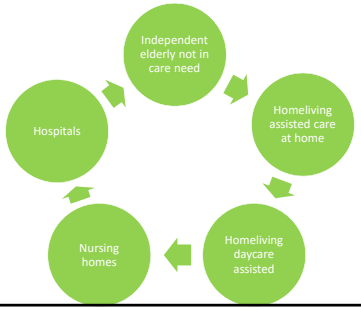
How digital welfare support technologies can remedy undernutrition – case insights from DIMS and NutriDia programs

Mikkelsen, BE, Professor of Nutrition & Public Food systems, Aalborg University

Conference: Eating, welbeing & nutrition in ageing societies
Nordic & Chinese perspectives Shanghai. Nordic centre, Fudan University, April 16, 2018

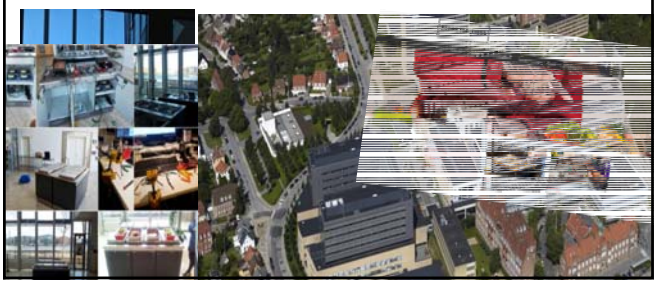
Abstract: Providing nutritional services to the elderly that are frequently at nutritional risk is of high importance. Using digitally supported welfare support technologies have shown promising results. This paper reports on the insights from the development of the Aalborg Model for nutritional care. In the program Aalborg University, Aalborg University Hospital and Aalborg Municipality has been cooperating to create better interfaces between the different digital instruments used for meal ordering and nutritional monitoring of food intake among elderly. The point of departure is that individuals from the target group is often in transit between private home, nursing home and hospital. The presentation reports on validation and feasibility studies carried out as part of the development of the two applications: Nutridia and DIMS. The DIMS is a Dietary Intake Monitoring System and the Nutridia is a mobile application for cancer patients with reduced appetite. The paper discusses some of the insights from developing integration across different digital nutritional support technologies.

Nutrition & Ageing – but where?



Digitization & food

Interdisciplinarity is the secret



Nutritional challenges

borderline between disease & ageing

- Nutrition related disorders is a significant societal problem and are caused by unhealthy eating patterns.
- In settings such as hospitals under-nutrition is also a problem with 23 to 38% in DK, CN and the US[1,2].
- Between 30 40 % are at nutritional risk at admission to hospital
- The nutritional challenges at hospitals are illustrated through the fact that up to 40 % of the food served is wasted[4]

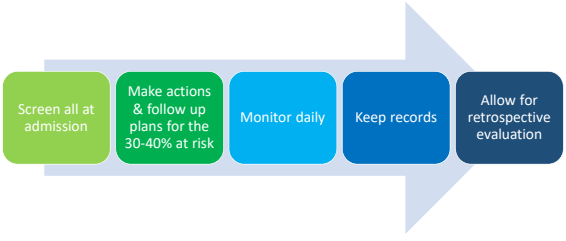
1. Kondrup J, Johansen N, Plum LN, et al. Incidence of nutritional risk and causes of inadequate nutritional care in hospitals. Clin Nutr. 2002;21(6):461-468. 2. Coats KG, Morgan SL, Bartolucci AA, Weinsier RL. Hospital-associated malnutrition: a reevaluation 12 years later. J Am Diet Assoc 1993;93:27–33. 3. Waitzberg DL, Caiaffa WT, Correia MITD. Hospital malnutrition: the Brazilian national survey (ibranutri): a study of 4000 patients. Nutrition 2001;17:573 4. Williams, P., Walton, K. Plate waste in hospitals and strategies for change, e-SPEN, the European e-Journal of Clinical Nutrition and Metabolism 6 (2011) e235ee241

Digitalisation create new avenues for nutrition

- Devices such as smartphones touch pads, etc. are increasingly used by consumers for self-tracking of lifestyle.
- The number of research studies applying such devices is growing (see for example: Jia et al 2011; Moulos et al 2015).
- New wearable devices that can objectively assess behaviours (Jia et al 2012, Jia et al 2013, Sun et al 2014) have been developed
- Signals such as biosignals, GPS, mobile positioning, Wi-Fi and Bluetooth are examples of signals and protocols that offer new potentials.

Nutritional monitoring – how

According to the NRS*2002



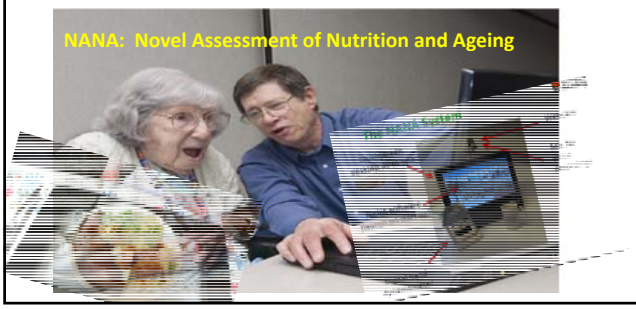
*Nutritional Risk Screening tool

Automatising food intake quantification (1)

So, how does it work? While the company chalks it up to "magic", we're assuming they've got a handful of people (be it through Amazon's Mechanical Turk, or a room full of dudes promised free Internet in exchange for calorie counting) breaking down the meal in your picture item by item. Snap a shot of a chicken salad? They punch in some chicken, some lettuce, maybe some dressing — and bam, they've got a rough estimate.
Is it a precise science? Hardly. Even in the screenshot above, you can see that there are some pretty wild variations. A "small handful of cashews", for example, comes back as being anywhere from 150 to 614 calories. Still, having some idea of what you're taking in is still far better than not having any idea at all.
You can find MealSnap on the App Store for $2.99 right here (iTunes link).

Gemming, et al., Eur J Clin Nutr (2013) 67, 1095–1099; Arab et al., Eur J Clin Nutr, 2011, 65(10):1156-1162,

Automatising food intake quantification (2)



Automatising food intake quantification (3)

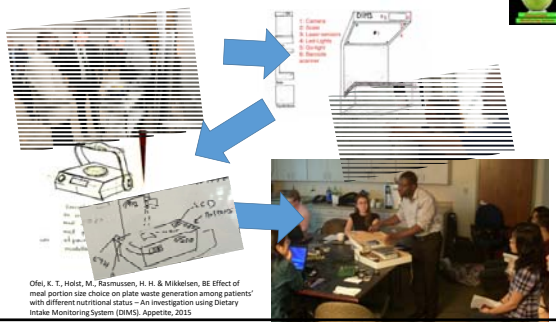
Video camera: looking at food and PA
GPS: positioning the individual
3-axis accelerometer – estimating motion
3-axis gyroscope: measuring body orientation
UV sensor – distinguishing indoor/outdoor
Barometer: determining body position/floor level

eButton

Automatising food intake quantification (4)
commercial applications

SCIO: https://beta.techcrunch.com/2016/09/

From DIMS1.0 to 1.5



Ofei, K. T., Holst, M., Rasmussen, H. H. & Mikkelsen, BE Effect of meal portion size choice on plate waste generation among patients' with different nutritional status – An investigation using Dietary Intake Monitoring System (DIMS). Appetite, 2015

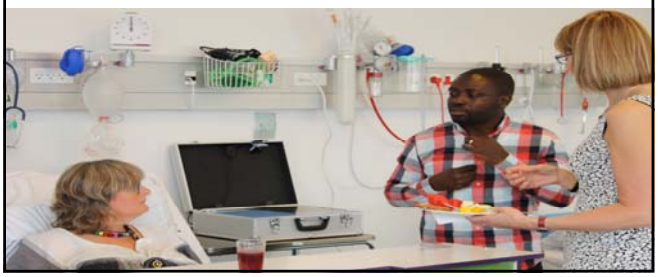
DIMS ver 2.0
on the go design

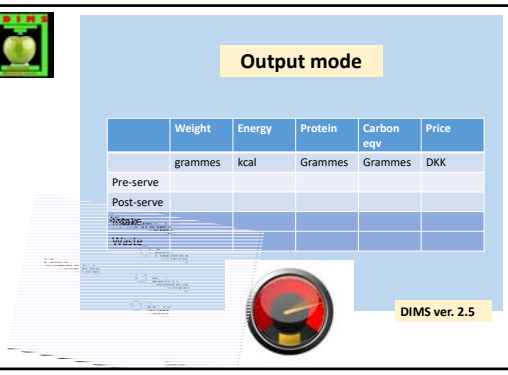
Can the DIMS approach be learnt?

Training course at Fudan, Shanghai, 2016

Is the DIMS robust in practice?

The Herlev stress test





Is the DIMS saving time?

The Aalborg feasbility study

- Reduces the time spent on NM from 15 to 4 minuttes
- Patients at nutritional risk produced increased amounts of plate waste, with less energy & protein intake when compared to patients not at nutritional risk.
- It can be used in co-creation mode improving accuracy

Ofei, K. T., Holst, M., Rasmussen, H. H. & Mikkelsen, BE Effect of meal portion size choice on plate waste generation among patients' with different nutritional status – An investigation using Dietary Intake Monitoring System (DIMS). Appetite, 2015

Is the DIMS accurate?

Validation Study 1: Herlev Hospital

Intervention:

- Front End Nutrition & Meal support
- Meal hosting

Results:

- No significance pre- og post test
- DIMS functions well with a trained operator
- Meal hosting requires training

Acknowledgement: catering manager Michael Allerup Nielsen

Ofei, K.T[1], Andersen, T[2] and Mikkelsen, B.E[3]. Measuring effect of Changes in Meal Service at hospital using digital technology – case insights from the Dietary Intake Monitoring System study

Is the DIMS accurate?

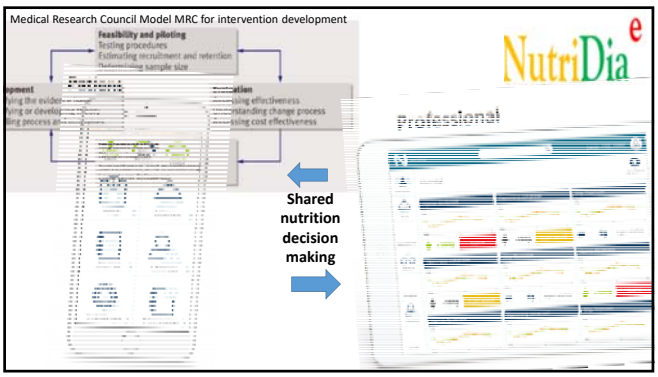
Validation 2: Odense University Hospital

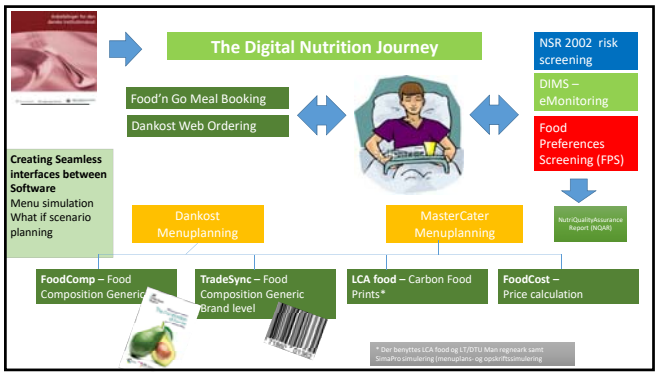
- **Hypothesis**
- High correlation between DIMS data and standard weighed method

- **Results:**
- Correlation: DIMS total energy/standard total energy (r= 0.990 and p value = 0.01)
- Correlation: DIMS total protein/standard total protein (r= 0.974 and p-value=0.01)

Acknowledgements: Dr. Rudolf Albert Scheller, Geriatric Dept G, Odense

Ofie. KO, ul Ain, Q, Scheller, R & Mikkelsen, BE: Validation of a novel image-weighed technique for monitoring food intake and estimation of portion size in hospital settings. Accepted for Public Health Nutrition. *2018*



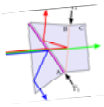


Conclusion:
eNutrition devices development lessons learnt

- "Everything is simple - once you know it"
- Hospital wards are busy
- Convenience & plug'n play is key
- Retrospective datainsight rated high
- Seamless interfacing is a must
- Must run in the cloud

Conclusion:
next steps

- Work to be done: algorithms, machine learning and imaging
- Cross disciplinarity needed
- Device flexibility: big sceereen, table, phones
- Open standards/API's is key
- Privacy issues needs to be dealt with
- eEnvironment and data security at hospital is a challenge
- Take2market is a challenge of its own



Thanks for your attention
感谢您的关注

read more about the Aalborg approach
http://www.capfoods.aau.dk/newslist/news/vous-connaisez-le-model-aalborg-.cid331849

bemi@dcm.aau.dk, 25 38 43 66
Personal web site:
http://personprofil.aau.dk/119690?lang=en
Linked in: http://dk.linkedin.com/pub/bent-egberg-mikkelsen/7/713/13b
ResearchGate:
http://www.researchgate.net/profile/Bent_Mikkelsen
Instagram: @bentegberg
Web: capfoods.aau.dk
Publons: https://publons.com/author/559299/bent-egberg-mikkelsen#profile

Upcoming
stay updated on www.capfoods.aau.dk

Aalborg University, Copenhagen, June 18 - 22, 2018

Advanced Training course:
Food: Small devices & Big data
June 19 - 22, 2018

Aalborg University Copenhagen. Arranged in cooperation with the Richfields consortium and Digital Foodscape Lab studies