Highlights 2012-2017

1. Setting and coordination of new large-scale epidemiological studies

Our research is largely based on cross-sectional and longitudinal observational and interventional studies, set up and coordinated by the team. During the previous mandate, two studies have been set-up or consolidated:

- The NutriNet-Santé study was set up to investigate nutrition and health relationships. Notably, it was the first web-based cohort worldwide in this area and on such a large scale (n=160 000 as of 2017). It is characterized by a very detailed assessment of nutritional exposure and dietary behaviour. A biobank comprising samples of serum, plasma, buffy-coats for genetic analyses, and urine has been set up for 19 600 subjects of the cohort. It represents a unique platform for multidisciplinary research projects and collaborations, with the capability and flexibility to add new protocols and questionnaires and therefore rapidly collect large amounts of high quality data. Our ambition is to expand NutriNet-Santé to other countries. It has already been launched in Belgium and pilot studies are ongoing in Switzerland, Spain, Canada and Mexico. Our team is pioneer at the international level regarding e-epidemiology and has conducted methodological research investigations in this field.
- The Esteban cross-sectional representative study (n=4116) is coordinated by the Santé Publique France part of the team. It reflects French dietary and physical activity habits for surveillance proposes (first results in 2017).

→ Examples of publications: Andreeva Am J Epidemiol 2016 and 2014 (Web of Science 2015 IF=5, rank Q1:12/173), Kesse-Guyot JMIR Public Health Surveill 2016, JMIR 2013; Lassale JMIR 2013; Pouchieu JMIR 2015; Méjean JMIR 2014 (IF=4.5, Q1:5/88)

2. Development of a multi-approach research strategy for etiological nutritional epidemiology

Nutrition is one of the most complex exposures. In order to comprehend all its dimensions and health implications, we have developed a multi-approach research strategy focusing on three levels of investigation: 1) specific food/beverage groups or bioactive compounds (e.g red and processed meat, dietary fibers, polyphenols), 2) biomarkers (e.g. 25OHD status, cholesterol, markers of inflammation, endothelial adhesion, and adiposity), and 3) holistic approach to the overall diet (e.g. nutritional scores, patterns, mixed methods). During the previous mandate, we have applied this research strategy to various health outcomes, resulting in >100 original papers. National and international expert groups in charge of evaluating the weight of evidence of nutrition-health relationships (e.g. INCa 2015, ANSES 2016&2017, WCRF 2017, USDA 2014) have already integrated several of these works in their expertise.

→ Examples of publications: Lassale IJO 2012 (IF=5.3,Q1:6/80); His Eur J Epidemiol 2014 (IF=7.1,Q1:7/173, Top1% citations); Andreeva Arch Intern Med 2012(IF=17.3, Q1:6/154); Deschasaux Am J Clin Nutr 2015 (IF=6.7, Q1:3/80, 1st journal for original studies, field Nutrition&Dietetics); Pouchieu Int J Epidemiol 2014 (IF=9.1, Q1:6/173, 1st journal for original studies, field Public Health); Touvier Int J Cancer 2014 (IF=5.5,Q1:29/213), Am J Epidemiol 2013 (IF=5,Q1:12/173, Top1% citations); Olié Stroke 2012 (IF=5.8,Q1:5/63)

3. From cardio-metabolic and cancer to diversified nutrition-related health outcomes

While maintaining high-quality and innovative research in the fields of cardio-metabolic diseases and cancer (our traditional expertise), we have recently broadened our scope of interest by investigating other nutrition-related health outcomes with high societal and economic burdens. Notably, we have obtained original findings on cognition, depression, chronic inflammation, sleep disorders, migraine, hearing impairment, healthy aging and functional digestive disorders. We recently developed, validated and deployed in the NutriNet-Santé cohort a computerized self-administered cognitive test battery (NutriCog). We also developed an indicator reflecting healthy aging based on the information collected in our cohorts and assessed its associations with various nutritional exposures.

→ Examples of publications: Kesse-Guyot Am J Public Health 2014 (IF=4.1, Q1:16/173), Am J Clin Nutr 2013 (IF=6.7, Q1:3/80, 1st journal for original studies), Am J Epidemiol 2012 (IF=5, Q1:12/173); Assmann JMIR 2016 (IF=4.5, Q1:5/88), Am J Epidemiol 2015 (IF=5, Q1:12/173); Andreeva Am J Clin Nutr 2012; Le Pluart Aliment Pharmacol Ther 2015 (IF=6.3, Q1:9/79)

4. From traditional to new dietary behaviours and exposures

Dietary behaviours are perpetually and rapidly evolving. We developed original projects on emerging dietary behaviours such as organic food and dietary supplement consumption: 1) We launched the ANR BioNutriNet multidisciplinary project in 2014 and developed a large and unique database including a wide range of epidemiological (nutritional and toxicological biomarkers in low and high organic food consumers, exposure to >200 pesticide residues) and environmental impact data, and economic indicators (diet-related expenditure). These will allow exploring the relationships between organic consumption/sustainable diets and health, and will constitute the core area in the European Network “Organic/Sustainable Food System Program” (FAO-labelled initiative). 2) In Western countries, several thousands of ever more diversified dietary supplements are available over the counter while their impact on major chronic disease risk remains largely unknown, with some suspected deleterious effects. During the previous mandate we developed a large dietary supplement use (n=160 000 subjects) and composition (>8000 products) database, making the NutriNet-Santé study the only French prospective cohort with quantitative and repeated assessment of dietary supplement intake (and one of the rare at the international level). Profiles of consumers have been extensively described and will serve as a basis for etiological work in this field during the next mandate.

→ Examples of publications: Baudry Br J Nutr 2015 (IF=3.5, Q1:18/77), Nutrients 2015 and 2017 (IF=3.8, Q1:16/80); Seconda Nutrients 2016; Graffouillere Am J Clin Nutr 2016 (IF=6.7, Q1:3/80, 1st journal for original); Pouchieu Int J Epidemiol 2014 (IF=9.1, Q1:6/173, 1st journal for original studies in the WoS field Public Health), Diallo Oncotarget 2016 (IF=6.3, Q1:36/213)

5. New research projects based on high-throughput omics technics applied to nutritional epidemiology

Metabolomics is an emerging science that provides a snapshot of metabolites present in a biomaterial. Its combination with epidemiological approach is very recent and opens new perspectives for ground-breaking discoveries. Since 2014 our team has obtained several contracts to set up large-scale metabolomics-based projects in diverse fields such as breast and prostate cancers, food metabolome, organic diet, gut microbiota, and cardio-metabolic health (INCa 2014, ANR 2014, Fondation de France 2015, Labex MI 2016, JPI HDHL 2017). For instance, we investigated for the first time whether plasma non-targeted metabolomic profiles could contribute to predict and better understand the risk of

developing breast cancer within the following decade. The first promising results need replication/validation in independent cohorts. They may contribute to developing screening strategies for the identification of at-risk women well before breast cancer symptoms appear and thus improve prevention strategies.

→ Examples of publications: Lécuyer et al, presentation at the World Cancer Research Fund – American Institute for Cancer Research Congress, Washington, October 2017 (corresponding article submitted)

6. Innovative research on determinants of dietary behaviours and physical activity

Among the multitude of factors potentially influencing dietary and physical activity behaviours, our team recently developed research programs on new or relatively unexplored determinants. For instance, we showed that intuitive eating and mindfulness may influence weight status, highlighting the relevance of considering positive (and not only at-risk) behaviours in obesity prevention. We also investigated sensory likings and saliva flow and composition (ANR 2014, INRA metaprogramme DID'IT 2012 and 2016) and demonstrated that individuals belonging to low socioeconomic categories had a stronger liking for fat and sweet, thereby contributing to better understand unhealthy dietary behaviours and their contribution to social inequalities in health. Finally, we initiated a research program on the contribution of life course to socioeconomic inequalities in dietary behaviours in the framework of the European JPI HDHL DEDIPAC. Our results received an international exposure and 2 publications were labelled by the network.

→ Examples of publications: Camilleri Am J Prev Med 2016 (IF=4.5, Q1:14/173); Lampuré IJBNPA 2016 (IF=4.0, Q1:15/83); Andreeva Nutrients 2016 (IF=3.8, Q1:16/80); Si Hassen Nutrients 2016 (IF=3.8, Q1:16/80); Menai IJBNPA 2015 (IF=4.0, Q1:15/83)

7. Epidemiological research with a direct public health application: example of food labelling

The improvement of public health nutrition policies is a major ultimate aim of our research. From 2001, Pr Hercberg has coordinated the French Nutrition and Health Programme (PNNS). In 2013, he was mandated by the French Minister of Health to produce a report in which, among other measures, the implementation of an easy-to-read front-of-pack nutritional label was retained and integrated in the Public Health Law in 2016. Front-of-pack nutritional labelling is thought to be an effective tool to both help consumers make healthier choices and entice food manufacturers to reformulate their products towards healthier nutritional composition. The EREN team developed the 5-colour nutritional label ("Nutriscore") based on the UK Food Standards Agency nutrient profiling system. It attributes a single score of nutritional quality to foods, based on their composition. >15 international publications have been disseminated by our team, based on both observational studies and randomized controlled trials (in collaboration with the CRESS-METHODS team), notably through an experimental online supermarket ("Supernet"). These results confirmed the interest of the Nutriscore as a public health tool, in particular for vulnerable populations. In March 2017, the French Ministry of Health endorsed the Nutriscore to be implemented on food packages in France. Our team has become a key stakeholder in the European debate on food labelling launched in 2017.

→ Examples of publications: Julia Br J Nutr 2014 (IF=3.5, Q1:18/77), J Nutr 2014 and 2015 (IF=3.7, Q1:17/80), IJBNPA 2016 (IF=4.0, Q1:15/83); Ducrot Am J Prev Med 2014 (IF=4.5, Q1:14/173), Nutrients 2015 (IF=3.8, Q1:16/80), Adriouch Int J Cardiol 2017 (IF=4.6, Q1:20/124); Deschasaux BMJ Open 2017 (IF=2.6, Q1:32/155); Donnenfeld Br J Nutr 2016 (IF=3.5, Q1:18/77)

8. Epidemiological research for the improvement of clinical practice

During the previous mandate, several projects have been conducted in close collaboration between epidemiologists and clinicians (inside or outside the team), leading to original results with a potential for direct clinical application. For instance, we developed (SU.VI.MAX) and validated (NutriNet-Santé) a quick screening test for vitamin D insufficiency that can be easily implemented in daily clinical practice. We also investigated the compliance with dietary recommendations among patients with cardiometabolic disorders. We laid the foundations for the setting of sub-cohorts of patients within the NutriNet-Santé study (in the fields of gastrointestinal diseases, rheumatoid arthritis and cancer), opening the way for tertiary prevention research. For instance, we coordinated a multidisciplinary INCa project on dietary and physical activity behaviours in cancer patients of the NutriNet-Santé cohort.

→ Examples of publications: Le Pluart Aliment Pharmacol Ther 2015 (IF=6.3,Q1:9/79); Fassier Medicine 2016 (IF=5.7,Q1:15/154), Int J Cancer 2017(IF=5.5,Q1:29/213), Oncotarget 2017 (IF=6.3,Q1:36/213); Touvier J Clin Endocrinol Metab 2014(IF=5.5,Q1:16/133), J Invest Dermatol 2015 (IF=6.9,Q1:1/61); Deschasaux Medicine 2016 (IF=5.7,Q1:15/154); Lelong J Hyp 2016 (IF=5.1,Q1:5/63)