

# Improving the Usability of Dietary Recall using Voice Assistant

Jing Yuan<sup>1</sup>, Xiaohui Liang<sup>1</sup>, Tiffany M. Driesse<sup>2</sup>, Youxiang Zhu<sup>1</sup>, Shiyong Li<sup>1</sup> and John A. Batsis<sup>2</sup>



<sup>1</sup>University of Massachusetts Boston

<sup>2</sup>University of North Carolina at Chapel Hill

## 1. Introduction

- Task: Web-based automated self-administered 24-hour assessment (ASA-24) is the essential clinical diet recall tool. We want to make it more efficient.
- Two methods for food recall as below:

Web-based food recall: Voice-based food recall:  
 • Time-consuming (15min) • Fast and efficient(3min)  
 • Lower Usability • Higher Usability

- Motivation: Voice assistants, such as Amazon Alexa, provide an opportunity at home to monitor wellness, oversee chronic care, and enhance independence. We envision voice assistants with task-based conversational AI can implement an easy-to-use interface for dietary recall.

## 2. Method

### Alexa Prototype

- An Alexa skill using 9 ASA-24 questions and 8 free-recall questions.
- The use of free-recall questions allows users to freely form recall utterances with multiple food items.

### Wizard Of Oz

- Participants don't know if the machine is controlled by human or not.
- 3 clarifying strategies to cope with conversation failures. 1. all options 2. more options 3. yes/no

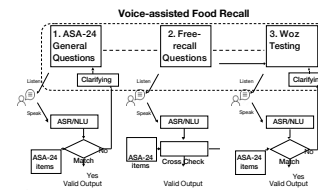


Fig. 1. Three questioning modules. ASR: Automated Speech Recognition. NLU: Natural Language Understanding.

Table 1. ASA-24 General Questions and Free-recall Questions

- Q1. Welcome, you can record your meal recall. Would you like to report breakfast, lunch, or dinner?
- Q2. Where did you eat this meal?
- Q3. What did you have for the last meal?
- Q4. Was this food homemade or where was it purchased?
- Q5. Can you provide more details about this food? For example, ingredients, brand, or size?
- Q6. How much of the food did you actually eat?
- Q7. Have you entered all details for this meal? (If Yes, continue. No go back to the Q1)
- Q8. Certain foods and drinks are frequently forgotten, did you have any other: regular coffee, tea, soft drinks, milk, juice, beer, wine?
- Q9. No, continue. Yes, repeat Q3 + Q5
- Q9. Did you have any other cookies, candy, ice cream, sweets, fruits, vegetables or chocolate?
- Q10. No, continue. Yes, repeat Q3 + Q5
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## Usability Evaluation

- We recruited 20 young adults (aged < 40 years) and 20 older adults (aged >65 years) to evaluate this prototype.
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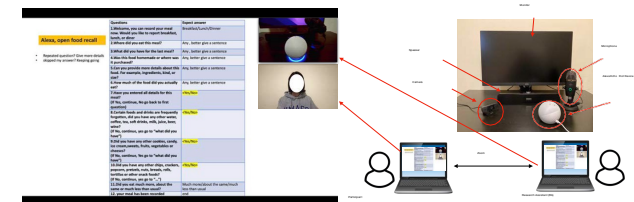


Fig. 3. Virtual evaluation of voice-assisted food recall

## 3. Results

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- According to the experiment results of our 40 participants.
- The mean success rate was 96.4% for young and 88.6% for older adults .
- The average session time was (141s) for young and (165s) for older adults .

	Young	Old
Success rate	96.4%	88.6%
Session time	141s	165s

Table 2: The average Success Rate and Session Time for each meal

	Young Older	
	18-40	65+
System Usability Scale	65.3	58.1
Positive about voice recall	4.2	3.7
Prefer voice recall to web	3.6	3.1
Voice recall while eat/cook	3.6	3.3
Web recall while eat/cook	3.1	3.4
Prefer voice for repeated use	3.5	3.0

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### Woz and Questionnaire Evaluation

- 60% of young participants like the first strategy And 45% of older participants like second strategy. Besides, the third strategy is the least favorite in both groups.
- 65% of young and 60% of older participants prefer voice-based diet recall over a web-based one.
- Older adult voice-based diet recall was easier and faster

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1.Interruption	60%	35%
2.More options	25%	45%
3.Yes/No	15%	20%

Table 4: Interview results for participants' strategy preference when AI handling conversation failures.

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Prefer voice-based	65%	60%
Think voice-based is faster and easier	50%	35%

Table 5: User experience feedbacks.

### Conclusion

- We applied design engineering and human-computer interaction principles to create a voice-based dietary recall system to improve the user experience, reduce time burden, and increase accessibility using voice.
- Our design and evaluation demonstrated the voice-based diet recall has a promising future.
- Meanwhile, it has a lot of room for improvement

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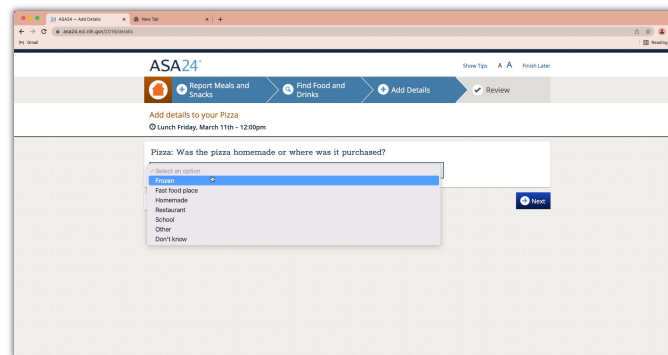
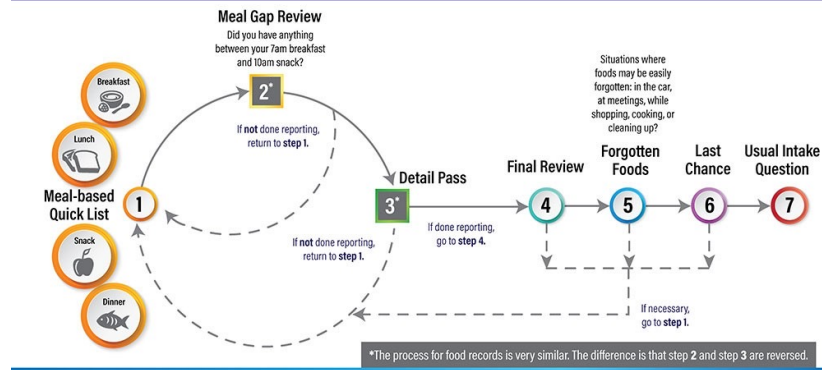
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## Steps for Completing a 24-hour Dietary Recall



VS



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Q1>Welcome, you can record your meal now. Would you like to report breakfast, lunch, or diner
Q2.Where did you eat this meal?
Q3.What did you have for the last meal?
Q4.Was this food homemade or where was it purchased?
Q5.Can you provide more details about this food. For example, ingredients, kind, or size?
Q6.How much of the food did you actually eat?
Q7.Have you entered all details for this meal? (If Yes, continue, No go back to the Q1)
Q8.Certain foods and drinks are frequently forgotten, did you have any other water, coffee, tea, soft drinks, milk, juice, beer, wine? (If No, continue; Yes, repeat Q3 + Q5)
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Type	ASA-24 Detailed Questions
Q12 Where	Where did you get this food (or most of the ingredients for it)?
Q13 Kind	What kind of burger?
Q14 Ingredient	Were there any other ingredients on the burger?
Q15 Size	What size was the meat?
Q16 Amount	How much of the burger did you <u>actually eat</u> ?

### Strategy 1: Reads list of options and expecting user interruption

Read option A, B, C, D, E, F, G...till no more options

E.g. : "Here are some examples. Stop me by speaking your answer."

### Strategy 2: Read partial options. Provide more options on demand

Read option A, B ,C and try to match user answer. Option D, E, F will be provided if user ask for more option.

E.g. : "Here are some three options A, B, C. You can speak your answer or say 'more options'."

### Strategy 3: Confirmation on each option provided

Yes or no questions will be asked when AI provides options.

E.g. : "Did you mean option A? Please say yes or no, or speak your answer."

E.g. : "Did you mean option B? Please say yes or no, or speak your answer."

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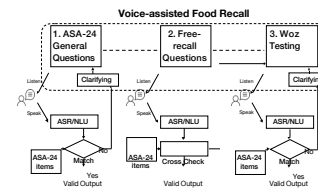


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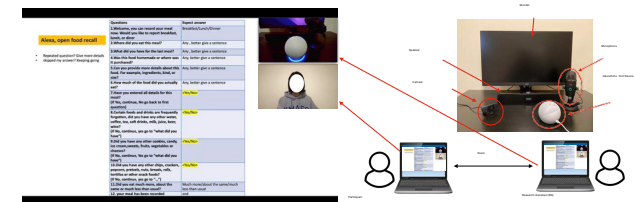


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