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RESEARCH ARTICLE

# Pre and Post-Operative Nutritional Intervention on the Phenotypic and Etiologic Criteria of GLIM in Gastric Cancer

**Kalaivani Panneerselvam[1], Hemamalini Arambakkam Janardhanam[2]**

[1]PhD Research Scholar, Department of Clinical Nutrition, Sri Ramachandra Faculty of Allied Health Sciences, Tamil Nadu, Chennai, India. [2]Professor & Head Department of Clinical Nutrition, Sri Ramachandra Faculty of Allied Health Sciences, Sri Ramachandra Institute of Higher Education and Research, Chennai-600116, Tamil Nadu, India.

## Abstract

**Background:** Malnutrition is a frequent and serious complication among patients with gastrointestinal (GI) cancers, adversely affecting clinical outcomes such as post-operative recovery, extended duration of hospitalization (LOS), overall survival, good health and well-being. The Global Leadership Initiative on Malnutrition (GLIM) provides standardized criteria for diagnosing malnutrition, this can be enriched by handgrip strength (HGS) as a functional marker. **Aim:**This research sought to assess the outcomes of structured dietary support on the phenotypic, etiological aspects of nutritional status in individuals with stomach cancer. **Methods:**This prospective interventional study included 30 adult participants with upper or lower GI cancers who underwent elective surgery at a multispecialty tertiary care hospital. Nutritional assessments were conducted pre- and post-operatively using GLIM criteria, and HGS. Individualized nutritional interventions included oral nutritional counselling, oral nutrition supplements (ONS), and post-operative dietary support with total parenteral nutrition (TPN) and enteral nutrition (EN) as indicated. The impact on nutritional status, time to achieve estimated calorie and protein requirements, and length of hospital stay (LOS) were evaluated. Statistical significance of the impact of nutritional intervention was assessed using chi-square and Wilcoxon signed-rank tests, and outcomes shown as $p<0.05$. **Results:** Pre-operatively, 80% of participants were classified as moderately malnourished and 20% as severely malnourished according to GLIM criteria. Post-operatively, all patients were categorized as moderately malnourished. Handgrip strength was below reference values in 73% pre-operatively and 80% post-operatively. However, the mean HGS demonstrated a statistically significant improvement following intervention ($p=0.026$). Participants receiving oral nutritional supplements and/or TPN achieved 75% of their estimated energy and protein requirements earlier compared to those maintained on oral diet alone. Severely malnourished patients had a significantly longer LOS ($11 \pm 0.7$ days) compared to moderately malnourished patients ($8.9 \pm 1.2$ days). **Conclusion:** Use of GLIM criteria combined with HGS is effective for timely identification and monitoring of malnutrition, structured nutritional interventions based on standardized screening may reduce length of hospital stay, enhance clinical outcomes, there by optimizing overall patient prognosis.

**Keywords:** Gastrointestinal cancer- GLIM criteria- nutritional intervention- handgrip strength- malnutrition

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## Introduction

As one of the most common malignancies, gastrointestinal (GI) cancers account for the second highest number of cancer-related deaths globally. Tumor burden, chronic inflammation often impair food intake and accelerate nutrient loss, predisposing patients to malnutrition. Malnutrition can affect up to 80% of UGI cancer patients and is well documented as an independent risk factor for increased mortality, length of hospital stay, surgical complications, and chemo-radiotherapy toxicity in cancer populations.

To address inconsistencies in malnutrition diagnosis, the Global Leadership Initiative on Malnutrition (GLIM)

**Corresponding Author:**
Dr.A.J.Hemamalini
Professor & Head, Department of Clinical Nutrition, Sri Ramachandra Faculty of Allied Health Sciences, Tamil Nadu, Chennai, India.
Email: hemamalini.aj@sriramachandra.edu.in

introduced a standardized set of diagnostic criteria in 2019. The GLIM framework includes three phenotypic criteria non-volitional weight loss, low body mass index (BMI), and reduced muscle mass and two etiologic criteria reduced food intake or assimilation, and disease-related inflammation. A diagnosis of malnutrition requires the presence of at least one phenotypic and one etiologic criterion [1].

GLIM guidelines recommend measuring skeletal muscle mass using imaging technologies; their clinical application maybe limited by cost, technical constraints, and lack of accessibility. Handgrip strength (HGS), a simple, validated, and cost-effective surrogate for muscle function and nutritional status, has emerged as a practical alternative. Studies have demonstrated the prognostic significance of low HGS in predicting mortality and treatment outcomes in cancer patients [2]. Moreover, HGS has been recognized as a functional marker for both cancer cachexia and sarcopenia, thus enhancing its utility in the clinical setting [3]. Given its predictive value, ease of use, and relevance to functional status, HGS serves as a feasible clinical adjunct to GLIM-based nutritional assessment, particularly in resource-limited settings.

This study evaluated the impact of a structured nutritional intervention on the phenotypic and etiologic criterion as assessed by GLIM among patients with GI cancers undergoing elective surgical procedures.

## Materials and Methods

A prospective interventional study was conducted between November 2024 and January 2025 in the Department ofSurgical Oncology at amulti-specialty tertiary care medical center, Chennai. A total of 30 adult patients (≥18 years) diagnosed with GI cancers and scheduled for elective surgery were enrolled. Patients with non-GI malignancies, those under 18 years, and critically ill patients were excluded. The study received ethical approval from the Institutional Ethics Committee (IEC/23/DEC/183/31) and was registered in the Clinical Trials Registry of India (CTRI/2024/12/078589). Written informed consent was obtained from all participants prior enrollment.

Baseline data collected pre-operatively included demographic characteristics, clinical diagnoses, nutritional history, and anthropometric measurements. Nutritional status was assessed pre- and post-operatively using the GLIM criteria. Handgrip strength (HGS) was measured using a hand-held dynamometer following standardized protocols. Within the GLIM framework, HGS was used as a functional indicator to reflect muscle function in patients with gastrointestinal malignancies. In addition to assessing muscle function, HGS can also be considered a practical surrogate marker of muscle mass. HGS is widely utilized in oncologic and surgical populations because it is simple, non-invasive, cost-effective, and has demonstrated associations with postoperative complications, treatment tolerance, length of hospital stay, and survival outcomes.

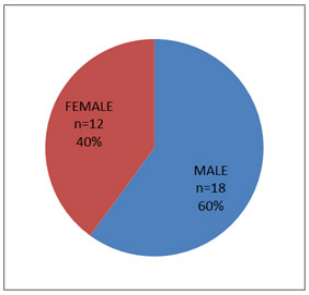

Figure 1. Gender Distribution.

Nutritional intervention was tailored to individual needs, including oral nutritional counselling, administration of oral nutritional supplements (ONS) pre operatively, enteral feeding and TPN as appropriate. Nutritional intake was monitored daily using a 24-hour dietary recall. Post-operative assessments were conducted prior to discharge.

The primary outcome was the change in phenotypic and etiologic criteria of malnutrition post operatively. Secondary outcomes included time toachieve estimated caloric and protein needs and hospital length of stay (LOS). Statistical analysis was performed using Wilcoxon signed-rank test and chi-square test with a $p < 0.05$ considered statistically significance.

## Results

The study included among 30 participants (18 males and 12 females), (Figure 1).Themean age of 60.6 ± 10.1 years among males and 59.7 ± 10.1 years for females.

Table 1. Distribution of Gastrointestinal Cancers

| Gender N=30 | Stomach n (%) | Colon n (%) | Rectum n (%) | Esophagus n (%) | Gallbladder n (%) | GIST n (%) | Mean age (years) |
|---|---|---|---|---|---|---|---|
| Male (n=18) | 4 (13) | 7 (23) | 5 (17) | 1 (3) | 1 (3) | 0 | 60.6±10.1 |
| Female (n=12) | 4 (13) | 1 (3) | 4 (13) | 1 (3) | 1 (3) | 1 (3) | 59.7±10.1 |

Table 2. Nutritional Status Assessed Using GLIM Criteria (N=30)

| GLIM category | Pre-operative n (%) | Post-operative n (%) |
|---|---|---|
| Moderate malnutrition (Score 1) | 24 (80) | 30 (100) |
| Severe malnutrition (Score >2) | 6 (20) | 0 |

Table 3. Comparison of Weight loss Pre and Post Operative (N=30)

| Period | Significant weight loss n (%) | Severe weight loss n (%) | No weight loss n (%) | p-value |
|---|---|---|---|---|
| Pre-operative | 5 (16.7) | 11 (36.7) | 14 (46.7) | 0.059 |
| Post-operative | 18 (60.0) | 0 | 12 (40.0) | 0.18 |

Table 4. Pre and Post Operative Body Mass Index (N=30)

| | Pre-operative BMI (Kg/m²) | Post-operative BMI (Kg/m²) | p-value |
|---|---|---|---|
| Gender | | | |
| Male (n=18) | 24.5±5.8 | 22.1±1.9 | 0.001* |
| Female (n=12) | 22.6±5.8 | 21.1±2.4 | 0.632 |

P <0.05 was considered statistically significant

*Distribution of GI cancers*

Among the 30 participants rectal cancer was most common diagnosis (30%), colon (27%), stomach cancer (27%), oesophagus cancer and gall bladder cancer each accounted for 7% cases, and gastrointestinal stromal tumour (3%) of the study populations (Table 1). Rosania R et al. [4] stated that gastric cancer ranks third in terms of cancer-related death worldwide and is the fifth most frequent type of cancer. Cancer patients often have malnutrition, with an incidence between 40% and 80% and a prevalence between 50% and 80%, depending on tumor type and site, disease stage, treatment, and nutritional assessment method.

*Nutritional Status as Assessed using GLIM Criteria*

Phenotypic criteria: Preoperatively, the assessment indicated that 80% (n=24) of the participants were moderately malnourished and 20% (n=6) were severely malnourished (Table 2). Weight loss was significant: 53% (n=16) of the patients experienced notable preoperative weight loss, with 68.7% (n=11) meeting the criteria for severe weight loss (mean 6.6 ± 2.7 kg). Interestingly, 14 participants reported no history of weight loss, showing heterogeneity in baseline nutritional status (Table 3). Preoperative weight loss has been widely recognized as a predictor of postoperative complications, nutritional decline, and prolonged recovery in GI cancer patients [5].

Postoperatively, the participants lost weight an average of 2±0.68 observed within the first week, and 12 patient has maintained stable weight. This observation may also be linked to changes in ghrelin secretion post-surgery. Ghrelin plays a vital role in promoting appetite, gastric motility, and energy regulation, and its decline may contribute to acute weight loss postoperatively [6].

The BMI analysis showed a significant postoperative reduction in males (24.5 ± 5.8 to 22.1 ± 1.9,p=0.001) (Table 4), however, the change was not substantial in females. Although BMI is widely used, it's utility as a predictor of surgical complications or long-term outcomes in cancer remains limited. Previous studies suggest that BMI alone may not reliably predict postoperative outcomes in gastric cancer [7].

K Segami et al. [8] in his study stated that Cytokines such as interleukin (IL)-6, IL-1, tumor necrosis factor, and interferon-γ play central roles in the host inflammatory response. Their synthesis depends on amino acids released from muscle catabolism, thereby contributing to body weight (BW) loss.

Meng et al. [9] conducted a randomized trial in gastric cancer patients at nutritional risk after

Table 5. Muscle Mass as Assessed using Handgrip Strength

| HGS N=30 | Pre-operative | Post-operative | p-value |
|---|---|---|---|
| Weak | 17.6±4.4 (22) | 20.1±4.3 (24) | 0.024* |
| Normal | 23.3±7.4 (8) | 23.5±6.9 (6) | 0.026* |

P <0.05 was considered statistically significant

Table 6. Pre op Nutrient Intake

| Mode of Nutrition Support (N=30) | Calorie Intake (kcal) -50% | Mean Duration of Days | Calorie Intake (kcal) – 75% | Mean Duration of Days | Protein Intake (g) – 50% | Mean Duration of Days | Protein Intake (g) – 75% | Mean Duration of Days |
|---|---|---|---|---|---|---|---|---|
| Oral Diet + ONS (n=25) | 980.3±95.7 | 1.24±0.43 | 1290.9±105.0 | 1.82±0.35 | 33.5±2.28 | 1.24±0.43 | 52.6±1.52 | 1.82±0.35 |
| Oral Diet without ONS (n=5) | 829.2±32.0 | 1.7±0.27 | 1228.4±60.2 | 2.2±0.27 | 30.4±0.89 | 1.7±0.27 | 46.4±3.13 | 2.2±0.27 |
| P–value | 0.001* | 0.031* | 0.122 | 0.02* | 0.016* | 0.031* | 0.001* | 0.02* |

P <0.05 was considered statistically significant

Table 7. Post op Nutrient Intake

| Mode of Nutrition Support | Calorie Intake (kcal) -50% | Mean Duration of Days | Calorie Intake (kcal) – 75% | Mean Duration of Days | Protein Intake (g) – 50% | Mean Duration of Days | Protein Intake (g) -75% | Mean Duration of Days |
|---|---|---|---|---|---|---|---|---|
| (N=30) | | | | | | | | |
| TPN | 874.9±95.9 | 1.25±0.5 | 1374.2±79.0 | 2.5±0.5 | 34.5±0.53 | 1.25±0.5 | 52.5±0.53 | 2.5±0.5 |
| (n=12) | | | | | | | | |
| EN+TPN | 916.5±44.5 | 1.6+0.5 | 1385.8±63.5 | 1.8±0.35 | 40.18±3.48 | 1.6+0.5 | 60.2±2.05 | 1.8±0.35 |
| (n=11) | | | | | | | | |
| ORAL DIET+ONS (n=7) | 902±55.0 | 2.5±0.54 | 1354.6±61.9 | 3.0±0.0 | 44.8±0.75 | 2.5±0.54 | 62.8±1.72 | 3.0±0.0 |
| P - value | 0.613 | 0.041* | 0.483 | 0.032* | 0.001* | 0.041* | 0.001* | 0.032* |

P <0.05 was considered statistically significant

Table 8. Etiologic Criteria

| Etiologic criteria | Pre-Operative | Post- Operative | p-value |
|---|---|---|---|
| N=30 | n (%) | n (%) | |
| Reduced Food Intake Or Assimilation | 21 (70) | 9 (30) | 0.022* |
| Nausea/vomiting | 7 (23) | 3 (10) | 0.018* |
| Diarrhea | 15 (50) | 4 (13) | 0.002* |
| Abdomen pain | 9 (30) | 0 | 0.001* |
| LOA | 7 (23) | 3 (10) | 0.018* |
| Fatigue | 15 (50) | 7 (23) | 0.032* |
| Feel full quickly | 8 (27) | 4 (13) | 0.197 |
| Dysphagia | 2 (7) | 0 | 0.13 |
| Inflammation and Disease Burden | 30 (100) | 30 (30) | 0.991 |
| Cancer | 30 (100) | 30 (30) | 0.991 |
| Diabetic | 13 (43) | 13 (43) | 0.991 |
| Hypertensive | 11 (37) | 11 (37) | 0.991 |
| CAD | 6 (20) | 6 (20) | 0.991 |
| Age greater than 65 | 11 (37) | 11 (37) | 0.991 |

P <0.05 was considered statistically significant

gastrectomy. Patients receivedONS plus dietary advice for 3 months post-discharge had significantlyless weight loss (–2.3 ± 3.1 kg) than those received dietary advice alone (–4.0 ± 3.3 kg, p<0.001), with concurrent preservation of skeletal muscle index.

The muscle mass, as assessed by Hand Grip Strength using the Hand Grip Strength dynamometer is presented in Table 5.

Handgrip strength (HGS), an essential functional marker, revealed that 73% (n=22) had weak muscle strength preoperatively. The mean HGS in this group was 17.6 ± 4.4 and only 27% (n=8) had normal strength (mean 23.3 ± 7.4). Postoperatively, the number of participants with low muscle strength increased to 24, though a slight increase in average HGS scores was noted. Two rectal cancer patients who had normal preoperative HGS showed a decline postoperatively, possibly due to surgical stress, systemic inflammation, and immobilization, all of which are known to drive muscle catabolism and protein breakdown in the early postoperative period [10, 11]. Lieffers and Weimann et al. [10, 11] stated that this could be attributed to surgical stress response, postoperative inflammation, and reduced mobility, all of which contribute to rapid muscle catabolism and functional decline in gastrointestinal cancer patients.

*Pre Op Nutrient Intake*

The mean estimated nutritional requirements for the study population were 1905 ± 136.0 kcal for energy and 69.3 ± 3.24 g for protein. In terms of pre op dietary intake, participants receiving oral diet with ONS achieved 50% of caloric/protein requirements in 1.24 ± 0.43 days and 75% in 1.82 ± 0.35 days (Table 6). Participants initiated with peripheral parenteral nutrition achieved 50% and 75% of estimated requirements in 1.25±0.5 and 2.5±0.5 days, respectively. The combination of EN and TPN facilitated a Signiant faster transition to optimal intake compared to oral diet alone (Table 7). Severely malnourished patients experienced a significantly extended length of stay 11 ± 0.7 days, compared to moderately malnourished patients (8.9 ± 1.2 days), (p-value=0.0002) (Table 9).

Among 25 patients receiving an oral diet along with oral nutrition supplements (ONS), the average duration to achieve 50% of estimated calorie and protein requirements was 1.24 ± 0.43 days, while the duration to reach 75% of requirements averaged 1.82 ± 0.35 days. In contrast, among 5 patients consuming only a homemade oral diet reached 50% of their calorie and protein needs

Table 9. Pre Op Nutritional Status Vs Length of Hospitalization

| Nutritional Status (N=30) | n (%) | Mean ± SD LOS Days | p-value |
|---|---|---|---|
| Moderately Malnourished | 24 (80) | 8.9±1.2 | |
| Severely Malnourished | 6 (20) | 11±0.7 | 0.0002* |

P <0.05 was considered statistically significant

in an average of 1.7 ± 0.27 days, whereas achieving 75% intake required a significantly longer duration, with a mean of 2.2± 0.27daysshowing that combined feeding routes accelerate nutritional restoration whereas Oral-only reach targets slowly, indicating the importance of oral or enteral or parenteral supplementation in early recovery [12].

*Etiologic Criteria*

Postoperatively, there was a significant reduction in several gastrointestinal-related etiologic factors among GI cancer patients following preoperative nutrition support. Notable improvements included decrease in reduced food intake or assimilation (70% to 30%, p = 0.022), nausea/vomiting (23% to 10%, p = 0.018), diarrhea (50% to 13%, p = 0.002), abdominal pain (30% to 0%, p = 0.001), loss of appetite (23% to 10%, p = 0.018), and fatigue (50% to 23%, p = 0.032) (Table 8). Early satiety and dysphagia showed non-significant trends towards improvement. However, inflammatory comorbid conditions such as diabetes, hypertension, and coronary artery disease, along with the underlying cancer burden and age distribution, remained unchanged postoperatively (p = 0.991).

*Pre op Nutritional status and Duration of Hospitalization*

The length of hospitalization (LOS) was significantly influenced by the patient's preoperative nutritional status. Severely malnourished patientsexperienced a significant extended hospital duration (11.0 ± 0.7 days) compared to those with moderate malnutrition (8.9 ± 1.2 days), with a statistically significant association (p=0.0002). This finding reinforces the value of early nutritional intervention in potentially reducing hospitalization duration and accelerating recovery [13].

In conclusion, the findings underscores the critical role of GLIM-based nutritional assessment in perioperative care of GI cancer patients. Despite a relatively short 12-day preoperative nutrition intervention a significant number of patients demonstrated improvement in intake and symptom relief. However, postoperative nutritional deterioration, characterized by decline in muscle strength and weight remained evident in a subset, emphasizing the need for continued nutrition therapy post-surgery.

The use of combined nutrition modalities (ONS+/ TPN + EN) postoperatively proved effective in achieving early nutritional targets, suggesting their benefit in recovery protocols. To optimize long-term clinical outcomes and well-being, a continuum of nutritional care from diagnosis through postoperative recovery is essential. Future research involving follow-ups larger cohorts are warrantedto further explore the impacts on survival, quality of life, and treatment tolerance.

*Data Availability Statement*

The data that support the findings of this study are available from the corresponding author, (Dr.A.J.Hemamalini), upon reasonable request.

*Approval of Institutional Ethical Review Board*

This study was approved by the Sri Ramachandra Institutional Ethical Committee and clinical Trials Registry India. (IEC/23/DEC/183/31)

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*Declaration of Interest*

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

All authors have read and approved the final version of the manuscript and agree with its submission to Asian Pacific Journal of Cancer Biology.

*Author Contribution Statement*

Ms. Kalaivani P. conducted the data collection, analyzed the data, and prepared the initial draft of the manuscript. Dr. A. J. Hemamalini (corresponding author) provided overall supervision, guided the work step by step, reviewed and corrected all versions of the manuscript, and oversaw the final revisions. Both authors read and approved the final version of the manuscript.

## References

1. Cederholm T, Jensen GL, Correia MITD, Gonzalez MC, Fukushima R, Higashiguchi T, Baptista G, et al. GLIM criteria for the diagnosis of malnutrition - A consensus report from the global clinical nutrition community. Clinical Nutrition. 2019 02;38(1):1-9. https://doi.org/10.1016/j.clnu.2018.08.002
2. Norman K, Stobäus N, Gonzalez MC, Schulzke J, Pirlich M. Hand grip strength: outcome predictor and marker of nutritional status. Clinical Nutrition. 2011 04;30(2):135-142. https://doi.org/10.1016/j.clnu.2010.09.010
3. Kilgour RD, Vigano A, Trutschnigg B, Hornby L, Lucar E, Bacon SL, Morais JA. Cancer-related fatigue: the impact of skeletal muscle mass and strength in patients with advanced cancer. Journal of Cachexia, Sarcopenia and Muscle. 2010 Dec;1(2):177-185. https://doi.org/10.1007/s13539-010-0016-0
4. Rosania R, Chiapponi C, Malfertheiner P, Venerito M. Nutrition in Patients with Gastric Cancer: An Update. Gastrointestinal Tumors. 2016 05;2(4):178-187. https://doi.org/10.1159/000445188
5. Shim H, Park YS, Kim YI et al. Prognostic Significance Of Weight Loss In Stage III Gastric Cancer Patients Undergoing Adjuvant Chemoradiotherapy. J Cancer Res ClinOncol.

2014;140(4):553–558.
6. Takachi K, Doki Y, Ishikawa O, et al. Postoperative Loss Of Ghrelin May Contribute To Body Weight Loss After Gastrointestinal Surgery. World J Surg. 2006;30(8):1510–1515..
7. Voglino C, Ferrero A, Sguazzini C, et al. Impact Of Body Mass Index on Surgical Outcomes After Gastrectomy For Cancer: A Propensity Score-Matched Analysis. Ann SurgOncol. 2015;22(1):232–238..
8. Segami K, Aoyama T, Kano K, Maezawa Y, Nakajima T, Ikeda K, Sato T, et al. Risk factors for severe weight loss at 1 month after gastrectomy for gastric cancer. Asian Journal of Surgery. 2018 07;41(4):349-355. https://doi.org/10.1016/j.asjsur.2017.02.005
9. Meng Q, Tan S, Jiang Y, Han J, Xi Q, Zhuang Q, Wu G. Post-discharge oral nutritional supplements with dietary advice in patients at nutritional risk after surgery for gastric cancer: A randomized clinical trial. Clinical Nutrition. 2021 01;40(1):40-46. https://doi.org/10.1016/j.clnu.2020.04.043
10. Lieffers JR, Bathe OF, Fassbender K, Winget M, Baracos VE. Sarcopenia is associated with postoperative infection and delayed recovery from colorectal cancer resection surgery. British Journal of Cancer. 2012 09 04;107(6):931-936. https://doi.org/10.1038/bjc.2012.350
11. Weimann A, Braga M, Carli F, Higashiguchi T, Hübner M, Klek S, Laviano A, et al. ESPEN guideline: Clinical nutrition in surgery. Clinical Nutrition. 2017 06;36(3):623-650. https://doi.org/10.1016/j.clnu.2017.02.013
12. Braga M, Gianotti L, Vignali A, Cestari A, Bisagni P, Di Carlo V. Artificial nutrition after major abdominal surgery: impact of route of administration and composition of the diet. Critical Care Medicine. 1998 01;26(1):24-30. https://doi.org/10.1097/00003246-199801000-00012
13. Barker LA, Gout BS, Crowe TC. Hospital malnutrition: prevalence, identification and impact on patients and the healthcare system. International Journal of Environmental Research and Public Health. 2011 02;8(2):514-527. https://doi.org/10.3390/ijerph8020514