

Health Information Technology (HIT) and Quality of Care for Patients with Diabetes

(Preliminary Findings from the IMPACT Study)

IMPACT Study:

Impact of Information Technology on Clinical Care: An
Evaluation of the Technology on Quality, Safety and
Efficiency of Chronic Disease Care

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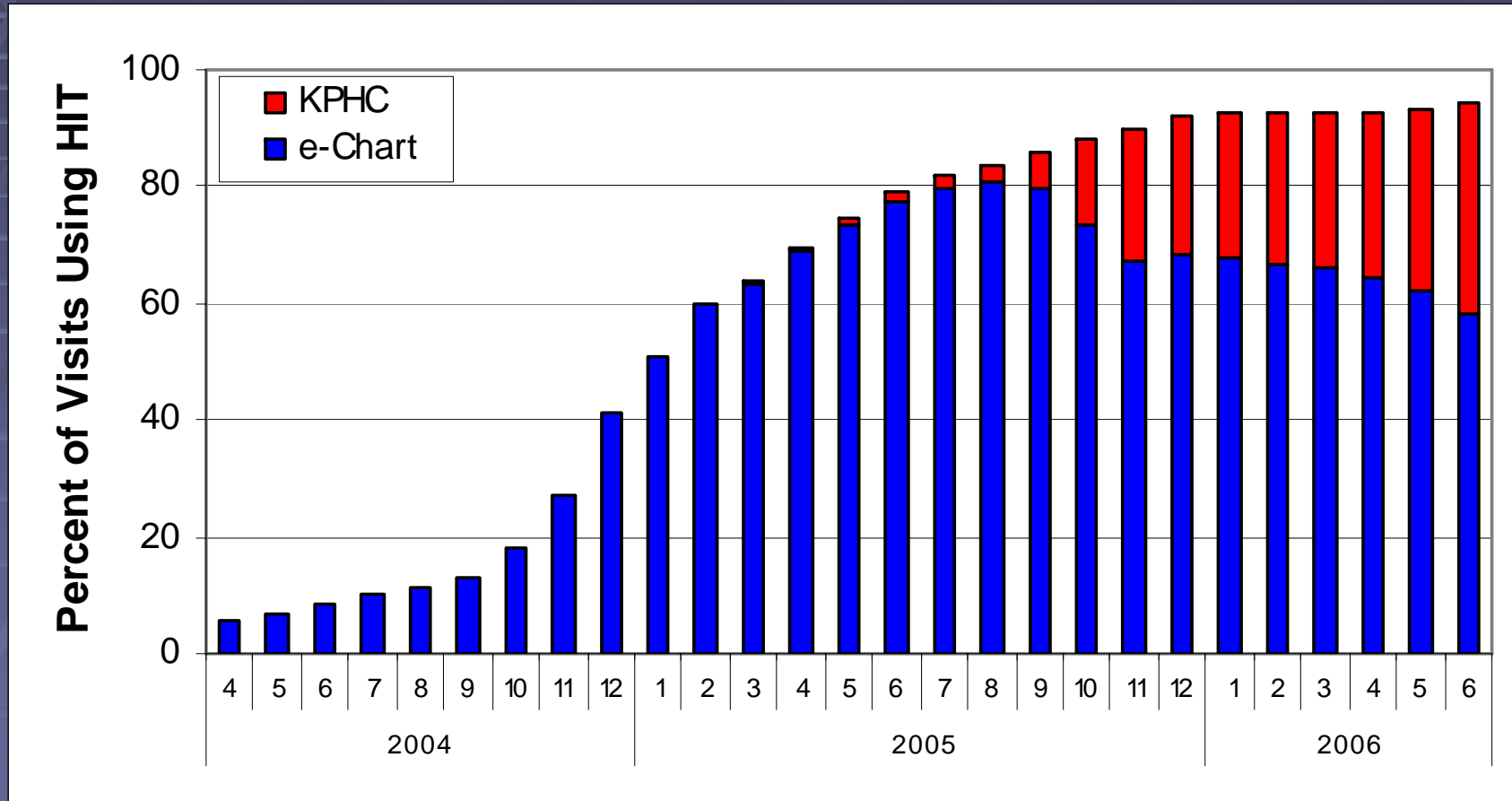
HIT Background

- Potential to improve the delivery of medical care
- Limited information of HIT effects in ambulatory setting
- Current methodological limitations
 - Lack of concurrent control groups
 - Lack of consideration of multi-level effects

HIT Implementation in KPNC

- Basic HIT:
 - Became available to all medical centers about one year before roll-out of Integrated HIT
 - Functions: e-Chart, e-Rx and e-Consult
 - Variable timing of initial use from physician to physician
- Integrated HIT System: KP HealthConnect (KPHC)
 - Staggered rollout across medical centers starting from 2005 to 2007
 - Functions available in one integrated system:
 - Electronic documentation with smart text
 - On-line lab, x-ray and Rx ordering
 - Full referrals documentation from e-Consult
 - Computer-based decision support system

Use of HIT Over Time in KPNC



Objective

- Assess changes in the quality of care before and after the introduction of KPHC
 - Focus on patients with diabetes mellitus because these patients may be particularly sensitive to changes in clinical care
 - Focus on changes in physiologic outcomes before and after the introduction of KPHC
 - Preliminary data from 7 teams in 2 facilities within 1 medical center

Method

- Setting: Integrated Delivery System (KPNC)
- Study Design: Quasi-experimental study
 - Staggered implementation of KPHC across medical centers
 - Study Period: 04/2004 – 06/2006
- Study population:
 - Continuously enrolled patients in two facilities that implemented KPHC at different time points in 2005
 - In the diabetes registry during the study period
 - Had at least one outcome measurement both before and after implementation of KPHC

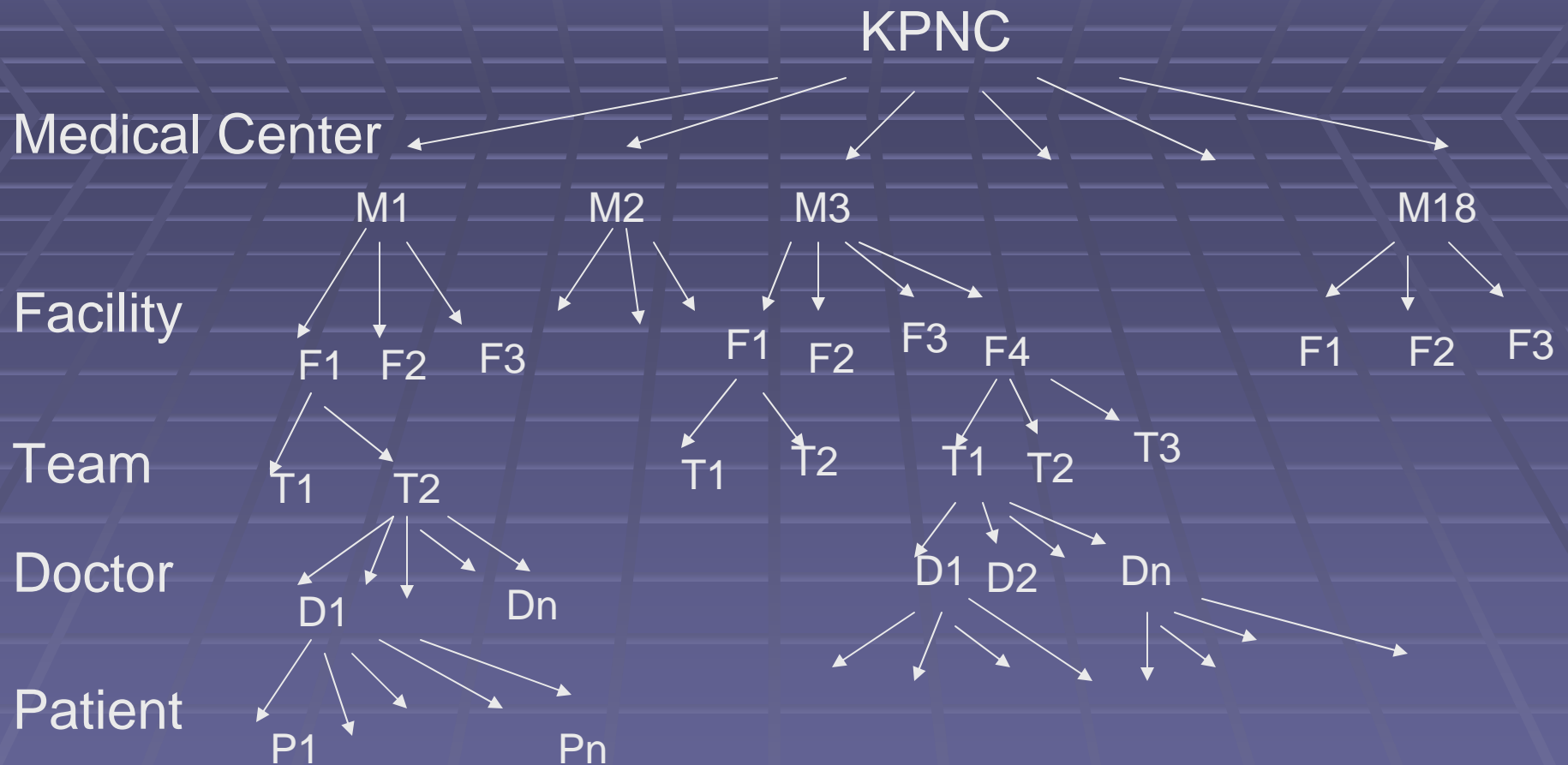
Measures

- Outcome Measures:
 - Low-density lipoprotein cholesterol (LDL)
 - Hemoglobin A1c (HbA1c)
- Predictor Measure:
 - Presence of HIT (0/1)
 - Monthly time-changing variable

Presence of HIT

- Different definitions for presence of HIT:
 - D1: Medical Center KPHC Implementation start date
 - D2: Medical Center KPHC Implementation complete date
 - D3: Team KPHC Use start date: 80% of office visits using KPHC
- Presence of HIT in this preliminary analysis:
 - Team KPHC Use start date
 - Pre-KPHC =0
 - Post-KPHC=1

Hierarchical Data Structure



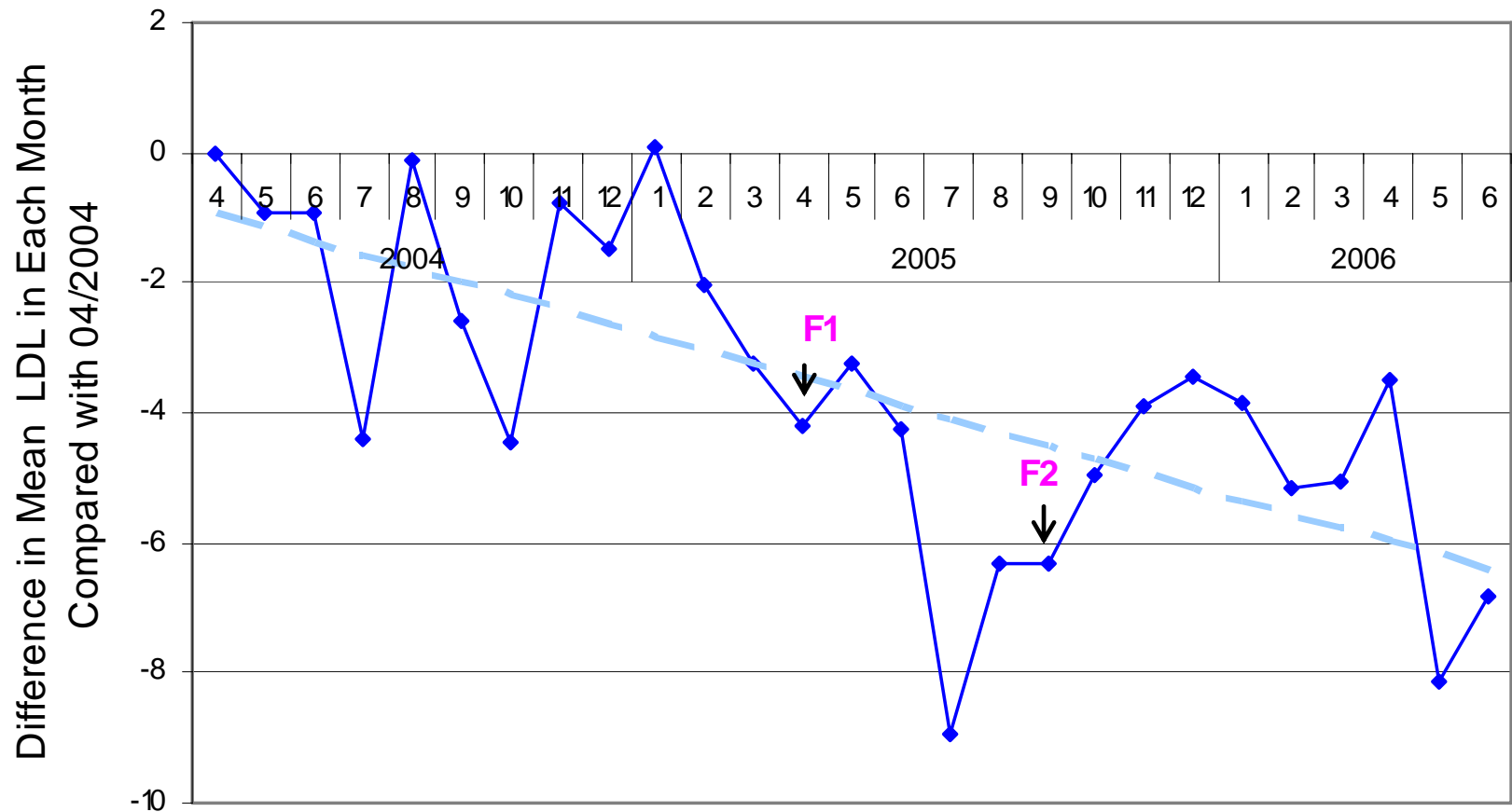
Statistical Analysis

- Mixed models
 - Fixed effect: facility
 - Random effects:
 - Team
 - Physician
 - Patient
- Covariates:
 - Age
 - Gender
 - Race/ethnicity
 - Neighborhood Socioeconomic Status (SES)

Patient Characteristics

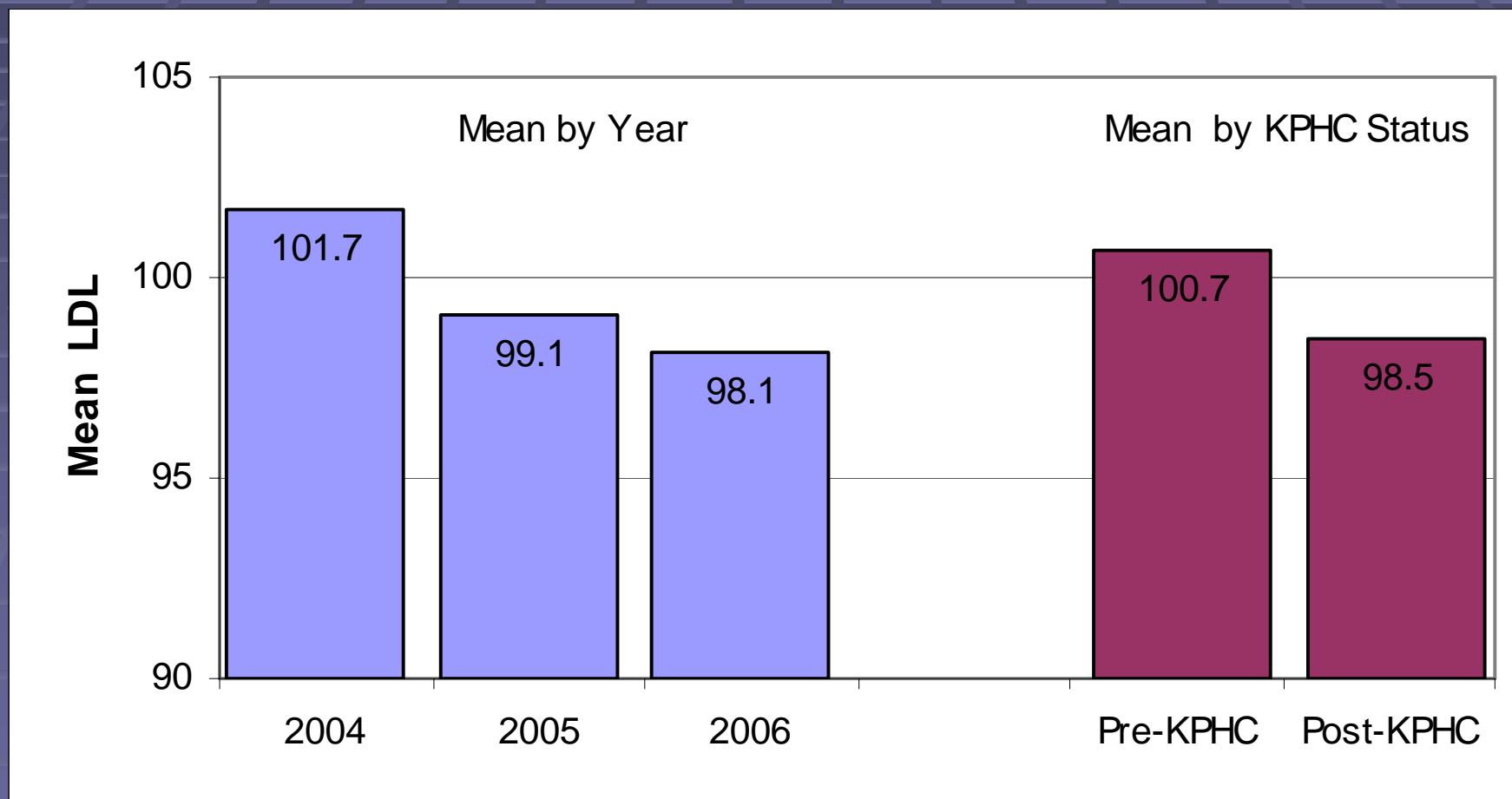
Characteristics		LDL cohort		HbA1c cohort	
		N	column %	N	column %
All Subjects		5,949	100.00%	6,111	100.00%
Age	18<=age <55	1,611	27.08%	1,797	29.41%
	55<=age<65	1,723	28.96%	1,710	27.98%
	65<=age<75	1,676	28.17%	1,671	27.34%
	age>=75	939	15.78%	933	15.27%
Gender	Female	2,903	48.80%	3,051	49.93%
	Male	3,046	51.20%	3,060	50.07%
Race/Ethnicity	Known	5,093		5,195	
	White	2,442	47.95%	2,472	47.58%
	Black	927	18.20%	951	18.31%
	Hispanic	743	14.59%	794	15.28%
	Asian	720	14.14%	725	13.96%
	Other	261	5.12%	253	4.87%
Neighborhood SES	Known	5,566		5,707	
	Non-low	3,280	58.93%	3,379	59.21%
	Low	2,286	41.07%	2,328	40.79%

Change in Mean LDL (mg/dL) (Unadjusted)

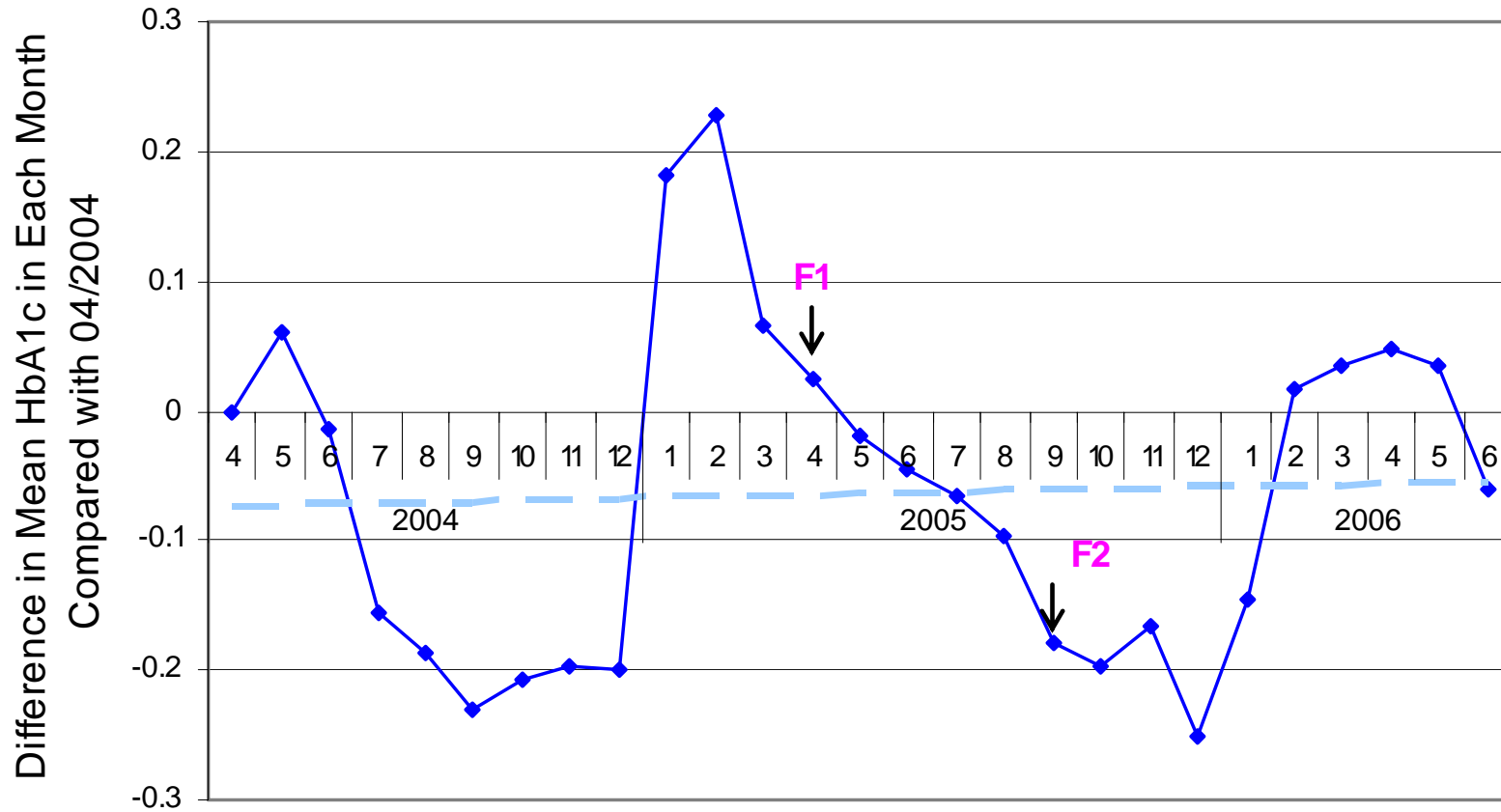


F1: KPHC starting date in Facility1
F2: KPHC starting date in Facility2

Mean LDL (mg/dL) by Year and KPHC (Unadjusted)

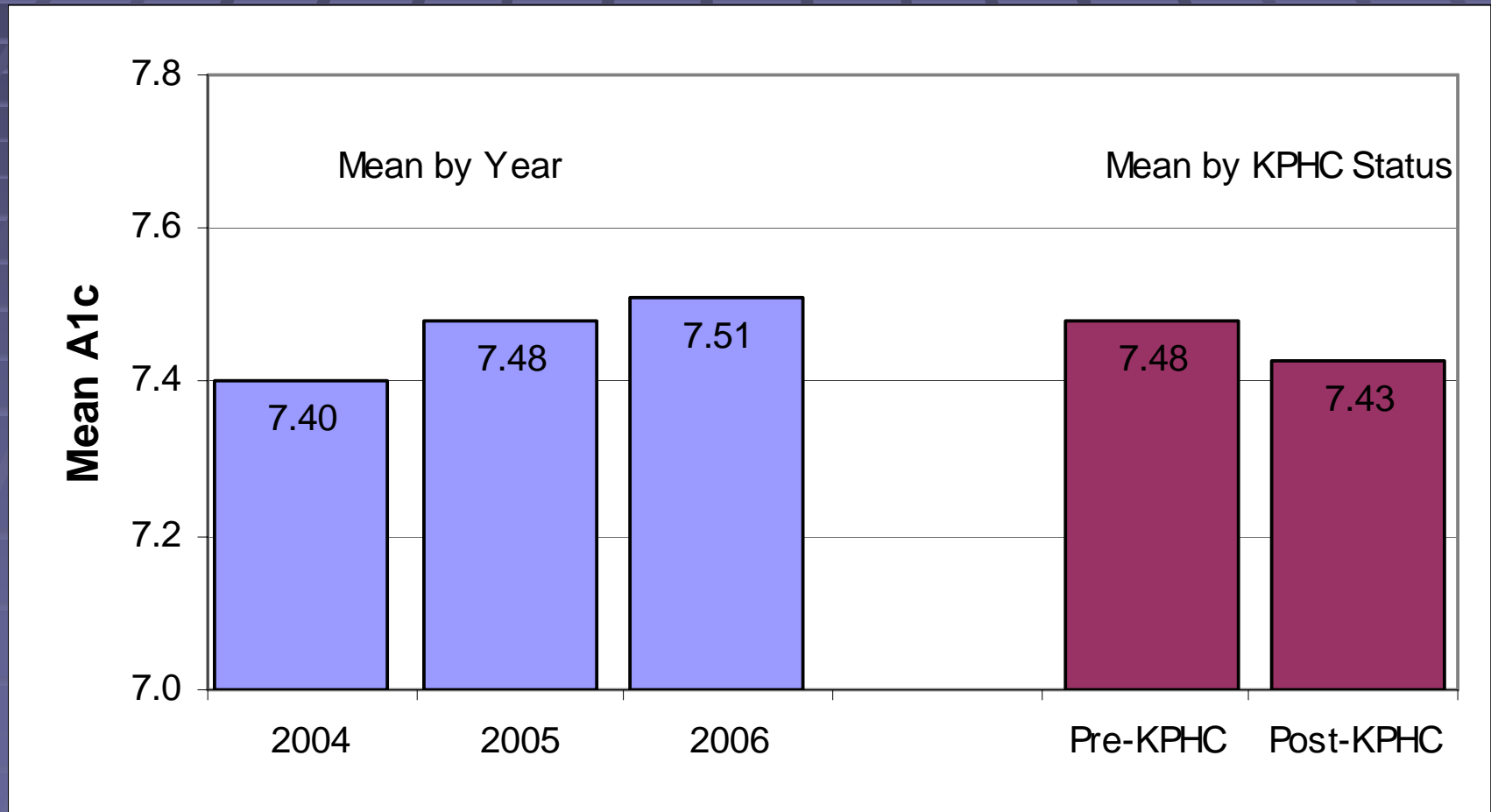


Change in Mean HbA1c (%) (Unadjusted)

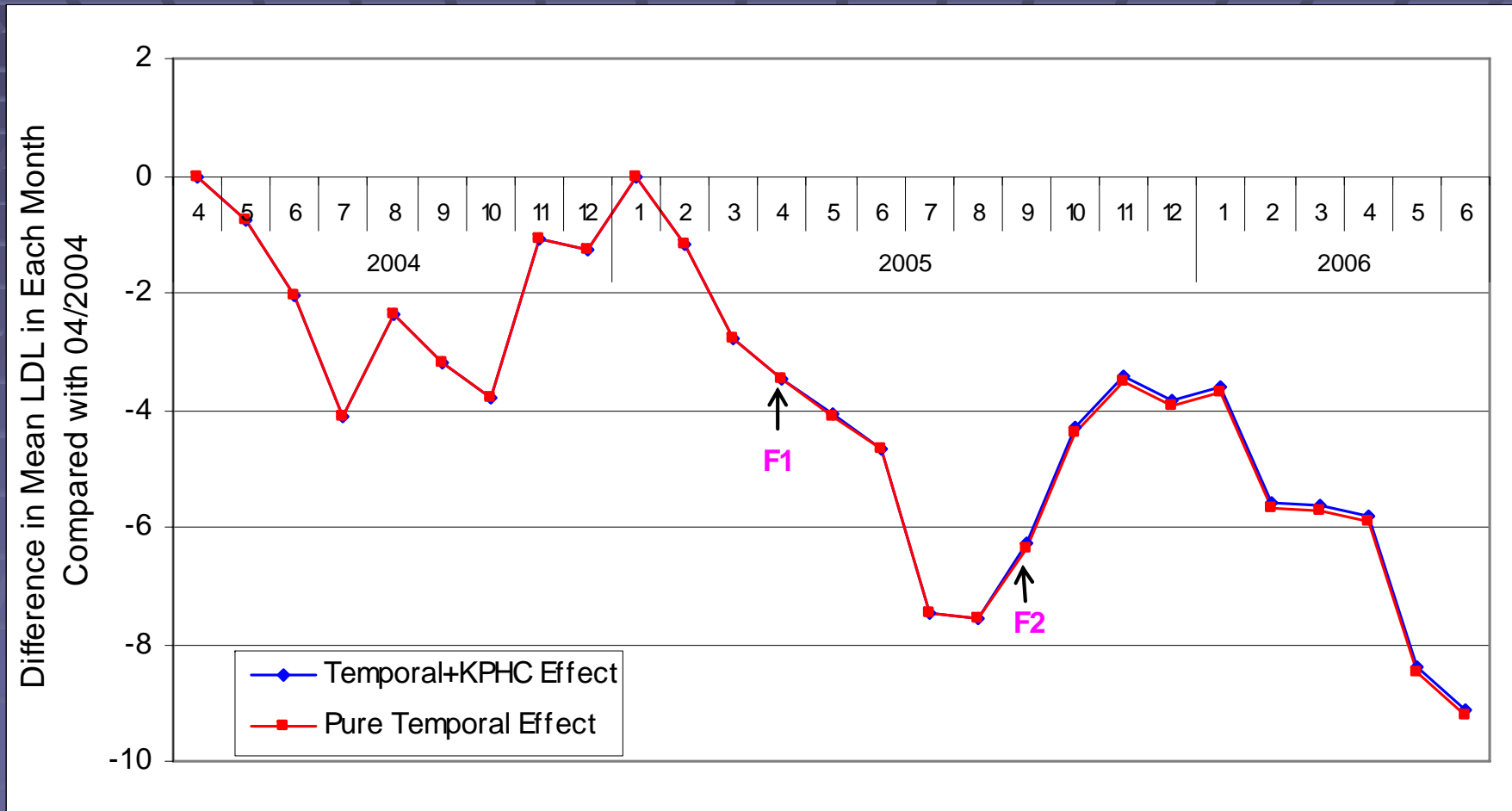


F1: KPHC starting date in Facility1
F2: KPHC starting date in Facility2

Mean HbA1c (%) by Year and KPHC (Unadjusted)

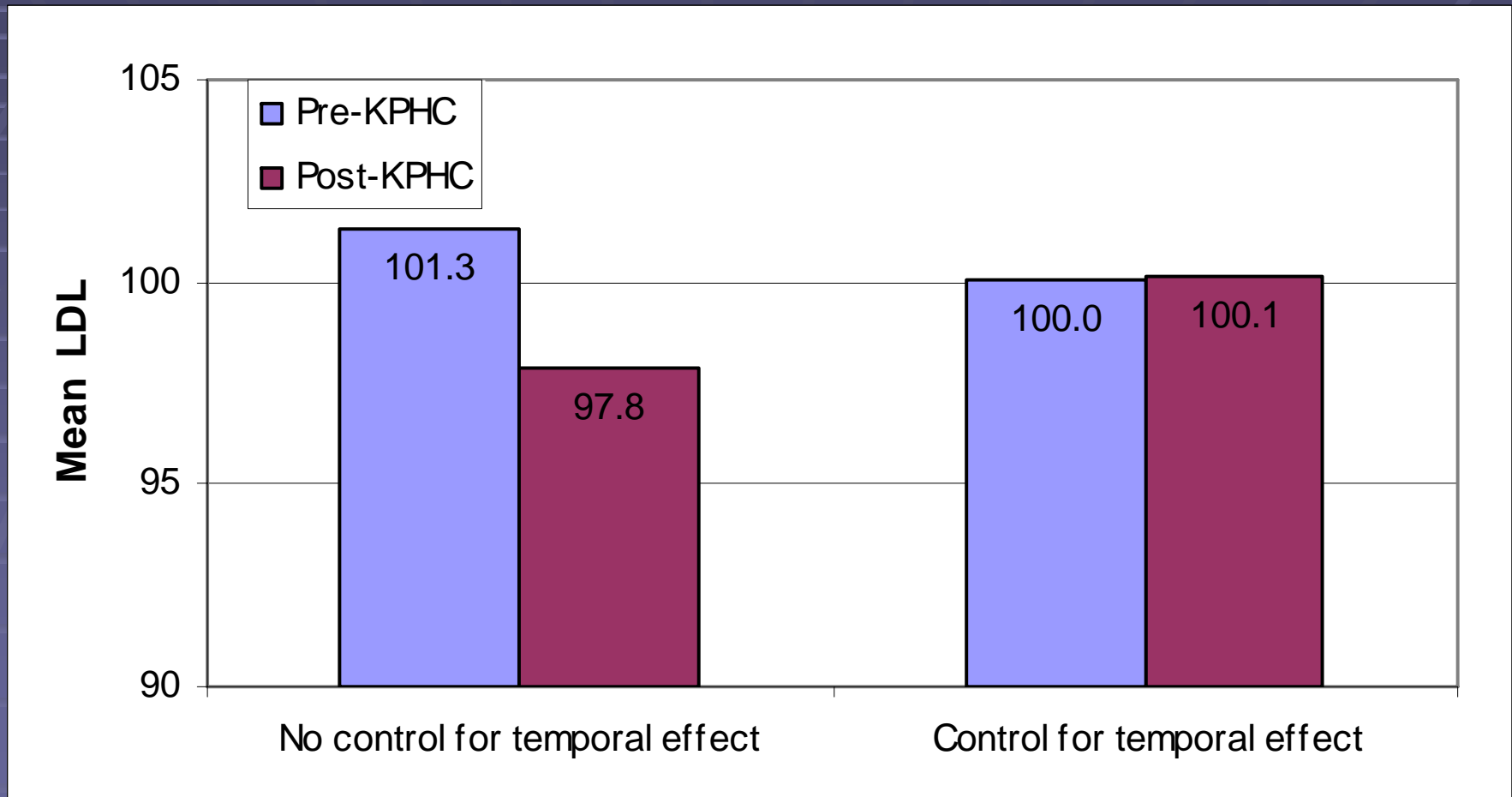


Change in LDL (mg/dL) (Model-based)



F1: KPHC starting date in Facility1
F2: KPHC starting date in Facility2

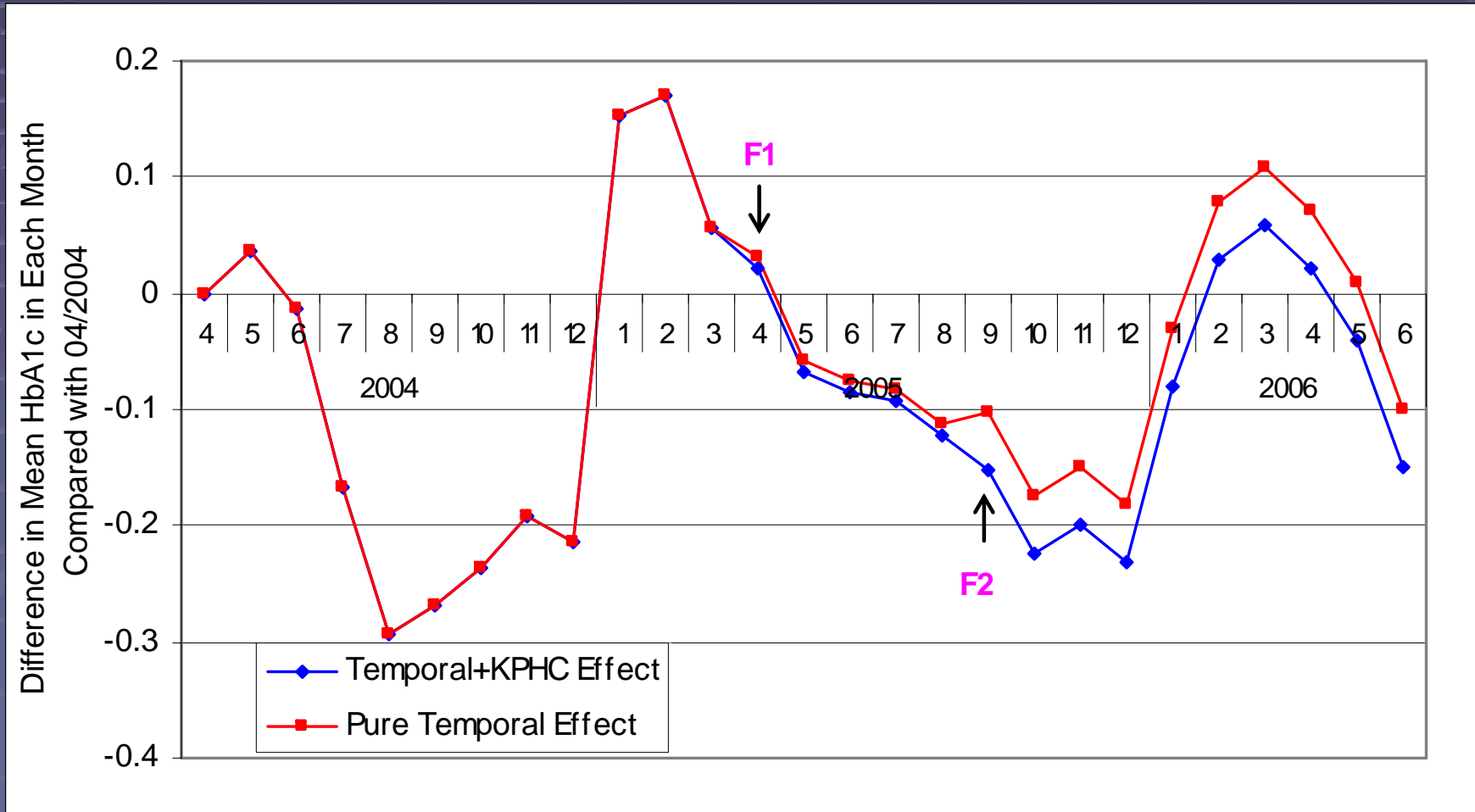
Mean LDL (mg/dL) (Model-based)



No control for temporal effect: Post-KPHC – Pre-KPHC: -3.46 (-4.12, -2.80)

Control for temporal effect: Post-KPHC – Pre-KPHC: 0.08 (-1.76, 1.93)

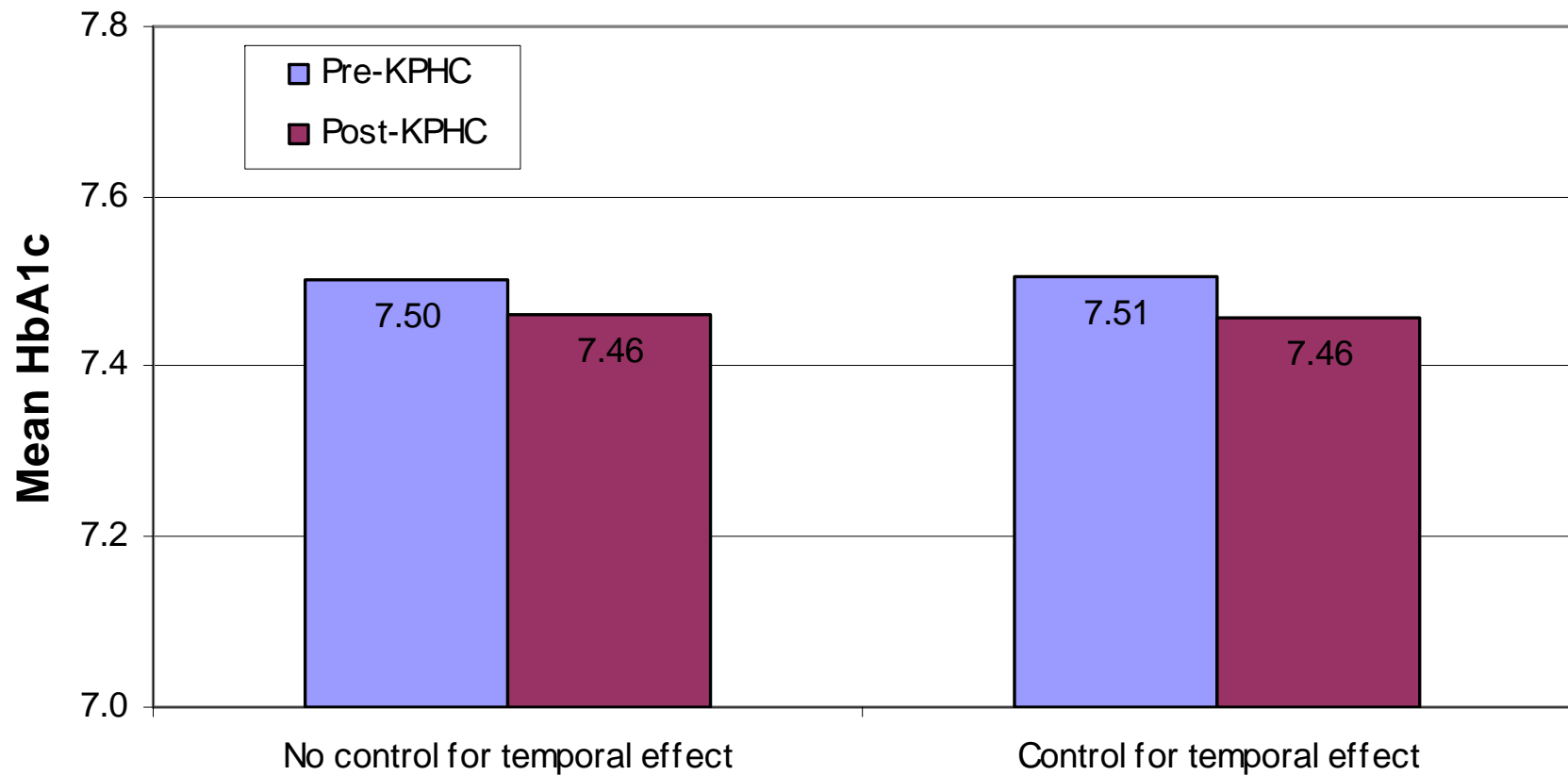
Change of HbA1c (%) Over Time (Model-based)



F1: KPHC starting date in Facility1
F2: KPHC starting date in Facility2

Mean HbA1c (%)

(Model-based)



No control for temporal effect: Post-KPHC – Pre-KPHC: -0.04 (-0.07, -0.01)

Control for temporal effect: Post-KPHC– Pre-KPHC: -0.05 (-1.26, 0.02)

Model Results for KPHC effects and random effects

	LDL		HbA1c	
KPHC Effect	Difference	95% CI	Difference	95% CI
Post-KPHC - Pre-KPHC	0.08	(-1.76,1.93)	-0.05	(-0.13,0.02)
Random Effects:	Variance	Column %	Variance	Column %
Total	970.12	100.00%	2.519	100.00%
Team Level	1.48	0.15%	0.002	0.09%
Physician Level	10.05	1.04%	0.025	1.00%
Between Patient	538.17	55.47%	1.660	65.88%
Within Patient	420.42	43.34%	0.832	33.03%

Models adjusted for temporal changes and covariates

Limitations

- Preliminary data from one medical center [total of 18 medical centers in full IMPACT study]
- Limited observation period for pre-KPHC and post-KPHC
- Not sufficient data yet to distinguish the effect of basic HIT and KPHC

Conclusions

- These preliminary analyses found:
 - Substantial improvements in some physiologic outcome (LDL) over time (temporal changes)
 - With limited preliminary data, no statistically significant improvements in either physiologic outcome associated with HIT after accounting for temporal changes
 - Model-based method is needed to disentangle temporal effect from HIT effect

Implications

- HIT implementation happens in the real-world, not in a vacuum
- Important to consider the temporal trends within the system
- Important to consider multiple outcomes