Modified Hospital Elder Life Program: Effects on Abdominal Surgery Patients

Cheryl Chia-Hui Chen, RN, DNSC, Ming-Tsan Lin, MD, PhD, Yu-Wen Tien, MD, PhD, Chung-Jen Yen, MD, Guan-Hua Huang, PhD, Sharon K Inouye, MD, MPH

BACKGROUND: Postsurgical functional decline is common in older patients and can lead to frailty and increased mortality. Comprehensive interventions such as the Hospital Elder Life Program (HELP) have been shown to be effective, but modifying the HELP to include only 3 key interventions might prove cost-effective for surgical patients.

STUDY DESIGN: Consecutive patients from August 2007 through April 2009 (n = 179) were enrolled if they had undergone common elective abdominal surgical procedures, such as gastrectomy, cholecystectomy, and Whipple surgery. A modified HELP intervention consisting of early mobilization, nutritional assistance, and therapeutic (cognitive) activities implemented by a trained nurse was introduced on a surgical ward in May 2008. Patients enrolled before May 2008 received usual care and served as controls (n = 77). Those enrolled after the modified HELP intervention constituted the experimental group (n = 102). Changes in performance of activities of daily living, nutritional status, and cognitive function between admission and discharge were the primary end points.

RESULTS: Independent of baseline functions, education, periampullary diagnosis, comorbidity, surgical procedure, and duration of surgery, patients in the HELP group declined significantly less on activities of daily living performance and nutritional status ($p < 0.001$) than controls. The delirium rate was also significantly lower in the HELP group (0%) than in the control group (16.7%) ($p < 0.001$).

CONCLUSIONS: The modified HELP intervention effectively reduced older surgical patients' functional decline and delirium rates by hospital discharge. This program, conducted by a trained nurse, was not costly but did require commitment and ongoing cooperation between physician and nursing leadership to achieve compliance with the protocols. (J Am Coll Surg 2011;213:245–252. © 2011 by the American College of Surgeons)

Surgical procedures are now more common in the elderly because of longer life expectancies and enhanced surgical safety. Fifty percent of individuals older than 65 years are estimated to undergo surgical procedures during their remaining years, and surgical admissions have already outnumbered nonsurgical admissions for older patients.[1] In fact, approximately 2 million older Americans undergo abdominal surgical procedures each year, and >36% of major elective abdominal operations in the United States were performed on patients at least 65 years old.[2] Similar trends are seen in Taiwan, with 39% of abdominal operations in 2005 were performed on older patients.[3] These percentages will likely increase because of aging populations worldwide, and the proportionately higher need for major surgery in the older age group.

The impact of surgery and hospitalization on older patients is substantial but not well-studied.[4] Older adults can have greater difficulty recovering from surgery because of decreased physiological reserves.[5] Surgery also evokes a stress response and can contribute to de-conditioning in older surgical patients.[6] In fact, surgery and prolonged bed rest during hospitalization have been associated with an up to 60% loss of muscle strength in 6 weeks and an additional 5% loss of muscle mass per week thereafter,[7] as well as a

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From the Department of Nursing, National Taiwan University College of Medicine, National Taiwan University Hospital (Chen), Departments of Surgery (Lin, Tien) and Internal Medicine (Yen), National Taiwan University College of Medicine, National Taiwan University Hospital, Taipei, Taiwan, Institute of Statistics, National Chiao Tung University, Hsinchu (Huang), Taiwan, and Department of Medicine, Beth Israel Deaconess Medical Center, Harvard Medical School and Institute for Aging Research, Hebrew Senior Life, Boston, MA (Inouye).

Correspondence address: Cheryl Chia-Hui Chen, DNSc, National Taiwan University School of Nursing, 1, Jen-Ai Rd, Section 1, Taipei, Taiwan ROC 100. email: cherylchen@ntu.edu.tw

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Abbreviations and Acronyms

ADL = activities of daily living
BI = Chinese Barthel Index
GDS-15 = Chinese Geriatric Depression Scale Short-Form
HELP = Hospital Elder Life Program
MMSE = Chinese Mini-Mental State Examination
MNA = Chinese Mini-Nutritional Assessment

17% to 88% incidence of postoperative pulmonary dysfunction due to decreased diaphragmatic excursion after abdominal surgery.[8] Additionally, slow return of bowel function after abdominal surgery is a common reason for prolonged nothing-by-mouth orders and can lead to weight loss and poor nutritional status.[9] Cognitive problems after noncardiac surgery are common; 10% to 60% of older patients experience delirium and 7% to 26% experience postoperative cognitive decline.[10,11] Older postsurgical patients are particularly vulnerable to functional decline because of common iatrogenic complications, including delirium, prolonged time to flatus, and loss of strength from immobilization.

Older patients' postsurgical functional decline can be prevented and reduced by the Hospital Elder Life Program (HELP),[12] the core interventions of which include a protocol for daily visits/orientation, therapeutic (cognitive) activities, early ambulation, vision/hearing adaptation, oral intake and feeding assistance, and sleep enhancement. Additional program interventions include geriatric nursing assessment and intervention, interdisciplinary rounds, discharge planning, provider education, and geriatrician and interdisciplinary consultation.[13] The program has been widely replicated in medical and geriatric wards, and its clinical effectiveness and cost-effectiveness are well-established.[13-17] However, such a comprehensive program might not be feasible for every health care system, particularly where reimbursement is minimal and qualified personnel are limited. On the other hand, modifying the HELP to include 3 key elements most relevant to surgical patients might prove more cost-effective in reducing older patients' functional decline after major surgery.

We selected 3 key elements based on our earlier work on functional decline[18-20] and the concept of shared risk factors.[21-23] We modified the HELP to include 3 shared risk factors (ie, functional, nutritional, and cognitive status) that were targeted by 3 modified HELP protocols, that is, early mobilization, nutritional assistance, and therapeutic cognitive activities. A modified HELP intervention such as the one proposed here has not previously been systematically evaluated. The purpose of this pre- and postintervention clinical trial was to examine the effects of a modified HELP intervention in reducing functional decline of older patients during hospitalization for abdominal surgery. Functional decline was defined as decreased performance of activities of daily living (ADL), nutritional status, and cognitive function.

Subjects could not be randomly assigned to the experimental or control group because of concerns about contamination. The majority of patient units in Taiwan are double- or triple-occupancy rooms, making it easy for patients and family caregivers in the control group to learn from what was done for patients in the experimental group. In addition, we wanted to assess the HELP in terms of its feasibility, efficacy, and clinical context by conducting a pre- and postintervention pilot trial before going to a full-scale randomized clinical evaluation.

METHODS

Subjects

For this pre- and postintervention clinical trial, consecutive older patients (65 years and older) admitted to the 36-bed gastrointestinal ward of a 2,200-bed urban medical center in Taipei were screened for enrollment. Patients were enrolled if they met 2 criteria, they were scheduled for elective abdominal surgery and their expected length of stay longer than 6 days. Patients were excluded if they had difficulty participating in interviews because of profound sensory impairment or aphasia that precluded verbal communication (n = 9), intubation or respiratory isolation (n = 14), and severe dementia, coma, or critical condition (n = 8).

Of 217 eligible patients, 189 (87%) were enrolled. The reasons given for not participating were: not feeling well (n = 6), family members refused (n = 4), and declined to consent (n = 18). The 179 participants (95%) who completed the study are the focus of this report. Primary reasons for attrition were death (n = 7) and withdrew consent (n = 3). Participants who did not complete the study (n = 10; 5 for the control and 5 for the HELP groups) were significantly older ($p = 0.03$), included more female patients ($p = 0.04$), and had poorer ADL performance at admission (Chinese Barthel Index [BI] score) ($p = 0.01$) than those who completed the study (n = 179). They did not differ, however, with respect to education ($p = 0.24$) and Charlson comorbidity index on admission ($p = 0.32$). Patients admitted from August 2007 to April 2008 served as the control group (n = 77) and received usual care. Patients enrolled from May 2008 to April 2009 constituted the experimental group (n = 102) and received the modified HELP intervention. The study was approved by the Research Ethics Review Committee of the medical center. Physicians and hospital staff at the study site were only aware of a pending nurs-

ing intervention study but were blinded to study design, hypothesis, and specific protocols of the HELP.

Intervention and usual care

The intervention (modified HELP) was implemented by a full-time trained HELP nurse who was blinded to the study hypothesis and did not serve as an outcomes assessor. The intervention consisted of a daily hospital-based care protocol, which included 3 key protocols, ie, early mobilization (ambulation or active range-of-motion exercise 3 times daily), nutritional assistance (daily oral care involving tooth brushing, nutrition screening, diet education, and feeding assistance if needed), and therapeutic (cognitive) activities (orientating communication and cognitively stimulating activities, such as discussing current events or word games 3 times daily).[13] In addition to usual care, participants received all 3 care protocols as soon as they returned to the surgical inpatient ward, straight from the postoperative room or had interim intensive care stays, and the intervention ended on hospital discharge. The majority of participants (54%) in the experimental group received approximately 7 days of the modified HELP intervention. All interventions were tracked daily for full implementation and adherence.

Usual care consisted of standard hospital care provided by physicians, nurses, and support staff (eg, dietitians, physical therapists) on the general surgery unit. The HELP nurses did not provide services to patients assigned to usual care. However, the same attending physicians provided care to patients in both the HELP and usual care groups.

Outcomes end points

The primary outcomes were the changes in functional status, nutritional status, and cognitive function between admission (T0) and hospital discharge (T1). Two trained outcomes assessors blinded to the study hypothesis used valid, standardized, and culturally validated instruments for both the experimental and control groups. Functional status was measured using the Chinese BI, which measures independence in performing 10 ADLs, with higher scores indicating better functional status.[24,25] Nutritional status was measured using the Chinese Mini-Nutritional Assessment (MNA). The 18-item MNA assesses nutritional status (state of nourishment), with possible scores of 0 to 30 and higher scores indicating better nutritional status.[26,27] Cognitive function was measured using the 11-item Chinese Mini-Mental State Examination (MMSE), which assesses orientation, registration, attention, calculation, recall, and language, with possible scores of 0 to 30 and lower scores indicating cognitive impairment.[28,29]

Secondary outcomes, such as changes in depressive symptoms between T0 and T1, were measured based on our hypothesis that improving ADL performance, nutrition, and cognitive function would improve depressive symptoms.[21] Depressive symptoms were measured by the15-item Chinese Geriatric Depression Scale Short-Form (GDS-15), the original scoring of which is scaled so higher scores indicate more depressive symptomatology.[30,31] However, we rescaled the GDS-15 scoring so that higher scores indicated fewer depressive symptoms. Higher scores indicated better status in all measures of our study. Other secondary outcomes included reduced body weight, grip strength, and delirium rate. Data were collected at T0 and T1 on grip strength of the dominant hand and on body weight. Grip strength was measured in kilograms of pressure using a digital hand-held dynamometer (GRIP-D, T.K.K 5401; Takei Scientific Instruments Co., Ltd) and body weight was measured by a portable digital scale (Tanita Corp.). Because many factors affect grip strength, measuring it consistently is important. For both groups, patients were required to stand with the shoulder slightly abducted (approximately 10 degrees), the elbow fully extended, and forearm in a neutral position. Measurements were taken from the mean of 2 trials, as suggested by the Japanese Physical Fitness Diagnosis Test.[32] Delirium was rated at T0 and T1 using the Confusion Assessment Method[33] based on MMSE scores.

Factors associated with functional decline

Clinical data were abstracted from medical records. Each patient's record was reviewed independently by at least 2 research nurses trained for this project. Baseline patient characteristics included age, sex, living with others (yes/no), marital status (married/unmarried), and education level (years). Clinical and hospital factors included diagnosis (gastric cancer, periampullary cancer, distal pancreatic cancer, and other), indication for surgery (malignant or not malignant), preoperative comorbidity, duration of surgery (minutes), surgical procedure (open, laparoscopic, or laparoscopic-assisted), hospital stay (days), and nothing-by-mouth orders (days). Comorbidity was measured using the Charlson Comorbidity Index, a multi−disease-specific weighted summary measure with possible scores of 0 to 37 and higher scores indicating greater mortality risk.[28] Duration of surgery, defined as the time between initial skin incision and skin closure, was assessed by reviewing anesthesia and operative notes.

Data analysis

Data were double-checked for accuracy and completeness. Data were analyzed using SAS software (version 9.2; SAS Institute, Inc.). Sample characteristics were analyzed and compared by treatment group at T0 and T1 using the *t*-test or Wilcoxon rank-sum test for continuous variables and chi-square test or Fisher's exact test for categorical vari-

Table 1. Baseline Characteristics and Hospital Factors by Group (n = 179)

Characteristic	HELP group (n = 102)	Control group (n = 77)	p Value
Demographic			
Age, y, mean (SD)*	73.3 (5.4)	72.6 (6.1)	0.46
Female, n (%)†	47 (46.1)	34 (44.2)	0.80
Living with other, n (%)†	100 (98.0)	73 (94.8)	0.41
Education, y, mean (SD)*	8.4 (4.7)	6.5 (5.7)	0.02
Diagnosis, n (%)			
Gastric cancer†	34 (33.3)	29 (37.7)	0.55
Periampullary cancer†	30 (29.4)	12 (15.6)	0.03
Distal pancreatic cancer†	8 (7.8)	6 (7.8)	0.99
Other†	30 (29.4)	30 (39.0)	0.18
Indication for surgery, n (%)			
Malignant†	83 (81.4)	57 (74.0)	0.24
Charlson index at admission, mean (SD)*	1.5 (1.4)	2.2 (2.2)	0.06
Baseline measures of outcomes, mean (SD)			
ADL performance status*	98.0 (6.1)	92.2 (13.6)	<0.001
Nutritional status*	24.0 (3.5)	20.7 (4.0)	<0.001
Cognitive status*	26.4 (4.3)	26.8 (3.7)	0.56
Hospital factors			
Surgical procedure, n (%)§			<0.001
Open	74 (72.6)	68 (88.3)	
Laparoscopic	10 (9.8)	0 (0)	
Laparoscopic-assisted	18 (17.6)	9 (11.7)	
Duration of surgery, min, mean (SD)*	226.8 (91.1)	199.0 (68.7)	0.04
Nothing-by-mouth, d, mean (SD)*	4.5 (4.0)	5.4 (4.4)	0.07
Length of hospital stay, d, mean (SD)*	17.4 (11.1)	19.4 (15.6)	0.27

*Based on Wilcoxon rank-sum test.
†Based on chi-square test.
§Based on Fisher's exact test.
ADL, activities of daily living.

ables. Variables were recoded as "changes in functional outcomes" using individual differences (T1−T0) and effects of the modified HELP intervention were evaluated using multiple linear regression analysis. To control for baseline cohort differences, we selected the variables that showed significant differences between the HELP and control groups in bivariate analyses and forced them into the regression models.

RESULTS

The modified HELP intervention was successfully implemented. Participants' mean ages for the HELP and control groups were 73.3 (SD 5.4) years and 72.6 (SD 6.1) years, respectively (Table 1). The most common diagnosis for both groups was gastric cancer, but the HELP group had more periampullary cancer (29.4% vs 15.6% in controls; $p = 0.03$). Therefore, more Whipple procedures were performed for the HELP group (18.6% vs 9.1% for controls; $p = 0.05$). The indication for surgery was primarily malignancy (81.4% for the HELP group vs 74.0% for controls; $p = 0.24$). Surgery duration was significantly longer for the HELP group (226.8 ± 91.1 minutes vs 199.0 ± 68.7 minutes for controls; $p = 0.04$), suggesting that they underwent more complex surgical procedures. In fact, surgical procedures differed between groups; the HELP group had more laparoscopic or laparoscopic-assisted procedures than the control group. Conversely, 73% of patients in the HELP group underwent an open procedure, and 88.3% of the control group had such a procedure ($p = 0.01$). In addition, the HELP group had significantly better baseline ADL performance and nutritional status than the control group ($p < 0.001$), but the groups did not differ in cognitive function ($p = 0.56$).

Effects on delirium, duration of nothing-by-mouth, and hospital stay

At hospital discharge, 12 control group subjects (16.7%) met delirium criteria, but none in the HELP group were delirious ($p < 0.001$). The HELP group had a shorter average duration of nothing-by-mouth (4.5 ± 4.0 days vs

Table 2. Group Means and Differences between Groups for Targeted Outcomes

Outcome	Hospital Elder Life Program (n = 102)		Control (n = 77)		Adjusted group difference in mean changes† (95% CI)	Adjusted p value†
	Baseline, mean (SD)	Change at discharge, mean (SD)	Baseline, mean (SD)	Change at discharge,* mean (SD)		
Primary						
Performance of ADLs	98.0 (6.1)	−11.8 (9.7)	92.2 (13.6)	−27.9 (10.3)	17.7 (14.7–20.7)	<0.001
Nutritional status	24.0 (3.5)	−2.8 (3.3)	20.7 (4.0)	−7.6 (3.7)	6.9 (6.0–7.8)	<0.001
Cognitive status	26.4 (4.3)	−0.4 (3.2)	26.8 (3.7)	−1.4 (1.8)	0.8 (0.0–1.6)	0.05
Secondary						
Depressive symptoms	11.4 (3.0)	−0.3 (3.1)	10.4 (2.9)	−4.4 (3.4)	4.4 (3.6–5.3)	<0.001
Body weight, kg	59.2 (10.4)	−2.2 (2.6)	59.4 (10.7)	−3.1 (2.9)	1.3 (0.5–2.0)	0.002
Grip strength, kg	24.2 (8.0)	−1.2 (3.6)	23.5 (8.7)	−2.6 (2.9)	1.8 (0.8–2.8)	<0.001

Performance of activities of daily living (ADLs) measured by Barthel Index; scores range from 0 (total dependence) to 100 (total independence). Nutritional status measured by Mini-Nutritional Assessment; scores range from 0 to 30, with higher scores indicating better nutritional status. Cognitive status measured by Mini-Mental State Examination; scores range from 0 to 30, with higher scores indicating better cognition. Depressive symptoms measured by Geriatric Depression Scale-short form; scores range from 0 to 15. Scoring was rescaled so higher scores indicate fewer depressive symptoms and better status.
*Changes = T1−T0.
†Adjusted for baseline functions, education, periampullary diagnosis, Charlson comorbidity, surgical procedure, and duration of surgery.

5.4 ± 4.4 days for controls), but this difference did not reach significance ($p = 0.07$). The HELP and control groups did not differ significantly in average length of hospital stay (17.4 ± 11.1 days vs 19.4 ± 15.6 days, respectively; $p = 0.27$).

Effects on postsurgical functional decline

With "change (T1−T0)" as the dependent variable, *t*-test revealed that the HELP group had less postsurgical functional decline than the control group (Table 2). Specifically, the control group's decline in BI score from pre- to post-hospitalization was more than double that of the HELP group (the HELP group's BI score declined 11.8 points by discharge, and the control group's score declined 27.9 points; $p < 0.001$). The HELP group's decline in BI score was only 42% of the corresponding decline in the control group. Likewise, the decline in MNA score was significantly less for the HELP group (2.8 vs 7.6 points for controls; $p < 0.001$) and this decline in the HELP group represented only 37% of the decline in the control group. The HELP group's decline in MMSE score was also much less (0.4 vs 1.4 MMSE points for controls), representing 28% of the corresponding decline in the control group. In addition, the HELP group had minimal changes in depressive symptomatology (−0.3 GDS-15 points), and the GDS-15 score of the control group declined considerably (−4.4 GDS-15 points) by hospital discharge.

The modified HELP intervention was also effective in maintaining weight and grip strength until discharge. The HELP group lost on average 2.2 kg body weight and the control group lost 3.1 kg ($p = 0.01$). For grip strength, the HELP group lost 1.2 kg and the control group lost 2.6 kg ($p < 0.001$). The HELP group's declines in body weight and grip strength were 71% and 46%, respectively, of corresponding control declines.

Significant differences in 6 baseline characteristics (Table 1) were adjusted for by multiple linear regression, with the 6 characteristics included as relevant covariates. Results confirmed that the HELP intervention substantially reduced in-hospital functional decline, adjusted for baseline cohort differences in functional status, education, presence of periampullary diagnosis, Charlson comorbidity, surgical procedure, and duration of surgery (Table 2). Only cognitive function had a borderline effect (adjusted $p = 0.05$). These results indicate that the modified HELP intervention is effective in reducing functional decline and delirium rates by hospital discharge.

DISCUSSION

The most important findings of our study are that the modified HELP intervention was successfully implemented and it ameliorated postsurgical functional decline and delirium rates for older patients undergoing common elective, abdominal surgical procedures. The functional benefits were clinically meaningful because ADL function (assessed by the BI) in the control group declined by 27.9 points in as little as 2 weeks of hospitalization, but by only 11.8 points in the HELP group. The HELP reduced functional declines, including 17.7 BI points (representing a full functional loss in 2 to 3 ADLs or a partial loss across more ADLs), 6.9 MNA points, 0.8 MMSE points, 4.4 fewer depressive symptoms, 1.3 kg less weight loss, and 1.8 kg less decline in grip strength. Those considerable reductions in functional decline are substantial and independent of baseline function, education, diagnosis, comorbidity, surgical procedure, and duration of surgery. In addition,

the modified HELP intervention effectively reduced delirium rates at discharge.

Our findings also indicate that the functional decline after surgery was protracted and substantial, suggesting that older surgical patients need interventions with proven efficacy. Our results are consistent with a report of functional decline in 372 American patients (60 years or older) who underwent major abdominal surgery and were followed for 6 months after discharge.[4] On average, these patients' ADL performances declined 2.8 points on the modified Katz scale (representing a loss of 2 to 3 ADLs), MMSE dropped 0.5 point, and grip strength declined 2 kg. Recovery was slow and persistent disability at 6 months ranged from 52% on grip strength to 17% on cognition.[34] Taken together, these results speak to the urgent need for implementing postoperative programs that can improve recovery and reduce such functional declines.

The modified HELP intervention has great potential to be clinically feasible for effectively reducing in-hospital functional decline among older surgical patients. Receiving 7 days of the modified HELP intervention prevented full functional loss in 2 to 3 ADLs (or partial loss in function across more ADLs), decreased weight loss by 30%, and reduced delirium rates before hospital discharge, which are clinically important results. Whether the modified HELP intervention will have lasting effects after hospital discharge will require additional investigation in a follow-up study.

The demonstrated effect of our modified HELP intervention echoes current research on "fast-track surgery." Programs of fast-track surgery, or enhanced recovery after surgery, have included epidural or regional anesthesia, minimally invasive techniques, and aggressive postoperative rehabilitation,[35,36] all of which optimize pain relief, early mobilization, and nutrition (early oral feeding). Combining these approaches reduces the stress response, organ dysfunction, and complications, improving postoperative recovery.[37,38] For geriatric patients undergoing surgical procedures, these approaches might be even more important. Our study suggests that recovery of older surgical patients is enhanced by adding orientation and therapeutic cognitive activities to prevent postoperative cognitive dysfunction and by strengthening the nutritional protocol to include oral care and diet education to facilitate oral intake.

The feasibility of one HELP nurse managing 4 to 5 patients per day with 3 daily visits was achievable for 2 reasons. First, we incorporated therapeutic cognitive activities into the HELP's mobilization and diet education protocols. In fact, the majority of our patients did not feel challenged by talking when walking and enjoyed the therapeutic cognitive activities during mobilization. We designed therapeutic cognitive activities to actively engage patients in recalling or discussing issues that interested them, for example, the day the patient underwent surgery or preparing a favorite food, helping to minimize the physical and mental task burden. Second, family members are often present at bedside in Taiwan, as in many Asian cultures. Therefore, 1 nurse could handle 3 visits a day because family members could learn to help with hallway ambulation while the nurse got another patient moving. Trained volunteers were used in the original HELP at Yale University to implement ambulation, therapeutic activities, and feeding assistance 3 times per day.[12] Because high-quality volunteers are not yet widely available in Taiwan, and Taiwanese family caregivers are highly committed, we modified the HELP by using a trained nurse.

In addition, the demonstrated effects of our modified HELP intervention support the theory that common geriatric conditions have a shared set of risk factors, namely functional impairment,[21-23] cognitive impairment,[21-22] nutritional impairment,[21] and depressive symptoms.[21,23] We purposely included only early mobilization, nutritional assistance, and therapeutic cognitive activities as the key elements of this modified HELP intervention. Our hypothesis was that improving older patients' cognitive, nutritional, and functional abilities would decrease their depressive symptoms. This hypothesis is preliminarily supported by the positive outcomes of this study. Future studies are required to confirm this hypothesis.

Despite the contributions of this study, it had several important limitations. First, it was not feasible to randomize patients to study groups, which showed some substantial differences at baseline. The direction of selection bias, however, went in both directions. For example, longer operations as well as higher prevalence of periampullary cancer and Whipple procedures in the HELP group might have favored the control group; so no treatment effect would have been found. On the other hand, more years of education, lower Charlson score, and better baseline ADL performance and nutritional status would have favored finding a treatment effect of the HELP. These differences were carefully controlled in the multivariate regression analyses, and the effect of the HELP on postsurgical functional decline was not trivial, minimizing the chance of type 1 error.

Second, temporal separation of study groups is inevitable in before-and-after studies; however, the impact of this effect was minimized by the <2-year duration of monitoring patients. Therapeutic approaches were unlikely to have changed substantially during this short period. Third, attrition was 5.3% (n = 10), including 7 deaths. Because outcomes were not imputed, inferences were conditional

on patient survival. With a sample size of 179, our study was powered at 100% for ADL performance, 100% for nutritional status, 100% for depressive symptoms, and 75% for cognitive function to detect group differences in mean changes as shown in Table 2 (2-sided testing with α levels set at 0.05),[39] suggesting sufficient power to assess ADL performance, nutrition, and depressive symptoms with confidence. However, future studies with larger samples might be needed to assess the impact on cognitive outcomes.

Fourth, the intervention was tested at only 1 surgical ward, limiting the generalizability of our findings.

Fifth, despite our efforts to adjust for confounding factors, other factors might have remained. For example, we did not collect data on postoperative complications (eg, infection), so we cannot exclude the possibility that the HELP nurse promptly reported status changes, leading to early identification/treatment of postoperative complications and preventing declines in the HELP group. This pre- and postintervention controlled trial provides empirical data that an established geriatric intervention program, HELP, modified to include 3 key elements, can be successfully replicated in a surgical ward in Taiwan, clinically benefitting older patients undergoing common abdominal surgical procedures.

CONCLUSIONS

Caring for more elderly patients represents one of the most important challenges facing surgeons during the next decade. The HELP, an intervention of proven efficacy, was successfully disseminated to a site in Taiwan. The modified program tested in this study greatly reduced postsurgical functional decline and delirium rates at discharge in older patients (65 years and older) undergoing major abdominal surgery, primarily for resection of malignancy. Because surgery alone is an insufficient treatment for most of these patients and those with good functional status can be treated with adjuvant therapy to improve survival,[40] preventing postsurgical functional decline, including weight loss, is important to avoid treatment delay and can contribute to reducing treatment toxicity. Meanwhile, the interventions, conducted by a trained nurse, were not costly but would have been impossible without buy-ins from surgery, nursing, and hospital administrations, as well as ongoing cooperation between physician and nursing leadership to achieve compliance with the protocols. This intervention has considerable implications for improving outcomes and quality of life for older persons after major surgery, and can contribute to addressing the challenges of providing health care for an aging society.

Author Contributions

Study conception and design: Chen, Lin, Yen
Acquisition of data: Chen, Lin, Tien
Analysis and interpretation of data: Chen, Lin, Yen, Huang, Inouye
Drafting of manuscript: Chen
Critical revision: Chen, Lin, Tien, Yen, Huang, Inouye
Statistical analysis: Chen, Huang, Inouye
Obtaining funding: Chen, Inouye
Administrative, technical, and material support: Chen, Lin, Tien, Yen
Study supervision: Chen

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