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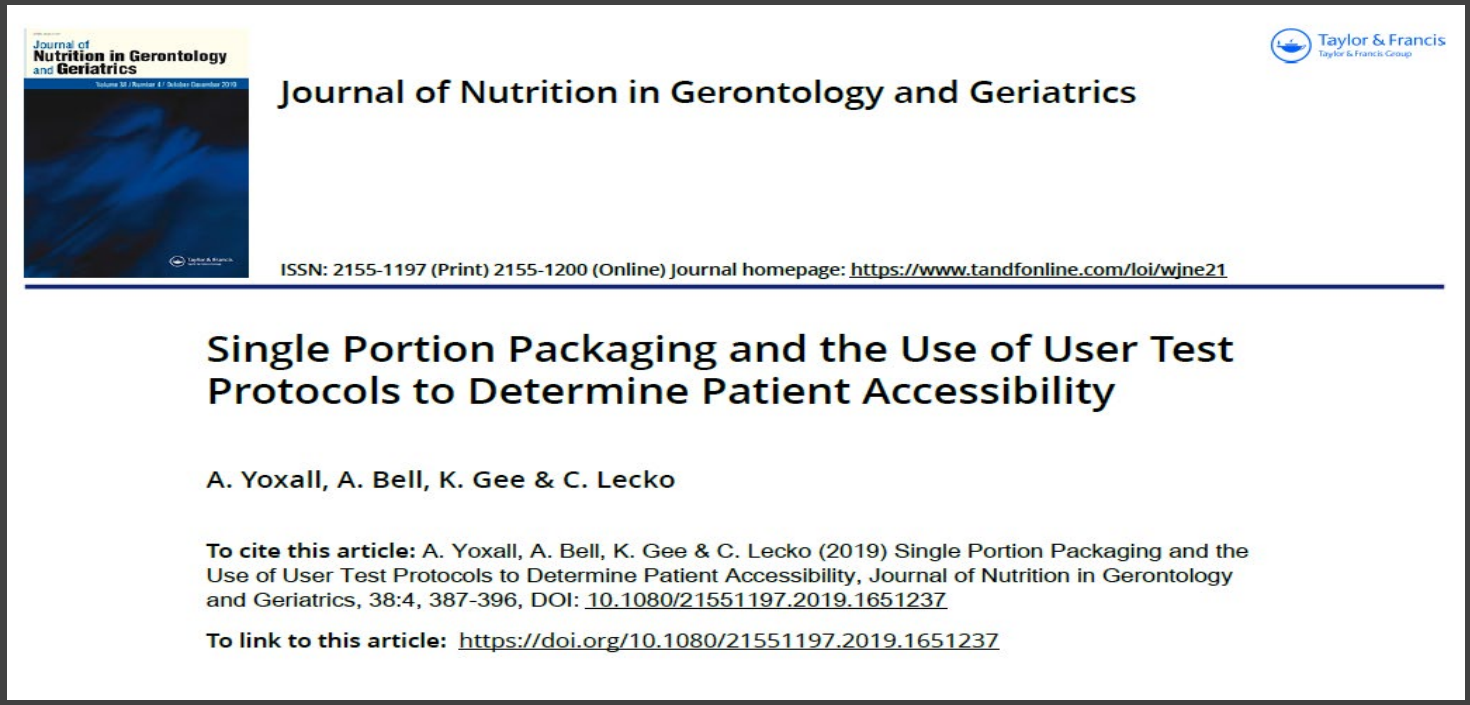
Inaccessibility of packaging in hospitalised settings is a serious worldwide issue with many health care providers resorting to packaged food delivery systems to reduce costs. Research by Bell et al., (2013) has shown a link to malnutrition for hospitalised patients due to the inability to access food, snacks and supplements. An NHS taskforce was set up to examine this issue in 2015, comprising of senior health care professionals, food service providers and Yoxall. Yoxall's expert contribution was to design a protocol that could be implemented by the NHS to establish if packaging could be easily opened and that packaging that failed the test would be either re-designed or removed from the system.

Yoxall developed the pass/ fail protocol around ISO17480, Packaging - Accessible Design - Ease of Opening, published in March 2015 (developed by a range of experts from Japan, the USA, Sweden, Germany and the Netherlands including Yoxall as the UK's technical expert) combined with the production of a technical handbook, pass fail certificates and 'easy open' logo. Before launch into system, the suitability of the protocol to determine what kind of packaging failed and the scale of the problem a series of tests of random packaging samples was undertaken.

The results of the random test found that the ISO 17480 standard provided useful assessment data, identifying that 70% of the packs including cheese (importantly used as nutritional supplement), jams, biscuits, fruit pots were so poorly designed that they failed to pass. Following national implementation, NHS supply chain audited their suppliers and found approximately 40% were aware of or using the protocol and a number of hospital trusts were implementing it into their purchasing contracts and packaging accessibility has been subsequently incorporated into National Care Quality Assessments.

Above: Flyer used to promote the results of the project to industry, hospital caterers and health professionals.



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Single Portion Packaging and the Use of User Test Protocols to Determine Patient Accessibility

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Above: Single Portion Packaging And The Use Of User Test Protocols To Determine Patient Accesibility. Journal of Nutrition in Gerontology and Geriatrics.

ISO 17480 'Guidelines for Accessible Packaging' was launched 2015. The guideline outlines useful information for packaging designers and manufacturers about font size and type, contrast, strength needed to open packaging, and information on visual acuity along with a designer checklist. Annex D of the standard describes a user panel test method for testing packaging accessibility.

Ten standard single portion packaging items were randomly selected for testing. The packs were chosen to reflect a broad range of food and beverage and packaging types as possible and to facilitate comparisons to earlier work undertaken by Australian researchers. All the packs were familiar to the participants and all participants had opened that pack or similar pack prior to testing. The packaging was also chosen to mostly reflect the common packaging formats used, i.e. 'flow-wrap' items, lidded-pots and shrink-wrap. The packaging chosen was single portion, cheese, jam, jelly, crackers, spread, orange juice, fruit pot, biscuits milk and sandwiches. Twenty participants were chosen with their age and gender profile matching that as defined by the ISO standard protocol. Each participant opened all ten packs with a break between packaging opening events. The order in which packaging was presented to each participant was also randomised.

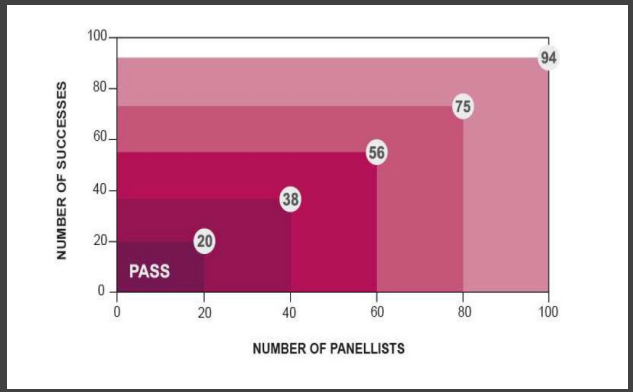

INTERNATIONAL STANDARD

ISO 17480

Packaging — Accessible design — Ease of opening

Above: ISO 17480 Packaging- Accesible design.

Below: Pass/fail criteria for ISO 17480.

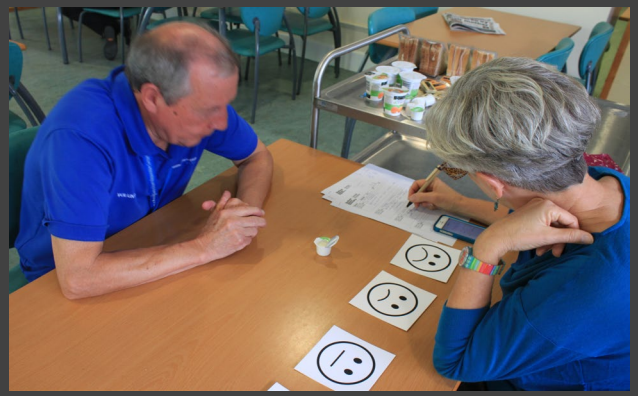


Above: Particpant attempting to open cheese portion.

ISO17480 does not request measurement of strength or dexterity it is of interest to understand the possible relationship between capability and the likelihood of opening the pack. Grip strength of each participant was measured using a Jamar Dynamometer whilst dexterity was measured using a Perdue Pegboard. Both instruments have significant published normative data for which our sample population could be compared.

Twenty participants were chosen with their age and gender profile matching that as defined by the ISO standard protocol. The test panel participants are skewed towards females (70 % of the panel make-up) with an upper age limit of 80 years. In this test, four different NHS sites were involved in the study, participants were randomly selected from patient representative groups from each hospital. Participants are asked to familiarize themselves with each packaging item and then subsequently attempt to open the packaging. Packaging is rated on a standard five point Likert scale. For the purposes of a pass or fail of the pack the ratings of “Extremely Dissatisfied”, “Dissatisfied” etc., are converted to a score (1 for “Extremely Dissatisfied”, and 5 for “Extremely Satisfied”). A pack is recorded as a failure if within the 20 people cohort there is an example of pack being unable to be opened within the time limit (defined as 1 minute) or the overall satisfaction score ranks below 3 (“Satisfied”). The test can be repeated on another cohort if there is a likelihood that the number of failures will remain below two or the likelihood of a score of 3 (“Satisfied”) can be attained. The number of permitted failures allowed increases as the cohort size increases. The test is stopped completely when the number of participants reaches 100. The statistical validity of the protocol is based on that used for Child resistant packaging in ISO 8317.

Below: Particpant being tested opening packaging.



Above: Rating of cream cracker pack.

Above: Participant pack on Likert Scale.

ISO17480 does not request measurement of strength or dexterity. However it is of interest to understand the possible relationship between capability and the likelihood of opening the pack and where our set of participants 'sit' within any normative data set. Grip strength of each participant was measured using a Jamar Dynamometer whilst dexterity was measured using a Perdue Pegboard.

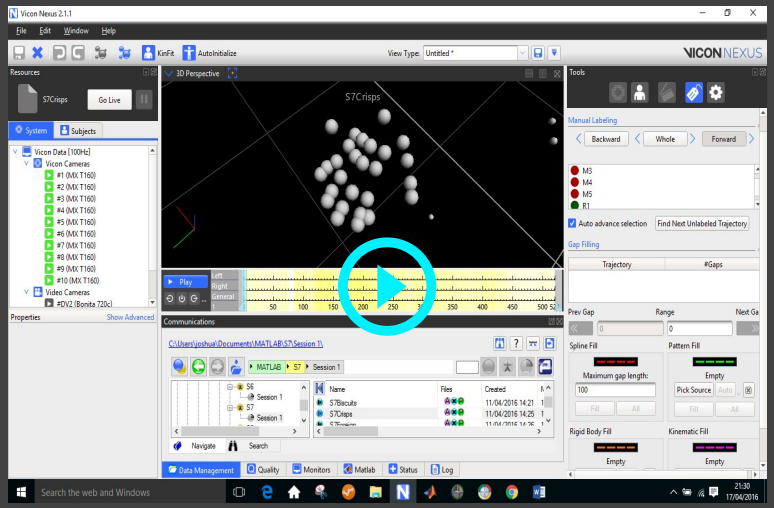
Above: measuring the dexterity of a participant using the Perdue Pegboard.

Above: Measuring the strength of a participant using a Jamar Dynamometer.

Understanding and measuring a participant's grip strength and understanding its relationship to packaging accessibility is relatively straightforward. The same is not true for dexterity as even the definition of what is dexterity is complex and it is measured by a plethora of tools and descriptors. The choice of the Purdue Pegboard and how to interpret the results and the statistical relevance is built of a series of earlier studies examining the nature of dexterity using motion capture and measuring the effectiveness of the Perdue Pegboard in assessing packaging accessibility. Bell, A., Tapsell, L., Walton, K., Yoxall, A. Accessing hospital packaged foods and beverages: the importance of a seated posture when eating (2017) Journal of Human Nutrition and Dietetics, 30 (3), pp. 394-402. Bell, A., Walton, K., Yoxall, A. Measure for Measure: Pack Performance versus Human Dexterity and Grip Strength (2017) Packaging Technology and Science, 30 (4), pp. 117-126. Gonzalez-Sanchez, V., Rowson, J., Yoxall, A. Analysis of finger movement coordination during the Variable Dexterity Test and comparative activities of daily living (2016) International Journal of Therapy and Rehabilitation, 23 (10), pp. 481-491. Gonzalez, V., Rowson, J., Yoxall, A. Development of the variable dexterity test: Construction, reliability and validity (2015) International Journal of Therapy and Rehabilitation, 22 (4), pp. 174-180.

Above: Participant about to undertake motion capture analysis of biscuit opening.

The background development and analysis included the use of motion capture study to measure the dexterous demands of the various packing through a kinematic analysis of the flexion angles in the joints of the hand and the correlation of finger movements was undertaken recording the movements of reflective markers placed on a set of anatomical hand landmarks. Markers were placed on specific areas of the dominant hand, located such that the flexion angles for the individual fingers and thumb could be calculated in conjunction with the correlation between the various joints. The video shows the finger motions of a participant opening flow-wrapped packaging.



Above: Edited motion capture analysis.

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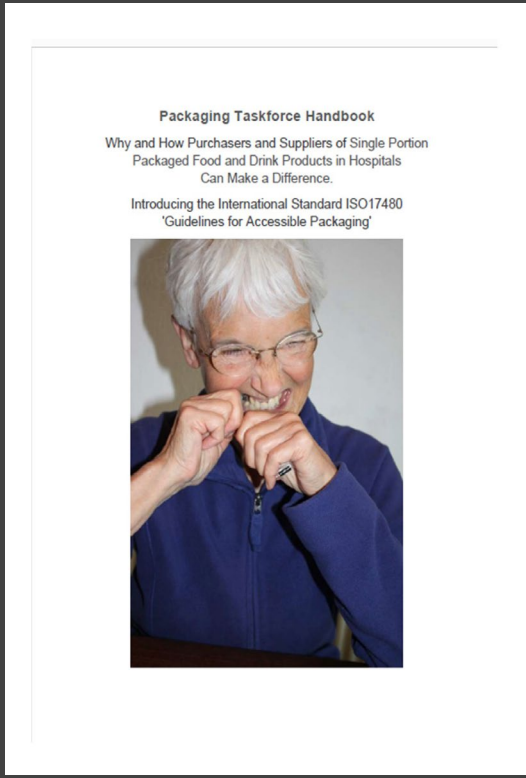
The project was promoted via the Hospital Caters Association (HCA) website and attendance at several HCA forums and networking at trade stands. To help suppliers a handbook was produced that detailed the process and provided practical information.


Packaging Taskforce Handbook

Why and How Purchasers and Suppliers of Single Portion Packaged Food and Drink Products in Hospitals Can Make a Difference.

Introducing the International Standard ISO17480 'Guidelines for Accessible Packaging'

Above: Packaging Taskforce Handbook providing information for caterers and suppliers.

Above: Participant having to use her mouth to mouth to open packaging.
Link to further project information on the Hopsital Caterers Website.

The NHS buys approximately 74 million packaged items a year from over 100 suppliers, many of whom are leading international brand owners such as Unilever, Nestle, United Biscuits, HJ Heinz, Mondelez, Kellogg's, Danone, Muller Wiseman, Premier Foods and Greencore, supplying diverse items such as crackers, cheese, yoghurts, cereals, jellies, deserts, biscuits and condiments including ketchup, vinegar and of course salt and pepper.

When contacted by NHS Supply Chain a number of these suppliers were aware of ISO17480 Guidelines for Accessible Packaging and had already had the packs tested or were considering having their packs tested in the future.

The study was presented at the Hospital Catering Leadership forum in 2017, 2018 and at and NHS Improvement Leadership event in Birmingham and at the European Design for Health Conference in Sheffield in 2018.

Left: "The Good the Bad and the Ugly: Understanding the role of single portion packaging and nutrition in a hospital environment" presentation given to NHS Improvement team in Birmingham 2018.

Right: "Warning Packaging Can Damage Your Health" presentation delivered at he European Design For Health Conference in Sheffield 2018.

The study was disseminated in a number of catering and packaging media, including the NHS Supply Chain News, The Grocer, Packaging News. It was also disseminated nationally as part of the NHS annual Nutrition and Hydration week an event highlighting the importance of food on patient wellbeing.


MEDIA & POLICY
news
LATEST HEALTHCARE NEWS FROM ACROSS THE UK
NHS
NHS Supply Chain

The ageing of society is a major public health success story. Average life expectancy today is 79 for a man and 83 for a woman, compared to one hundred years ago when it was half that. It is estimated that by 2020, half the adult UK population will be over 50. However, such longevity can bring health issues as well as loss of strength, dexterity and cognition.

Working towards easy-to-open consumer product packaging

NHS Improvement wanted to ensure that all patients using the NHS were getting the correct nutritional advice and had the ability to open products they were given with ease.

Above: The work was disseminated in a number of catering and food tradee magazines including the Grocer and NHS Supply Chain News.

Above: Stand showcasing work at NHS nutrition and hydration event.

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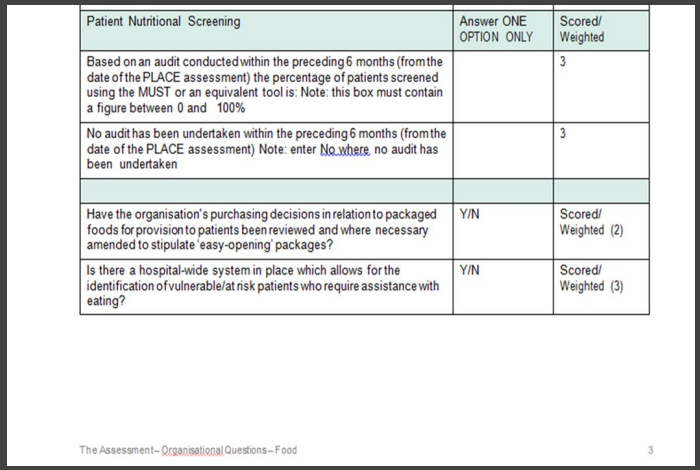
As a direct result of the research, questions about packaging were put into the 2018 patient Led Assessment of the Care Environment (PLACE) NHS Improvemnet iniative. PLACE results show how hospitals are performing both nationally and in relation to other hospitals providing similar services. They provide motivation for improvement by offering a clear message, directly from patients, about how the environment or services might be enhanced.

Above: Patient Led Assessment of the Care Environment Food Assessors Booklet



Patient Nutritional Screening	Answer ONE OPTION ONLY	Scored/ Weighted
Based on an audit conducted within the preceding 6 months (from the date of the PLACE assessment) the percentage of patients screened using the MUST or an equivalent tool is: Note: this box must contain a figure between 0 and 100%		3
No audit has been undertaken within the preceding 6 months (from the date of the PLACE assessment) Note: enter No where no audit has been undertaken		3
Have the organisation's purchasing decisions in relation to packaged foods for provision to patients been reviewed and where necessary amended to stipulate 'easy-opening' packages?	Y/N	Scored/ Weighted (2)
Is there a hospital-wide system in place which allows for the identification of vulnerable/at risk patients who require assistance with eating?	Y/N	Scored/ Weighted (3)

The Assessment – Organisational Questions – Food 3

Above: Packaging accessibility question in the PLACE assessment handbook.

Pass/Fail certificates have been produced for a number of packaging items tested by the research team to the devised protocol. The certificate below is for the Unilever product Flora 10g margarine. A record of the packs tested either by the research team or other consumer research groups is kept by purchasing teams and NHS supply chain (NHSSC).

Date/Period Tested: 27/02/17-24/03/17
Location Tested: Cantor Building, Sheffield Hallam University, Banner Cross Methodist Church, Private Location, Dronfield

Sheffield Hallam University | Design Futures

Ref: DF/17480/Unilever/01

To whom it may concern,

This is to certify that the following items have **passed** testing as per Annex D of ISO17480.

- Flora 10g Portion — Product Code 18750201

Primary Packaging — Pot – 0.8g polyethylene terephalate (PET); Lid – 0.1g polyethylene (PE)

Tested by: Alaster Yoxall
Title: Principal Research Fellow

A. Yoxall

Date: 28/03/17

Disclaimer: This certificate relates to the items as listed. Subsequent changes to the manufacture, materials or packaging design will require re-testing.

Average time taken to open: 7.54 s

Average satisfaction score: 4.2 / 5

Number of failures: 0/ 20

ANNEX D TESTED
PASS

DF/ISO17480/01

Above: Pass/Fail certificate of 10g single portion Flora pack.

Above: Participant opening 10g Flora pack.

Several the items tested were re-designed with input from Yoxall by the Design Futures team at Sheffield Hallam University. Most notable was the Jacob's double cracker pack that underwent complete visual re-design and matching changes to the flow-wrap edge to improve the affordance of opening the pack. The process involved discussions with users, designers, and the use of eye tracking equipment. The pack went from recording 8 failures in 20 to 0 failures is subsequent re-tests.

Above: Original 2 portion Jacob's Cracker design failing protocol.
Link to video of participants attempting to open pack

Below: Eye tracking heat map of new design of cracker pack.

Right: Participant examining different pack design options.
Link to video of participant opening production pack of new design.