



The Economics of Preventing Hospital Falls

Demonstrating ROI Through a Simple Model

Joanne Spetz, PhD, FAAN

Diane S. Brown, PhD, RN, CPHQ, FNAHQ, FAAN

Carolyn Aydin, PhD

OBJECTIVE: The objective of this study was to assess the cost savings associated with implementing nursing approaches to prevent in-hospital falls.

BACKGROUND: Hospital rating programs often report fall rates, and performance-based payment systems force hospitals to bear the costs of treating patients after falls. Some interventions have been demonstrated as effective for falls prevention.

METHODS: Costs of falls-prevention programs, financial savings associated with in-hospital falls reduction, and achievable fall rate improvement are measured using published literature. Net costs are calculated for implementing a falls-prevention program as compared with not making improvements in patient fall rates.

RESULTS: Falls-prevention programs can reduce the cost of treatment, but in many scenarios, the costs of falls-prevention programs were greater than potential cost savings.

CONCLUSIONS: Falls-prevention programs need to be carefully targeted to patients at greatest risk in order to achieve cost savings.

Patient falls are a significant concern for hospitals and the public and result in patient mortality and morbidity, legal risk, and increased costs. More than 1 million patient falls are estimated to occur in hospitals per year, making falls one of the most commonly reported adverse hospital events.¹ Falls occur in 2% to 20% of inpatient stays,²⁻⁴ and 10% to 30% of falls result in injury.^{1,2,5,6} Fall-related injuries can cause pain, disability, and functional impairment and may lead to death.^{2,6-8} Older, frail patients are more prone to falls in the hospital, and the likelihood of injury and increased long-term morbidity are greater among these patients.⁹ Patient falls impose significant financial costs, including increased expenditures to ensure an injury did not occur, treatment in the case of injury, and expenses associated with lawsuits.^{7,10,11}

Nursing care is recognized as an important factor in preventing patient falls.¹² The National Quality Forum has the rate of falls and falls with injury as nursing-sensitive indicators of the quality of care.¹³ Patient fall rates are measured and reported in nursing-sensitive quality registries that meet Centers for Medicare & Medicaid Services (CMS) requirements, such as the Collaborative Alliance for Nursing Outcomes (CALNOC) data registry and the National Database of Nursing Quality Indicators.¹⁴ Falls-prevention programs intensively engage nurses, typically involving multiple components that require coordination among all patient care staff and strong leadership.¹⁵ Nurses are responsible for assessing patients, developing care plans that include falls prevention approaches, and working with all staff who interact with patients (such as transporters, dietary aides, and technicians) to ensure patient safety. Despite the significant investment that is

Author Affiliations: Professor (Dr Spetz), Philip R. Lee Institute for Health Policy Studies & Center for the Health Professions, University of California, San Francisco; Executive Director for Cost Improvement Strategy (Dr Brown), Kaiser Permanente Northern California, Oakland, and Senior Scientist (Dr Brown), Collaborative Alliance for Nursing Outcomes (CALNOC), San Ramon, California; and Research Scientist, Cedars-Sinai Medical Center and Burns & Allen Research Institute, Los Angeles; and Data Management Services Director (Dr Aydin), CALNOC, San Ramon, California.

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Correspondence: Dr Spetz, Philip R. Lee Institute for Health Policy Studies, 3333 California St, Ste 265, San Francisco, CA 94118 (joanne.spetz@ucsf.edu).

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typically required for a falls-prevention program, some programs have not successfully reduced fall rates.² Nonetheless, most studies have found some cost savings associated with patient falls-prevention programs.^{16,17} This article presents a simple model that can be used by nurse leaders to use data from their own organizations to assess the cost savings that can be achieved from patient falls prevention programs.

Background

Many studies have focused on the identification of factors that predict greater risk for patient falls and on the effectiveness of approaches to reduce fall rates based on those risk factors. Intervention studies have measured fall rates ranging from 0.51 falls per 1000 patient-days to 4.37 per 1000 patient-days.^{16,18-23} Patient falls frequently result in a range of injuries, with measured rates ranging from 10% to 30% of falls.^{1,2,5,6,16,23} Falls occur more frequently among patients with confusion, greater comorbidity, gait instability, urinary incontinence, use of psychotropic medications, and a history of falls.^{10,24} Injuries are predicted by age, gender, ambulatory status, and the use of some medications such as antipsychotic agents and diuretic nonantihypertensive agents.^{1,7}

Falls-prevention programs typically involve multiple interventions including fall risk assessments to target interventions; patient and family education; care, safety, and toileting rounds; clutter-free environments; medication reviews; low beds; easily accessed call lights; alert signs in patient rooms and notes in patient records; and nonskid socks and footwear.¹⁵ Programs use a variety of implementation strategies including staff education, establishment of interdisciplinary task forces or committees, internal pilot-testing of programs, efforts to increase leadership engagement, and continuous quality improvement techniques.¹⁵ Evidence concerning the effectiveness of falls-prevention programs has been conflicting. A review published in the *Cochrane Database of Systematic Reviews* examined 17 trials in hospitals and concluded that multifactorial interventions reduced the rate of falls and the risk of falling.²⁵ Numerous individual studies have linked falls-prevention interventions with reductions in fall rates.^{18-23,26-31} However, 2 meta-analyses did not find significant evidence that multifactorial interventions reduce fall rates,^{15,32} and a number of individual studies also have not found improvements.^{2,33,34}

Reducing the incidence of patient falls should be a priority for hospitals because of both the significant morbidity falls incurred upon patients^{35,36} and the substantial financial costs of in-hospital fall treatment and lack of reimbursement by many payers for treatment following a hospital-acquired condition.^{37,38} A patient

fall necessitates a careful physical examination and often requires a computed tomography study to ensure that the patient has not sustained a head injury.³⁹ If an injury has occurred, there may be substantial increases in the length of stay and cost of care,¹⁰ as well as a greater risk of death. One study of 42 falls with injury identified 9 subsequent deaths; 5 of 18 patients with hip fractures died.³⁶

Payers are increasing pressure on hospitals to improve patient safety and reduce the costs associated with adverse events. Starting in 2008, the CMS eliminated reimbursements for in-hospital falls with trauma,⁴⁰ and some private insurers have followed suit.³⁷ Value-based purchasing³⁸ will further push hospitals to focus on the quality of care they provide and the elimination of hospital-acquired conditions such as injury falls. Moreover, inpatient falls often lead to lawsuits and thus have become a priority in hospitals to reduce risk of legal liability and protect their reputation.^{7,10,11}

Some research suggests that falls-prevention programs can be cost saving for hospitals. An analysis of hospital care for older patients at risk of falling found that hospitals whose expenditures in falls-prevention activities were in the top quartile had lower total per-patient costs than hospitals with falls-prevention spending in the lowest quartile.⁴¹ This suggests that larger investments in falls-prevention programs can produce lower overall costs. Galbraith and colleagues¹⁶ examined a specific multidisciplinary falls-prevention program in an orthopedic hospital and measured significant decreases in fall incidence, fall-related morbidity, and consequent costs. Targeting such programs toward patients identified by a physiotherapist to be at greatest risk can increase their cost-effectiveness.¹⁷

Overall, the research literature does not point to a single falls-prevention program as being preferred. Thus, nurse leaders must carefully assess the strategies to implement to reduce hospital inpatient falls and select approaches that are most likely to be clinically and financially successful for the population served. This article presents a simple model that can be used to examine the cost savings that might be associated with implementing a falls-prevention program. We first assess the degree of improvement in patient fall rates that has been found in the published literature. From the literature, we measure the costs of patient falls, as well as reported costs of various falls prevention activities. We then demonstrate how these data can be integrated into a calculation of the net cost savings—or net cost increase—associated with a program to reduce patient falls. The cost calculations are based on the Agency for Healthcare Research and Quality (AHRQ) Quality Indicators Toolkit, which provides clear instructions for estimating the return on investment (ROI) to quality improvement programs.⁴²

Data and Methods

Hospital Inpatient Fall Rates and Impacts of Interventions

Data on the impact of falls-prevention programs on the rate of hospital inpatient falls were obtained through a review of published articles indexed by PubMed. Selected articles were required to provide clear data on both the preintervention and postintervention fall rates (usually defined as unplanned descent to the floor), the number of hospitals engaged in the intervention study, and the types of patient care units in the study. Preintervention fall rates ranged from 0.67 falls per 1000 patient-days to 4.37 per 1000 patient-days, and postintervention rates ranged from 0.51 to 3.29 falls per 1000 patient-days.^{16,18-23} Reductions in fall rates achieved by the interventions ranged from 0.16 to 3.08 falls per 1000 days. We compared these data with patient fall rates obtained from the CALNOC, a not-for-profit, self-sustaining nursing-sensitive benchmarking registry.⁴³⁻⁴⁶ In 2007, median patient injury fall rates among hospitals that submitted data to CALNOC averaged 0.8 per 1000 patient-days and dropped to 0.5 per 1000 patient-days by 2013.⁴⁷

We also relied on the literature to measure the proportion of patient falls that result in serious injury¹⁶ and any injury.^{23,30} Many studies were conducted in single hospitals; 2 studies involved multiple hospitals within healthcare systems.^{20,22} We calculated rates of mild to moderate injury by subtracting the rate of serious injury from the rate of all injuries. Table 1 summarizes the fall rate data from these studies.

Cost of Hospital Patient Falls

The costs of hospital patient falls vary with whether an injury occurred and the severity of the injury. Many studies report the total costs of care; we focused on studies that reported the incremental cost associated with caring for a patient after a fall. Costs were obtained from published studies and, where necessary, converted to 2012 US dollars. Each study had a slightly different definition of mild, moderate, and serious injuries; in general, serious injuries involved fractures (including hip fractures), dislocations, and subdural hematoma. Mild and moderate injuries included nonsubdural hematoma and lacerations. The costs of noninjurious patient falls ranged from \$1,139 to \$2,033.^{39,48} Costs of injurious falls ranged from \$7,136 to \$15,444, and serious injury costs ranged from \$17,567 to \$30,931.^{10,39,49-52} These data are summarized in Table 2.

Costs of Hospital Patient Falls-Prevention Programs

The costs of patient falls-prevention programs include implementation costs, the cost of delivering the intervention, and costs associated with monitoring program effectiveness.⁵³ The implementation costs include fixed costs, which are incurred regardless of the size of the hospital or the number of patients who might be affected by the intervention. These costs include the purchase of equipment, such as low-height beds, floor mats, and bed-exit alarms, as well as program management and the expertise of specialized personnel. Fixed costs also can include training costs, which might vary with the number of staff but will not directly change with normal fluctuations in patient volume. Variable

Table 1. Patient Fall Rates Before and After Fall Interventions

Citation	Setting	Preintervention Fall Rate (per 1000 Patient-Days)	Postintervention Fall Rate (per 1000 Patient-Days)	Decline (per 1000 Patient-Days)
Any falls				
Dykes et al, ¹⁸ 2010	1 Hospital	4.18	3.15	1.03
Galbraith et al, ¹⁶ 2011	1 Orthopedic hospital	3.49	2.68	0.81
Lancaster et al, ²⁰ 2007	Ascension system	3.65	3.29	0.36
Neiman et al, ²¹ 2011	1 Hospital	0.67	0.51	0.16
Ohde et al, ¹⁹ 2012	1 Hospital in Japan	2.13	1.53	0.60
Wayland et al, ²² 2010	Rural health system	4.37	1.29	3.08
Weinberg et al, ²³ 2011	1 Tertiary hospital	3.61	1.31	2.30
Average		3.16	1.97	1.19
Falls with injury				
Quigley et al, ³⁰ 2009	2 Veterans Affairs hospitals	1.63	0.67	0.96
Weinberg et al, ²³ 2011 (imputed)	1 Tertiary hospital	1.74	0.52	1.22
Average		1.69	0.58	1.11
Serious falls				
Galbraith et al, ¹⁶ 2011 (imputed)	1 Orthopedic hospital	0.30	0.12	0.18

Table 2. Patient Fall Costs by Severity of Fall (2012 US dollars)

Citation	Noninjurious Fall	Minor/Moderate Injury Fall	Severe Injury Fall
Bates et al, ^{3,10} 1995		\$7,136-\$8,963	\$17,567
Boswell et al, ⁴⁹ 2001		\$7,327	
Haines et al, ³⁰ 2013		\$12,993	
Rizzo et al, ⁴⁸ 1998	\$2,033		
Spetz et al, ³⁹ 2007	\$1,139	\$8,112	
Wong et al, ⁵¹ 2011		\$15,444	
Zecevic et al, ^{10,39,49-52} 2012			\$30,931
Average	\$1,586	\$9,996	\$24,249
Minimum	\$1,139	\$7,136	\$17,567
Maximum	\$2,033	\$15,444	\$30,931

^aBates et al reported costs for mild and moderate injury.

costs are directly connected to the number of patients in the hospital and are often measured on a per-patient-day basis; these include costs such as patient sitters.

We identified 5 studies that provided sufficient data on the costs of patient falls-prevention interventions to incorporate into a cost analysis. Two studies focused on the costs associated with using patient sitters to prevent falls,^{49,54} and 1 compared the costs associated with using sitters to the use of a bed-exit monitoring device.³⁹ The average variable costs associated with these strategies ranged from \$3.42 per day to \$33.07 per day, depending on whether patient sitters were on duty at all times for patients at risk or only for selected periods of the day. The bed-exit monitoring device was charged on a per-occupied-bed-day basis and thus was a variable cost. We also examined data from a patient education program designed to reduce falls⁵⁰ and a multidisciplinary prevention program.¹⁶ These 2 approaches included both fixed and variable costs. These data are summarized in Table 3.

Methods of Analysis

We used the AHRQ Patient Safety Indicators Toolkit as a guide for our cost calculations.⁴² The toolkit provides instructions to calculate the ROI for a project, which is the ratio of the net returns from quality improve-

ment activities versus the net investment in those activities. If the ROI ratio is greater than 1, then the quality improvement activity provides a positive net return and is a cost-saving investment for the hospital. Rather than calculate a ratio, we calculated the net returns minus the net investment; if this value is positive, there are cost savings, and if it is negative, there is a cost increase.

We used the data from the published literature on improvements in hospital fall rates, costs of falls, and costs of prevention programs to estimate the net savings from investment in falls prevention. These net savings are the incremental savings achieved by reducing inpatient fall rates. The expected cost of falls is as follows:

$$E(\text{fall costs}) = \text{prob}(\text{serious injury}) * \text{cost}(\text{serious injury}) + \text{prob}(\text{minor injury}) * \text{cost}(\text{minor injury}) + \text{prob}(\text{no injury}) * \text{cost}(\text{no injury})$$

These costs are computed for preintervention fall rates and for postintervention fall rates. The net savings are computed as follows:

$$E(\text{savings}) = E(\text{fall costs with no intervention}) - E(\text{fall costs with intervention}) - (\text{cost of intervention program})$$

If this value is positive, then the program achieved net cost savings.

We tested the sensitivity of this calculation to using higher or lower estimates of the cost of patient falls

Table 3. Costs of Fall Prevention Programs (2012 US dollars)

Citation	Type of Intervention	Variable Cost per Patient-Day	Fixed Cost
Boswell et al, ⁴⁹ 2001	Patient sitters	\$33.07	
Harding, ⁵⁴ 2010	Patient sitters	\$18.42	
Spetz et al, ³⁹ 2007	Patient sitters (targeted to high-risk patients)	\$3.42	
Spetz et al, ³⁹ 2007	Bed-exit monitor	\$36.35	
Galbraith et al, ¹⁶ 2011	Multidisciplinary integrated program	\$0.00 ^a	\$16,736.20
Haines et al, ³⁰ 2013	Patient education program	\$10.74	\$420.90
Average		\$17.00	
Minimum		\$3.42	
Maximum		\$36.35	

^aGalbraith et al did not report costs per patient-day.

Table 4. Cost Savings From Inpatient Falls-Prevention Programs, Variable Costs Only, for Average Length of Stay of 4.9 Days

Cost Savings From Falls Prevention		Noninjury Falls	Mild/Moderate Injury Falls	Severe Injury Falls	Total
1	Fall rate preintervention (from Table 1, multiplied by 4.9 d)	0.718%	0.683%	0.145%	
2	Mean cost per fall (from Table 2)	\$1,586.00	\$9,995.83	\$24,249.00	
3	Predicted cost per patient preintervention (row 1 * row 2)	\$11.39	\$68.27	\$35.34	\$115.00
4	Fall rate postintervention (from Table 1, multiplied by 4.9 d)	0.678%	0.230%	0.055%	
5	Predicted costs per patient postintervention (row 4 * row 2)	\$10.75	\$22.95	\$13.45	\$47.15
6	Predicted savings per patient (row 5 – row 3)				\$67.85
Costs for falls prevention					
7	Mean costs of interventions per patient, assuming 4.9-d length of stay (from Table 3)				\$83.30
8	Net savings (cost increase) per patient from investment, variable costs only (row 6 – row 7)				(\$15.45)

and the cost of falls-prevention programs. We assumed the falls-prevention activities occurred in 1 year.

Results

Table 4 presents the results of the cost calculation for variable costs, to reflect the ongoing costs of maintaining a patient falls-prevention program. For this analysis, we assumed that a hospital would achieve the average change in fall rates presented in Table 1. Note that the rates of mild/moderate injury falls and noninjury falls were calculated by subtracting the severe injury fall rate from the total injury rate, and the total injury rate from the total fall rate, and then multiplying by an average length of stay of 4.9 days.⁵⁵ All costs are in 2012 US dollars. Prior to a falls-prevention program, the expected cost of a fall is \$115.00 per patient, based on mean costs of falls reported in the literature. Reducing fall rates to the average postintervention level lowered costs to an expected level of \$47.15 per patient, achieving a net savings in fall costs of \$67.85.

However, the mean costs for falls prevention are \$83.30, based on an average hospital length of stay of 4.9 days.⁵⁵ A comparison of the net savings from reduced fall costs per patient and expenditures for prevention produces a net cost increase of \$15.45.

We examined the sensitivity of our calculations to alternative costs of inpatient fall treatment and prevention and for alternate improvements in fall rates. The top panel of Table 5 presents the net savings from investment in falls prevention for each of the lowest, mean, and highest fall treatment and prevention costs. If falls-prevention costs are at the minimum level reported in the literature, then prevention is cost saving at any level of cost for caring for patients after fall. However, if falls-prevention costs are at the maximum, then prevention is always cost increasing. At the average of prevention costs, prevention programs are cost saving only if the cost of caring for patients after fall is at the maximum.

The lower panel of Table 5 presents the net savings from investment in falls prevention if the highest

Table 5. Sensitivity Analysis of Net Savings (Cost Increase) From Investment to Fall Prevention Programs, Variable Costs Only

Net Savings/Loss (Positive Numbers Are Net Savings)	Min Fall Care Costs	Mean Fall Care Costs	Max Fall Care Costs
Fall rates at averages preintervention and postintervention			
Min falls-prevention cost	\$31.91	\$51.09	\$82.00
Mean falls-prevention cost	(\$34.63)	(\$15.45)	\$15.46
Max falls-prevention cost	(\$129.45)	(\$110.27)	(\$79.36)
Fall rates at highest preintervention and lowest postintervention			
Min falls-prevention cost	\$46.64	\$71.64	\$110.18
Mean falls-prevention cost	(\$19.90)	\$5.10	\$43.64
Max falls-prevention cost	(\$114.72)	(\$89.72)	(\$51.17)

preintervention rate was present (4.37), and the lowest postintervention rate was achieved (1.29).²² In this case, the cost savings associated with the lowest-cost falls-prevention program were larger than when average preintervention and postintervention rates prevail. Prevention programs are cost saving if the cost of prevention is at the minimum, and also if prevention costs are at the average and treatment costs are at the average or maximum.

These calculations do not include the fixed costs of training managers and staff to engage in surveillance and coordinate falls-prevention activities. The costs for management and staff training for a prevention program range from \$420.90 to \$16,736.20 (Table 3). If a hospital's variable falls-prevention costs are at the minimum, these fixed costs could be absorbed by the cost savings per patient. For example, if the cost savings per patient are \$82.00 (maximum cost for fall care and minimum cost for prevention), a fixed cost of \$16,736.20 would be offset if patient volumes are 205 patients per year or greater. Hospitals with fewer patients would not generate enough cost savings in 1 year to make up for an initial investment of \$16,736.20. Thus, hospitals should carefully examine the upfront fixed costs associated with their falls-prevention program alongside the per-patient savings and patient volume they anticipate.

Discussion

This analysis demonstrates that falls prevention can be cost saving, but only if the investment in falls-prevention programs is relatively small. This differs from prior analysis of preventing hospital-acquired pressure ulcers, which is cost saving in most cases.⁴⁶ The lower return to falls-prevention programs is largely the result of patient falls being comparatively rare events—occurring less frequently than other adverse events such as pressure ulcers—and falls with injury are even less common. For example, among CALNOC participating hospitals, median injury fall rates were 0.5 per 1000 patient-days in 2007, and hospital-acquired stage 2 or greater pressure ulcer rates were 3.3%.⁴⁷ However, after concerted effort by CALNOC hospitals to reduce pressure ulcer rates, the median rate for stage 2 or greater ulcers was 0 in 2013, whereas the fall rate remained at 0.5 per 1 000 patient-days.⁴⁷ The savings a hospital achieves from falls prevention will depend on the reduction in fall rates attained, the hospital's own historic costs of caring for patients after fall, the hospital's non-reimbursement rates for hospital-acquired conditions, and the amount spent on prevention activities.

Limitations

Our analysis is based on several assumptions. We assume that hospitals will achieve improvements in fall

rates through active prevention efforts. This is based on a growing literature that demonstrates that falls-prevention programs can successfully reduce fall rates, but the literature varies by patient population studied and interventions implemented, making it challenging to predict how any specific intervention might work in another hospital. The costs of fall treatment and prevention are drawn from a variety of published sources, and there is some inconsistency in these estimated costs. The costs of fall treatment and prevention will vary also with local costs of labor and equipment.

This and other economic analyses of patient falls have not included other variables that may have financial impact, such as the costs of regulatory fines for adverse patient events, costs of malpractice lawsuits, and gains associated with improving market competitiveness by demonstrating high quality (or losses for low quality). Adding these costs and gains to the analysis would improve the precision of the analysis for the purposes of decision making. Publication of research and quality improvement efforts that quantify improved performance and costs is needed to continue to refine these estimates.

Conclusions and Implications for Nursing Administration

Patient falls are a substantial cause of morbidity within hospitals, associated with increases in length of stay and greater risk of death.^{36,56} Multifactorial approaches to reduce fall rates have generally been demonstrated effectively,^{19,29} as have simpler approaches such as the use of patient sitters.⁴⁹ However, nurse leaders must be cautious when considering implementing patient falls-prevention programs, as these programs may not be cost saving. Prior to embarking on a falls-prevention program, nurse leaders should analyze their hospital's unique factors associated with falls, the morbidity experienced by patients, litigation costs associated with falls incidents, and other factors that identify both the patient population who will benefit most from a prevention program and the costs that can be avoided. Investments in relatively low-cost prevention programs, or targeting programs to patients at greatest risk, are likely to reduce net costs, but expensive falls-prevention programs may not produce a positive return to the hospital.

Even if a falls-prevention program is not anticipated to produce a positive ROI, nursing leaders and their healthcare organizations may choose to pursue falls prevention because of the imperative to protect patients and organizational reputation. Nonmonetary costs such as patient function and quality of life are important factors both to healthcare providers and

society as a whole.³⁵ When implementing quality improvement programs, hospitals must carefully track adherence to the program among staff. It has been demonstrated that adherence to falls-prevention protocols has a significant impact on success.¹⁵ One study of barriers to adoption by nurses of a falls-prevention program identified knowledge and motivation, availability of support staff, access to facilities, health status of patients, and education of staff and patients as the main factors that inhibited successful implementation.⁵⁷ Careful tracking of fall rates, along with benchmarking over time and in comparison to other organizations, can provide knowledge to nurses and information with which there can be continuous quality improvement. Nurse leaders need access to data that support

analysis of quality improvement efforts, including drilling down to understand structure and process data.

Nurse leaders can use the framework presented in this article to develop and estimate the cost savings that can be attained by their own falls-prevention programs. They can use their own data on the costs of caring for patients after falls, as well as fall rates, to estimate potential savings and tailor their interventions to increase the likelihood of savings. Nurse leaders should continuously monitor the literature to ensure they are following best evidence-based practices. Given the increased attention to patient falls, and increasing public reporting of them as important adverse events,⁵⁸ data tracking, benchmarking, and prevention programs are likely to be of increasing importance in the future.

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