London Procurement Partnership

Scoping the sustainability impact of Oral Nutritional Supplements

Integrating sustainabilty with procurement and prescribing

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Executive summary

‘Scoping the sustainability impact of Oral Nutritional Supplements’ is intended to start conversations about how the NHS understands the impact of current prescribing and procurement practices and what we can do to improve. Sustainable healthcare principles recognise that there are limited resources available to deliver best possible patient care and outcomes. Sustainable value can be described as an equation when value = benefits/costs. In recent years, there has been a shift to questioning the clinical and cost benefits of Oral Nutritional Supplements, therefore we have focused on the environmental costs and social aspects of current prescribing and procurement practices. The document offers a structured approach and applies basic methodology to assess the impact, where possible, of the category overall:

1. The CO_2e cost of production and processing
2. The CO_2e cost of transportation
3. Disposal: packaging and challenge of recycling
4. Disposal: wastage of nutrient dense product: impact on sewage system and water quality (eutrophication)
5. Social issues

The impact of these nutrition products is explored from a range of perspectives, including procurement, healthcare professionals, patient and public. It uses a wide range of evidence but is not exhaustive and further discussion is welcomed.

Recommendations are provided to begin addressing the sustainability impact including many actions that can be implemented by the NHS now.

In future, collaboration with suppliers and colleagues across the health system can identify further actions, as we work towards net zero, whilst maintaining access to products when appropriate. We look forward to engaging in further discussion.

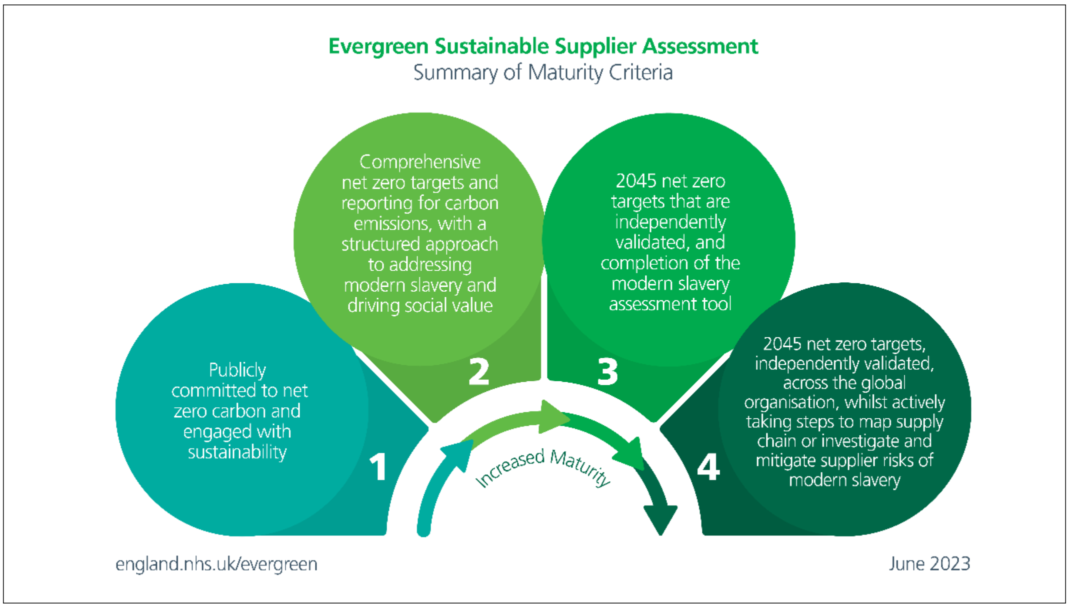
Introduction

Purpose
Oral Nutritional Supplements (ONS) are a popular intervention to manage risk of undernutrition, but the sustainability of this practice is yet to be widely discussed. We therefore aim to encourage discussion on the impact of ONS on sustainability.

Audience
Healthcare professionals, Medicines Optimisation teams, procurement and sustainability teams.

Background
The cost of prescribing standard Oral Nutritional Supplements (ONS) in Primary Care in England was £198,166,430 on 3,903,460 items (12 months data, May 2023 to April 2024 ePACT2 accessed via openprescribing.net). In London, over the same time period, the cost is £25,087,801 on 436,894 items (ePACT2 accessed via openprescribing.net). There are concerns about the clinical and cost-effectiveness of these products in frail older adults (Thomson et al, Baldwin et al) and a lack of patient involvement in understanding the rationale for their use and the setting of meaningful outcomes (Thomson et al). This is in the context of the need to improve the assessment of older adult's nutrition and to take an aetiology-based approach (Fisher et al). Whilst ONS are of limited value in certain patient groups (e.g. older, frail adults) which account for a majority of prescriptions, access is essential for others, such as patients with Inflammatory Bowel Disease for whom evidence demonstrates cost and clinical effectiveness. ONS are now included in the oversupply dashboard by the NHS Business Services Authority. The focus of Medicines Optimisation (MO) with regards to ONS has so far been their clinical and cost-effectiveness, while MO's sustainability focus has been on medicines with a high environmental impact, such as inhalers and anaesthetic gases. There is an increasingly urgent need to evaluate ONS from a sustainability perspective, due to the impact they have in terms of the carbon dioxide equivalent emissions (CO_2e) - cost of production, processing and transportation, the disposal of packaging and challenge of recycling, and the impact that disposing of wasted nutrient-dense products has on sewage systems and water quality (eutrophication). This paper aims to initiate discussion on the environmental impact of ONS and make interim recommendations for measurement.

Additional consideration should be given to social value. Procurement Policy Note PPN06/20 requires evaluation of social value, applying a minimum overall weighting of 10% in NHS procurements. Medicines procured by NHS England require Evergreen Sustainable Supplier Assessment tool completion from January 2024:



This assessment criteria illustrates the increasing expectations of suppliers to demonstrate sustainability (ONS are not procured by NHS England). In recognition of supply of ONS being via a number of different routes (procured and supplied direct to a hospital, prescription, an off-script model or an over the counter purchase), we have also considered social value in addition to sustainability.

Over the years, NHS LPP has provided NHS England with subject matter advice regarding overprescribing of ONS across workstreams. Oversupply of ONS is often the result of ONS products being provided for zero or penny pricing to hospitals as part of the enteral feeds contracts, coupled with a lack of structured review process and dietetic workforce to support improved pathways of care.

Scope

Standard ONS (section 9.13.1 British National Formulary) are the only nutritional products under consideration, but the learnings can be applied to other categories of products managed by the Advisory Committee on Borderline Substances (ACBS), as the NHS works towards its ambition of achieving net zero. The majority of standard ONS are dairy-based. Whilst it is recognised that plant-based milk alternatives are likely to have a lower carbon impact compared with dairy, this is beyond scope. This discussion relates to the impact of existing prescribing practices. If a patient has acute disease related malnutrition and prescribing is appropriate, product choice should follow normal dietary beliefs and preferences of the patient, in addition to local formulary guidance:

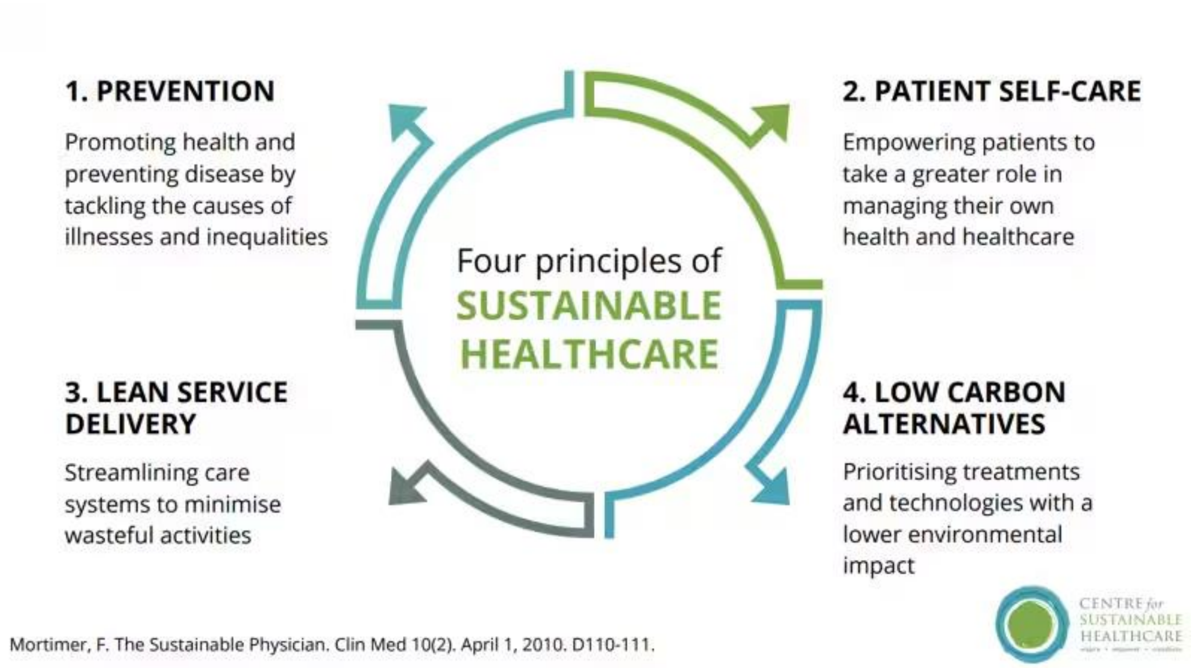
- Dairy-based ONS unless vegan
- Plant-based ONS for vegan patients (or any patient preferring a dairy-free option)

Research on patients' views on sustainability is mixed. Work on inhalers suggests that patients would like the environmental impact to be part of the decision-making process (Greener NHS » Improving health outcomes for respiratory patients while reducing carbon emissions (england.nhs.uk)). Similar research does not exist for patients requiring ONS, but anecdotal reports from MO dietitians suggest that patients are motivated to make changes based on sustainability. Additionally, poll data reveals that whilst there is public support on reducing carbon footprint, this does not correspond to individual patient care (The Health Foundation). The public are in strong support of backing British farming, including sourcing at least half of the food for schools, prisons and hospitals from British farms (National Farmers Union).

Approach

We have looked at the environmental aspects of ONS separately and applied standard methodologies. For example, we have applied carbon emissions factors based on cost of the category overall and for transport emissions applied factors based on one tonne, distance travelled and the number of servings provided.

Additionally, we have used the Centre for Sustainable Healthcare's Principles of Sustainable Healthcare to guide the work:



Discussion

1. The CO_2e cost of production and processing

NHSE has previously categorised Oral Nutrition as “Basic pharmaceutical products and pharmaceutical preparations” which have a carbon emissions factor of 0.581 kgCO_2e per £. We believe that these products are closer to dairy products as they are modified milkshakes. It is unclear if this factor has been based on a previous category of Oral Nutrition that previously included products such as gluten free alternatives.

a) Pharmaceutical preparations as the emission factor : 0.581 kgCO_2e /£ spent (Methodology for the NHS Carbon Footprint Plus - Greener NHS Knowledge Hub - FutureNHS Collaboration Platform note NHS Futures login required).

b) Dairy products: 0.969 kgCO_2e /£ spent: UK and England's carbon footprint to 2021 - GOV.UK (www.gov.uk)

For England, this gives a range of (a) 115,134,696 kgCO_2e to (b) 192,023,271 kgCO_2e. Using different methodologies to estimate this does not seem robust. Additionally, as ONS are highly processed compared with standard dairy products, if a specific calculation/methodology were to be developed, a highly processed ONS would likely have a higher impact. We therefore suggest that true CO_2e cost of production and processing to be in excess of 192,023,271 kgCO_2e. As such we have adopted the dairy products emissions factor.

Table 1. Current and potential reductions in CO_2e, London region Primary Care usage of standard ONS based on dairy product carbon emission factors

	Current	**10% reduction**	**20% reduction**	**50% reduction**
Cost of standard ONS	£25,087,801	£22,579,021	£20,070,241	£12,543,901
CO_2e impact	24,310,079 kgCO_2e	21,879,071 kgCO_2e	19,448,063 kgCO_2e	12,155,040 kgCO_2e
Equivalent to car miles driven (mile driven in an average car including fuel + well to tank* emissions) **CO_2e impact/0.36503**	66,597,482 miles	59,937,734 miles	53,277,986 miles	33,298,741 miles

Note: due to the lack of data oversight of secondary care and supply of ONS via an alternative model, 'off script' (without an FP10), it is not possible to provide provisional current kgCO_2e from hospital use or the off script route. The above figures are therefore an underestimate. Future work could ask hospitals and off script areas to provide average ONS use/month to build estimates for 12 months for London.

*well to tank (WTT) refers to energetic consumption to extract and transport the fuel to the tank.

Further detail of methodology can be found in the appendix.

Future work may include comparing the CO_2e impact to known examples to improve understanding and context of these figures.

2. The CO_2e cost of transportation

All manufacturers were contacted and requested to provide information on processing plant location. Ten suppliers were contacted and the responses were highly variable. Seven provided locations and three volunteered further information on their efforts to decarbonise. Three suppliers either did not provide or declined to provide information. The majority of supplements are not manufactured in the UK. Just one supplier produces ready to drink ONS in the UK and due to the weight of the liquid products, this is of particular concern. In future, we would like to see labelling of all ONS with where it was produced so that consumers, patients, clinical staff and formulary decisions are informed.

To assess carbon emissions in transportation the following process and examples are given using the conversion factors cited here:Greenhouse gas reporting: conversion factors 2024 - GOV.UK. The model uses known locations for illustrative purposes but we recognise that there are wide range of suppliers using a number of manufacturing sites. We acknowledge that there are a number of reports of manufacturing sites being significantly further afield than modelled. A comparison weight of one tonne has been used. However, it should be noted that one tonne of Ready to drink (RTD) ONS compared with one tonne of powdered ONS plus the milk required to make it up, provides a significantly different number of servings.

Three examples have been modelled:

1. One tonne Ready to Drink (RTD) 1.5kcal/ml transported from Western Europe to London
2. One tonne Ready to Drink (RTD) 2.4kcal/ml transported from Western Europe to London
3. One tonne of powdered ONS from Midlands to London + 3.5 tonnes fresh milk from a home county to London

See appendix for further information.

Table 2. ONS product type comparison of CO_2e by distance

Product	Presentation	1kg	Servings in 1 tonne (1000kg)	kgCO2e for 1 tonne product transport	kgCO2e per serving
Ready to drink (RTD)1.5kcal/ml	200ml	5 x 200ml	5000 servings	40.5571 kgCO2e	0.0081
Ready to drink (RTD) 2.4kcal/ml	125ml	8 x 125ml	8000 servings	40.5571 kgCO2e	0.0051
Powdered ONS + 3.5 tonnes fresh milk	57g	17.5 x 57g	17, 545 servings	67.47954 kgCO2e	0.0038

Our modelled distances suggest that:

- **Powdered ONS (with fresh milk) has 24% lower carbon transport costs than 2.4kcal/ml RTD ONS**
- **Powdered ONS (with fresh milk) has 53% lower carbon transport costs than 1.5kcal/ml RTD ONS**

It is clear that the carbon impact for transporting one ONS is not particularly high, however, based on the national prescribing, (which we know is under reported), transporting example one would cost 32 tonnes of CO_2e compared to 15 tonnes of CO_2e for a powdered version. Further work should examine ONS composition and location of all processing sites more precisely to add to this initial CO_2e cost of transportation work. We believe the distances modelled for RTD are highly variable and that we have been cautious but further work may reveal significantly higher transport costs. Trackers can also be developed using local address/distances to provide transparency and allow hospitals, Integrated Care Systems (ICS) and even patients to make individual decisions. Future dashboards could use the 'Quantities X Items' to calculate at scale the $kgCO_2e$ per presentation of ONS but would not be able to account for different locations and potential changes.

Further work should investigate integrating the carbon impact of transport and production costs of RTD vs more local production of powdered ONS and supply of fresh milk. Powdered ONS are recommended overall (if prescribed appropriately) as ONS made with fresh milk can:

- Align with patient preference
- Have rehabilitation potential (practicing shaking the milkshake to combine for 30 seconds each arm as a strength building exercise)

- Lower cost to the NHS prescribing budget (and already local formulary first choice products)
- Lower transport costs.

Note: there are frequent ‘barriers’ to prescribing powders include a lack of access to fresh milk, inability to open packaging and/or prepare, however these represent more significant holistic concerns about access to food and drink than any ONS will be able to address.

3. Disposal: ONS packaging and challenge of recycling

The challenge of recycling ONS packaging should not be underestimated (Chalke R):

1. **What** is recycled or disposed of
    - ONS packaging typically consists of between five and seven different elements; the bottle/pot/cup/sachet, lid, seal under the lid, label, cardboard wrap, tray and shrink wrap for transporting larger volumes.
    - Types of plastic used; plastic resin IDs with Mobius Loop with a numerical indicator (1-7).
    - Mixed composition packaging (e.g. aluminium/plastic laminate) such as sachets may have a lower life cycle analysis but due to separate recycling arrangement, it is not necessarily clear cut if this is better than classic HDPE/PET where there is demand for food grade recyclate.
    - The seal is not recycled and will be disposed of via landfill/incineration
2. **Where** it can be recycled at the kerbside or supermarket soft plastic recycling
3. **Who** is recycling or disposing of the packaging, and their commitment and motivation to understanding the need to recycle and relevant processes such as rinsing out or taking soft plastics to be recycled rather than kerbside. Given that a majority of prescribing of ONS is in malnourished, frail older adults, the requirement to segregate recycling into kerbside or take soft plastics to the supermarket is ambitious and potentially a more significant issue than recognised?
4. **Whether** the Local Authority recycling stream can sort the packaging: mixed (comingled) or ‘two-stream’ (difficult/unlikely to recycle) and multistream (can recycle). For plastics that are contaminated with ‘3D waste’ (e.g. have not been rinsed out) or cannot be sorted then disposal is via incineration or landfill.

Further discussion of environmental costs of producing and recycling plastic are beyond scope.

4. Disposal: Wastage of nutrient dense product: impact on sewage system and water quality (eutrophication)

ONS not consumed must be disposed of after 4-12 hours at room temperature for food safety reasons (see specific brand for guidance). Palatability will also reduce with time and temperature changes after serving. ONS will be disposed of by either putting the bottle/sachets with contents in the packaging into the bin or by disposing of the powder or liquid by pouring any liquids down the sink into the sewage system and potentially recycling the packaging. ONS disposed of into the sewage system may contribute to eutrophication of aquatic ecosystems (Chislock et al). Eutrophication is described as the over enrichment by nutrients of water systems, leading to oxygen depletion and/or algal blooms. To date, wastage of ONS has focused on cost reduction. However future work should also consider;

a) Disposal of ONS and impact on our water systems. Discussion with water companies would be useful to understand mitigation measures for reducing impact on water quality.
b) Wastage and carbon emissions. Undrunk products have already incurred production costs with no clinical benefits. Providing ONS prescription reviews at scale is operationally challenging. Greater standardisation of criteria for initiation, continuation and discontinuation with links to outcomes could be explored to reduce wastage and improve patient-centred care. This should include clear pathways for reducing or stopping ONS prescriptions if not being consumed. Additionally, greater monitoring of overprescribing of ONS is required as per the National medicines optimisation opportunities 2023/24, NHS England.

5. Social value considerations

Social and environmental determinants are shown to influence health and life expectancy. To help address this there is an increasing focus on sustainability and social value in procurement. Applying social value criteria has yet to be explored in procurement of nutrition supply overall but factors pertinent to ONS are discussed here:

- **Employment and supply of raw ingredients**

Further investigation could explore assuring the milk component of standard ONS comes from local farms. This potentially represents significant social value in supporting local jobs in farming. Supporting employment for rural communities is especially important as rural deprivation is less likely to be shown in standard deprivation measures and relatively higher costs of living (transport, food and types of energy) are reported in the Statistical Digest of Rural England: 4 – Communities and Households, March 2024. For powdered ONS that are made with fresh milk it is highly likely that the added milk will be locally produced. The costs of CO_2e transport are explored in section 2, and are reduced by using locally produced raw ingredients.

- **Employment and location of manufacturing/processing plants**

Suppliers with no manufacturing/processing plants in the UK/Republic of Ireland may have significantly higher CO_2e transport costs, and cannot demonstrate the same social value by provision of local jobs. The environmental cost of production may be higher in countries without moderate/cool temperatures and regular rainfall suited to dairy production.

- **Competition**

A small choice of suppliers and challenging procurement model have long been recognised in the enteral nutrition market. The Competition and Markets Authority (CMA) is currently investigating the infant formula market due to concern regarding above inflation price increases of 25% over two years. The standard ONS market has had price increases of 20% over the last two years (Advisory Committee Borderline Substances (unpublished data)). Infant formula brands and medical nutrition brands have the same parent companies or significant overlap with shared ingredients, suppliers, processes and market share.

Considered collectively, demonstrating combined social and environmental responsibility such as UK processing plants to reduce transport CO_2e costs whilst employing local people, is important. Improving the sustainability of ONS will be challenging due to the small number of suppliers and significant revenues generated. Future sustainability tools or dashboards can help inform formulary choice, procurement or making recommendations regarding purchasing Over the Counter (OTC). Dashboards understanding market share will also be beneficial, particularly regarding understanding subsidiaries, parent companies and expectations on suppliers to demonstrate the journey towards improved sustainability and social value.

Limitations

At present, we can apply CO_2e emissions of production based on cost, and a separate rough estimate CO_2e emission of transport using models of miles and number of servings. This is neither robust nor comparable enough to enable full understanding of the total CO_2 of production and transportation of ONS (i.e. fully understand scope 1/2/3 greenhouse gas emissions for ONS). Engagement with suppliers on scoping and the NHS net zero supplier roadmap would be beneficial.

Conclusion

There are a range of areas that require further exploration. This work highlights a number of areas that can be taken forward to understand the sustainability impact of ONS as we work towards net zero. A key message of sustainability is reduce, reuse and recycle. As reuse of ONS is not possible, recycling of ONS packaging has significant complexities and as the clinical and cost effectiveness of ONS is limited our focus should be; reduce overprescribing, and reduce both the distance and weight of products to lessen the transport impacts, reduce weight.

Recommendations

Table 4: Summary of recommendations

Recommendations for improvement	
I	Improve awareness that there are issues of oversupply and overprescribing of ONS and that this is not sustainable or in line with net zero aspirations. This is in line with the lean pathways principle of sustainable practice.
II	Clinical and procurement teams should re-evaluate the costs and benefits of including ONS in enteral feed contracts and use of principles of sustainable practice
III	Future work could seek to understand ONS use in hospitals and off script areas to enable full oversight of carbon and plastic impact. Additionally, this is advantageous in terms of improving enteral nutrition supply transparency.
IV	Food-based advice to support ageing well is required by all older adults and an understanding of aetiology reduces risk of inappropriate prescribing of ONS. Prescribers should be cautious in initiating, monitoring outcomes and discontinuing ONS due to the uncertain evidence base (Thomson et al, Baldwin et al). Standardised pathways and criteria for initiation/continuation/discontinuation are needed with outcome setting and aetiology-based management plans. This is in line with the patient empowerment principle of sustainable practice.
V	If appropriate, powdered ONS should be prescribed as they provide significantly better value across multiple perspectives overall and patients are keen to support sustainable choices and British farming when possible.
VII	Improvement on how to measure the CO_2e impact of ONS including development of a unit-based carbon factor and life cycle assessments
VIII	To explore a sustainability tool to identify best ONS option by geography and enable measurement of social value and sustainability, applying procurement best practice and consideration of social value and sustainability to formulary and prescribing choices.

X	Engagement with suppliers on sustainability and social value to promote understanding of net zero and promote best practice such as all ONS should have their country of origin clearly identified on the packaging.
XI	Recognise the challenge that ACBS products as neither food nor medicines, and occupy a unique area of procurement and prescribing in terms of value to patients, identifying and reducing the carbon emissions, governance and wider social value and sustainability.
XII	Undertake a sustainable quality improvement (SusQI) project to make meaningful changes in your ONS practice to benefit patients and staff while reducing carbon and financial cost (see further resources).
Recommendations for measurement	
VI	Future overprescribing dashboard for ONS will be highly valuable in monitoring progress and local ICS's are encouraged to use this.
IX	To develop a dashboard to monitor carbon emissions of ONS in Primary Care based on prescribing data and consideration of how to measure secondary care and off script use of ONS.

Further resources:

Sustainability in Quality Improvement (SusQI) | Centre for Sustainable Healthcare

Open access SusQI resources

- Sustainability in Quality Improvement (SusQI) at Health System Level - The Community of Practice for Climate Resilient and Low Carbon Sustainable Health Systems (a recent summary put together for a WHO hosted network).
- Step-by-step guide | CSH
- Educator Pack | CSH
- Case Studies | Sustainable Quality Improvement
- SusQI Case Study: Enteral feeding equipment sustainability initiative

SusQI Course:

- Sustainability in Quality Improvement | Centre for Sustainable Healthcare

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References

Baldwin C, Smith R, Gibbs M, Weekes CE, Emery PW. Quality of the Evidence Supporting the Role of Oral Nutritional Supplements in the Management of Malnutrition: An Overview of Systematic Reviews and Meta-Analyses. Adv Nutr. 2021 Mar 31;12(2):503-522. doi: 10.1093/advances/nmaa108. PMID: 32945835; PMCID: PMC8009750.

Chalke R. Oral nutritional supplements – a packaging minefield. Dietetics Today, September 2023 p26-28.

Chislock, M. F., Doster, E., Zitomer, R. A. & Wilson, A. E. (2013) Eutrophication: Causes, Consequences, and Controls in Aquatic Ecosystems. Nature Education Knowledge 4(4):10 https://www.nature.com/scitable/knowledge/library/eutrophication-causes-consequences-and-controls-in-aquatic-102364466/

Competition and Markets Authority, Press Release Published
29 November 2023, CMA sets out Autumn update in review of competition in groceries sector
https://www.gov.uk/government/news/cma-sets-out-autumn-update-in-review-of-competition-in-groceries-sector

Fisher R, Martyn K, Romano V, et al Improving the assessment of older adult's nutrition in primary care: recommendations for a proactive, patient-centred and aetiology approach BMJ Nutrition, Prevention & Health 2023;e000661. doi: 10.1136/bmjnph-2023-000661

Mortimer F. The sustainable physician. Clin Med (Lond). 2010 Apr;10(2):110-1. doi: 10.7861/clinmedicine.10-2-110. PMID: 20437974; PMCID: PMC4952075. Accessed via
https://networks.sustainablehealthcare.org.uk/sites/default/files/resources/2010_mortimer_0.pdf

NHS England, Greener NHS, Improving health outcomes for respiratory patients while reducing carbon emissions
https://www.england.nhs.uk/greenernhs/whats-already-happening/improving-health-outcomes-for-respiratory-patients-while-reducing-carbon-emissions/

The Health Foundation
https://www.health.org.uk/publications/public-perceptions-of-climate-change-and-health-september-2021

National Farmers Union
New survey shows importance of British farming to voters
https://www.nfuonline.com/media-centre/releases/press-release-new-survey-shows-importance-of-british-farming-to-voters/
NFU24: A nation in tune with farmers?
NFU24: What the countryside thinks – NFUonline

Oversupply dashboard | NHSBSA
https://www.nhsbsa.nhs.uk/access-our-data-products/epact2/dashboards-and-specifications/oversupply-dashboard

NHS England, Improving health outcomes for respiratory patients while reducing carbon emissions
https://www.england.nhs.uk/greenernhs/whats-already-happening/improving-health-outcomes-for-respiratory-patients-while-reducing-carbon-emissions/

NHS England, National medicines optimisation opportunities 2023/24, https://www.england.nhs.uk/long-read/national-medicines-optimisation-opportunities-2023-24/

Statistical Digest of Rural England: 4 – Communities and Households, March 2024
https://assets.publishing.service.gov.uk/media/65ef74aeff117000196158e9/4_Communities_and_Households__12_03_2024.pdf

Thomson K, Rice S, Arisa O, Johnson E, Tanner L, Marshall C, et al. Oral nutritional interventions in frail older people who are malnourished or at risk of malnutrition: a systematic review. Health Technol Assess 2022;26(51) https://www.journalslibrary.nihr.ac.uk/hta/CCQF1608#/s8

Appendix 1 – Carbon Calculations

The carbon calculations are limited to the carbon impact of oversubscribing and supply. The carbon factors used are from the UK Government 2024 library and the 2021 carbon factors by SIC code spend

Carbon Factors	Factor	WTT	Total
Basic Pharmaceutical Preparations ($KGCO_2e/£$)	0.581	0	0.581
Dairy Products ($KGCO_2e/£$)	0.969	0	0.969
Cargo ship ($KGCO_2e$/tonne.km)	0.01321	0.003	0.01621
HGV ($KGCO_2e$/tonne.km)	0.09752	0.02359	0.12111
HGV Refrigerated ($KGCO_2e$/tonne.km)	0.11417	0.02769	0.14186
Medium car (per mile including WTT) per mile	0.28526	0.07977	0.36503

We have selected the Dairy Products Carbon factor to represent ONS as, given their high dairy content we believe that this is a more suitable factor. In reality it is likely that the carbon factor will be higher than this.

The calculation has been restricted to production and processing based on spend data and transport based tonne.km using a distance-based method.

The same carbon factor has been used for both powdered and ready-made ONS. The development of a more robust, unit-based carbon factor is required, alongside more prescribing data from primary care but the methodology used still demonstrates the impact of prescription behaviors. We welcome and encourage further engagement and advances on this methodology.

Production and Processing

- Spend from primary care (via ePACT2 dashboard x Dairy Product Carbon Factor ($KGCO_2e/£$)

Transport

- This highlights the impact what is transported and where from.
- It has been calculated based on three example scenarios to calculate a carbon cost of transport per serving.
- Using Google Maps, we identified feasible standard routes and modes of transport for these journeys and split this into HGV, cargo ship and refrigerated HGV KMs and calculated using the carbon factors above.
- The factors are based on $KGCO_2e$/tonne.km. WTT emissions have also been included.
- For illustrative purposes 1 tonne of product has been considered. It is noted that 1 tonne of powdered product requires 3.5 tonnes of fresh milk.
- Packaging weight has not been considered as it will not make a material difference to the findings
- 1ml = 1g
- Different nutritional composition of the formulations is recognised but simplified for comparison purposes and in recognition that they are prescribed in broadly similar ways e.g. 1-3 times/day

E.g. 1 Ready To Drink ONS

Western Europe to London

Mode of Transport	Distance (km)	kg of product	tonne.km	kgCO2e
Cargo Ship	283	1	283	4.58743
HGV	297	1	297	35.96967
				40.5571

E.g. 2 Powdered ONS

Midlands, England to London (Powder)

Mode of Transport	Distance (km)	kg of product	tonne.km	kgCO2e
HGV	262	1	262	31.73082

Home County to London (Milk)

Mode of Transport	Distance (km)	kg of product	tonne.km	kgCO2e
Refrigerated HGV	72	3.5	252	35.74872

67.47954 Total