Applied nutritional investigation

Detection and treatment of medical inpatients with or at-risk of malnutrition: Suggested procedures based on validated guidelines

Lisa Bounoure Ph.D., Filomena Gomes R.D., Ph.D., Zeno Stanga M.D., Ulrich Keller M.D., Rémy Meier M.D., Peter Ballmer M.D., Rebecca Fehr R.D., Beat Mueller M.D., Laurence Genton M.D., Pauline Coti Bertrand M.D., Kristina Norman Ph.D., Christoph Henzen M.D., Alessandro Laviano M.D., Stephan Bischoff M.D., Ph.D., Stéphane M. Schneider M.D., Jens Kondrup M.D., Philipp Schuetz M.D., M.P.H. Members of the Working Group

Objective: Despite the high prevalence of malnutrition in the general inpatient population, there is a lack of knowledge in regard to detecting disease-related malnutrition and implementing nutritional support. Our aim was to suggest practical procedures for screening and treating malnourished or at-risk patients hospitalized in medical wards, thereby fostering a straightforward implementation of nutritional therapy independent of the underlying disease and comorbidities.

Methods: A working group of experts in clinical nutrition selected and analyzed published disease-specific European Society for Clinical Nutrition and Metabolism (ESPEN) guidelines relevant for our aim. Eight questions in population, intervention, control, outcome format were defined to cover topics such as screening, nutritional targets, and routes of feeding. Individual studies were extracted from the guidelines by applying inclusion and exclusion criteria targeting the heterogeneous population of medical inpatients with or at-risk of disease-related malnutrition. We used those studies as evidence, as well as recommendations from the selected ESPEN guidelines, to formulate answers to the questions. Final agreement with the statement was obtained by consensus of the whole working group.

L.B. and F.G. contributed equally to this study. We thank warmly all member of the expert working group for their contribution to the development of these suggested procedures. The working group (see Acknowledgment section) selected relevant ESPEN disease specific guidelines, defined topics of interest, and developed the clinical questions. L.B. and F.G. extracted the studies from each selected guidelines after defining the inclusion and exclusion criteria applying to participants, outcomes, and study design; compiled the recommendations of the selected ESPEN guidelines; analyzed the extracted evidence, formulated the statements for each question, and drafted the manuscript. All members of the working group expressed their level of agreement with each statement. All authors reviewed and approved the manuscript. P.S. has primary responsibility for final content. P.S. is supported by the Swiss National Science Foundation (SNSF Professorship, PP00P3_150331/1) and the Research Council of the Kantonsspital Aarau, Switzerland (1410.000.044). Nestle Suisse SA supported the research project with an unrestricted research grant. Abbott AG provided a fellowship grant for the development of nutritional guidelines.

* Corresponding author. Tel.: +41 (0)62 838 9524; fax: +41 (0)62 838 6945.
E-mail address: Philipp.Schuetz@unibas.ch (P. Schuetz).
Results: Procedures on how to provide integrated nutritional therapy (oral, enteral, and parenteral) to a heterogeneous patient population were suggested, including how to identify malnourished or at-risk patients, nutrient targets, choice of feeding route, monitoring, and assessment of patients. We also developed a simple algorithm to facilitate the implementation of a nutritional care plan for the general medical inpatient population.

Conclusion: By compiling evidence and recommendations from disease-specific guidelines, we were able to suggest a nutritional strategy applicable to large and heterogeneous group of malnourished or at-risk patients admitted to hospitals. A large randomized controlled trial is currently investigating whether this strategy improves outcomes of patients.

© 2016 Elsevier Inc. All rights reserved.
The NRS is a nutrition screening tool that includes the evaluation of nutritional risk, disease severity and age of the patient. It was developed based on a retrospective analysis of 128 RCTs of nutritional therapy versus no therapy on clinical outcome in hospitalized patients [13]. This analysis suggested that the NRS was able to identify patients at risk of malnutrition and to determine who would or would not benefit from nutritional support, being a score of at least 3 indicative of a increased risk of DRM and potential benefits from nutritional interventions. The trials included in the study were performed in clinically heterogeneous groups of patients including surgical, critically ill, and long-term care patients. Following this retrospective analysis, a prospective RCT focusing on 212 patients, predominantly hospitalized on medical wards (68% of the included patients) was conducted. The NRS enabled to identify individuals at risk of DRM, yet the intervention did not result in significant effects on complications rate, length of hospital stay or quality of life (QoL), questioning therefore the capacity of the NRS to predict positive outcomes following nutritional therapy in the medical inpatient population [14].

For the hospital setting, ESPEN recommends using the NRS to determine the risk of malnutrition within 48 h post-admission [15]. Most disease and organ-specific selected guidelines, however, do not provide recommendation on the choice of malnutrition screening and assessment tools, rather relying on weight loss or BMI to identify patients at risk of malnutrition. Those parameters are also commonly used to diagnose DRM.

The following table provides an example of Studies extracted from selected ESPEN guidelines and used to answer each clinical question:

<table>
<thead>
<tr>
<th>Search question</th>
<th>Source, year</th>
<th>Studies included (author, year)</th>
<th>Study design</th>
<th>Participants (main diagnostic, N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 1</td>
<td>ESPEN Guidelines for Nutrition Screening 2002, 2003</td>
<td>Kondrup et al., 2003</td>
<td>Retrospective analysis</td>
<td>Various acute illnesses, 8944</td>
</tr>
<tr>
<td>Question 2</td>
<td>ESPEN Guidelines for Nutrition Screening 2002, 2003</td>
<td>Johansen et al., 2003</td>
<td>RCT</td>
<td>Various diagnostics, 212</td>
</tr>
<tr>
<td></td>
<td>ESPEN Guidelines for Nutrition Screening 2002, 2003</td>
<td>Johansen et al., 2003</td>
<td>RCT</td>
<td>Various diagnostics, 212</td>
</tr>
</tbody>
</table>

**Note:** RCT, randomized controlled trial.
Based on the available evidence, the NRS should be used in medical wards to identify patients at risk of malnutrition and start nutritional therapy in patients with a score of at least 3 points within 48 h post hospital admission. Yet, the NRS is not intended to establish the diagnosis of existing malnutrition. When possible, a full nutrition assessment (including an in-depth evaluation of anthropometric, biochemical, clinical, and dietary information) should be performed in patients with an NRS ≥3 to determine if the patient is truly malnourished, to understand the causes of malnutrition and thus to support the development of a tailored nutrition care plan.

Table 2: Consensus opinion on nutritional therapy for general patients in medical wards of hospitals

<table>
<thead>
<tr>
<th>Topics</th>
<th>Recommendations</th>
<th>Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>The NRS should be used in medical wards to identify patients at risk of malnutrition (i.e. with a score of at least 3 points), within 48 h post–hospital admission. A full nutritional assessment (including an in-depth evaluation of anthropometric, biochemical, clinical, and dietary information) should be performed in patients with an NRS ≥3 to determine if the patient is truly malnourished, to understand the causes of malnutrition and thus to support the development of a tailored nutrition care plan.</td>
<td>Strong</td>
</tr>
<tr>
<td>Energy and protein requirements</td>
<td>REE should be individually measured by indirect calorimetry. When indirect calorimetry cannot be used, we suggest calculating REE with the body weight-adjusted Harris-Benedict formula as long as clinical judgment and experience is also used to determine the final caloric targets. Intakes of protein increased to at least 1.2 g/kg BW/d should be provided to correct or prevent protein malnutrition in malnourished or at-risk medical inpatients. We suggest lowering the protein intake to 0.8 to 1 g/kg BW/d for patients with acute and chronic renal failure without renal replacement therapy.</td>
<td>Strong</td>
</tr>
<tr>
<td>Micronutrients and other nutrients requirements</td>
<td>We suggest supplementing malnourished or at-risk medical inpatients on oral nutrition with multivitamins and multiminerals to reach the recommended dietary allowance for micronutrients, thereby correcting or preventing deficiencies. However, an individual assessment of patients remains crucial to specifically correct deranged values of micronutrients.</td>
<td>Weak</td>
</tr>
<tr>
<td>Additional oral supplementation</td>
<td>ONS should be used in addition to hospital meals ideally adapted to individual preferences, to meet nutritional requirements and improve outcomes of malnourished or at-risk medical inpatients. Fortification of meals and providing patients with between-meal snacks should be at least equally part of the strategy to supplement intakes.</td>
<td>Strong</td>
</tr>
<tr>
<td>Route, monitoring and reassessment</td>
<td>Enteral tube feeding, ideally maintaining some oral food intake, should be implemented in medical inpatients with or at-risk of DRM who could not reach 75% of their energy and protein targets (or consume more than 75% of the food served daily) within 5 d of oral feeding and for whom clinical judgment predicted that oral nutrition would not be sufficient to improve nutritional intakes. Intakes should be reassessed every 24 to 48 h. We recommend starting parenteral nutrition with a minimal oral or enteral feeding when possible, if oral and/or enteral nutrition is not possible or if at least 75% of energy and protein targets have not been reached during the 5 d following the beginning of enteral nutrition. Intakes should be reassessed every 24 to 48 h.</td>
<td>Strong</td>
</tr>
</tbody>
</table>

BW, body weight; d, days; DRM, disease-related malnutrition; ONS, oral nutritional supplements; NRS, Nutritional Risk Screening; REE, resting energy expenditure

Question 2. In malnourished or at-risk medical inpatients, does nutritional therapy result in improved outcomes when compared with usual care?

Studies describing any type of nutritional therapy interventions (oral, enteral, or parenteral) in medical inpatients with or at-risk of DRM were considered.

From six studies extracted, 1 systematic review of 325 patients showed weight gain and improved health-related QoL (measured by St George’s Respiratory Questionnaire) in patients with chronic obstructive pulmonary disease (COPD) receiving oral, enteral, or parenteral feeding versus control [17]. We found three RCTs, two of which confirmed positive effects of nutritional therapy on weight stabilization (31 randomized patients with alcoholic hepatitis fed by the enteral route) [18] and weight gain (29 patients with acute leukemia receiving dietary counselling) [19]. The third found no effect in 212 patients with various diseases receiving dietary counselling and tailored nutritional support [14]. In the same study, the intervention resulted in increased protein and energy intake. One very small non-randomized trial from 1989 performed on eight patients with congestive heart failure treated with enteral feeding resulted in gain of lean body mass but loss of weight [20]. In the sixth study, a non-randomized trial of 273 patients with alcoholic hepatitis receiving high-calorie, high-protein supplements with oxandrolone versus low-calorie, low-protein supplements without the drug, reduction of mortality, severity of disease and malnutrition was observed [21]. None of the studies included demonstrated effects of nutritional therapy interventions on length of stay (LOS) [14] or prevention of infection [19].

Due to inconsistent results and/or the lack of well-designed high-quality evidence, some of the disease-specific guidelines we selected are not providing recommendations about nutritional therapy in malnourished or at-risk patients. Available recommendations, however, consistently support this practice to improve nutritional status. Nutritional therapy is also recommended to improve other outcomes in particular groups of patients (e.g., improve survival in liver failure or geriatric patients).

Based on the limited available evidence and recommendations found in selected guidelines, there is a good rationale that nutritional therapy should be considered in malnourished or at-risk medical inpatients for at least 5 to 7 d in order to improve nutrition-related outcomes. More studies are needed in this group of patients to better understand if other outcomes can be improved in general medical inpatients (e.g., clinical, health resources and patient-centered outcomes).

Energy and protein requirements

Question 3. In malnourished or at-risk medical inpatients, should the gold-standard method indirect calorimetry be used to determine individual energy requirements, when compared with predictive equations?
**Fig. 1.** Nutritional algorithm: graphical representation of the suggested procedures.
Energy requirements of hospitalized patients differ depending on total energy expenditure, which is largely affected by body size, composition, as well as type and severity of disease. Indirect calorimetry is the gold standard method to determine total energy expenditure by measuring resting energy expenditure (REE) and including energy expenditure linked with physical activity and consumption of food [22,23]. However, the costs, availability, and practical considerations (e.g., requirement of trained personal to perform measurements or fasting periods before measurement) impose major barriers in using this method and might explain its underuse often observed in medical wards of hospitals [24]. The Harris-Benedict equation is more frequently used in hospitals to calculate REE and estimate caloric requirements, taking in consideration activity and stress factors. In under- and overweight patients, this equation does not enable precise calculation of REE. Using the Harris-Benedict equation with adjusted body weight (BW) calculated with the formula adjusted BW = (actual BW - ideal BW) x 25% + ideal BW might improve its accuracy, although it is still unclear how to ideally adjust BW in patients with a body weight outside of the normal range [25].

We found eight studies among the guidelines assessing REE in groups of malnourished or at-risk medical patients with various acute illnesses (acute renal failure [26], cancer [27,28], ulcerative colitis [29], acute pancreatitis [30], alcoholic hepatitis [31,32], congestive heart failure [33]). Among them, we found six studies (four observational studies [27–30] and two non-randomized trials [31,32]), in which REE was measured by indirect calorimetry and compared to the value predicted by Harris-Benedict formula. The formula failed to accurately predict REE in all studies. In addition, of the eight studies extracted, four non-randomized trials showed an increase REE of 42% [26], 55% [29], 6% [30], and 18% [33] for inpatients, compared to healthy controls.

If recommendations given by ESPEN for energy intakes are different for each disease type, indirect calorimetry is invariably suggested as the method of choice to determine energy targets. Because the total energy expenditure of malnourished or at-risk patients hospitalized in medical wards varies largely among this heterogeneous group, REE should be individually measured by indirect calorimetry to enable an accurate calculation of the energy requirements. However, when this method cannot be used, we suggest calculating REE with the body weight-adjusted Harris-Benedict formula as long as clinical judgement and experience is also used to determine the final caloric targets.

Question 4. In malnourished or at-risk medical inpatients, do increased protein intakes result in improved outcomes, when compared with usual care?

Protein needs are generally increased in case of illness and hospitalization as a compensation for higher protein breakdown and to limit loss of total body protein mass and malnutrition [34].

A total of six studies from the selected guidelines met our selection criteria and were included. One observational study of eight ulcerative colitis patients suggested that intakes of at least 1.4 g/kg BW/d are necessary to achieve nitrogen equilibrium [29]. In another small sample of six HIV patients, parenteral feeding supplying at least 1.2 kg BW/d of protein enabled patients to reach a positive nitrogen balance [35]. Of four studies conducted on individuals with liver disease [36–39], two studies (one observational of 37 patients [36] and one non-RCT of eight patients [37]) showed that patients receiving hospital diet providing 1.2 g of protein/kg BW/d achieved positive nitrogen balance. Improved physical condition was also found in the small non-RCT [37]. One RCT of 36 patients found that oral diet providing 1.5 g of protein/kg BW/d had no effect on mortality, complications, or nutritional status [38]. The fourth study, an RCT of 64 patients from 1985 showed that protein supplementation of 65 g/day resulted in a positive nitrogen balance, but higher complication rates and no effect on mortality [39]. It is however impossible to assess the amount of protein per kilogram of BW that those patients received. Consistent with our findings, most selected guidelines recommend higher protein intakes (at least 1.2 g/kg BW/d). If malnutrition is diagnosed, including in elderly individuals, the ESPEN recommended protein intakes are further increased to 1.2 to 1.5 g protein/kg BW/d.

Intakes of protein increased to at least 1.2 g/kg BW/d should be provided to correct or prevent protein malnutrition in malnourished or at-risk medical inpatients. More studies are needed to draw conclusions about the clinical benefits of increased protein intake and optimal amounts to treat different diseases.

Detrimental effects of high protein consumption on kidneys have been demonstrated [40]. Defining the protein targets of patients with or at risk of DRM and with altered kidney function is challenging, particularly for elderly patients, whose protein needs are further increased, creating a paradox difficult to handle for clinicians. Interestingly, soy-based proteins might be less harmful for kidneys [41], although their use is still controversial and requires more RCTs to be implemented safely [42].

No study from the ESPEN guidelines for acute renal failure patients met our inclusion criteria because a large majority was performed on intensive care patients. Based on the recommendations found in ESPEN guidelines and clinical judgement, we suggest lowering the protein intake to 0.8 to 1 g/kg BW/day for at-risk or malnourished medical inpatients with acute and chronic renal failure without renal replacement therapy.

**Micronutrients and other nutrients requirements**

**Question 5. In malnourished or at-risk medical inpatients, does the supplementation of vitamins, minerals, and/or other nutrients (e.g. n-3 fatty acids and branched amino-acids) result in improved outcomes, when compared with usual care?**

Electrolytes and vitamins deficiencies are common in patients with or at-risk of DRM with acute diseases requiring hospitalization in medical wards [43]. Furthermore, overfeeding of those patients can result in refeeding syndrome, also creating or worsening micronutrient deficiencies. Providing patients with supplementation (such as multivitamin, multimineral, or micronutrient supplements) might help prevent or correct existing deficiencies. Due to their anti-inflammatory properties, n-3 fatty acids supplementation might also be beneficial in some hospitalized patients.

We found two studies investigating micronutrient supplementation in medical inpatients with or at risk of DRM. Both were recent RCTs studying acute pancreatitis patients for the effects of high-dose vitamin C and vitamin C in combination with selenium and n-acetylcysteine, respectively. The first study was performed on 84 patients and showed increased recovery rate, improved cellular immune function as well as reduced rate of complications and LOS in the intervention group [44]. In the second study of 43 patients, vitamin C, selenium, and n-acetylcysteine treatment did not improve organ function, mortality, and LOS and did not reduce oxidative stress [45]. Three other RCTs investigated the effect of n-3 fatty acids supplementation in oncology patients. In one study of 200 patients from 2003, supplementation resulted in weight gain, increased lean body...
mass, and improvement of QoL [46]. None of the two other RCTs of 60 and 30 patients conducted in 2003 and 1998, respectively, reported beneficial effects on weight and functional status [47,48]. Additionally, no effect could be detected on appetite, nausea, tiredness, overall sensation of well-being, caloric intake, lean body mass [47], or survival rates [48] on supplemented patients.

The supporting evidence regarding vitamins, minerals, or other nutrients’ supplementation on outcomes is limited to particular groups of patients (pancreatitis and cancer) and nutrients (vitamin C and n-3 fatty acids). It is therefore difficult to extrapolate those findings to general medical inpatients. Based on recommendations found in most selected guidelines, we suggest supplementing malnourished or at-risk medical inpatients with multivitamins and multiminerals to reach the recommended dietary allowance for micronutrients, thereby correcting or preventing deficiencies. Patients fed with enteral nutrition are addressed in question 7. Furthermore, an individual assessment of patients is needed in order to specifically correct out-of-norm values of micronutrients. No recommendations for supplementation with other nutrients (e.g. n-3 fatty acids) can currently be made based on available evidence.

Additional oral supplementation

Question 6. In malnourished or at-risk medical inpatients, does additional oral supplementation (e.g. oral nutritional supplements (ONS) and fortified meals) result in improved outcomes, when compared with standard care?

We identified five studies that explored the effect of ONS in at-risk or malnourished medical inpatients (elderly with various acute illnesses) and one in patients hospitalized for an acute exacerbation of COPD.

In a Cochrane review from 2002, the subgroup analysis of “unwell” (n = 1623) or “undernourished” (n = 854) elderly patients demonstrated beneficial effects of ONS on mortality reduction [49]. In a subsequent meta-analysis from the same author published in 2006 [50], supplementation of undernourished hospitalized elderly individuals reduced mortality and complications, improved nutritional status, but had no effect on LOS. Three other studies (RCTs) consistently found nutritional intake improvements and overall status of hospitalized elderly patients who received ONS [51–53]. Two of those studies [51,53] additionally reported improved functional status, and one also showed reduced risk of mortality, but no difference in LOS [51].

In a RCT conducted in 33 COPD patients, supplementation with ONS or extra snacks in addition to the hospital diet resulted in increased forced vital capacity, protein, and energy intakes, but no significant changes were observed in other functional and nutritional parameters.

None of these RCTs have analyzed data based on both protocol analysis and intention to treat analysis. Among the RCTs included in the systematic reviews, some studies reported that participants were excluded from the analysis because they felt unable to take the supplements, but the analysis of outcomes on an intention to treat basis was overall deficient. Poor compliance with ONS treatments may limit their effectiveness, although this is a parameter that is not always assessed. Moreover, other nutritional interventions such as serving smaller and fortified meals or between-meal snacks may also help improving the nutritional intakes of hospitalized patients, particularly in the elderly [54,55].

Given these findings and that the geriatric population represents a large proportion of patients hospitalized in medical wards, as well as the consistent recommendations among selected guidelines, ONS should be used in addition to hospital meals ideally adapted to individual preferences to meet nutritional requirements and improve outcomes of malnourished or at-risk medical inpatients. Fortification of meals and providing patients with between-meal snacks should be at least equally part of the strategy to supplement intakes.

Route, monitoring, and reassessment

Question 7. In malnourished or at-risk medical inpatients able to consume food orally, does enteral tube feeding result in improved outcomes when compared with oral nutrition?

Oral feeding constitutes the most physiological route of feeding to correct DRM, but it is not always sufficient to treat DRM and improve outcomes, especially in cases of acute illness.

The supporting evidence we found to determine the preferred way of feeding malnourished or at-risk medical inpatients is limited to one RCT [56] conducted in acute pancreatitis patients where only one outcome (pain relapse following oral or enteral refeeding) was measured and no difference was found between both groups [56]. No data addressing the question of how long oral nutrition should be implemented before starting enteral tube feeding were found within the selected ESPEN guidelines.

All selected guidelines recommend oral nutrition as the first route of feeding for nutritional therapy of malnourished or at-risk patients who are able to ingest food. When the nutritional requirements cannot be met via this route during the recommended 5 to 7 d (according to the majority of the guidelines, although this period can be extended to 8 wk in chronic infectious diseases), enteral tube feeding is recommended. In most guidelines, the recommended route of feeding is a nasogastric tube or a percutaneous endoscopic gastrostomy, for example, when long-term tube feeding is required.

Based on ESPEN recommendations, on the observation that body weight stabilizes in patients able to reach 75% of their nutritional needs [57] and on our own clinical experience rather than on supportive data, enteral tube feeding, ideally maintaining some oral food intake, should be implemented in medical inpatients with or at-risk of DRM who could not reach 75% of their energy and protein targets (or consume more than 75% of the food served daily) within 5 d of oral feeding and for whom clinical judgment predicted that oral nutrition would not be sufficient to improve nutritional intakes. Intakes should be reassessed every 24 to 48 h.

Depending on how long enteral tube feeding is foreseen, both nasogastric tube and percutaneous endoscopic gastrostomy are possible routes. Unless enteral tube feeding provides more than 1500 kcal/d, a multivitamin and micronutrient supplementation is needed to cover micronutrient needs.

Question 8. In malnourished or at-risk medical inpatients who are not able to consume sufficient food, does parenteral nutrition result in improved outcomes when compared with enteral nutrition?

One meta-analysis compared enteral with parenteral nutrition in 263 medical inpatients with acute pancreatitis [58]. Enteral nutrition resulted in reduced incidence of surgical interventions and LOS, but no effects on mortality or non-infectious complications were observed.

The recommendations provided in all selected guidelines state that in patients with an intact gastrointestinal tract,
parenteral nutrition should be seen as a last resource when patients cannot be fed sufficiently orally or enterally.

Although supportive evidence is missing, we also recommend starting parenteral nutrition with a minimal oral or enteral feeding when possible, if oral and/or enteral nutrition is not possible or if at least 75% of energy and protein targets have not been reached during the 5 d after the beginning of enteral nutrition. Intakes should be reassessed every 24 to 48 h.

**Discussion**

The procedures for detecting and treating DRM suggested in the present study should not be considered as providing robust recommendations such as those developed in validated guidelines (ESPEN or from other societies) for several reasons:

1. Our suggestions were developed using evidence extracted from selected current ESPEN disease- and medical specialty-specific guidelines (Table 1). Therefore, we relied on the studies identified and included by the authors of those guidelines rather than conducting a new systematic search of the literature, with the possibility that several studies potentially relevant to answering our clinical questions might have been missed. Moreover, the guidelines used as a source of evidence were updated for the last time at least 6 y ago, which consequently resulted in the extraction of studies published until 2007. Studies conducted later than this were therefore not captured and not used as evidence behind our questions.

2. The methodological quality and potential biases of the studies we extracted from the selected guidelines were not reassessed and were not taken in consideration when analyzing their results. This may have led to over- or underestimation of the effects of the interventions on the analyzed outcomes.

3. Due to limited evidence found to answer our questions, the procedures we suggest are not only based on published studies, but also take in consideration the recommendations given in the ESPEN guidelines we selected, as well as expert opinions, based on the clinical experience of the members of our working group.

4. Although the procedures suggested in this report are intended to apply to any medical inpatient independent of underlying disease, they do not exempt clinicians from identifying particular groups of patients for which an adaptation is needed to ensure optimal, clinically and ethically sound nutritional support, such as in the management of acute pancreatitis or patients in terminal conditions. A uniform nutritional strategy suitable for all medical inpatients might also lack from precision and might lead to a less sensitive effect compared to a more targeted approach. Yet, due to the growing challenges of older and frail medical inpatients, a pragmatic and integrated approach may still be needed.

**Conclusion**

Although this work differs from validated guidelines, we were able to develop and provide practical and simple guidance to detect existing DRM as well as those patients at-risk of developing DRM and implement nutritional therapy in the heterogeneous population of medical inpatients. Our suggestions are summarized in Table 2 and also graphically represented in the form of a user-friendly nutritional algorithm (Fig. 1), which is currently used to provide nutritional therapy in medical wards of several Swiss hospitals as part of a large multicenter RCT.

While this RCT includes the heterogeneous medical inpatient population receiving nutritional therapy according to the herein described practical procedures, it should be noted that particular subgroups of patients requiring a specific nutritional therapy approach are excluded from the trial (e.g., pancreatitis, terminal patients), in accordance with the previously acknowledged limitation of this study.

**Acknowledgments**

Members of the Working Group: Dr. Lisa Bounoure, Dr. Filomena Gomes, Rebecca Fehr, Dr. Martina Bally, Isabel Pulvermüller, Manuela Deiss, Prof. Dr. Philipp Schuetz, Prof. Dr. med. Beat Mueller, Department of Endocrinology, Diabetes and Clinical Nutrition, University Department of Internal Medicine, Cantonal Hospital Aarau. Prof. Dr. Zeno Stanga, Department of Endocrinology, Diabetes and Clinical Nutrition, University Hospital Bern. Prof. Dr. Ulrich Keller, Endocrine Practice and University of Basel, Switzerland. Dr. Rémy Meier, Gastrocenter Obach, Solothurn, Switzerland. Dr. Peter Ballmer, Maya Ruehlin, Dr. med. Reinhard Imoberdorf Department of Internal Medicine, Kantonsspital Winterthur, Switzerland. Dr. Alexander Spielmann, Hospital Muri, Switzerland. Dr. Laurence Genton, University Hospital Geneva (HUG), Switzerland. Dr. Kristina Norman, Charité Medical University Berlin, Germany. Dr. Pauline Coti Bertrand, University Hospital Lausanne (CHUV), Switzerland. Dr. Christoph Henzen, Kantonsspital Luzern, Switzerland. Prof. Dr. Alessandro Laviano, University Hospital Roma, Italy. Prof. Dr. Stephan Bischoff, University of Hohenheim, Germany. Dr. Stéphane Schneider, University Hospital and University of Nice Sophia-Antipolis, Faculty of Medicine, France. Dr. Jens Kondrup, Rigshospitalet University Hospital, Blegdamsvej, Copenhagen.

**Supplementary data**

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.nut.2016.01.019.

**References**


