Falls, Nutrition and Hydration

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Schlegel Research Chair, Nutrition & Aging, University of Waterloo
Outline

• The link between nutrition, hydration and falls
• What leads to poor dehydration and malnutrition among older adults across the continuum of care
• How to identify nutrition risk/malnutrition
• How to identify dehydration
• What interventions can be put in place across the continuum of care
Nutrition, hydration & falls (1)

• Mechanisms that lead to poor food intake, also poor fluid intake
• Relatively little research on hydration and falls
  – Falls listed as a health outcome of dehydration
    • Delirium, attention, visomotor, psychomotor
    • Blood pressure
    • Drug toxicity?
    • Balance?
    • Muscle weakness?
Nutrition, hydration & falls (2)

• More research on nutrition and falls
  – Falls identified as an outcome of malnutrition
    • Sarcopenia
    • Balance
    • Muscle weakness
    • Specifically vit D and calcium and bone and muscle strength
  – Nutrition interventions decrease risk of falls

Bischoff-Ferrari et al., 2004; Chevalier et al., 2008; Neelemaat et al., 2012; McTiernan et al., 2009; Shahar et al., 2009; Vivanti et al., 2009
What are we talking about?

• There is no absolute definition; no single parameter, symptom or sign

• Dehydration: Reduction in total body water (Thomas et al, 2008)
  • Rapid weight loss of 3% body weight
  • Water depletion
  • Sodium depletion

• Starvation Malnutrition: poor food intake related to environmental and psychosocial factors that leads to physiological & functional deficits
Three types of dehydration...

<table>
<thead>
<tr>
<th></th>
<th>Isotonic</th>
<th>Hypotonic (hyponatremic)</th>
<th>Hypertonic (hypernatremia)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What</strong></td>
<td>Balance H2O and Na loss</td>
<td>Na &gt; H2O loss</td>
<td>H2O &gt; Na loss</td>
</tr>
<tr>
<td><strong>Why</strong></td>
<td>Fast, vomiting, diarrhea</td>
<td>diuretics</td>
<td>Fever, exercise, iatrogenic, low intake, neglect</td>
</tr>
<tr>
<td><strong>Serum Na</strong></td>
<td>135-145 mmol/L</td>
<td>Low (&lt; 135 mmol/L)</td>
<td>High (&gt; 145 mmol/L)</td>
</tr>
<tr>
<td><strong>Urine Specific Gravity</strong></td>
<td>1.002-1.004</td>
<td></td>
<td>&gt; 1.015</td>
</tr>
<tr>
<td><strong>Serum Osmolality</strong></td>
<td>280-294 mmol/L</td>
<td>&lt; 280 mmol/L</td>
<td>&gt; 295 mmol/L</td>
</tr>
<tr>
<td><strong>BUN: Creatinine</strong></td>
<td></td>
<td>Elevated + uric acid</td>
<td>&gt; 25</td>
</tr>
</tbody>
</table>

Hodgkinson et al., 2003; Thomas et al, 2008
# Prevalence of Nutrition Risk in Canada

<table>
<thead>
<tr>
<th>Author</th>
<th>Sample</th>
<th>Tool</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tannenbaum &amp; Shatenstien 2007</td>
<td>Postal sample</td>
<td>SCREEN I</td>
<td>34% (HR)</td>
</tr>
<tr>
<td>Roberts, Wolfson &amp; Payette 2007</td>
<td>75+ y; random sample</td>
<td>Nutrition Risk Tool</td>
<td>60%</td>
</tr>
<tr>
<td>Keller et al., 2007</td>
<td>5 communities across Canada</td>
<td>SCREEN</td>
<td>42%</td>
</tr>
<tr>
<td>Statistics Canada</td>
<td>CCHS sample 2008</td>
<td>Abbreviated SCREEN II</td>
<td>33% (HR)</td>
</tr>
</tbody>
</table>
CMTF: Prevalence of Hospital Malnutrition at Admission and Discharge Based on SGA

~ 40% of Canadian hospital patients are malnourished
## Prevalence of Malnutrition in LTCH

<table>
<thead>
<tr>
<th>Author</th>
<th>Sample</th>
<th>Tool</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keller &amp; Hirdes, 2000</td>
<td>Chronic disease hospitals</td>
<td>MDS</td>
<td>26%</td>
</tr>
<tr>
<td>Bowman &amp; Keller, 2006</td>
<td>LTC/chronic Care hospital</td>
<td>Dietitian Assessment</td>
<td>83% (moderate or high)</td>
</tr>
<tr>
<td>Carriet et al., 2006</td>
<td>Cognitively well, LTCH</td>
<td>BMI and weight loss</td>
<td>37%</td>
</tr>
<tr>
<td>Carrier et al., 2007</td>
<td>Dementia, LTCH</td>
<td>BMI and weight loss</td>
<td>70%</td>
</tr>
<tr>
<td>Sitter &amp; Lengyel, 2011</td>
<td>LTCH</td>
<td>Comprehensive assessment</td>
<td>77%</td>
</tr>
</tbody>
</table>
How common is dehydration?

- Under-evaluated, reported, studied
- Prevalence ~35% in LTCH
  - 6.5-22.5/1000 hospital admissions from LTCH (Hodgkinson et al., 2003)
  - 8% hospitals (Thomas et al., 2008)
- Almost 100% of residents consume < 1500 ml/d (Kayser-Jones et al., 1999)
  - 10% BW loss = serious illness
  - 20% loss = death
- In US considered a sentinel event demonstrating neglect → sanctions, fines
Potential causes...

- Lack access
- Lack of preferences, choice
- Polypharmacy
- Infections with fever
- Dysphagia
- Drooling
- Thickened fluids
- Incontinence (fear/management)
- Dementia
- Aphasia, impaired communication
- FADL impairment
- Income, transportation

- Depression
- Food refusal
- Poor food intake, appetite
- Inadequate feeding assistance, supervision, training
- Overuse of diuretics, laxatives
- Lack of family support
- Lack of pain management
- Language barriers
- Lack of staff time, turnover, quality care
Is age a risk factor for dehydration?

- Decreased renal perfusion
- Decreased sensitivity to ADH
- Decreased thirst sensation- opioid system, osmoreceptors and baroreceptors
- Decreased urine concentrating capacity
- Impaired excretion by kidney (dec GFR)
- Decreased renin and aldosterone, and renal responsiveness to vasopressin
- Decreased reserve (LBM)

*Note renal changes are variable, dependent on HTN*
Why...

- Hypovolemia less potent at stimulating kidney to retain fluid than hypertonicity
- Thirst primarily driven by hypertonicity
- Older adults less sensitive to low volume
  - Do exhibit lower thirst for a given serum osmolality
  - Replace fluids more slowly

(Kenny & Chiu, 2001)
Determining risk for malnutrition, dehydration

COMMUNITY
What is SCREEEN?

Seniors in the Community: Risk Evaluation for Eating and Nutrition
Example Question

How often do you have milk products?

Examples are fluid milk, cooking with milk, milk puddings, ice cream, cheese, yogurt, and milk alternatives like fortified soy beverages.

4 ☐ Three or more times a day
3 ☐ Two to three times a day
2 ☐ One to two times a day
1 ☐ Usually once a day
0 ☐ Less than once a day
SCREEN

- SCREEN can be self or interviewer administered
- Expert involvement in wording
- Seniors involved in development
- Abbreviated version also available
- Validated against a dietitian’s rating of nutritional risk
- Demonstrated test-retest reliability
- Intermodal, inter-rater reliability
- SCREEN program
  - Referral process based on identified risk items
- E-SCREEN

EJCN, 2005; J Clin Epi, 2007
Comparison of SCREEN II Versions

Abbreviated = 8 items

- Weight change
- Fruit and vegetable intake, fluid intake
- Skip meals, eat alone, appetite, swallowing, meal preparation

Full = 14 items (sub questions)

- Perception of weight, attempting to change weight
- Milk/alternate, meat/alt, restrictive diet
- Chewing, meal replacements, grocery shopping
What are some specific concerns? CJDPR, 2003

367 vulnerable seniors; 20% hospitalized in prior 6 months

- Weight change 33%; loss 22%
- Restricts food 45%
- Low fruit/vegetable intake 48%
- Chewing difficulty 34.6%
- Swallowing difficulty 22.9%
- Poor Appetite 28%
- Cooking difficulty 42%
- Shopping difficulty 69%
Example of when Older Adults are Referred in a Screening Program

Score

Score 54 - 64
Senior is doing well. Encourage them to continue.
EatRight Ontario and A Guide to healthy Eating for Older Adults

Score 50 – 53
No Challenges

Score 50– 53
Some Challenges

Score <50
Some Challenges

Some Challenges

Senior has some risks and is having challenges in some areas.
EatRight Ontario and A Guide to healthy Eating for Older Adults

At High Risk

Key Messages

Action

EatRight Ontario and A Guide to healthy Eating for Older Adults

Specific Educational Resource

Community Referral

Specific Educational Resource

Community Referral

MD/NP/RD Referral especially if score ≤ 46

and/or

Community Referral

LEGEND
1 Score on any item ≤ 2 is considered to be a challenge
2 See SCREEN© Resource Selection
3 Based on SCREEN© Referral Map for your site/community
MD= physician
NP= Nurse Practitioner
RD= Registered Dietitian
Institutional Environments

- MNA®
- MST
- MUST

Dietitian Assessment to Determine Extent of Malnutrition and Treatment Options
Mini Nutritional Assessment (MNA®)

Complete the screen by filling in the boxes with the appropriate numbers. Total the numbers for the final screening score.

### Screening

<table>
<thead>
<tr>
<th>A</th>
<th>Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>severe decrease in food intake</td>
</tr>
<tr>
<td>1</td>
<td>moderate decrease in food intake</td>
</tr>
<tr>
<td>2</td>
<td>no decrease in food intake</td>
</tr>
<tr>
<td>B</td>
<td>Weight loss during the last 3 months</td>
</tr>
<tr>
<td>0</td>
<td>weight loss greater than 3 kg (6.6 lbs)</td>
</tr>
<tr>
<td>1</td>
<td>does not know</td>
</tr>
<tr>
<td>2</td>
<td>weight loss between 1 and 3 kg (2.2 and 6.6 lbs)</td>
</tr>
<tr>
<td>3</td>
<td>no weight loss</td>
</tr>
<tr>
<td>C</td>
<td>Mobility</td>
</tr>
<tr>
<td>0</td>
<td>bed or chair bound</td>
</tr>
<tr>
<td>1</td>
<td>able to get out of bed / chair but does not go out</td>
</tr>
<tr>
<td>2</td>
<td>goes out</td>
</tr>
<tr>
<td>D</td>
<td>Has suffered psychological stress or acute disease in the past 3 months?</td>
</tr>
<tr>
<td>0</td>
<td>yes</td>
</tr>
<tr>
<td>2</td>
<td>no</td>
</tr>
<tr>
<td>E</td>
<td>Neuropsychological problems</td>
</tr>
<tr>
<td>0</td>
<td>severe dementia or depression</td>
</tr>
<tr>
<td>1</td>
<td>mild dementia</td>
</tr>
<tr>
<td>2</td>
<td>no psychological problems</td>
</tr>
<tr>
<td>F1</td>
<td>Body Mass Index (BMI) (weight in kg) / (height in m²)</td>
</tr>
<tr>
<td>0</td>
<td>BMI less than 19</td>
</tr>
<tr>
<td>1</td>
<td>BMI 19 to less than 21</td>
</tr>
<tr>
<td>2</td>
<td>BMI 21 to less than 23</td>
</tr>
<tr>
<td>3</td>
<td>BMI 23 or greater</td>
</tr>
</tbody>
</table>

**IF BMI IS NOT AVAILABLE, REPLACE QUESTION F1 WITH QUESTION F2.
DO NOT ANSWER QUESTION F2 IF QUESTION F1 IS ALREADY COMPLETED.**

<table>
<thead>
<tr>
<th>F2</th>
<th>Cell circumference (CC) in cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>CC less than 31</td>
</tr>
<tr>
<td>3</td>
<td>CC 31 or greater</td>
</tr>
</tbody>
</table>

**Screening score (max. 14 points)**

- 12-14 points: Normal nutritional status
- 9-11 points: At risk of malnutrition
- 0-7 points: Malnourished

For a more in-depth assessment, complete the full MNA® which is available at www.mna-elderly.com


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For more information: www.mna-elderly.com
Have you lost weight recently without trying?
Yes  0
Unsure  2
If yes, how much weight (kilograms) have you lost?
1 to 5  1
6 to 10  2
11 to 15  3
> 15  4
unsure  2

Have you been eating poorly because of a decreased appetite?
no  0
yes  1
Total
score of 2 or more = patient at risk of malnutrition
Step 1
BMI score

BMI kg/m² | Score
--- | ---
>20 (>30 Obese) | 0
18.5-20 | 1
<18.5 | 2

Step 2
Weight loss score

Unplanned weight loss in past 3-6 months

% | Score
--- | ---
<5 | 0
5-10 | 1
>10 | 2

Step 3
Acute disease effect score

If patient is acutely ill and there has been or is likely to be no nutritional intake for >5 days
Score 2

Step 4
Overall risk of malnutrition
Add scores together to calculate overall risk of malnutrition
Score 0 Low Risk | Score 1 Medium Risk | Score 2 or more High Risk

Step 5
Management guidelines

0 Low Risk
Routine clinical care
- Repeat screening
  Hospital – weekly
  Care Homes – monthly
  Community – annually for special groups e.g. those >75 yrs

1 Medium Risk
Observe
- Document dietary intake for 3 days
- If adequate – little concern and repeat screening
  Hospital – weekly
  Care Home – at least monthly
  Community – at least every 3 months
- If inadequate – clinical concern – follow local policy, set goals, improve and monitor overall nutritional intake, monitor and review care plan regularly

2 or more High Risk
Treat*
- Refer to dietitian, Nutritional Support Team or implement local policy
- Set goals, improve and increase overall nutritional intake
- Monitor and review care plan
  Hospital – weekly
  Care Home – monthly
  Community – monthly
* Unless detrimental or no benefit is expected from nutritional support e.g. imminent death.

All risk categories:
- Treat underlying condition and provide help and advice on food choices, eating and drinking when necessary.
- Record malnutrition risk category.
- Record need for special diets and follow local policy.

Obesity:
- Record presence of obesity. For those with underlying conditions, these are generally controlled before the treatment of obesity.

Re-assess subjects identified at risk as they move through care settings
See the "MUST" Explanatory Booklet for further details and the "MUST" Report for supporting evidence.
HYDRATION STATUS
Biochemical Assessment

• Commonly done to ‘diagnose’ dehydration
  • Tends to overestimate, all non-specific
• Urine Specific Gravity
  • can be done in house with mini Urine analyzer and chem strips
• Bun:Creatinine
• Serum Na
• Serum osmoality
  • differentiates hyperglycemia induced dehydration if hyponatremic
  • influenced by other solutes (e.g. Glucose, BUN)

Hodgkinson, 2003; Thomas et al., 2008
Other Assessment

- 24-hour intake and output
- Daily weight
- BIA- Inc ECF
- Urine colour
- Bed-side assessment for signs
Simple Screen for Dehydration

(members of the Dehydration Council; Thomas et al., 2008)

- Drugs e.g. diuretics
- End of life
- High fever
- Yellow urine turns dark
- Dizziness (orthostasis)
- Reduced oral intake
- Axilla dry
- Tachycardia
- Incontinence (fear of)
- Oral problems/sippers
- Neurological impairment (confusion)
- Sunken eyes
Urine Colour Chart

- Early change in hydration
- First developed by Armstrong 1994- athletes
- Correlated with Usg
- Second void
- Put in test-tube and compare to chart
- Some meds affect – reddish (multivits, aspirin, wafarin)
- Some foods affect (fresh berries, rhubarb, spinach, beets)
Does it work with older adults?
Mentes et al., 2006

• Nursing home 98 residents; 8 weeks, weekly measures
• Inter-rater reliability; trained RA
• Food and drugs had minimal effect
• Compared to Usg; significant moderate corrl’n
• Correlation influenced by renal function, gender (female better corrl’n)

• Conclude: relationship between Ucol and Usg preserved in old age; moderate correlation
• Issues: CrCl, toileting ability/provide specimen, individual specific colour needs to be taken into account; some seniors do not concentrate urine well
PREVENTING & TREATING MALNUTRITION AND DEHYDRATION
Key activities

• Monitor weight
  – Unintentional weight loss is a high risk indicator for falls (Ensrud et al., 1997)
  – Rapid weight loss signals dehydration

• Monitor intake
  – Quality food sources, sufficient micronutrients and protein
    • Calcium 1200 mg, Vitamin D 400IU
    • Higher protein diet 1.0-1.2 g/kg body weight
  – Sufficient fluid to keep urine light in color
In the Community...

• Support food-related ADL
• Meal programs- congregate
• Small, nutritious portions
• Fluids throughout day
• Self-monitoring
• Companionship for meals
• Address barriers like dentition
When you treat malnutrition...

- ONS, vit D/Ca, RD counselling (Neelemaat et al., 2012)
  - Increased weight by 3.7 Kg in 3 mo
  - Improved functional performance measures

- Serum vitamin D > 65 nmol/l improves muscle function and reduces falls (Dawson-Hughes, 2008)

- Healthy diet (low fat, inc F&V, GR) (McTiernan et al., 2009)
  - Decreased falls after 8 years
  - Slight decrease in BMD but no diff in fracture

- Sufficient protein (of animal origin) is preventative and can modify the effect of weight loss (Zlotick et al., 2012)
Complexity in Care Homes & Hospitals

System

Staff

Family

Older person
How much fluid is needed?

- DRI > 50 years M= 3.7 L F= 2.7 L
  - all sources, incl caffeinated
  - note this is an AI
  - 35-54% should be water

- Minimum for LTCH- 1500 ml/L
  - Better consumption when with meals (Kayser-Jones et al., 1999)
  - Fluid at meals reduces food intake?

- Most accurate estimation
  - 100 ml/kg first 10Kg; 50 ml/kg for next 20 kg, 15 ml/kg for remainder
So what can we do?

Prevention ➔ Vigilence!
• Monitor fluid, food intake
• Monitor voids
• Monitor weight
• Education on incontinence and fluid intake
• Education on malnutrition & effects
• Fluid/food available and accessible
• Fluid/food offered frequently
• Review meds
• Address pain
• Ensure access
• Ensure artificial feed has supplementary water

Dehydration Treatment
• Hyponatremic— isotonic, normal saline
• Hypernatremic— hypotonic fluid - water
• Oral rehydration therapy
• IV?
• Hypodermoclysis-subcutaneous administration
Treating Starvation Malnutrition

• Sufficient staff who know resident well to provide assistance
• Menu planning that takes into account preferences
• High energy/protein snacks
• Nutrient dense/small volume foods
  – ONS
• Sensory appeal
• Encouraging family to participate in meals
• Dining environments conducive to food intake
What can staff do?

- Provide encouragement to eat & drink, especially those at risk
- Offer food and fluids throughout day- spend time with resident
- Vary types of foods and fluids, preferences
- Make it a social opportunity
- Family awareness and support
- Snack aide
- Hydration and medpass protocol/program
- Communication- formalize
Treating based on Etiology

Can’t Drink

- Independent
  - Educate
  - Use graduated cup
  - Preferred bev

- Dysphagic
  - Swallowing exercises
  - Foods high in fluid
  - Fraser protocol

- Forgets
  - Frequent offers
  - Fluid during activities
  - Teatime/happy hours
  - Beverage care

Physically Dependent

- Sipper
  - Frequent small amounts
  - Fluid with activities
  - Preferred bev

- Fears
  - incontinence
  - Educate
  - Kegels
  - medication

Physical aids

Frequent

- Sipper
  - Fluid with activities
  - Preferred bev

- Fears
  - incontinence
  - Educate
  - Kegels
  - medication

End of Life

Provide based on family/resident preferences

Mentes, 2006
DISCUSSION