TELEPHONE-LINKED COMMUNICATIONS (TLC) IN HEALTH CARE

THE PRESENTATION

- Objectives of the TLC Research Program
- General Description of TLC
- Systems Built & What They Accomplish

OBJECTIVES OF OUR RESEARCH PROGRAM

- Design & Build Totally Automated, Telephone-Based Dialogue Systems that Deliver an Array of Health Services
- Demonstrate that these TLC Systems will be Used and will be Effective
- Build the Case for the Routine Use of these Systems in Health Care Delivery

WHAT IS TLC?

WHAT IS TLC?

- Interactive, Totally Automated, Computer-Controlled Telephone Conversation System
- Conversations in User's Home or Office or on Mobile (cell) Phone
- Delivered as a Stand Alone Program or as Part of a Comprehensive Service Program with Health Professionals

WHAT IS TLC?

- TLC Uses Digitized Human Voice to Speak to User
- User Communicates by Speaking into the Telephone Receiver (or by using the telephone keypad)
- TLC Teaches Users How to Communicate with TLC

WHAT IS TLC?

- A Call Lasts Between 2-20 Minutes
- Periodic Calls Over 1-24 Months
- Calls Usually Scheduled (daily to every 2 months)
- User Can Call TLC at Other Times

WHAT IS TLC?

- Either TLC or User Can Initiate Calls
- TLC Can Remind User to Call
- TLC Monitors Content of Calls & Can Generate Actionable Alerts
- Alerts Can Be Communicated to Responsible Physicians/Other Health Professionals
- Alternatively, Special IT-Enabled Case Managers Can Receive & Process Alerts

WHAT HAPPENS IN A TLC CONVERSATION?

- TLC Asks Questions of the User
- TLC Comments on User's Responses to its Questions
- TLC Provides Information to User
- TLC Counsels User

STRUCTURE OF A TLC CALL

- Salutation
- Password (PIN) Verification
- Conversation Clinical Core
- Closing

STRUCTURE OF A TLC CALL

- Salutation

  "Hello! You've reached the Harvard Health Care's TLC Line."

TLC-ACT CONVERSATION CLINICAL CORE

Assess PA Level

"On how many days during the past week did you take part in activities such as walking, biking or other types of exercise? You can include any physical activity that you participated in, for 10 minutes or more, at a time."

TLC-ACT CONVERSATION CLINICAL CORE

Assess Goal Attainment

"Mrs. Smith, in your last TLC call, you set a goal for yourself of exercising three days a week for 20 minutes each day. It looks like you didn't quite do it."

TLC-ACT CONVERSATION CLINICAL CORE

Stage-Specific Exercise Prescription
(Example for a Precontemplator)

"For next week, read an article about physical activity and its benefits. A good place to find an article is in magazines such as *Prevention* or *Reader's Digest*. Think about whether the benefits of being active could make a difference in your life."

STRUCTURE OF A TLC CALL

- Closing

  "John, Please call me next week on Thursday. I look forward to speaking with you then."

PRINCIPAL TYPES OF TLC SYSTEMS

- Health Behavior Promotion
- Chronic Disease Management

TLC HEALTH BEHAVIOR PROMOTION SYSTEMS

- Medication-Taking
- Scheduled Visits with Health Professionals
- Home Self-Monitoring by Patients

TLC HEALTH BEHAVIOR PROMOTION SYSTEMS

- Diet-General
- Diet-Special Diets (low fat, low salt, etc.)
- Diet-Weight Management
- Physical Activity (lifestyle)
- Physical Activity (muscle strengthening)

TLC HEALTH BEHAVIOR PROMOTION SYSTEMS

- Mammography Screening
- Alcohol Use Screening
- Alcohol Control
- Cigarette Smoking Cessation
- Multiple Behavior Change
- Maintenance of Behavior Change

OBJECTIVES OF HEALTH BEHAVIOR SYSTEMS

- Monitor Behavior
- Educate & Counsel Patients to Change or Sustain Specific Behaviors

SYSTEM ARCHITECTURE TLC HEALTH BEHAVIOR PROMOTION SYSTEMS

- Structured by Behavior Theory, Empirical Research & Health Professional Expert Input:
  - Defines How Users Are Assessed
  - Intervention Strategies Used
  - Expected Effects of the Intervention

SYSTEM ARCHITECTURE TLC HEALTH BEHAVIOR PROMOTION SYSTEMS (cont.)

- Consider User's Intention to Engage in Targeted Behavior
- Contain Education & Counseling
- Single or Multiple Contacts Depends upon:
  - Amount of content
  - Is the behavior change incremental?
  - Is the behavior constantly engaged in?

PRINCIPAL TYPES OF TLC SYSTEMS

- **Health Behavior Promotion**
- Chronic Disease Management

TLC CHRONIC DISEASE MANAGEMENT SYSTEMS

- Hypertension
- Angina Pectoris
- Congestive Heart Failure (CHF)
- Chronic Obstructive Pulmonary Disease (COPD)

TLC CHRONIC DISEASE MANAGEMENT SYSTEMS

- Adult and Childhood Asthma
- Diabetes Mellitus (DM)
- Depression
- Multiple Chronic Diseases (Heart, COPD, DM)
- Chronic Disability-Functional Impairment

OBJECTIVES OF CHRONIC DISEASE SYSTEMS

- Monitor Patients, Identify Potential Clinical Problems & Other Issues, and Transmit this Information to Clinicians or IT-Enabled Case Managers on a Timely Basis
- Help Clinicians Better Deal with Clinical Problems & thus Better Control Patients' Disease

OBJECTIVES OF CHRONIC DISEASE SYSTEMS (cont.)

- Help Clinicians Become Aware of Significant Clinical Issues Sooner & thus Intervene Sooner to Prevent Bad Outcomes (ED visits, hospitalization, morbidity, mortality)

SYSTEM ARCHITECTURE TLC CHRONIC DISEASE SYSTEMS

- Structured by Physician Practice Guidelines
  - Evaluating Disease Status
  - Evaluating Patient Self Care
  - Educating & Counseling to Improve Patient Self-Care Management
- Multiple Contacts

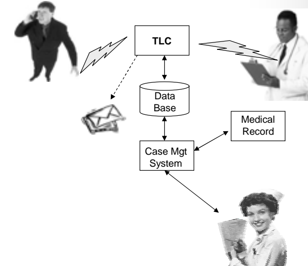
SYSTEM ARCHITECTURE TLC CHRONIC DISEASE SYSTEMS (cont.)

- Communication to Responsible Health Professionals Directly (via EHR) or Other Means (Fax, Voicemail, Voice Page)
  - "Results" Reporting
  - Alerting of Potential Clinical Problems

SYSTEM ARCHITECTURE TLC CHRONIC DISEASE SYSTEMS (cont.)

- Role for a New Health Professional: an IT-Enabled Nurse Case Manager
  - First Professional Contact
  - Use Web-based Case Management System to Process & Manage Alerts
  - Communicates with the Patient's Health Providers via EHR, etc.
  - Can Modify What TLC Does with Individual Patients

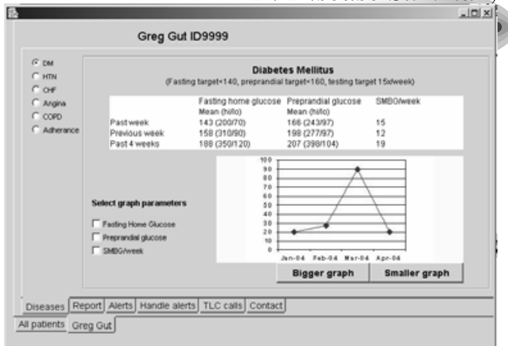
Telephone Linked Care



Case Mgt System Case Manager Alert Overview

Case Mgt System Alert Management

Case Mgt System Pt Disease Summary



Case Mgt System Contact History

Case Mgt System Physician Panel Overview

CMS Summary for Dr. Foobar, week ending 3/26/04

	Diabetes	HTN	CHF	Angina	COPD	Adherance	New Alerts	
	Fstng Gluc...	SBM/DBM	Dyspnea	Episodes/...	Dyspnea	Overall	Urgent	Non-urgent
Sally Smurf ID2345	143	143/82				84%	3	10
Joe James ID4587	188			4		92%	2	7
Nancy Nut ID3674		150		0	0	23%	7	12
Greg Gut ID9999	158		10			77%		

Summary | Unsigned alerts

All patients | No patient selected

EVALUATION STUDIES

EVALUATIONS: HEALTH PROMOTION PROGRAMS

- TLC-ACT2
- TLC-ACT3
- TLC-EAT1
- TLC-EAT2

TLC-ACT2

- Monitors Amount of Exercise
- Promotes Regular Exercise for Sedentary Individuals
- Uses Behavior Theory (Transtheoretical Model) to Tailor Intervention

TLC-ACT2

- Randomized Clinical Trial Conducted in Multi-Site General Medical Practice
- Subjects – 298 Sedentary Adults, Mean Age=46 years
- Random Assignment to TLC-ACT2 or an Attention Placebo Control Condition

TLC-ACT2

- Goal: CDC-ACSM Criterion for Moderate Intensity Physical Activity (≥ 30min/d x 5d/wk)
- Six Months Intervention and Follow-up
- Weekly TLC-ACT2 Calls

PROPORTION OF SUBJECTS AT GOAL LEVEL FOR PHYSICAL ACTIVITY AT 3 AND 6 MONTHS FOLLOW-UP

Follow-up Period	TLC	Control	P
3 Months	27%	18%	.03
6 Months	21%	17%	.32

Pinto BM, Friedman RH, Marcus BH, Kelley H, Tennstedt S, Gillman MW. Effects of a computer-based telephone counseling system on physical activity. *Am J Preventive Medicine.* 2002; 23, 113-120.

TLC-ACT3

- Modified version of TLC-ACT2
- Randomized Clinical Trial Conducted Among Respondents to Media Advertisements
- Subjects-218 Sedentary Adults, Aged 55+
- Random Assignment to TLC vs. Human Telephone Counselor vs. Assessment-Only Control Condition

TLC-ACT3

- Goal: Improved Exercise Levels
- 18 Months Intervention and Follow-Up
- Weekly → Monthly Calls x 12 Months; Discretionary Calls x 6 Months

NUMBER OF MINUTES PER WEEK OF MOD+ PHYSICAL ACTIVITY AT 12 MONTHS FOLLOW-UP*

TLC	162
Human Counselor	172
Control	119

* Adjusted means from ANCOVA, controlling for gender and baseline value ($p = .056$ for TLC vs. Control; $p = .045$ for Counselor vs. Control; $p > .66$ for TLC vs. Counselor)

King AC, Friedman RH, Marcus B, Napolitano M, Castro C, Forsyth L. Increasing regular physical activity via humans or automated technology: 12-month results of the CHAT trial. Ann Beh Med 2004; 27: S044

TLC-EAT1 OBJECTIVES

- Improve Overall Diet Quality
- Modify Unhealthy Eating Behaviors
- Change Food Consumption at Home and at Restaurants

TLC-EAT1: THE STUDY

- Conducted in a Multi-Site General Medical Practice
- Subjects - 298 Adults Who Had Suboptimal Diet Quality

TLC-EAT1: THE STUDY

- Random Assignment to TLC-EAT or a TLC Attention Placebo Control Condition
- Six Months Use & Follow-up

SIGNIFICANT CHANGES IN CONSUMPTION OVER SIX MONTHS (TLC-CONTROL)

	TLC-Control*
Fruit	+39%
Global Diet Quality	+16%
Saturated Fat	-17%
Fiber	+18%

* $p < 0.05$

Delichatsios HK, Friedman RH, Glanz K, Tennstedt S, Smigelski C, Pinto BM, Kelley H, Gillman MW. Randomized trial of a “talking computer” to improve adults’ eating habits. Amer J Health Promotion 2001; 15(4): 215-224.

TLC-EAT2 OBJECTIVES

- Reduce the Intake of Foods that Are High in Saturated Fat
- Reduce Saturated Fat Consumption

TLC-EAT2: THE STUDY

- Conducted in 6 Primary Care Practices in Metropolitan Boston
- Subjects – 233 Adults with Hypercholesterolemia (total serum cholesterol ≥ 240 mg/dL)

CONSUMPTION OF TARGETED FOODS AT 6 MONTHS FOLLOW-UP

Food Subgroup	TLC-EAT*	Control*	P Value
Red Meat	0.3	0.5	**0.008**
Processed Meat	0.2	0.4	**0.002**
Cheese	0.3	0.4	**0.02**
Fats & Oils	3.6	4.6	**0.02**

* Adjusted least square mean daily servings at 6 months follow-up from ANCOVA, controlling for gender & baseline value

Friedman RH, Glanz K, Heeren T, Kelley H, Millen B, Mitchell D, et. al. Presented at the 25th Society of Behavioral Medicine, Baltimore, 2004

CONSUMPTION OF TARGETED NUTRIENTS AT 6 MONTHS FOLLOW-UP

Nutrient	TLC-EAT*	Control*	P Value
Total Fat (% kcal)	27.7	32.1	**<0.0001**
Saturated Fat (% kcal)	8.9	10.9	**<0.0001**
P/S Ratio	0.84	0.69	**0.008**
Cholesterol (mg)	226	287	**0.001**

* Adjusted least square means at 6 months follow-up from ANCOVA, controlling for gender & baseline value

TLC-HYPERTENSION OBJECTIVES

- Improve Blood Pressure Control
- Improve Medication Adherence

TLC-HYPERTENSION THE STUDY

- Community-Based Randomized Clinical Trial in 29 Communities in Boston Metropolitan Area
- Subjects – 267 Elderly Hypertensive Patients Cared for by 132 Physicians
- Random Assignment to TLC & Usual Medical Care vs. Usual Care Alone
- Six Months Follow-up

CHANGE IN DIASTOLIC BLOOD PRESSURE*

	TLC	Usual Care	P
Total Study Population	-5.2	-0.8	.02
Non Adherent Subjects	-6.0	+2.8	.01
Adherent Subjects	-4.5	-4.4	.97

* Mean change in Diastolic Blood Pressure (DBP), Adjusted for Age, Sex, Baseline DBP and Baseline Adherence by Treatment Group.

Friedman RH, Kazis LB, Jette A, Smith MB, Stollerman J, Torgerson J, Carey KB. A telecommunications system for monitoring and counseling patients with hypertension: impact on medication adherence and blood pressure control. Am J Hypertension 1996; 9: 285-92

TLC-HYPERTENSION PATIENT ATTITUDES

	% Agree
"I would be better off with TLC"	85
"Too many TLC telephone contacts"	3
"TLC made me aware of my BP"	95
"TLC relieved my worries about my hypertension"	79

Friedman RH, Kazis LB, Jette A, Smith MB, Stollerman J, Torgerson J, Carey KB. A telecommunications system for monitoring and counseling patients with hypertension: impact on medication adherence and blood pressure control. Am J Hypertension 1996; 9: 285-92

TLC-COPD OBJECTIVES

- Prevent COPD Exacerbations that Lead to Emergency Health Service Use
- Maintain Function and Quality of Life

TLC-COPD: THE STUDY

- Three Hospital Randomized Clinical Trial
- Subjects – 137 COPD Patients with Moderate or Severe Disease ($FEV_1 \leq 65\%$)
- Random Assignment to TLC vs. Usual Care
- 6 Month Participation & Follow-up

CHANGE IN QUALITY OF LIFE AND FUNCTION AT 6 MONTHS FOLLOW-UP

	TLC	Control	P
Global Quality of Life*	+.26	-1.4	.05
Dyspnea†	+.26	-5.2	.04

* Chronic Respiratory Questionnaire

† Pulmonary Functional Status & Dyspnea Questionnaire

Sparrow D, Friedman RH, Gottlieb DJ, DeMolles DA. A telephone linked computer system for COPD care improves quality of life and health care utilization. Am J Med, 2004 (in press)

HOSPITALIZATION DURING 6 MONTHS

TLC	2 subjects (4.0%)
Control	10 subjects (19.2%)
Risk Ratio	0.18 (95% CI: 0.36-0.86, p=0.02)

Sparrow D, Friedman RH, Gottlieb DJ, DeMolles DA. A telephone linked computer system for COPD care improves quality of life and health care utilization. Am J Med, 2004 (in press)

LESSONS LEARNED

LESSONS LEARNED

- Programs Benefit from Structure & Content that Is Derived from Good Theory, Empirical Data & Input of "Experts"
- Emulating the Processes of Experts ("Expert Systems") is Necessary but Not Sufficient

LESSONS LEARNED (cont.)

- Experts and Researchers Vary in their Ability to Design Good Systems & Write Good Dialogue
- Collaboration Across Disciplines Is Essential in Developing & Evaluating Systems

LESSONS LEARNED (cont.)

- Collaboration Is Often Difficult & Needs to Be Managed
- Content Is More Important Than Technology
- Thinking About the Potential Competitive Advantages of a System in Carrying Out a Health Care Function Is Essential, but Is Often Inadequately Considered

LESSONS LEARNED (cont.)

- It Is Important to Iterate System Development & Evaluation
- There are Pros & Cons for Making Only Small Changes or Dramatic Changes in Developing New Versions of Systems
- Evaluating System Performance Is Essential but Difficult, Time-Consuming & Expensive

LESSONS LEARNED (cont.)

- A Mix of Quantitative & Qualitative Evaluation Methods Is Best
- Evaluation Should Look at the Why in Addition to the What

LESSONS LEARNED (cont.)

- Finite State Algorithms for Driving the Dialogues Work Well for Even Complex Programs, But Are Limiting & Expensive to Create & Maintain
- The Content of Programs Should Be Played Out over Time

WHAT HAVE WE LEARNED ABOUT WRITING DIALOGUE

- Good Dialogue Writers Think Logically & Write Conversational Text Well
- Need to Train & Quality Control Content Experts Who Write Dialogue
- Use Experienced Dialogue Writers to Train & Review Dialogues

WHAT HAVE WE LEARNED ABOUT WRITING DIALOGUE (cont.)

- Need to Communicate to Dialogue Writers What Is Different About Dialogue (compared to print communications)
  - It Is Conversational
  - Use Humor, Personal Stories, etc.
  - Speak in the First Person, Singular & Refer to the Person by Name or by Second Person Singular Pronoun
  - Each Utterance Should Be Short
  - Be Concerned About Information Retention

WHAT HAVE WE LEARNED ABOUT WRITING DIALOGUE (cont.)

- Users Anthropomorphize the Speaker
- Users Know the Speaker Is a Machine, but Suspend Judgment
- Personalize the Dialogue (users like it; the machine looks smart; tailoring improves engagement & intervention effect)
- Be Concerned About Tone

WHAT HAVE WE LEARNED ABOUT WRITING DIALOGUE (cont.)

- Be Concerned About User Burden
- Write Out the Structure of the Dialogue First Before You Write the Dialogue
- Define Dialogue Modules & Submodules & the Relationships Between Them
- Define Structure of Each Component

WHAT HAVE WE LEARNED ABOUT WRITING DIALOGUE (cont.)

- Be Clear on the Goals of the Program, the Modules, the Utterances
- Be Aware of Information that Will Be Needed by the System at Each Point in the Dialogue
- Listen to the Dialogues Before You Release the System; Modify as Required
- Be Aware of Your Audience: Education Level, Language Skills, Ethnicity, etc.

WHAT ARE THE QUESTIONS?

- What Are the Low-Hanging Fruit for Targeted Applications, User Groups, etc?
- Which Technology Platforms Are Most Useful & Likely to Have a Future?
- Which Technology Developments Would Really Matter & Which Might Be Fun to Work on but Are Irrelevant?

WHAT ARE THE QUESTIONS?

- How Complex & Sophisticated Does a System Need to Be to Be Effective?
- How Do We Make Systems Smarter?
- Should We Be Building Stand Alone Systems or Ones that Interact/Become Integrated Into the Health Care Delivery System?
- How Do We Get the Target Audience to Use These Systems?