

Health Literacy and Self-Management

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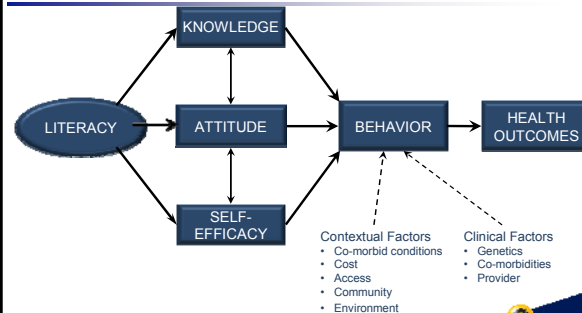
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Outline of Talk

- **Model for Health Literacy and Self-Management Behavior**
- **Cross-Sectional Studies Linking Health Literacy/Numeracy and Diabetes Outcomes**
- **Longitudinal Studies Linking Health Literacy/Numeracy and Diabetes Outcomes.**
- **Challenges & Opportunities**

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Health Behavior Model



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Literacy/Numeracy & Diabetes

- **Literacy skills needed:**
 - Knowledge of disease prevention and disease
 - Understanding of educational materials
 - Performance of self-management tasks
 - Interaction with medical system
- **Numeracy skills needed:**
 - Understanding of risk and probability
 - Understanding weight status
 - Understanding medications
 - Understanding nutrition information
 - Understanding exercise
 - Interpreting glucose and other measures

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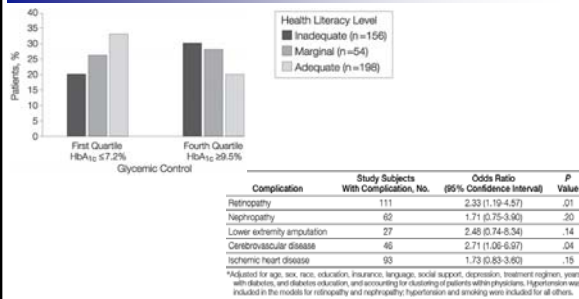
Cross-Sectional Studies



Math phobic's nightmare!

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Literacy and Diabetes Outcomes



Complication	Study Subjects With Complication, No.	Odds Ratio (95% Confidence Interval)	P Value
Retinopathy	111	2.33 (1.19-4.57)	.01
Nephropathy	62	1.71 (0.75-3.90)	.20
Lower extremity amputation	27	2.48 (0.74-8.34)	.14
Cardiovascular disease	46	2.71 (1.06-6.97)	.04
Ischemic heart disease	93	1.73 (0.83-3.62)	.15

Schillinger, JAMA, 2002

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Diabetes and Numeracy Study

- Design: Cross sectional survey
- Setting: Endocrine and Primary Care Clinics
- Instruments:
 - Demographics
 - A1C and Meter Downloads
 - Assessed literacy with REALM
 - Assessed math skills with WRAT3
 - Diabetes Knowledge (DKT), Self Care (SSCA)
 - Assess diabetes numeracy with DNT

Hultziga et al, BMC Health Services Res, 2008
Cavanaugh et al, Annals of Internal Medicine, 2008

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Demographics

Variable (n=398)	Number (%) or Mean (SD)
Age, yrs (SD)	54.2 (12.9)
Female, No. (%)	202 (51)
Race, No. (%)	
White	249 (63)
Black	134 (34)
Other	14 (3)
Education, No. (%)	
≤ High School or GED	168 (43)
Some college	115 (29)
College or more	109 (28)
Literacy Status (REALM), No (%)	
≤ 8 th grade	124 (31)
≥ High School	273 (69)
Numeracy Skills (WRAT), No (%)	
≤ 8 th grade	276 (69)
≥ High School	122 (31)
Type 2 Diabetes (%)	341 (86)
On Insulin (%)	241 (61)
A1C (SD)	7.6 (1.7)

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Overall DNT Results

- Mean score 61% (SD 25%)
- Range 5%-100%
- Internal Reliability: 0.95
- Trouble Spots
 - Interpreting serving sizes
 - Fractions or decimals
 - Applying multi-step regimens (ex. sliding scale and carb-ratios)
 - Applying titration instructions

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Serving Size

- If you ate the entire bag of chips, how many total grams of carbohydrate would you eat?

Correct Response: 63 gms
Correct: 44%

Serving Size 1 oz (28g) (About 10 chips)	
Servings Per Container 3.5	
Amount Per Serving	
Calories 140	Calories from Fat 60
% Daily Value*	
Total Fat 6g	10%
Saturated Fat 0.5g	4%
Cholesterol 0mg	0%
Sodium 160mg	7%
Total Carbohydrate 18g	6%

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Monitoring

- Your target blood sugar is between 60 and 120. Please circle the values below that are in the target range (circle all that apply):

55
145
118

Correct Response: Circle 118 only
Percent Correct: 74%

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Insulin Correction Scale (I)

You are told to follow the sliding scale shown here. The sliding scale indicates the amount of insulin you take based upon your blood sugar levels:

If Blood sugar is:	Units of Insulin
130-180	0
181-230	1
231-280	2
281-330	3
331-380	4

Percent Correct: 85%

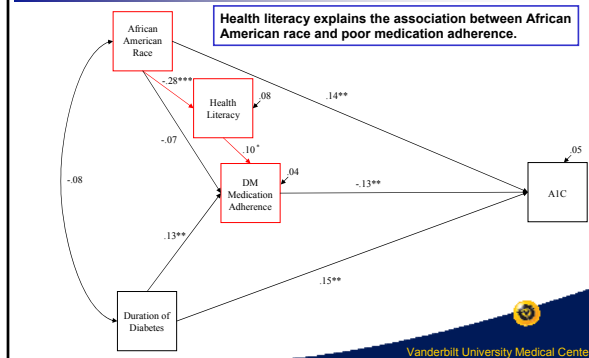
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DNT and other measures

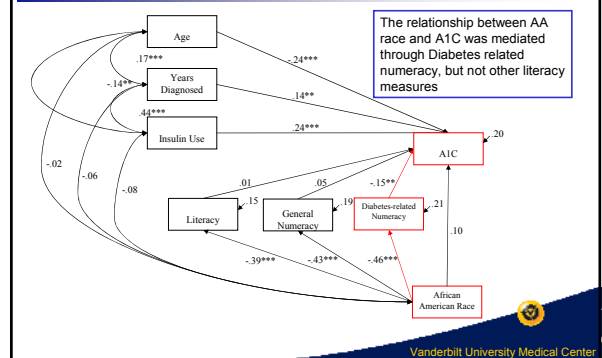
- Higher DNT scores were sig. correlated with higher:
 - education ($r=0.51$)
 - literacy ($r=0.50$)
 - math skills ($r=0.64$)
 - diabetes knowledge ($r=0.78$)
 - Frequency of glucose monitoring ($r=0.21$)
 - Self-efficacy ($r=0.15$)
- And modestly correlated with lower:
 - A1C ($r=-0.11$ in adjusted analysis)
- Literacy was not associated with A1C

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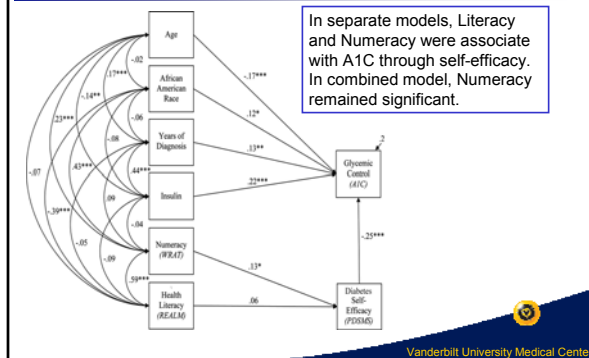
Literacy and Med Adherence



Diabetes Numeracy and A1c



Self-Efficacy, Literacy and A1C

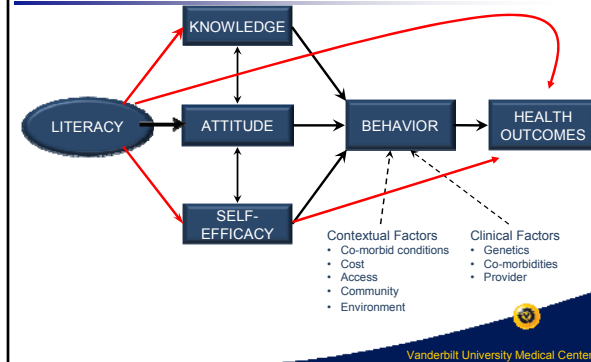


Conclusions

- Performance on DNT was fair/poor. Often a disconnect between what is taught and what patients can do.
- Strong link between literacy/numeracy and Knowledge. Weaker links to Self-Efficacy, Behaviors, and A1C.
- Typically stronger links with numeracy
 - Due to focus on a disease that requires numeracy dependent self-care?
 - Due to more granular measurement of numeracy than literacy?
- Behaviors are very hard to measure!

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Back To Health Behavior Model



Longitudinal Studies



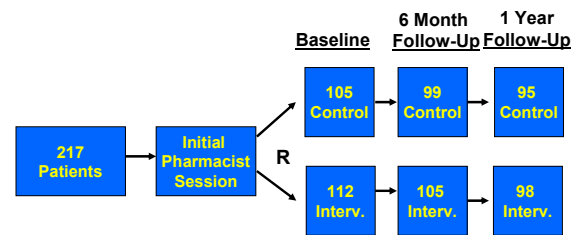
Diabetes Intervention

- To examine whether literacy influences the effectiveness of a comprehensive diabetes disease management program to improve glycemic control.

Rothman, JAMA, 2004
Rothman, Am J Med, 2005

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Diabetes Intervention Study



Diabetes Intervention Study

- Diabetes Education
- Evidence-based medication algorithms
- Database to track and manage patient outcomes
- Diabetes Care Coordinator
- Addressed literacy by using:
 - Individualized verbal education
 - Low literacy material
 - Teaching concepts in a simplified manner
 - "Teach back" techniques to confirm learning

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Similar Patient Characteristics

Variable	Control (n=105)	Interv. (n=112)
Female	56%	56%
Age	57 yrs	54 yrs
African American	60%	69%
Household Income ≤ \$20,000	75%	70%
Less than a High School Education	44%	36%

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Similar Diabetes Measures and Literacy

Variable	Control (n=105)	Interv. (n=112)
Baseline A1C (%)	10.7	10.9
Duration of Diabetes	8.6 yrs	8.1 yrs
Use of insulin at Enrollment	38%	40%
Hypertension	82%	83%
Hypercholesterolemia	63%	60%
Realm Score (0-66)	46	45
Low Literacy ($\leq 6^{\text{th}}$ Grade)	32%	44%

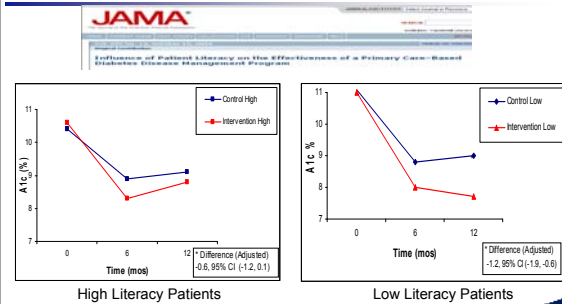
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Significant Clinical Improvements at 12 mos

Variable	Control (n=95)	Intervention (n=98)	Difference
A1C (%)	-1.2%	-2.1%	0.9% (0.8,1.0)
SBP (mmHg)	+2.3	-6.9	9.2 (2.3,16.1)
DBP (mmHg)	+1.2	-3.6	4.8 (1.1,8.6)
ASA (mmHg)	+6%	+47%	41% (25-55)
T. Chol. (mg/dL)	-12	-27	15 (-4, 35)

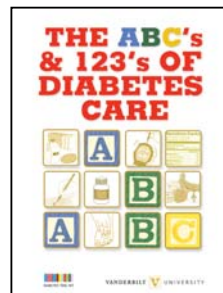
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Impact on Literacy



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DLNET STUDY



Diabetes
Literacy &
Numeracy
Education
Toolkit
(DLNET):
A RCT

Cavanaugh et al, Diabetes Care 2009

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Diabetes Literacy & Numeracy Education Toolkit (DLNET) RCT

- Objective
 - Evaluate a literacy and numeracy-focused diabetes self-management education intervention on patient self-efficacy, satisfaction and glycemic control
- Design
 - Randomized controlled trial
- Setting
 - Enhanced diabetes management programs at two institutions

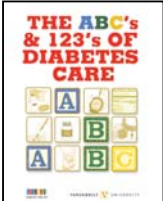
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DLNET Intervention

Control (Enhanced Care)	Intervention (Enhanced Care Plus Literacy/Numeracy)
Nurse practitioner/CDE visits (1-3)	Nurse practitioner/CDE visits (1-3)
Dietitian/CDE visits (1-3)	Dietitian/CDE visits (1-3)
Usual diabetes patient education materials	Diabetes Literacy & Numeracy Education Toolkit (DLNET)
	Clear health communication training
Usual care from primary care or endocrine physician	Usual care from primary care or endocrine physician

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DLNET Toolkit




Goals

- Facilitate diabetes education and self-management
- Type 1 or Type 2 diabetes mellitus
- Oral medications or insulin
- Individual modules to **customize** for each patient
 - Blood Glucose Monitoring
 - Exercise planning
 - Foot care
 - Nutritional management
 - Carbohydrates
 - Medications
 - Logbooks/worksheets

Available at:
www.mc.vanderbilt.edu/diabetes/drtc/preventionandcontrol/tools.php
 Wolff K et al. The Diab Educ 2009

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DLNET Toolkit



- Text at 5th grade reading level
- Color coding
- Pictures for key concepts
- Step-by-step instructions
- Simplified medication instructions
- Practice skills worksheets

Wolff K et al. The Diab Educ 2009

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DLNET Study Results

A1c	3-months	Adjusted p-value [Intervention vs. Control]*	6-months	Adjusted p-value [Intervention vs. Control]*
Intervention	-1.63 [-2.03, -1.23]	0.03	-1.11 [-1.54, -0.65]	0.437
Control	-0.97 [-1.37, -0.53]		-1.17 [-1.61, -0.71]	

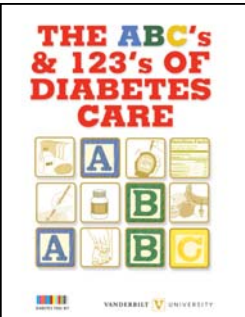
Mean [95% bootstrap Confidence Interval]
 *Adjusting for age, gender, race, type of diabetes, income level, site of intervention and baseline DNT score and HbA1c levels

*In adjusted analyses, there were no significant improvements in Self-Efficacy or Self-Management behaviors

Cavanaugh KL et al. Diabetes Care 2009

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DINES RCT



Diabetes Nutrition Education Study (DINES): A Randomized Controlled Trial

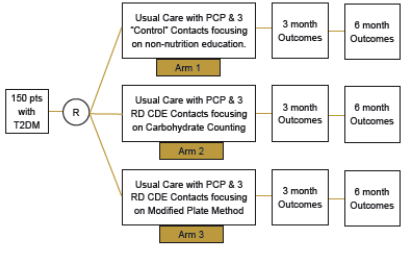
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Diabetes Nutrition Study (DINES)

- Objective**
 - To perform a randomized controlled trial to determine the efficacy of different approaches to nutrition education in the treatment of type 2 diabetes mellitus

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Diabetes Nutrition Study (DINES)



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Control Group



- 2-3 patient encounters
- Covered general non-nutrition topics:
 - Foot care
 - Fall prevention
 - Immunizations
 - Osteoporosis
 - Diabetic Retinopathy
 - Oral care

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Diabetes Nutrition Study (DINES)

■ Carb Counting Vs Plate Method

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Diabetes Nutrition Study (DINES) A1C at 3-months & 6-months by study group

Variable	Group	Baseline	Baseline to 3 months	Baseline to 6 months
A1C (%) Δ A1C	Carb Count n=50	8.4 (7.6, 9.7)	7.3 (6.9, 8.5) n=37	7.8 (6.9, 9.7) n=41
			-0.70 (-1.2, -0.1)	-0.30 (-1, 0.2)
	Plate n=50	8.3 (7.5, 10.4)	7.5 (6.9, 8.4) n=42	7.5 (6.9, 8.4) n=43
			-0.60 (-1.5, -0.3)	-0.50 (-1.2, 0.05)
	Control n=50	8.0 (7.5, 9.7)	7.3 (6.9, 7.9) n=41	7.8 (7, 9.2) n=42
			-0.60 (-1.4, 0.0)	-0.30 (-0.80, 0.4)

Median (Interquartile Range)

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Diabetes Nutrition Study (DINES) Adjusted A1C

	Mean ΔA1C (%) 6-Months	95% Confidence Interval	p-value
Carb Counting vs. Control	-4.9	[-11.9 – 1.7]	0.220
Plate vs. Control	-6.6	[-13.3 – 0.1]	0.051

*Adjusted for age, gender, race, income, years of diabetes, baseline A1C, and time interval

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DINES RESULTS

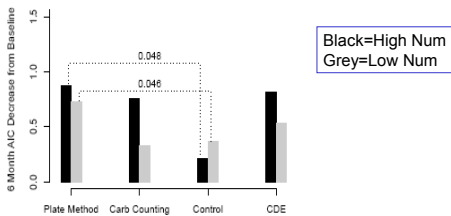


Figure 3: Change in A1C.

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Diabetes Nutrition Study (DINES) Adjusted A1C: Subgroup Analysis

Participants with baseline A1C ≥ 7.0% & ≤ 10.0%

	Mean ΔA1C (%) 6-Month	95% Confidence Interval	p-value
Carb Counting vs. Control	-9.3	[-17.9 - -1.8]	0.005
Plate vs. Control	-8.2	[-16.6 - -0.9]	0.005

*Adjusted for age, gender, race, income, years of diabetes, baseline A1C, and time interval

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Diabetes Nutrition Study (DINES)

Secondary outcomes at 3- & 6-months

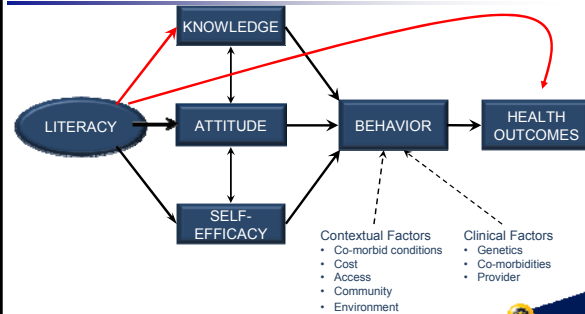
Variable	Treatment Arm	Baseline	Baseline to 3 months	Baseline to 6 months
Weight, lbs	Carb	218 (189, 253)	-1 (-5.3, 0.3)	-1.8 (-6.5, 1)
	Plate	224 (189, 259)	-1 (-3.5, 0)	-1.0 (-10, 5)
	Control	216 (180, 243)	0 (-2, 2.6)	0 (-4, 5.8)
Treatment Satisfaction (range 6-36)	Carb	24 (17, 30)	3 (0.3, 8.5)	4 (-1, 9)
	Plate	22.5 (17, 29)	7 (0.5, 11)	7 (1, 13)
	Control	26 (19, 31)	2 (-1, 5)	3 (-2, 9)
Self-Efficacy (range 8-40)	Carb	23.5 (18, 29)	2 (0, 9)	2 (0, 9)
	Plate	24 (21, 27)	4 (-1, 10)	5 (-2, 8)
	Control	24 (21, 29)	3 (-2, 7)	2.5 (0, 8)

Median (Interquartile Range)

*Adjusted for age, gender, race, income, years of diabetes, baseline A1C, and time interval

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Back To Health Behavior Model



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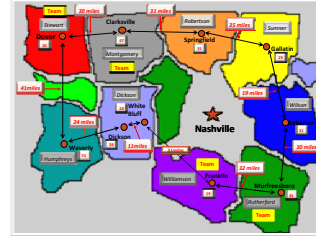
Conclusions

- Studies link literacy to knowledge, self-efficacy, and even health outcomes (A1C)
- However, link between literacy and self-management is more challenging
 - Difficult to measure self-management behaviors
 - Many other factors contribute to behavior
- Future studies needed to further address this issue

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NIH (NIDDK) R18 Study

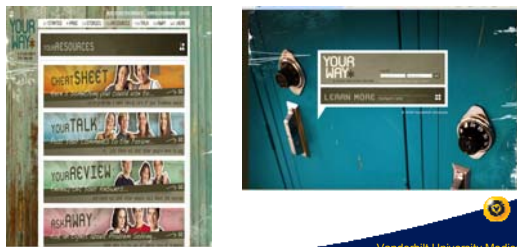
- To address health communication issues to improve diabetes care in middle TN
- 5 year cluster randomized study involving 10 Health Dept Clinics
- Collaboration between TN Department of Health, Vanderbilt, and Meharry



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Adolescents with Diabetes

- Web-based intervention to promote problem solving skills



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National Initiative (GreenLight)

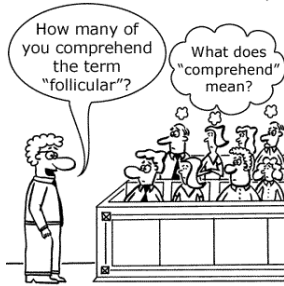
- Project supported by NIH (NICHD). Collaboration between Vanderbilt, UNC, NYU, and UMiami
- Will enroll 1,000 English and Spanish speaking families with children age 2 months and follow for 22 months. Intervention sites will focus on obesity prevention, while control sites will focus on injury prevention.
- Will train intervention Pediatric providers in improved health communication skills and give them a literacy sensitive toolkit to use with families to promote healthy lifestyles for their children



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Questions

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