

Institution: University of Surrey		
Unit of Assessment: 3 Allied Health Professions, Dentistry, Nursing and Pharmacy		
Title of case study: Population Vitamin D Requirements: Change in UK Policy and Clinical Guidelines		
Period when the underpinning research was undertaken: 2005-2017		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Prof Susan Lanham-New	Professor of Nutrition; Head Department of Nutritional Sciences	01/04/2011 - present
Dr Kathryn Hart	Senior Lecturer	01/09/2005 - present
Dr Ruan Elliott	Senior Lecturer in Nutritional Science	01/08/2011 - present
Prof Simon de Lusignan	Professor in Primary Care and Clinical Informatics; Vice-Chancellor's Fellow	01/02/2011 - 31/05/2019 01/06/2019 - present
Dr Khim Horton	Senior Lecturer; Care of Older Adults Lead	01/04/2009 - 28/02/2015
Prof Colin P. Smith	Professor of Functional Genomics	01/04/2006 - 01/03/2016
Dr Laura Tripkovic	Teaching Fellow in Nutrition & Dietetics	01/03/2011 - 01/04/2018
Period when the claimed impact occurred: 2016-2020		
Is this case study continued from a case study submitted in 2014? N		
1. Summary of the impact (indicative maximum 100 words) <p>Prior to 2016, no UK Reference Nutritional Intake (RNI) for Vitamin D (VitD) existed as Government nutrition scientists considered that enough VitD was made from sunlight exposure during the spring/summer months in the UK to last through the autumn/winter. Our extensive research on VitD has demonstrated that this is not the case, and our scientific evidence underpinned the UK Government's establishment of the first ever UK RNI for VitD in July 2016. Furthermore, we provided the evidence base for the enhanced benefit of VitD derived from animals (D3) over that derived from plants (D2) and have driven changes within the food industry.</p>		
2. Underpinning research (indicative maximum 500 words) <p>Our work with VitD began in 2005 with a £0.65m grant from the Food Standards Agency (FSA; Grant No. N5064) to investigate the interaction between diet and sunlight exposure on VitD status in White Caucasian and South Asian populations in the UK (Diet, Food Intake, Nutrition and Exposure to the Sun in Southern England – The D-FINES study). In this comparative longitudinal study, we showed that: i) no matter how much VitD was made during the summer months, this was not sufficient to maintain blood VitD levels in the winter months in either group; ii) South Asian</p>		

populations were deficient in VitD for the entirety of the year in the UK [3.1]. In addition, these longitudinal data showed that there were significant regional and ethnic differences in UVB exposure and Vitamin D status for postmenopausal women at northerly latitudes [3.2].

Surrey's Vitamin D group were awarded further pivotal VitD grants. In 2011, the BBSRC Diet & Health Research Industry Club funded project (DRINC - (Grant No. BB98720; £0.78m)) was the largest food fortification study comparing VitD2 (plant form of VitD) and VitD3 (animal form of VitD). Historically, it had been suggested that there was no difference between VitD2 (ergocalciferol) and VitD3 (cholecalciferol) in their effectiveness of improving VitD status. Our research enabled us to challenge the scientific 'status-quo' that VitD2 and VitD3 are equally bioavailable and we were able to demonstrate, in the first-ever D2-D3 meta-analysis and largest D2-D3 Randomised Control Trial (RCT) using VitD fortified foods (rather than VitD supplements), that VitD3 is far superior than VitD2 in raising VitD status [3.3, 3.4].

In 2012, we were successful Co-Investigators on a University College Cork (UCC)-led bid on VitD (ODIN - Grant No. EU00567; €6.2m) and published findings from two RCTs in collaboration with the University of Copenhagen and UCC demonstrating the VitD requirements in two different age-cohorts (4 to 8 yrs and 14 to 18 yrs), for which there was a paucity of data [3.5, 3.6]. This important data was required to support decisions around the appropriateness of any future RNI levels set for VitD.

Our portfolio of VitD research was a key part of our success in the University of Surrey winning the 2017-2018 Queen's Anniversary Prize as a Department and discipline of Nutritional Sciences; and our specific work on D2 vs. D3 has been highlighted in the BBSRC Strategic Document for Nutrition & Health (2015-2020) as an example of exemplary nutrition work with impact. Furthermore, Prof Lanham-New won the prestigious 2018 British Nutrition Foundation (BNF) Annual Prize for her work on VitD and health, delivering the Annual Lecture at the Royal College of Physicians (2019), in the presence of HRH, The Princess Royal.

3. References to the research (indicative maximum of six references)

Bold denotes a University of Surrey affiliation.

- [3.1] **Darling, A., Hart, K., MacDonald, H.M., Horton, K., Kang'Ombe, A.R., Berry, J.L., Lanham-New, S.A.** (2013). Vitamin D deficiency in UK South Asian Women of childbearing age: A comparative longitudinal investigation with UK Caucasian women, *Osteoporos Int* 24 (2) pp. 477-488 DOI: [10.1007/s00198-012-1973-2](https://doi.org/10.1007/s00198-012-1973-2)
- [3.2] **Macdonald, H.M., Mavroei, A., Fraser, W.D., Darling, A.L., Black, A.J., Aucott, L., O'Neill, F., Hart, K., Berry, J.L., Lanham-New, S.A., Reid, D.M.** (2011). Sunlight and dietary contributions to the seasonal vitamin D status of cohorts of healthy postmenopausal women living at northerly latitudes: a major cause for concern? *Osteoporos Int* 22 (9) pp. 2461-2472. DOI: [10.1007/s00198-010-1467-z](https://doi.org/10.1007/s00198-010-1467-z)
- [3.3] **Tripkovic, L., Lambert, H., Hart, K., Smith, C.P., Bucca, G., Penson, S., Chope, G., Hyppönen, E., Berry, J., Vieth, R., Lanham-New, S.A.** (2012). Comparison of vitamin D2 and vitamin D3 supplementation in raising serum 25-hydroxyvitamin D status: a systematic review and meta-analysis., *Am J Clin Nutr* 95 (6) pp. 1357-1364. DOI: [10.3945/ajcn.111.031070](https://doi.org/10.3945/ajcn.111.031070)
- [3.4] **Tripkovic, L., Wilson, L.R., Hart, K., Johnsen, S., de Lusignan, S., Smith, C.P., Bucca, G., Penson, S., Chope, G., Elliott, R., Hyppönen, E., Berry, J.L., Lanham-New, S.A.** (2017). Daily supplementation with 15 µg vitamin D2 compared with vitamin D3 to increase wintertime 25-hydroxyvitamin D status in healthy South Asian and white European women: a 12-wk randomized, placebo-controlled food-fortification trial, *AJCN* (2) pp. 481-490. DOI: [10.3945/ajcn.116.138693](https://doi.org/10.3945/ajcn.116.138693)

[3.5] Smith, T.J., Tripkovic, L., Damsgaard, C.T., Mølgaard, C., Ritz, C., Wilson-Barnes, S.L., Dowling, K.G., Hennessy, Á., Cashman, K.D., Kiely, M., Lanham-New, S.A., Hart, K. (2016). Estimation of the dietary requirement for vitamin D in adolescents aged 14–18 y: a dose-response, double-blind, randomized placebo-controlled trial. *Am J Clin Nutr* 104(5), pp.1301-1309. DOI: [10.3945/ajcn.116.138065](https://doi.org/10.3945/ajcn.116.138065)

[3.6] Mortensen, C., Damsgaard, C.T., Hauger, H., Ritz, C., Lanham-New, S.A., Smith, T.J., Hennessy, A., Dowling, K., Cashman, K.D., Kiely, M., Mølgaard, C. (2016). Estimation of the dietary requirement for vitamin D in 4-8 year-old, white children: A randomized, controlled, dose-response trial. *Am J Clin Nutr*, 104, pp.1310-1317. DOI: [10.3945/ajcn.116.136697](https://doi.org/10.3945/ajcn.116.136697)

4. Details of the impact (indicative maximum 750 words)

Our scientific research across the life cycle and in different ethnicities, has demonstrated that sunlight exposure in the summer does not maintain VitD health during the winter and that the setting of a VitD Reference Nutrient Intake (RNI) was of paramount importance for population health. We have also provided the evidence base for the enhanced benefit of VitD derived from animals (VitD3) over that derived from plants (VitD2). Our scientific evidence through the life-cycle and across groups of different ethnicities has driven changes in UK VitD policy and clinical guidelines and a re-think as to the most effective form of VitD to use in food supplementation/fortification.

1. Change in UK Policy and Clinical Guidelines

Establishment of UK and European RNIs for VitD – Our D-FINES study research outcomes were presented to a UK Government-funded VitD Workshop and were instrumental (together with data from the University of Aberdeen and University College Cork) in persuading the Scientific Advisory Committee on Nutrition (SACN), the FSA and the Department of Health (DoH) to commence a full Risk Assessment for VitD. The scientific evidence used in SACN's deliberations included Surrey's key publication from our VitD study **[3.1]** and also drew on our other key studies **[3.2, 3.3]**. The SACN 'Vitamin D and Health Report' published in July 2016 **[5.1]**, established the first ever RNI for VitD in the UK at 10 micrograms of VitD daily. In their accompanying press release SACN stated *"This recommendation includes pregnant women and population groups at increased risk of vitamin D deficiency: people with dark skin from African, Afro-Caribbean and South Asian backgrounds; people who are confined indoors, such as those in care homes, and people who habitually cover up their skin while outdoors"* thus reinforcing the importance of this policy change for the health of a wide range of the UK population. Establishment of the UK RNI for VitD has initiated national changes for VitD recommendation in the following areas: i) NHS NICE guidelines **[5.2]**; ii) Royal Osteoporosis Society guidelines **[5.3]**; iii) NHS Royal National Orthopaedic Hospital Guidelines **[5.4]**; iv) UK Medicines Information (UKMi) **[5.5]**.

Furthermore, promptly following the publication of the UK SACN report, the European Food Safety Authority (EFSA) published their European Scientific Opinion on Dietary Reference Values for VitD in Oct 2016 **[5.6]** citing our research **[3.1, 3.2, 3.3]** as key scientific evidence.

2. Commercial Impact

Increase in sales of VitD Supplements – As a result of our scientific research and the subsequent SACN report, an article published in *The Grocer* (June 2017) reported that sales of VitD had increased by a third to £7m (Kantar Worldpanel 52 w/e 29 January 2017), making VitD the fastest-growing supplement in the UK vitamins & minerals sector **[5.7]**.

Viridian: As a leading UK Vitamin D supplement company, Viridian realised an increase in Vitamin D supplement sales following establishment of the UK VitD RNI. {Text removed for publication} **[5.8]**.

Food Fortification with VitD by the Food Industry – Our research has also impacted on food fortification strategies within the food industry for example:

Yakult: Establishment of the first RNI for VitD in the UK, and the European (EFSA) dietary recommendation for VitD, directly led Yakult to reformulate their 'Yakult Light' product to incorporate VitD. The reformulated product utilising VitD3 was launched onto the market in January 2020. This addition has enabled Yakult to communicate to their consumers both a nutrient claim and a health claim relating to the benefits of VitD in their product and this has positively impacted on their sales for this product [5.9].

Warburtons: As a result of the implementation of the SACN RNI, Warburtons reformulated their 'Half White Half Wholemeal' sliced bread to incorporate VitD (launched August 2020). The outcomes of the Surrey-led VitD2-D3 study [3.3, 3.4] establishing the enhanced bioavailability of VitD3 directly informed their decision to utilise a vegan friendly form of VitD3 in their reformulation rather than VitD2. Addition of VitD3 into their product is at a level whereby two slices of the bread provide one third of an Adult's RNI and as such is aimed to contribute a significant amount to the daily diet of their consumers. {Text removed for publication} [5.10]

5. Sources to corroborate the impact (indicative maximum of 10 references)

- [5.1] Scientific Advisory Committee on Nutrition (SACN) Vitamin D and Health Report. (July 2016). Public Health England, London. Available at: <https://www.gov.uk/government/publications/sacn-vitamin-d-and-health-report>
- [5.2] NICE Guidelines on Vitamin D (Aug 2017) Available at: <https://www.nice.org.uk/guidance/ph56>
- [5.3] Royal Osteoporosis Society recommendations on Vitamin D. Available at: <https://theros.org.uk/information-and-support/looking-after-your-bones/vitamin-d/>
- [5.4] Vitamin D in Children. NHS. Available at: <https://www.noh.nhs.uk/services/children-and-adolescents/vitamin-d-children>
- [5.5] UK Medicines Information (UKMI) pharmacists vit D advice for NHS healthcare professionals, (Dec 2017). Available at: https://www.sps.nhs.uk/wp-content/uploads/2017/02/UKMI_QA_Vitamin-D-treatment_Jan_2018.docx
- [5.6] EFSA NDA Panel (EFSA Panel on Dietetic Products, Nutrition and Allergies), 2016. Scientific opinion on dietary reference values for vitamin D. *EFSA Journal*, 14(10):4547,145. Doi: [10.2903/j.efsa.2016.4547](https://doi.org/10.2903/j.efsa.2016.4547)
- [5.7] Vitamin D supplement sales boosted by medical reports. The Grocer (08 Jun 2017) Available at: <https://www.thegrocer.co.uk/health/vitamin-d-supplement-sales-boosted-by-medical-reports/553722.article>
- [5.8] Testimonial from Head of Technical Services, Viridian Nutrition [CONFIDENTIAL]
- [5.9] Testimonial from Managing Director, Yakult UK Ltd. (PDF)
- [5.10] Testimonial from Quality Director, Warburtons Ltd [CONFIDENTIAL]
- [5.11] BBSRC 2015-2020. Strategic Plan for Nutrition and Health. Available at: <https://bbsrc.ukri.org/documents/1503-fnh-strategic-framework/>.