

# How to achieve patient-centered testing: role of the protocol nurse

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**Introduction.** Patient-centered cardiac testing is predicated on choosing the right test for the right patient. We studied the effects of changing from script-driven scheduling to nurse-driven protocoling of stress tests.

**Methods and Results.** A protocol nurse reviewed records before scheduling and communicated with patients and ordering providers if needed. We found that instituting nurse protocoling of all non-imaging (ETT) and nuclear (MPI) stress tests (N = 3071) resulted in protocol changes in 37% of our patients, and reduced the proportion of tests that could not be performed as scheduled by 56% and cancellations by 71% ( $P < 0.001$  for each). These changes were sustained over two successive 6-month periods following a baseline observation period of 6 months. For MPI, the most frequent nurse interventions were re-protocoling as stress-first MPI (12% of tests), changing test location for clinical reasons (13%), changing stress modality (7%), and care coordination (5%).

**Conclusions.** Changing from script-driven scheduling to protocol nursing contributed measurably to patient-centered testing. (*J Nucl Cardiol* 2019;26:536–40.)

**Key Words:** Myocardial perfusion imaging: SPECT • exercise: stress testing • myocardial perfusion imaging: PET

## Abbreviations

ETT	Exercise treadmill test
MPI	Myocardial perfusion imaging
LBBB	Left bundle branch block
ECG	Electrocardiogram
BMI	Body mass index

SPECT	Single-photon emission computed tomography
PET	Positron emission tomography
FTE	Full time equivalent

**See related editorial, pp. 541–542**

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The authors of this article have provided a PowerPoint file, available for download at SpringerLink, which summarizes the contents of the paper and is free for re-use at meetings and presentations. Search for the article DOI on SpringerLink.com.

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## INTRODUCTION

Patient-centered cardiac testing means selecting the right test with or without imaging for each patient and attending to patient safety and capacity for testing.<sup>1</sup> Multiple concerns inform test selection, including appropriate use criteria and patient factors. The choice between different imaging protocols and stressors is influenced by various considerations like a history of myocardial infarction, inability to exercise, the presence of left bundle branch block (LBBB) or baseline ECG changes, and the incremental value of nuclear

cardiology stress testing compared to its theoretical health risks of radiation exposure.

Optimally, all these are taken into account when a test is ordered.

Recent efforts to ensure patient-centered testing have been directed at developing electronic decision support tools based on appropriate use criteria such as the American College of Cardiology's FOCUS product (<http://www.acc.org/tools-and-practice-support/quality-programs/imaging-in-focus>), and shared decision-making instruments.<sup>2</sup> Overall, however, close communication between those who order and perform the test remains important, as referenced in the ASNC 2012 Practice Statement.<sup>1</sup> In practice, electronic order forms can be used as a one-way communication tool to obtain the necessary information for correct protocoling and study interpretation.<sup>3</sup> For example, questions about ability to exercise and history of coronary disease can be incorporated as discrete entry fields. To our knowledge, no prior study has evaluated the effect of communication by an expert stress-testing nurse on changing of testing protocol and location to enhance patient-centered testing.

At the University of Vermont Medical Center, cardiac stress tests used to be scheduled by non-medically trained staff with the use of scripts to optimize appropriate testing. Scripts included patient instructions for avoiding caffeine, algorithms to avoid scheduling higher risk patients in the outpatient practice, and algorithms to schedule patients without previous myocardial infarction as stress first tests. However, we observed that this practice did not achieve our goal of patient-centered testing. In fact, a proportion of tests could not be performed as scheduled because scheduling algorithms were not applied properly or patients had not abstained from caffeine. Therefore, we studied the effects of a change from script-driven scheduling to expert nurse-driven protocol selection of stress tests.

## METHODS

For this single-center prospective quality improvement project, nurse-driven review and protocoling of all nuclear myocardial perfusion imaging (MPI) and non-imaging (ETT) stress tests was implemented in July 2015. The Institutional Review Board of the University of Vermont approved the protocol for this study, which analyzed baseline data and compared them to data after implementation, with a waiver of informed consent. MPI and ETT studies were protocolled in accordance with the written institutional policies on non-invasive cardiac testing that are regularly reviewed and signed by the laboratory director and authorized user of radioisotopes (FKK).

The 6-month time period (period 1) before and two 6-month periods after (periods 2 and 3) the start of nurse protocoling were compared. During period 1, tests were scheduled by non-

medically trained scheduling staff with the use of scripts addressing special situations such as patients with high BMI or arrhythmia. During periods 2 and 3, a protocol nurse trained in nuclear and non-nuclear stress testing reviewed the chart of patients for whom stress tests had been ordered, including prior ECGs if available. The nurse then initiated changes in modality or location of the test, communicated with patients, and communicated with ordering providers if needed before the test was scheduled (Figure 1). Order forms (electronic or paper) did not change during the study. The outcome was the number of tests that could not be performed as scheduled. These included no-shows and day-of-testing changes (cancellations, rescheduled tests, and tests moved to a different location within the center for clinical or safety reasons).

Outcomes were compared with the use of Student's T test for continuous variables and Fisher's Exact test for categorical variables.

## RESULTS

### Overall Cohort

The study population consisted of 3071 patients (1810 ETT and 1261 MPI). Overall results are shown in Table 1. The most common day-of-test changes were cancellations and no-shows. Reasons for cancellations included patient preference and nurse decision based on patient presentation. Examples for the latter include ineligibility for the protocol ordered (eg patient actively wheezing) and wrong protocol ordered without ability to change on the spot (e.g., ETT ordered for patient with LBBB and SPECT ordered for patient with high BMI). The relative frequency of reasons for nurse decision was not tracked. When tests had to be rescheduled due to patient request, they were tracked as "reschedule." When patients had been scheduled at the wrong site and had to be rescheduled at a different site, they were tracked as "move." This applied to patients who were higher risk (for example, history of ventricular tachycardia) or required specialized support or space (for example, difficult iv access, mobility issues and home O2).

During period 1 (pre intervention), 14.8% of all non-imaging (ETT) and nuclear (MPI) stress tests could not be performed as scheduled. The most common reasons were day-of-test cancellations and no-shows, as shown in Figure 2. In periods 2 and 3, the percentage of tests that could not be performed as scheduled was significantly lower (6.5% and 7.7%,  $P < 0.001$ ). This decrease was largely due to a significant reduction in no-shows and cancellations in the 6-month period (period 2) after implementation of protocol nursing (Figure 2). The results were maintained over the next 6 months (period 3). cancellations dropped from 7.0% to 2.0% and 1.9%, respectively ( $P < 0.001$ ). No-shows decreased from 5.9% in period 1 to 2.9% and 3.8% ( $P < 0.001$ ). The

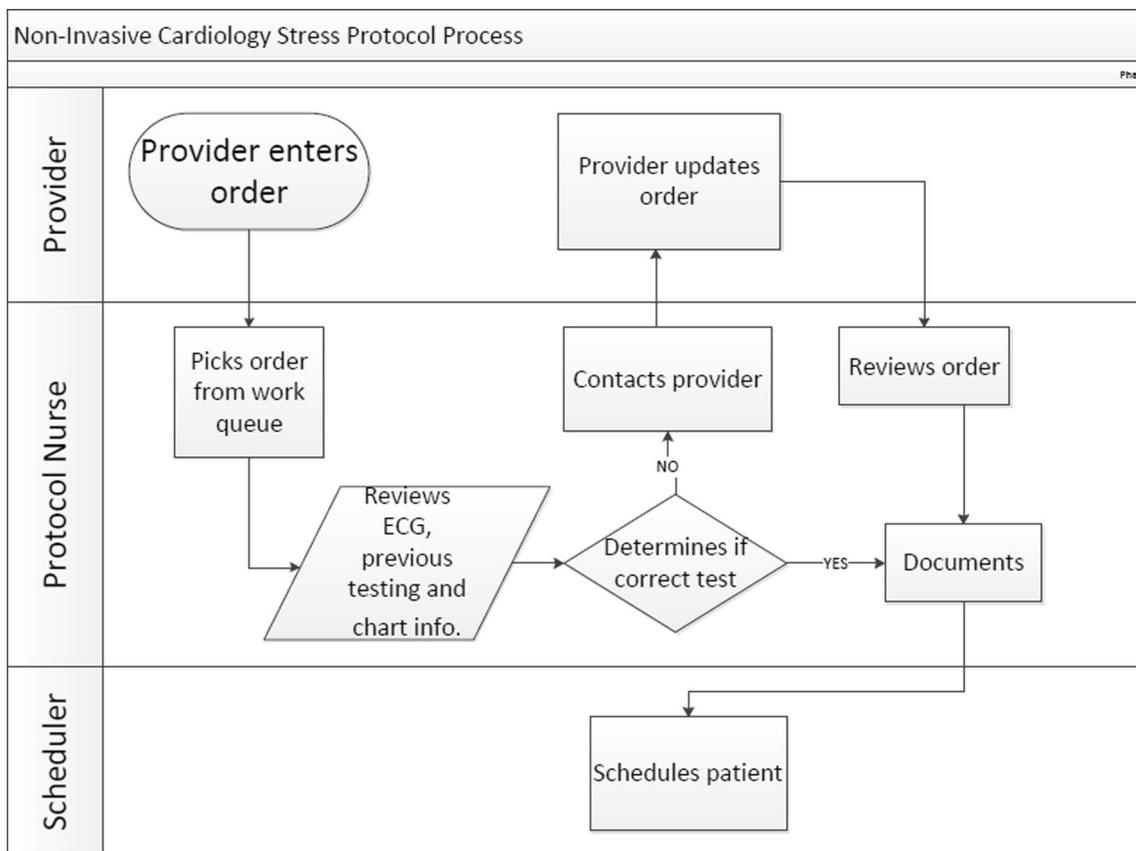


Figure 1. Protocol nursing workflow diagram.

Table 1. Studies that could not be performed as scheduled

	Period 1 (before)		Period 2		P	Period 3		P
	All	Not performed	All	Not performed		All	Not performed	
MPI + ETT	1136	168 (14.8%)	943	61 (6.5%)	<0.0001	992	76 (7.7%)	<0.0001
ETT	680	101 (14.9%)	556	32 (5.8%)	<0.0001	574	55 (9.6%)	<0.0001
MPI	456	80 (17.5%)	387	32 (8.3%)	<0.0001	418	27 (6.5%)	<0.0001

MPI, Myocardial perfusion imaging (nuclear) stress tests; ETT, exercise tolerance (non-imaging) stress tests. Not performed: Tests that could not be performed as scheduled. P values are for comparison with Period 1

number of patients who required rescheduling or had to be moved to a different location on the day of testing was overall not significantly different. The additional nursing effort required for this process amounted to 0.7 FTE.

**MPI Cohort**

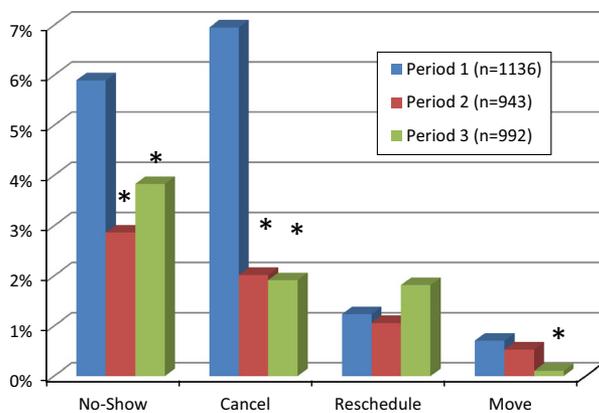
The patient characteristics of the subgroup of patients scheduled for MPI are shown in Table 2. More than 85% of orders were reviewed by protocol nurses.

The remainder was orders not received electronically and orders scheduled before they could be reviewed. Out of all protocolled tests, changes were made for 37%. The most common changes included protocoling as stress first studies and changing test location due to patient factors. Other frequent actions included changes in modality (for example, SPECT to PET due to high BMI) and care coordination. The most frequent interventions by protocol nurses were analyzed for the subgroup of patients with MPI scheduled (Figure 3). The outcomes among the subgroup of patients scheduled for MPI were

similar to the overall group. There was a significant reduction in tests that could not be performed as scheduled, from 17.5% of tests in period 1 to 8.3% and 6.5% in periods 2 and 3 ( $P < 0.001$  for comparison with period 1), mostly driven by a significant reduction in test cancellations. In addition, fewer vasodilator MPI could not be performed as scheduled due to caffeine intake in period 2 than in period 1 ( $P < 0.04$ ), although that reduction was no longer statistically significant in period 3 ( $P = 0.38$ ).

## DISCUSSION

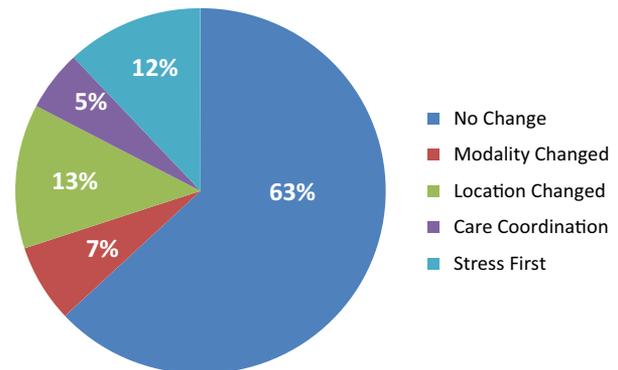
Patient-centered cardiac testing begins with scheduling patients for the appropriate procedure and



**Figure 2.** Day-of-testing events during six months before (period 1) and 12 months after (periods 2 and 3) the implementation of protocol nursing, as a percentage of all tests ordered, for nuclear stress (MPI) and non-imaging stress tests (ETT). \* $P < 0.05$  for comparison with period 1.

ensuring that the patient is prepared to undergo that procedure. The present study demonstrated that including an expert stress-testing nurse in the scheduling process for ETT and MPI can result in fewer no-shows and day-of-testing cancellations. Our approach increased communication between those ordering and those performing these tests.

Previous studies have established the role of communication in the scheduling process and more generally in the management of chronic conditions. Adherence to scheduled appointments can be improved with various communication tools including telephone reminders and text messaging.<sup>4</sup> It is possible that some or most of the reduction in no-shows and day-of-testing cancellations in our study was achieved by the increased quantity rather than quality of communication. On the other hand, there is evidence that telephone communication between patients and healthcare providers improves health



**Figure 3.** Protocol nurse interventions after implementing protocol nursing (periods 2 and 3).

**Table 2.** Patient characteristics, MPI subgroup

	Period 1 (before)	Period 2	P	Period 3	P
Patients (N)	456	387		418	
Female (%)	43	42	0.8	42	0.83
Age (years, mean)	65	67	0.06	66	0.68
BMI (Kg/m <sup>2</sup> , mean)	31	31	0.42	32	0.09
PET (%)	10	13	0.23	14	0.08
SPECT (%)	90	87	0.23	86	0.08
ETT (%)	31	27	1.0	27	0.89
Regadenoson (%)	69	73	1.0	73	0.89
Pretest <10% (%)	15	18	0.22	18	0.24
Known CAD (%)	36	34	0.61	32	0.23
Normal Perfusion (%)	69	67	0.51	67	0.51

BMI, Body mass index; PET, positron emission tomography; SPECT, single-photon emission computed tomography; ETT, exercise tolerance (non-imaging) stress test; CAD, coronary artery disease

outcomes<sup>5</sup> and the adherence to therapy recommendations,<sup>6</sup> and a similar effect is at least as likely to have contributed to our results. In fact, patient-centered stress testing requires careful attention to correct test selection and patient preparation. To the best of our knowledge, there are no prior data on employing the expertise of nurses at this early stage of stress testing.

Clinical decision support instruments can help health care professionals to order imaging stress tests appropriately and may assist the additional efforts of the expert nurse to optimize patient-centered testing. The FOCUS program of the American College of Cardiology (<http://www.acc.org/tools-and-practice-support/quality-programs/imaging-in-focus>) provides the health care professional feedback on the level of appropriateness based on guidelines published and reviewed by clinical experts in the field. Other programs such as the American College of Radiology's ACR-Select (<https://www.acr.org/Quality-Safety/eNews/Issue-04-December-2013/ACR-Select>) are also available. Our study did not explore ordering physician satisfaction of the added communication with the protocol nurses which remains an opportunity for further study. Further study appears indicated to evaluate point-of-ordering questionnaires compared to web-based decision tools and person-to-person communication methods on laboratory clinical and cost efficiency and patient satisfaction.

Nurse protocoling could be extended to encompass an assessment of appropriateness. In the present study, nurses did not review appropriateness of study indication. The "rarely appropriate" category of the appropriate use criteria (AUC) which has a low prevalence (<5%) in our laboratory is most often noted in patients who have low pretest likelihood of coronary disease, have an interpretable baseline ECG, and are able to exercise. The data used for the present study were limited in that patient-level information was only available for the MPI subgroup and did not include details on ECG findings. A cost benefit analysis of the

incremental 0.7 FTE for an expert nurse to help optimize patient-centered testing and streamline appropriate throughput appears warranted.

## NEW KNOWLEDGE GAINED

The present study demonstrates that expert protocol nurses contributed measurably to patient-centered testing by reducing the number of tests that could not be performed as scheduled. We believe an optimal patient-centered approach might include a combination of electronic point-of-ordering tools and expert nurse review of protocols.

## Disclosure

*P. Salimi, J. Niggel, and F. Keating have no conflict of interest to declare.*

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