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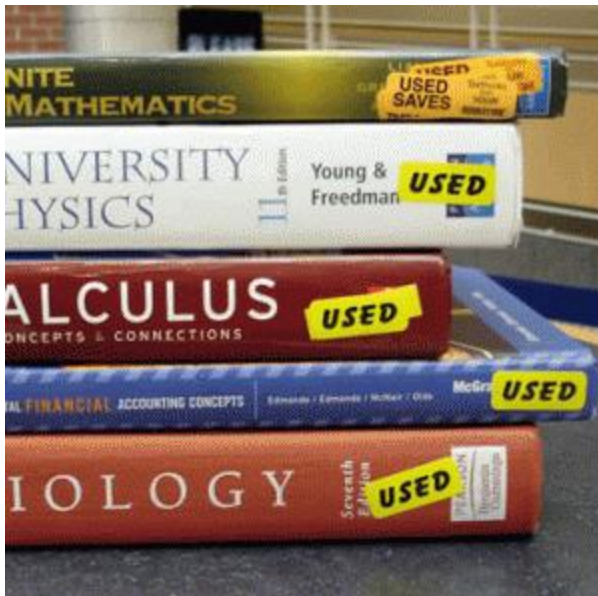


Building a Connected Strategy: From Customer Experience to Technology Platforms

Fall Conference, Philadelphia, 2016



amazon



Operations Management

Cachon • Terwiesch



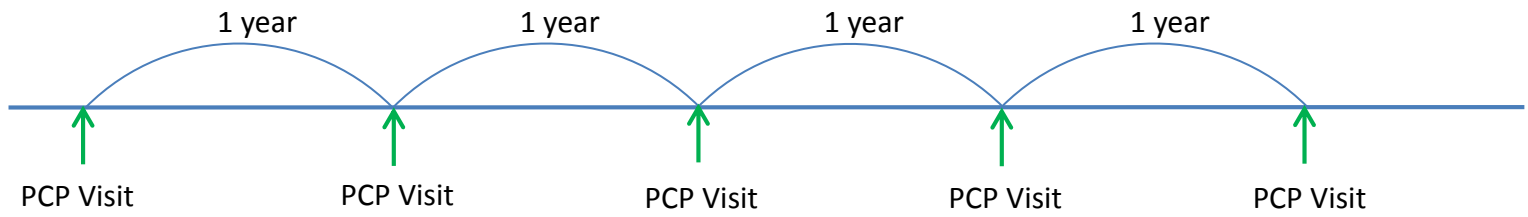
Combination of

- Reading
- Videos
- Problem sets

Helps students by directing them back to the appropriate content in the book

Helps professor by:

- Providing feed-back where students struggle
- No more grading



myPennMedicine

 Penn Medicine

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*The region's first patient-accessible,
online health records.*

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you need most – whenever you need it – test
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JeffConnect

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Scheduled Online Visits

Through video conferencing technology, patients and clinicians connect virtually to discuss recovery progress after procedures or illnesses, and address other important information related to patient care.



Remote Second Opinion

People who have been seen and diagnosed by their own physician can request a second opinion from a Jefferson physician without having to travel to Philadelphia, Pennsylvania.

[READ MORE >](#)

Best Health And Fitness Apps



What is the Pattern Here?

The old way



Student reading

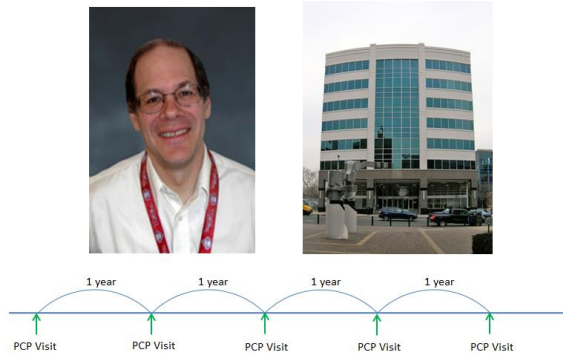
The Internet Way



The New Way



Personal health



⇒ Increase in “smart devices” and “connectivity”

Goal of this Conference: Understanding Connected Strategies



Customer Experience



Business model / service
delivery model



Technology platform
Enabling technology

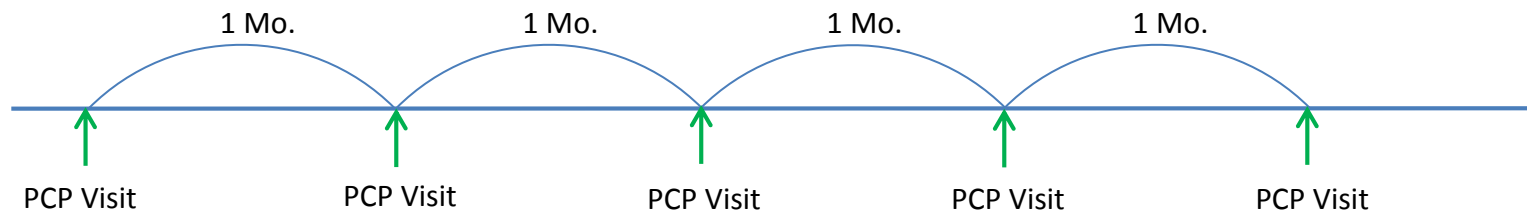
Innovations in Service Delivery Models: Reimagining Primary Care*

Christian Terwiesch

Traditional Care Delivery Model: Episodic Care Based on Fixed Revisit Intervals & Urgent Care Appointments

Physician / Provider

Choose a revisit interval based on the health condition of the patient
Paradigm of an “inspection policy”



Patient

See your doctor as scheduled

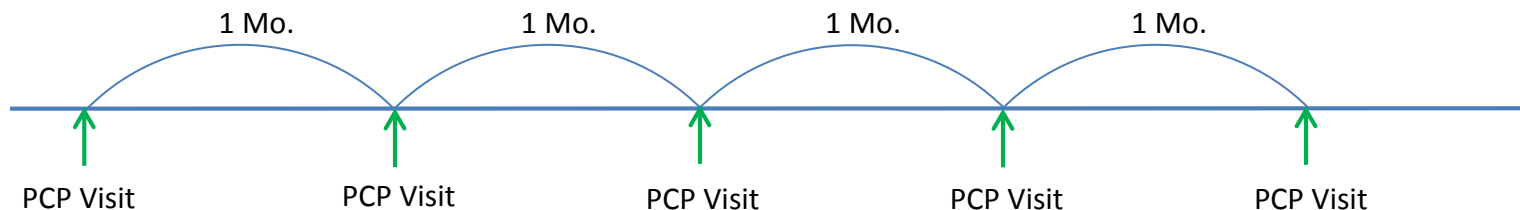
In case of emergency, call the practice or go to the ER



Study 1: Looking for Improvement Potential: A Time and Motion Study for the Current Work of a PCP

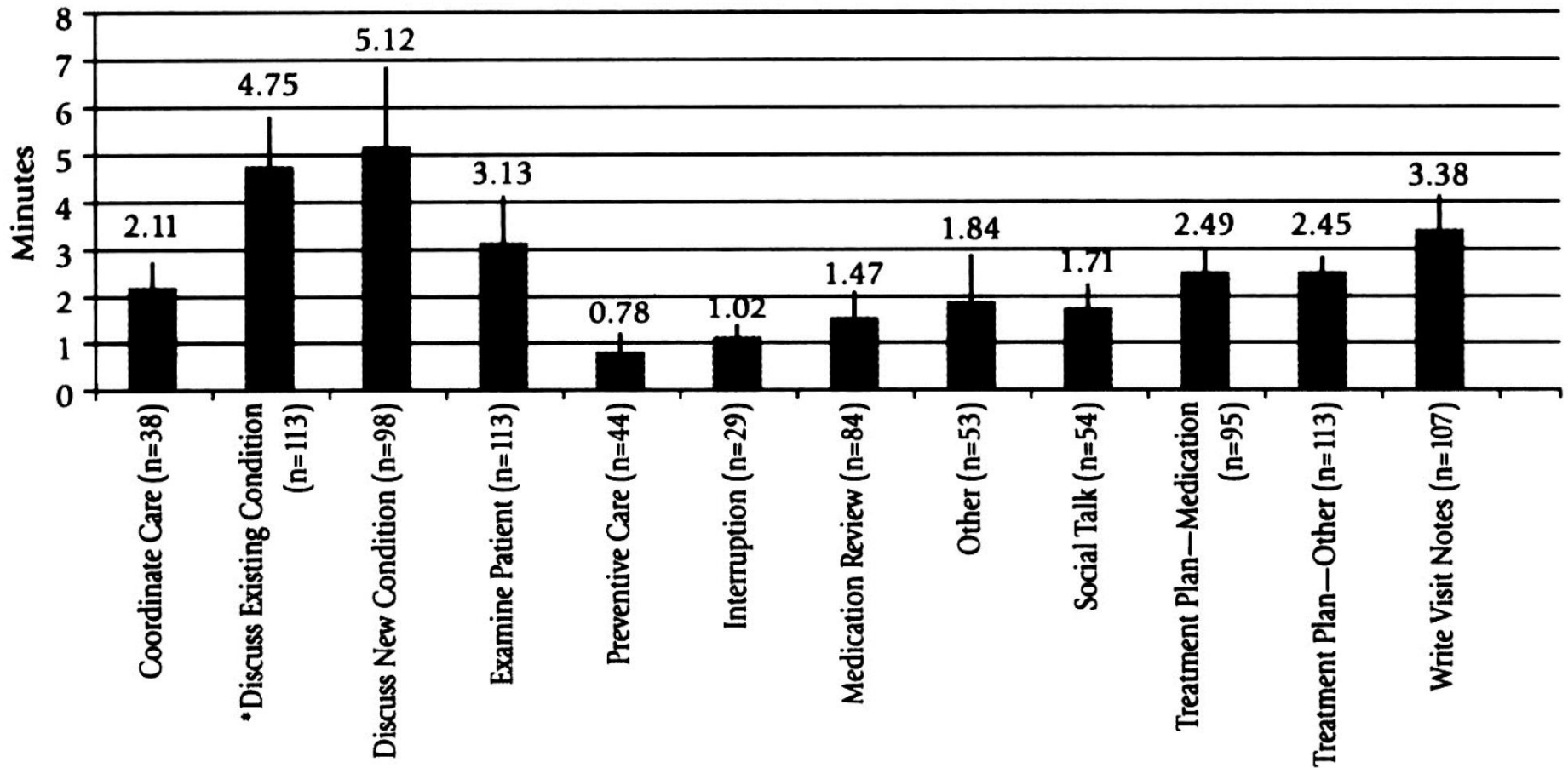
Time [min]	Activity
0	Patient enters
1	Pt asks about glucose levels and insulin shot levels
2	Dr. looks up prescription information on pc
3	Dr calls pt's caregiver to consult about pt's insulin medication
11	Dr discusses possibility of signing pt up for diabetes management
12	Dr discusses getting the pt glucagon
14	Dr/off phone, on computer
15	Dr asks pt about any low blood sugar history
16	Dr explains to pt how to store new meds
17	Dr/on computer, prints something
19	Dr gives patient printout of medication information
20	Pt asks Dr to make consult for liver ultrasound
20	Dr puts in liver ultrasound and pharmacy consultation
21	Dr/on computer
25	Dr briefly examines pt
26	They discuss pt's weight and exercise
27	Dr goes through meds
27	Dr/on comp
28	Dr orders blood work to watch sugar & reschedules ultrasound
29	Dr/on computer
30	Dr examines pt briefly again
31	Pt leaves

Based on a video-ethnography of 121 provider patient encounters in the VA



Study 1a: Looking for Improvement Potential: A Time and Motion Study for the Current Work of a PCP

Average visit length: 22.9 minutes per visit

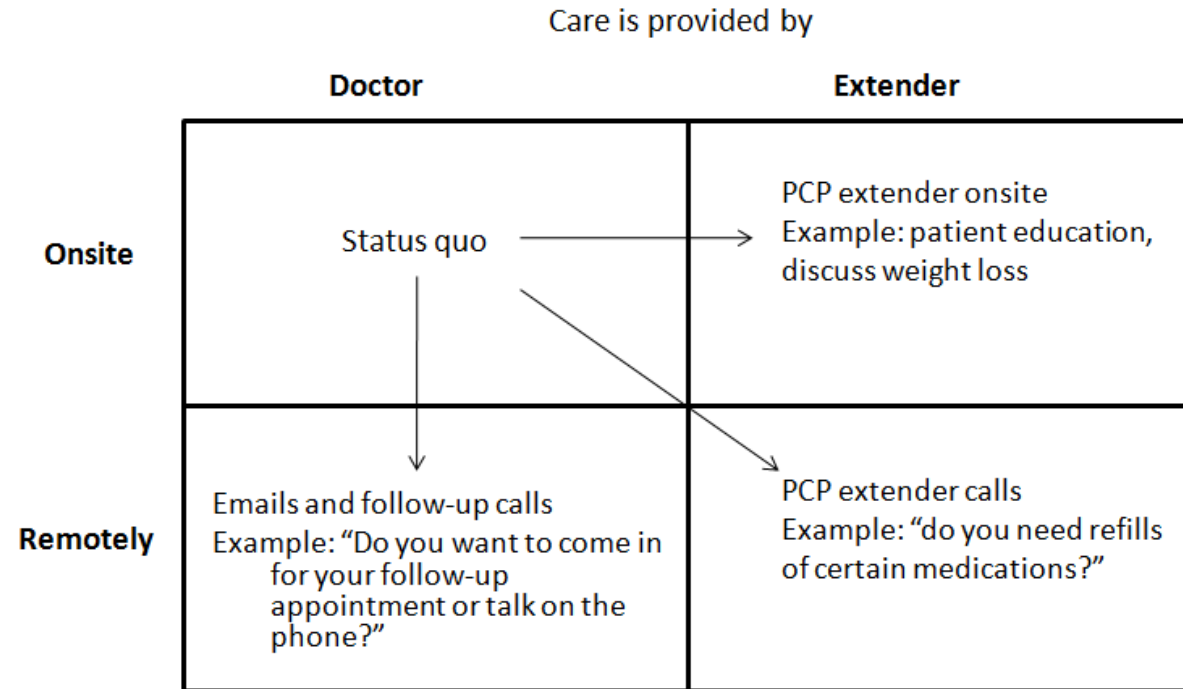


Study 1b: Redesigning the Care Delivery Process

Each of the videos broken up into “episodes”

Each episode categorized in the following matrix

Time [min]	Activity
0	Patient enters
1	Pt asks about glucose levels and insulin shot levels
2	Dr. looks up prescription information on pc
3	Dr calls pt's caregiver to consult about pt's insulin medication
11	Dr discusses possibility of signing pt up for diabetes management
12	Dr discusses getting the pt glucagon
14	Dr/off phone, on computer
15	Dr asks pt about any low blood sugar history
16	Dr explains to pt how to store new meds
17	Dr/on computer, prints something
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20	Dr puts in liver ultrasound and pharmacy consultation
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26	They discuss pt's weight and exercise
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27	Dr/on comp
28	Dr orders blood work to watch sugar & reschedules ultrasound
29	Dr/on computer
30	Dr examines pt briefly again
31	Pt leaves



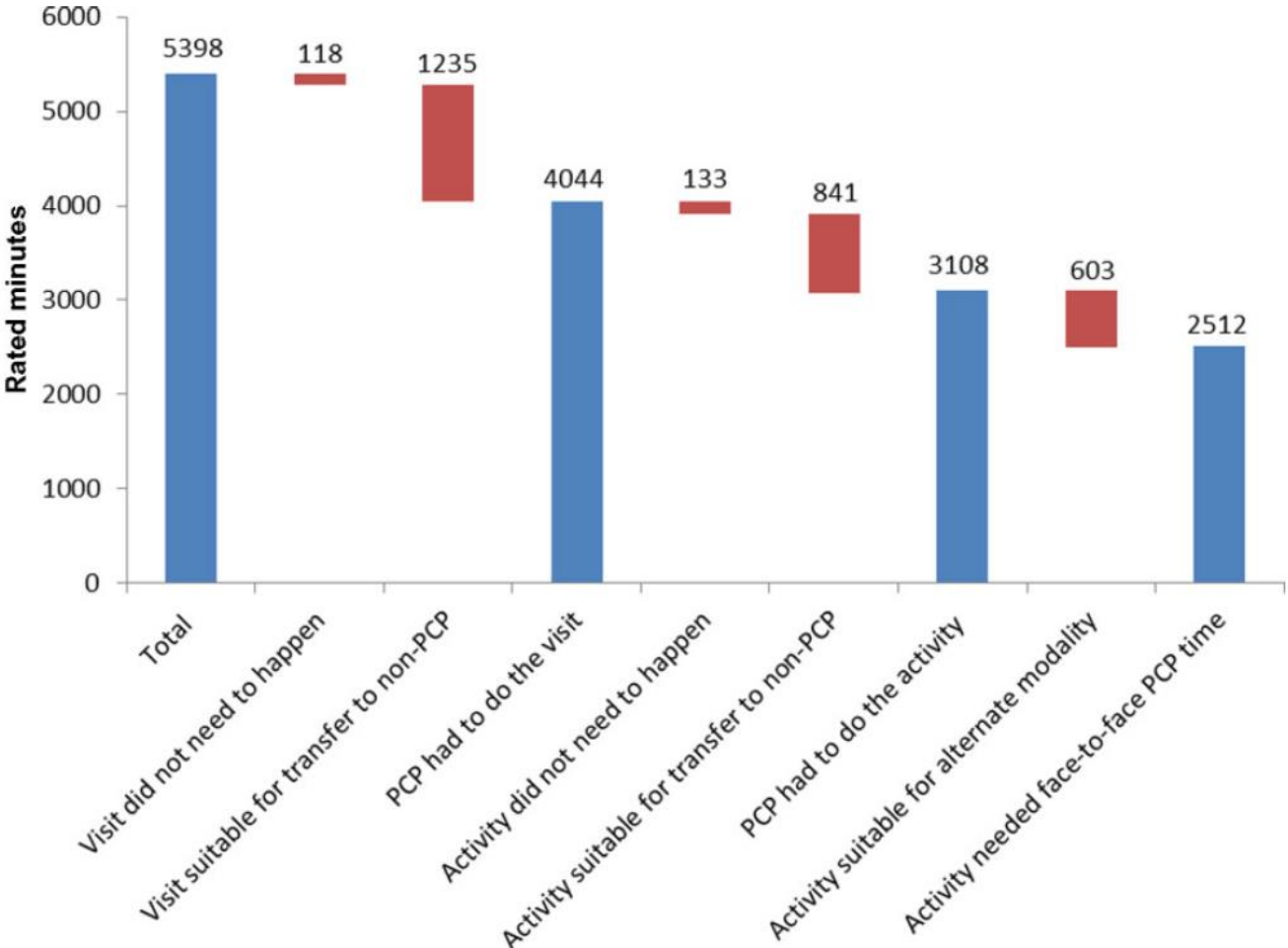
⇒ What distribution over these four cells would you expect?

⇒ Allocation done by an expert panel of three primary care providers with VA experience

Only Half of the Work Needs to Happen “The Old Way”

Little variation across practices can be explained by the usage of PCMH

Suggests a different delivery models with an emphasis on remote access

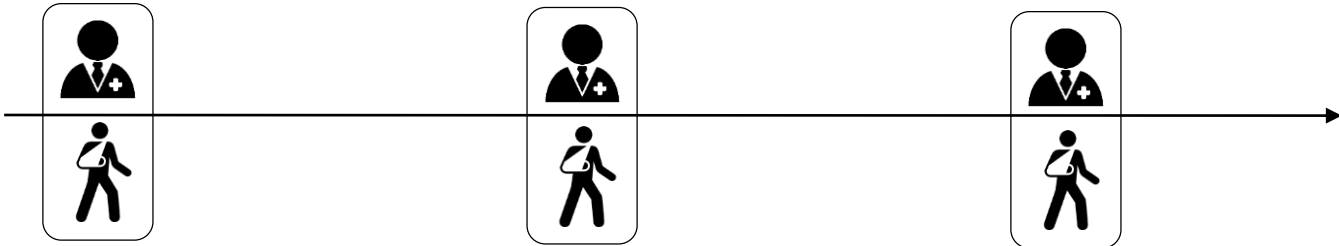


Source: Mary Pelak, Amy Pettit, Jennifer Gutierrez, Christian Terwiesch, Steven Marcus, “Rethinking Primary Care Visits: How Much Can Be Eliminated, Delegated, or Performed Outside of the Face-to-Face Visit?”, *Journal of Evaluation in Clinical Practice*, Vol. 21, August 2015

Can we Rethink Primary Care Emphasizing Email Encounters?

Traditional Office visits

Regular encounters, initiated by a scheduled revisit on an emergency visit



Alternative 1: Virtual Office visits

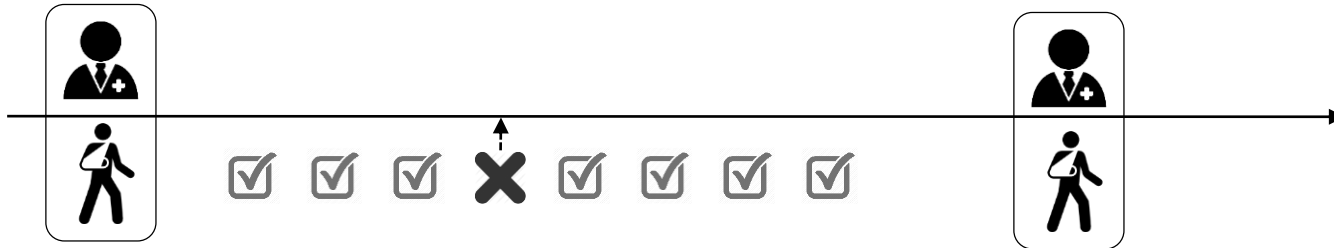
Patient can reach the provider via a portal; messages can be exchanged
Potential use of a physician extender



This is an Important Question as This Could be the Beginning to a Longer Journey...

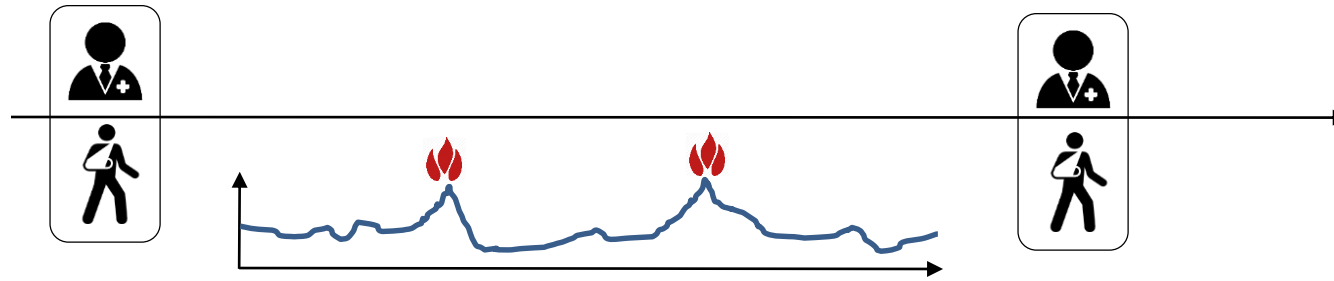
Alternative 2: Check lists, health-loops

Patient is given a set of milestones; follow-up with provider only needed in case of an exception
Milestones can be automated and be pushed out to the patient



Alternative 3: Automated hovering

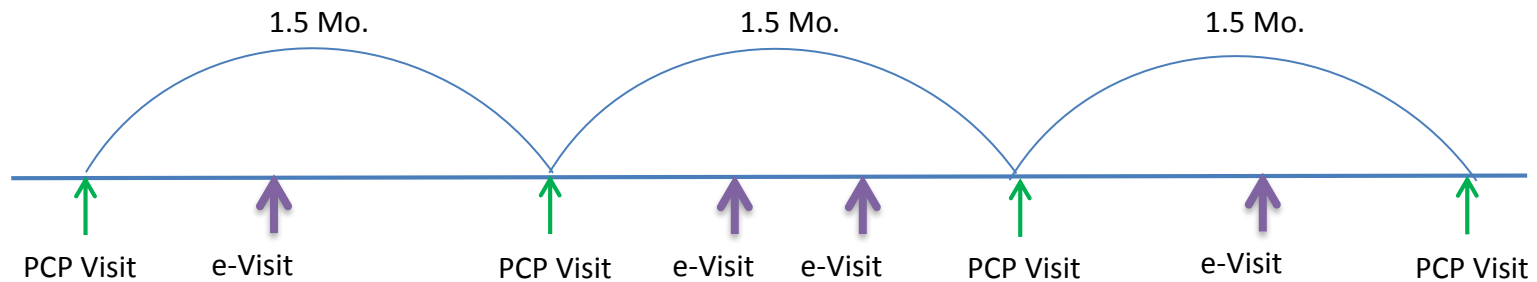
Continuous time monitoring of the patient (or, at least daily)
Requires some degree of automation in interpreting the data



Example at PennMedicine: Patient portal allows for easy access without appointment or office visit

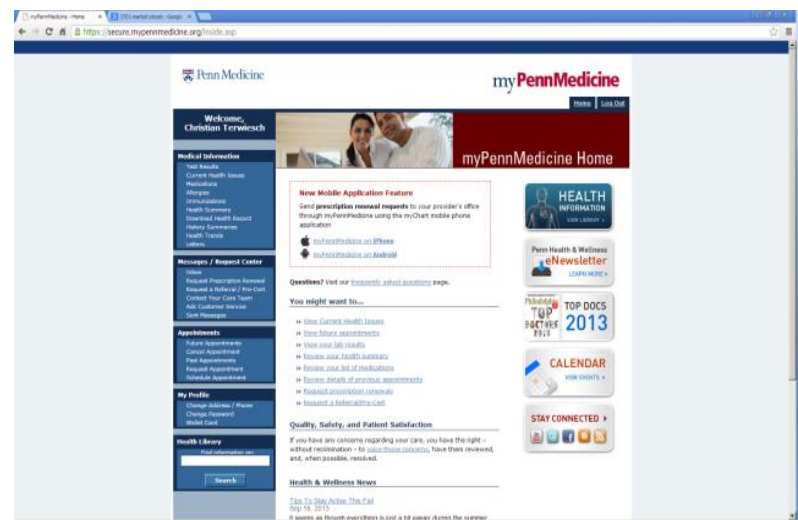
Physician / Provider

Choose a revisit interval based on the health condition of the patient
You know that the patient can reach you as needed, so most likely, choose longer interval
Substitution effect

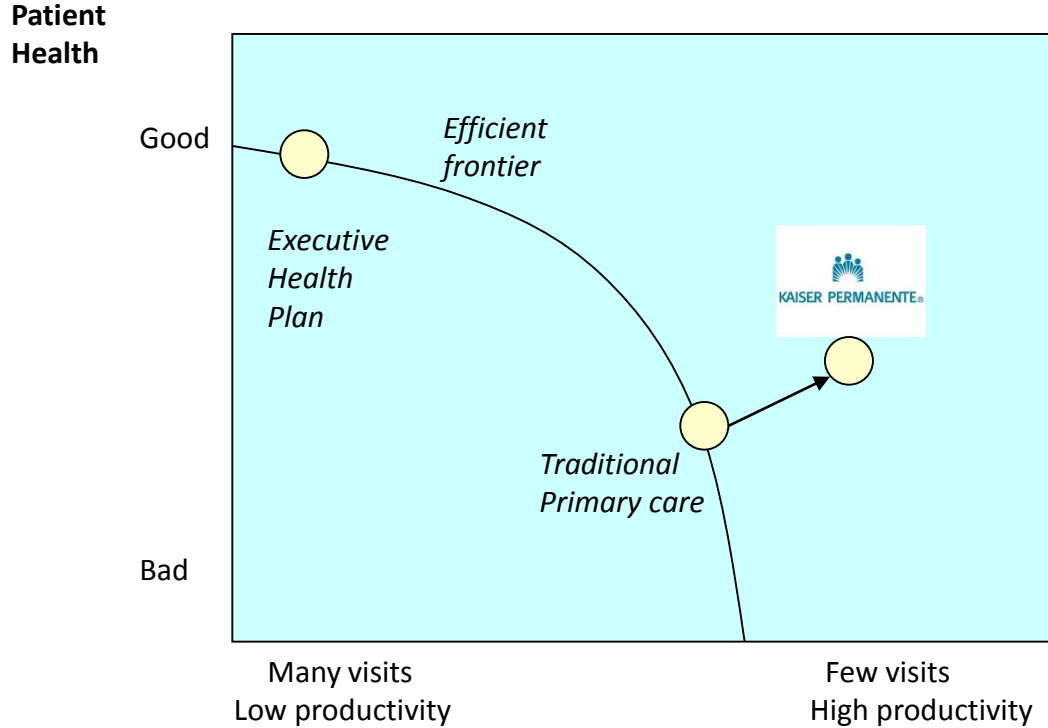


Patient

See your doctor as scheduled
In case of emergency, call the practice,
go to the ER,
or use the patient portal



Goal of the Present Study



Prior Research

Kaiser Permanente: 6.7% decrease in office visits, 13.7% decrease in phone visits, 2-6.5% improvement in HbA1c outcomes / screening

Source: Zhou et al, AJMC 2007

Specific Research Goals

How does the usage of patient portals (in the case of MyPennMedicine) impact the frequency of office and phone encounters as well as the health of the patient?

Overcome methodological shortcomings of prior work

Study 2: Archival Analysis of PennMedicine Data to Find the Effect E-visits Have on Traditional Encounters

Practices include Media, Bucks County, Cooper, 3701 Market, Radnor, Penn Center for Primary Care, Penn Family Care, St Leonard's Court, Bala Cynwyd

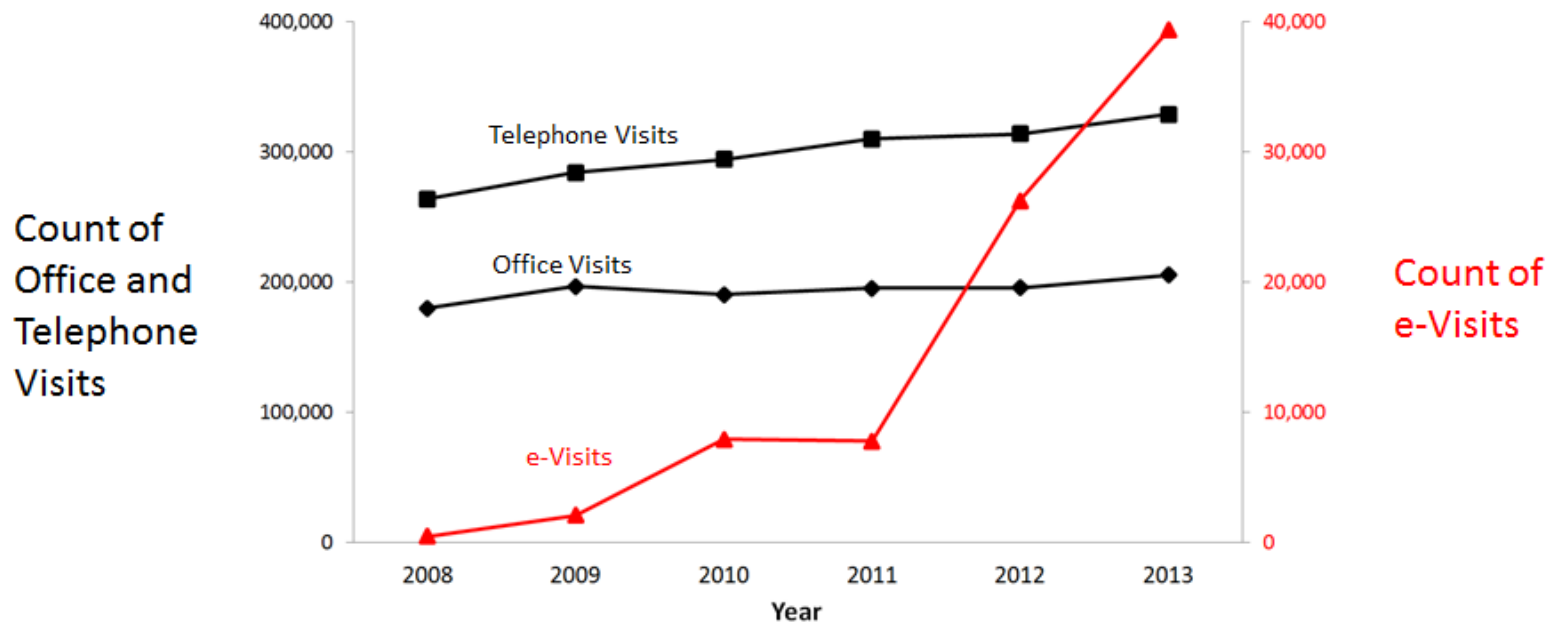
2008-2013Q1

All primary care visits: 2.5M encounters (office visits, telephone visits, e-visits)
51,169 e-visits

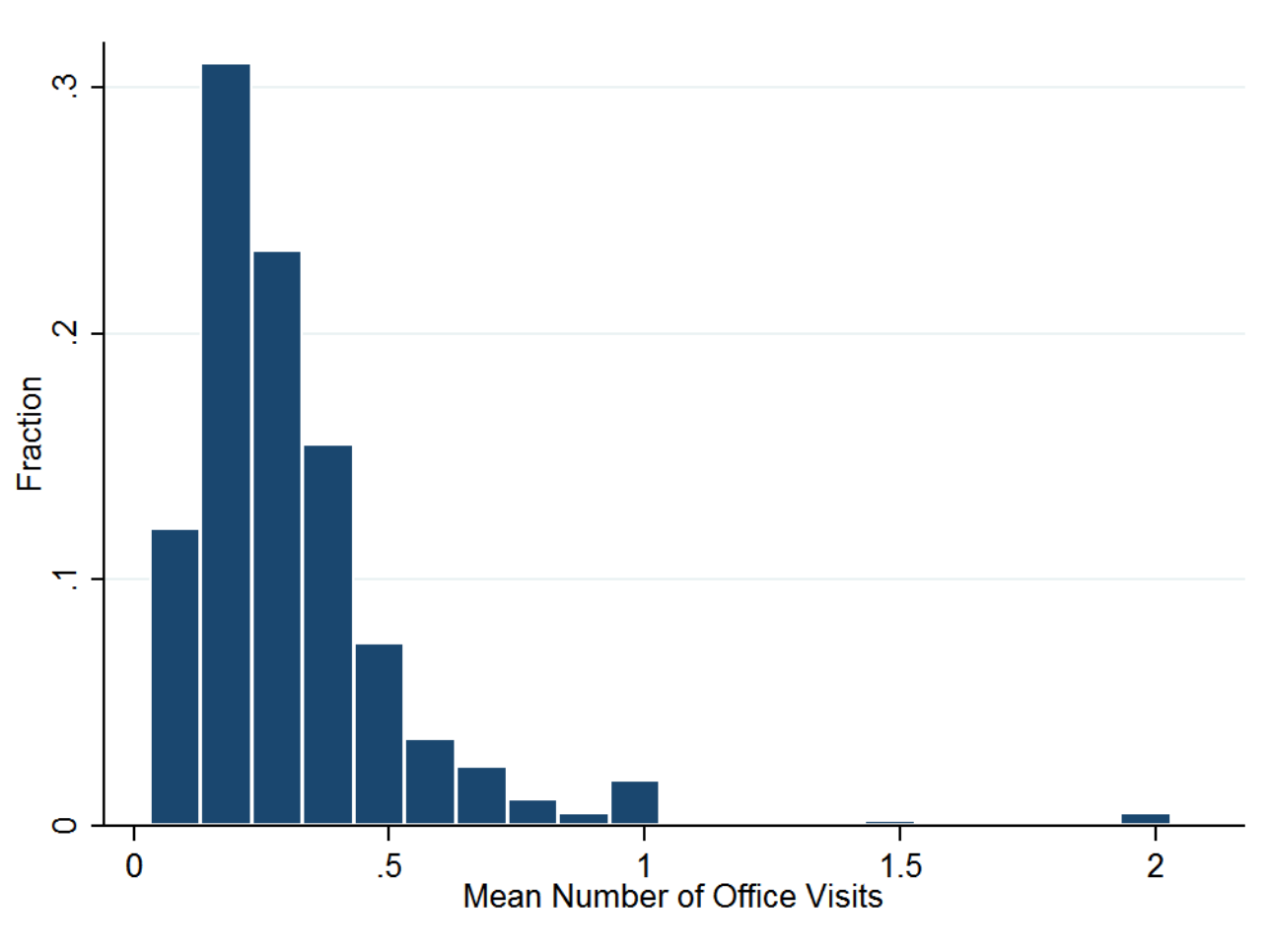
Sample Construction

143,256 unique patients

Include only patients with continuous care => 65,282 patients



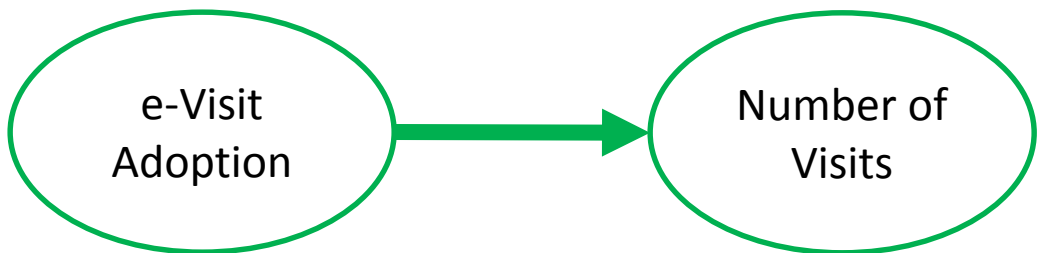
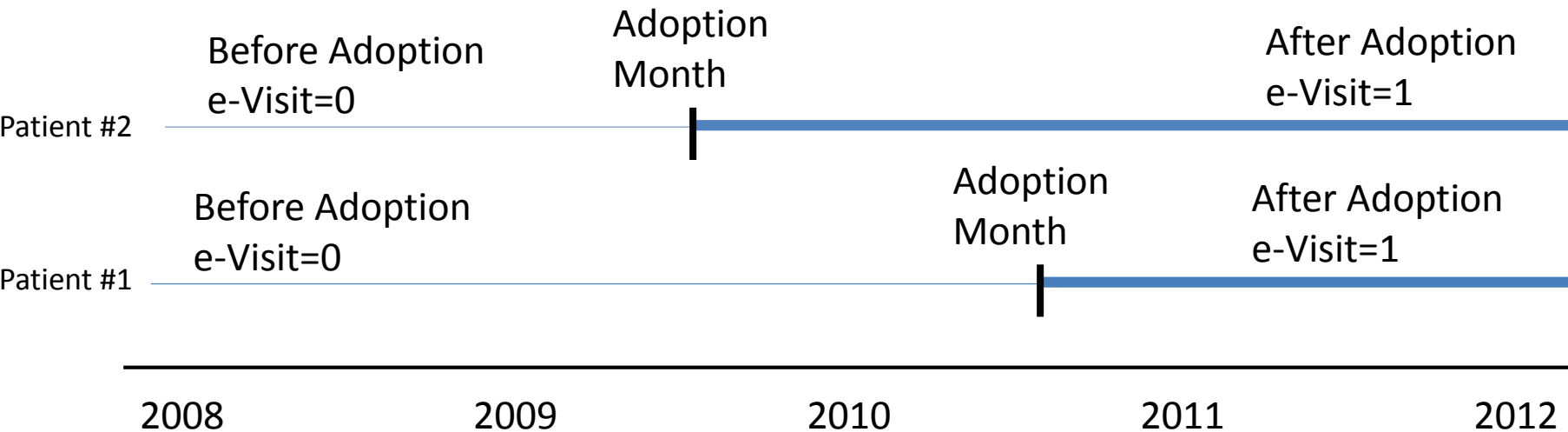
Distribution of days between office visits



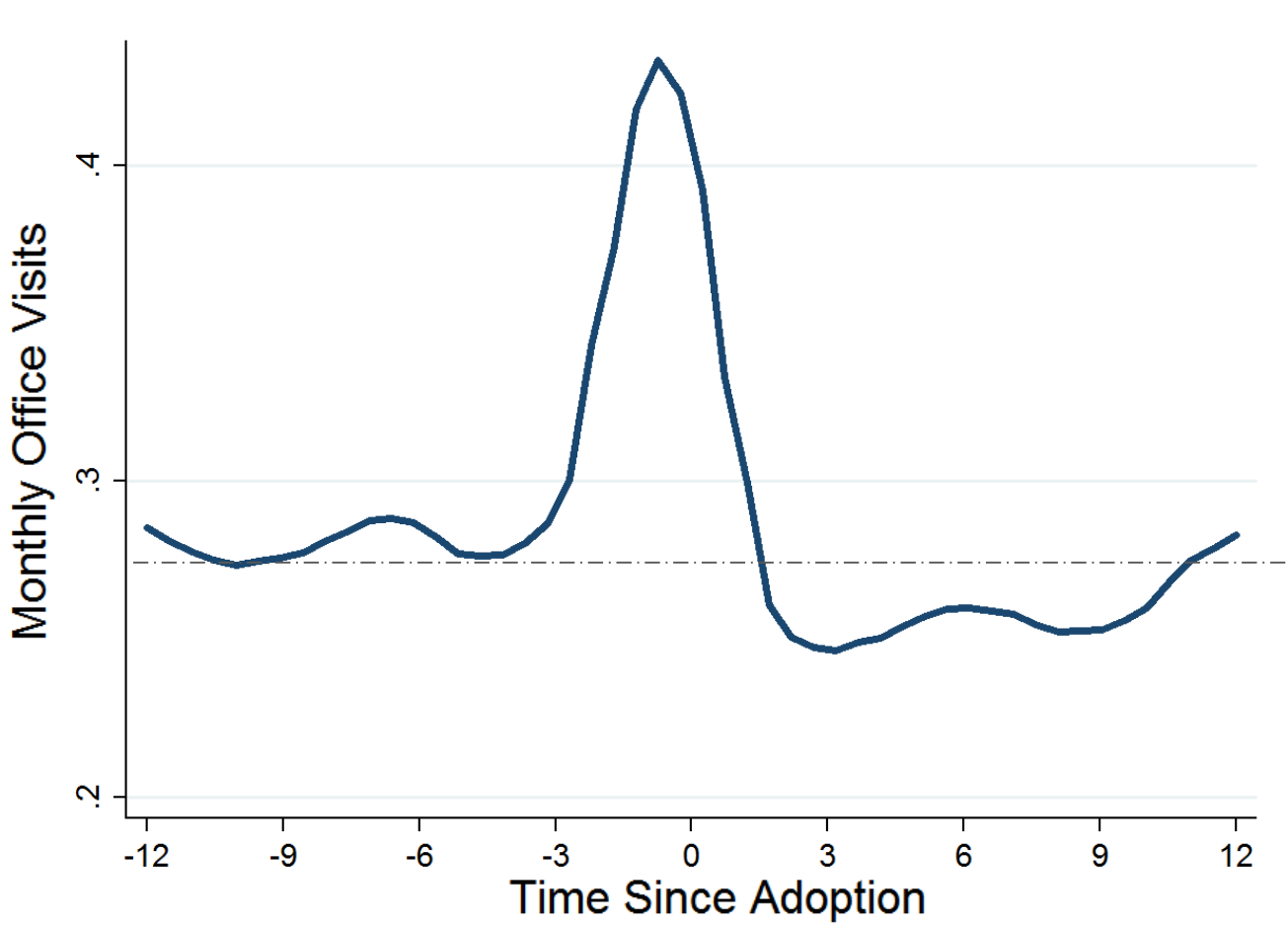
Can we explain some of this variation via the usage of MyPennMedicine?

Source: Hessem Bavafa, Lorin Hitt, Christian Terwiesch, "The Effect of Patient Portals on Care Utilization", revised for *Management Science*

Does the e-Visit Adoption Predict the Number of Visits?



Before and after analysis on adoption shows reduction in the number of office visits

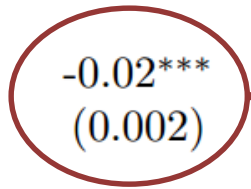


Analysis 1: Significant reduction in the number of office visits

OLS (Adopters Only)

e-Visit Adoption	-0.02*** (0.002)
Adoption Month	0.19*** (0.004)

Observations	347,993
# Patients	7,409



7.4% decrease in the number of office visits (consistent with Kaiser's 6.7%)

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

$$\text{MonthlyVisits}_{it} = \alpha \cdot \mathbf{eVisit}_{it} + \beta \cdot \text{AdoptionMonth}_{it} + \text{patient}_i + \text{provider}_{it} + \text{month}_t + \text{year}_t + \epsilon_{it}$$

Problems with Analysis 1

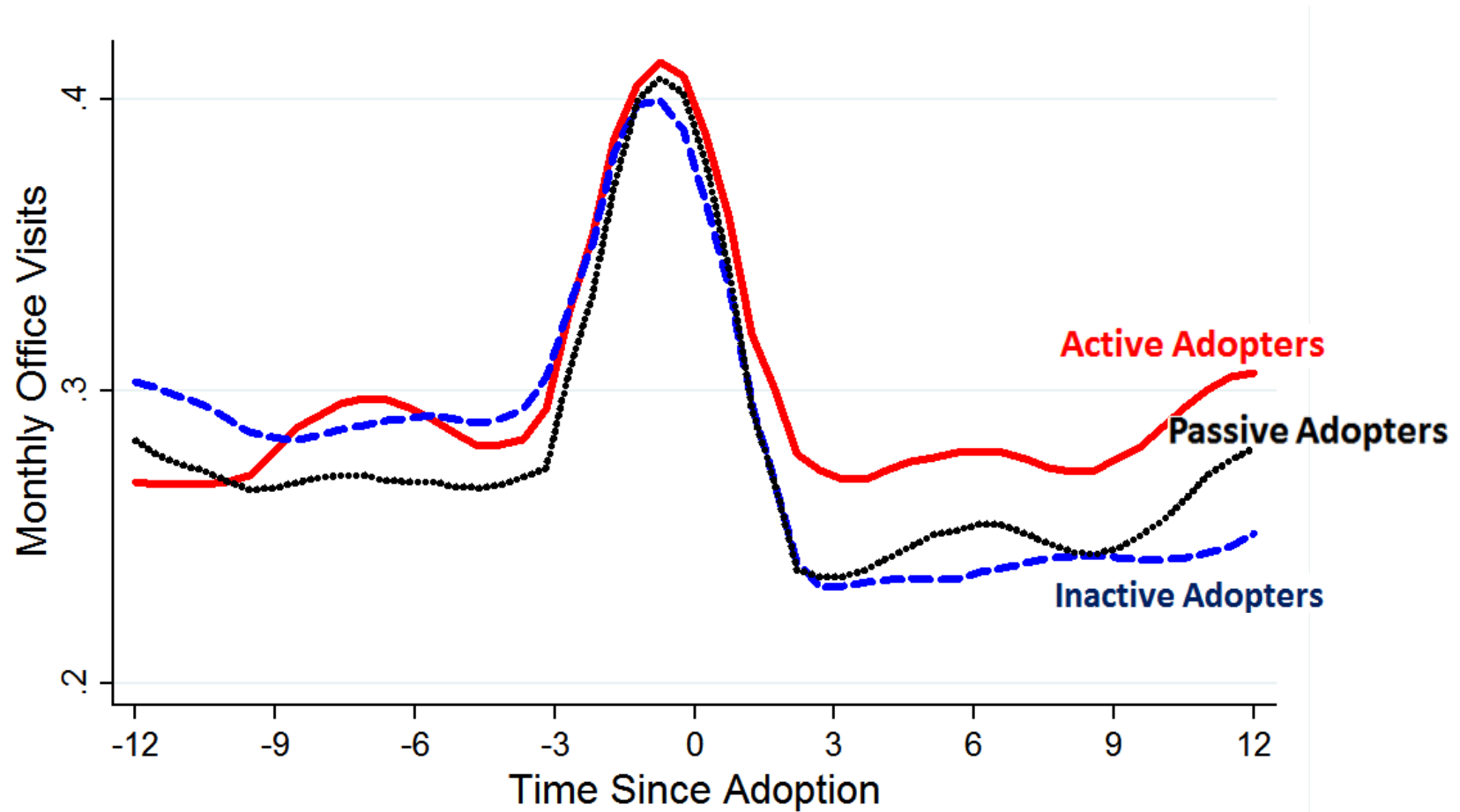
Patients vary in their level of adoption and usage of MyPennMedicine

Three groups of adopters

Inactive Adopters	1,680	Adopted and never used it again
Passive Adopters	1,872	Sent fewer than 4 messages per year (below median)
Active Adopters	1,789	Sent more than 4 messages per year (above median)

Goal of Analysis 2: stratify the effect of adoption by adoption intensity

Analysis 2: Active Adopters and Inactive Adopters are Identical Before Adoption Date But Differ Afterwards



Analysis 2: suggests that Active adopters of e-visits use more office visits

	Office Visits
POST	-0.189*** (0.0165)
POST × PASSIVE	0.059*** (0.0189)
POST × ACTIVE	0.125*** (0.0168)
Adoption Month	0.741*** (0.0123)
Observations	537,182
# Patients	10,507

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

$$\text{MonthlyVisits}_{it} = \gamma_0 + \gamma_1 \text{POST}_{it} + \gamma_2 \text{POST}_{it} \times \text{PASSIVE}_i + \gamma_3 \text{POST}_{it} \times \text{ACTIVE}_i + \theta \cdot \text{AdoptionMonth}_{it} + \text{patient}_i + \text{provider}_{it} + \text{month}_t + \text{year}_t + \epsilon_{it}$$

Conclusion

Our results suggest that e-visits increase frequency of on-site patient-provider interactions

Similar results obtained for telephone encounters

No measurable effects on patient health

Too much connection is not always a good thing

Importance of reimbursement setting