The impact of computerization of the nutrition support process on the nutrition support program in a tertiary care hospital in the Philippines: Report for the years 2000–2003

Luisito O. Llido

Room 315-316, MAB, Nutrition Support Services, St. Luke’s Medical Center, E. Rodriguez Sr. Avenue; Quezon City, Metro-Manila, Philippines

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Summary

Background & aims: To improve hospital health care delivery by identifying malnutrition in all admitted patients and following up those identified to be malnourished and “at risk of developing malnutrition” a hospital nutrition support program based on the JCAHO system was initiated in 1999. Two major problems were encountered: first, the inability to perform a nutrition surveillance process due to failure by the staff to implement existing nutrition screening tools and second, the lack of awareness and support from the medical staff in this initiative. Two solutions were implemented in 2000: computerization of the nutrition screening and nutrition support process and synchronizing this with the whole nutrition support program.

Methods: A computer program was developed which performs BMI-based nutrition screening, produces lists of all malnourished patients, and computes the different formulas for either nutritional requirement or parenteral and/or enteral formulation. It also generates patient status reports based on encoded data from the nutrition support team, which prioritized these patients for management based on the data output.

Results: From 2000 to 2003, improvement was seen in these areas: entry of height and weight in the patient record increased from 30% to 90%; nutrition surveillance shows nutritional status distribution to be: normal (58%), underweight (9%), overweight (25%), and obese (8%), referrals to the nutrition support team based on the screen notification increased from 37% to 100%, patient coverage by nutrition services increased from 7374 (38.8%) in 2000 to 11,369 (83%) in 2003, and critical care patients seen increased from 10% in 2000 to 99% in 2003.

Keywords

JCAHO; Computerization; Nutrition computer database; Nutrition support

Abbreviations: JCAHO, Joint Commission on Accreditation of Health Care Organizations (2); BMI, body mass index

Tel.: +632 7230301 local 6315 or 6316.
E-mail address: llido2001@yahoo.com.
Improvement is needed in physician response to nutrition support recommendations, which still remains low (11.2–24%).

**Conclusions:** Computerization helps to improve nutrition support delivery in the hospital, but more cooperation and support from the medical staff is still needed for better results.

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**Introduction**

Malnutrition has been documented to be prevalent in a sizable portion of the hospital population with more patients getting more malnourished as their stay increased. With the objective of improving hospital-based patient health care delivery through malnutrition detection and instituting a nutrition support management system, the nutrition committee of our hospital (St. Luke’s Medical Center) started a program in 1999 based on the guidelines delineated by the Joint Commission on Accreditation of Health Care Organizations (JCAHO). The JCAHO was organized in the United States with the main goal of instituting and sustaining the highest standard of hospital patient care delivery through the establishment of policies and guidelines, which are to be implemented in these institutions. The hospital nutrition support program consists of these procedures in the following order: nutrition screening of all admitted patients to identify the malnourished and at risk of developing malnutrition, nutritional assessment of identified patients at risk of developing malnutrition or malnutrition-associated problems, developing nutrition care plans for these patients, solution formulation either parenteral or enteral for nutrition delivery, monitoring of the nutrition management process, and reevaluation of the result of nutrition management and redesign of the nutrition care plan if needed. Implementation was done by the nutrition support services, which consists of the clinical nutrition section of the dietary department and the nutrition support team. For standardization purposes, the hospital nutrition committee defined malnutrition as either “undernutrition” or “overnutrition”. The criteria for “undernutrition” are the following: body mass index (BMI) below 18.5, BMI of 18.5 and above with weight loss of more than 10% of the usual weight, and patients with subjective global assessment (SGA) grade of “B” or “C”. Patients with BMI above 25 are classified as having “overnutrition” further subdividing them to either “overweight” if their BMI falls within 25.1–30 and “obese” if their BMI goes above 30. Malnutrition refers to the “undernutrition” and “overnutrition-obese” group.

Two major problems were immediately encountered when the program was implemented in the first quarter of 1999. The first problem was the inability to achieve an accurate nutrition surveillance system using available nutrition screening tools (Nutrition Screening Initiative) due to a lack of involvement from the medical staff in implementing them. The few personnel capable of correctly doing this could not adequately cover the rapid patient turnover rate (average patient stay of 4 days). Although all new hospital personnel underwent orientation and training on how to get a nutrition history, perform nutrition screening, and accomplish SGA, they hardly performed these or placed the data in the patient record. Thus it was impossible to identify all patients who are malnourished and “at risk of developing malnutrition” on entry, ending up with only a few patients receiving adequate nutrition care. The second problem was the absence of a system which will get more physicians to be fully involved in the nutritional care of their patients, thus failing to maximize utilization of the few personnel available, who can perform adequate nutrition support on these patients. Support in all areas from the medical staff is also minimal.

Measures to achieve an effective nutrition surveillance of the whole hospital population and to fully maximize the services delivered by the nutrition support services to the malnourished patient population were developed and immediately implemented. The initial step was computerization of the nutrition support process followed by redesigning the nutrition support team roles to involve more hospital staff in performing the nutrition management process. Efforts were focused by the nutrition support services on education and encouragement by showing tangible beneficial effects of nutrition support on the patients. All these measures were implemented in the year 2000. This is the progress report on the implementation of the program from the years 2000 to 2003. The objectives of this report are: to present the mechanics of the nutrition support program computerization, to present the program’s outcome like the values and trends of the computer-generated nutrition surveillance data for the
years 2000–2003, to show its subsequent impact on the hospital-based nutrition support program, and to present the areas where improvements need to be done.

Methods

Nutrition screening and assessment

The nutrition screening process is initiated by taking the patient’s height in meters and weight in kilograms on admission. The height is taken using a standardized stadiometer while the weight is taken from a weighing scale, which is regularly calibrated (once every 6 months). A history of weight loss is elicited and documented by the admitting nurse from all admitted patients. The identified patients are tagged by the computer program and a list of patients is generated for the nutrition support team for follow-up. These patients are identified to be “at risk of developing malnutrition or malnutrition-associated problems” who fit the following criteria: BMI below 18.5, BMI above 18.5 with weight loss of more than 10%, intensive care, cancer, stroke, or geriatric patients. A more comprehensive nutritional assessment is then done by the nutrition support dietitian or physician on these patients. For determining the BMI-based nutritional status, the nutrition support services adopted the values recommended by the World Health Organization (WHO) for adult and geriatric patients. The values are: BMI below 18.5—underweight, BMI between 18.5 and 25—normal, BMI between 25.1 and 30—overweight, and BMI above 30—obese. For the pediatric patients the BMI values were based on data provided by the Food and Nutrition Research Institute of the Philippines (FNRI) and the Philippine Pediatric Society (PPS).

The computerization program

A nutrition management computer program was developed by the author and installed in the hospital network by the hospital information technology personnel (Fig. 1). This program performs the following functions: nutrition screening, nutritional assessment, nutritional requirement computation, parenteral or enteral solution formulation, and data entry for progress notes and other nutrition data like calorie counts, laboratory results, and progress notes. The patient’s height in meters and weight in kilograms are entered by the nursing unit secretary into the nursing unit computer. These data are stored in the hospital central computer database server together with nutrition-related data, which are: patient identification number; patient name; age; sex; nationality; religion; height in meters, weight in kilograms; room number; initial diet ordered; and name of attending physician. These data are downloaded to the nutrition support service computer database server, which processes the information into utilisable nutrition data. Additional information is entered by the nutrition support encoder. A key information produced by the program is the patient’s BMI and corresponding nutritional status, which is automatically computed by the program. The BMI was chosen as the cut off point to group patients into different nutritional status groups, which makes it easier to prioritize the ones who

![Figure 1 Nutrition support computer database set up.](image-url)
need to be seen first by the nutrition support team
aside from the identified "at risk population"
already present in the nutrition support services
database.

Nutrition surveillance
After downloading and updating the nutrition data,
the nutrition support services encoder can now
generate a daily nutrition surveillance list of all
admitted patients with the following informa-
tion—over-all hospital census for the day; the
number of patients with normal, underweight,
overweight, and obese BMI in every unit; the
number of patients with no height or weight or
wrong data entry, which serve as quality care and
performance indicators for the nurses. These lists
are given to the nursing service director and other
interested departments for their own records and
reference. Lists of specific malnourished patients
can also be generated for the different depart-
mments of the medical staff for their own patient
follow-up.

The nutrition support process
One of the first outputs of the program is the
generation of nutrition screen sticker printouts
which will be placed in the patient’s medical
record. These small notes contain the following
information: the patient’s BMI, nutritional status,
ideal body weight, recommended total calorie and
protein requirements (Fig. 2). This procedure
serves two purposes: first, the information on the
patient’s nutritional status with the suggested
nutritional requirements will initiate the attending
physician’s involvement in the nutritional care of
the patient. Second, the presence of this note will
further interest him/her in nutrition support. Only
patients tagged as underweight, overweight with
BMI of 27 and above, and obese had these stickers
pasted in their charts. If the attending physician
sees the need for nutrition management he/she
refers the patient to the nutrition support team or
the clinical dietary section for co-management.
The BMI of 27 was an arbitrary value, set through
the consensus the nutrition support services mem-
bers, to mark the start of obesity in recognition of
the "Asian criteria",8,9 which classifies obesity
starting from a BMI of 25.1. The WHO values are
still the official reference points and the decision
to make this minor change was done in order to make
some comparison studies on these two criteria. The
"underweight" and "obese" patients are initially
seen by the clinical dietitians, who either give
them leaflets or small "guidebooks" for weight
gain or weight loss. Eventually full management by
diet prescriptions and related activities are given
when the patients are formally referred by the
attending physician to the nutrition support
service.

Full nutritional assessment is done on the
identified nutritionally at-risk patients by the
nutrition support team with the main bulk of
patients handled by the clinical dietitians. Nutri-
tional assessment and requirement data, sugges-
tions on nutrition delivery, and comments on
progress of the patient are placed in the team in
the patient’s medical record and encoded into the
computer program. Intensive care patients are seen
daily while the other patient groups are followed
up on a regular basis. The nutrition software
computes the data for nutritional assessment like
the prognostic nutrition index and nutritional
requirement values like the calorie and protein
requirements for pediatric and adult patients.
Several methods like the "short method" (actual
body weight in kilograms multiplied by 25 kcal/kg
for the critically ill and 30–35 kcal/kg for the rest)
or the "long method" like the Harris-Benedict
equation, special formulas for ventilator or non-
ventilator pulmonary care patients are computed
with ease by the program which then presents all
values for comparison and decision making pur-
poses. An enteral nutrition order is calculated by
the program based on the content of the different
formulas which can be immediately accessed by the
dietitian from the program, thus shortening the
preparation period. Parenteral nutrition formula-
ion is automatically processed either in the

![Figure 2](image-url)

The nutrition screen sticker and its contents:
BMI, BMI-based nutritional status, ideal body weight,
suggested total calorie and protein requirement based
on the ideal body weight. This is placed in the patient’s
medical record.

St. Luke’s Medical Center

<table>
<thead>
<tr>
<th>Family Name</th>
<th>First Name</th>
<th>Middle Name</th>
<th>Height (meters)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.60</td>
<td>50</td>
</tr>
<tr>
<td>This is the Patient’s Ideal Body Weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Room</td>
<td>Attending MD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male 60.6 kg.</td>
<td>Fem 57.9 kg.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI 18.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Suggested Requirements based on the IDEAL BODY WEIGHT |
|----------------|----------------|
| Total Energy Requirements | 1376 to 1819 kcal/day |
| Total Protein Requirements | 58 to 61 gm/day |

<table>
<thead>
<tr>
<th>Nutritional Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
</tr>
<tr>
<td>Underweight</td>
</tr>
<tr>
<td>Overweight</td>
</tr>
<tr>
<td>Obese</td>
</tr>
</tbody>
</table>

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The nutrition support team and the target patient population

The nutrition support team is composed of three nutrition support physicians, three nutrition support fellows, five clinical dietitians, one clinical pharmacist, and two nutrition support nurses (only supervisory, not active in direct patient care). They are tasked to follow-up the "need to be seen" patient population (Tables 3 and 4). The "need to be seen" patient population is the priority patient population for nutritional management. They consist on the average of around 80 patients per day or 20% of the daily hospital census. The hospital has 100–150 new admissions per day with a daily census of 400–500 in-patients. The patient average length of stay is 4–5 days (89% of all admissions), however, the longer term patients (more than 2 weeks hospital stay comprising 3–4% of all admissions) are the ones who receive the nutrition support care ranging from regular nutritional assessment, access evaluation and placement, calorie counting, enteral and parenteral nutrition delivery or evaluation. Most of these patients are seen by the nutrition support team. The hospital diet is handled by the therapeutic dietitians, who handle the menu preparations, which range from the regular hospital food to the special diets such as standard and modular enteral formulas.

The physician acts as the team leader who gives direction for the team in both individual patient care and team interaction. He/she also acts as the intermediary between the nutrition support team, nutrition committee, and the whole medical staff. He has assistant nutrition support physicians for help. The clinical dietitians are in charge of nutrition screening and assessment, calorie counting, and making suggestions on the diet prescription. The nurses are in charge of proper delivery and monitoring of enteral and parenteral nutrition while the clinical pharmacist is in charge of quality control in the preparation of parenteral nutrition solutions. All procedures on nutrition support are based on the guidelines on hospital nutrition support as outlined by the JCAHO.2

Continuing education program

In order to sustain the goals of nutrition support the whole medical staff is continuously updated through the following activities: nutrition support practice orientation on entry of all residents, fellows, and interns, postgraduate courses once a year on parenteral and enteral nutrition, a two day intensive basic clinical nutrition course called Total Nutrition Therapy (TNT)10 held once or twice a year, and a 2-year clinical nutrition fellowship program (hospital based).

Statistical analysis

To show difference in proportions in the different nutritional status groups the z test for independent proportions was used. Correlations were analyzed using the Pearson correlation coefficient and significant values are expressed as $P < 0.05$.11

Results

The computerization program outcomes are shown in the nutrition surveillance data which presents the profile of the nutritional status of the hospital population from the years 2000 to 2003. The outcome and progress of the nutrition support team’s work on the patients identified for nutrition support are also shown with focus on the response of the medical staff to these efforts to involve them in the nutrition management process. The areas where improvement is seen and finally where more work needs to be done are presented last.

Nutritional status profile of the hospital patient population

A total of 135,888 patients were collected in the nutrition data bank. The "malnourished group" and thus the malnutrition prevalence rate is between 15% and 19% (Table 1). The malnutrition prevalence is not showing any significant increase or decrease from 2000 to 2003. The "normal"
population, which is the biggest group, shows a decreasing trend from 60% to 49.5%. The “overweight” population, which is the next biggest group, shows the opposite pattern, increasing from 20.6% to 31.3%. The “malnourished” population fluctuates between 15% and 19%. The “underweight” group shows a decreasing trend from 11.2% to 9.1% while the “obese” group shows the opposite, increasing from 8.1% to 10.1%.

Malnutrition profile in the different age groups

1. The Pediatric Age Group (Table 2)—this group comprises the smallest segment of the whole hospital population (16.4%). The “normal” group is decreasing from 53% to 42% in the years 2000–2003. The “overweight” group shows the opposite trend, increasing from 19% to 32%. The “malnourished” group is decreasing from 29% to 26% with its two subgroups showing these patterns—the “underweight” subgroup is decreasing from 27% to 24% while the “obese” subgroup is stable at 1–2%.

2. The Adult Age Group (Table 2)—this is the biggest segment of the hospital population (60.7%). The “normal” group is decreasing from 65% to 49% from 2000 to 2003. The “overweight” group is increasing from 21% to 33%. The “malnourished” is also increasing from 14% to 18% with its two subgroups giving contrasting patterns. The “underweight” group is slightly

Table 1  Nutritional status profile, admitted patients (n = 135,888).

<table>
<thead>
<tr>
<th>Nutritional Status</th>
<th>Year 2000</th>
<th>Year 2001</th>
<th>Year 2002</th>
<th>Year 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal (%)</td>
<td>60.1</td>
<td>63</td>
<td>57.4</td>
<td>49.5***</td>
</tr>
<tr>
<td>Underweight (%)</td>
<td>11.2</td>
<td>8</td>
<td>8.9</td>
<td>9.1***</td>
</tr>
<tr>
<td>Overweight (%)</td>
<td>20.6</td>
<td>22</td>
<td>25.7</td>
<td>31.3**</td>
</tr>
<tr>
<td>Obese (%)</td>
<td>8.1</td>
<td>7</td>
<td>7.9</td>
<td>10.1***</td>
</tr>
<tr>
<td>Malnourished (%)</td>
<td>19.3</td>
<td>15</td>
<td>16.8</td>
<td>19.2†</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>38,063</td>
<td>36,641</td>
<td>29,982</td>
<td>31,202</td>
</tr>
</tbody>
</table>

Malnourished = underweight + obese.

**P<0.05, z approximation, (+) Pearson R, year 2000–2003.

Table 2  Nutritional status in different age groups, admitted patients.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Nutritional status</th>
<th>Year 2000</th>
<th>Year 2001</th>
<th>Year 2002</th>
<th>Year 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pediatric (n = 22289 or 16.4%)</td>
<td>Normal (%)</td>
<td>53</td>
<td>67</td>
<td>53</td>
<td>42***</td>
</tr>
<tr>
<td></td>
<td>Underweight (%)</td>
<td>27</td>
<td>16</td>
<td>21</td>
<td>24***</td>
</tr>
<tr>
<td></td>
<td>Overweight (%)</td>
<td>19</td>
<td>16</td>
<td>24</td>
<td>32**</td>
</tr>
<tr>
<td></td>
<td>Obese (%)</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2†</td>
</tr>
<tr>
<td></td>
<td>Malnourished (%)</td>
<td>29</td>
<td>17</td>
<td>23</td>
<td>26***</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5480</td>
<td>6695</td>
<td>5320</td>
<td>4794</td>
<td></td>
</tr>
<tr>
<td>Adult (n = 82447 or 60.7%)</td>
<td>Normal (%)</td>
<td>65</td>
<td>61</td>
<td>52</td>
<td>49***</td>
</tr>
<tr>
<td></td>
<td>Underweight (%)</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>5†</td>
</tr>
<tr>
<td></td>
<td>Overweight (%)</td>
<td>21</td>
<td>24</td>
<td>31</td>
<td>33**</td>
</tr>
<tr>
<td></td>
<td>Obese (%)</td>
<td>8</td>
<td>9</td>
<td>12</td>
<td>13**</td>
</tr>
<tr>
<td></td>
<td>Malnourished (%)</td>
<td>14</td>
<td>15</td>
<td>17</td>
<td>18**</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>24,502</td>
<td>22,028</td>
<td>17,177</td>
<td>18,740</td>
<td></td>
</tr>
<tr>
<td>Geriatric (n = 31152 or 22.9%)</td>
<td>Normal (%)</td>
<td>55</td>
<td>65</td>
<td>60</td>
<td>56†</td>
</tr>
<tr>
<td></td>
<td>Underweight (%)</td>
<td>17</td>
<td>8</td>
<td>8</td>
<td>10***</td>
</tr>
<tr>
<td></td>
<td>Overweight (%)</td>
<td>21</td>
<td>20</td>
<td>23</td>
<td>24**</td>
</tr>
<tr>
<td></td>
<td>Obese (%)</td>
<td>7</td>
<td>7</td>
<td>9</td>
<td>10**</td>
</tr>
<tr>
<td></td>
<td>Malnourished (%)</td>
<td>23</td>
<td>15</td>
<td>17</td>
<td>19***</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>73,42</td>
<td>82,111</td>
<td>78,64</td>
<td>77,35</td>
<td></td>
</tr>
</tbody>
</table>

Malnourished = underweight + obese.

**P<0.05, z approximation, (+) Pearson R, year 2000–2003.
decreasing from 6% to 5% (not significant), while the "obese" subgroup is increasing from 8% to 13%.

3. The Geriatric Age Group (Table 2)—this segment comprises 22.9% of the overall hospital population. Its "normal" group is slightly increasing from 55% to 56% (not significant), while the "overweight" population increased from 21% to 24%. The "malnourished" group is decreasing in trend from 23% to 19%, with its "underweight" segment decreasing from 17% to 10% and its "obese" segment increasing from 7% to 10%.

Nutrition support program implementation and response by the medical staff

1. Nutrition screening and referrals to the nutrition support services by the medical staff—there is an increasing trend in the number of referrals to the nutrition support services as shown by the following data. First, referrals following placement of sticker notifications in the patient’s medical record grew from 33.9% in 2000 to 100% in 2003 (Table 5). Second, the volume of referrals handled by the nutrition support team alone increased from 508 (6.8%) to 1920 (16.8%) (Table 6). Third, the volume of referrals handled by the nutrition support team members and clinical dietitians also increased from 7374 (38.8%) to 11,369 (83%) from 2000 to 2003 (Table 6).

2. The nutrition support management of the "needed to be seen" patient population (Table 6)—over all, there is an increase in services delivered to the patients who need nutrition support and marked as "priority" for follow-up by the nutrition support services (Tables 3 and 4). The volume of critical care patients seen from 2000 to 2003 increased from 10.3% to 99%. Enteral nutrition services per patient like formulation, delivery, and monitoring also doubled in volume from 405 (1.06%) to 856 (2.7%). An increase in the utilization of parenteral nutrition was noted, but this was very minimal from zero (0%) in year 2000 to 64 (0.21%) in 2003. The number of patients who were identified to have low albumin on admission and were evaluated for malnutrition increased from zero (0%) in 2000 to

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**Table 3** Criteria for the "needed to be seen" patient population.

<table>
<thead>
<tr>
<th>Description</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI screen</td>
<td>Patients with BMI of &lt;18.5 (underweight), 27 and above (obese) are given sticker notification in the charts and followed up at least once during hospital stay or when the attending physician refers them to the team</td>
</tr>
<tr>
<td>Critical care</td>
<td>Intensive care, coronary care, acute stroke, and major surgical patients with post-operative complications are checked daily while in the ICU and twice a week hereafter. Patients in the intermediate care unit are checked at least once a week.</td>
</tr>
<tr>
<td>Parenteral nutrition</td>
<td>Patients on parenteral nutrition are checked for intake and status at least twice a week</td>
</tr>
<tr>
<td>Tube fed</td>
<td>Tube-fed patients are checked for intake and status at least twice a week with priority given to the difficult to manage or critical care patients</td>
</tr>
<tr>
<td>Referrals</td>
<td>Formal referral for nutrition support from the attending physician</td>
</tr>
<tr>
<td>Low albumin</td>
<td>Patients with albumin of 3 g/dl or lower and clinically correlated to have malnutrition risks are followed up twice a week or at least once during the hospital stay</td>
</tr>
</tbody>
</table>

**Table 4** The “priority” patient population for nutritional management.

<table>
<thead>
<tr>
<th>Patient type</th>
<th>Year 2000</th>
<th>Year 2001</th>
<th>Year 2002</th>
<th>Year 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical care</td>
<td>4471</td>
<td>3208</td>
<td>2585</td>
<td>977</td>
</tr>
<tr>
<td>Geriatric</td>
<td>3107</td>
<td>3808</td>
<td>2994</td>
<td>2487</td>
</tr>
<tr>
<td>Cancer</td>
<td>4472</td>
<td>4158</td>
<td>3059</td>
<td>1541</td>
</tr>
<tr>
<td>Stroke</td>
<td>1960</td>
<td>2888</td>
<td>2170</td>
<td>1217</td>
</tr>
<tr>
<td>Coronary care</td>
<td>893</td>
<td>670</td>
<td>510</td>
<td>253</td>
</tr>
<tr>
<td>Others &gt; 15 hospital days (includes surgical patients)</td>
<td>414</td>
<td>625</td>
<td>1249</td>
<td>1540</td>
</tr>
<tr>
<td>Referrals</td>
<td>3687</td>
<td>2788</td>
<td>4167</td>
<td>5684</td>
</tr>
<tr>
<td>Total</td>
<td>19,004</td>
<td>18,145</td>
<td>16,734</td>
<td>13,699</td>
</tr>
<tr>
<td>Patients &gt; 2 weeks hospital stay</td>
<td>1653</td>
<td>1304</td>
<td>1586</td>
<td>1464</td>
</tr>
<tr>
<td>Total Admissions</td>
<td>38,063</td>
<td>36,641</td>
<td>29,982</td>
<td>31,202</td>
</tr>
</tbody>
</table>
451 (1.4%) in 2003. Even referrals to the nutrition support team for management of complications or issues of management priorities in these “needed to be seen” patients increased from 508 (6.8%) in 2000 to 1920 (16.8%) in 2003.

3. Response of specialty groups to the nutrition support process (recommendation given and the response of the attending physician among the different age groups): In the number of referrals category there was a good increase in the adult and geriatric age group, but a minimal rise in the pediatric age group (Fig. 3).

Areas where improvement is seen

1. Data entry—the data entry of height and weight in the patient’s medical record increased from 30% to 90% within the year 2000. This is in stark contrast to the rate of data entry in 1995 (Nutrition surveillance and management, St. Luke’s Medical Center, initial report for the year 2000, unpublished) where the best effort could only achieve a 30% data entry accomplishment. Accuracy in data entry also improved as shown by the decreasing percentages of wrong entries and improved nurse compliance in the decreasing rate of non-entries either of weight and/or height (Table 5).

2. Nutrition support services from nutrition screening to assessment followed by nutrition care delivery such as enteral and parenteral nutrition to the “needed to be seen” patients have all increased (Table 6).

3. Referrals to and increased productivity of the clinical dietitians—involvement of the clinical dietitians in total patient care is seen in the increasing referrals from the medical staff from 38% in year 2000 to 83% in 2003 and the increased coverage of critical care patients from 10.3% in 2000 to 99% in 2003 (Table 6).

Table 5 Recommendations given, response to the recommendations, and referrals for nutrition services (indicators of nutrition management compliance).

<table>
<thead>
<tr>
<th></th>
<th>Year 2000</th>
<th>Year 2001</th>
<th>Year 2002</th>
<th>Year 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referrals made after BMI screen notification</td>
<td>508/1499 (33.9%)</td>
<td>785/785 (100%)</td>
<td>1135/1595 (71%)</td>
<td>1697/1697 (100%)</td>
</tr>
<tr>
<td>Recommendation carried out after BMI screen referral</td>
<td>168/1499 (11.2%)</td>
<td>251/785 (32.1%)</td>
<td>328/1135 (29%)</td>
<td>408/1697 (24%)</td>
</tr>
<tr>
<td>No weight and/or height entered in the medical record</td>
<td>6777 (17.5%)</td>
<td>7621 (20.8%)</td>
<td>4098 (13.8%)</td>
<td>5232 (16.6%)</td>
</tr>
<tr>
<td>Wrong entries of height and/or weight in the medical record</td>
<td>434 (1.12%)</td>
<td>172 (0.47%)</td>
<td>59 (0.20%)</td>
<td>154 (0.49%)</td>
</tr>
</tbody>
</table>

* p < 0.05, z approximation, (--) Pearson R, year 2000 < 2003.

Figure 3: Referrals to the nutrition support team is higher in the adult and geriatric patient groups compared to the pediatric patient group. Percent referrals = total referrals for the year divided by total admissions for the year. *P < 0.05, z test for independent proportions, pedia < adults and pedia < geria.
Discussion

The realization of the global prevalence of malnutrition in the hospital setting started the impetus for the development of nutrition support. Improvement concerns in patient health care delivery specially in reducing morbidity and mortality, costs, and development of new products and systems that improve patient nutritional status and recovery have led to the organization of the nutrition support service and team. Essentially, the main goal of nutrition support is to organize and rationalize the different modes of nutritional management to deliver the best health care to the patient. Despite its acknowledged value, implementation of the whole nutrition support process from the time a patient is admitted to discharge met drawbacks in this institution (SLMC) due to factors, attitude wise and economic, which hamper the organization and implementation of an effective nutrition support process. A major obstacle is the lack of awareness on the existence and value of nutrition support among the medical staff. Attending physicians also shied away from referring due to concerns of adding more expense for their patients. Adding more personnel to boost the care delivery process is difficult due to economic factors, which the hospital administration has no control.

The development of a computerized system of performing nutritional surveillance and a multi-disciplinary approach to nutrition management has helped in improving the hospital-based nutrition support program through these approaches. First, an improved performance in the nutrition screening process and enhanced information dissemination to the attending physician without added cost is achieved. The generation of nutrition stickers and lists of malnourished patients, which are immediately released and placed in the patient’s medical record directly involved the physician in the nutritional care of his patient. It has even improved the whole health care surveillance process by involving the nursing staff and clinical pharmacists in noting the deficiencies reported by the program in nutrition screening and utilization of enteral and parenteral nutrition. Secondly, the redefining of the nutrition support team and nutrition team member roles with clear patient inclusion criteria have increased patient coverage, increased

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**Table 6** Nutrition support procedures performed during the years 2000–2003.

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Year 2000</th>
<th>Year 2001</th>
<th>Year 2002</th>
<th>Year 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI screen given</td>
<td>1499/38063* (3.9%)</td>
<td>785/36641+ (2.1%)</td>
<td>1595/29982* (5.3%)</td>
<td>1697/31202* (5.4%)</td>
</tr>
<tr>
<td>Critical care patients seen/target patients</td>
<td>459/4471 (10.3%)</td>
<td>651/3208 (20.3%)</td>
<td>1360/2585 (49.8%)</td>
<td>975/977 (99.8%) **</td>
</tr>
<tr>
<td>Enteral nutrition</td>
<td>405/38063* (1.06%)</td>
<td>713/36641* (1.9%)</td>
<td>866/29982* (2.9%)</td>
<td>856/31202* (2.7%)</td>
</tr>
<tr>
<td>Parenteral nutrition</td>
<td>0/38063* (0.00%)</td>
<td>7/36641* (0.02%)</td>
<td>88/29982* (0.29%)</td>
<td>64/31202* (0.21%)</td>
</tr>
<tr>
<td>Referred to NST/target patients seen</td>
<td>508/7374 (6.8%)</td>
<td>869/5576 (15.5%)</td>
<td>1135/8335 (13.6%)</td>
<td>1920/11369 (16.8%) **</td>
</tr>
<tr>
<td>Albumin &lt;3 g/dl</td>
<td>0/38063* (0.00%)</td>
<td>91/36641* (0.25%)</td>
<td>448/29982* (1.5%)</td>
<td>451/31202* (1.4%)</td>
</tr>
<tr>
<td>Target patients seen by NSS/target population</td>
<td>7374/19004 (38.8%)</td>
<td>5576/18145 (30.7%)</td>
<td>8335/16734 (49.8%)</td>
<td>11369/13699 (83%) **</td>
</tr>
</tbody>
</table>

*Please see Table 4.

**P<0.05, z approximation, (+) Pearson R, year 2000<2003.

**Total admissions for the year; NST = Nutrition Support Team; NSS = Nutrition Support Services.
awareness of nutrition support among medical staff, and better physician involvement in nutritional management of the patient.

Indicators from the computer program makes identification and follow-up of these patients easier due to the daily production of a nutrition surveillance report and nutrition support monitoring list. The rapid patient turnover rate (89% discharged within 4–5 days) made nutrition surveillance a challenge, but with computerization and a clear design of the whole procedure flow, all patient data were captured and a clearer view of the patient health profile was achieved. The malnutrition profile shows similar prevalence rates with studies done in major centers worldwide, but what is noticeable is the increasing "overweight" population in the hospital. This may be a reflection of the economic status of patients admitted in this institution (Class A and B), hence reflecting the increasing "heaviness" of the Asian population due to globalization of the diet. Obesity is still low at 8–10% in the over-all general population. The finding of an increasing "underweight" pediatric population may just be a reflection of the type of patients and disease state admitted in this institution.

A better appreciation of the patient’s nutritional status and its effect on management by the physician is seen through the increased referrals to both the nutrition support team and clinical dietitians. The referrals are mainly for the nutrition care of patients, both in the critical care and long-term care setting. Identification of the long-term patients also made better follow-up of this group, with the whole nutrition support service involved in quality care delivery and monitoring. Regular nutritional assessment data, calorie counts, and progress reports are done on these patients and the data are all encoded, currently available for both the nutrition team and attending physician to see. Essentially, the nutrition support physician is involved in patient assessment, evaluation, and prescription, while the clinical dietitians are involved in the diet prescription, formulation, either as enteral or parenteral nutrition, and calorie counts. At this point outcome data are still being collected for evaluation of the effects of these nutritional interventions to this group of patients.

The low physician response to the recommendations of the nutrition support team is an indicator showing that more work still needs to be done in the area of information regarding the mechanics and value of nutrition support to patient care. There are indications that the nutrition support team is slowly getting there, but a more aggressive and thorough follow-up is required. This deficiency may be corrected through the following strategies which are now currently in the implementation phase: (a) active involvement of the whole medical staff in the nutrition management process through placing nutrition support progress forms and nutrient monitoring forms in the patient’s chart, (b) involvement of the team in the regular updates and grand rounds of the different departments and institutes, (c) lower parenteral nutrition costs through formulation standardization, (d) regular scheduled nutrition support service orientation for the whole year to the different staff and departments of the hospital, and (e) initiating a clinical nutrition fellowship training program (focused on nutrition support). Finally, a more meticulous documentation of the services, performance, and results on the patient health care delivery process is needed in order to show areas of improvement or where more work needs to be focused on. It is with the presence of a nutrition support database computer program, which can objectively show improvement in nutrition care delivery and ultimately better patient outcome, and a rationalized system of nutrition support care that the above goals will hopefully be achieved in a shorter period of time in the future. Although some progress has been made in reaching out to the adult and geriatric care practitioners, more involvement by the team in pediatric nutrition support is still needed. An initial discussion and linkage with the pediatric consultants and training officers has to be done. A difference in approach to nutrition support for adult and pediatric patients has been observed especially in the area of nutritional assessment, requirement computation, and parenteral nutrition formulation which needs to be ironed out in order to have an effective cooperation between the two groups. Finally the very low utilization of artificial nutrition in this institution shows the concern of the medical staff on cost for their patients, thus putting the utilization rate of this mode of nutrition to a very low level. Additional factors noted are unfamiliarity with parenteral nutrition formulation and fears of introducing sepsis to the patient. This situation is an urgent call for more information dissemination on the long-term advantages of adequate nutrition through artificial nutrition. Involvement of the whole nutrition support team, especially the physicians and clinical pharmacist, is needed in bridging this gap and thus increase utilization of this valuable mode of therapy.

Acknowledgments

Nutrition Support Services Team, St. Luke’s Medical Center, Manila, Philippines—Members: Nutrition
support physicians (Luisito O. Llido, MD; Gabriel Jasul, MD; Michael John Encarnacion, MD); Nutrition Support Dietitian, Fellow (Edel Navarette); Dietitians (Marilu Rivera, RD; Eloisa Villaraza, RD; Ma. Nenita Umali, RD; Michele Malicdem, RD; Juvy Martillos, RD; Iree Velasco, RD; Aileen Macapagal; Ruby Frane, RD); Nursing Service (Josefina Levosada, RN); Pharmacy (Edmon Gutierrez); Nutrition Data Encoder/Secretary (Danilo Palomar).

References