A SYSTEMATIC AND UNIVERSAL ARTIFICIAL INTELLIGENCE METHOD FOR OROPHARYNGEAL DYSPHAGIA (OD) SCREENING

How to increase diagnosis of OD using risk management

Alberto Martín[1,2], Xavier Tibau[1], Omar Ortega[1], Emilia Michou[3], Pere Clavé[1,2]

1. Gastrointestinal Physiology Laboratory, Hospital de Mataró (Barcelona, Spain); 2. Centro de Investigación Biomédica en Red en Enfermedades Hepáticas y Digestivas (CIBERehd), ISCIII (Barcelona, Spain); 3. University of Patras (Patras, Greece).

Contact: **pere.clave@ciberehd.org; +34 937417700 ext. 1046**

Description of the initiative: Prevalence of oropharyngeal dysphagia (OD) among older patients hospitalized for acute diseases is close to 50% and is independently associated with respiratory infections, dehydration and malnutrition (MN), prolonged length of stay, health-economic costs and mortality. OD is not diagnosed in many hospitalized older patients in the EU and this leads to inequity. Diagnosis of OD is a 3-step procedure: positive patients in the screening (at risk of OD) need a more comprehensive clinical or instrumental assessment. Machine learning (ML) and the hospital electronic medical records enable the development of risk management algorithms with artificial intelligence (AI) for universal and systematic OD screening. OD can then be detected earlier and nutritional treatments applied (viscosity adaptation of fluids, texture-modified foods and nutritional supplementation) to avoid complications and improve patient's clinical outcomes. Our **aim** is to assess the clinical effects of an expert system (ES) based on ML in assessing the risk of OD in hospitalized older patients in real time on admission and for the result to be shown at the workstation of HCP (nurses, SLP, dietitians, physicians, etc.) in 2 different hospitals in the EU (*Fig. 1*).

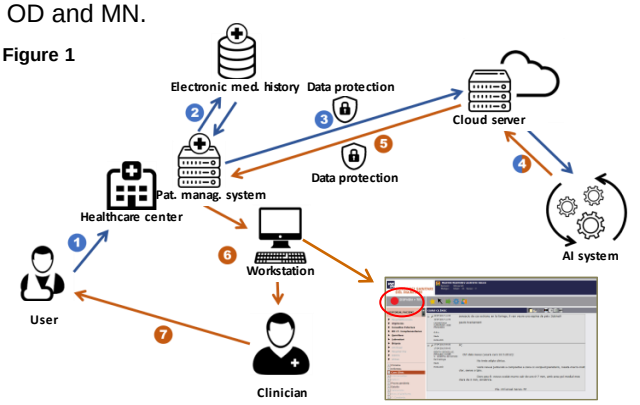
Planned activities & deliverables: we studied 5,159 patients and developed an ES following an ML analysis of 17,732 variables, the 129 more closely associated with OD were included in our AI algorithm (**Phase 1**). Up to 61% of patients admitted to the Hospital de Mataró were finally diagnosed as having OD, and our ES learned from them. The ES was evaluated by "cross-fold validation" showing 0.9 diagnostic sensitivity and 0.6 specificity (P201931028) (**Phase 2**). Our ES is now ready to be installed in different hospital's clinical information systems in the EU, or in an App and to be validated under real clinical conditions with older patients (≥70y) admitted for acute diseases, such as COVID-19, to allow risk management of OD and improve its clinical diagnosis, nutritional treatment and clinical outcomes (**Phase 3**). A schematic representation the ES is described in *Fig. 1*.

Deliverables and possible achievements in 1-2 years: we expect to install our ES for the risk management of OD in 2 Hospitals in EU (Spain and Greece) within the next 12 months, adapting it to the national policy of data protection, and to validate it in the following 12 months. The risk assessment of OD and MN (NRS 2002) is linked to an algorithm for prescription of thickened fluids, texture modified foods and texturized ONS according to individual risk of OD and MN.

Resources & enablers

- Activities: optimization of the ES in real clinical practice; implementation of the ES in 2 hospitals; validation of our ES.
- Personnel, financial needs: the main resources that we need for our ES project (Phase 3) are computer engineer services to implement our AI algorithm in the Hospital and to assess its clinical impact (number of patients with diagnosis/treatment of OD).
- Specify how the grant will be spent: the grant will cover the 2-year salary (part time) of the computer engineer and the expenses of assessing the clinical effect of the implementation of IA system (App and hospital workstation).

Figure 1



- What factors will make it successful: we have a patented prototype, with high diagnostic Ss/Sp and accuracy for OD, and the project is approved by the Ethics Committee of the CSdM (code: 40/17). Our ES will enable clinicians to identify patients at risk that should be clinically assessed for OD, allowing early nutritional management, reducing nutritional complications, and optimizing resource consumption. The AI system is connected to an algorithm for nutritional treatments (viscosity adaptation of fluids/texture-modified foods and nutritional supplementation) to avoid complications and improve patient's clinical outcomes and quality of life (QoL). The system fulfills regulatory issues on data protection.

Results/outcomes & expected impact

- **How will the findings be implemented?** Our ES system will be introduced in the hospital's electronical medical system by its IT department and used in the wards by its professionals in their multidisciplinary dysphagia team (*Figure 1*). The individual risk of OD for each patient will be shown in an App or in the workstation.
- **How will this project advance patient care / contribute to optimal nutritional care?** ES provides an automatic, universal, real time prediction of the risk of OD in each patient during admission procedures. This will increase the number of OD patients diagnosed, reduce the human resources dedicated (resource optimization), avoid inequity and differences between hospitals, and increase the quality of the diagnosis. Diagnosis of OD enables the clinician to treat the patient with fluid adaptation of viscosity with thickeners and nutritional support with texture-modified diets, and texturized ONS. This will reduce OD complications, dehydration, MN, respiratory infections, readmissions and thus, improve patients health and QoL. Our ES system will be also useful for COVID-19 hospitalized patients as they also have high prevalence of OD and MN.
- **What makes the project innovative?** It provides an innovative solution to the underdiagnosis of OD through an automatic, systematic and massive screening AI algorithm that will increase the number and quality of OD diagnosis.
- **Will the project be likely to influence national nutrition policy?** Increasing the number of OD diagnosis will speed the implementation of new nutritional strategies and policies with this relevant group of older patients at risk of OD.
- **Is the project transferable to other settings/countries?** It could be exported to other national and international centers across EU, due to its high feasibility and its cost-effectiveness in early management of OD /MN.

2020 MNI Grant Submission Initiative/Research Project for Optimal Nutritional Care