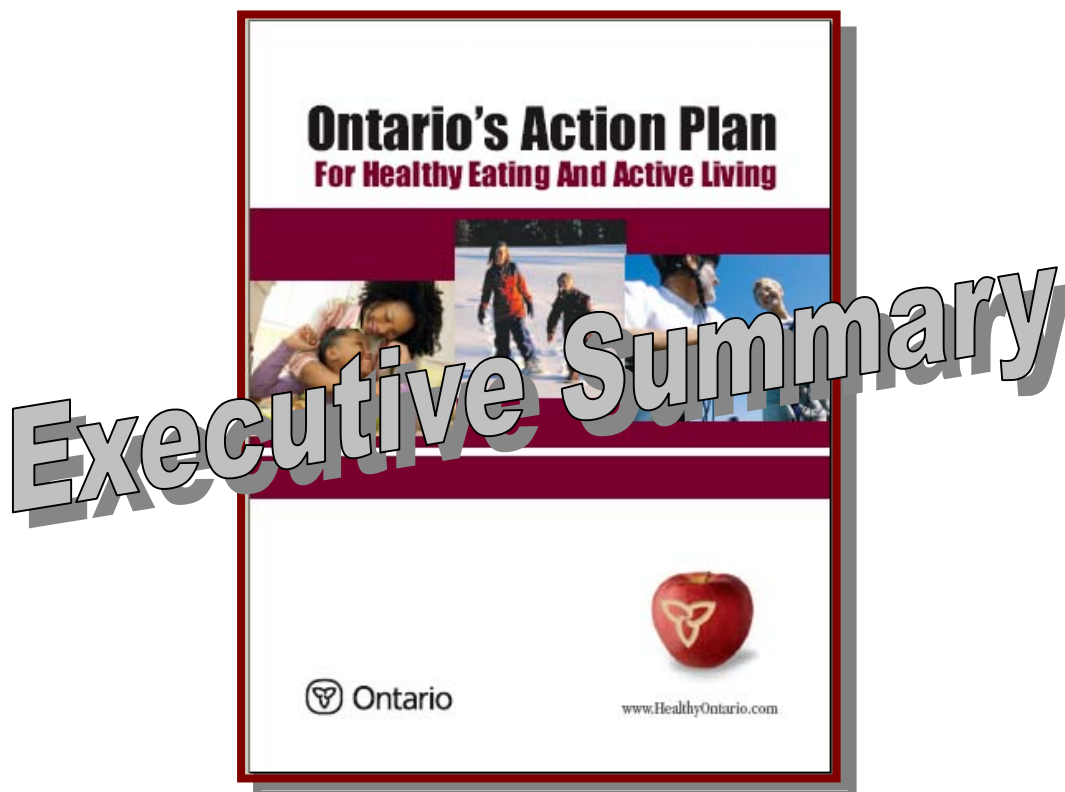


MINISTRY OF HEALTH PROMOTION  
SUBMISSION

MEASURING FRUIT AND VEGETABLE CONSUMPTION  
IN 4-9 YEAR OLDS: A SEARCH FOR A VALID AND  
RELIABLE POPULATION-BASED TOOL



SUBMITTED BY THE PUBLIC HEALTH RESEARCH, EDUCATION & DEVELOPMENT (PHRED) PROGRAM

MARCH 31, 2008



Public Health  
Services  
City of Hamilton

Kingston, Frontenac and  
Lennox & Addington  
Public Health

Middlesex-London  
Health Unit

Ottawa Public Health

Sudbury and District  
Health Unit

Public Health Division,  
Ontario Ministry of Health  
And Long-Term Care

## **AUTHORS:**

---

- Dr. Paula Dworatzek, PhD RD, Assistant Professor, Department of Food and Nutritional Sciences, Brescia University College
- Ms. Larissa Lenhardt, HBSc, (MScFN and RD candidate), Brescia University College
- Dr. Meizi He, PhD. Nutrition Researcher / Educator, PHRED\* Program, MLHU and Associate Professor, Brescia University College
- Dr. Danielle Battram, Research Associate, PHRED Program, MLHU
- Ms. Elaine Murkin, RD, MSc, Supervisor, Public Health Nutritionist, Ottawa Public Health

## **PHRED INVESTIGATORS TEAM:**

---

- Ms. Charlene Beynon, MScN, Director, Public Health Research, Education & Development (PHRED) Program, Middlesex-London Health Unit (MLHU) and Associate Professor, The University of Western Ontario
- Dr. Meizi He, PhD. Nutrition Researcher / Educator, PHRED Program, MLHU and Associate Professor, Brescia University College
- Ms. Elaine Murkin, RD, MSc, Supervisor, Public Health Nutritionist, Ottawa Public Health
- Ms. Michelle Sangster Bouck, MA, Research Associate, PHRED Program, MLHU
- Ms. Susan Stewart, MA, Research Associate, PHRED Program, Kingston, Frontenac and Lennox & Addington Public Health
- Ms. Renée St Onge, MA, Research and Development Specialist, PHRED Program, Sudbury & District Health Unit

\* Public Health Research Education and Development Program

## **CITATION:**

---

Dworatzek, P., Lenhardt, L., He, M., Battram, D., Murkin, E. (2008). Measuring fruit and vegetable consumption in 4-9 year olds: A search for a valid and reliable population-based tool. London, Ontario: PHRED Program, Middlesex-London Health Unit.

## **FOR FURTHER INFORMATION CONTACT:**

---

Charlene Beynon, PHRED Lead  
Director, Public Health Research, Education and Development (PHRED) Program  
Middlesex-London Health Unit  
50 King Street  
London, ON  
N6A 5L7  
519-663-5317 ext. 2484  
cbeynon@uwo.ca

# TABLE OF CONTENTS

<b>ACKNOWLEDGEMENTS</b> .....	<b>i</b>
<b>EXECUTIVE SUMMARY</b> .....	<b>1</b>
<b>1. INTRODUCTION</b> .....	<b>3</b>
1.1 Purpose .....	3
<b>2. LITERATURE REVIEW</b> .....	<b>4</b>
2.1 Methodology .....	4
2.2 Results .....	4
2.3 Discussion of Tools and Methodologies for Assessing Dietary Intake in Children Aged 4-9 Years.....	4
2.3.1 Food Frequency Questionnaires.....	4
2.3.2 24-Hour Recall .....	6
2.3.3 Observation .....	8
2.3.4 7 Day Food Diaries .....	9
2.4 Implications and Conclusions .....	9
<b>3. KEY INFORMANT INTERVIEWS</b> .....	<b>10</b>
3.1 Methodology.....	10
3.2 Findings.....	10
3.2.1 Challenges .....	10
3.2.2 The Types of Tools Available.....	11
3.2.3 Feasibility of adapting or developing a new tool .....	13
3.3 Implications and Conclusions .....	15
<b>4. SUMMARY</b> .....	<b>16</b>
<b>5. RECOMMENDATIONS</b> .....	<b>18</b>
<b>REFERENCES</b> .....	<b>19</b>
<b>APPENDICES</b> .....	<b>21</b>
Appendix A: CADET (Child and Diet Evaluation Tool) .....	23
Appendix B: Letter of Information .....	25
Appendix C: Key Informant Telephone Interview Guide.....	27
<b>FIGURES</b>	
Figure 1: Distribution of Methodologies .....	5



## EXECUTIVE SUMMARY

### Key Findings

Based on a comprehensive literature review and expert key informant interviews:

1. There are significant challenges in measuring fruit and vegetable intake of 4-9 year old children on a population level. These challenges are primarily related to their developmental stages with respect to literacy and cognition.
2. Due to developmental differences, no one tool can be used with this age group.
3. Some expert informants thought the challenges to develop a population-based tool were so great that the development of such a tool did not justify the effort and expense required. Such actions would be labour and resource intensive.
4. There are two tools available i.e. Child and Diet Evaluation Tool (CADET) and 'A Day in the Life of' Questionnaire<sup>1</sup> (DILQ) that have been validated for this age group in other countries; however, there are limitations and challenges with these tools. Modifications for a Canadian context and re-validation of the tools would be required.

### Objective

A comprehensive literature review together with expert key informant interviews were conducted to determine if there is a published, valid and reliable population-based tool that measures fruit and vegetable consumption in young children (ages 4-9 years; grades JK-4). In addition, the key informant interviews explored the feasibility of developing a population-based tool that measures fruit and vegetable consumption in young children (ages 4-9 years).

### Methodology

An electronic literature search was conducted in a number of bibliographic databases using a keyword search. Results were limited to English articles published between 1988 and 2007. The comprehensive search captured 995 papers. Two teams of two independent reviewers conducted a relevancy review for each article retrieved, by screening the titles and abstracts and when necessary, the full article. After the relevancy review, two independent reviewers completed a methodology review of each study and categorized the articles by the type of dietary assessment tool utilized, the reported reliability

and validity, and any advantages and disadvantages. A total of 44 papers were identified; however, not all of these specifically measured the validity or reliability of the tool. Nine in-depth interviews were conducted via telephone or in person using a semi-structured interview guide. Interviews were recorded and audiotapes were transcribed verbatim. Data were analyzed sequentially using a combination of editing and immersion crystallization organizing styles (1). Several techniques were used to promote the trustworthiness and credibility of the findings.

### Findings

The literature review and key informant interviews have provided us with many consistent and reinforcing messages regarding the methodologies in measuring fruit and vegetable intake with children aged 4-9 years. The increasing trend of fruit and vegetable intervention programs targeting young children require valid and practical tools in evaluating intervention effect. Expert key informants perceived the value of measuring fruit and vegetable intake in young children at a population level. However, there are many challenges and limitations associated with measurement of fruit and vegetable intake among young children. For instance, limited literacy and cognitive ability at this age does not allow young children to grasp the concept of food consumption frequency, thus food frequency questionnaires, a most commonly used population-based dietary tool among adults, cannot be used with this age group.

As children clearly undergo dramatic cognitive and literacy development between the ages of 4 and 9 years, no one tool is appropriate across all age ranges of this target group. It is necessary to segment the target population into 4-6 and 7-9 year olds and to utilize different tools with each segment.

For children aged 4 to 6 years old, parental proxy approaches were clearly identified as necessary in both the literature and by informants. There are a number of factors that may impede the accuracy of parental proxy including employment outside of the home, child's intake at school or away from home, and larger family size (2). Thus, consensus recall with the child, parents, and other care providers, including classroom lunch supervisors, was discussed as an approach which may improve the accuracy of reporting in the younger age range. It is noteworthy that this could require significantly more resources to implement. The CADET is a consensus recall instrument utilizing a three-part tick list to be completed by parents, caregivers and the children. There are a number of challenges and limitations

<sup>1</sup> 'A Day in the Life of' Questionnaire is available online at: <http://laureledmunds.com/download.php>

associated with the application of this instrument at a population-level. First, CADET requires involvement from three parties, i.e., parents, caregivers and children; as a result, data collection will be a very labour and resource intensive process with relative low data completion rates (i.e. missing values from any of the three parties). Second, while the CADET tool was validated, it was shown to over-report fruit and vegetable intake in children and the correlation coefficient, while significant, was somewhat low at 0.40 for total fruit and vegetable intake. Third, CADET was developed in the United Kingdom and the quantification of serving sizes was not individualized to each child but rather the National Diet and Nutrition Survey results from the UK were used to estimate portion sizes. Thus, this tool would require modification and re-validation in a Canadian setting, which will be a resource and labour intensive process.

For older children aged 7-9 years, 24-hr recall method could be used, either through in-person interview by trained professional or a self-administered simple picture-based instrument. The DILQ, a picture-based 24-hr instrument, is completed by children in a supervised classroom environment. The DILQ has been reported to be a valid and sensitive tool to detect changes in fruit and vegetable consumption and was well known to informants. It is worth noting that DILQ only quantifies fruit and vegetable intake by counts and not serving sizes and the authors did not report whether the tool typically under- or over-reported intake. It should also be noted that it was not feasible to assess fruit juice consumption because the children were often not aware whether their drink was 100% juice vs. a drink, cocktail, or beverage. In addition, DILQ was developed in the United Kingdom and would required modification and revalidation for use with a Canadian population.

Despite the limitations of the CADET and DILQ, any new tool for 4-9 year olds will exhibit similar challenges and limitations. Further, many of the expert informants thought that the development of a new tool for this age range was a project that was not worthy of the time and money required.

## Recommendations

Based on a review of the literature and expert key informant interviews, the following recommendations are presented.

1. Due to developmental differences, the target population needs to be segmented into 4-6 and 7-9 year olds and distinct tools are required for each age grouping.
2. For children aged 4-6, the Child and Diet Evaluation Tool (CADET) could be utilized; however, this tool requires completion by a parent/caregiver, lunchroom supervisor and by the child, with

classroom support. This protocol would be very challenging for large scale population-based studies.

3. For children 7-9, 'A Day in the Life of' questionnaire (DILQ) could be utilized with classroom teacher support.
4. Both the CADET and DILQ need to be modified and validated for use in a Canadian context. This is a resource and labour intensive process.
5. No new tools should be developed for this age group.