

Real-world Dietary Data Collection: Current Challenges and Opportunities for Innovations

Neil R. Brett¹, Marielle Bassel¹, Mengyin Hong¹, Mary Kay Margolis²

¹Strategic and Scientific Affairs, Real-world Evidence, Evidera, Montreal, Canada; ²Strategic and Scientific Affairs, Real-world Evidence, Evidera, Bethesda, MD, USA

Introduction

- Though often not considered as a covariate for studies of treatment outcomes, nutrition has been shown to be an important modifiable risk factor that can beneficially affect the effectiveness of medical treatments for many conditions, for example:
 - Changes in fat and protein type and quantity alter treatment outcomes in gastrointestinal diseases such as inflammatory bowel disease and pancreatic insufficiency¹
 - Avoiding intake of certain carbohydrate and fatty acid may improve treatment effectiveness of metabolic diseases such as dyslipidemia and type 2 diabetes, by helping to manage the disease²
 - Vitamins and minerals may improve the effectiveness of treatment in musculoskeletal conditions such as osteoporosis and rheumatoid arthritis³
- Commonly used dietary data collection approaches include:
 - Short dietary assessments (short questionnaires focusing on a certain aspect of dietary intake)
 - Diet history or food frequency questionnaires (retrospectively estimate usual intake with questionnaires completed by the respondent or interviewer)
 - 24-hour dietary recalls (retrospectively assess actual 24-hour intake with questionnaires) or multi-day food records (prospectively recorded intake [usually 3- or 7-day])
- Current challenges in dietary data collection include high patient burden, dietary recall bias, data missingness, data analysis complexity and cost. These may be alleviated through technological innovations.

Objective

- Describe current challenges in real-world dietary data collection and propose innovative approaches to address challenges.

Methods

Figure 1. Real-world Dietary Data Collection Considerations, Challenges, and Innovations



Results

Figure 2. Comparison of Data Collection Approaches

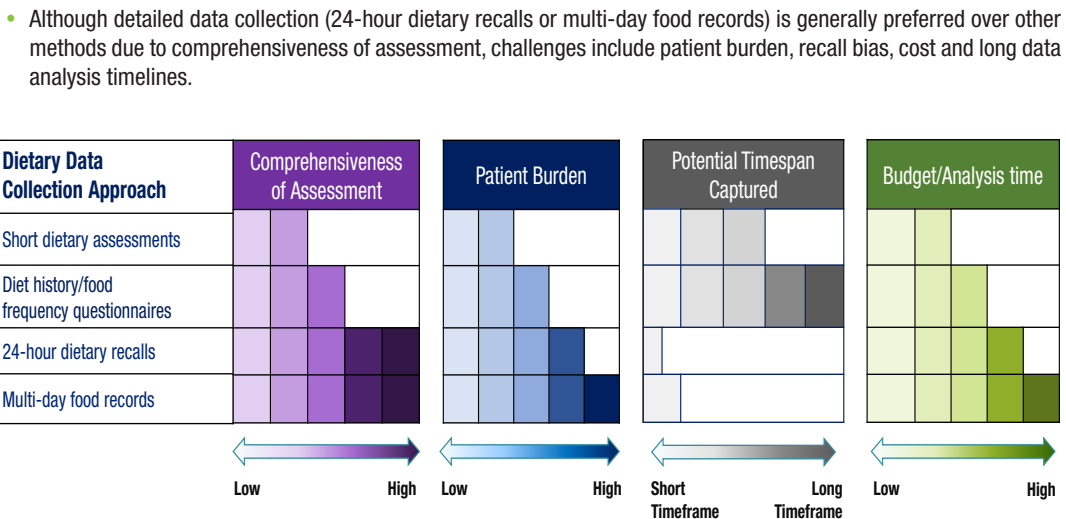


Figure 3. Real-world Challenges of Dietary Data Collection Approaches

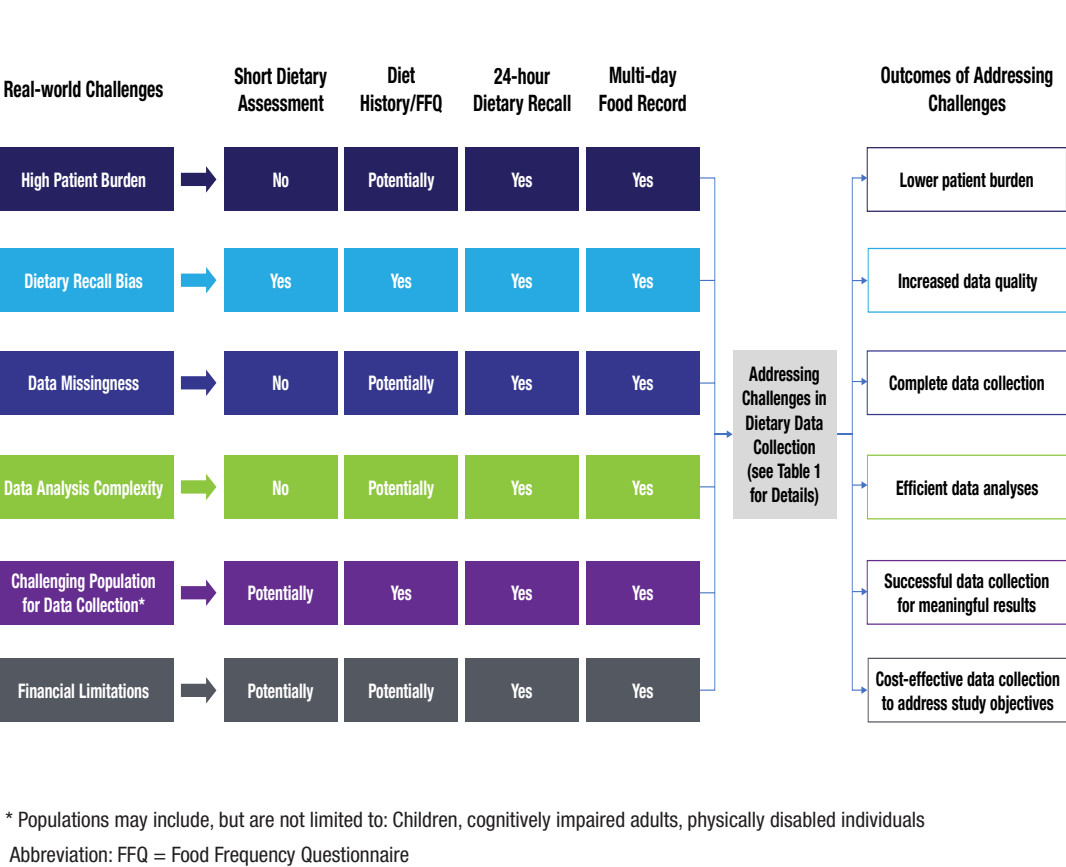


Table 1. Challenges Addressed by Technological Solutions for 24-hour Recalls and Multi-Day Food Records

Real-world Challenges	Addressed by:		
	Web/Mobile Applications with Guided Questions or Animations	Food Recognition Platforms Powered by Artificial Intelligence	Audio Transcription Software
Patient Burden			
Dietary Recall Bias	Displays choices from large standardized food databases	Platform can send reminders to count hidden ingredients and easy-to-forget foods	For Multi-day Food Records ONLY: Allows for real-time audio descriptions
Data Missingness	Provides real-time reminders to participants and give instant feedback	Provides real-time reminders to participants and give instant feedback	This solution does not prompt participants to provide more detail when needed
Data Analysis Complexity			This solution would still need detailed analyses
Challenging Population for Data Collection	Support from caregivers may be required for populations who are not tech savvy	Support from caregivers may be required for populations who are not tech savvy	Suitable for cognitively impaired and/or visually impaired individuals
Financial Limitations			This solution would still require a large amount of time for detailed analyses

Real-world challenge after being addressed by solutions
Note: The lighter the color the lesser the challenge; the darker the color the greater the challenge

Table 2. Additional Advantages and Limitations of the Technological Innovations

Solution	Advantages	Limitations
Web/Mobile Applications with Guided Questions or Animations	- Can be monitored by health professionals in real-time - Can be analyzed in real-time, give instant feedback and track progress	- Difficult to use for populations that are not technologically savvy - Requirement to have internet/smartphone - Steeper learning curve compared with pen-and-paper
Food Recognition Platforms Powered by Artificial Intelligence	In addition to the web/mobile advantages: - Generate automatic reminders: 1) hidden ingredients, 2) easy-to-forget foods; 3) usual portion sizes - Facilitate study data collection quality control with all food image data saved in the platform	In addition to the limitations in web/mobile applications: - May still require manual correction for: 1) hidden ingredients; 2) combined foods; 3) volume estimation - Has rapidly evolving technologies and may not be regulatory-compliant (e.g., 21 CFR Part 11).
Audio Transcription Software	Automatic timestamping capabilities	- Accuracy is limited by noise level, pronunciations and accents in non-native speakers. - May not support certain languages/dialects

Conclusions

- Technological solutions for dietary data collection, such as web/mobile applications, food recognition platforms powered artificial intelligence, and audio transcription software, have the potential to address key real-world dietary data collection challenges.
 - With limited research using these technological solutions⁴⁻⁶, especially across broad populations, further work is needed to understand how technological solutions can modify the challenges posed by real-world data collection.
- Methodological decision-making to utilize innovations should be led by experts:
 - With knowledge of real-world dietary data collection and operational challenges.
 - With experience operationalizing technology solutions.

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Disclosures

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