National Cancer Institute

New Technologies and Analytic Techniques for Dietary Assessment

Amy F. Subar, PhD, MPH, RD

US National Cancer Institute
Division of Cancer Control and Population Sciences
Risk Factor Monitoring and Methods Group

Outline

- Challenges in dietary assessment
  - Measurement error
- New self-report tools
  - Food records
  - 24-hour recalls
- New analytic methods: combining long and short-term instruments

Goals in dietary assessment

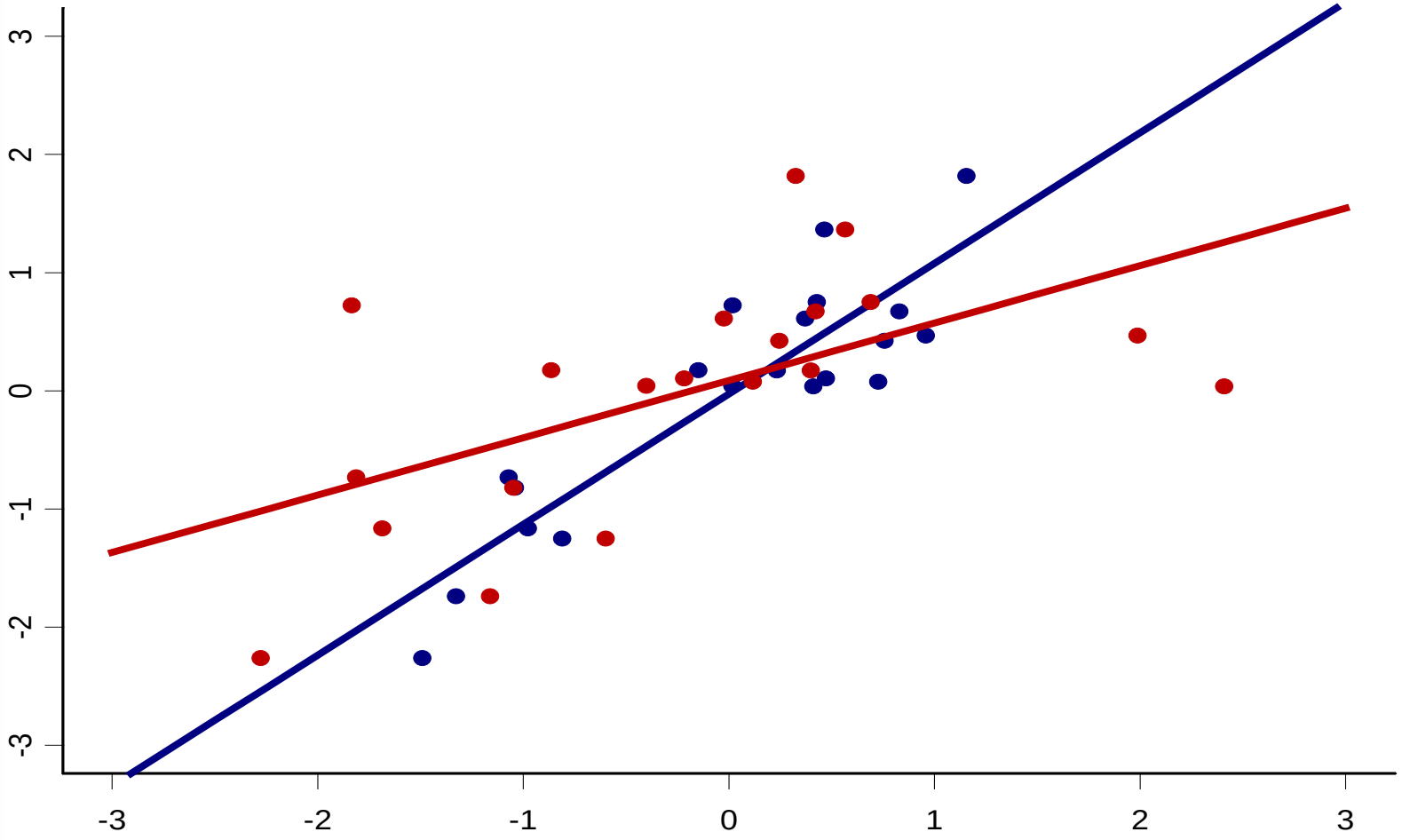
- Usual dietary intakes → typically the relevant exposure; impossible to measure directly
- Surveillance: recalls or records used
  - Modeled to estimate distributions of usual intakes
  - NCI Method: http://riskfactor.cancer.gov/diet/usualintakes/
- Epidemiology: FFQs are typical
  - Increasing recognition FFQs may have more error than other methods
  - 24-hour recalls and food records provide more detail
    - Traditionally too expensive & burdensome
    - Require multiple administrations
    - Modeled to estimate usual intakes

Challenges in dietary assessment

- Data collection is primarily self-reported
  - Prone to measurement error (recall bias, respondent bias, poor memory, etc.)
  - High respondent burden
  - Costly or burdensome processing (except for FFQs)
- Biomarkers:
  - Limited in those that provide information about amount consumed (recovery biomarkers)
  - More would be welcome; unlikely to have enough to assess all diet-disease relationships of interest

National Cancer Institute

Impact of measurement error



Observed (red) vs True (blue) Data

Impact of measurement error

- Typically measurement error causes two things:
  - Bias in the estimated exposure effect (flattened or attenuated true slope)
  - More variation about the flattened line, thus loss of statistical power for testing significance of the exposure effect
- Real effects may be obscured, inconclusive, or misleading

Correcting for error in the absence of recovery biomarkers

- FFQs
  - Use biased short-term reference instruments such as recalls or records to do regression calibration
  - Energy adjustment
- Recalls or food records
  - Use regression calibration
    - Assumes instrument is unbiased; removes effect of day-to-day variation
  - Energy adjustment

National Cancer Institute

What we wish for….

Technology explosion in dietary assessment methodology

- New methods seek to:
  - Increase accuracy
  - Ease administration for respondents
  - Reduce costs for researchers/clinicians
  - Automate coding and analysis for detailed reports
- New methods need to be as applicable as possible for:
  - Multiple age and diverse population groups
  - Various field and research environments

National Cancer Institute

Advances in technology

- Computers
- Web-based systems
- Mobile telephones
- Digital imaging
- Global Positioning System (GPS)

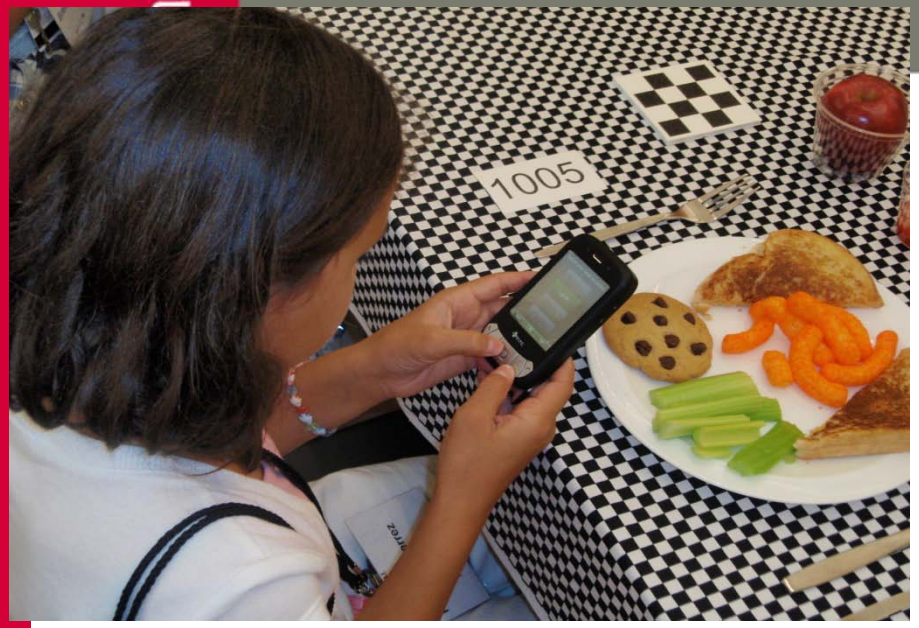
National Cancer Institute

Technology Assisted Dietary Assessment (TADA)

PI: Carol Boushey, Purdue University/ Univ Hawaii

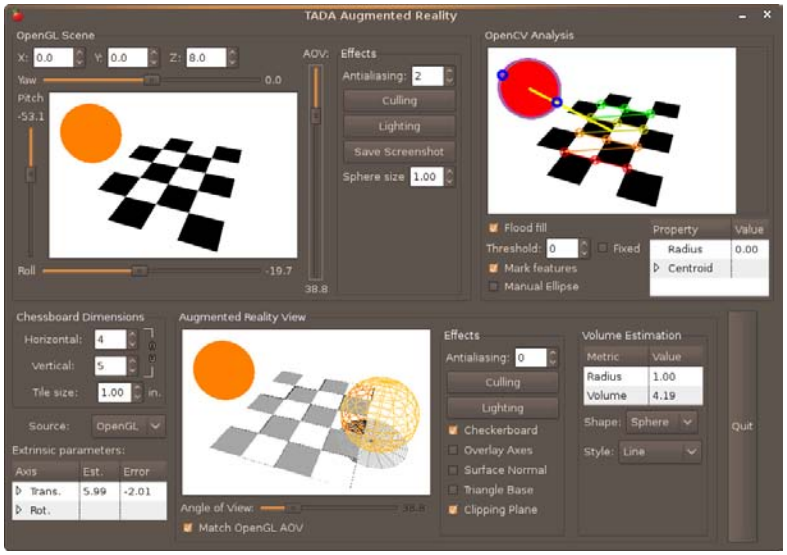
- Record Meal (eating events)
  - Capture series of before/after meal images
- Review Meal
  - Review food items in images, confirm and adjust food identification and food volume
- Alternate Method
  - Manage eating events when food images are not captured (e.g., driving a vehicle, user forgets to take an image), recall and enter foods eaten using integrated mobile application
- Not yet commercialized; pilot testing

TADA System

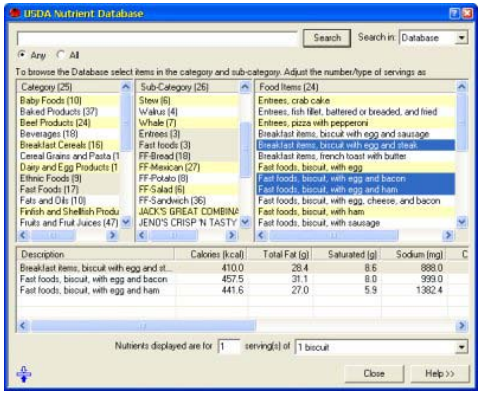


1. Photos are taken with mobile phone before and after foods consumed

2. Photos tagged with additional details as needed



3. Visualization to estimate portion size and image segmentation/analysis



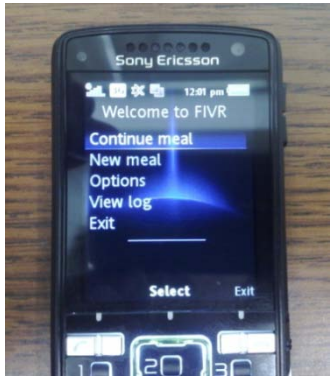
4. Data links to nutrient database for fully automated assessment

National Cancer Institute

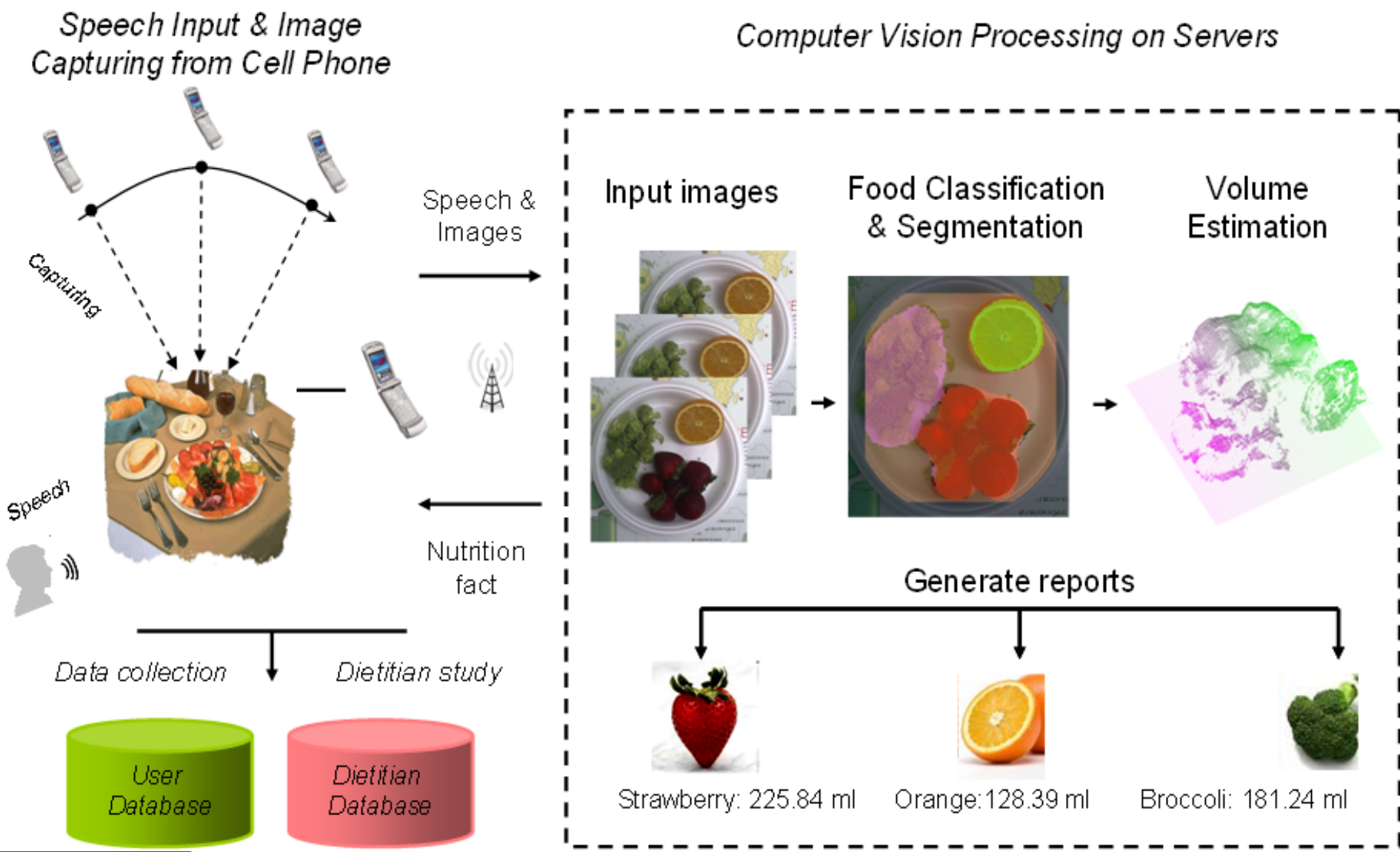
Mobile Food Intake Visualization and Voice Recognizer (FIVR)

PI: Rick Weiss, Viocare, Inc.

- Uses a mobile phone as a food record
- Video and voice to record before/after eating
- Automatically identify foods and portion sizes to reduce participant burden
  - Computer vision techniques
  - Speech recognition software
  - Eating habits questionnaire
  - 3-D structure analysis to calculate volume (portion size)
- Calculates nutrient and food intake
- Not yet commercialized; pilot testing



FIVR System

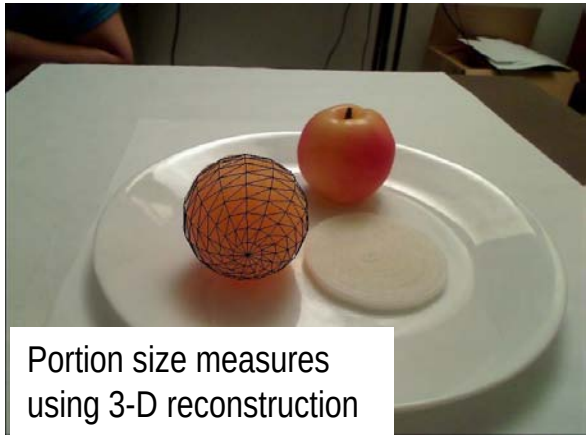

Speech Input & Image Capturing from Cell Phone
Computer Vision Processing on Servers
Capturing
Speech
Speech & Images
Nutrition fact
Input images
Food Classification & Segmentation
Volume Estimation
Generate reports
Strawberry: 225.84 ml
Orange:128.39 ml
Broccoli: 181.24 ml
Data collection
Dietitian study
User Database
Dietitian Database

National Cancer Institute

A unified sensor system for ubiquitous assessment of diet and activity

PI: Mingui Sun, University of Pittsburgh

- Wearable device for objective measures of intake and activity
  - Video camera, GPS sensor, accelerometer, UV sensor, digital compass included in button-like device
  - Subject wears device and recharges it nightly
- Compressed data are stored in a SD card and uploaded
- Multimedia data processing used to evaluate intake and activity



Portion size measures using 3-D reconstruction

National Cancer Institute

A unified sensor system for ubiquitous assessment of diet and activity

Self-administered recalls

- Traditional 24-hour recalls
  - Previously not feasible in large-scale research
  - Expensive: trained interviewers, multiple days
- NCI's response: Automated Self-administered 24-hour Dietary Recall (ASA24)
  - Low-cost means to obtain high-quality dietary data

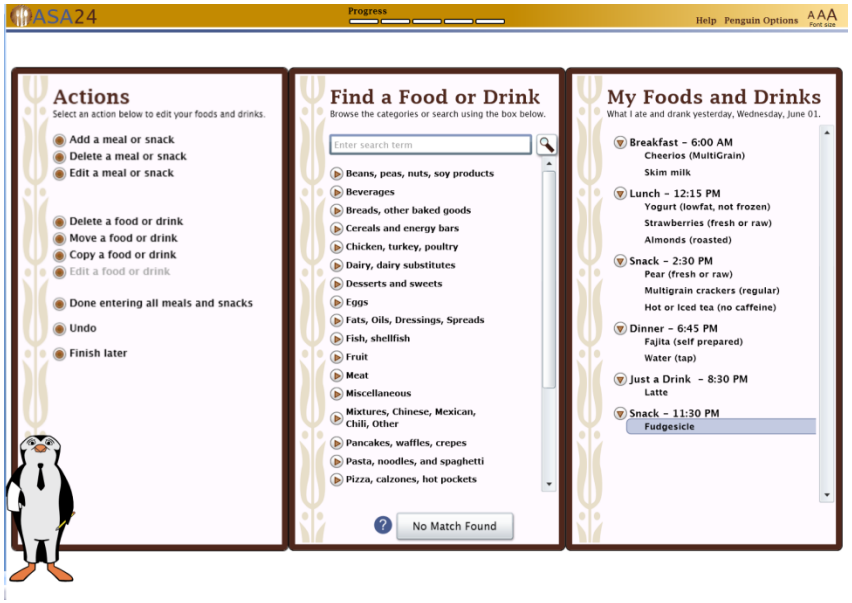
What is ASA24?

- Fully automated, web-based, self-administered 24-hour recall
  - Format based on recalls collected in the National Health and Nutrition Examination Survey (NHANES)
  - Uses dynamic user interface including a talking, animated guide
  - Culturally neutral

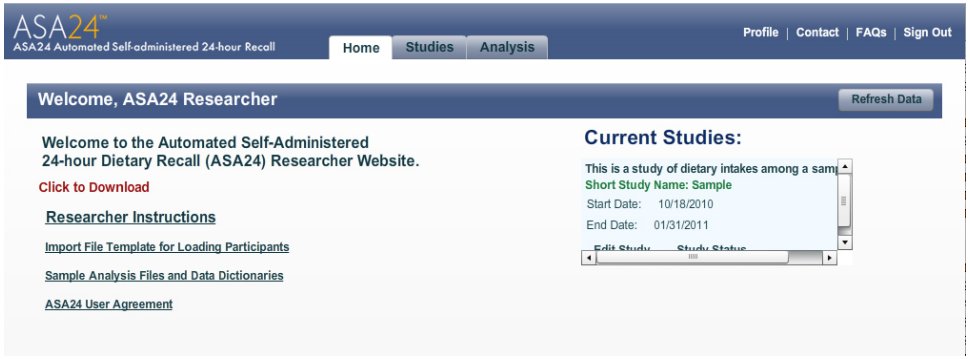
ASA24

ASA24 Automated Self-administered 24-hour Recall

Interview function (*respondent site*)



Study setup and analysis function (*researcher site*)



Conversion to a self-administered tool

- AMPM
  - Quick List
  - Forgotten Foods
  - Time & Occasion
  - Detail Cycle
  - Final Probe
- ASA24
  - Quick List
  - Meal Gap
  - Detail Cycle
  - Forgotten Foods
  - Final Probe

- ASA24: ~30 minutes to complete

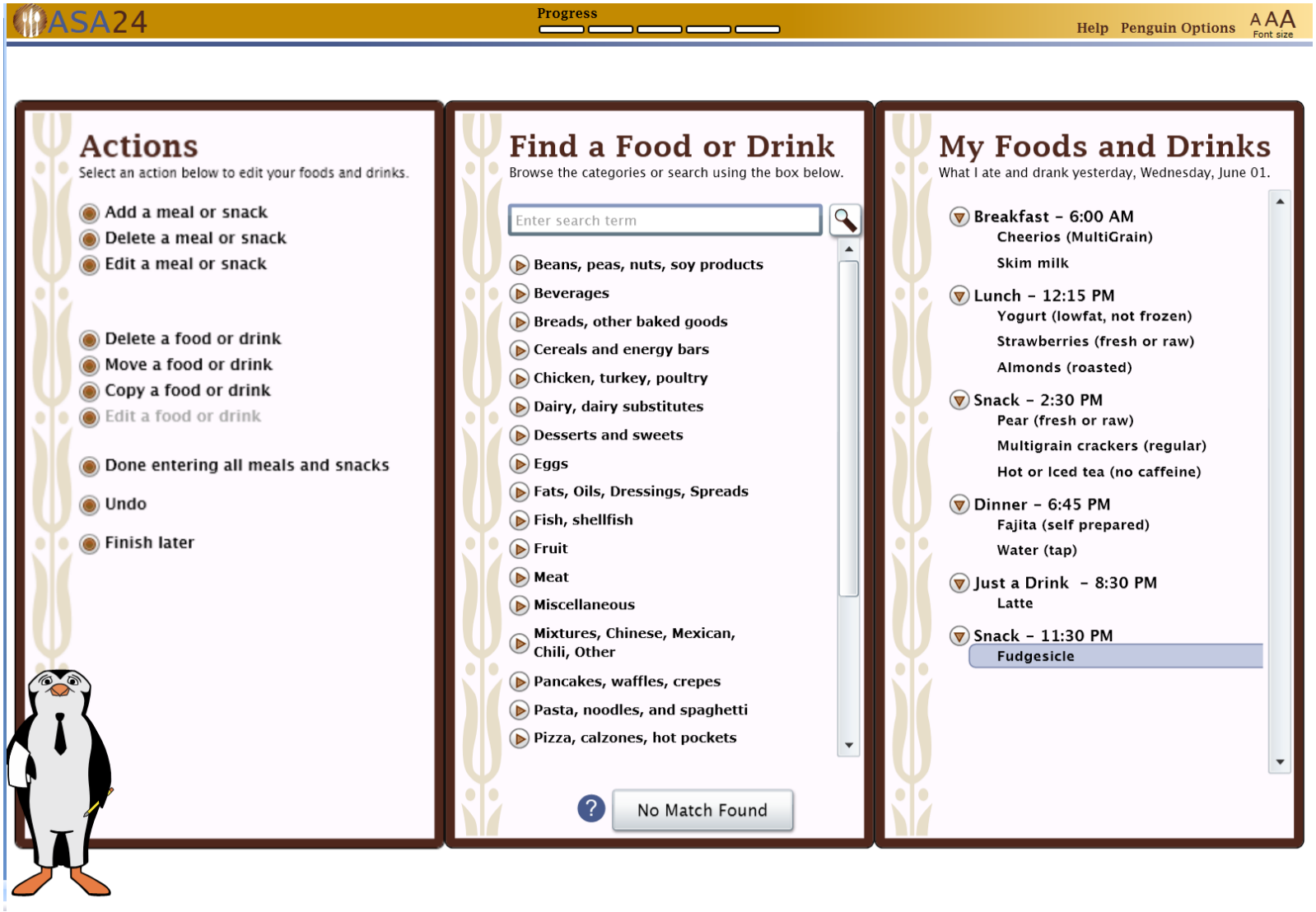
Status of respondent site

- Beta site available since 2009
  - >200 registered studies, >20,000 recalls completed
  - Supported until end of June 2012

Status of respondent site

- Version 1 – released September 21, 2011
  - New interface for respondent site
  - Updates to food list terms and related probes
  - Database updates (FNDDS 4.1, MPED 2.0, NHANES 07-08 supplement database)
  - New optional modules: supplements, who ate with, TV/computer use
  - Spanish version

Respondent site demonstration



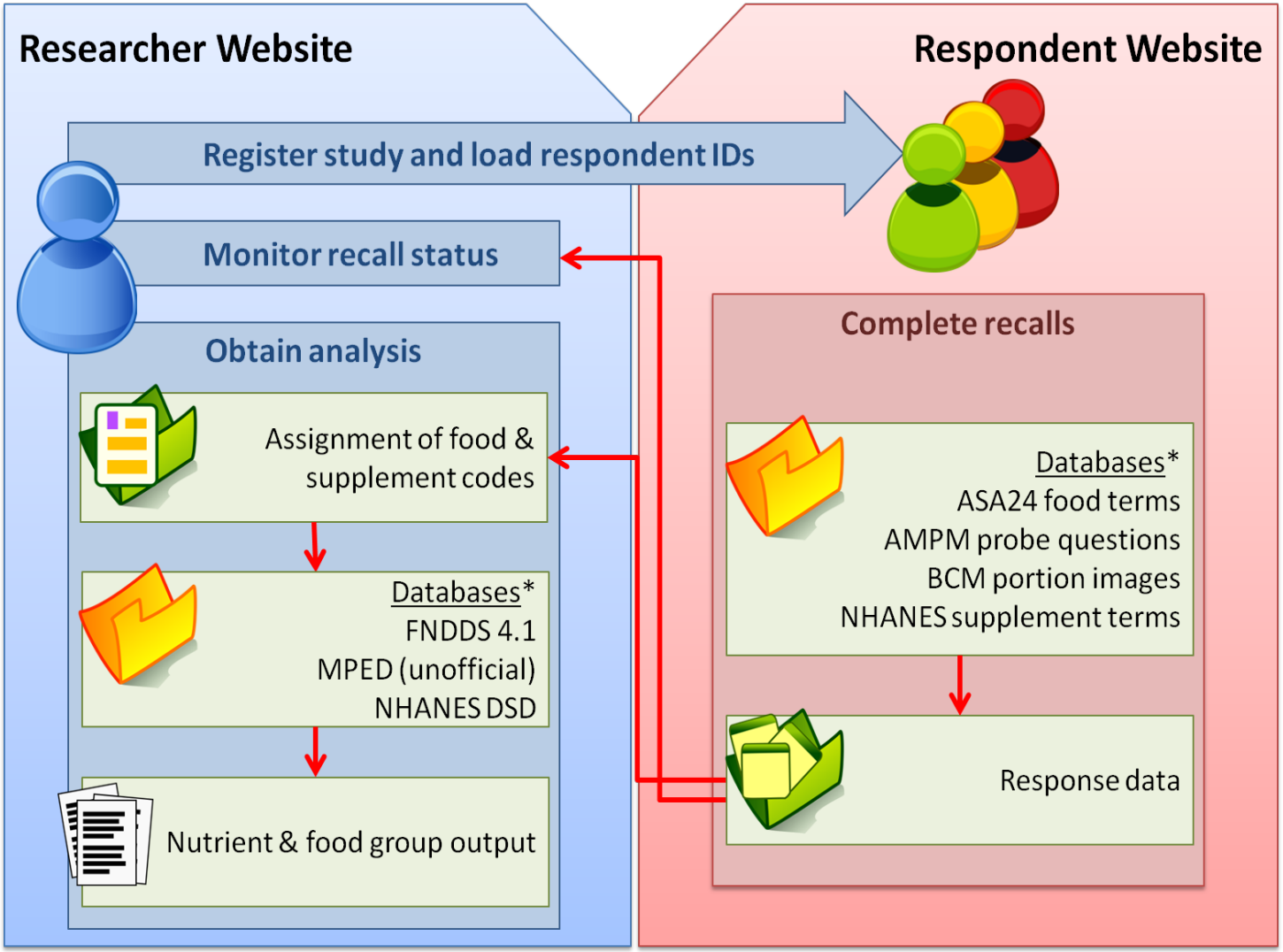
Researcher site

- Allows researchers to set up studies and manage participants' use of ASA24
  - Upload participant identifiers and set parameters for recall completion (e.g., number of recalls, dates)
  - Monitor participant progress (e.g., missed or completed recalls)
  - Obtain analytic output

Analytic output

- My Selections
- Nutrients
  - For each food reported
  - Total daily
- Food groups
  - For each food reported
  - Total daily
- Supplements
  - Nutrients from each supplement and all supplements
  - Nutrients from foods and supplements

ASA24 System



*Abbreviations: AMPM, Automated Multiple Pass Method; BCM, Baylor College of Medicine; DSD, Dietary Supplement Database; FNDDS, Food and Nutrient Database for Dietary Surveys; MPED, MyPyramid Equivalents Database; NHANES, National Health and Nutrition Examination Survey

Comparison and validation studies

- Compare ASA24 to standard interviewer-administered 24-hour recalls (AMPM) in 1000 participants to assess:
  - Means, within person variation, correlations
  - Attrition, response rates
- Feeding study of 80 participants to assess:
  - Accuracy of ASA24 and AMPM compared to truth

Comparison and validation studies

- Multi-Cohort Eating and Activity Study for Understanding Reporting Error (MEASURE)
  - Assess structure of measurement error in self-report diet and physical activity instruments in multiple large cohorts (n = 2300):
    - Harvard Nurses' Health Study
    - Harvard Health Professionals Follow-Up Study
    - National Institutes of Health-AARP Diet and Health Study
  - Doubly labeled water, 24-hour urine, physical activity monitors

Food Intake Recording Software System (FIRSSt)

- Modified version of ASA24 for use with school-aged children
  - Dr. Tom Baranowski, Baylor College of Medicine
  - Simplified interface:
    - Shorter list of foods and beverages and fewer follow-up probes
    - Based on cognitive testing among children 10-13 years and national survey data

Impact of using ASA24

- High-quality dietary data
  - Validation work underway will assess new administration mode
- Enhanced ability to detect relationships between dietary intakes and health outcomes
- Significant cost savings to researchers and funding agencies

More information on ASA24

- riskfactor.cancer.gov/tools/instruments/asa24
  - Links to:
    - FAQs
    - Demo version of respondent site
    - Researcher instructions and researcher website for registering a new study
    - ASA24 Portal

Innovation in analysis of dietary assessment data

- Combining instruments: FFQs and record or recalls

Combining records/recalls with FFQs

- FFQs ask about intake over an extended period but have limited usefulness as sole instrument
- 24HRs/FRs provide needed detail, but individuals do not eat the same thing day-to-day, week-to-week, or season-to-season
  - Snapshot in time
- Might they be combined?

Combining records/recalls with FFQs

- Research questions
  - How many recalls do you need to model individual usual intakes if that's your only instrument?
  - Does covariate FFQ data help?
  - What's better?
    - Some number of recalls alone
    - FFQ alone
    - Some combination of recalls and an FFQ

Combining records/recalls with FFQs: Methods

- Eating at America's Table Study (EATS)
  - Two FFQs and four 24-hour dietary recalls (3 mo apart)
  - Representative sampling nationwide
  - N=965 men and women, 20-70 years

Combining records/recalls with FFQs: Methods

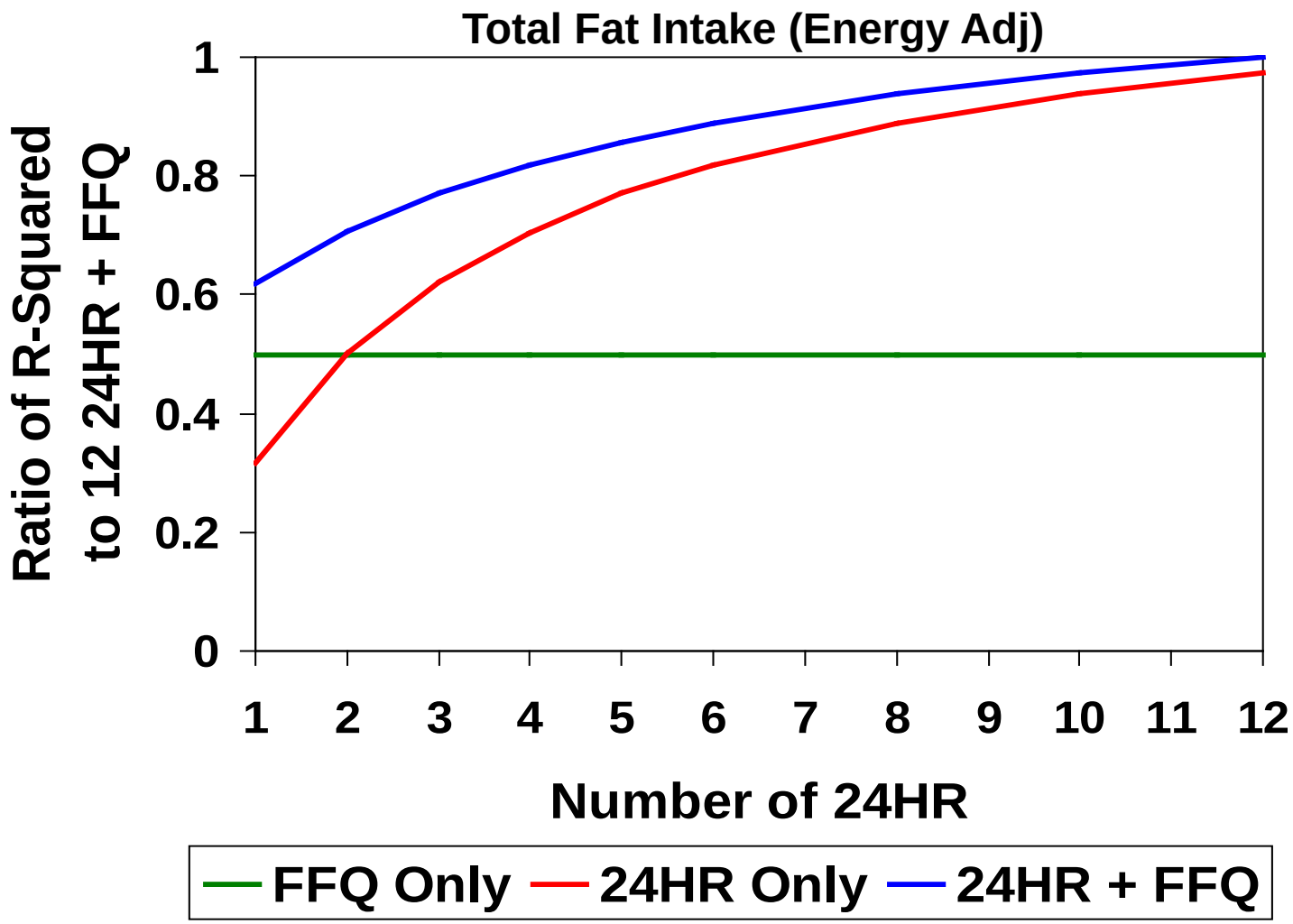
- Models used to compare various dietary assessment methods with "truth"
  - Nutrient and food intakes energy adjusted
  - Recalls are calibrated (regression calibration) using NCI method
  - FFQs are calibrated (regression calibration) using recalls as reference instrument
  - Recalls + FFQ: FFQ data used as covariate information in NCI model of recalls
- Variables of interest (closely related)
  - Precision of estimate, power, sample size

Combining records/recalls with FFQs

- Data on women presented
  - Similar results for men
- Nutrients/food groups tested
  - Selected those representing wide range of intakes
  - Present only a few

National Cancer Institute

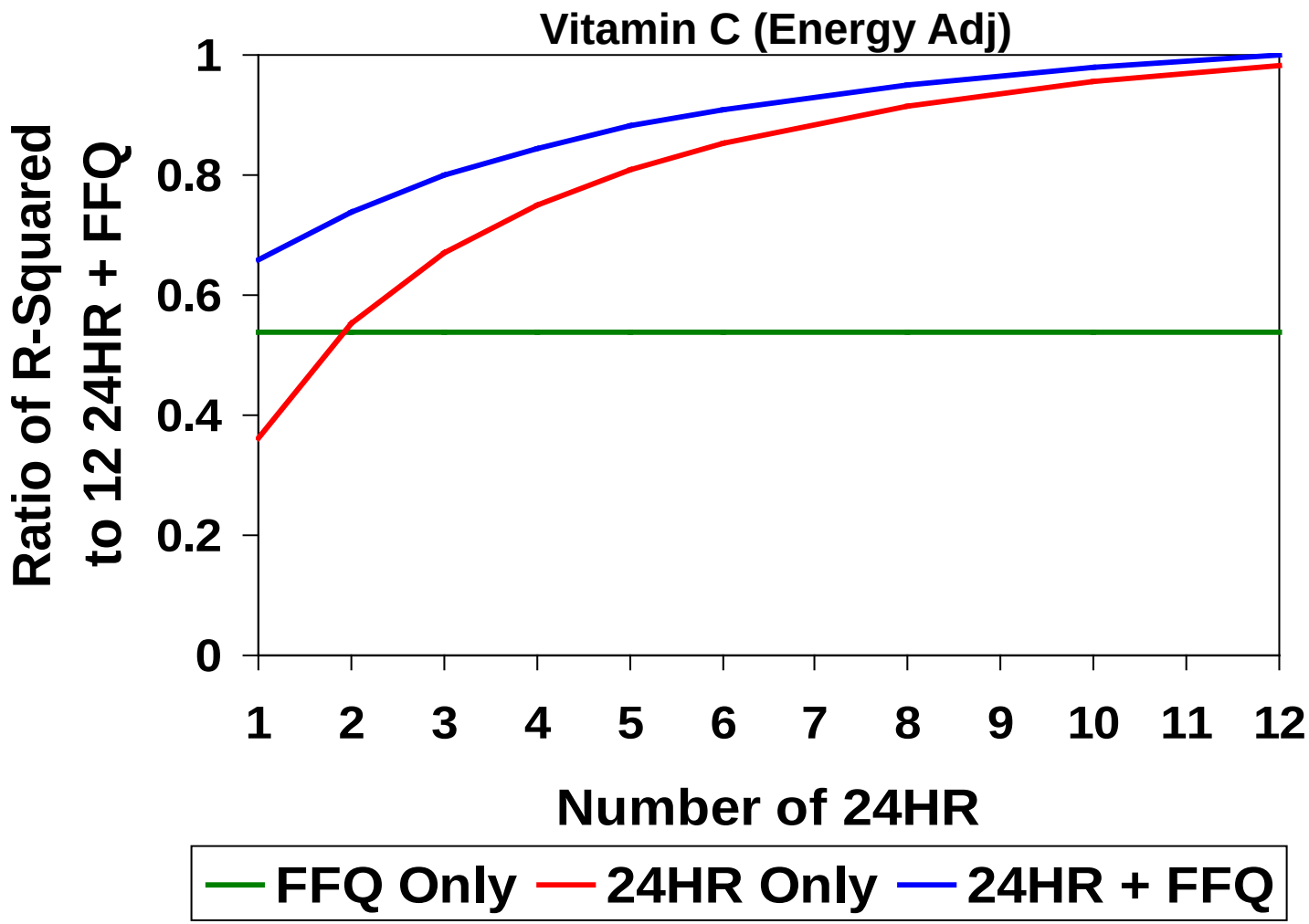
Precision between true and predicted intake using 24HR and/or FFQ to predict intake



EATS Study (Women)

National Cancer Institute

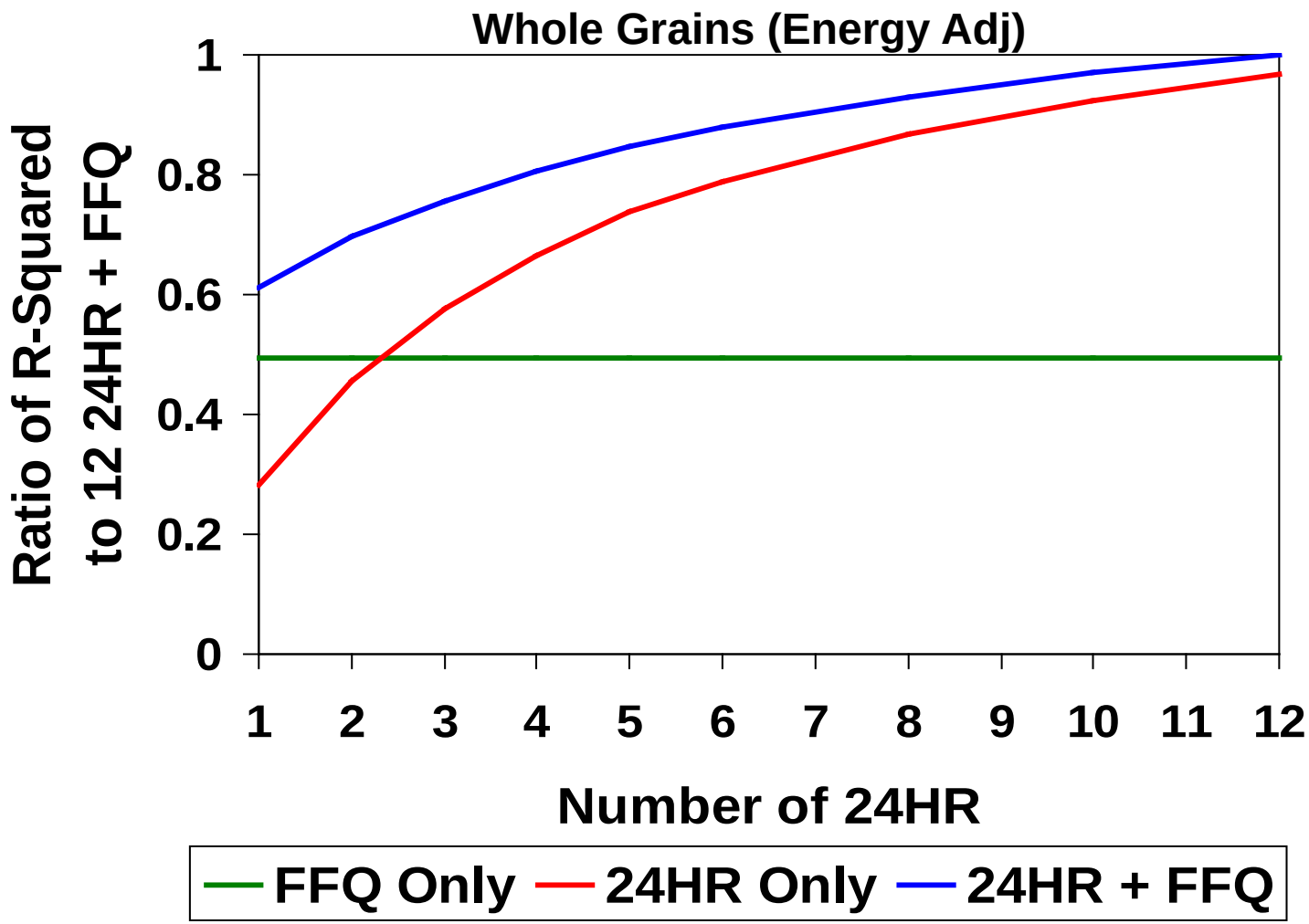
Precision between true and predicted intake using 24HR and/or FFQ to predict intake



EATS Study (Women)

National Cancer Institute

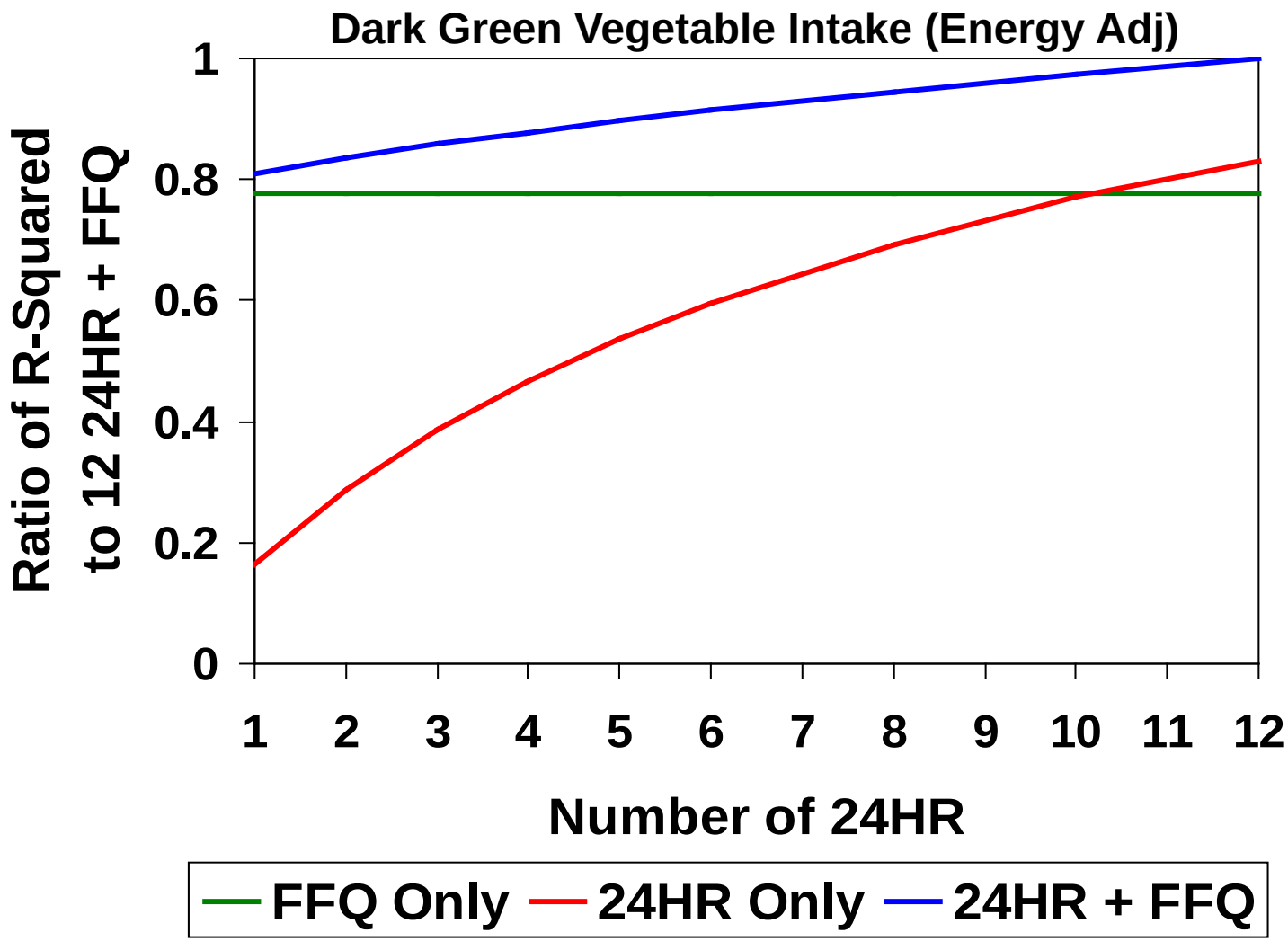
Precision between true and predicted intake using 24HR and/or FFQ to predict intake



EATS Study (Women)

National Cancer Institute

Precision between true and predicted intake using 24HR and/or FFQ to predict intake



EATS Study (Women)

Combining instruments: Conclusions

- Results vary for nutrients/foods consumed nearly daily vs. episodically
- 4-6 recalls with an FFQ serves most purposes
- FFQs alone contain error but inclusion as covariate in modeling of recalls can be quite useful
- Limitations:
  - Analyses assume recall is unbiased
  - Recalls beyond 4 are simulated

Combining instruments: Considerations

- Respondent burden, response rates
- Costs: Automated tools may be free, but what about oversight and monitoring?
- Would food records behave like recalls?
  - More research needed
  - Costs of coding now; automation in the future

National Cancer Institute

Summary

- Exciting research and development going on in all areas of dietary assessment
  - Tools
  - Methods
  - Analyses
- Self-report is a long-term reality
  - Useful data

    collected, despite error and bias

National Cancer Institute

Thank you!

- Questions?

National Cancer Institute

Extra Slides if there are problems with demo

The NCI Automated Self-Administered 24-hour Recall (ASA24) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

The NCI Automated Self-Administered 24-ho...

ASA24

Progress

Help

Penguin Options

AAA Font size

Meal Details

Enter the details of the first meal or snack you would like to report.

Meal or snack:

Breakfast

Time of meal or snack:

08 : 00

- (•) AM
- ( ) PM

Location:

Home

TV and computer use while eating and drinking:

Watching TV

Did you eat alone? ( ) Yes (•) No ( ) Don't know

Who you ate with (check all that apply):

- [x] Spouse/Partner
- [ ] Child/children
- [ ] Other adult(s)

Next

The NCI Automated Self-Administered 24-hour Recall (ASA24) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

The NCI Automated Self-Administered 24-ho...

ASA24

Progress

Help

Penguin Options

AAA Font size

Actions

Select an action below to edit your foods and drinks.

- Add a meal or snack
- Delete a meal or snack
- Edit a meal or snack
- Delete a food or drink
- Move a food or drink
- Copy a food or drink
- Edit a food or drink
- Done entering all meals and snacks
- Undo
- Finish later

Find a Food or Drink

Browse the categories or search using the box below.

Enter search term

- Beans, peas, nuts, soy prod
- Beverages
- Breads, other baked goods
- Cereals and energy bars
- Chicken, turkey, poultry
- Dairy, dairy substitutes
- Desserts and sweets
- Eggs
- Fats, Oils, Dressings, Sp
- Fish, shellfish
- Fruit
- Meat
- Miscellaneous
- Mixtures, Chinese, M Chili, Other
- Pancakes, waffles, c
- Pasta, noodles, and s
- Pizza, calzones, hot p

No Match F

The right panel is where the foods and drinks you report will be listed.

My Foods and Drinks

What I ate and drank Yesterday, Monday, October 17.

Breakfast - 08:00 AM

The NCI Automated Self-Administered 24-hour Recall (ASA24) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

The NCI Automated Self-Administered 24-ho...

ASA24

Progress

Help

Penguin Options

AAA Font size

Actions

Select an action below to edit your foods and drinks.

- Add a meal or snack
- Delete a meal or snack
- Edit a meal or snack
- Delete a food or drink
- Move a food or drink
- Copy a food or drink
- Edit a food or drink
- Done entering all meals and snacks
- Undo
- Finish later

Find a Food or Drink

Browse the categories or search using the box below.

Enter search term

- Beans, peas, nuts, soy products
- Beverages
- Breads, other baked goods
- Cereals and energy bars
- Chicken, turkey, poultry
- Dairy, dairy substitutes
- Desserts and sweets
- Eggs
- Fats, Oils, Dressings, Spreads
- Fish, shellfish
- Fruit
- Meat
- Miscellaneous
- Mixtures, Chinese, Mexican, Chili, Other
- Pancakes, waffles, crepes
- Pasta, noodles, and spaghetti
- Pizza, calzones, hot pockets

No Match Found

My Foods and Drinks

What I ate and drank Yesterday, Monday, October 17.

Breakfast - 08:00 AM

The NCI Automated Self-Administered 24-hour Recall (ASA24) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

The NCI Automated Self-Administered 24-ho...

ASA24

Progress

Help

Penguin Options

A AA Font size

Actions

Select an action below to edit your foods and drinks.

- Add a meal or snack
- Delete a meal or snack
- Edit a meal or snack
- Delete a food or drink
- Move a food or drink
- Copy a food or drink
- Edit a food or drink
- Done entering all meals and snacks
- Undo
- Finish later

Find a Food or Drink

Browse the categories or search using the box below.

Cheerios

-- Suggestions --

Cheerios

Cheerios Treats bar

- Breads, other baked goods
- Cereals and energy bars
- Chicken, turkey, poultry
- Dairy, dairy substitutes
- Desserts and sweets
- Eggs
- Fats, Oils, Dressings, Spreads
- Fish, shellfish
- Fruit
- Meat
- Miscellaneous
- Mixtures, Chinese, Mexican, Chili, Other
- Pancakes, waffles, crepes
- Pasta, noodles, and spaghetti
- Pizza, calzones, hot pockets

No Match Found

My Foods and Drinks

What I ate and drank Yesterday, Monday, October 17.

Breakfast - 08:00 AM

The NCI Automated Self-Administered 24-hour Recall (ASA24) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

The NCI Automated Self-Administered 24-ho...

ASA24

Progress

Help

Penguin Options

A A A Font size

Actions

Select an action below to edit your foods and drinks.

- Add a meal or snack
- Delete a meal or snack
- Edit a meal or snack
- Delete a food or drink
- Move a food or drink
- Copy a food or drink
- Edit a food or drink
- Done entering all meals and snacks
- Undo
- Finish later

Find a Food or Drink

Browse the categories or search using the box below.

Enter search term

- Beans, peas, nuts, soy products
- Beverages
- Breads, other baked goods
- Cereals and energy bars
- Chicken, turkey, poultry
- Dairy, dairy substitutes
- Desserts and sweets
- Eggs
- Fats, Oils, Dressings, Spreads
- Fish, shellfish
- Fruit
- Meat
- Miscellaneous
- Mixtures, Chinese, Mexican, Chili, Other
- Pancakes, waffles, crepes
- Pasta, noodles, and spaghetti
- Pizza, calzones, hot pockets

No Match Found

My Foods and Drinks

What I ate and drank Yesterday, Monday, October 17.

Breakfast - 08:00 AM
- Cheerios
- Coffee

Lunch - 12:00 PM
- Tuna salad sandwich
- Potato chips (unknown brand)
- Orange juice

Dinner - 06:00 PM
- Chicken leg (drumstick and thigh)
- Broccoli
- Brown rice (regular)
- Green salad
- Ice cream

The NCI Automated Self-Administered 24-hour Recall (ASA24) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

The NCI Automated Self-Administered 24-ho...

ASA24

Progress 1 of 5

Help Penguin Options

A AA Font size

Actions

Select an action below to edit your foods and drinks.

- Add a meal or snack
- Delete a meal or snack
- Edit a meal or snack
- Add a food or drink
- Delete a food or drink
- Move a food or drink
- Copy a food or drink
- Edit a food or drink
- Done entering all meals and snacks
- Undo
- Finish later

Add Detail

Cheerios:

What kind was it?

- Apple Cinnamon
- Berry Burst
- Frosted
- Honey Nut
- Multigrain
- Plain
- Other Specify other
- Don't know

Next

My Foods and Drinks

What I ate and drank Yesterday, Monday, October 17.

Breakfast - 08:00 AM
- Cheerios
- Coffee

Lunch - 12:00 PM
- Tuna salad sandwich
- Potato chips (unknown brand)
- Orange juice

Dinner - 06:00 PM
- Chicken leg (drumstick and thigh)
- Broccoli
- Brown rice (regular)
- Green salad
- Ice cream

The NCI Automated Self-Administered 24-hour Recall (ASA24) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

The NCI Automated Self-Administered 24-ho...

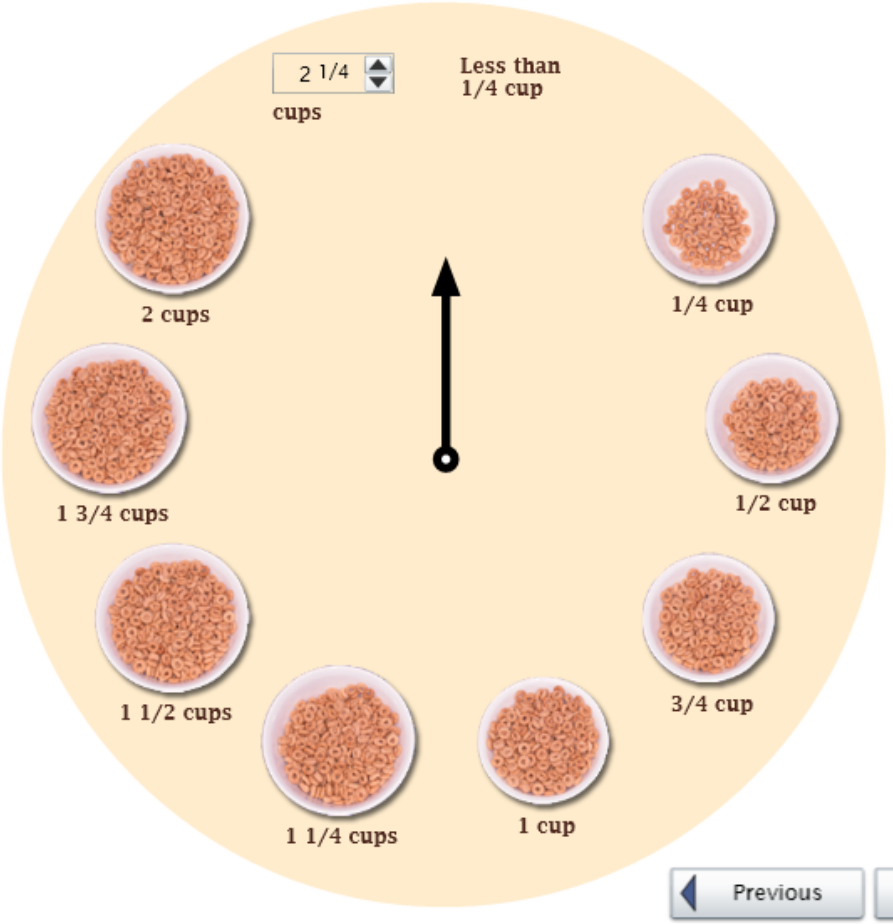
ASA24

Progress 1 of 5

Help Penguin Options AAA Font size

Cheerios: How much did you actually eat?

Select the image that best represents the amount you ate at breakfast.



Amount eaten:

Previous Don't Know Next

Actio

Select an ac

Add a

Delete

Edit a

Add a

Delete

Move

Copy

Edit a

Done

Undo

Finish

Drinks

day, October 17.

and

The NCI Automated Self-Administered 24-hour Recall (ASA24) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

The NCI Automated Self-Administered 24-ho...

ASA24

Progress 1 of 5

Help Penguin Options AAA Font size

Actions

Select an action bel

Add a meal

Delete a me

Edit a meal

Add a food

Delete a foo

Move a food

Copy a food

Edit a food

Done enteri

Undo

Finish later

Did you add anything to your Cheerios that you haven't already reported?

Select all that apply.

Search or browse to find foods added to your Cheerios. Use the arrows to add or remove additions. If nothing was added or you have already reported the additions, select **Nothing Added** below.

Enter search term

- Cold cereals
- Fruit
- Milk
- Sugars and sugar substitutes

Common Additions

- 1% milk
- Buttermilk
- Skim milk
- Soy milk
- Whole milk
- Dry milk (1% fat)

Other Additions

- Acidophilus milk
- Calcium fortified milk (skim or nonfat)
- Coconut milk
- Dry milk (lowfat)
- Dry milk (skim or nonfat)

2% milk

Previous | Don't Know | Nothing Added | Next

nd Drinks

ay, Monday, October 17.

AM

1 cup

wich

known

mstick and

lar)

The NCI Automated Self-Administered 24-hour Recall (ASA24) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

The NCI Automated Self-Administered 24-ho...

ASA24

Progress 1 of 5

Help Penguin Options

AAA Font size

Actions

Select an action below to edit your foods and drinks.

- Add a meal or snack
- Delete a meal or snack
- Edit a meal or snack
- Add a food or drink
- Delete a food or drink
- Move a food or drink
- Copy a food or drink
- Edit a food or drink
- Done entering all meals and snacks
- Undo
- Finish later

Add Detail

Coffee:

Was it regular or decaffeinated?

- (●) Regular
- ( ) Decaffeinated
- ( ) Blend of regular and decaf
- ( ) Don't know

Previous Next

My Foods and Drinks

What I ate and drank Yesterday, Monday, October 17.

Breakfast - 08:00 AM

Cheerios

Kind: Multigrain

Amount eaten: 1 cup

Anything Added:

2% milk

Amount you added: 1 1/2 cup

Banana

Report as: Whole fruit

Size: Small (6 to 6 7/8 inches long)

Amount eaten: 1/2 fruit

Coffee

Type: Brewed

Regular: Regular

Container type: Cup

Container size: 12 fluid ounces

Amount you drank: 90%

Anything Added: Nothing Added

Lunch - 12:00 PM

Tuna salad sandwich

Potato chips (unknown brand)

The NCI Automated Self-Administered 24-hour Recall (ASA24) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

The NCI Automated Self-Administered 24-ho...

ASA24

Progress 2 of 5

Help Penguin Options

A A A Font size

REVIEW

Are these ALL the foods and drinks you had Yesterday?

- Breakfast - 08:00 AM
  - Cheerios
  - Coffee
- Lunch - 12:00 PM
  - Tuna salad sandwich
  - Potato chips (unknown brand)
  - Orange juice
- Dinner - 06:00 PM
  - Chicken leg (drumstick and thigh)
  - Broccoli
  - Brown rice (regular)
  - Green salad
  - Ice cream

Show Food Detail

Make Changes

Next

The NCI Automated Self-Administered 24-hour Recall (ASA24) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

The NCI Automated Self-Administered 24-ho...

ASA24

Progress 3 of 5

Help Penguin Options AAA Font size

FREQUENTLY FORGOTTEN FOODS

Certain foods and drinks are frequently forgotten. Did you forget to report any of the following foods and drinks? Please respond to each item by selecting **Yes** or **No**.

In addition to the foods and drinks you already reported, did you have any:

Water, including tap, faucet, bottled, water fountain?	Yes	No
Coffee, tea, soft drinks, milk or juice?	Yes	No
Beer, wine, cocktails or other drinks?	Yes	No
Cookies, candy, ice cream or other sweets?	Yes	No
Chips, crackers, popcorn, pretzels, nuts or other snack foods?	Yes	No
Fruits, vegetables or cheese?	Yes	No
Breads, rolls or tortillas?	Yes	No
Anything else?	Yes	No

Next

My Foods and Drinks

Monday, October 17.

The NCI Automated Self-Administered 24-hour Recall (ASA24) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

The NCI Automated Self-Administered 24-ho...

ASA24

Progress 4 of 5

Help Penguin Options

A AA Font size

Actions

Select an action below to edit your supplements.

- Delete a supplement
- Edit a supplement
- Done entering supplements
- Undo
- Finish later

Find a Supplement

Browse the categories or search using the box below.

Enter search term

- Antacids
- Calcium products
- Childrens
- Fiber Supplements
- Glucosamine products
- Herbal/Botanical Supplements
- Minerals
- Multi-Vitamin/Mineral
- Other Supplements
- Potassium Supplements
- Prenatal
- Vitamins

No Match Found

My Supplements

Supplements I took Yesterday, Monday, October 17.

Supplements

The NCI Automated Self-Administered 24-hour Recall (ASA24) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

The NCI Automated Self-Administered 24-ho...

ASA24

Progress 4 of 5

Help

Penguin Options

AAA Font size

Actions

Select an action below to edit your supplements.

- Delete a supplement
- Edit a supplement
- Done entering supplements
- Undo
- Finish later

Find a Supplement

Browse the categories or search using the box below.

Enter search term

- Antacids
- Calcium products
- Childrens

No Match Found

My Supplements

Supplements I took Yesterday, Monday, October 17.

- Supplements
  - Centrum Multivitamin / Multimineral Balanced and Complete From A To Zinc New Formula
    - Amount taken: 1 Tablet(s)

DONE WITH SUPPLEMENTS DETAILS

You have added details about all the vitamins, minerals, and other supplements you reported for Yesterday.

Do you want to add any other supplements?

Yes No

The NCI Automated Self-Administered 24-hour Recall (ASA24) - Mozilla Firefox

File Edit View History Bookmarks Tools Help

The NCI Automated Self-Administered 24-ho...

ASA24

Progress 5 of 5

Help

Penguin Options

AAA Font size

SESSION COMPLETE

Thank you very much for completing the **ASA24!**

OK