Tackling the increasing problem of malnutrition in older persons: The Malnutrition in the Elderly (MaNuEL) Knowledge Hub

M. Visser*,†, D. Volkert‡, C. Corish§, C. Geisler¶, L. C. de Groot**, A. J. Cruz-Jentoft††, C. Lohrmann‡‡, E. M. O’Connor §§, K. Schindler¶¶, M. A. de van der Schueren*, and on behalf of the MaNuEL consortium

*VU University Medical Center, Amsterdam, The Netherlands; †Vrije Universiteit Amsterdam, Amsterdam, The Netherlands; ‡Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen-Nürnberg, Germany; §University College Dublin, Dublin, Ireland; ¶Christian-Albrechts-Universität, Kiel, Germany; **Wageningen University, Wageningen, The Netherlands; ††Hospital Universitario Ramón y Cajal (IRYCIS), Madrid, Spain; ‡‡Medical University of Graz, Graz, Austria; §§University of Limerick, Limerick, Ireland; ¶¶Medical University Vienna, Vienna, Austria; ***HAN University of Applied Sciences, Nijmegen, The Netherlands

Abstract

In order to tackle the increasing problem of malnutrition (i.e., protein-energy malnutrition) in the older population, the Joint Action Malnutrition in the Elderly (MaNuEL) Knowledge Hub has been recently launched as part of the Strategic Research Agenda of the Joint Programming Initiative (JPI) A Healthy Diet for a Healthy Life (HDHL). This paper introduces this new European initiative and describes its objectives and design. The MaNuEL consortium consists of 22 research groups from seven countries (Austria, France, Germany, Ireland, Spain, The Netherlands and New Zealand). The Consortium aims to extend scientific knowledge; strengthen evidence-based practice in the management of malnutrition in older persons; build a sustainable, transnational, competent network of malnutrition experts; and harmonise research and clinical practice. MaNuEL is built on five interconnected work packages that focus on (i) defining treatable malnutrition; (ii) screening of malnutrition in different settings; (iii) determinants of malnutrition; (iv) prevention and treatment of malnutrition; and (v) policies and education regarding malnutrition screening and treatment in older persons across Europe. Systematic literature reviews will be performed to assess current research on malnutrition and identify potential knowledge gaps. Secondary data analyses of nutritional intervention trials and observational studies will also be conducted. Using Web-based questionnaires, MaNuEL will provide insight into current clinical practice, policies and health professionals’

Correspondence: Prof. Marjolein Visser, Professor of Healthy Aging Department of Health Sciences, Faculty of Earth and Life Sciences, Vrije Universiteit Amsterdam, De Boelelaan 1085, 1081 HV Amsterdam, The Netherlands.

E-mail: m.visser@vu.nl

1MaNuEL Knowledge Hub coordinators and shared first authorship
Introduction

Protein-energy malnutrition in older Europeans is an increasing health problem, mainly due to changes in demographics. In 2015, 18.9% of the European population was aged 65 years and older. This percentage is expected to increase to 28.1% in 2050 (Eurostat 2017). The prevalence of malnutrition varies widely across different population subgroups of older persons but is generally acknowledged to be higher in older persons with deteriorating health and functional status, and increasing dependency and disability. In the community, malnutrition affects less than 10% of independently living older persons; however, the prevalence of malnutrition has been reported to be 50% and higher in nursing home residents, geriatric patients in acute care hospitals and patients in geriatric rehabilitation (Kaiser et al. 2010; Cereda 2012; Kruizenga et al. 2016; Rojer et al. 2016; Van Zwienen-Pot et al. 2016). Apart from prevalent malnutrition, in all settings a large proportion of older people are at risk of developing malnutrition (Kaiser et al. 2010; Cereda 2012).

Unequivocally, malnutrition is associated with serious health problems, which impact negatively on the wellbeing and quality of life of the individual and also healthcare systems (Abizanda et al. 2016). Earlier studies have focused on malnutrition in older persons in terms of clinical outcomes and consistently reported an increased risk of morbidity (e.g. the development of pressure ulcers and poor wound-healing, infectious complications and hospital readmissions) and mortality (Sullivan & Walls 1998; McMinn et al. 2011) but, in recent years, the relationship between nutritional deficits and functional impairment has become more apparent (Kiesswetter et al. 2014). Energy intake below bodily requirements and the accompanying weight loss aggravate age-related loss of muscle mass and physical function (Newman et al. 2005; Ritchie et al. 2008). Thus, malnutrition has emerged as an important aetiological factor in the development of sarcopenia and frailty, two major geriatric health threats, which, in turn, provoke nutritional problems and may further aggravate malnutrition (Cruz-Jentoft et al. 2010; Mezuk et al. 2016).

Despite increasing scientific interest in malnutrition in older persons over the last decades, many uncertainties remain. There is, for example, still debate about a unified definition of malnutrition in older persons and, consequently, about the optimal screening tool to identify malnourished persons. The effectiveness of nutritional interventions remains unclear (Health Council of The Netherlands 2011), especially in community-dwelling older adults (De van der Schueren et al. 2016). In addition, it is unclear who will benefit most from which intervention and in what setting.

Although malnutrition is currently higher on the agenda of policymakers in several European countries, there is still low awareness of malnutrition in many healthcare settings among healthcare professionals, older persons themselves and their caring relatives (Monteagudo et al. 2015; Ziylan et al. 2015; Craven et al. 2016). Furthermore, research, educational programmes and health policies that contribute to tackling malnutrition in old age mainly take place at a local or national level and employ different methods and strategies. Thus, there is a clear need for more attention to the problem of malnutrition in older adults (Volkert 2013) and for increased communication and co-operation between key stakeholders in government, health care and academia in order to harmonise efforts and strengthen malnutrition research, education and policymaking. A European joint effort could contribute to achieving these aims.

In 2010, the Joint Programming Initiative (JPI) A Healthy Diet for a Healthy Life (HDHL) was launched to achieve the vision that by 2030 all citizens will have the motivation, ability and opportunity to consume a healthy diet from a variety of foods and have healthy levels of physical activity, and that the incidence of diet-related diseases will have decreased significantly (JPI 2015). Within this initiative, in 2015 a call for a Joint Action ‘Malnutrition in the Elderly...
Knowledge Hub’ was launched to support networking activities in this field. On 1 March 2016, the Malnutrition in the Elderly (MaNuEL) Knowledge Hub was established. It includes a consortium of 22 research groups from seven countries [Austria, France, Germany, Ireland, Spain, The Netherlands and New Zealand (Table 1)] supported by a stakeholder advisory board of geriatric nutrition experts who represent relevant European expert societies (Table 2). This paper introduces this new European initiative and describes its objectives and design.

**Objectives of the MaNuEL knowledge hub**

The MaNuEL Knowledge Hub focuses on protein-energy malnutrition in older persons aged 65 years and older. Its four overarching objectives are as follows: gaining knowledge; strengthening evidence-based best practice; building capacity; and harmonising research and clinical practice across Europe.

**Gaining knowledge**

MaNuEL intends to summarise all available information and, thereby, extend scientific knowledge on the definition, prevalence, effective screening and aetiology of protein-energy malnutrition in older persons (aged 65 years and older). Effective interventions to prevent and treat malnutrition in older persons in different healthcare settings across Europe are being evaluated. Thus, MaNuEL will critically appraise the current literature on malnutrition and identify knowledge gaps to be addressed in future projects.

**Strengthening evidence-based best practice**

MaNuEL will translate scientific knowledge into effective, evidence-based strategies such as providing recommendations on the screening and identification of older persons who will benefit from nutritional interventions. The project will also contribute to the identification of effective nutritional interventions for older persons. Finally, it will propose validated methods for assessing determinants of malnutrition and raise awareness of different nutritional needs in specific subgroups of older persons.

**Building capacity**

MaNuEL will develop a productive, sustainable and competent network of researchers from various European countries and beyond with complementary expertise in the field of malnutrition in older persons. It will support transnational communication and collaboration between individual researchers, research groups, European research organisations and other stakeholders, and thus support ‘joined-up’ research and advice in the area of malnutrition in older persons.

**Harmonising research and clinical practice**

MaNuEL will promote harmonisation of clinical practice, research, policies and education with regard to malnutrition. Particular emphasis will be placed on harmonising screening and assessment of malnutrition in older persons in clinical practice and research. Furthermore, harmonisation of data collection, databases and data analyses will occur within MaNuEL. Together, these efforts will facilitate future collaborative projects in European countries and optimise ongoing work in the area.

**Design of the MaNuEL knowledge hub**

The MaNuEL Knowledge Hub comprises five interrelated work packages focused on (i) the definition of malnutrition; (ii) screening of malnutrition; (iii) determinants of malnutrition; (iv) interventions to prevent and treat malnutrition; and (v) policies and education regarding malnutrition screening and interventions. These work packages are built on the MaNuEL conceptual model of malnutrition (Fig. 1). A sixth work package is dedicated to the management of the MaNuEL Knowledge Hub. The objectives and work plan of each work package are described below and summarised in Table 3.

**The definition of malnutrition**

Protein-energy malnutrition in older persons is not well defined, which has resulted in incomparable and widely varying prevalence data and confusion about correctly identifying affected persons. Definitions tend to be consensus based and not empirically derived, for example the recently published European Society for Clinical Nutrition and Metabolism (ESPEN) criteria for the diagnosis of malnutrition (Cederholm et al. 2015).

The first objective of this work package is to develop a definition of treatable malnutrition in older persons based on empirical data. Treatable malnutrition describes malnutrition that can be successfully treated using a nutritional intervention (*i.e.* by the...
<table>
<thead>
<tr>
<th>Country</th>
<th>Partner organisation</th>
<th>Names of researchers involved</th>
<th>Role in project</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Netherlands</td>
<td>VU University Medical Center, Amsterdam</td>
<td>Prof. Marjolein Visser, Dr. Ilse Reinders, Judith van Zwiienen-Pot</td>
<td>Knowledge Hub co-coordinator, WP1 leader, WP6 leader</td>
</tr>
<tr>
<td></td>
<td>Wageningen University, Wageningen</td>
<td>Prof. Lisette de Groot, Elen Sneets</td>
<td>WP1 leader</td>
</tr>
<tr>
<td></td>
<td>Nijmegen University of Applied Sciences, Nijmegen</td>
<td>Dr. Marian de van der Schuuren, Dr. Susanne Leij-Halfwerk</td>
<td>WP2 leader</td>
</tr>
<tr>
<td></td>
<td>Dutch Malnutrition Steering Group, Amsterdam</td>
<td>Dr. Eva Leistra, Dr. Elke Naumann, Ellen van der Heijden</td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>Friedrich-Alexander-Universität Erlangen-Nürnberg</td>
<td>Prof. Dorothee Volkert, Dr. Eva Kieswetter, Melanie Streicher, Gabriel Torbahn</td>
<td>Knowledge Hub co-coordinator, WP3 leader, WP6 leader</td>
</tr>
<tr>
<td></td>
<td>University Kiel, Kiel</td>
<td>Dr. Corinna Geisler, Dr. Antje Hebestreit, Dr. Maike Wolters</td>
<td>WPM1 leader</td>
</tr>
<tr>
<td></td>
<td>Leibniz Institute for Prevention Research and Epidemiology, Bremen</td>
<td>Dr. Gabriele Nagel, Dr. Marion Flechtner-Mors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ulm University, Ulm</td>
<td>Prof. Heiner Boeijing, Dr. Marta Stelmach-Mardas</td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>Medical University Vienna, Vienna</td>
<td>Dr. Karin Schindler, Tamara Ranzenberger-Haider</td>
<td>WP5 leader</td>
</tr>
<tr>
<td></td>
<td>Medical University Graz, Graz</td>
<td>Prof. Christa Lohmann, Dr. Sandra Schüssler, Doris Egseer, Isabell Kravanja</td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>Champmaillot Centre Geriatric Research Unit, Dijon</td>
<td>Dr. Virginie van Wymelbeke</td>
<td></td>
</tr>
<tr>
<td></td>
<td>French National Institute for Agricultural Research, Dijon</td>
<td>Dr. Claire Sulmont Rossé</td>
<td></td>
</tr>
<tr>
<td></td>
<td>French National Institute for Agricultural Research, Clermont-Ferrand</td>
<td>Dr. Dominique Dardevet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>School of Agricultural Studies, Angers</td>
<td>Dr. Isabelle Maitre, Prof. Yves Rolland</td>
<td></td>
</tr>
<tr>
<td>Ireland</td>
<td>University College Dublin, Dublin</td>
<td>Dr. Clare Corish, Dr. Eileen Gibney, Dr. Michelle Clarke, Prof. Giuseppe De Vito, Laura Bardon, Lauren Power</td>
<td>WP2 leader</td>
</tr>
<tr>
<td></td>
<td>University of Limerick, Limerick</td>
<td>Dr. Eibhils O’Connor, Dr. Mary O'Keffe, Mary Kelly, Prof. Paul O'Toole, Dr. Eileen O'Herlihy</td>
<td>WP3 leader</td>
</tr>
<tr>
<td></td>
<td>University of Cork, Cork</td>
<td>Dr. Suzanne Timmons, Prof. Paul O’Toole, Dr. Eileen O’Herlihy, Dr. Patricia Kearney, Dr. Suzanne Timmons</td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>Instituto Ramón y Cajal de Investigación, Santanera, Madrid</td>
<td>Prof. Alfonso Cruz-Jentoft, Dr. Isabel Lozano, Dr. Andrea Correa</td>
<td>WPM1 leader</td>
</tr>
<tr>
<td>New Zealand</td>
<td>University of Auckland, Auckland</td>
<td>Dr. Ruth Teh</td>
<td></td>
</tr>
</tbody>
</table>
supplementation of energy and protein) leading to improved nutritional status and clinical outcome. The clear advantage of developing criteria for treatable malnutrition is that it allows the identification of those older persons who are more likely to benefit from treatment. It also contributes to more effective screening and intervention, not only benefitting the malnourished older individual but also health care in general by improving intervention strategies and reducing costs. If possible, the definition of treatable malnutrition will be based on secondary data analyses of multiple, international nutritional intervention trials conducted in older persons with malnutrition or at high risk of malnutrition. The participant data from these studies will be harmonised and pooled to establish a unique international database. In case of insufficient information on, or inadequate data quality of, the required variables in the available trials, the pooled data set will be used to determine the overall effectiveness of nutritional interventions in older persons and to identify potential factors (e.g., intervention or patient characteristics) that may influence their effectiveness. The second objective of this work package is to report the prevalence of malnutrition across Europe using a standardised definition and secondary data analyses of multiple existing data sets available within the Knowledge Hub (see also work package 3). By using a standardised definition, prevalence data can be directly compared between cohorts, countries, settings, and sex and age groups. The third and final objective of this work package is to provide insight into body composition characteristics of older persons with malnutrition. Existing databases, which include detailed body composition measures using accurate techniques such as dual-energy X-ray absorptiometry, computed tomography and/or magnetic resonance imaging, are being consolidated for standardised secondary analyses.

### Screening of malnutrition

Early detection of malnutrition or risk of developing malnutrition is important to start effective treatment or mitigate its development and the associated negative health effects. Screening should focus on those at risk as well as on those already affected as both can be addressed by intervention. Screening tools that consider several aspects of malnutrition simultaneously are currently considered appropriate for the identification of persons with malnutrition or at risk of malnutrition (Kondrup et al. 2003; Bauer et al. 2010). Unfortunately, there is presently no agreement on the types and combination of factors which should be assessed by these tools. A multitude of tools are available differing in, for example, the parameters included, tested validity and reproducibility, time to administer and practicability for use in older persons. Importantly, screening should detect older persons who are likely to be malnourished and, if malnutrition is confirmed after assessment, who are likely to benefit from nutritional intervention, as this will lead to (cost-)effective screening and treatment of malnutrition. Finally, older persons at risk of developing malnutrition should also be screened, so that preventive measures may be started to avert malnutrition. Screening tools addressing the risk of malnutrition should use evidence-based information on the most relevant

#### Table 2

<table>
<thead>
<tr>
<th>Name</th>
<th>Representing organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elizabeth Archer</td>
<td>The European Federation of the Associations of Dietitians (EFAD)</td>
</tr>
<tr>
<td>Dr. Anne Marie Beck</td>
<td>Herlev University Hospital, Gentofte, Denmark</td>
</tr>
<tr>
<td>Prof. Alfonso Cruz-Jentoft</td>
<td>European Union Geriatric Medicine Society (EUGMS)</td>
</tr>
<tr>
<td>Prof. Marcello Maggio</td>
<td>University of Parma, Italy</td>
</tr>
<tr>
<td>Dr. Frank de Man</td>
<td>The European Nutrition for Health Alliance (ENHA)</td>
</tr>
<tr>
<td>Dr. Marian de van der Schueren</td>
<td>The European Society for Clinical Nutrition and Metabolism (ESPEN)</td>
</tr>
</tbody>
</table>

#### Figure 1

The MaNuEL Knowledge Hub conceptual model of malnutrition in older age

The first objective of this work package is to identify existing screening tools for malnutrition in older adults reported in the scientific literature. Following a comprehensive search for existing tools, details about each tool (e.g. setting, screening parameters, validity, reproducibility, language) will be listed. The second objective is to select the best malnutrition screening tool(s) for older adults in different community and healthcare settings. This will be achieved by developing an objective rating system based on, among others, the validity and suitability of the parameters included to assess malnutrition risk in older people and its practical use (e.g. time taken to perform the screening). The third objective is to obtain malnutrition and malnutrition risk prevalence data in older adults across Europe (and beyond) by reviewing published literature and analysing existing data sets using the identified preferred screening tools. By restricting the previously published prevalence data to those collected by the preferred tool(s), the obtained prevalence data can be compared across different sex and age groups, setting and countries.

Determinants of malnutrition

Generally, malnutrition is caused by an imbalance between energy intake through the diet and energy requirements. In older persons, many factors may contribute to this imbalance. In addition to the age-related physiological decrease in appetite [i.e. anorexia of ageing (Landi et al. 2010)], many common characteristics of older age – for example sensory decline, chewing and swallowing problems, physical and cognitive impairment, depression, polypharmacy, low-grade inflammation, imbalanced gut microbiome, poverty and loneliness – may reduce dietary intake and could be regarded as causes of malnutrition (Clarke et al. 1998; McMinn et al. 2011; Claesson et al. 2012; Van der Pols-Vijlbrief et al. 2014). An imbalance between energy intake and requirements may also develop when nutritional needs increase, for example as a consequence of acute or chronic disease, maldigestion and malabsorption, which are most
prevalent in geriatric patients in acute care and rehabilitation. Inadequate dietary intake and increased nutritional requirements will result in malnutrition in older persons. There is a clear lack of knowledge about determinants of malnutrition in older persons based on prospective studies. Furthermore, knowledge is lacking on how these determinants might interact. Finally, previous studies have used different definitions of malnutrition and different assessment tools to measure the determinants, which complicates interpretation of the findings. Lastly, determinants may vary according to older persons’ characteristics (e.g. according to function level) or healthcare setting.

The first objective of this work package is to summarise the present knowledge about determinants of malnutrition in older persons by means of a systematic literature review with a focus on longitudinal studies (which are more informative than cross-sectional studies regarding the direction of a potential relationship) and modifiable determinants (which are most relevant to the prevention and treatment of malnutrition). The findings will be combined in a model, similar to the Determinants Of Nutrition and Eating (DONE) model developed in the Determinants of Diet and Physical Activity (DEDIPAC) Knowledge Hub (Stok et al. 2017). The second objective is to identify determinants of (incident) malnutrition in existing data sets from MaNuEL partners by secondary data analysis using uniform and standardised approaches. The third objective is to create a list of commonly used methods to specifically assess the identified determinants of malnutrition (e.g. questionnaires to assess poor appetite), including information about their validity and reliability for older persons in different settings, derived from the literature and personal experience. It is hoped that this work package will result in a better understanding of the aetiology and complex network of determinants of malnutrition, which is important for effective prevention and treatment of malnutrition.

Interventions to prevent and treat malnutrition

Malnutrition due to anorexia of ageing is regarded as a ‘true geriatric syndrome’ (Morley 2012) that needs active prevention and treatment. Treatment of malnutrition currently does not receive appropriate attention within health care due to low awareness (Leach et al. 2013). In addition, the effectiveness of many malnutrition treatment strategies used in clinical practice and potential differences in their efficacy in different care settings are still largely unknown. Treatment has mainly focused on increasing energy and protein intake through oral nutritional supplements, dietary counselling or the combination of both, but other treatment interventions (e.g. involving food fortification, texture modification and physical activity) as well as preventive interventions (e.g. elimination of risk factors) are relatively understudied (Van der Pols-Vijlbrief et al. 2016). An assessment of the benefits achieved by specific intervention approaches to prevent and/or treat malnutrition is needed. This will support the development of effective, evidence-based approaches for different healthcare settings.

The first objective of this work package is to review the effectiveness of nutritional and other non-pharmacological interventions for the prevention and treatment of malnutrition in older persons. This will be achieved by means of a systematic literature review using the SENATOR-ONTOP systematic review protocol (Abrahã et al. 2015). The second objective is to develop an international inventory of all ongoing and planned nutritional and non-nutritional (excluding pharmacological) intervention studies for the prevention and treatment of malnutrition in older persons. Thus, this work package will provide evidence-based and current recommendations on the prevention and treatment of malnutrition in older persons on which future practice and scientific studies can be based.

Policies and education regarding screening and intervention for malnutrition

Although it is known that policies and practices for screening and treatment of malnutrition in older persons vary widely across Europe (Cruz-Jentoft 2011; Hrnčiaríková & Zadák 2011; Ihle-Hansen et al. 2011; Vandewoude et al. 2011), at present little is known about the specific activities in different countries. Best practice examples may exist and serve as models for other countries. Also, it is known that healthcare professionals receive little education on nutrition despite this being highly relevant to patient care (Devries et al. 2014) and it is unknown to what extent and in which form knowledge about malnutrition in older persons is imparted to different groups of healthcare professionals. Therefore, it is imperative to determine the policies, practices and education curricula that are implemented across Europe in order to establish the best practice.

The first objective of this work package is to review current policies and practices across Europe regarding screening and treatment of malnutrition in older persons in different healthcare settings. The second objective is to review the formal education of healthcare
professionals across Europe about the screening and treatment of malnutrition in older persons. This work will be conducted using Web-based surveys among relevant stakeholders throughout the European Union.

Management

The MaNuEL Knowledge Hub is managed by two co-coordinators: Professor Dorothee Volkert (Friedrich-Alexander University, Nurnberg, Germany) and Professor Marjolein Visser (VU University Medical Center and Vrije Universiteit Amsterdam, The Netherlands). In addition, leaders and co-leaders have been appointed to manage the work conducted within the work packages (see Table 1). The MaNuEL Knowledge Hub is supported by a stakeholder advisory board, which includes five international malnutrition experts who also represent relevant European professional societies (see Table 2).

Conclusion

Dietary behaviour and nutrition are considered key factors influencing healthy ageing (WHO 2015). In older persons, the problem of malnutrition and its negative consequences are well acknowledged; however, many challenges remain with regard to the optimal screening, assessment and treatment of malnutrition. MaNuEL aims to fulfill the need for an international approach to address these challenges. The two-year MaNuEL project will serve as an important basis for establishing a collaborative network of researchers in the field of malnutrition in older persons.

Acknowledgements

This work was initiated by the Joint Programming Initiative A Healthy Diet for a Healthy Life. The funding agencies supporting the MaNuEL Knowledge Hub are as follows (in alphabetical order of participating Member State): Austria, Federal Ministry of Science, Research and Economy (BMWFW); France, Ecole Supérieure d’Agricultures (ESA); Germany, Federal Ministry of Food and Agriculture (BMEL) represented by Federal Office for Agriculture and Food (BLE); Ireland, Department of Agriculture, Food and the Marine (DAFM) and the Health Research Board (HRB); Spain, Instituto de Salud Carlos III, and the SENATOR trial (FP7-HEALTH-2012-305930); and The Netherlands, The Netherlands Organisation for Health Research and Development (ZonMw).

Conflict of interest

The authors have no conflict of interest to disclose.

References


