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Clinical Studies

A successful, cost-effective low back pain triage system: a pilot study

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ABSTRACT

Background: Effective triage - directing patients with low back pain to appropriate treatment or correct referral - is fundamental to quality care. Without guidelines, a physician's initial decision may lead to unnecessary investigation, unneeded intervention or unwarranted consultation.

Methods: To compare the functional outcomes of patients triaged by a classification based on clinical presentation with those of patients selected at the clinicians' discretion, an insurance-owned hospital network employed forty-seven specially-trained physical therapists, working within participating primary care practices, to classify low back pain patients into specific Patterns of Pain. Between October 2017 and April 2019, the primary care physicians used this classification, derived entirely from the patient's history and physical examination, to direct subsequent treatment for 260 consecutive low back pain patients. Patients with systemic symptoms, recent substantial trauma or non-mechanical diagnoses indicative of spinal infections or possible malignancy were excluded. Functional outcome measures were spinal imaging, opioid use, length of treatment and number of visits, back-related unplanned care, frequency of spinal surgery and back-related episode cost. These were compared with a control group of 256 propensity-matched patients and, for assessing the financial impact, with a historic cohort of 111 previously treated, non-classified patients.

Results: Spinal imaging: study group 24.5%; controls 42.2% ($P< .001$). Narcotic use: study group 4.6%; controls 13.3% ($P< .001$). Treatment length: study group 62.2 days; controls 74.5 days ($P=.10$). Treatment visits: study group 1528 visits; controls 2,046 visits ($P=.003$). Unplanned care: study group 1.9%; controls 12.8% ($P< .001$). Spine surgery: study group 15.4%; controls 26.2% ($P=.005$). Episode cost: study group $1453; controls $2334 ($P=.005$).

Conclusions: A well-defined clinically-based triage system produced meaningful reductions in imaging, opioid use, treatment duration, unplanned interventions, surgery and cost of care.

Introduction

Matching the back pain patient with the correct healthcare provider and subsequently with the right treatment is an ongoing challenge. Effective triage mechanisms, which lead to the appropriate treatment or correct referral in a timely fashion are essential components of quality care and cost-effective management. A variety of factors ranging from hospital policy to physician choice can influence the clinical decisions that determine a patient's therapeutic destination producing widely divergent results and needless expense [1,2,3].

In 2017, as part of an initiative to improve care delivery and cost efficiency, an insurance-owned hospital network began using a classification system based on the patient's clinical presentation to establish the appropriate therapeutic regimen or referral options for low back pain patients. This validated Patterns of Pain classification reflects, but is not bound to, an underlying pathological process [4,5,6]. Initial treatment decisions are based solely on the pattern established by a specific set of history questions and a concordant physical examination [7]. The pathology is inferred but does not need to be verified. The classification separates back dominant pain arising from purely structural problems from leg dominant pain arising from nerve root inflammation or ischemia.

The approach categorizes patients using three essential elements to establish a pattern: location of the dominant pain (back or leg), consistency of the pain (constant or intermittent) and the effect of flexion

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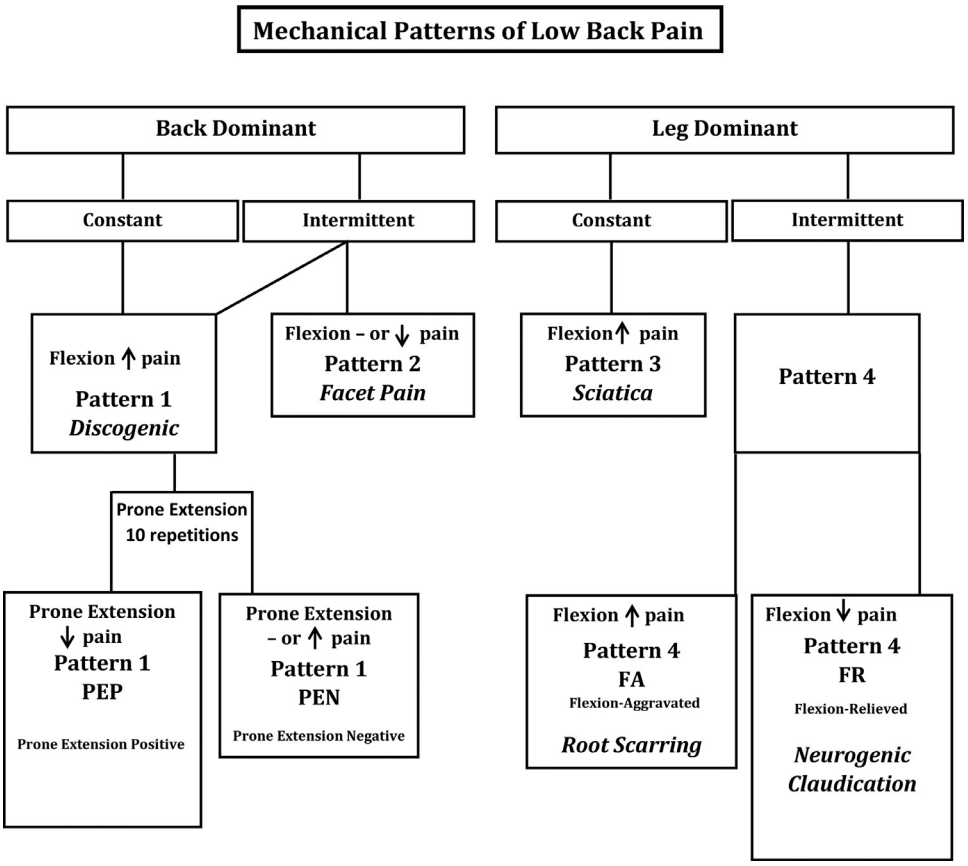


Fig. 1. The flowchart for the Patterns of Pain shows the four main categories and the four subsets. Standard terminology appears with each classification. The distinction between Pattern 1 **P**rone **E**xtension **P**ositive and **P**rone **E**xtension **N**egative is whether or not the typical back pain is reduced within 10 repetitions of a prone passive extension.

(aggravating / relieving / no effect). Fig. 1 outlines the full classification.

Additional necessary information includes bowel and bladder function, the extent and principal cause of disability (back or leg), relieving factors and previous episodes of back or leg pain. The physical examination incorporates movement testing (specifically the effect of flexion and extension), nerve root irritation and conduction tests, upper motor assessment and saddle sensation.

By identifying four mechanical patterns (back dominant, flexion aggravated; back dominant, flexion relieved; leg dominant, constant; leg dominant, intermittent) and including selected questions and physical tests, the classification separates out non-mechanical, "Red Flag" presentations that require more immediate action [8].

Differentiating between benign mechanical conditions and more sinister pathologies requires only the relevant history and confirmatory physical examination. Being able to rapidly and correctly classify patients on clinical grounds without imaging or additional investigations instills a justified confidence in both the patient and the provider. The Patterns of Pain classification directs initial management while the accuracy of the diagnosis is rapidly confirmed by the patient's clinical course [9]. Additional investigations or consultations may be required only with a failure to follow the anticipated improvement [10,11],.

This study tested the hypothesis that a structured, easily-applicable, directive triage tool will improve functional outcomes and reduce cost compared to patient care delivered according to individual physician choices.

Materials and methods

Participant training

Beginning in the spring of 2017 the hospital network initiated a series of training sessions for those primary care physicians and physical therapists interested in using the Patterns of Pain system. All the physicians and therapists received a minimum of four hours of lectures and interactive instruction on using the classification. A subgroup of 47 physiotherapists were designated to make the pattern determinations for the patients in each medical practice and received additional training. Robarts et al. have reported success using advanced practice physical therapists in a triage program for low back pain [12].

Individual Patterns suggest a particular course of therapy or referral. A pattern-based Care Pathway was developed, reviewed and accepted by the participating physicians. In addition to specific mechanical treatment strategies, the pathway offered advice on further investigation, medication and a follow-up schedule to evaluate the patient's response. Pathways included appropriate patient information and handout material.

Study design

This study compared treatment records and functional outcomes for two patient cohorts enrolled between October 2017 and April 2019. The study group consisted of low back pain patients referred by the participating primary care physicians to one of the specially trained physical therapists for a Patterns of Pain classification and entry into the study. Patients with non-mechanical back pain from infection, tumor or recent significant trauma were excluded. Once classified, the treating physician managed the patient according to the accepted Care Pathway.

All patients provided a signed, written, informed consent for participation and release of information. No patient was contacted directly by the investigators. Patient names were removed to make the data anonymous; only identification numbers were used for recognition.

Ethics approval was obtained from the hospital IRB.

There were two control groups. The principal control cohort was propensity-matched; the propensity score is the probability of treatment assignment conditional on observed baseline characteristics [13,14].

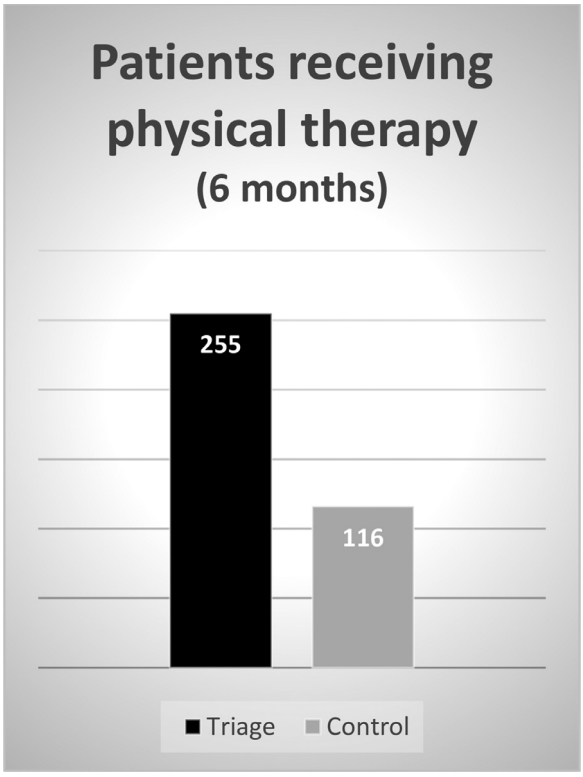


Chart 1.

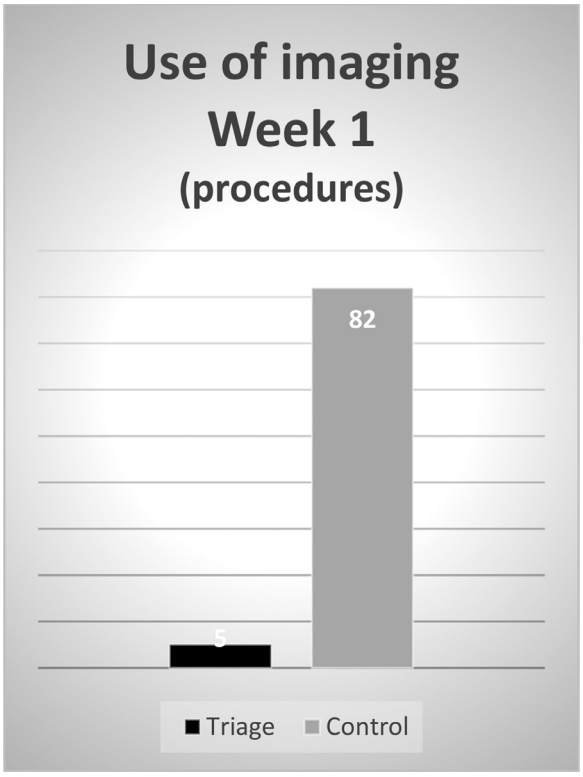


Chart 2.

This group was drawn from 16,802 patients insured by the same insurance company who had been managed contemporaneously, who had the same low back pain ICD 10 code and who were equally likely to require treatment. Individuals were matched for age, gender, duration of the painful episode, and, since treatment costs varied by location, the patient's geographic region. The propensity match can become a surrogate when, as in this case, a prospective, randomized, double-blind study is not possible [15,16,17].

Because the study design required physical therapists to establish the pattern for every patient, there was a substantial discrepancy between the amount of physical therapy contact in the study group and the propensity matched controls. Assessing the financial impact of attending a physical therapist required a second historical control group. This cohort of patients, previously treated without pattern classification and matched by age, gender, symptom duration and geography, was compiled from the medical practice records of the 47 classifying therapists.

Study population

The study group consisted of 260 consecutively treated episodes of low back pain. There were 114 men and 142 women. One man and three women suffered a second occurrence of back pain during the study period for which they received new independent management. These four patients appear twice in the list of sequential cases. The propensity-matched controls were 101 men and 155 women.

The mean age of the study group was 54.7 years (men 53.0; woman 56.0). For the controls, the mean age was 55.1 (men 56.6: women 54.1).

The practices of the physical therapists who participated in the classification contained 116 previously treated patients (the control group) who were managed without a pattern diagnosis and who could be matched to 111 study patients.

Statistical analysis

SAS software, Version 9.4 (SAS Institute Inc. Cary N.C) was utilized to pull the data and perform the propensity matching. The significant differences between the study cohort and the control groups were determined using t tests and χ^2 tests, as appropriate.

Results

Triaging by pattern led to the anticipated divergence in outcomes among the four classifications. These variations, reflecting the nature of the underlying pathologies, have already been published and are beyond the scope of the current study [5].

Use of physical therapy

Since the study design necessitated that every patient visit a physical therapist for classification before beginning treatment, the discrepancy in the amount of contact in the first week is not surprising or relevant. Only 19.1% of the control patients attended physical therapy during the first seven days. However, because the Patterns of Pain approach to low back pain emphasizes therapist-mediated mechanical techniques, posture control and activity modification, 98.1% of the study group continued to utilize physical therapy compared to 45.3% of the control patients ($P < .001$). See Chart 1. The number of patients who continued with scheduled physical treatment after six months was approximately equal in both groups.

Use of imaging

Differences in the utilization of imaging were dramatic. In week one, there were 82 images ordered for the control group (53 x-rays, 21 MRIs, 8 CTs). The study group had only five (one x-ray and four MRIs). See Chart 2. Overall, for patients triaged by pattern, 24.6% had an x-ray, CT

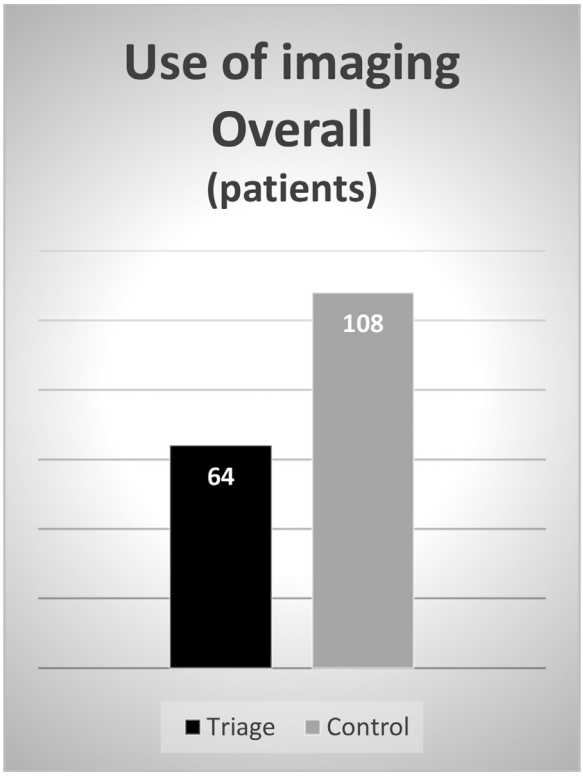


Chart 2. Continued

or MRI. The rate increased to 42.2% for the control patients ($P < .001$). See Chart 2a.

Use of narcotics

Narcotic use varied substantially. In the Patterns of Pain cohort, 4.6% of the patients received a narcotic prescription while 13.3% of the control group were given one ($P < .001$). See Chart 3.

Treatment duration and progression to surgery

Combining all Patterns, the average duration of scheduled treatment for the study group was 62.2 days. The propensity-matched controls attended for 74.5 days (P=.10). See Chart 4.

In the Pattern group, 15.4% of the patients went on to spinal surgery. For the control group, 26.2% had a back operation (P=.005). See Chart 5.

Days in treatment and unplanned care

The total number of treatment visits, both planned and unplanned, was lower for the study group than for the controls: 1528 to 2046 respectively ($P = 0.003$). See Chart 6. In the control group, 27 patients sought additional, unplanned care for a spine-related issue in the first week with the total rising to 35 patients by the end of the first year (12.8%). For the Patterns of Pain cohort only five patients required unplanned back-related treatment in the first 12 months (1.9%) ($P < .001$). See Charts 7 and 7a.

Episode cost versus propensity controls

The average cost of care for each episode of back pain for patients in the triage group was $1453. This was 62% of the average episode cost for the control patients of $2334 ($P$=.005). See Chart 8.

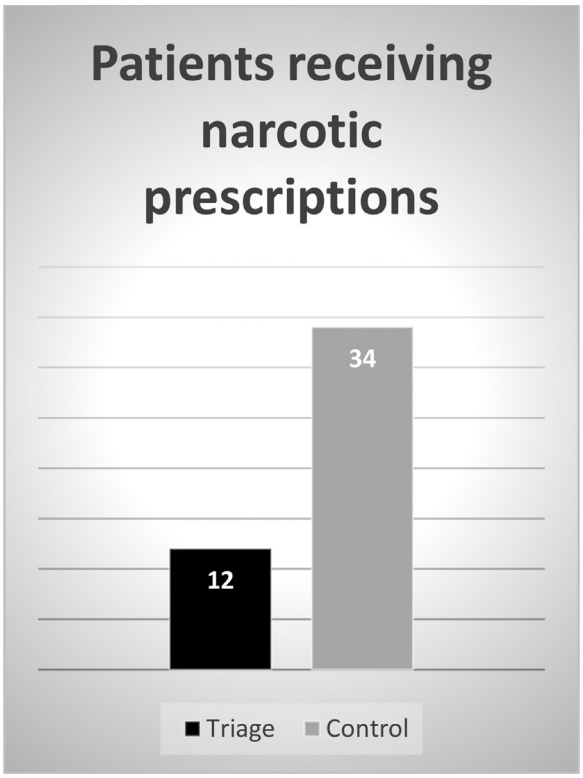
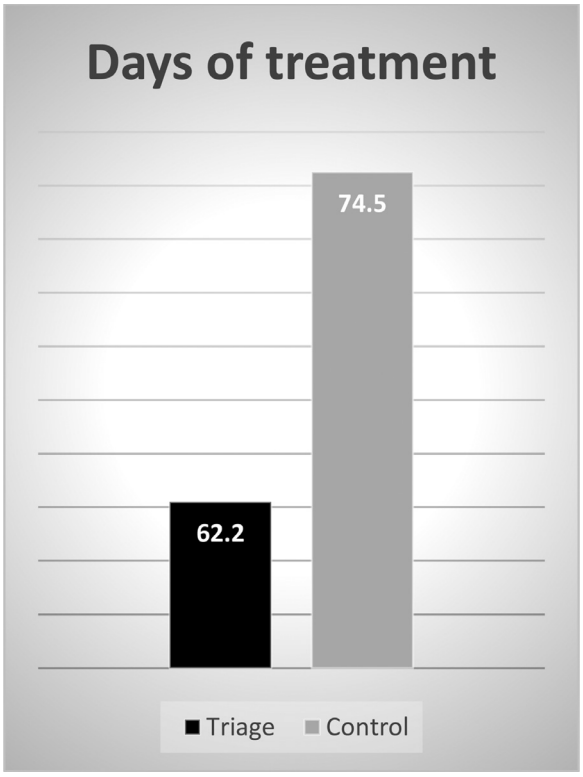


Chart 3.



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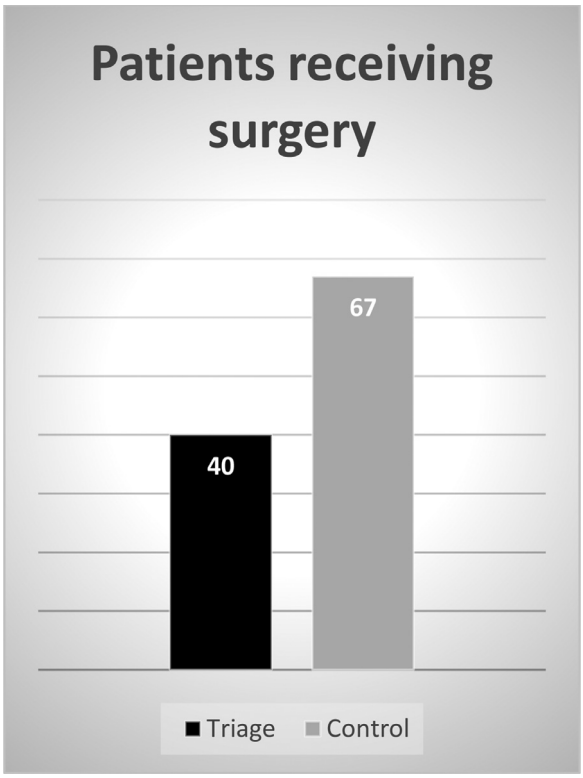

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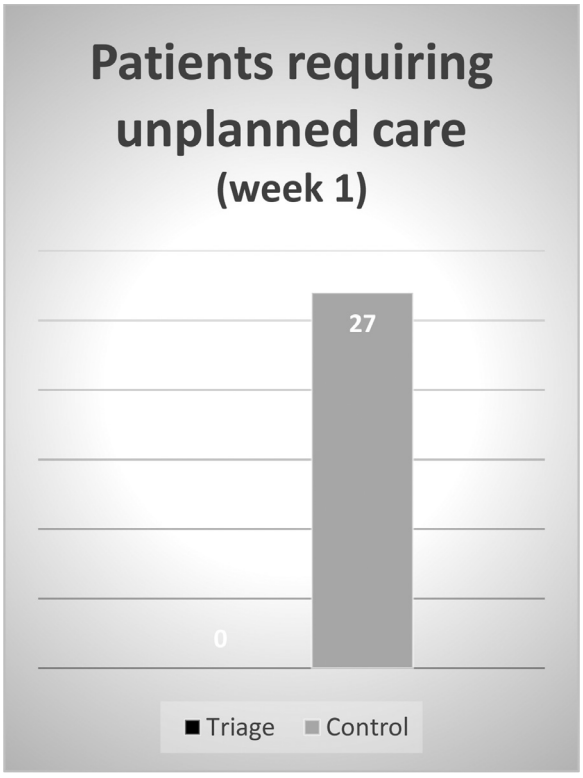

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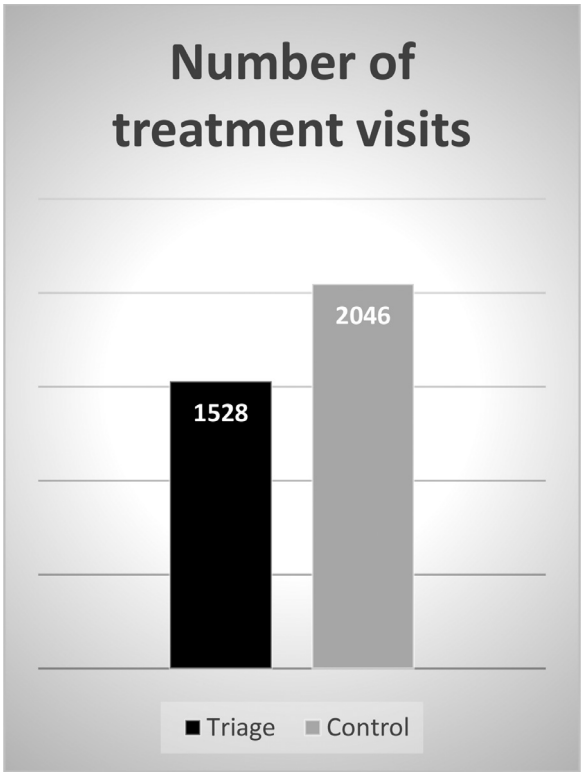

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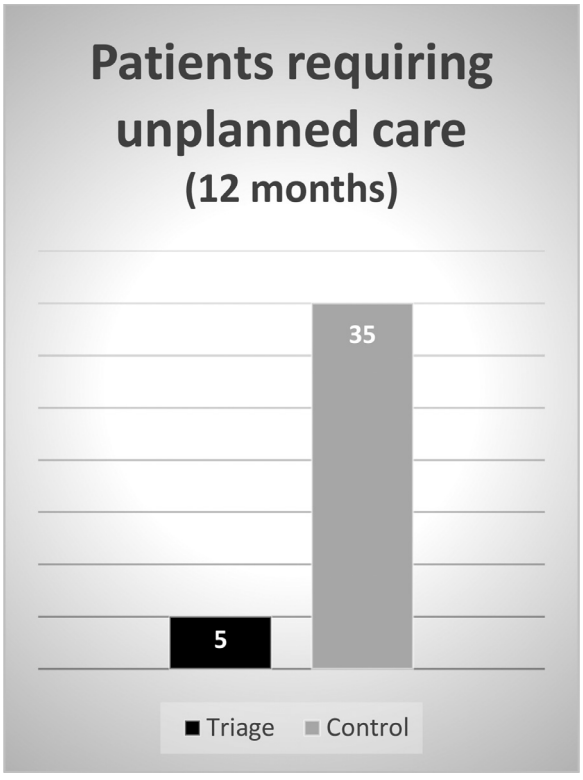

Chart 7. Continued

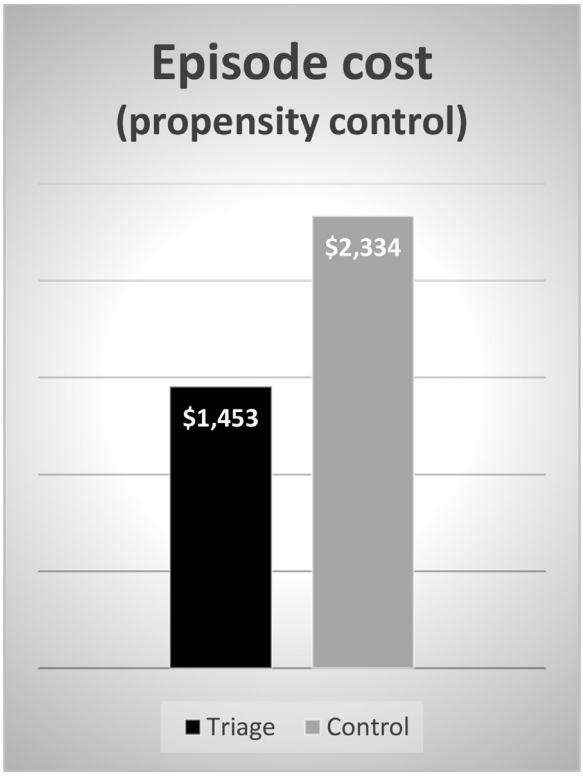

Chart 8.

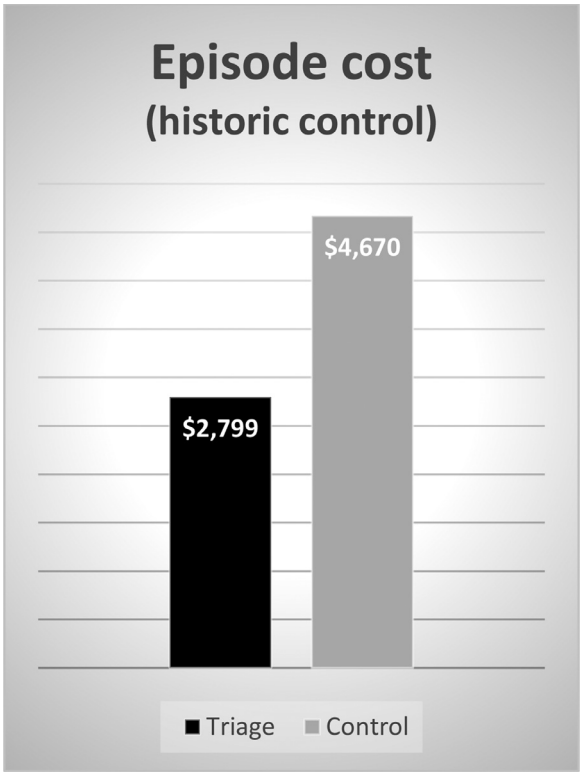

Chart 8a.

Episode cost versus historic controls

The total treatment costs for the 116 patients who received care from the participating physical therapists before the start of the pattern classification (the control group) were compared with the total treatment costs for the 111 patients treated according to a recognized pattern (the study group). The average episode of care cost for the controls was $4670 while the average cost for the Pattern of Pain cohort was $2799 ($P$=.0246). See Chart 8a. The higher overall costs can be explained by the smaller sample size but the difference between the two groups is virtually the same as the difference between the triaged patients and the propensity matched controls; the expenses for the pattern group were 60% of those for the unclassified cohort.

Discussion

A successful triage system directs patients to the proper care in a timely and cost-efficient manner. It must avoid potentially catastrophic diagnostic errors and should enhance patient satisfaction and provider acceptance. Such a system needs to rely on a classification with sufficient detail to provide an entirely reliable screen but is still flexible enough to allow clinician agreement. The Patterns of Pain arise from a carefully structured analysis of the patient's clinical presentation that permits standardization of both the history questions and accompanying physical examination. By using only features available to every observer without requiring assumptions, the classification offers an agreed starting point. By including queries and tests that search for ominous pathologies, it becomes a robust filter.

The Patterns of Pain classification is possible because over 90% of low back pain results from minor alterations of spinal mechanics or benign nerve root irritation, conditions which generate discrete, defined clinical presentations [18]. These varied presentations differentiate individual instances of "non specific" back pain into clinically useful scenarios, patterns that direct initial management. Because it is the pattern and not the putative pathology that determines care, clinicians can agree on a course of action without having to identify the precise source of the pain. The small number of patients who present without a clear mechanical pattern or who fail to respond as anticipated to a pattern-selected therapy require further investigation.

The Pattern approach recommends mechanical management so each suggested Care Pathway begins with activity modification and pain control maneuvers particular to the clinical presentation. The structure of the study meant the triage classification was made by a physical therapist. This was the main reason for the imbalance in the use of physical therapy between the study and control cohorts during the first week of treatment. However, when a healthcare system incorporates this triage approach as a first step, it is the generally the primary care doctor who recognizes the pattern and begins treatment while the physical therapist provides additional patient education and training only if necessary.

Recognizing a pattern allows the healthcare provider to offer a cogent description of the problem to the patient. Since first treatment is pattern-based, there is little ambiguity. Having a clear path gives both patient and provider justifiable confidence to move forward. Trust in the classification's diagnosis was probably the main reason the study group required so few images - 5 compared to 82 - in the first week of care. Since the pattern provided the necessary guidance, there was little impetus to search for a pathology. Most of the imaging in the study cohort occurred during the second and third months, presumably for patients who failed to respond as anticipated. This is clinically reasonable.

Over the course of a back pain episode, patients in the pattern cohort attended physical therapy more than twice as often as the control group - 98.1% to 45.3% - but the specificity of the pattern-directed treatment reduced the number of visits the individual required for symptom relief. The average Patterns of Pain patient required about six sessions while the average control patient needed eight. Patients in the study group completed therapy 12 days faster and ultimately had 518 fewer treatment sessions than the controls.

The effectiveness of the triage combined with the appropriateness of the selected Care Pathway may have been factors in reducing opioid use in the study group. Only 4.6% of the patients managed with the Pat-

terns of Pain required narcotics, a major reduction from the 20.8% in the control group. Because of the propensity-matched similarity in patient characteristics between the two cohorts, the variation in opioid use almost certainly reflects treatment effect. Since historically back pain has been one of the commonest reasons for prescribing a narcotic, the Patterns of Pain approach could produce not only individual benefits but a broader positive societal impact [19].

Back pain is a recurrent condition and unexpected attacks frequently occur during treatment. How patients react depends in large measure upon their expectations. If, with proper education and adequate understanding, patients realize that temporary painful episodes can be part of a normal recovery, most will continue the prescribed regimen and not seek supplementary help. One of the benefits of the Patterns of Pain classification is its ability to give both the healthcare professional and the patient a sense of direction and prognosis. Commencing a treatment that rapidly delivers the predicted symptom reduction reinforces the patient's belief in both the clinician and the value of the therapy, hence fewer patients seek additional unplanned care. In this study, only five pattern-selected patients sought extra help for their back pain: four in week two and one in the third month of treatment. Thirty-five patients in the control group requested supplementary care: 27 in the first week alone.

Nearly 40% fewer patients had surgery in the study group compared to the control group: 15.3% to 26.2% respectively. Given the similarity in the clinical characteristics between the groups, the reduced surgical rate for the Patterns of Pain cohort could reasonably be attributed to a treatment regimen producing more rapid pain control and higher satisfaction with the outcome, a positive result of the triage process.

From a financial perspective, shorter treatment times with fewer sessions, less unplanned care, a decrease in imaging and a decline in the number of surgeries mean a sizeable cost saving. These reductions more than offset the increased use of physical therapy although even here the average length of treatment for individual Patterns of Pain patients was less than for patients in the control group. The back pain episode cost per patient in the study group was $1453 compared with $2334 for control patents. In the historical sub-analysis of patients managed before and after the start of the pattern triage system, the higher episode costs can be explained by the matching of a smaller cohort but difference in cost between the two groups exactly reflected the findings of the primary study. The total saved in managing 260 attacks of back pain using this triage system was approximately $230,000. If the treating physician initially employs the patterns to direct care, the financial benefits could be even greater.

In conclusion, utilizing a triage system based on classification by clinical presentation resulted in significant reductions in the use of imaging, opioid prescriptions, unplanned care and surgery. Training primary care physicians and physical therapists to categorize low back pain patients using Patterns of Pain permitted the rapid initiation of therapy resulting in decreased treatment duration and improved functional outcomes. Enhanced patient care delivered a back pain episode cost saving of nearly 40%.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.xnsj.2021.100051.

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