



VA CENTER FOR
CLINICAL MANAGEMENT RESEARCH

**Health Research
That Improves Lives**

Advances in Mobile Health –
Increasing Veterans' Access to Self-Management Support

John Piette, PhD
VA Senior Career Scientist
University of Michigan Professor of Global Public Health

M | **CENTER FOR MANAGING CHRONIC DISEASE**
UNIVERSITY OF MICHIGAN

On mentoring.....

Thank you to my mentors:

- Vincent Mor, PhD, VA and Brown University
- Morris Weinberger, PhD, VA and UNC School of Public Health

Thank you to my mentees:

- James Aikens, PhD
- G. Caleb Alexander, MD
- Chris Bryson, MD
- Laura Chess, MD
- Michele Heisler, MD, MPA
- Mary Janevic, PhD, MPH
- Helen Kales, MD
- Jacob Kurlander, MD, MPH
- Connie Mah Trinacty, PhD
- Evan Milton, MD, MPH
- Huang-Tz Ou, PhD
- Caroline Richardson, MD
- Ann Marie Rosland, MD
- Allison Rosen, MD, MPA
- Laura Saslow, PhD
- Dean Schillinger, MD
- Maria Silveira, MD
- Laura Stevenson, PhD
- Ranak Trivedi, PhD
- Chung-Hsuen Wu, PhD



Nicolle Marinec



Dana Striplin



Jenny Chen
(actual picture)

And a special thanks to VA HSR&D...

- For my mentors and mentees
- For funding our research
- and for the RCS Program

WORLD EXECUTIVE FORUM

The best meet the best

John Piette

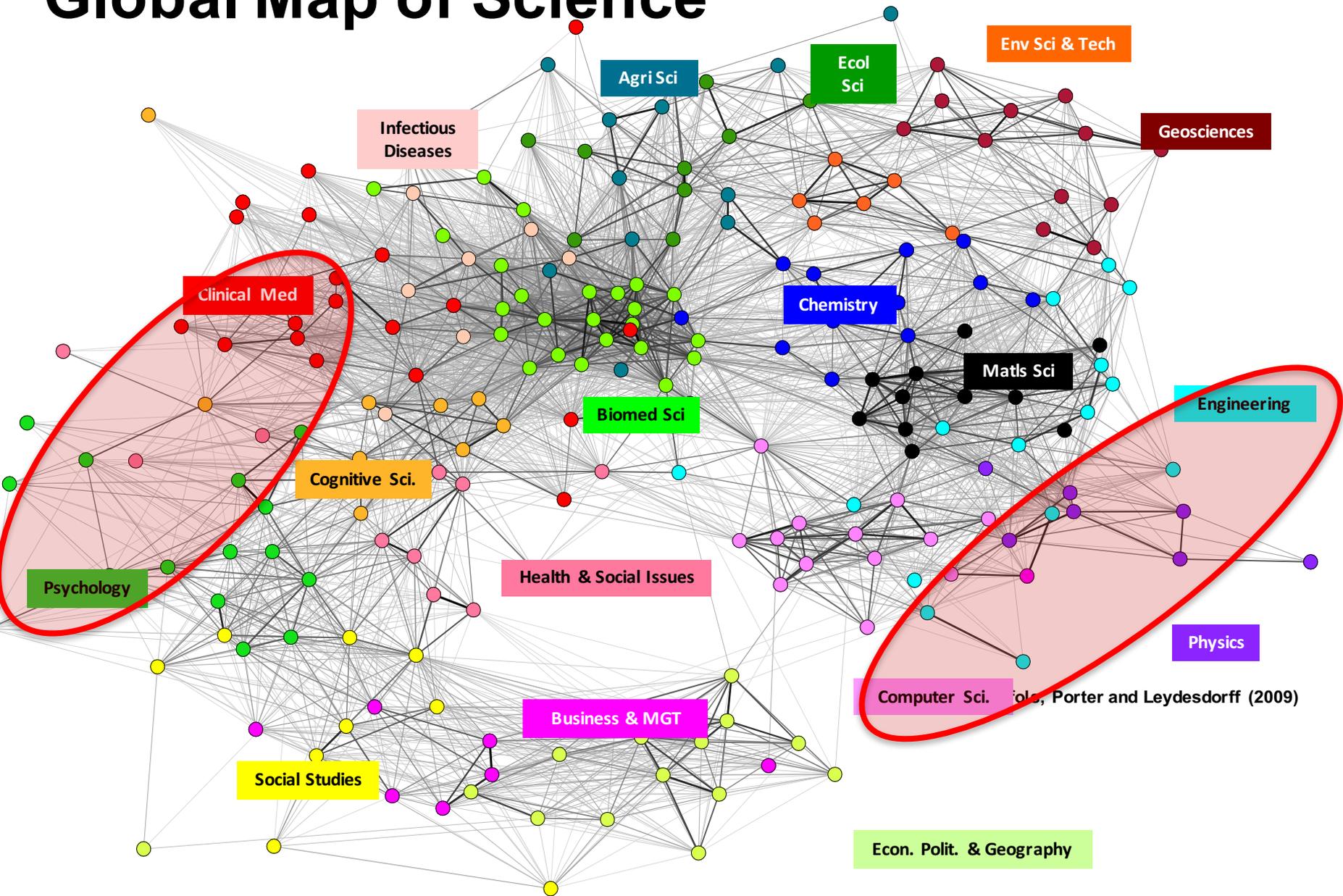
CEO

**UNIVERSITY OF MICHIGAN CENTER FOR
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UNITED STATES

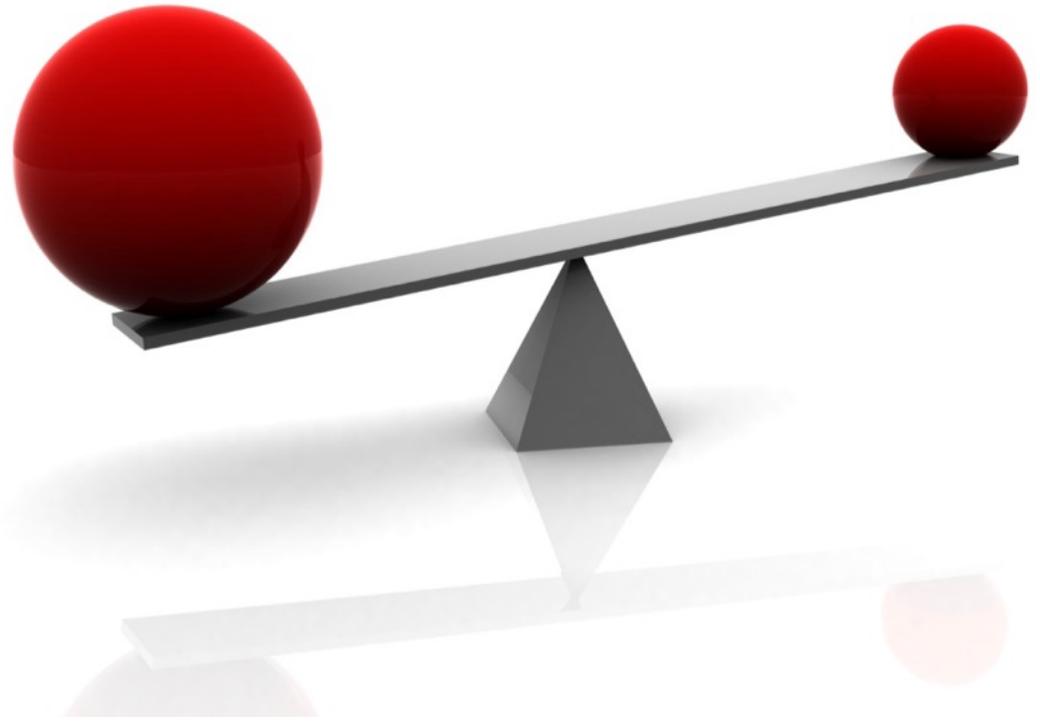


Global Map of Science



Porter, Porter and Leydesdorff (2009)

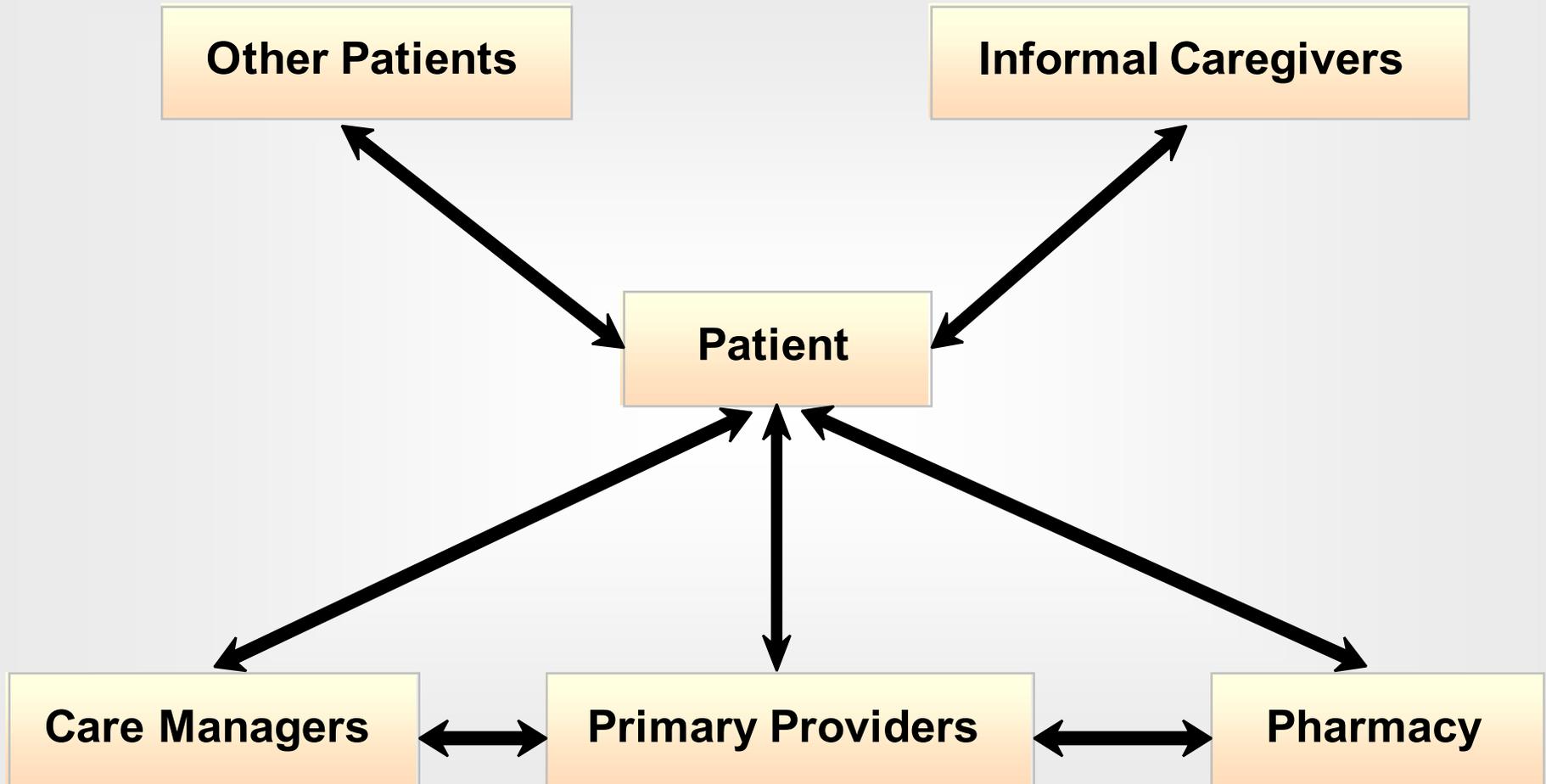
Many patients need
more help than
clinicians can ever
realistically provide
during standard
encounters.



Rubenstein LV et al. Improving care for depression: there's no free lunch. *Annals of Internal Medicine* 2006;145:544-546.

Dobscha SK et al. Depression decision support in primary care: a cluster randomized trial. *Annals of Internal Medicine* 2006;145:477+.

Focus of our interventions



We emphasize
reaching people
when and where
they need it via
mobile health
tools



Assessing the Effect of mHealth Interventions in Improving Maternal and Neonatal Care in Low- and Middle-Income Countries: A Systematic Review

Stephanie Felicie Victoria Sondaal^{1*}, Joyce Linda Browne¹, Mary Amoakoh-Coleman^{1,2}, Alexander Borgstein¹, Andrea Solnes Miltenburg³, Mirjam Verwijs^{4,5}, Kerstin Klipstein-Grobusch^{1,6}

1 Julius Global Health, Julius Center for Health Sciences and Primary Care, University Medical Centre, Utrecht, The Netherlands, **2** School of Public Health, University of Ghana, Legon, Accra, Ghana, **3** Department of Community Medicine, Institute of Health and Society, University of Oslo, Oslo, Norway, **4** Afya Connect(4)Change, Change Lake Zone, Mwanza, Tanzania, **5** International Institute for Communication and Development, The Hague, The Netherlands, **6** Division of Epidemiology and Biostatistics, School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

Mobile Text Messaging for Health: A Systematic Review of Reviews

Amanda K. Hall,¹ Heather Cole-Lewis,^{2,3} and Jay M. Bernhardt⁴

¹Department of Biomedical Informatics and Medical Education, University of Washington, School of Medicine, Seattle, Washington 98105; email: mandiha@uw.edu

²Department of Biomedical Informatics, Columbia University, New York, NY 10032; email: hc2645@columbia.edu

³ICF International, Rockville, Maryland 20850

⁴Center for Health Communication, Moody College of Communication, University of Texas, Austin, Texas 78712; email: jay.bernhardt@austin.utexas.edu

A review of reviews!!

Mobile Health Devices as Tools for Worldwide Cardiovascular Risk Reduction and Disease Management

John D. Piette, PhD; Justin List, MD; Gurpreet K. Rana, MLIS; Whitney Townsend, MLIS; Dana Striplin, MHA; Michele Heisler, MD, MPA

Abstract—We examined evidence on whether mobile health (mHealth) tools, including interactive voice response calls, short message service, or text messaging, and smartphones, can improve lifestyle behaviors and management related to cardiovascular diseases throughout the world. We conducted a state-of-the-art review and literature synthesis of peer-reviewed and gray literature published since 2004. The review prioritized randomized trials and studies focused on cardiovascular diseases and risk factors, but included other reports when they represented the best available evidence.

Burns *et al.* *BMC Public Health* (2016) 16:778
DOI 10.1186/s12889-016-3408-z

BMC Public Health

RESEARCH ARTICLE

Open Access

A systematic review of randomised control trials of sexual health interventions delivered by mobile technologies



Kara Burns^{1*}, Patrick Keating² and Caroline Free³

JOURNAL OF MEDICAL INTERNET RESEARCH

Berrouiguet et al

Review

Fundamentals for Future Mobile-Health (mHealth): A Systematic Review of Mobile Phone and Web-Based Text Messaging in Mental Health

Sofian Berrouiguet¹, MD; Enrique Baca-García², MD, PhD; Sara Brandt³; Michel Walter¹, MD, PhD; Philippe Courtet⁴, MD, PhD

¹Brest Medical University Hospital at Bohars, Adult Psychiatry, Brest, France

²Department of Psychiatry at Fundación, Jimenez Diaz Hospital, Madrid, Spain

³Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, USA., New York, NY, United States

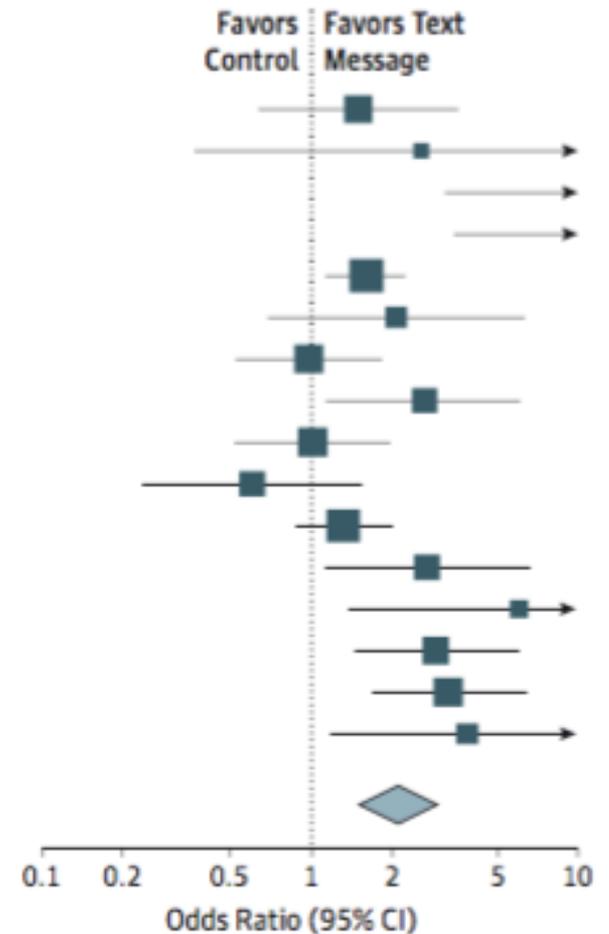
⁴Department of Emergency Psychiatry and Post Acute Care, CHRU Montpellier, University of Montpellier, Montpellier, France. FondaMental Foundation, Créteil, France, Montpellier, France

The humble reminder



Figure 2. Meta-analysis of the Effect of a Mobile Telephone Text Message Intervention on Medication Adherence

Source	Statistics for Each Study		
	Odds Ratio	(95% CI)	P Value
Márquez Contreras et al, ⁴³ 2004	1.508	(0.631-3.605)	.36
da Costa et al, ²⁹ 2012	2.571	(0.371-17.831)	.34
Hardy et al, ³⁰ 2011 ^a	21.131	(3.161-141.237)	.002
Khonsari et al, ³¹ 2015 ^a	12.273	(3.405-44.236)	<.001
Lester et al, ³² 2010	1.612	(1.144-2.271)	.006
Lv et al, ²¹ 2012	2.074	(0.686-6.251)	.20
Lua and Neni, ³³ 2013	0.985	(0.535-1.812)	.96
Maduka and Tobin-West, ³⁴ 2013	2.644	(1.135-6.160)	.02
Mbuagbaw et al, ³⁵ 2012	1.026	(0.519-2.026)	.94
Park et al, ³⁶ 2014	0.610	(0.236-1.585)	.31
Pop-Eleches et al, ³⁷ 2011	1.330	(0.882-2.005)	.17
Quilici et al, ³⁸ 2013	2.705	(1.109-6.596)	.03
Strandbygaard et al, ³⁹ 2010	6.018	(1.368-26.466)	.02
Vervloet et al, ⁴⁰ 2012	2.959	(1.448-6.046)	.003
Wald et al, ⁴¹ 2014	3.267	(1.686-6.331)	<.001
Wang et al, ⁴² 2014	3.857	(1.180-12.606)	.03
Overall	2.107	(1.517-2.926)	<.001



Thakkar et al. Mobile telephone text messaging for medication adherence in chronic disease: A meta-analysis. *JAMA Internal Medicine* 2016;176(3):340-349.

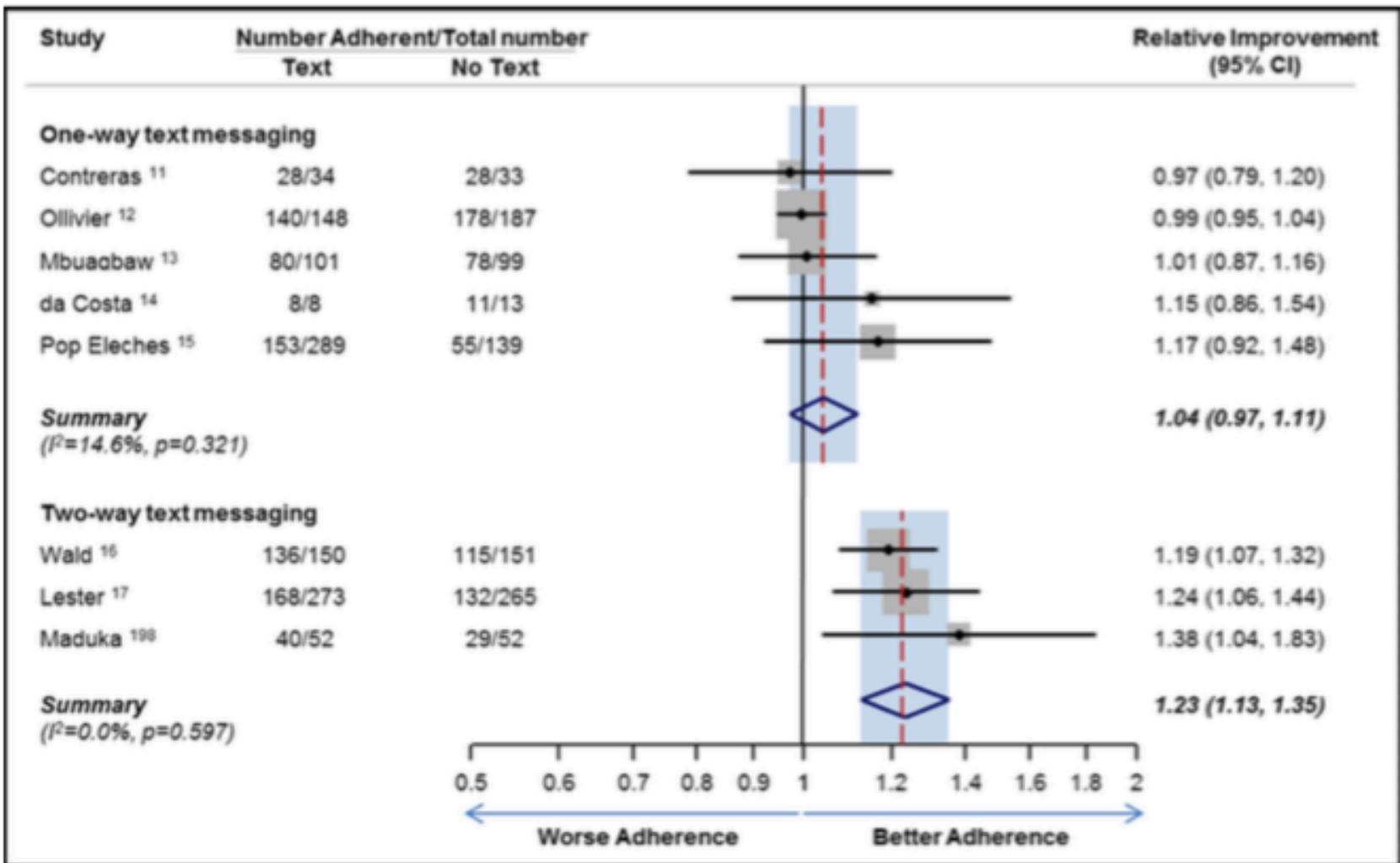


Figure Meta-analysis plot of randomized trials of text messaging on medication adherence according to use of 1-way messaging and 2-way messaging. CI = confidence interval.

Wald DS et al. One-way versus two-way text messaging on improving medication adherence: Meta-analysis of randomized trials. *AJM* 2015;128:1139+.

Smoking cessation support delivered via mobile phone text messaging (txt2stop): a single-blind, randomised trial



Caroline Free, Rosemary Knight, Steven Robertson, Robyn Whittaker, Phil Edwards, Weiwei Zhou, Anthony Rodgers, John Cairns, Michael G Kenward, Ian Roberts

Summary

Background Smoking cessation programmes delivered via mobile phone text messaging show increases in self-reported quitting in the short term. We assessed the effect of an automated smoking cessation programme delivered via mobile phone text messaging on continuous abstinence, which was biochemically verified at 6 months.

Methods In this single-blind, randomised trial, undertaken in the UK, smokers willing to make a quit attempt were randomly allocated, using an independent telephone randomisation system, to a mobile phone text messaging smoking cessation programme (txt2stop), comprising motivational messages and behavioural-change support, or to a control group that received text messages unrelated to quitting. The system automatically generated intervention or control group texts according to the allocation. Outcome assessors were masked to treatment allocation. The primary outcome was self-reported continuous smoking abstinence, biochemically verified at 6 months. All analyses were by intention to treat. This study is registered, number ISRCTN 80978588.

Findings We assessed 11914 participants for eligibility. 5800 participants were randomised, of whom 2915 smokers were allocated to the txt2stop intervention and 2885 were allocated to the control group; eight were excluded because they were randomised more than once. Primary outcome data were available for 5524 (95%) participants. Biochemically verified continuous abstinence at 6 months was significantly increased in the txt2stop group (10.7% txt2stop vs 4.9% control, relative risk [RR] 2.20, 95% CI 1.80–2.68; $p < 0.0001$). Similar results were obtained when participants that were lost to follow-up were treated as smokers (268 [9%] of 2911 txt2stop vs 124 [4%] of 2881 control [RR 2.14, 95% CI 1.74–2.63; $p < 0.0001$]), and when they were excluded (268 [10%] of 2735 txt2stop vs 124 [4%] of 2789 control [2.20, 1.79–2.71; $p < 0.0001$]). No significant heterogeneity was shown in any of the prespecified subgroups.

Interpretation The txt2stop smoking cessation programme significantly improved smoking cessation rates at 6 months and should be considered for inclusion in smoking cessation services.

Funding UK Medical Research Council, Primary Care Research Networks.

Lancet 2011; 378: 49–55

Published Online
June 30, 2011
DOI:10.1016/S0140-6736(11)60701-0

See [Comment](#) page 6

Clinical Trials Research Unit, London School of Hygiene and Tropical Medicine, London, UK (C Free PhD, R Knight RGN, S Robertson BA, W Zhou MSc, Prof J Cairns PhD, Prof M G Kenward PhD, Prof I Roberts PhD, P Edwards PhD); Clinical Trials Research Unit, University of Auckland, Auckland, New Zealand (R Whittaker MPH); and The George Institute for Global Health, University of Sydney, Sydney, Australia (Prof A Rodgers PhD)

Correspondence to:
Dr Caroline Free, Clinical Trials Research Unit, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK
caroline.free@lshtm.ac.uk

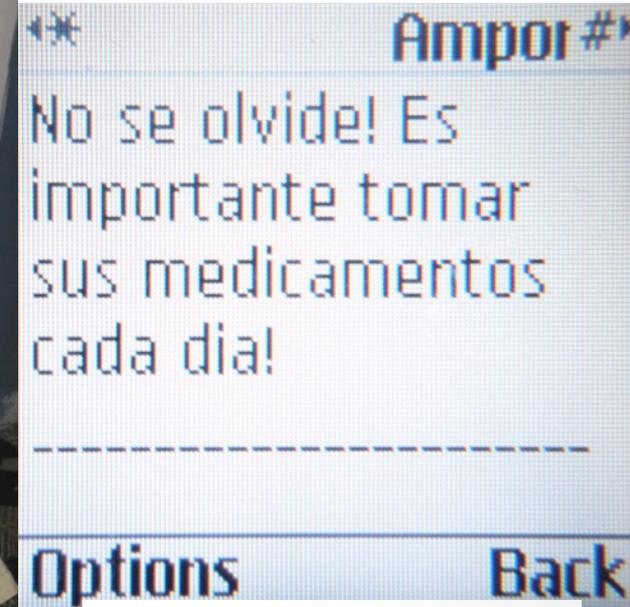
Special devices



Automated calls (IVR)



Text messages (SMS)



Smartphones



The Feasibility of Automated Voice Messaging as an Adjunct to Diabetes Outpatient Care

JOHN D. PIETTE, PHD
CONNIE A. MAH, BA

OBJECTIVE — To determine whether automated voice messaging (AVM) systems could be used as an adjunct to primary care for diabetic patients, we examined whether patients were able to respond to AVM queries for clinical information, whether sufficient numbers of problems were identified to warrant the implementation of the service, and whether patients found the system helpful.

RESEARCH DESIGN AND METHODS — The AVM system we examined uses specialized computer technology to telephone patients, communicate messages, and collect information. Sixty-five diabetic patients participated. Based on a review of the literature and the input of diabetes clinician-researchers, we developed an AVM monitoring protocol to inquire about patients' symptoms, glucose monitoring, foot care, diet, and medication adherence. Patients also were given the option to listen to health promotion messages and to report their satisfaction with the calls. Patients responded by using their touch-tone telephone keypads.

One promising strategy for addressing these problems is to communicate with diabetic patients between outpatient visits using an automated voice messaging (AVM) system. AVM systems use specialized computer technology to contact patients in order to communicate messages and to collect information that providers can use in managing their patients' care. The goal of these calls is to assist patients by rendering tailored diabetes education and reminders regarding medication and visit adherence. Also, AVM calls can support clinicians' efforts to maintain up-to-date clinical data that they can use in making treatment decisions.

Previous research indicates that AVM calls may be useful in a variety of clinical

An Examination of 26,168 Hamilton Depression Rating Scale Scores Administered via Interactive Voice Response Across 17 Randomized Clinical Trials

Heidi K. Moore, PhD, James C. Mundt, PhD,* Jack G. Modell, MD,† Heidi E. Rodrigues, BS,‡¶
David J. DeBroda, MD,§ James J. Jefferson, MD,* and John H. Greist, MD**

Feasibility and validation of a computer-automated Columbia-Suicide severity rating scale using interactive voice response technology[☆]

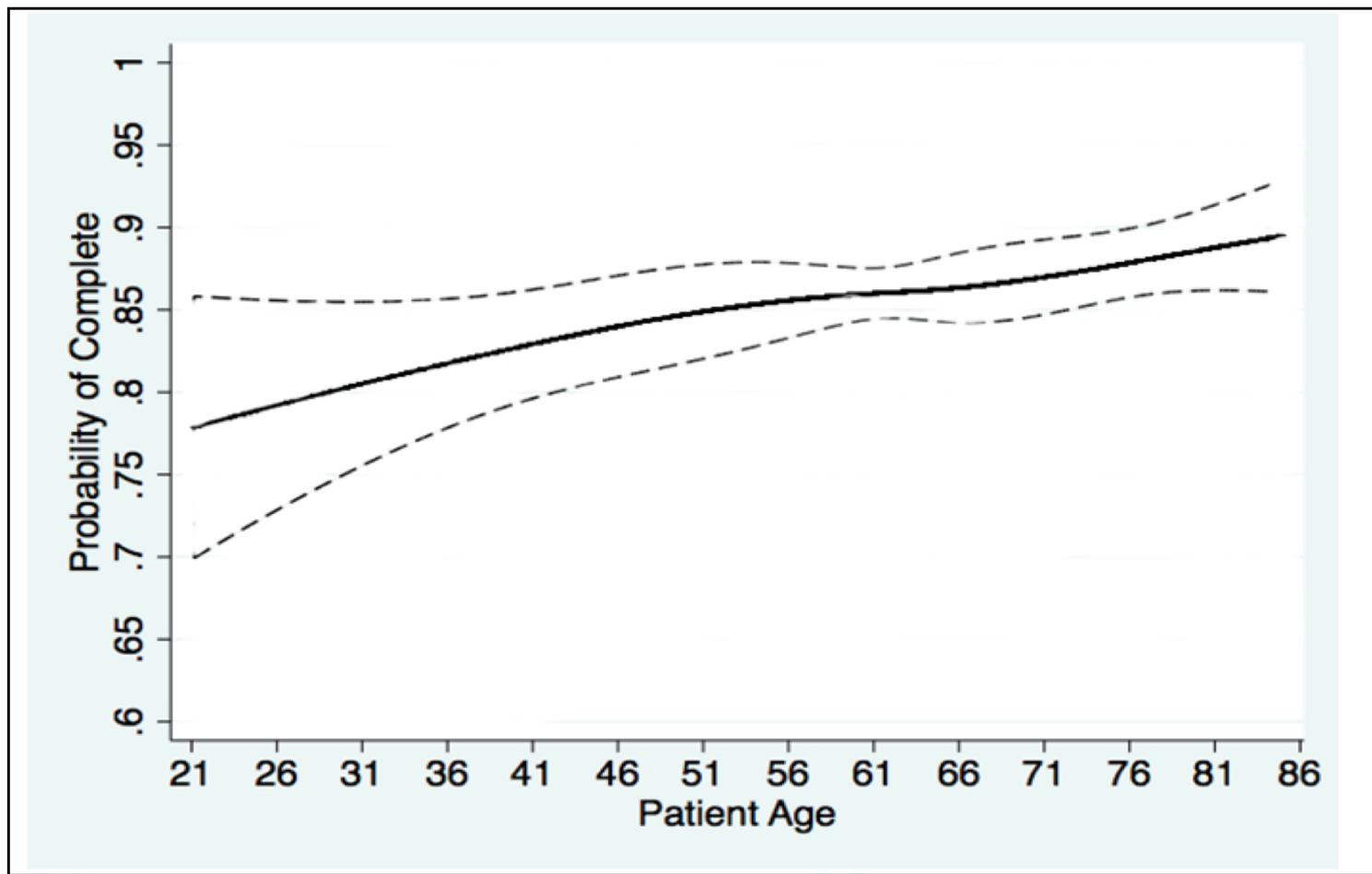
James C. Mundt^a, John H. Greist^{a,b,*}, Alan J. Gelenberg^{a,b}, David J. Katzelnick^{a,b},
James W. Jefferson^{a,b}, Jack G. Modell^c

^aHealthcare Technology Systems, Inc., 7617 Mineral Point Road, Ste. 300, Madison, WI 53717, USA

^bUniversity of Wisconsin—Madison, Madison, WI, USA

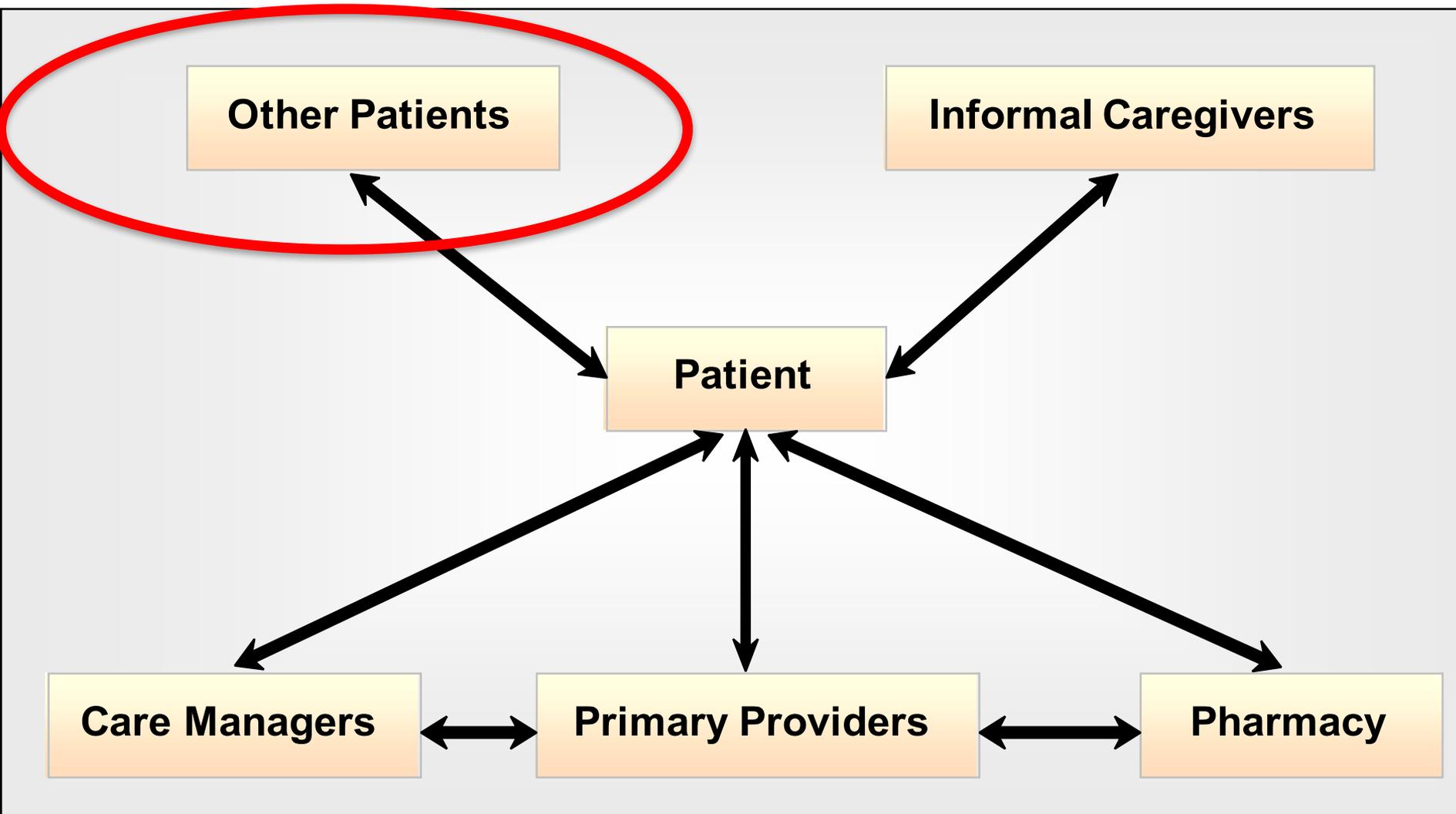
^cGlaxoSmithKline, Inc., Research Triangle Park, NC, USA

Patient Engagement Rates are High for 2000+ Patients with a Variety of Chronic Diseases



Piette J, Rosland AM, Marinec NS, Striplin D, Bernstein S, Silveira MJ. Engagement in automated patient monitoring and self-management support calls: experience with a thousand chronically-ill patients. Medical Care 2013.

Our targets for improving Veterans' chronic illness care



Diabetes Control With Reciprocal Peer Support Versus Nurse Care Management

A Randomized Trial

Michele Heisler, MD, MPA; Sandeep Vijan, MD, MS; Fatima Makki, MPH; and John D. Piette, PhD

Background: Resource barriers complicate diabetes care management. Support from peers may help patients manage their diabetes.

Objective: To compare a reciprocal peer-support (RPS) program with nurse care management (NCM).

Design: Randomized, controlled trial. (ClinicalTrials.gov registration number: NCT00320112)

Setting: 2 U.S. Department of Veterans Affairs health care facilities.

Patients: 244 men with hemoglobin A_{1c} (HbA_{1c}) levels greater than 7.5% during the previous 6 months.

Measurements: The primary outcome was 6-month change in HbA_{1c} level. Secondary outcomes were changes in insulin therapy; blood pressure; and patient reports of medication adherence, diabetes-related support, and emotional distress.

Intervention: Patients in the RPS group attended an initial group session to set diabetes-related behavioral goals, receive peer communication skills training, and be paired with another age-matched peer patient. Peers were encouraged to talk weekly using a telephone platform that recorded call occurrence and provided remind-

Results: Of the 244 patients enrolled, 216 (89%) completed the HbA_{1c} assessments and 231 (95%) completed the survey assessments at 6 months. Mean HbA_{1c} level decreased from 8.02% to 7.73% (change, -0.29%) in the RPS group and increased from 7.93% to 8.22% (change, 0.29%) in the NCM group. The difference in HbA_{1c} change between groups was 0.58% ($P = 0.004$). Among patients with a baseline HbA_{1c} level greater than 8.0%, those in the RPS group had a mean decrease of 0.88%, compared with a 0.07% decrease among those in the NCM group (between-group difference, 0.81%; $P < 0.001$). Eight patients in the RPS group started insulin therapy, compared with 1 patient in the NCM group ($P = 0.020$). Groups did not differ in blood pressure, self-reported medication adherence, or diabetes-specific distress, but the RPS group reported improvement in diabetes social support.

Limitation: The study included only male veterans and lasted only 6 months.

Conclusion: Reciprocal peer support holds promise as a method for diabetes care management.

Primary Funding Source: U.S. Department of Veterans Affairs Health Services Research and Development Service.

Our targets for improving Veterans' chronic illness care

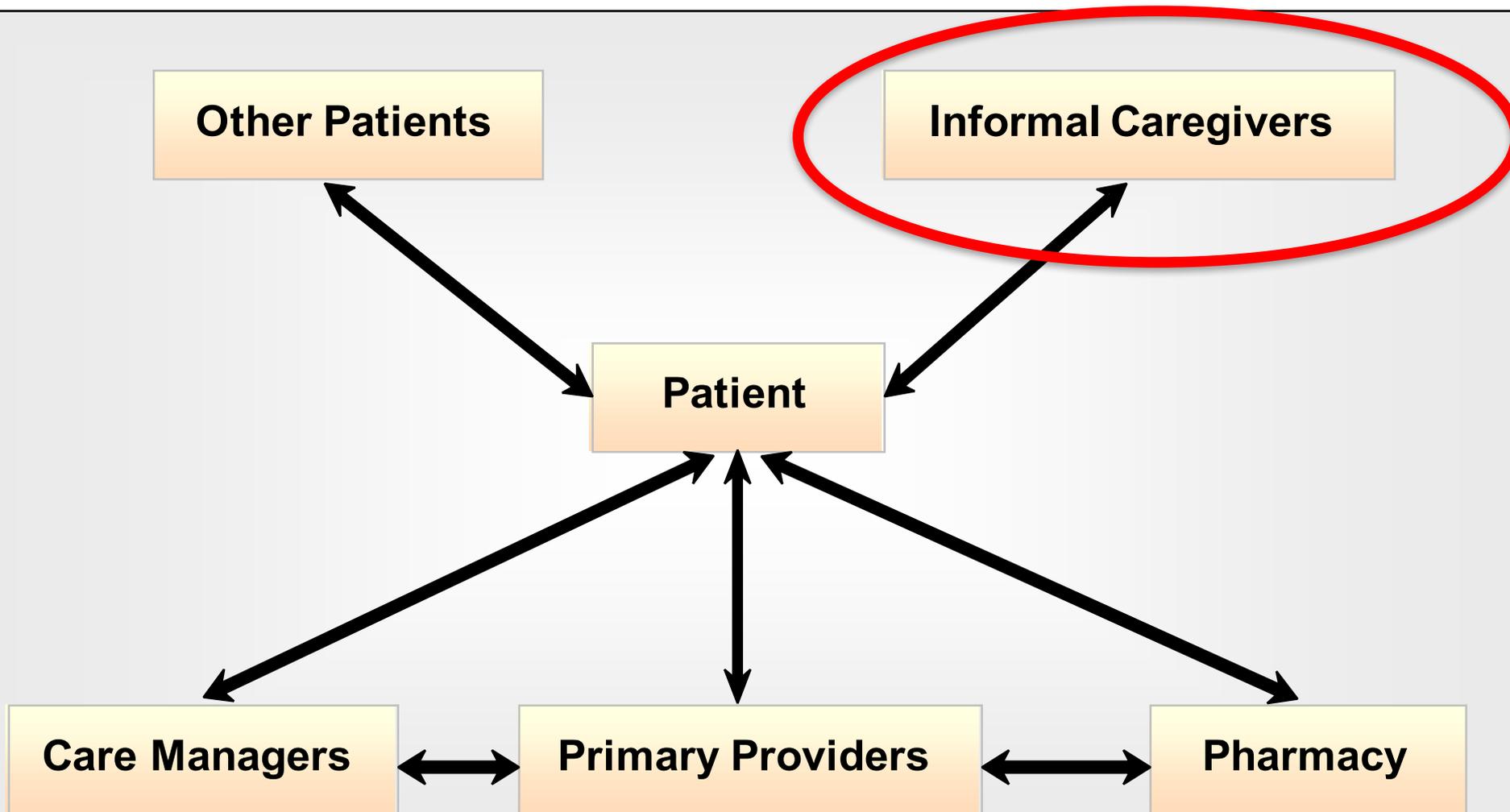


TABLE 3. *Chronic conditions and functional limitations among wives of married male respondents*

Wives' Characteristics	Total (N=3916)	Male respondent's chronic diseases			p-value
		1 (N=1027)	2 (N=1171)	3+ (N=1718)	
Medical condition					
Hypertension	60.6	55.5	60.0	64.8	<0.0001
Diabetes	18.5	16.4	18.8	19.8	0.18
Lung disease	10.2	9.3	8.2	12.3	0.02
Heart problem	20.5	18.7	20.1	22.1	0.21
Cancer	15.4	13.5	14.7	17.2	0.09
Stroke	5.5	6.0	5.2	5.4	0.73
Psychiatric problem	22.6	19.9	22.0	24.9	0.03
Arthritis	75.1	68.8	73.7	78.1	<0.0001
No. of chronic diseases					
0	18.2	25.5	19.2	10.6	<0.0001
1	27.5	31.5	27.9	23.4	
2	26.3	24.1	25.3	29.1	
3 or more	28.0	18.9	27.6	36.9	

Piette J, Rosland AM, Silveira MJ, Kabeto M, Langa K. The case for involving adult children outside of the household in the self-management support of older adults with chronic illnesses. *Chronic Illness*, Mar 2010;6(1):34-45.

TABLE 4. *Frequency of contact with children*

	Total	Number of chronic conditions			p-value
		1	2	3+	
Number of children					<0.0001
0 children	7.6	7.8	7.1	7.9	
1-2 children	38.5	40.3	39.8	36.1	
3-4 children	35.4	35.2	36.0	35.2	
5+ children	18.4	16.7	17.1	20.8	
Distance to children					<0.0001
No children	7.6	7.9	7.1	7.9	
Resident children	24.3	27.8	23.4	22.4	
1+child within 10 miles	12.4	11.0	12.0	13.7	
Children >10 miles only	29.7	30.6	30.6	28.2	
Child meet up in person^a					0.36
1+times/week	44.5	42.4	44.5	46.1	
1-2 times/month	23.1	24.3	22.0	22.8	
Every few months	15.5	16.4	16.5	14.0	
≤2 times/year or never	16.9	16.9	17.0	16.9	
Child speak on phone^a					0.28
1+times/week	78.4	77.2	77.9	79.8	
1-2 times/month	14.1	14.0	14.8	13.6	
Every few months	4.0	5.0	3.4	3.5	
≤2 times/year or never	3.6	3.9	3.9	3.1	

Piette J, Rosland AM, Silveira MJ, Kabeto M, Langa K. The case for involving adult children outside of the household in the self-management support of older adults with chronic illnesses. *Chronic Illness*, Mar 2010;6(1):34-45.

J Behav Med (2012) 35:221–239

DOI 10.1007/s10865-011-9354-4

The impact of family behaviors and communication patterns on chronic illness outcomes: a systematic review

**Ann-Marie Rosland · Michele Heisler ·
John D. Piette**

Received: June 24, 2010 / Accepted: May 16, 2011 / Published online: June 21, 2011

© Springer Science+Business Media, LLC 2011

Characteristics and well-being of informal caregivers: Results from a nationally-representative US survey

Chronic Illness

2014, Vol. 10(3) 167–179

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DOI: 10.1177/1742395313506947

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**Ranak Trivedi,¹ Kristine Beaver,²
Erin D Bouldin,² Evercita Eugenio,²
Steven B Zeliadt,^{2,3} Karin Nelson,^{2,4}
Ann-Marie Rosland,^{5,6} Jackie G Szarka² and
John D Piette^{5,6}**





The CarePartner Program

The CarePartner Program



1 Patient receives a call from the system and reports information regarding their health. Based on the responses, the patient receives information to improve their self-care.



2 Clinic receives alerts about the patients' worrisome signs and symptoms.



3 Family member or friend receives an email, IVR call, or SMS with updates on the patient's status.



Integrating Support Persons into Diabetes Telemonitoring to Improve Self-Management and Medication Adherence

James E. Aikens, PhD¹, Ranak Trivedi, PhD^{2,3}, David C. Aron, MD, MS^{4,5}, and John D. Piette, MSc PhD^{6,7}

¹Department of Family Medicine, University of Michigan, Ann Arbor, MI, USA; ²Center for Innovation to Implementation, VA Palo Alto Health Care System, Palo Alto, CA, USA; ³Department of Psychiatry and Behavioral Sciences, Stanford University, Palo Alto, CA, USA; ⁴Department of Medicine, Case Western Reserve University, Cleveland, OH, USA; ⁵Louis Stokes VA Cleveland Medical Center, Cleveland, OH, USA; ⁶Ann Arbor Department of Veterans Affairs Center for Clinical Management Research, Ann Arbor, MI, USA; ⁷Department of Health Behavior and Health Education, School of Public Health, and Department of Internal Medicine, University of Michigan, Ann Arbor, MI, USA.

OBJECTIVE: The purpose of this study was to investigate the potential benefits for medication adherence of integrating a patient-selected support person into an automated diabetes telemonitoring and self-management program, and to determine whether these benefits vary by patients' baseline level of psychological distress.

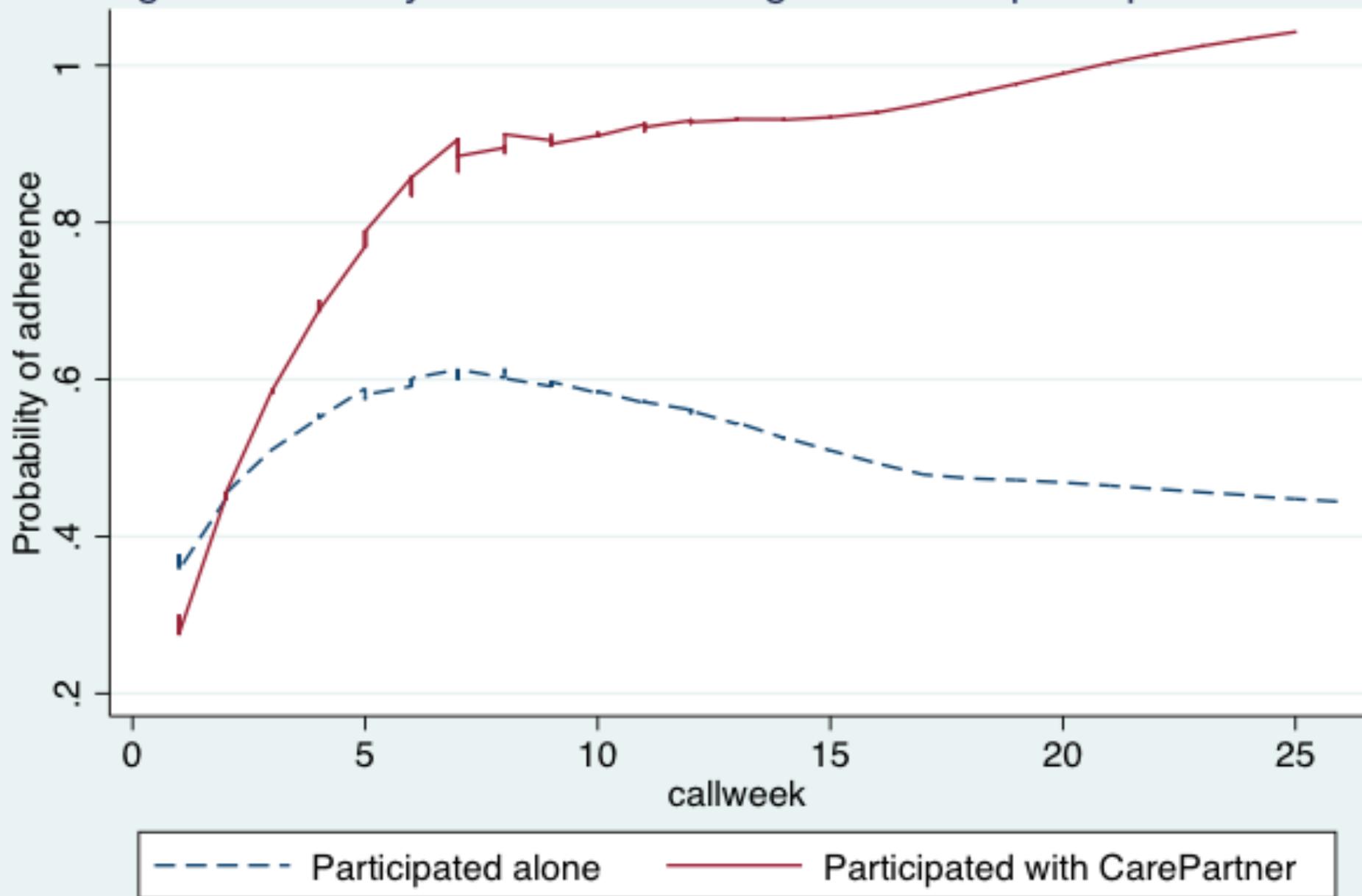
STUDY DESIGN: The study was a quasi-experimental patient preference trial.

METHODS: The study included patients with type 2 dia-

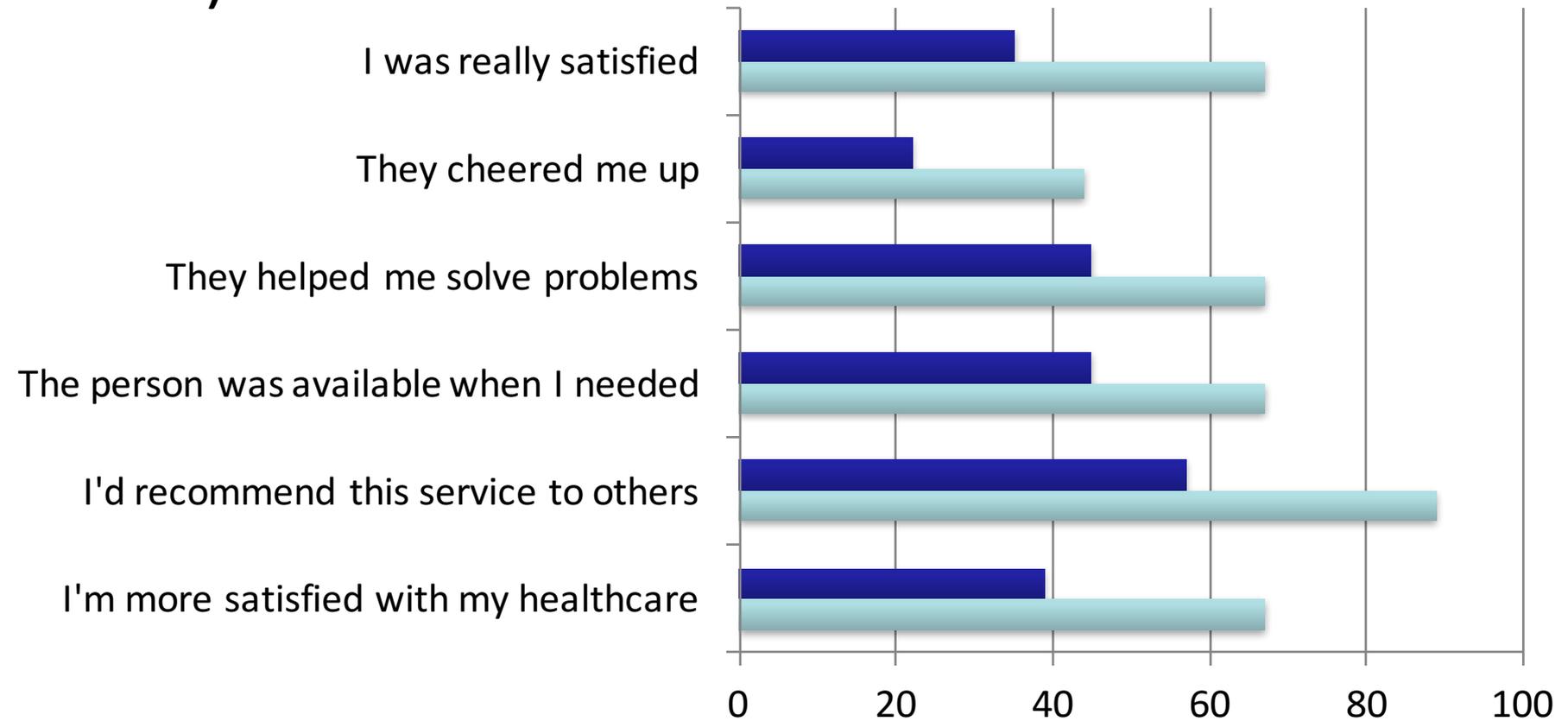
INTRODUCTION

Poorly controlled blood glucose in type 2 diabetes increases the risk of chronic hyperglycemia, microvascular complications, and heart disease.¹ Most patients are advised to perform numerous daily self-management behaviors, including medication regimens that vary in complexity. Regular adherence to antihyperglycemic medication is, by far, one of the best predictors of long-term glycemic control.² Although there

Figure 3. Weekly adherence among distressed participants



Depressed patients' satisfaction with a peer specialist (dark blue) versus family supporter (light blue)



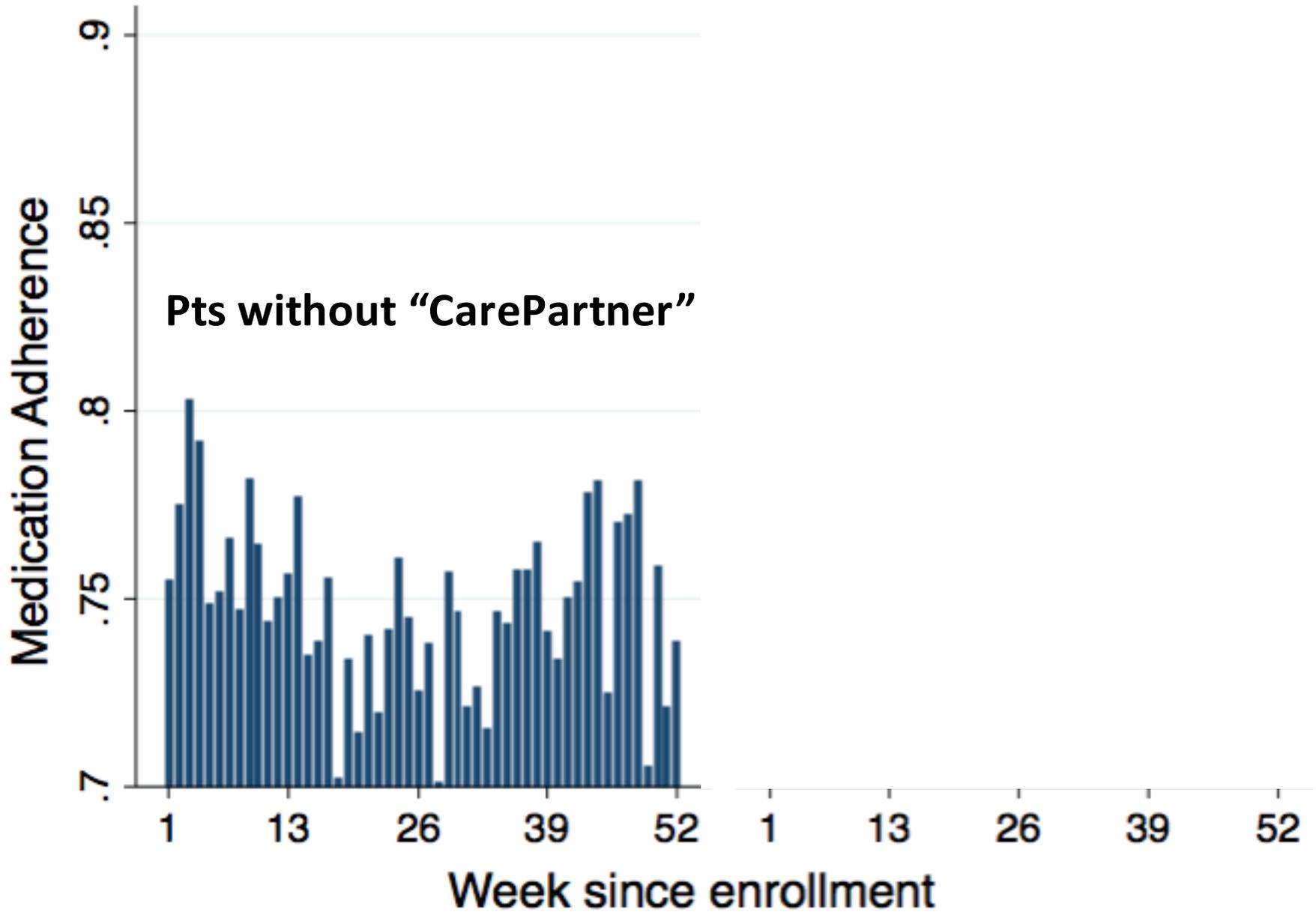
Pfeiffer PN, Valenstein M, Ganoczy D, Henry J, Dobscha SK, Piette JD. Pilot study of enhanced social support with automated telephone monitoring after psychiatric hospitalization for depression. Social Psych and Psychiatric Epi 2016 .

A healthcare professional in blue scrubs is using a stethoscope and a mobile device to monitor an elderly patient's blood pressure. The patient is sitting on a couch, and the professional is holding a blood pressure cuff on his arm. The scene is set in a bright, indoor environment with large windows in the background.

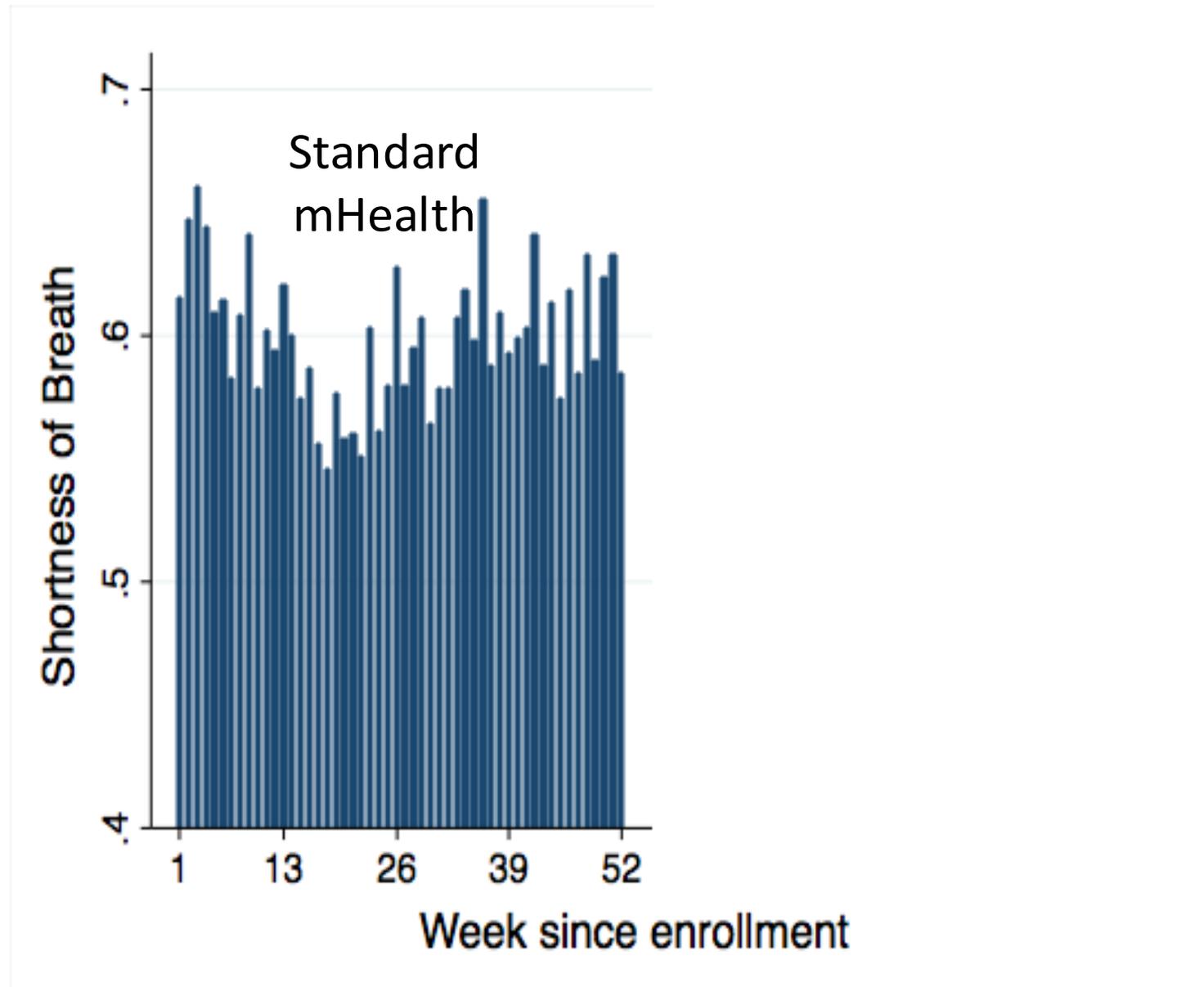
CHF CarePartners: A Randomized Comparative Effectiveness Trial

Piette, J. D., Striplin, D., Marinec, N., Chen, J., Trivedi, R. B., Aron, D. C., ... & Aikens, J. E. (2015). A mobile health intervention supporting heart failure patients and their informal caregivers: A randomized comparative effectiveness trial. *Journal of medical Internet research*, 17(6).

IVR-Reported Medication Adherence



IVR-Reported Shortness of Breath



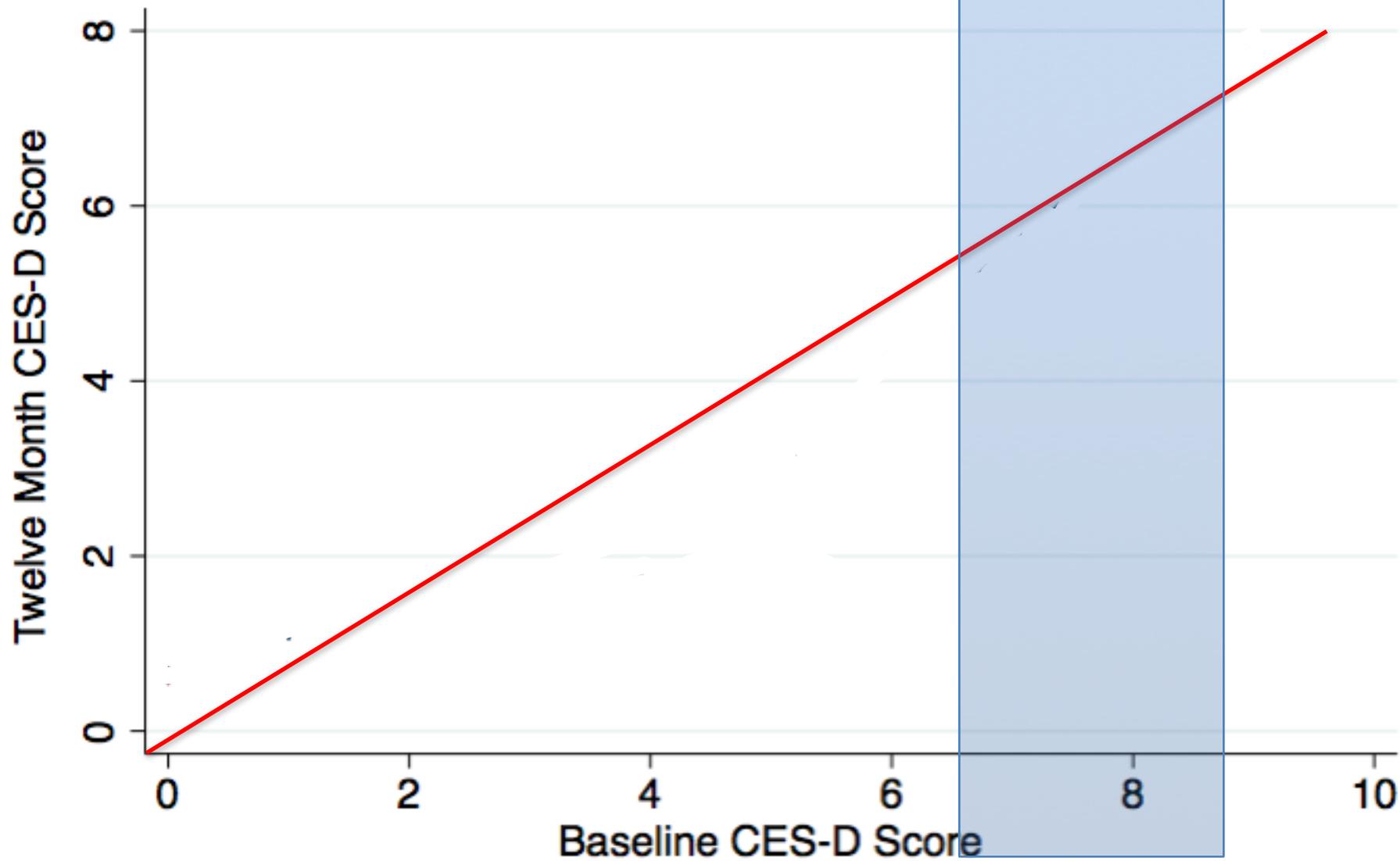
Reports of being bothered by shortness of breath every day or several days in the prior week. P-value for the main effect of arm, $P_{\text{arm}}=.983$.





Caregivers felt less burden

Piette, J. D., Striplin, D., Marinec, N., Chen, J., & Aikens, J. E. (2015). A randomized trial of mobile health support for heart failure patients and their informal caregivers: impacts on caregiver-reported outcomes. *Medical Care*, 53(8), 692-699.



--- Standard mHealth — mHealth+CP





Randomized non-inferiority trial of IVR-based CBT versus face to face CBT for chronic low back pain

Heapy AA, Higgins DM, Driscoll M, et al. Cooperative pain education and self-management (COPE): A randomized non-inferiority trial of interactive voice response-based self-management for chronic back pain. JAMA Internal Med, in press.



Face to Face CBT

IVR CBT

10 weekly sessions



10 weekly sessions

8 self-mgmt skills



8 self-mgmt skills

Therapist teaching



Handbook/IVR teaching

Assigned steps goals



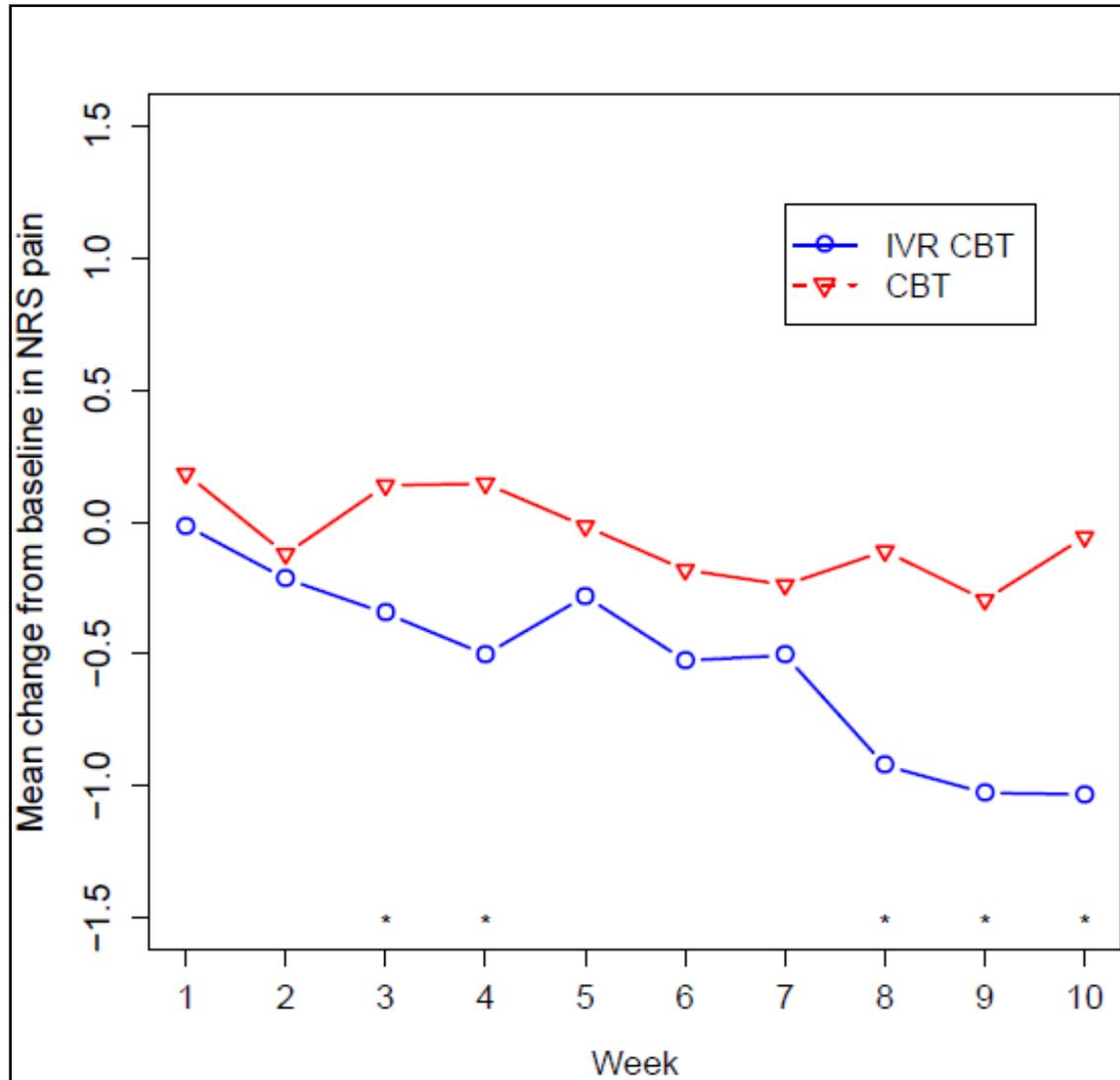
Assigned steps goals

Pedometer logs

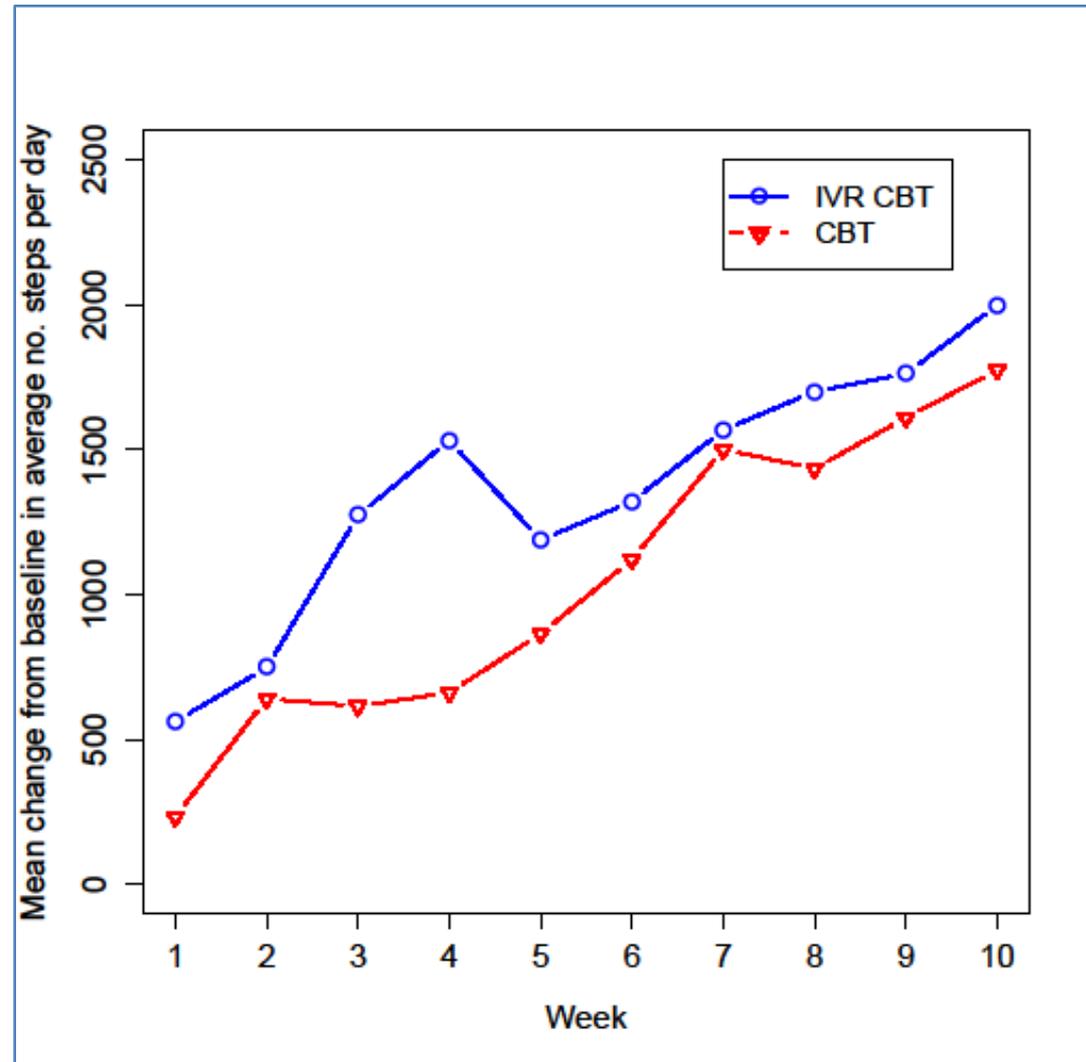


IVR reporting of steps for
weekly pre-recorded
feedback

Pain Intensity: Call data



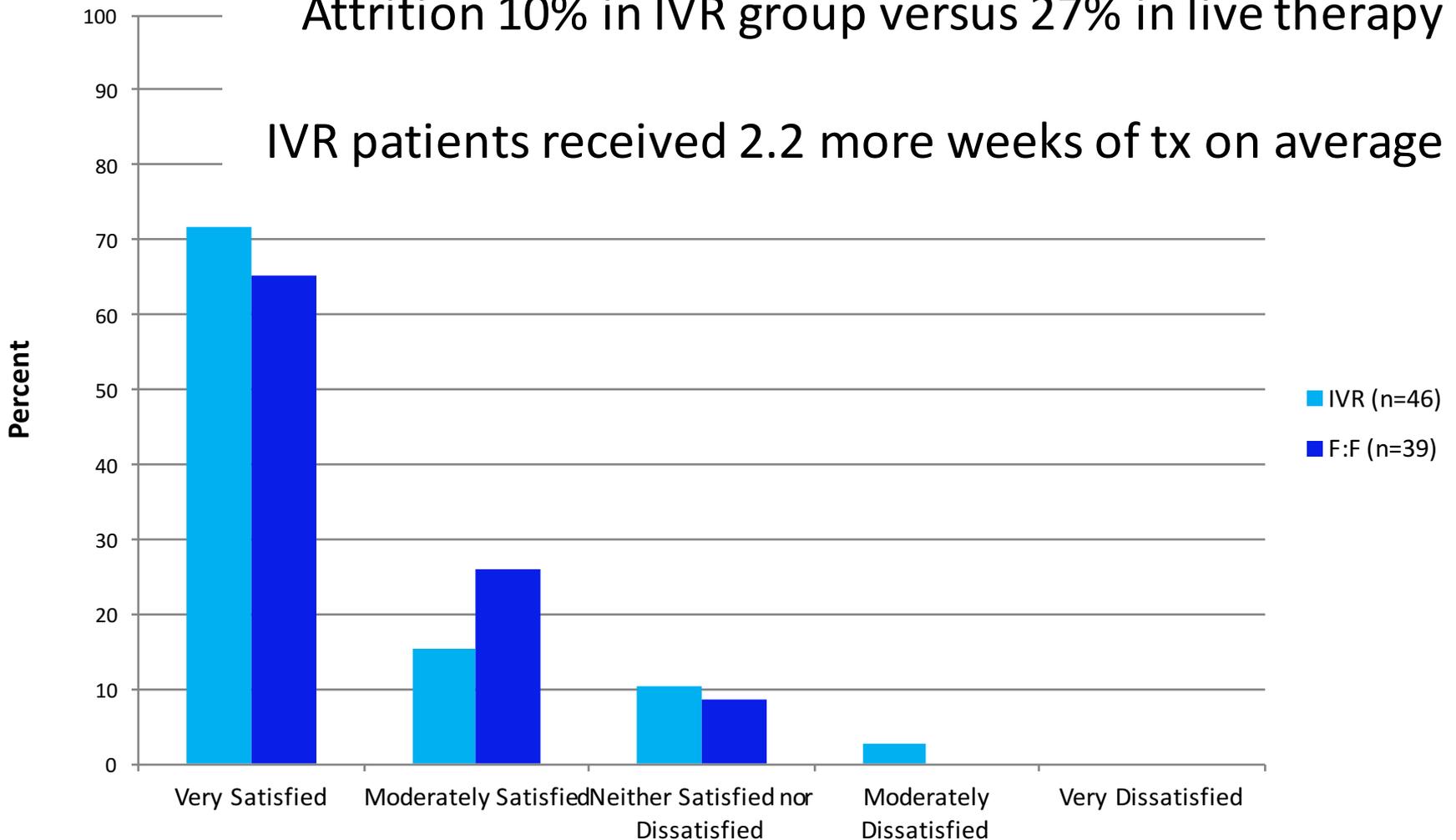
Steps



Treatment Satisfaction

Attrition 10% in IVR group versus 27% in live therapy

IVR patients received 2.2 more weeks of tx on average



Cost-Related Nonadherence to Medications Among Patients With Diabetes and Chronic Pain

Factors beyond finances

JACOB E. KURLANDER, MD, MS^{1,2,3,4}
LYE A. KERR, MD, MPH^{2,3,4}
SARAH KREIN, PHD, RN^{2,3,4}

MICHELE HEISLER, MD, MPA^{2,3,4}
JOHN D. PIETTE, PhD^{2,3,4}

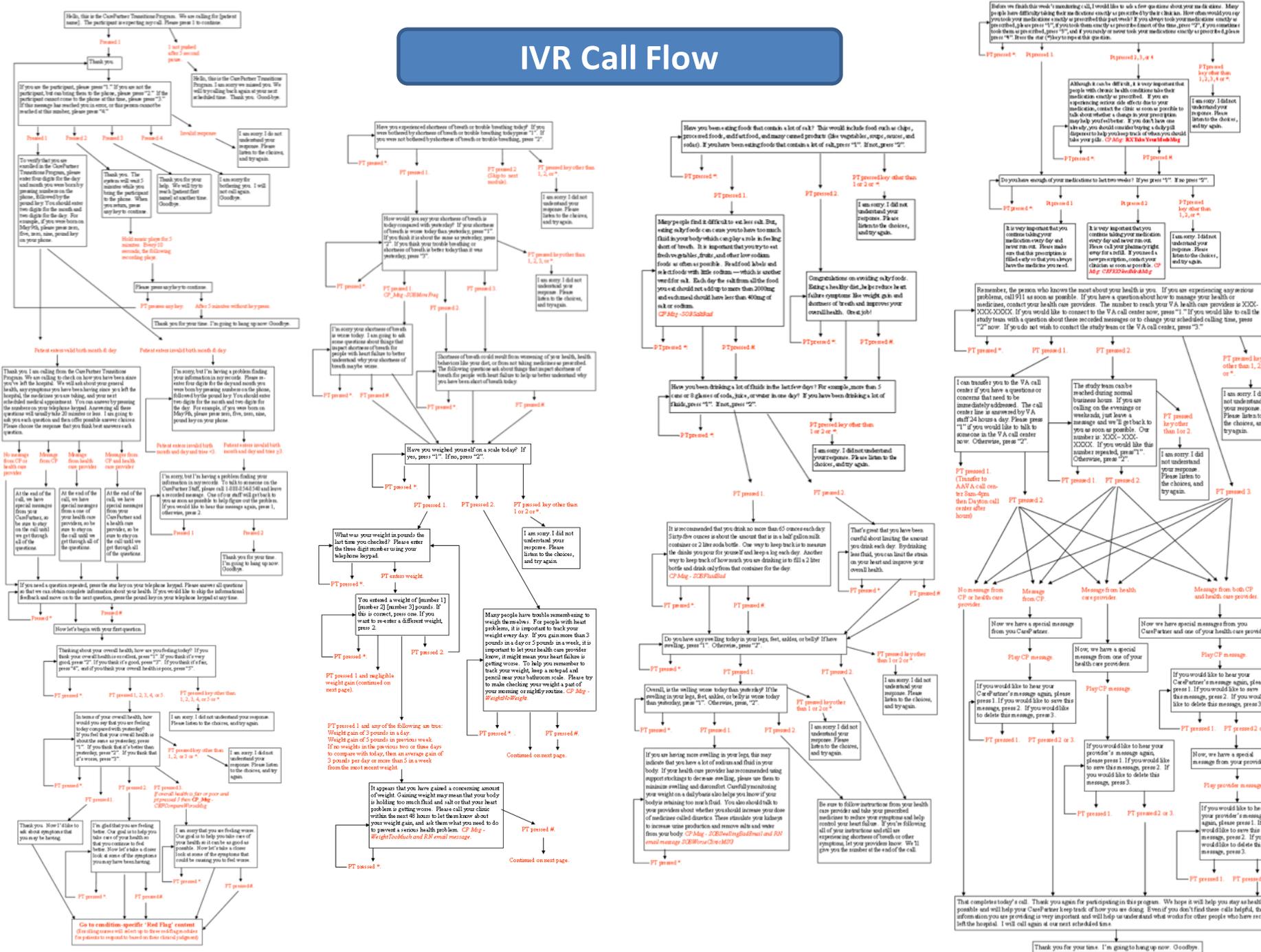
OBJECTIVE — In the face of financial constraints, diabetic patients may forgo prescribed medications, causing negative health effects. This study examined how cost and noncost factors are associated with patterns of cost-related nonadherence to medications (CRN).

RESEARCH DESIGN AND METHODS — This was a cross-sectional survey of patients using medications for both diabetes and chronic pain (n = 245). Patients reported their income, out-of-pocket medication costs, education level, depressive symptoms, and medication-related

Empirical studies have implicated financial, attitudinal, mood, and provider influences in CRN, although their relative effects are not well understood (4,9). Most of the variance in patients' reports of CRN remains unexplained by financial measures (10). Although economic pressures drive these decisions, noncost factors appear to modify the effect of medication cost at a given level of ability to pay (11).

Most survey-based studies of CRN

IVR Call Flow





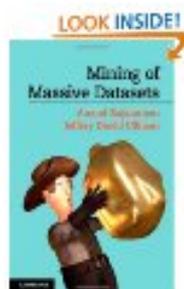
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Original Paper

Maximizing the Value of Mobile Health Monitoring by Avoiding Redundant Patient Reports: Prediction of Depression-Related Symptoms and Adherence Problems in Automated Health Assessment Services

John D Piette¹, PhD, ScM; Jeremy B Sussman¹, MD; Paul N Pfeiffer², MD; Maria J Silveira¹, MD; Satinder Singh³, PhD; Mariel S Lavieri⁴, PhD

¹VA Center for Clinical Management Research and Division of General Medicine, Department of Internal Medicine, University of Michigan, Ann Arbor, MI, United States

²VA Center for Clinical Management Research and Department of Psychiatry, Ann Arbor VA Healthcare System and University of Michigan, Ann Arbor, MI, United States

³Artificial Intelligence Laboratory, Department of Electrical Engineering and Computer Science, College of Engineering, University of Michigan, Ann Arbor, MI, United States

⁴Department of Industrial and Operations Engineering, College of Engineering, University of Michigan, Ann Arbor, MI, United States

Thank you

