

# Enabling Web Search for Low Health Literacy Individuals Using Conversational Agents

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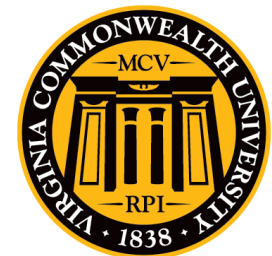
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# Barriers to Participation in Clinical Trials

- 85% of cancer patients are unaware that there are clinical trials they could participate in
- 77% of patients who participate in a trial learned about it from their health care provider
- 34% of clinical trials recruited less than 75% of their planned sample

# Objective: Increase Participation in Clinical Trials by Disadvantaged Populations

- Several web-based search engines available.
  - National Cancer Institute
  - ClinicalTrials.gov
  - Etc

# National Cancer Institute

at the National Institutes of Health

[We Can Answer Your Questions](#)  
1-800-4-CANCER

SEARCH

[NCI Home](#)[Cancer Topics](#)[Clinical Trials](#)[Cancer Statistics](#)[Research & Funding](#)[News](#)[About NCI](#)

## Search for Clinical Trials



### Clinical Trial Questions?

Get Help:

1-800-4-CANCER

[LiveHelp online chat](#)

### Video Guide:

How to Use the NCI Clinical Trials Search Form

Search NCI's list of 8,000+ clinical trials now accepting participants, or use more search options to search the set of 19,000+ clinical trials that are no longer recruiting.

**Search Tip:** Skip any items that are unknown or not applicable.

### Cancer Type/Condition

Colon cancer



### Stage/Subtype

- ☐ All
- ☐ stage 0 colon cancer
- ☐ stage I colon cancer
- ☒ stage II colon cancer
- ☐ stage IIA colon cancer
- ☐ stage IIB colon cancer

### Popular Resources

[Help Using the NCI Clinical Trials Search Form](#)[Learn About Clinical Trials](#)[About NCI's List of Cancer Clinical Trials](#)[NCI Dictionary of Cancer Terms](#)[NCI Drug Dictionary](#)

### Location

- ☒ Near ZIP Code
- ☐ At Hospital/Institution
- ☐ In City/State/Country
- ☐ At NIH



### Near ZIP Code

Show trials located within:

100 miles

of ZIP Code: 02115

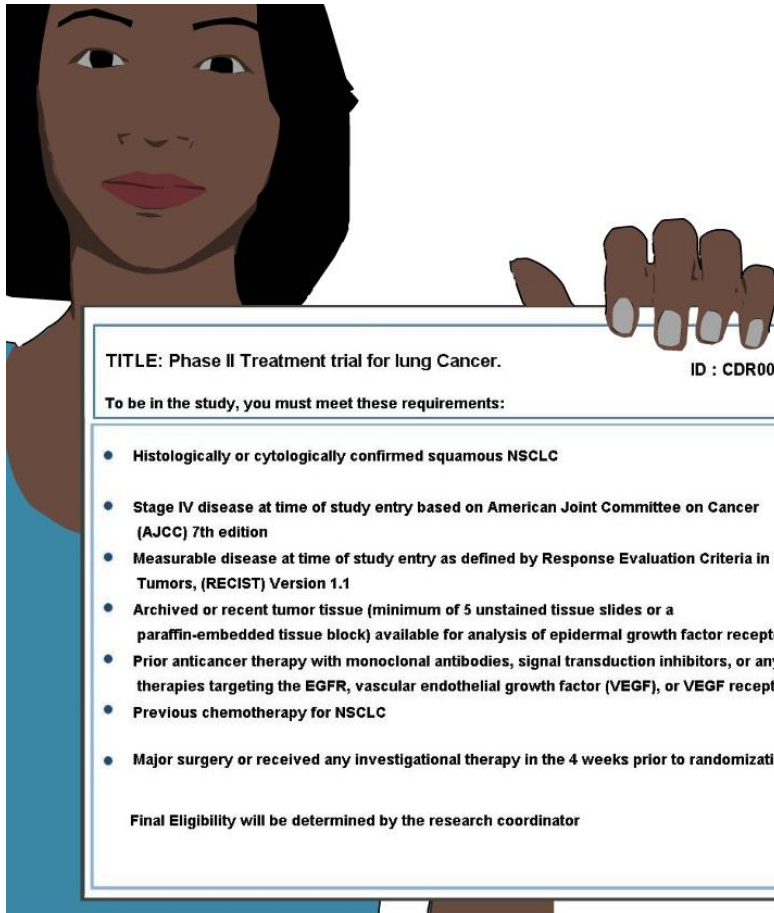
[ZIP Code Lookup](#)

# Usability Results

N=23, 26% LHL

- Participants with adequate health literacy completed 1.25 search tasks on average.
- Participants with low health literacy failed to complete any of the tasks.
- Difference is significant (Mann-Whitney  $p < .05$ ).

# Conversational Agent Interface



**TITLE:** Phase II Treatment trial for lung Cancer. **ID :** CDR0000745315

To be in the study, you must meet these requirements:

- Histologically or cytologically confirmed squamous NSCLC
- Stage IV disease at time of study entry based on American Joint Committee on Cancer (AJCC) 7th edition
- Measurable disease at time of study entry as defined by Response Evaluation Criteria in Solid Tumors, (RECIST) Version 1.1
- Archived or recent tumor tissue (minimum of 5 unstained tissue slides or a paraffin-embedded tissue block) available for analysis of epidermal growth factor receptor . . .
- Prior anticancer therapy with monoclonal antibodies, signal transduction inhibitors, or any therapies targeting the EGFR, vascular endothelial growth factor (VEGF), or VEGF receptor
- Previous chemotherapy for NSCLC
- Major surgery or received any investigational therapy in the 4 weeks prior to randomization

Final Eligibility will be determined by the research coordinator

**Yes. Who should I contact to participate?**

**No, I don't meet the requirement.**

**Show me more details of the study**

**Save this for later Viewing**

**No thanks! Show me something else.**

**Explain it to me.**

**Show me the trials I have looked at.**

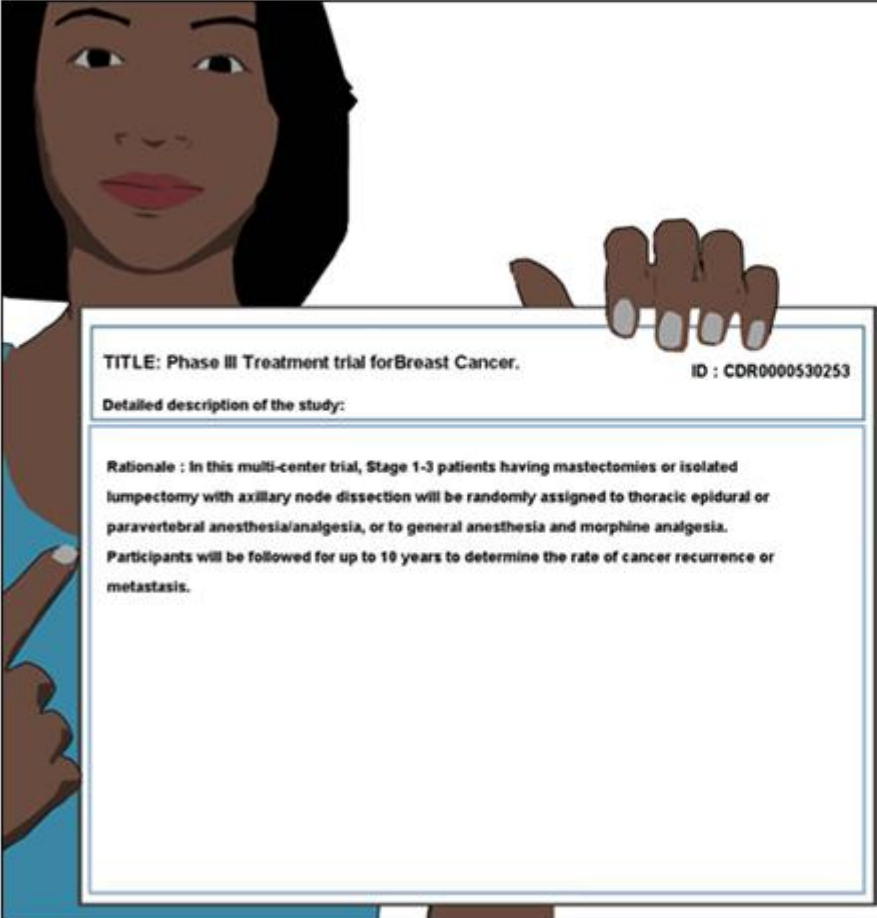
**Could you repeat that please?**

# Design:

## Search Criteria

- NCI database indices
  - age, sex, cancer type, geographic location, trial type and phase, medication use
- Inferred through text classification
  - pain tolerance, invasiveness tolerance, time commitment

# Search Interface Feature: Dictionary



**TITLE:** Phase III Treatment trial for Breast Cancer. **ID :** CDR0000530253

**Detailed description of the study:**

**Rationale :** In this multi-center trial, Stage 1-3 patients having mastectomies or isolated lumpectomy with axillary node dissection will be randomly assigned to thoracic epidural or paravertebral anesthesia/analgesia, or to general anesthesia and morphine analgesia. Participants will be followed for up to 10 years to determine the rate of cancer recurrence or metastasis.

**Read more**

**Show me a different trial**

**I want to learn more about the trial**

**Who should I contact to participate?**


**I don't understand the word anesthesia**

**I don't understand the word axillary**

**I don't understand the word lumpectomy**

**I don't understand the word analgesia**

**I don't understand the word epidural**

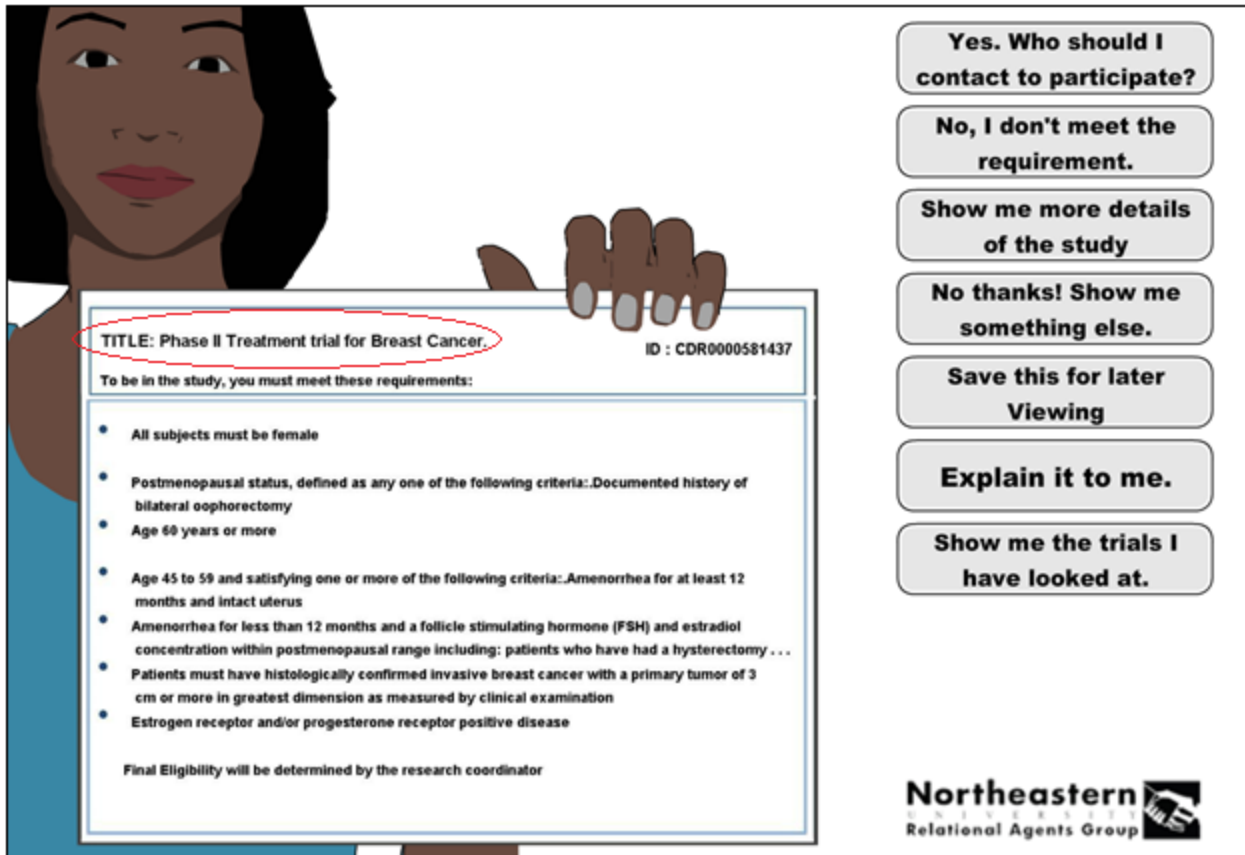
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Relational Agents Group 



# Search Interface Feature: Simplified Title

## Original title:

“Phase IV Randomized Study of Doxorubicin Hydrochloride Liposome Versus Capecitabine as First-Line Chemotherapy in Women With Metastatic Breast Cancer”



The image shows a digital interface for a clinical trial search. On the left, a woman with dark skin and hair is looking at a screen. The screen displays a search result for a clinical trial. The title 'TITLE: Phase II Treatment trial for Breast Cancer.' is circled in red. Below the title, the ID 'ID : CDR0000581437' is shown. A section titled 'To be in the study, you must meet these requirements:' lists several criteria. On the right side of the interface, there are seven buttons with different actions. At the bottom right, the logo for the Northeastern University Relational Agents Group is visible.

**TITLE: Phase II Treatment trial for Breast Cancer.** ID : CDR0000581437

To be in the study, you must meet these requirements:

- All subjects must be female
- Postmenopausal status, defined as any one of the following criteria: Documented history of bilateral oophorectomy
- Age 60 years or more
- Age 45 to 59 and satisfying one or more of the following criteria: Amenorrhea for at least 12 months and intact uterus
- Amenorrhea for less than 12 months and a follicle stimulating hormone (FSH) and estradiol concentration within postmenopausal range including: patients who have had a hysterectomy ...
- Patients must have histologically confirmed invasive breast cancer with a primary tumor of 3 cm or more in greatest dimension as measured by clinical examination
- Estrogen receptor and/or progesterone receptor positive disease

Final Eligibility will be determined by the research coordinator

**Yes. Who should I contact to participate?**

**No, I don't meet the requirement.**

**Show me more details of the study**

**No thanks! Show me something else.**

**Save this for later Viewing**


**Explain it to me.**

**Show me the trials I have looked at.**

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# Search Interface Feature: Levels of information detail

## Eligibility Criteria



Yes. Who should I contact to participate?

No, I don't meet the requirement.

Show me more details of the study

No thanks! Show me something else.

Save this for later Viewing

Explain it to me.

Show me the trials I have looked at.

Northeastern  
Relational Agents Group


**TITLE:** Phase II Treatment trial for Breast Cancer. ID : CDR0000581437

To be in the study, you must meet these requirements:

- All subjects must be female
- Postmenopausal status, defined as any one of the following criteria: Documented history of bilateral oophorectomy
- Age 49 years or more
- Age 45 to 58 and satisfying one or more of the following criteria: Amenorrhea for at least 12 months and intact uterus
- Amenorrhea for less than 12 months and a follicle stimulating hormone (FSH) and estradiol concentration within postmenopausal range including: patients who have had a hysterectomy...
- Patients must have histologically confirmed invasive breast cancer with a primary tumor of 2 cm or more in greatest dimension as measured by clinical examination
- Estragen receptor and/or progesterone receptor positive disease

Final Eligibility will be determined by the research coordinator

## Trial Protocol



Who should I contact to participate?

No thanks! Show me something else.

Save this and show me next study

Show me more details of the study

Explain it to me.

Show me the trials I have looked at.

What was that again?


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**TITLE:** Phase II Treatment trial for Breast Cancer. ID : CDR0000581437

This is what you will be doing if you choose to participate in the study:

aromatase inhibition therapy ,antiestrogen therapy ,metastoid therapy ,biopsy

## Detail Description



Who should I contact to participate?

No thanks! Show me something else.

Save this and show me next study

Explain it to me.

Show me the trials I have looked at.

Could you repeat that please?

Northeastern  
Relational Agents Group


**TITLE:** Phase II Treatment trial for Breast Cancer. ID : CDR0000581437

Detailed description of the study:

Description : Endocrine agents without any agent effect could potentially be used in combination with aromatase inhibitors, under the rationale that the combination would essentially blockade estrogen receptor signaling, thus potentially improving the anti-tumor effect. Fulvestrant (FASLODEX) is a pure estrogen antagonist with no known agent effect; thus, it has the potential to provide additional benefit when combined with an aromatase inhibitor. ...

Rationale : Combination endocrine therapy: Using endocrine agents with different mechanisms of action together has the potential advantage of more effectively blocking ER signaling, thus improving the efficacy of each agent against breast cancer. In the past, attempts to combine endocrine agents for ER-positive breast cancer have had mixed results, depending on the setting and the patient population studied.

## Contact Information



Thanks!

OK!

Excuse me?

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Relational Agents Group


Contact Information : Please find below the protocol organization to contact:  
ID : CDR0000581437

Site name : Dan L. Duncan Cancer Center at Baylor College of Medicine  
City : Houston,77030  
Phone : 713-798-5589  
Role of the Person :

# Preliminary Evaluation

- Between subject randomized trial

## AGENT



**TITLE:** Phase II Treatment trial for lung Cancer. **ID:** C0R090743315

To be in the study, you must meet these requirements:

- Histologically or cytologically confirmed squamous NSCLC
- Stage IV disease at time of study entry based on American Joint Committee on Cancer (AJCC) 7th edition
- Resectable disease at time of study entry as defined by Response Evaluation Criteria in Solid Tumors (RECIST) Version 1.1
- Activated or recent tumor tissue (minimum of 1 unstained tissue slides or a paraffin-embedded tissue block) available for analysis of epidermal growth factor receptor...
- Prior anticancer therapy with monoclonal antibodies, signal transduction inhibitors, or any therapies targeting the EGFR, vascular endothelial growth factor (VEGF), or VEGF receptor
- Previous chemotherapy for NSCLC
- Major surgery or received any investigational therapy in the 4 weeks prior to randomization

Final Eligibility will be determined by the research coordinator

**Yes. Who should I contact to participate?**

**No, I don't meet the requirement.**

**Show me more details of the study**

**Save this for later Viewing**

**No thanks! Show me something else.**

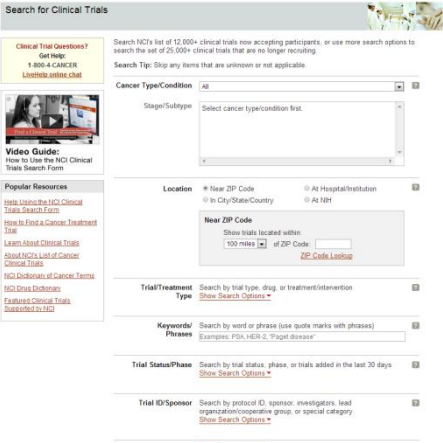
**Explain it to me.**

**Show me the trials I have looked at.**

**Could you repeat that please?**

**Northeastern**  
Relational Agents Group

## CONTROL



Search for Clinical Trials

Search NCI's list of 12,000+ clinical trials now accepting participants, or use more search options to search the set of 25,000+ clinical trials that are no longer recruiting.

Search Tip: Skip any items that are unknown or not applicable.

**Cancer Type/Condition:**   
Select cancer type/condition list.

**Location:** ☐ Near ZIP Code ☐ At Hospital/Institution ☐ In City/State/Country ☐ At NCI

**Near ZIP Code:**   
[ZIP Code Lookup](#)

**Trial/Treatment Type:** Search by trial type, drug, or treatment/intervention  
[Show Search Options](#)

**Keywords/Phrases:** Search by word or phrase (use quote marks with phrases)  
Examples: PSA, HER2, "Papilloma"

**Trial Status/Phase:** Search by trial status, phase, or trials added in the last 30 days  
[Show Search Options](#)

**Trial ID/Sponsor:** Search by protocol ID, sponsor, investigators, lead organization/cooperative group, or special category  
[Show Search Options](#)

[Go](#) [Cancel](#)

- The agent used the same data from the NCI database of clinical trials

# Preliminary Evaluation

- Search Tasks:
  - T1: search for trials with user's own criteria
  - T2 (standardized task): search for trials with specified criteria
- Measure:
  - Self-report scale measures
  - Number of trial examined
  - Number of trial that met criteria
  - ID of trial found
  - Elapsed time

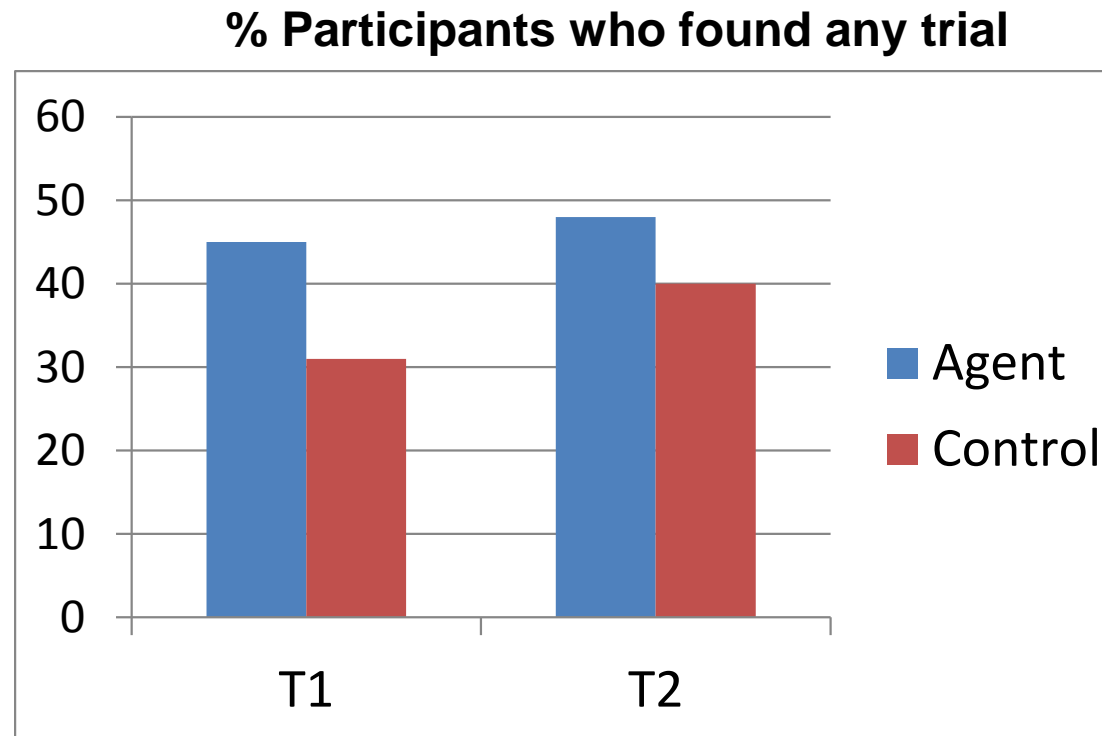
# Participants

- 87 participants:
  - 42 in the AGENT condition, 45 in CONTROL
  - 50 in person, 37 online
- Age:
  - Mean: 50.1 years (SD: 9.9)
- Gender:
  - 46% male
- **Health literacy:**
  - 26% low health literacy
- Computer Experience:
  - I've never used one: 8%
  - I've used one a few times: 24%
- Search Engine Experience:
  - I've never used one: 17%
  - I've used one a few times: 18%

# Results:

## Success Rate

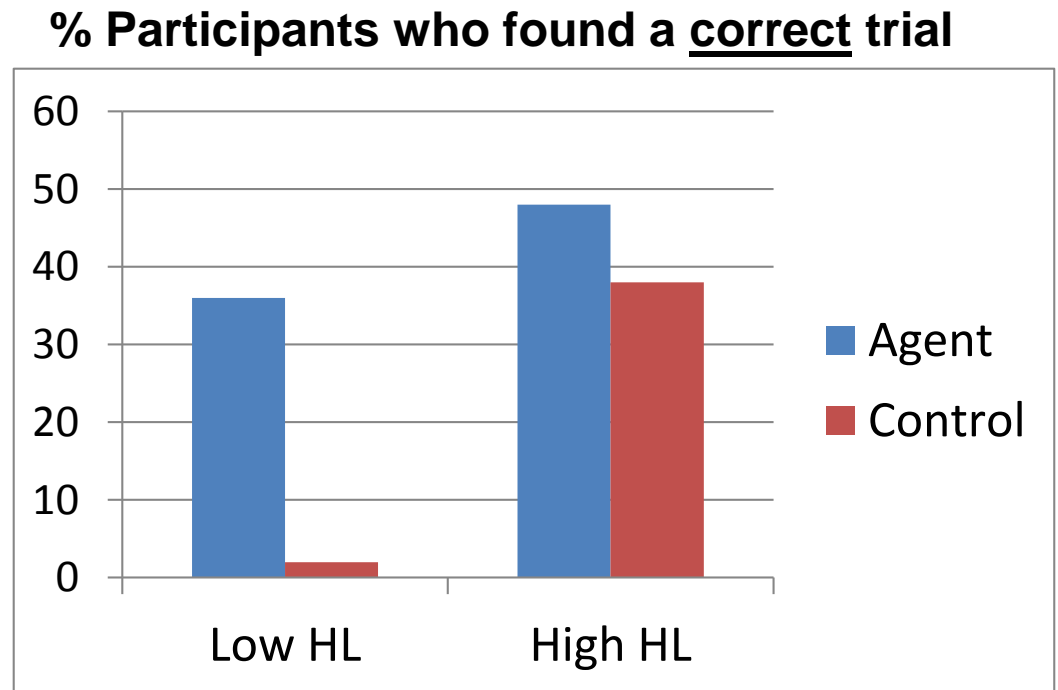
- The AGENT is at least as effective as the web-based search engine
  - T1: 45% vs. 31% (ns.)
  - T2: 48% vs. 40% (ns.)
- T2: Low HL found significantly fewer trials (27% vs. 50%)



# Results:

## T2 Success Rate

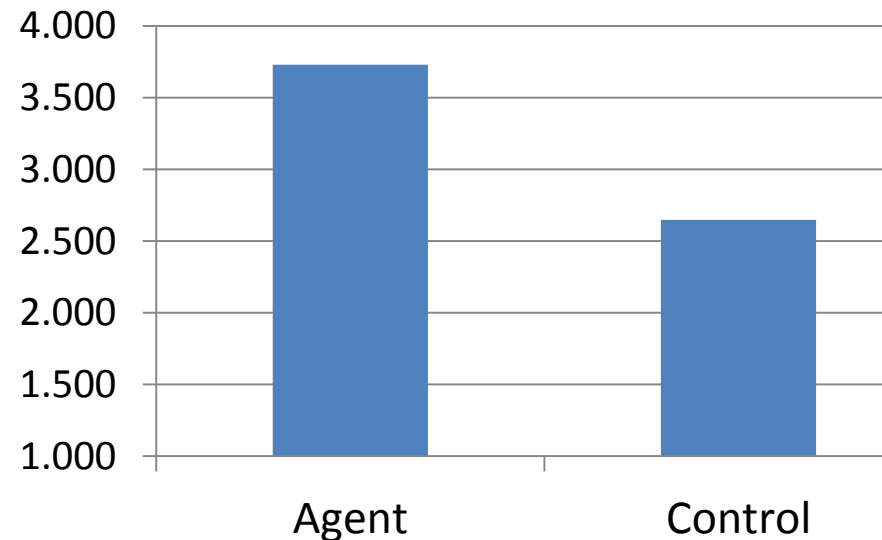
- Main effects for AGENT and Literacy



# Results:

## T1 Matching of Result and Criteria

- Those in the AGENT group felt that the trials they found matched their criteria to a greater degree than those in the CONTROL group.
  - T1: 3.7 vs. 2.6,  $p < .01$
  - No diff by literacy



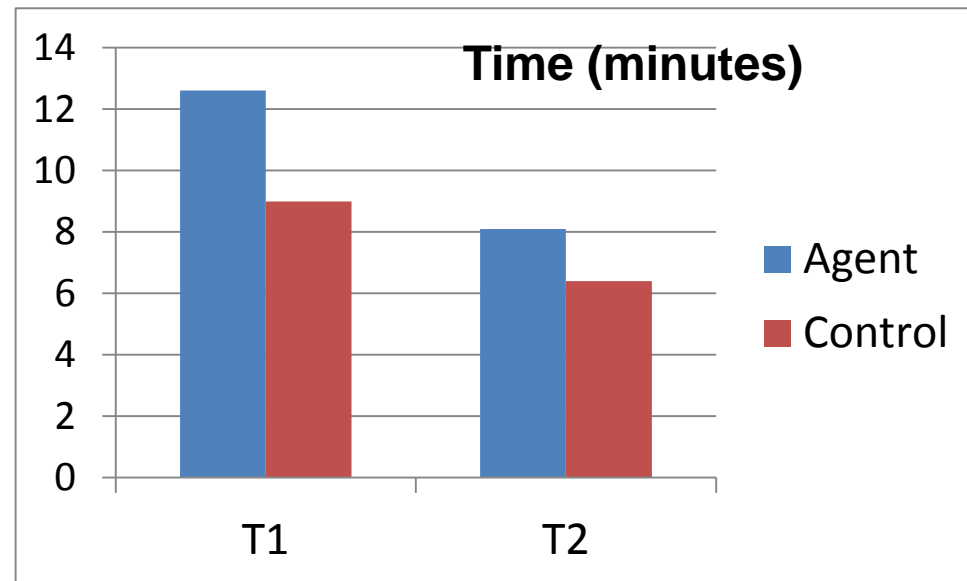
**To what degree did the trial match what you were looking for? (1=Not at all, 7=Exactly)**



# Results:

## Actual Search Time

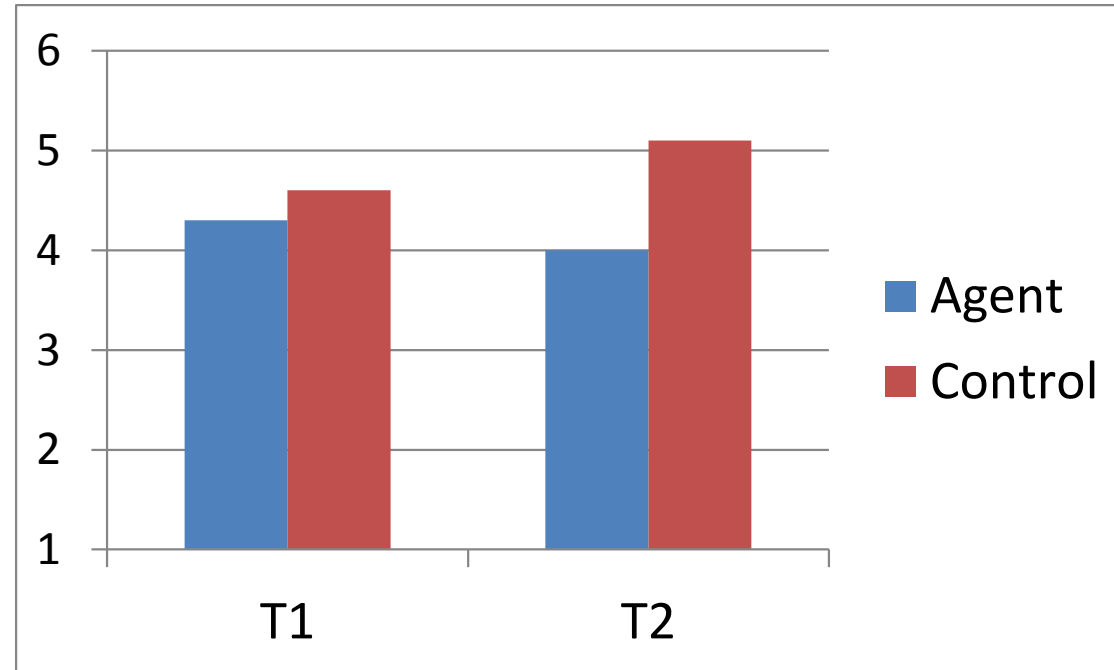
- Those in the AGENT group spent significantly more time using the system, compared to the CONTROL group.



# Results:

## Perceived Search Time

- T1: No significant difference in the **perceived** time spent using the system.
- T2: Agent perceived as taking significantly less time.

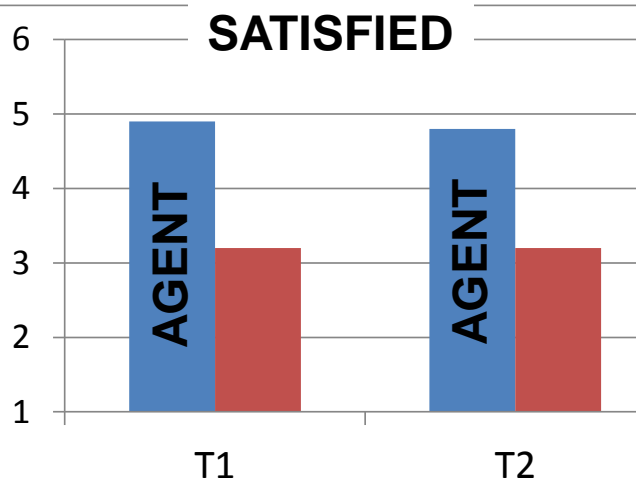


How much time do you feel it took to use the system?  
(1 = Too little, 7 = Too much)

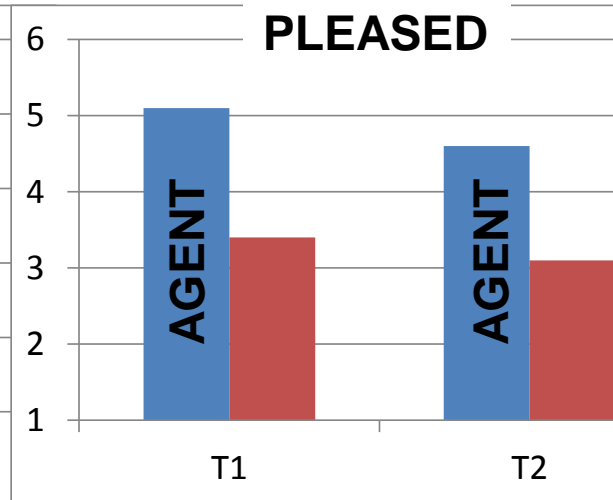
# Results: T1 Satisfaction

- All participants in the AGENT group were significantly more satisfied with the experience compared to those in the CONTROL group. ( $p < .001$ , in T1)

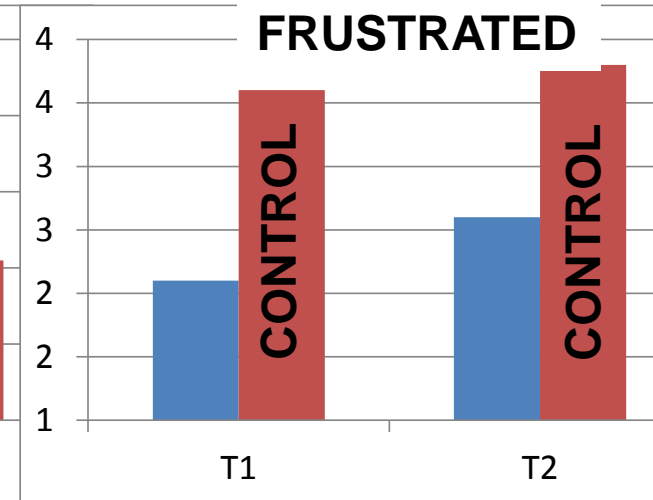
1 = Not at all, 7 = Very much



How satisfied were you with the clinical trial search system?



How pleased do you feel?

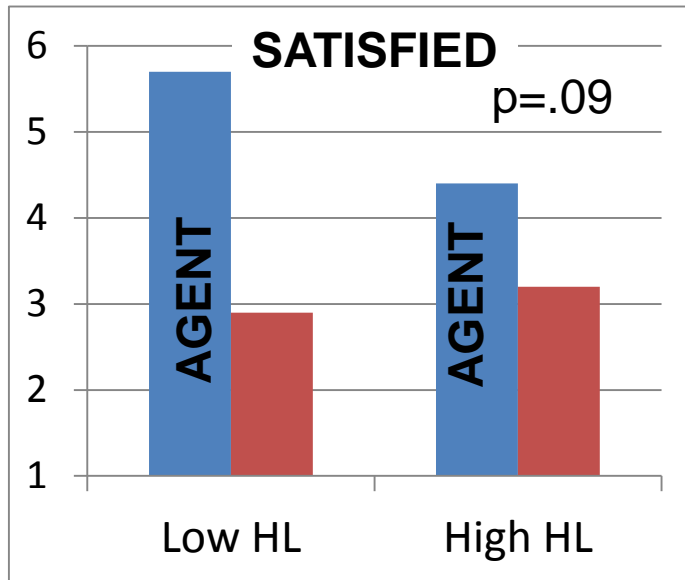


How frustrated do you feel?

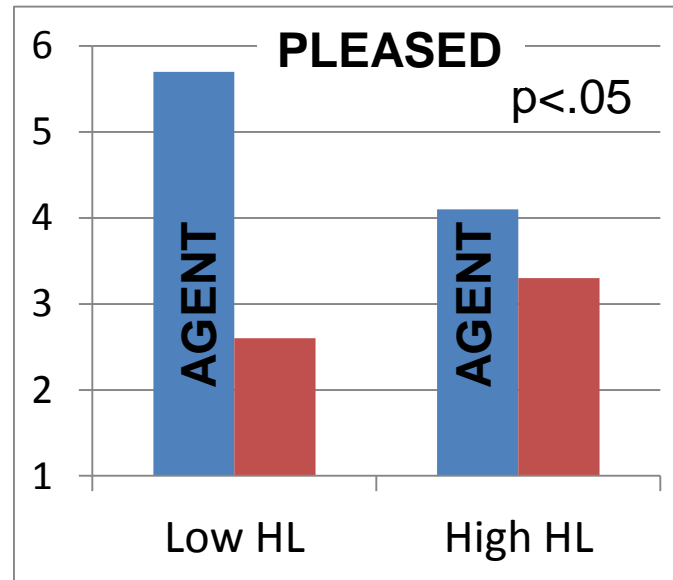
# Results: T2 Satisfaction x Literacy

- Low Health Literacy Participants even more satisfied with Agent than High Literacy

1 = Not at all, 7 = Very much



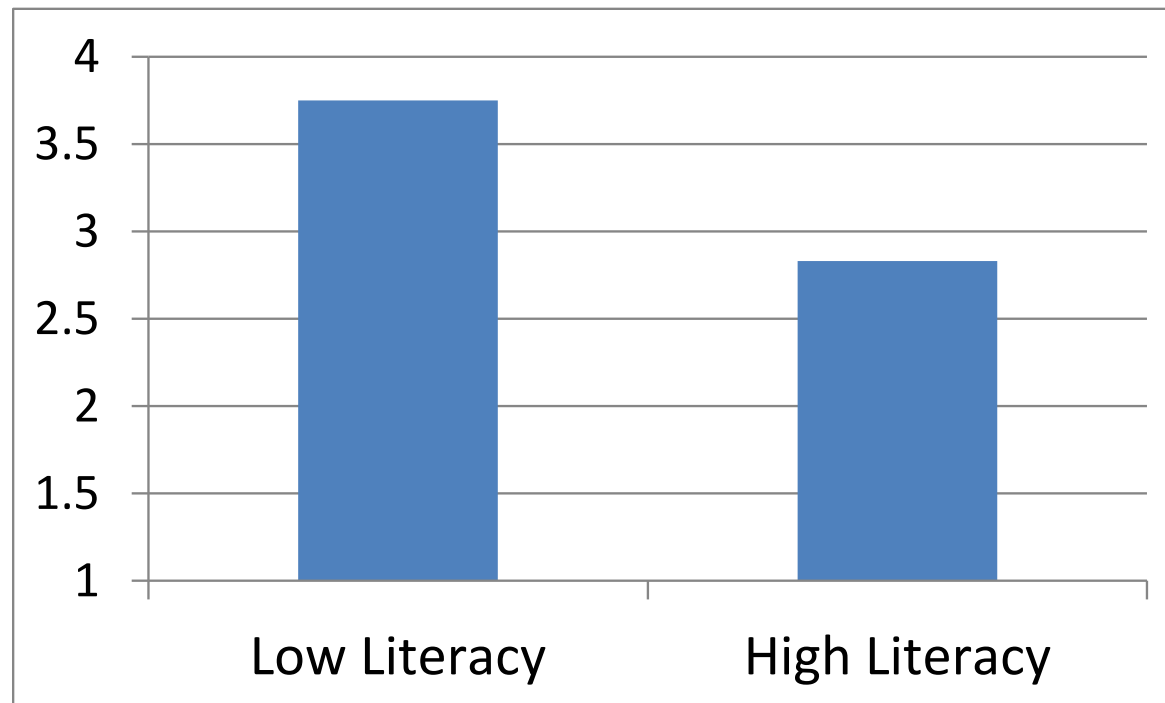
How satisfied were you  
with the clinical trial  
search system?



How pleased do you  
feel?

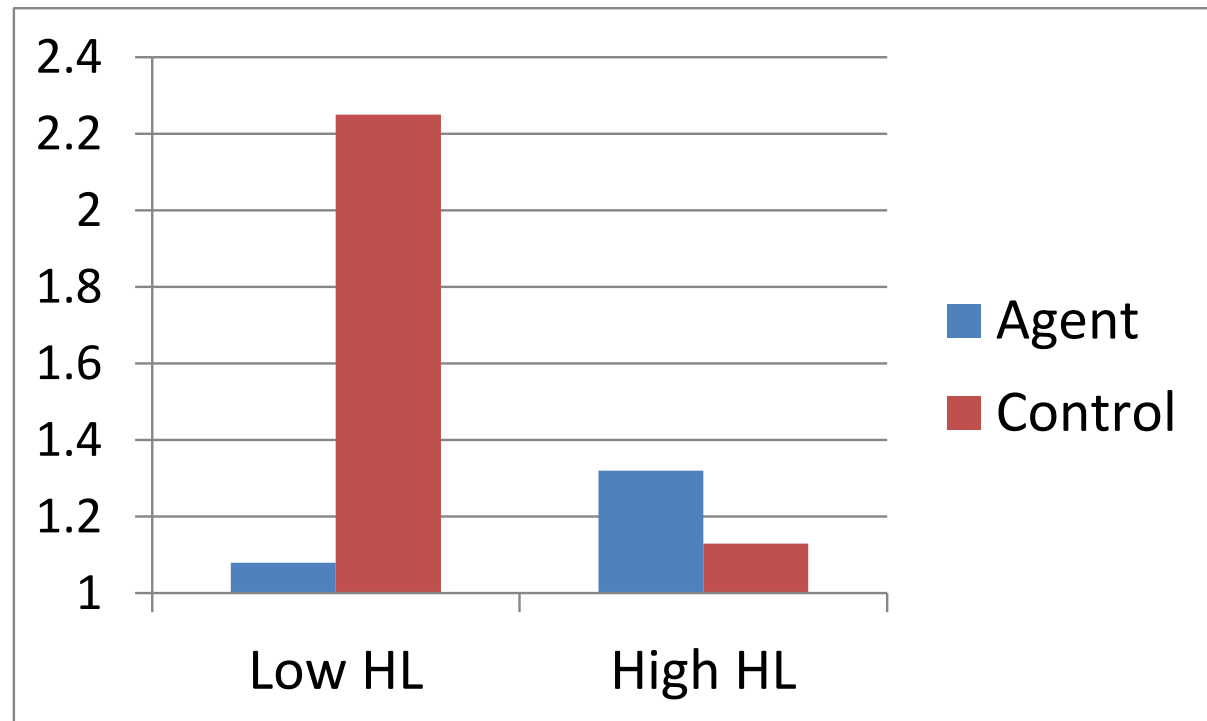
# Results: T1 Likelihood to Volunteer

- Low Health Literacy participants were significantly more likely to say they would actually volunteer for the trial ( $p=.06$ )



# Results: T1 Pressure to Sign

- Low health literacy participants felt the most pressure to sign up for the trial with the Web (significant interaction)



How much pressure did you feel to sign up for the trial?

# Conclusions

- Participants of all literacy levels performed as well or better with Agent than Web site.
- Those in the Agent group felt better about the trials they found and were more satisfied.
- Low literacy participants:
  - Performed better (T2)
  - Even more satisfied
  - Felt less pressure