

## Original Article

**Health insurance or subsidy has universal advantage for management of hospital malnutrition unrelated to GDP**

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**Background and Objectives:** Protein-energy and micronutrient malnutrition are global public health problems which, when not prevented and severe, require medical management by clinicians with nutrition expertise, preferably as a collectively skilled team, especially when disease-related. This study aimed to investigate barriers and facilitators of clinical nutrition services (CNS), especially the use of oral, enteral (EN) and parenteral (PN) nutrition in institutional and home settings. **Methods and Study Design:** An international survey was performed between January and December 2014 in twenty-six countries from all continents. Electronic questionnaires were distributed to 28 representatives of clinical nutrition (PEN) societies, 27 of whom responded. The questionnaire comprised questions regarding a country's economy, reimbursement for CNS, education about and the use of EN and PN. **Results:** The prevalence of malnutrition was not related to gross domestic product (GDP) at purchasing power parity (PPP) per capita ( $p=0.186$ ). EN and PN were used in all countries surveyed (100%), but to different extents. Reimbursement of neither EN nor PN use depended on GDP, but was associated with increased use of EN and PN in hospitals ( $p=0.035$ ), although not evident for home or chronic care facilities. The size of GDP did not affect the use of EN ( $p=0.256$ ), but it mattered for PN ( $p=0.019$ ). **Conclusions:** A worldwide survey by nutri-

tion support societies did not find a link between national economic performance and the implementation of medical nutrition services. Reimbursement for CNS, available through health insurance systems, is a factor in effective nutrition management.

**Key Words:** health insurance, subsidy, malnutrition, hospital malnutrition, nutritional management

## INTRODUCTION

Disease-related malnutrition (DRM) represents an indisputable global public health issue, as it increases morbidity, mortality, readmission rates, length of hospital stay and health-care costs.<sup>1-3</sup> It is diagnosed in some 7-16% of outpatients and 20-60% inpatients.<sup>4-8</sup> Yet, the problem of DRM often passes unnoticed in the health care system or is trivialised.<sup>5-11</sup> Effective intervention for DRM requires a systematised clinical nutrition approach.<sup>12</sup> This involves an appreciation of where nutritional problems may be encountered and diagnosed, how they relate to the overall clinical picture and what the management options are.<sup>13</sup> The technical aspects of nutritional management are generally available in urbanized societies, irrespective of geography, but their prioritisation and utility varies greatly. The basic forms of oral and enteral support are relatively simple and accessible, even though their sophistication is growing; the resource, training requirements and risk management of parenteral nutrition are more demanding. The constraints on the practice of clinical nutrition might be better appreciated through inter-healthcare system and international comparison.<sup>14</sup>

In various settings, the introduction of clinical nutrition programs remains a work-in-progress. The implementation of a novel medical procedure is complex. Where it is multidisciplinary, as with nutrition, it requires much organisational and educational effort along with resource allocation. It also needs the case made by evidence-based nutrition initiatives.<sup>15</sup> Clinical nutrition trials are generally more challenging than their pharmacotherapeutic counterparts. This is partly on account of the limits to randomisation and blinding, which characterise RCTs (randomised clinical trials) and tend to skew the evidence-based approaches away from food.<sup>16</sup> In any event, international organisations like WHO (World Health Organisation), along with national bodies and scientific societies develop protocols on the best available evidence. These are to be found on the web-sites and in the publications of, for example, the American Society for Parenteral and Enteral Nutrition (ASPEN) and the European Society for Clinical Nutrition and Metabolism (ESPEN), as well as many national PEN societies. The professional bodies of medical specialists such as physicians and surgeons, pediatricians, geriatricians, obstetricians, psychiatrists, together with those of dietitians, pharmacists and nurses, are also involved. So too are politicians, health authorities and the media. These activities increase awareness, improve screening, and encourage advances in clinical alongside public health nutrition.

The pressures on health expenditure and for cost containment grow globally and locally. It is, therefore, of interest to know whether and how current differentials in national economies and healthcare funding arrangements might influence clinical nutrition programs, at least as seen in secondary and tertiary institutions and those

which are more technically demanding, like enteral (EN) and parenteral nutrition (PN).

An international survey among healthcare institutions about clinical nutrition services has been conducted in relation to economic development and with regard to the funding of health services. Although a limited economic measure with little to do with intranational equity), we have used GDP, (gross domestic product) allowing for PPP (purchasing power parity) as a guide to international economic difference.

## METHODS

An international survey, with an electronic questionnaire, was undertaken between January and December 2014. Questionnaires were distributed to representatives of twenty-eight national parenteral and enteral (PEN) societies. Participants were required to answer all questions, including those to do with the prevalence of health care institutional malnutrition, using recent, already collected data or new survey information collected for the study. Twenty-seven questionnaires were completed (response rate: 96.4%) and analyzed. The Ethics Committee of Stanley Dudrick's Memorial Hospital in Krakow, Poland, approved the study (SKAW2/2013), which was carried out in accord with the international ethical recommendations of the Helsinki Declaration.

Participating countries (n=26 with 27 responding societies) were categorized for economic comparison according to World Bank criteria for national incomes as GDP (allowing for PPP) per capita in four categories:<sup>9</sup>

- Lower middle income countries: Burkina Faso, India, Sri Lanka, Indonesia, Philippines
- Upper middle income countries: Cuba, Venezuela, Mexico, Republic of South Africa, Lebanon, Argentina, Brazil
- High income: Saudi Arabia, Chile, Uruguay, South Korea, Israel, Japan, Australia, United States of America (USA)
- Europe: Ukraine, Serbia, Turkey, Latvia, Poland, Russia, Croatia

Group d was formed artificially to include European countries and enable a world-wide analysis. The money spent in those countries on health care (<1,000 USD per capita/year) allowed fair comparison with countries from other continents.

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The following parameters were analyzed:

- 1) Population size and distribution
- 2) Number of hospitals and institutions subject to health care regulations
- 3) Health care costs as a % of gross domestic product (GDP)
- 4) Prevalence of malnutrition in clinical care settings
- 5) Availability and type of health insurance organisation (public/ private/ both)
- 6) Use of clinical nutrition support (CNS) by way of oral, enteral (EN) or parenteral (PN) nutrition, according to setting (hospitals, home, chronic care facility)
- 7) Availability of reimbursement for EN and PN
- 8) Presence and type of education in the fields of EN and PN

'*Clinical Nutrition*' is used in this paper to indicate an overall program or approach which entails both assessment and management. In the wider community and primary health care setting, the terminology embraces the food system and has psychosocial dimensions, but, for the purposes of this paper, the focus is on secondary (as in step-down) and tertiary care and the technical support required.

Insofar as *settings* are concerned, '*hospital settings*' refers to all in-patients; '*home*' to all out-patients at home alone, with family or other care-givers, but without any additional chronic care at the household level; *chronic and palliative care centres* refer to settings for patients outside home or long term care facilities, whether for any chronic condition or advanced cancer.

### Statistical analysis

Statistical analysis was performed using SPSS v.19 (SPSS Inc., Chicago, IL) software. The chi-square test was used if the expected frequency was less than 5 in less than 20% of cells, otherwise the F-Fisher's exact test was performed. A *p* value of <0.05 was accepted as being statistically significant.

## RESULTS

Medical insurance companies (responsible for the reimbursement) operate in 26 of 27 countries (96%), except

for Cuba. South Africa, Burkina Faso, Sri Lanka, Serbia and Ukraine have no state-dependent insurance, but do have private facilities. Private health insurance does not operate in Poland, Cuba, Croatia or France; in these, health care expenses are covered by state-funded or state-governed entities. In twenty countries studied, both private and state insurance companies are operative. As expected, the Ministry of Health was responsible for health care policy in 26 of 27 countries (96%) with budgetary relevance to CNS. Australia has a national health insurance system known as Medicare, but ultimate policy reflects both federal and state governmental arrangements, and public and private health insurance. The Federal Drug Administration (FDA) in the USA and the Hospital Accreditation Board in India are the relevant agencies for ensuring CNS in those jurisdictions.

Generally speaking, enteral (EN) and parenteral nutrition (PN) are used in all study countries (100%), but to different extents. EN and PN are potentially available to all patients in hospital settings (100%), independent of reimbursement or national economic rank. EN and PN are not routinely used in chronic care facilities in Indonesia, Cuba, Latvia, Croatia, Ukraine, Sri Lanka and Mexico, at home in Russia, Latvia, Mexico, Sri Lanka, Burkina Faso and Indonesia, or in palliative cancer care centres in Latvia, Croatia, Serbia, Russia, Burkina Faso, Cuba, Indonesia, Argentina, Uruguay, Sri Lanka and Mexico. There was not any one common denominator for these countries in regard to responsibility for utilization and funding of EN or PN.

Country income was not associated with the use of EN and PN, as shown in Table 1. There was no significant economic association with home EN and PN (*p*=0.073). In the case of chronic and palliative care centers there was also no evidence of dependency on country income (*p*=0.334 and *p*=0.332, respectively).

Country income did not influence reimbursement for EN and PN, as shown in Table 2 (*p*=0.072). The prevalence of malnutrition was not related to the country income (*p*=0.186).

An interesting correlation was observed in regard to reimbursement (Table 3). It was associated with the use of EN and PN as far as treatment priority was concerned (for

**Table 1.** GDP (PPP) and the use of clinical nutrition programs

Description	Low income & lower middle income outside Europe		Upper middle income outside Europe		High income outside Europe		Europe		<i>p</i> <sup>F</sup>
	n	%	n	%	n	%	n	%	
Clinical nutrition used in general	5	100	7	100	8	100	7	100	---
Clinical nutrition used at hospitals	5	100	7	100	8	100	7	100	---
Clinical nutrition used at chronic care facilities	2	40.0	5	71.4	7	87.5	4	57.1	0.334
Clinical nutrition used at palliative cancer care	2	40.0	4	57.1	7	87.5	4	57.1	0.362
Clinical nutrition used at home	2	40.0	6	85.7	8	100	5	71.4	0.073
Clinical nutrition used at all of the aforementioned facilities	2	40.0	4	57.1	7	87.5	3	42.9	0.246

**Table 2.** Jurisdictional GDP (PPP) and reimbursement for clinical nutrition support (CNS)

Reimbursement	Low income & lower middle income outside Europe		Upper middle income outside Europe		High income outside Europe		Europe		$p^F$
	n	%	n	%	n	%	n	%	
	None	4	80.0	1	14.3	1	12.5	1	
Yes for PN, no for EN	0	0.0	0	0.0	1	12.5	2	28.6	
Yes for all types of CNS	1	20.0	6	85.7	6	75.0	4	57.1	

EN: enteral nutrition; PN: parenteral nutrition.

the utilization of EN and PN at hospitals ( $p=0.035$ ), and mattered less at other settings); reimbursement did not associate with the type of therapy - neither EN nor PN was dependent on it ( $p\geq 0.05$ ).

If the CNS was not provided by the unit through public funding, it was paid or co-paid by the patient or family (Table 3).

The economy was associated with the usage of nutrition for patients where indicated. Nevertheless, there were patients who did not receive PN where indicated ( $p=0.019$ ); this was not apparent for EN ( $p\geq 0.05$ ) (Table 4).

Training for clinical nutrition was in place in all twenty-seven countries participating in the study (100%). The most usual educational activities were those of local PEN societies (21 countries [77.7%]), followed by postgraduate training and ESPEN LLLs (20 countries [74.1%] and 13 [48.1%]). Pre-graduate activities were the least popular (12 countries, 44.4%) (Table 5).

Table 6 presents the relation between various types of training for clinical nutrition and the use of EN and PN. There was no correlation for any of the analyzed factors ( $p>0.05$ ).

All survey participants could freely comment on the situation regarding clinical nutrition and efforts to reduce hospital malnutrition. All emphasized the need for education and greater awareness, mostly among decision-makers. Most pointed out the need to implement EN and

PN at chronic care facilities and in home settings. Detailed comments follow below.

#### *Nutritional issues regarded as the most important for each country*

##### **Serbia**

Differences between use of clinical nutrition among institutions depend on the awareness of the importance of parenteral and enteral nutrition and education of the staff to implement parenteral and enteral nutrition. The focus is on reimbursement for both enteral and parenteral nutrition, not only in hospitals, but in all circumstances.

##### **Russia**

It is seen as important to include Clinical Nutrition in medical training in (pre- and postgraduate) and foster a clinical specialty to be termed "Specialist in clinical nutrition" for all hospitals. Enteral and parenteral nutrition should be included in the general guidelines for medical management of every medical condition. There is a need to argue for the reimbursement of enteral formulas by the insurance industry and develop a system for home care nutrition, and nutrition in palliative care and chronic care facilities.

##### **Brazil**

The development of Government funded home TPN programs is most important.

**Table 3.** The reimbursement of different forms of clinical nutrition support (CNS) by jurisdiction

Reimbursement	Low income & lower middle income outside Europe		Upper middle income outside Europe		High income outside Europe		Europe		$p^F$
	n	%	n	%	n	%	n	%	
	At hospital	1	20.0	6	85.7	7	87.5	6	
At chronic care									
No	5	100	4	66.7	3	37.5	5	71.4	
Partially	0	0.0	1	16.7	0	0.0	0	0.0	
Yes	0	0.0	1	16.7	5	62.5	2	28.6	0.130
At palliative care	0	0.0	1	16.7	5	62.5	2	28.6	0.119
At home									
No	5	100	5	71.4	3	37.5	4	57.1	
Partially	0	0.0	2	28.6	1	12.5	0	0.0	
Yes	0	0.0	0	0.0	4	50.0	3	42.9	0.072
At all the above	0	0.0	0	0.0	4	50.0	2	28.6	0.073
Type of nutrition support									
EN – oral supplements	1	20.0	4	57.1	5	62.5	5	71.4	0.429
EN – tube feeding	1	20.0	6	85.7	6	75.0	6	85.7	0.070
PN	1	20.0	5	71.4	7	87.5	6	85.7	0.062
All types of CNS	1	20.0	4	57.1	5	62.5	5	71.4	0.429

EN: enteral nutrition; PN: parenteral nutrition.

**Table 4.** Jurisdictional GDP (PPP) and the presence of malnutrition

Country	Low income & lower middle income outside Europe	Upper middle income outside Europe	High income outside Europe	Europe	<i>p</i>
Prevalence of malnutrition at admission (%)					
Number of countries with the provided data	N=3	N=5	N=7	N=6	
Mean (SD)	48.3 (2.9)	29.5 (18.2)	35.7 (15.9)	30.6 (21.8)	
Median (Q1-Q3)	50.0 (45.0-nd)	35.0 (10.5-45.6)	40.0(35.0-45.0)	29.2 (15.0-46.3)	
Min-max	45.0-50.0	8.5-50.0	1.0-49.0	0.0-65.0	<i>p</i> <sup>kw</sup> =0.186
Proportion of patients with indications for enteral nutrition. Who receive treatment (%)					
Number of countries with the provided data	N=5	N=7	N=8	N=6	
Mean (SD)	21.8 (23.8)	56.9 (34.7)	53.6 (29.1)	42.5 (36.8)	
Median (Q1-Q3)	20.0 (2.0-42.5)	70.0 (15.0-90.0)	50.0 (28.8-82.5)	40.0 (5.0-76.3)	
Min-max	1.0-60.0	3.0-90.0	15.0-99.0	5.0-95.0	<i>p</i> <sup>kw</sup> =0.256
Proportion of patients with indications for parenteral nutrition. Who receive treatment (%)					
Number of countries with the provided data	N=5	N=7	N=8	N=6	
Mean (SD)	15.8 (24.9)*	51.6 (35.1)	69.4 (23.4)*	46.7 (39.3)	
Median (Q1-Q3)	5.0 (2.0-35.0)	50.0 (30.0-90.0)	75.0 (42.5-88.8)	47.5 (8.8-80.0)	
Min-max	1.0-60.0	1.0-100.0	40.0-100.0	5.0-95.0	* <i>p</i> <sup>gh</sup> =0.019

**Table 5.** Jurisdictional GDP (PPP) and type of clinical nutrition training

CNS training	Low income & lower middle income outside Europe		Upper middle income outside Europe		High income outside Europe		Poorer in Europe		<i>p</i> <sup>F</sup>
	n	%	n	%	n	%	n	%	
Undergraduate	3	60.0	3	42.9	5	62.5	1	14.3	0.278
Postgraduate	3	60.0	6	85.7	6	75.0	5	71.4	0.930
ESPEN LLL	2	40.0	2	28.6	4	50.0	5	71.4	0.471
Local PEN trainings	4	80.0	5	71.4	7	87.5	5	71.4	0.861
Other training	2	50.0	2	40.0	1	25.0	3	75.0	0.733

**Argentina**

That nutrition education and practice be mandatory in health care at national and provincial levels.

**Australia**

The lack of HPN (home parenteral nutrition) programs and its funding is a major concern. There is developing support by the Federal government for CNS for intestinal failure.

**Turkey**

Priorities are: (a) Medical education: (i) Education in clinical nutrition should become a part of the curriculum for medical students, dieticians, nurses and pharmacists. (ii) The training should also continue in the postgraduate level. (b) All patients in hospitals, all individuals in nursing homes and those at risk living in community should be routinely screened for malnutrition and nutritional risk. (c) Educational campaigns about malnutrition should be organized to raise awareness among the public.

**South Korea**

Priorities are: (a) Education of medical students and doctors in nutritional therapy (b) Education & enlightenment of the public about nutrition (c) To encourage nutrition support team (NST) activity in hospitals & chronic care facilities (d) To reimburse EN, PN formula usage & devices and the activities of NSTs

**Sri Lanka**

Private hospitals have both EN and PN (including 3-in-1 packs), but patients have to bear the cost. In the government hospitals, which are in the majority, EN (commercial supplements) and PN are avoided due to cost. Blended products are used by government hospital staff. Nutritional training for doctors is vital to increase awareness of hospital malnutrition and other situations where nutrition support is important. Government should support commercial nutrition supplements for hospital patients. Currently, only limited products are included in hospital drug lists.

**Cuba**

To train personnel at the primary care level in nutrition and to expand Home Enteral and Parenteral Nutrition services

**Chile**

Priorities are to: (a) Establish the reimbursement of out-patients nutritional support (b) Increase the number of physicians trained in clinical nutrition at public hospitals (c) Re-educate medical personnel in clinical nutrition

**United States of America**

Attitudinal change is encouraged towards: Nursing home acceptance of patients not only with gastrostomy or jejunostomy, but also nasogastric/enteral feeding tubes and with TPN.

**Table 6.** Proportion of patients with indications for clinical nutrition management who received treatment related to different types of EN and PN training

	Absent	Present	
<b>Undergraduate training</b>			
Proportion of patients with indications for enteral nutrition, who receive treatment [%]			
Number of countries	15	11	
Mean (SD)	46.3 (30.0)	45.1 (37.3)	
Median (Q1-Q3)	55.0 (15.0-70.0)	40.0 (3.0-90.0)	
Min-max	5.0-95.0	1.0-99.0	$p^{mw}=0.795$
Proportion of patients with indications for parenteral nutrition, who receive treatment [%]			
Number of countries	15	11	
Mean (SD)	52.0 (32.1)	45.0 (39.5)	
Median (Q1-Q3)	50.0 (20.0-75.0)	40.0 (3.0-85.0)	
Min-max	5.0-100	1.0-100	$p^{mw}=0.516$
<b>Postgraduate training</b>			
Proportion of patients with indications for enteral nutrition, who receive treatment [%]			
Number of countries	7	19	
Mean (SD)	46.6 (39.6)	45.5 (30.8)	
Median (Q1-Q3)	60.0 (5.0-90.0)	50.0 (20.0-70.0)	
Min-max	1.0-95.0	3.0-99.0	$p^{mw}=0.977$
Proportion of patients with indications for parenteral nutrition, who receive treatment [%]			
Number of countries	7	19	
Mean (SD)	40.9 (34.0)	52.1 (35.6)	
Median (Q1-Q3)	40.0 (5.0-70.0)	50.0 (10.0-85.0)	
Min-max	1.0-90.0	1.0-100	$p^{mw}=0.418$
<b>ESPEN LLL</b>			
Proportion of patients with indications for enteral nutrition, who receive treatment [%]			
Number of countries	14	12	
Mean (SD)	47.8 (35.5)	43.5 (30.2)	
Median (Q1-Q3)	50.0 (12.5-90.0)	47.5 (16.3-67.5)	
Min-max	1.0-95.0	3.0-99.0	$p^{mw}=0.857$
Proportion of patients with indications for parenteral nutrition, who receive treatment [%]			
Number of countries	14	12	
Mean (SD)	44.6 (37.2)	54.3 (32.7)	
Median (Q1-Q3)	45.0 (5.0-82.5)	65.0 (22.5-82.5)	
Min-max	1.0-100	1.0-95.0	$p^{mw}=0.536$
<b>Local PEN training</b>			
Proportion of patients with indications for enteral nutrition, who receive treatment [%]			
Number of countries	6	20	
Mean (SD)	51.8 (41.1)	44.0 (30.6)	
Median (Q1-Q3)	60.0 (4.0-91.3)	45.0 (16.3-67.5)	
Min-max	1.0-95.0	3.0-99.0	$p^{mw}=0.714$
Proportion of patients with indications for parenteral nutrition, who receive treatment [%]			
Number of countries	6	20	
Mean (SD)	32.7 (33.2)	54.0 (34.6)	
Median (Q1-Q3)	25.0 (4.0-60.0)	60.0 (15.0-83.8)	
Min-max	1.0-90.0	1.0-100	$p^{mw}=0.190$

EN: enteral nutrition; PN: parenteral nutrition; CNS: clinical nutrition support.

### India

Basic nutritional intervention is reflected in guidelines and practiced in about 25% of Indian hospitals. More technical nutritional interventions depend on the advice of the clinician, whose familiarity with guidelines is often substandard. Medical nutrition therapy is substandard in the majority of Indian hospital. Nutritional services in India could be improved by: (a) Comprehensive nutrition care (of hospitalised patients and non-hospitalised individuals) inclusion in the core-curriculum of undergraduate and postgraduate health care professional training programmes. (b) Regular training programmes (workshops, case-study modules, lectures, seminars) about medical nutrition therapy on a regular basis, conducted by local PEN and critical care societies. (c) Junior medical and nutritional professional appointments with attendance at national and international conferences related to nutri-

tion support. (d) A need for regular and frequent nutrition training programmes throughout the country.

### Lebanon

The health care in Lebanon is very much advanced as its considered one of the best in the Middle East/ Arab Countries due to both high number and highly educated medical doctors and medical staff, however the problem relies on the fact that health care is not state covered for everyone in the country and the patient may still be required to pay part of his fees for enteral/parenteral nutrition sometimes even with private insurance or state covered social health care. As for the organization, a PEN society should be established that I started talks a few years back on and then it was on hold until today. Also more up to date and intensive training especially for the nurses/dieticians and of course aiming that the enteral

nutrition section be covered 100% for everyone by the state no matter how long the patient requires it and what expensive products are involved.

### Uruguay

There is a need for government-introduced regulations about enteral and parenteral nutrition as well as nutrition support teams.

### Indonesia

The notion that clinical nutrition is simply supplementation needs to shift towards one of more comprehensive nutritional care, including its need for individualisation and the provision of technical measures as appropriate. Government (health ministry) involvement and policy development will provide more opportunity to advance CNS and their funding, including reimbursement of enteral or parenteral nutrition.

The Indonesian society (Inaspen) has had the support of the Ministry of health to enable NSTs (Nutritional Support Team) or "TTG (Tim Terapi Gizi) through their hospital accreditation.

### Venezuela

The clinical nutrition education of all healthcare professionals (Medical practitioners, Dieticians, Nurses, Pharmacists) and hospital administrators is required. Post graduate and under graduate courses are needed. The PEN society should cooperate with other scientific societies (Gastroenterology, Surgery, Paediatrics, Oncology, Critical Care and others).

## DISCUSSION

Even though health and reimbursement systems may differ significantly worldwide, development brings with it the governmental and professional responsibility to provide access to essential health and nutrition services.<sup>10</sup> These may be provided through the public or private sector with insurance, community or family network safety nets. Within healthcare institution CNS may create costs which are unaffordable by the system or individual in to, as co-payment, subsidy or reimbursement.<sup>10</sup> This survey finds that CNS are available across many different national economies. While this is encouraging, the question remains as to how uniform this is within country and with regard to social disparity and inequity. We must presume, given how widespread national health insurance programs or their analogues are, that they provide a valuable, if not essential, safety net to allow CNS availability, albeit with a lack of clarity about public and private sector responsibility.<sup>10</sup>

Primary and disease-related malnutrition are both of public health concern as they increase the total burden of disease through co-morbidities, length of hospital stay and readmission rates as well as out-of-institution and ambulatory health care costs. Understanding the barriers to nutritional diagnosis and care has been a driver for the present study, especially in regard to the presumption that a compromised national economy may preclude CNS.<sup>1,2</sup> A recent Croatian study showed that the total cost of adult malnutrition for selected diagnoses was 97.35 million EURO, accounting for 3.38% of the total Croatian na-

tional health care budget with an average cost per patient estimated at 1640 EURO.<sup>11</sup> Another European survey showed that the implementation of CNS varied across Europe and seemed influenced by the political situation, local economy and activity of the local PEN society.<sup>11</sup> The latter differed in training engagement, cooperation with authorities and awareness raising.

Evidence-based nutrition (EBN) needs to find its place alongside evidence-based medicine (EBM) in health system advocacy. This is a challenge where randomised, clinical nutrition trials may not always be feasible, especially when any feeding protocol may alleviate malnutrition and comparisons unethical. The present study goes some way to providing evidence that a healthcare system approach to CNS can make progress in the face of economic disparity. However, the present data base does not provide the detail or trend analysis which would allow particular approaches to be regarded as internationally robust or instrumental in delivering CNS as an outcome.

The study showed that enteral (EN) and parenteral nutrition (PN) were used in all countries (100%) irrespective of country income. EN and PN were available to all patients at hospital settings, but not available to everyone in chronic care facilities or at home. The relation between use of clinical nutrition at chronic care centers or palliative care centers was statistically insignificant ( $p=0.334$  and  $p=0.332$ , respectively).

The level of country income was apparently not principally responsible for reimbursement being possible for EN and PN ( $p=0.072$ ), although an indirect benefit to the health system and its ability to reimburse may not have been detected, given the crude methodology of this study. The reimbursement mattered for the use of EN and PN at hospitals ( $p=0.035$ ), and mattered less at other settings. Reimbursement was unimportant for any type of clinical nutrition ( $p<0.05$ ). If the EN or PN was not provided by the unit, it was paid or co-paid by the patient himself or his/ her family.

Training for clinical nutrition was present in all countries participating in the study but one. The most popular were local PEN societies training, postgraduate trainings, and ESPEN LLLs. Unfortunately, pre-graduate training was extremely scarce, which partly answers the question of limited awareness in health care professionals. This aspect was not related to the wealth of the country, such that the economy was not primarily to blame. On the other hand, there was no correlation between various types of training for clinical nutrition and the use of EN and PN. It may suggest the impact of health care professionals on the use of nutrition, is more important than government actions. All participants emphasised the importance of early and continuing education for greater awareness of the need for CNS.

### Strengths and limitations

This survey explored both the educational and economic aspects of nutritional therapeutic strategy from an international perspective. A somewhat inevitable limitation has been that locality and author bias may have affected data relativity. Respondent credibility has been dependent on peer awareness and association. The inputs have also come exclusively from parenteral and enteral nutrition

(PEN) societies and not from the extensive range of disciplines involved in clinical nutrition diagnosis and management. The nutritional problems reported have not been in detail and probably confined to those expressed as frank undernutrition or protein-energy malnutrition (PEM). This will have resulted in much under-reporting of clinical nutrition disorders.<sup>13</sup> Within jurisdictions, the choice of responders may not have been representative of national or local hospitals and medical centres. However, alternative sources of the required information are limited. Another limitation is that, although a wide spectrum of countries has been studied, the sample size is small for the analyses conducted. Thus, type 2 error is very likely for each of the questions posed, giving rise to false negatives. Therefore, great care must be exercised in asserting that something does not occur. This applies to propositions like the non-recognition of an association between CNS usage and international difference in economic status. More confidence can be had in the finding that CNS are practiced in a variety of economic circumstances. To some extent, we can draw on the country-specific narratives to inform this question. Notwithstanding the limitations, the study provides new data and insights into the resource determinants of malnutrition management, with implications for health care in general.

### Conclusions

The present study explores the resource dependency of nutritional management within health care systems. It demonstrates that the effective allocation of the required resources is less a matter of conventional measures of national economic status, and more a question of shared risk and benefit through health insurance, subsidy or reimbursement. The realization of such arrangements reflect in part healthcare professional education and an environment where management protocols are evidence-based and operationalized

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SK and MC coordinated the research, both were responsible for critical data analysis, evaluation of the outcome, and writing of the manuscript. AG was responsible for the statistics and data analysis. All other authors have made substantial contributions to the data collection and drafting of the manuscript.

### AUTHOR DISCLOSURES

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