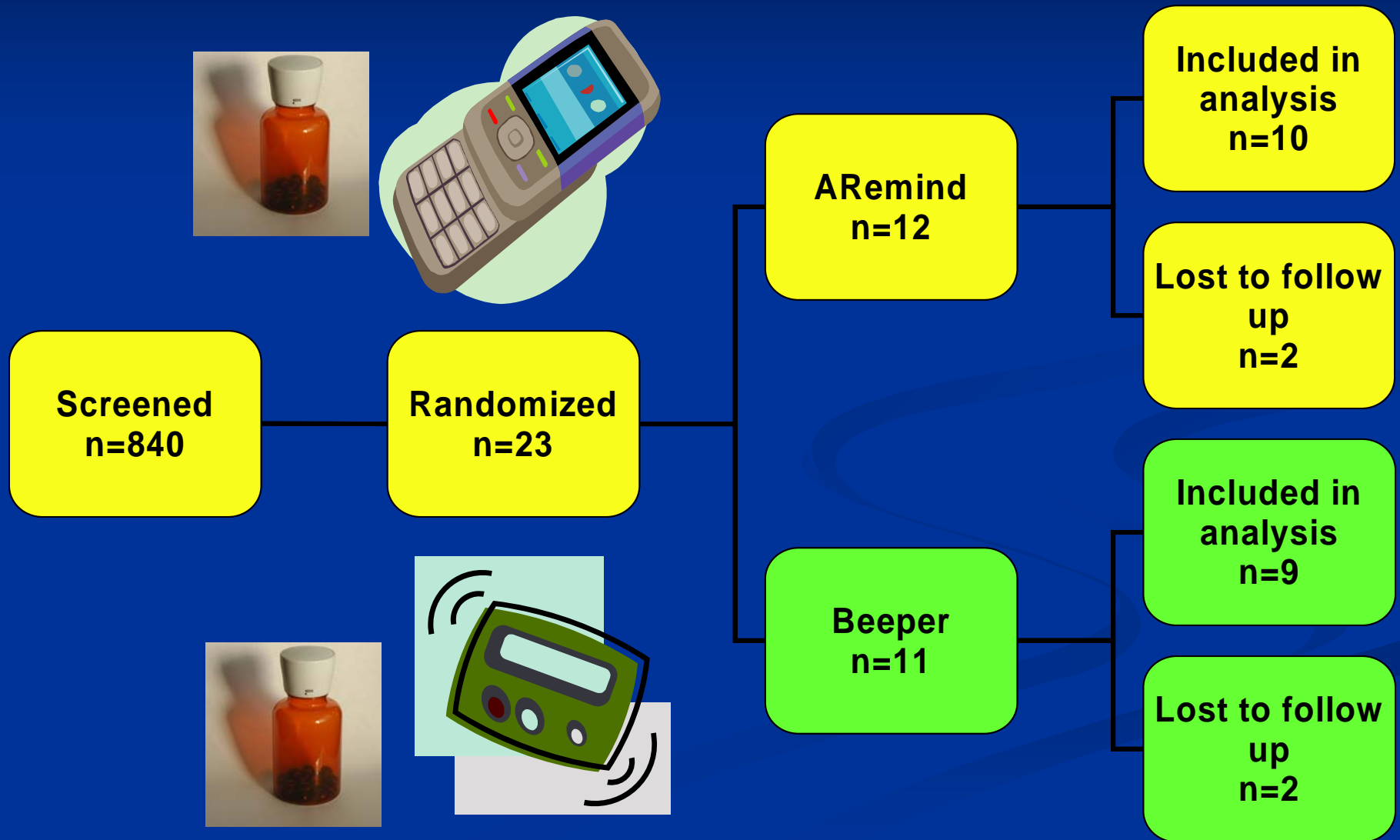
- II. To explore the *effect of Aremind on adherence* to antiretroviral therapy

Methods

- Prospective, 2-arm randomized pilot cohort study (beeper vs Aremnd)
- Inclusion Criteria: HIV, ≥ 18 yo, on ART x 3 mo, $\leq 85\%$ adherence (SR, past 3 days)
- 6 week follow-up
- Face to face interview @ Bl, wk 3, wk 6
- Adherence Measures:
 - MEMS (wk 3, wk 6)
 - Pill count (PC, bL, wk 3, wk 6)
 - Self-report (SR, bl, wk3, wk 6)
 - Composite adherence score: MEMS / PC / SR (Calibration to MEMS values or pill count)¹



Study Design



Analysis

- Objective 1 (feasability & content dynamic):
 - Qualitative Analytic techniques (HyperResearch Software)
 - “Time effect” of intervention (Aremind) was analyzed as odds of following scenarios listed below at wk 3 and 6

Mess. → Resp. → MEMS
Mess. → Resp. → ∅ MEMS
Mess. → ∅ Resp. → MEMS

- Objective 2 (effect of Aremind on Adherence)
 - Comparison of Adherence Measures done using a longitudinal analysis based on Linear Mixed Effects Model
 - Sensitivity analysis performed for the inputations of MEMS (calibration model based on pill count)

Results

Patient Characteristics	Cell-Phone	Beeper	P-value
Gender			
Male, n	5	5	1.0
Female, n	5	4	
Age, yrs(± SD)	42 ± 8	44± 4	0.592
Race			
White, %	50	22	0.536
Employed, %	20	22	1.0
Sexual Orientation			
MSM	10	11	
Heterosexual	90	89	1.0
HIV Disease Diagnosis, years	14± 5	14± 9	-
Mental Health co-morbidities, %	70	89	0.582
Baseline HIV labs			
Viral Load	30,920 ± 97,525	9,352 ± 21,836	0.526
CD4 count	378 ± 324	281 ± 159	

Feasibility & Content

	Aremind	Beeper
Prior Exp with Cell & text messaging	Most had a cell (pay-as-you-go) 50% exp texting	Most had cell None had experience texting
Prior Exp using reminder devices	No exp	1 pt had exp using cell as reminder
How Technology helped taking meds	All except 1 pt thought cell helped reminding to take ART & take it on time	3 pt said it did not help much Some concerns about carrying a beeper (confid.)*
Comments about Technology	All liked it, 1 suggestion: add other functions like appt reminders	All but 2 said it was easy to use. Suggestions: vibrate, beep louder
Text to communicate with MD & content	All but 2 said they would like to communicate via text with MD All except 1 like the messages but did not feel content was important	-
Continued use & experience being in study	Liked texting back but most would not continue due to \$\$. “Made me more aware of missed doses”	Good experience. A couple said they would start using different type reminders

Areminind: “Time to Response” Effect Week 3 & 6

Week 3:

Mean of 24 ± 10 reminders sent per wk & per person

- 73% overall response rate per person and per wk
- Wk 3/CAS/Time to Resp (-0.58, $p=0.07$)
- Wk3/PC/TR(-0.6, $p=0.05$)

Week 6

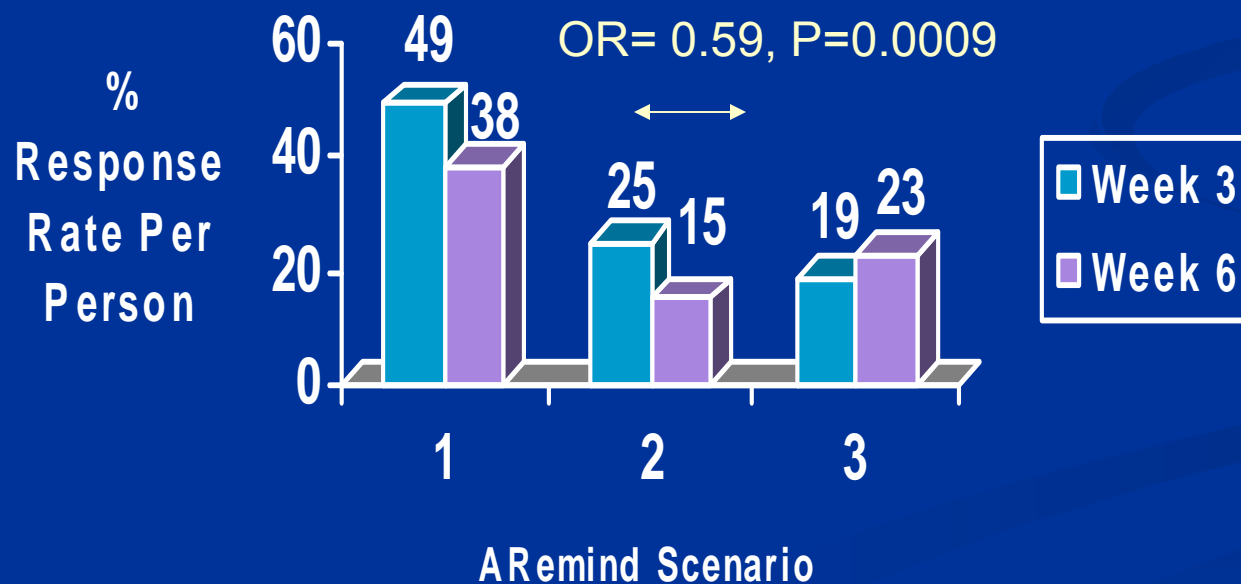
Mean of 32 ± 12 reminders sent per wk & per person

- 53% overall response rate per person and per wk

ARemind: “Response to Reminders” Effect

ARemind Scenarios:

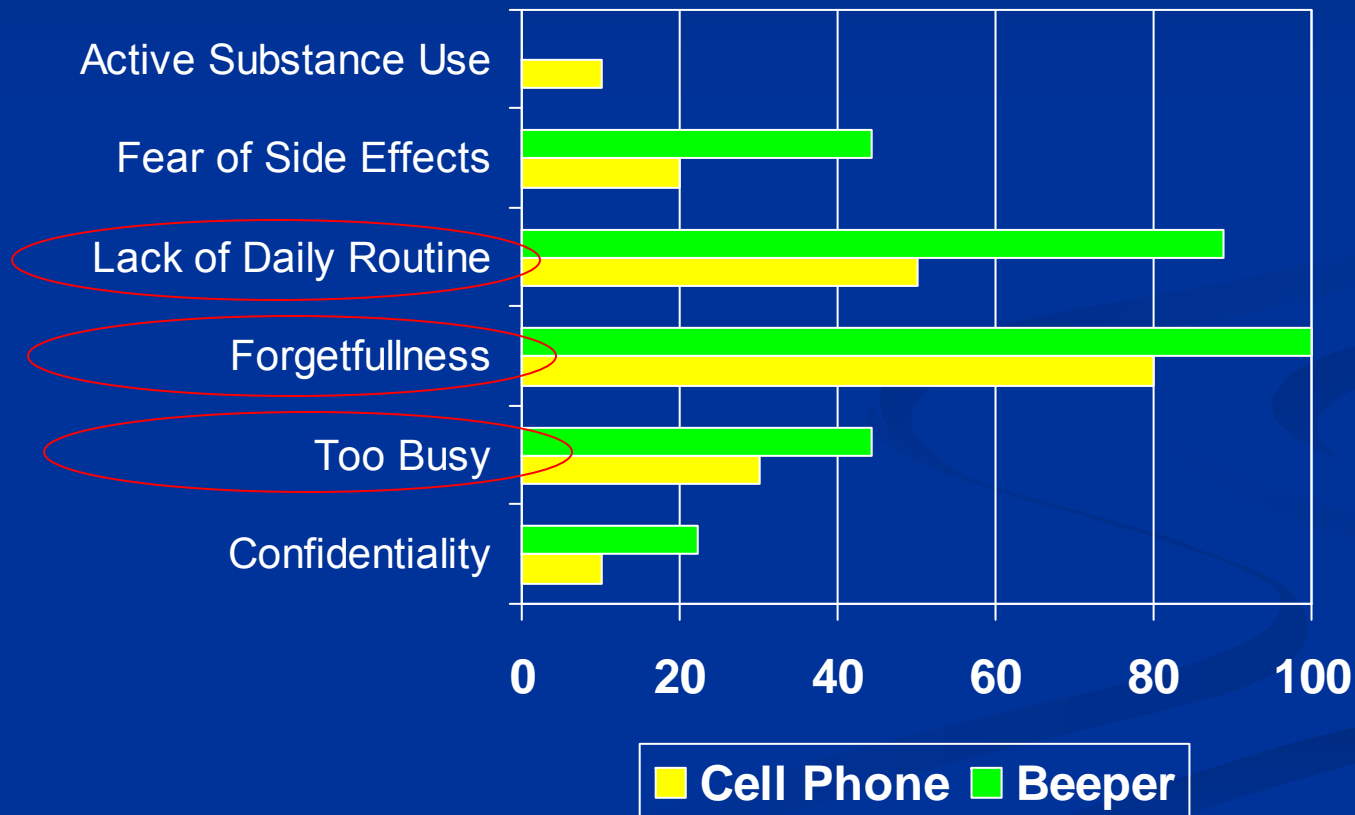
1. Receive Reminder → Respond → Open MEMS
2. Receive Reminder → Respond → **Do Not Open MEMS**
3. Receive Reminder → **Do Not Respond** → Open MEMS



Odds of responding to reminder were **HALF** at wk 6 than the odds at wk 3 (OR = 0.586, p= 0.0323)

Baseline Adherence Identified Barriers

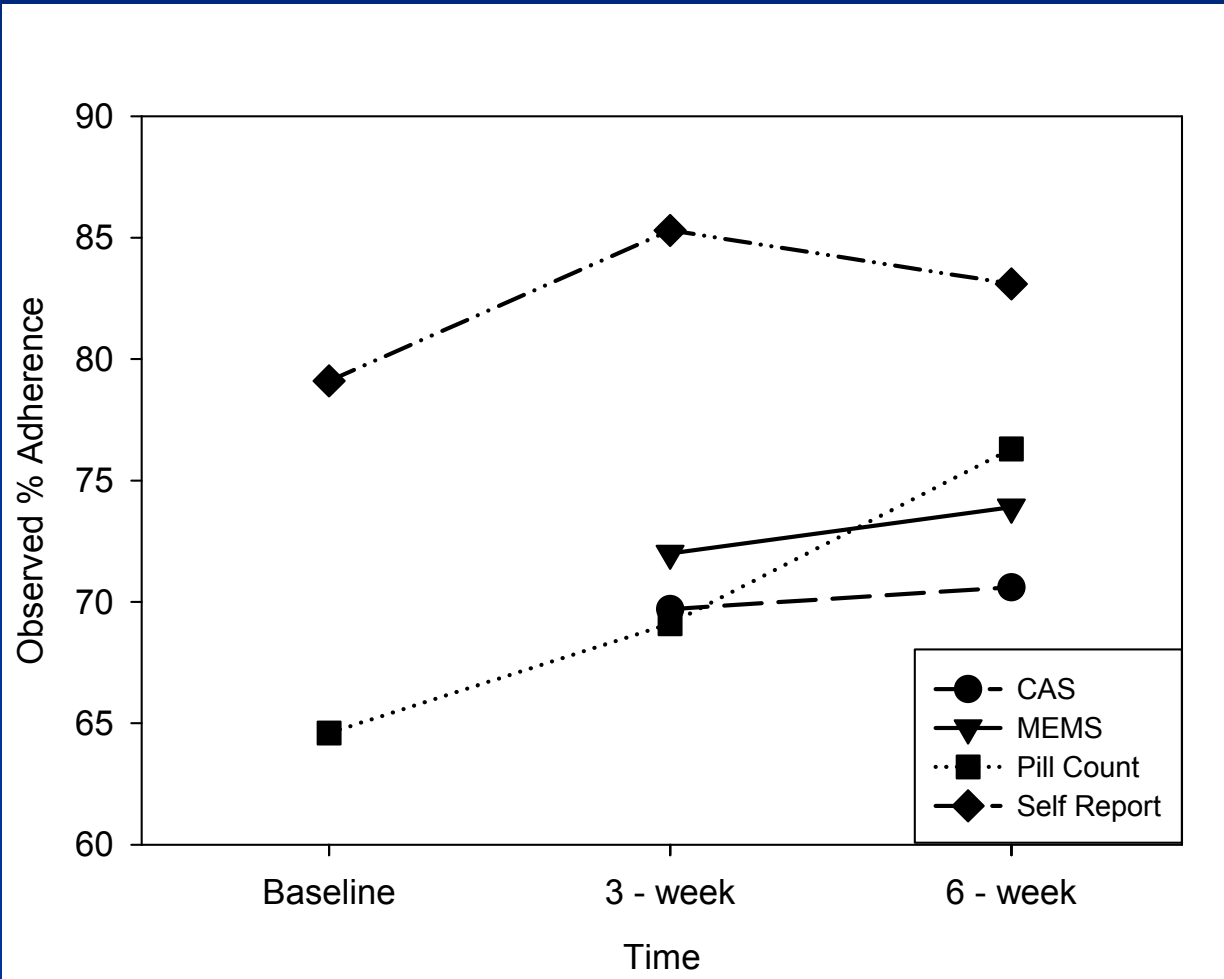
- Groups balanced in term of adherence barriers



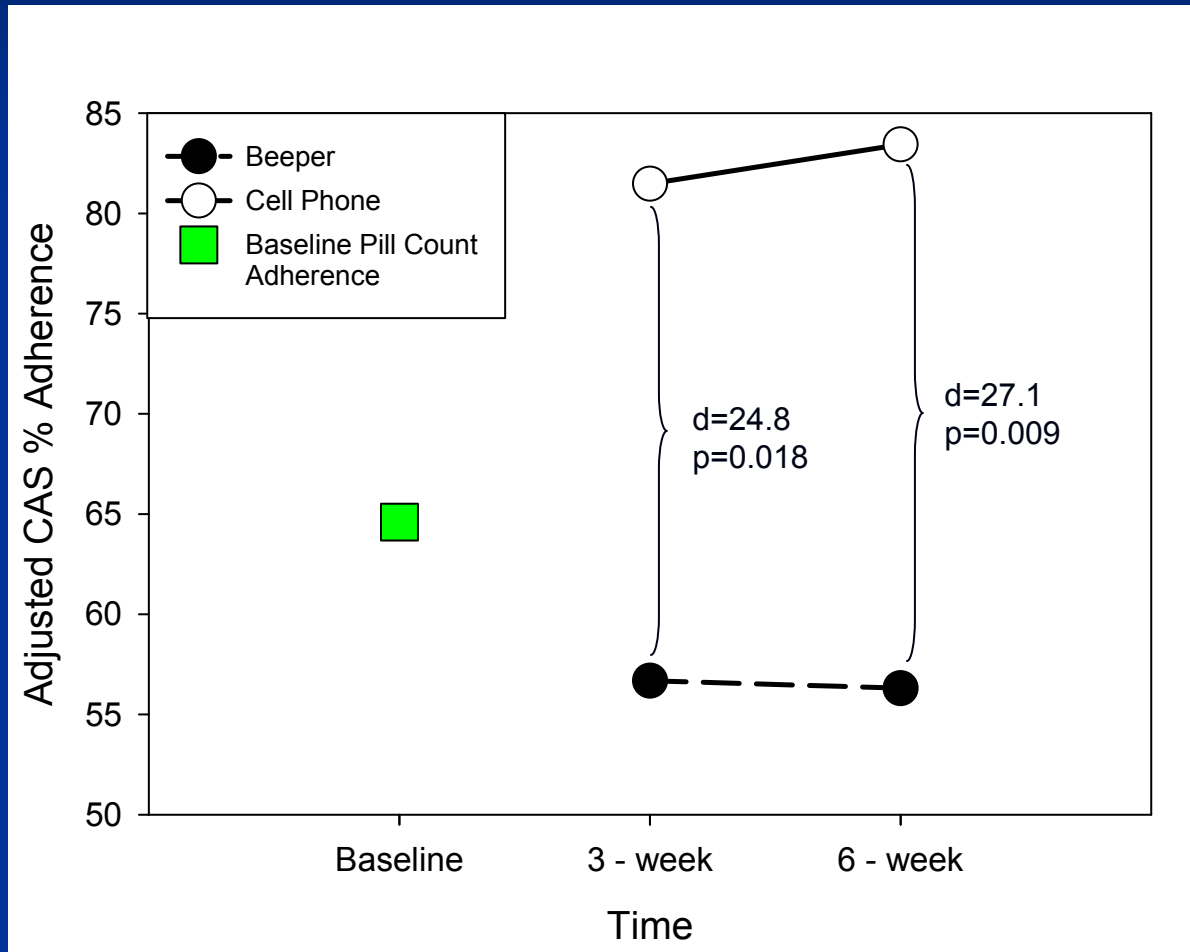
Antiretrovirals at Baseline

- ART backbone:
 - 10 on Boosted PI
 - 4 on NNRTI
 - 2 on II
 - 1 on unboosted PI
 - 2 on Other
- 9 subjects on QD dosing; 10 subjects on BID

Adherence (%) Fluctuations Observed Over Time



Comparison in Adherence to ART (CAS) Aremind versus Beeper



Study Limitations

- Small sample size
- Short follow-up period (6 wks)
- Content of messages was informational but not educational
- Cost effectiveness of the intervention was not assessed

Technical Challenges

- Data outage at the start of the study
- Phones set to notify users of a new text message every 15 minutes until acknowledged; not beepers
- No qualitative feedback during the longitudinal study

Conclusion

- Aremind was well received & appeared to be a possible vehicle for adherence interventions
- Aremind users had higher adherence rates to ART over a 6 wk period versus beeper users (MEMS, CAS, SR)
- Response to reminders via text decreased over time suggesting a possible “fatigue”

Acknowledgments

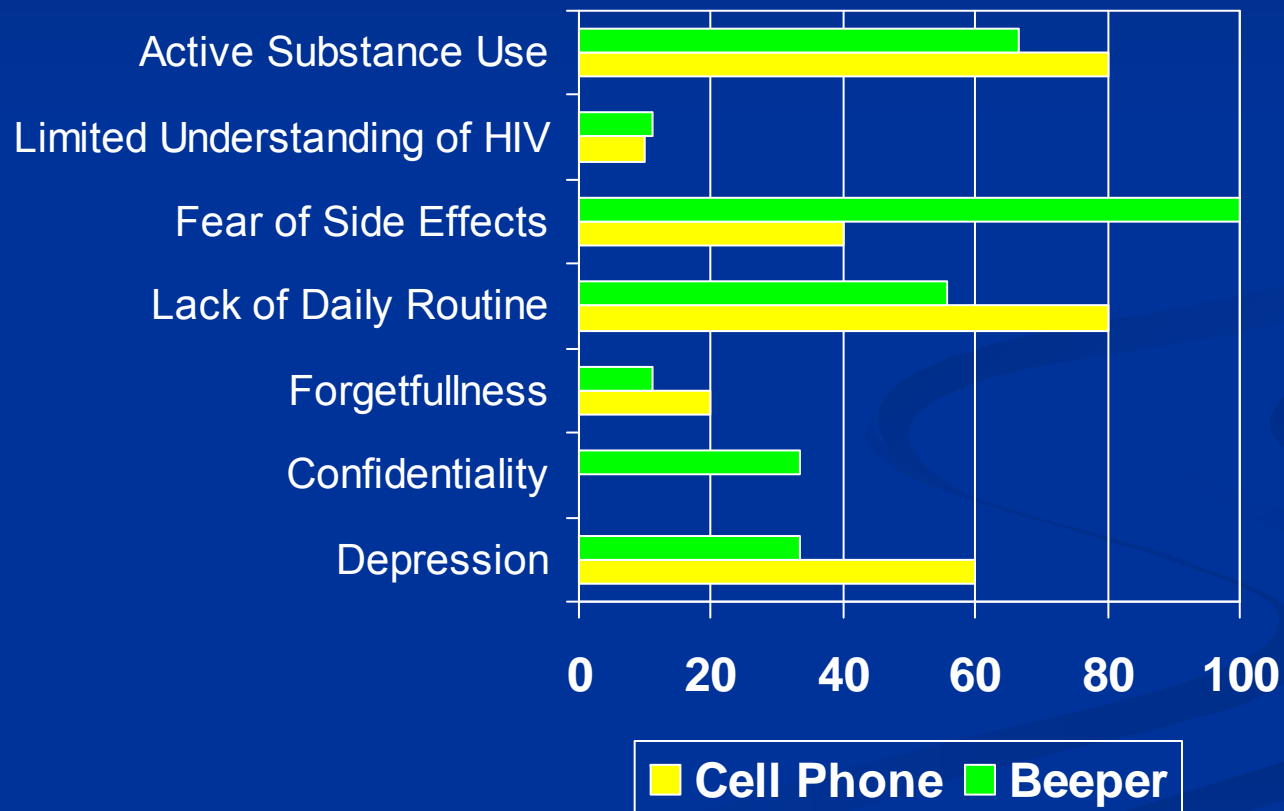
- Our study patients
- **BU/BMC Team** – Paul Skolnik MD, E Farmer Pharm.D, A Marilyn Drainoni PhD Stanic Pharm.D, E Backman Pharm.D, Dr. Gheorghe Doros PhD, and Denis Rybin MS
- **Dimagi Team** – Dr. Vikram S Kumar MD, Jonathan Jackson, Dan Myung, Cory Zue, Justin Sitter
- This study was funded by an SBIR (1R43MH080655-01A1) to Dimagi Inc. by the **National Institute of Mental Health**
- We appreciate the loan of devices by **Verizon Wireless** for the study

Back-up slides

Baseline Adherence

Potential Barriers

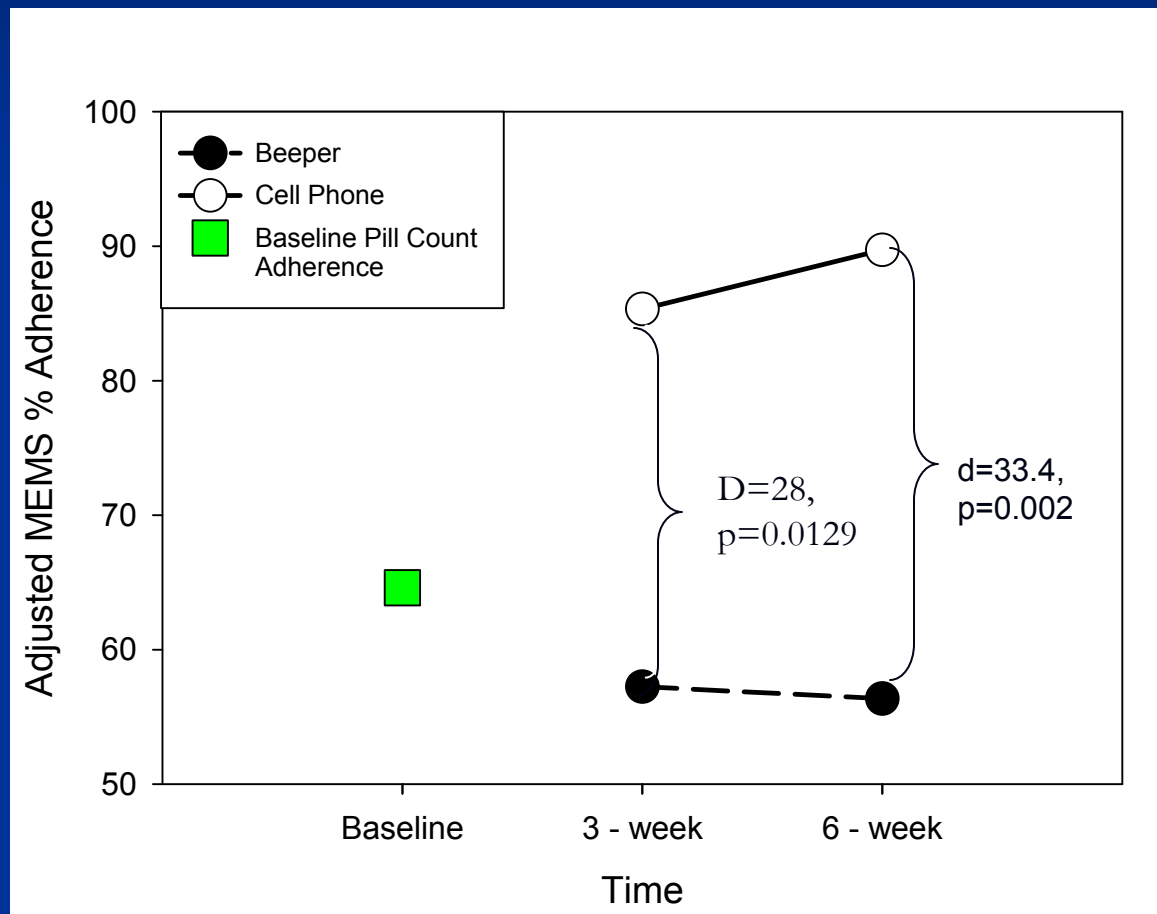
- Groups balanced except: Fear of Side Effects ($P=0.01$)



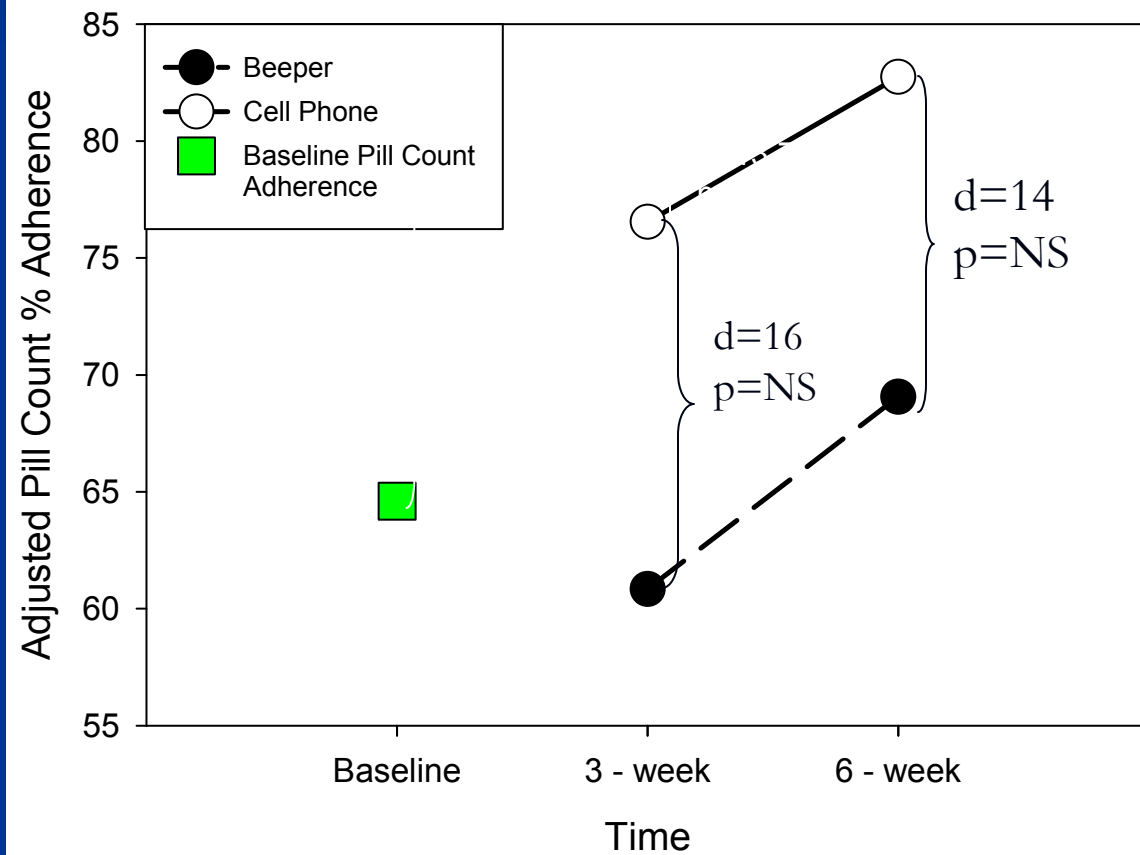
Correlations of Adherence Measures

- Baseline: SR/PC (0.43)
 - Wk 3: SR/PC (0.49) – PC/MEMS (0.74) – CAS/PC (0.74)
 - Wk 6: SR/PC (0.64) – PC/MEMS (0.71) – CAS/PC (0.74)
- No gold standard to measure adherence
 - Discrepancies in the adherence measures
 - CAS had the highest correlation coefficients over time

Comparison in Adherence to ART (MEMS) Aremind versus Beeper



Comparison in Adherence to ART (Pill count) Aremind versus Beeper



Comparison in Adherence to ART (SR) Aremind versus Beeper

