Dietary Supplement Label Imaging in the National Health and Nutrition Examination Survey

Jaime Gahche, M.P.H.
Jerry Del Rosso, BSEE

CDC Health Information Innovation Consortium (CHIIC)
February 25, 2016
Presentation Outline

- Overview of NHANES
- Overview of dietary supplements data collection in NHANES
- Exploring the use of digital imaging technology for dietary supplements data collection
- Proof-of-concept study
Presentation Outline

- Overview of NHANES
  - Overview of dietary supplements data collection in NHANES
  - Exploring the use of digital imaging technology for dietary supplements data collection
  - Proof-of-concept study
NHANES Overview

- Cross-sectional survey of the civilian, non-institutionalized population
- Assess the health and nutritional status of adults and children in the U.S.
- A nationally representative sample of about 5,000 individuals a year
- Household interview and a physical examination
Presentation Outline

- Overview of NHANES
- Overview of dietary supplements data collection in NHANES
- Exploring the use of digital imaging technology for dietary supplements data collection
- Proof-of-concept study
Why Do We Collect Dietary Supplement Data?

- Dietary supplement data used to:
  - Characterize usage
  - Estimate nutrient intake
  - Assess the percentage of the population meeting or exceeding dietary recommended intakes for specific nutrients
  - Help guide research needs and resources
What is a Dietary Supplement?

- A product that:
  - is intended to supplement the diet
  - contains one or more dietary ingredients:
    - Macronutrients
    - Vitamins, Minerals, Amino Acids
    - Herbs or other botanicals
    - “Other” dietary substances
  - is intended to be taken by mouth
Who are the Stakeholders?

- National Institutes of Health, Office of Dietary Supplements (Collaborator)
- United States Department of Agriculture, Nutrient Data Laboratory and Food Survey Research Groups
- Researchers
How is this Data Collected?

- Participants' are asked:
  - If they have used or taken any vitamins, minerals, herbals or other dietary supplements in the past 30 days?
  - Includes prescription and non-prescription supplements
  - To show supplement containers (seen ~86% of time)
What Information is Collected by the Interviewer?

- Complete name from the front of the container
- Form of the product (e.g. tablet)
- Manufacturer/distributor name and address
What Information is **NOT** Collected by the Interviewer?
Currently: Labels Obtained from Manufacturers

During the Household Interview
- Product name collected
- Manufacturer name collected

After the Household Interview
- NCHS staff contact manufacturers and ask for the “Supplement Label”
- Estimate nutrient intake from supplements per respondent
Currently: Labels Obtained from Manufacturers

During the Household Interview:
- Product name collected
- Manufacturer name collected

After the Household Interview:
- NCHS staff contact manufacturers and ask for the “Supplement Label”
- Estimate nutrient intake from supplements per respondent

**Timeliness and level of effort:** 2 Years
**Accuracy:** 1 out of 5 “seen” containers do not have an “exact match”
Ultra Women’s, Ultra Men’s, Silver, for Adults 50+
This Project’s Objectives

- Adapt a more efficient process to collect the information
  - Reduce effort to obtain product labels
  - Increase timeliness of data release

- Improve data quality by increasing accuracy
Presentation Outline

- Overview of NHANES
- Overview of dietary supplements data collection in NHANES
- Exploring the use of digital imaging technology for dietary supplements data collection
- Proof-of-concept study
Capturing Supplement Label Images

- **Challenges**
  - Most labels are cylindrical – cannot be imaged in focus with conventional cameras
  - Some labels are oversized
  - Inadequate lighting, background clutter, uneven framing
  - Interviewers are not trained in photography
Capturing Supplement Label Images

- **Early Effort – conventional camera**
  - Newer cameras offering actual or “stitched” panoramic images were considered
  - Actual panorama deemed too unpredictable – not practical for users to hold/rotate a container while making an exposure

- **Results**
  - Stitched panorama mode was tried but did not yield readable images
  - Text could not be aligned between images
Conventional Camera

Soft focus
Poor lighting
Poor framing
Busy background
Capturing Supplement Label Images

- **Early Effort** – conventional camera with post-editing
  - Photoshop allows for more precise image stitching
  - User makes several (usually 4) images, one of each side
  - Images are submitted to stitching algorithm in the software

- **Results**
  - Software stitching algorithm did not yield readable images
  - Text could not be aligned between images
  - Frequently the software rejected the images as not matchable
Conventional Camera with Post-Editing

Soft focus
Poor lighting
Poor framing
Busy background
... and worst of all
Text Mismatch
Meditory RxLabelReader
Capturing Supplement Label Images

- **Meditory RXLabelReader -- Pros**
  - Line scanner with self-contained lighting and rotating platform
  - Captures images of cylindrical images as if unrolled and flattened
  - Consistent framing, focus, lighting, with clean background
  - Optional Optical Character Recognition (OCR)
  - Optional image segmentation and field sorting
Capturing Supplement Label Images

- **Meditory RXLabelReader -- Cons**
  - Size, weight, setup time, capture time, user training
  - Does not accommodate oversized or non-cylindrical containers
  - Integration with proprietary software
  - Requires battery to operate, battery life untested
  - Start-up company, prototype units, difficult to obtain units for testing and integration, questions about future support
  - Not for sale, leasable only
Capturing Supplement Label Images

- **Meditory RXLabelReader** – Other considerations
  - An early prototype was delivered for testing and performed image capture functions as described.
  - Efforts were made to obtain APIs to integrate the device but due to delays in production, and device upgrades and redesigns, we were unable to configure a fully functional device for testing.
  - CMS evaluated the same device and kindly allowed us to observe a demonstration created by their data collection contractors.
  - Our conclusion is that the device has great potential but may not be ready in reasonable time for our needs.
IPEVO Ziggi-HD Plus
Capturing Supplement Label Images

- **IPEVO Ziggi-HD Plus -- Pros**
  - Flat document scanner with cantilevered arms can take in any size or shape
  - Autofocus
  - Lightweight, needs no battery (USB powered)
  - Simpler software integration
  - Far less expensive, bought and owned outright
Capturing Supplement Label Images

- IPEVO Ziggi-HD Plus – Cons
  - A flat “unrolled” image cannot be obtained
  - “Stitching” ruled out based on earlier testing
  - Consistent framing, lighting, and clean background only possible if a strict user protocol is followed, requiring user training
  - Simpler software means future enhancements such as segmentation, OCR, or field sorting would require additional software or logic
Capturing Supplement Label Images

- IPEVO Ziggi-HD Plus – Other considerations
  - Mature technology, test units have been delivered and perform as expected, software performs as expected
  - Established vendor, no issues expected with delivery of camera units in any quantity
  - Compromise over the RXLabelReader is that finished product will consist of four separate images per label, instead of one flat “unrolled” label
  - High quality of the images produced allows all relevant information to be read
Presentation Outline

- Overview of NHANES
- Overview of dietary supplements data collection in NHANES
- Exploring the use of digital imaging technology for dietary supplements data collection
- Proof-of-concept study
Objective: Can this device be pilot tested in NHANES?

Goals of the study:

- Assess the feasibility of integrating the IPEVO camera with the Blaise survey software
- Conduct a user test to assess the accuracy of data collected, timing, the protocol for taking pictures, and logistics of use
- Assess survey design implications (i.e. importing data into the questionnaire)
User Test

- 9 interviewers (participants)
  - Range of experience on WESTAT projects
- Equipment: tablet with test survey (Blaise), camera and dietary supplement bottles
- Participants will be trained
- Three separate tests to assess timing and accuracy
  - Order will be randomized (current protocol, camera only, manual entry and camera)
- Debriefing questionnaire
Project Timeline

- Development: 12/29-2/17
- Testing: 2/9-3/1
- User Test: 3/23
- Data analysis: 3/24-4/16
- Pilot test in NHANES September, 2016?
Questions?
Two Options

RxLabelReader (Meditory)

Ziggi-HD Plus (IPEVO)