NANA - A novel method of dietary assessment in older adults

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NANA – Novel Assessment of Nutrition & Ageing
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Background

- 1 in 4 people on admission to hospital are malnourished
- Levels of malnutrition in the community more difficult to assess 5-10%
- >30% of older adults have one or more micronutrient deficiencies
- Relationships between dietary intake, cognition & physical function are poorly defined.
- Current methods are inadequate for integrated and extended assessment of nutrition, cognitive, physical and mental health in older people
Aims

• To improve the assessment of dietary intake, physical health, mental health and cognitive function

• To improve understanding of the interactions between these factors.
Development of NANA

**Phase 1:** User needs analysis: Focus groups with nutritionists, older adults & health professionals to establish requirements and inform the conceptual and physical design

**Phase 2:** Iterative development of assessment technology:
- Dietary assessment techniques
- Cognitive and mental health measures
- Physical activity/function

**Phase 3:** Full validation of the assessment toolkit:
- Comparison of the integrated ‘toolkit’ with traditional methods
Exploring available technologies
Using a mobile phone to record dietary intake gave variable picture quality
Touchscreen computer seems most appropriate
The NANA system

- Web camera
- 15” touch screen computer
- Speaker for voice recording
- Plate guide mat
Key features of the NANA system

- Captures description & photographs food in real time
- 17” touch screen computer with web-cam
- Software uses a hierarchical food tree structure
- 12 categories of food on top level of food tree
- 1045 item food tree
- Option to photograph leftovers
- Audio recording for items consumed out of the home
Touch the screen to start
Select meal

Select your meal:

- Breakfast
- Lunch
- Dinner/Tea
- Snacks & Drinks
- Out of Home or Forgotten
Select choose a food or drink
Select food/ drink category

- Drinks
- Bread, cereal, pasta, rice
- Dairy
- Meat, poultry & eggs
- Fish and seafood
- Convenience, sandwiches, fast food
- Fruit
- Vegetables
- Desserts, cakes & biscuits
- Sweets & chocolate
- Savoury snacks, crisps & nuts
- Sauces, spreads, condiments & other

[Image: Food categories diagram]
Select food/ drink item
Cranberry juice
Cranberry juice
Select another food / drink category
Select another food/ drink item

- Apples
- Banana
- Citrus
- Grapes (red & white)
- Juices
- Pears
- Tomatoes
- Dried
- Berries & Currants
- Canned
- Fruit salad, homemade
- Other

Item not found
Cancel this item
Selected items

Items you have chosen:
- Cranberry juice
- Banana

Choose a food or drink
Favourites
Start again
Finished
Photograph food/drink item
Photograph food/drink item
Enjoy your meal!

After you have finished eating, answer the following.

Have you eaten all the food in your meal, or do you have leftovers?

I have leftover food  I ate everything
Clinician tool
Validation – diet, cognition, mood, physical function

- 40 older adults, mean age 72 years
- Dietary assessment
  - NANA on 3 occasions
  - 4 day food diary
- Cognition, mood, activity, grip strength
  - NANA
  - Traditional methods

Timeline: Weeks

1  2  3  4  5  6  7  8  9  10  11  12  13  14

Assessment  NANA  NANA  NANA  Diary  Assessment

Blood/urine
### Results – validation 2

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>NANA (Mean, SD)</th>
<th>Estimated Food Diary (Mean, SD)</th>
<th>Correlation Coefficient (r)</th>
<th>Significant Difference (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (KJ/d) ‡</td>
<td>7098 (1381.8)</td>
<td>7366 (1529.5)</td>
<td>0.875***</td>
<td>0.037*</td>
</tr>
<tr>
<td>Fat (g/d) †</td>
<td>71.3 (17.04)</td>
<td>70.3 (18.23)</td>
<td>0.781***</td>
<td>0.637</td>
</tr>
<tr>
<td>Saturated fat (g/d) ‡</td>
<td>26.4 (7.90)</td>
<td>25.5 (8.21)</td>
<td>0.716***</td>
<td>0.382</td>
</tr>
<tr>
<td>Carbohydrate (g/d) ‡</td>
<td>185 (19.1)</td>
<td>193 (57.7)</td>
<td>0.822***</td>
<td>0.130</td>
</tr>
<tr>
<td>NMES (g/d) †</td>
<td>40.1 (19.13)</td>
<td>39.2 (20.40)</td>
<td>0.507**</td>
<td>0.789</td>
</tr>
<tr>
<td>NSP (g/d) ‡</td>
<td>12.5 (4.44)</td>
<td>12.7 (4.43)</td>
<td>0.726***</td>
<td>0.619</td>
</tr>
<tr>
<td>Protein (g/d) ‡</td>
<td>75.5 (16.20)</td>
<td>78.9 (17.50)</td>
<td>0.812***</td>
<td>0.061</td>
</tr>
<tr>
<td>Cholesterol (mg/d) ‡</td>
<td>297 (98.4)</td>
<td>304 (122.0)</td>
<td>0.483**</td>
<td>0.681</td>
</tr>
<tr>
<td>Alcohol (g/d) †</td>
<td>7.81 (10.204)</td>
<td>11.18 (11.580)</td>
<td>0.774***</td>
<td>0.051</td>
</tr>
<tr>
<td>Vitamin A (µg/d) †</td>
<td>833 (389.7)</td>
<td>1176 (1213.2)</td>
<td>0.338*</td>
<td>0.051</td>
</tr>
<tr>
<td>Vitamin B12 (µg/d) †</td>
<td>4.64 (1.747)</td>
<td>5.60 (4.251)</td>
<td>0.149</td>
<td>0.582</td>
</tr>
<tr>
<td>Folate (µg/d) †</td>
<td>261 (141.4)</td>
<td>292 (143.4)</td>
<td>0.637***</td>
<td>0.026*</td>
</tr>
<tr>
<td>Vitamin C (mg/d) †</td>
<td>96.7 (42.64)</td>
<td>107 (64.7)</td>
<td>0.551**</td>
<td>0.441</td>
</tr>
<tr>
<td>Vitamin D (µg/d) †</td>
<td>2.77 (1.491)</td>
<td>3.10 (2.095)</td>
<td>0.134</td>
<td>0.660</td>
</tr>
<tr>
<td>Vitamin E (mg/d) †</td>
<td>8.08 (3.246)</td>
<td>6.78 (2.805)</td>
<td>0.429**</td>
<td>0.027*</td>
</tr>
<tr>
<td>Calcium (mg/d) †</td>
<td>820 (250.2)</td>
<td>854 (266.9)</td>
<td>0.633***</td>
<td>0.278</td>
</tr>
<tr>
<td>Iron (mg/d) ‡</td>
<td>10.72 (3.272)</td>
<td>11.37 (3.563)</td>
<td>0.704***</td>
<td>0.150</td>
</tr>
<tr>
<td>Retinol (µg/d) †</td>
<td>394 (287.8)</td>
<td>492 (890.2)</td>
<td>0.450**</td>
<td>0.388</td>
</tr>
<tr>
<td>Carotenoids (µg/d) †</td>
<td>2641 (1777.8)</td>
<td>4134 (3120.8)</td>
<td>0.488**</td>
<td>0.005**</td>
</tr>
</tbody>
</table>
• Energy intakes recorded using the “NANA” were 238 KJ lower than reported from the food diary.
- Protein intakes recorded using the “NANA” were on average 3.3g lower than recorded from the food diary.
Relationship between protein intake and urinary urea

**NANA**

![Graph showing the relationship between NANA protein intake and urinary urea.](image)

**Food diary**

![Graph showing the relationship between food diary protein intake and urinary urea.](image)

R² Linear = 0.417

R² Linear = 0.549
Relationship between vitamin C intake and plasma vitamin C

**NANA**

![Graph showing the relationship between NANA Vitamin C intake and plasma vitamin C concentration. The R² value for the linear regression is 0.291.]

**Food diary**

![Graph showing the relationship between diary Vitamin C intake and plasma vitamin C concentration. The R² value for the linear regression is 1.006E-4.]
Discussion

• Strong correlation between NANA system and a 4 day food diary
• Small, but significantly lower energy recorded by the NANA system
  – omission of snacks and drinks?
  – more accurate portion size assessment?
• Amenable to longitudinal capture of dietary intake
• Amenable to simultaneous capture of multiple domains (cognition, mood, physical function)
Acknowledgements

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The NANA team

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