PATIENT ACTIVATION|

MEDICAL SELF-MANAGEMENT IN THE CONTEXT OF A CARE TRANSITIONS INTERVENTION

By Molly McClain

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CERTIFICATE OF APPROVAL

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This is to certify that the Master's thesis of

Molly McClain

has been approved

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Mentor/Advisor

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Member

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Member

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Member

TABLE OF CONTENTS

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ABSTRACT

BACKGROUND
The Patient Activation Measure (PAM) quantifies patients' confidence, skills, and knowledge in regards to managing their own health. Higher levels of activation have been linked to improved health behaviors and health outcomes, and lower health care utilization. However, little is known about the use of the PAM during times of care transitions, or in adults who are socioeconomically disadvantaged.

METHODS
The study is a secondary analysis of data collected in the Care Transitions Innovation study, a multicomponent transitional care intervention for uninsured and low-income publicly insured adults. Regression analysis was used to determine if PAM scores predicted readmission and if PAM scores improved more in a group who received a transitional care intervention.

RESULTS
Multivariable logistic regression modeling revealed the odds of 30-day readmission was roughly 40% less for those with high PAM scores [OR: 0.57, 95% CI: 0.34-0.96, P-value: 0.04]. This association was adjusted for race, gender, severity of illness, depression, and social support. Whereas multivariate linear regression modeling, controlling for the same co-variates, demonstrated that a 30-day multicomponent transitional care intervention did not affect a change in PAM scores compared to the control group [B-coefficient: -1.06, 95%CI: -4.36- 2.11, P-value: 0.52].

CONCLUSION
Low baseline PAM scores were associated with higher rates of 30-day readmission, but PAM scores did not improve in those participating in a transitional care innovation program compared to those who received standard of care discharge procedure.   The PAM needs further study in the setting of transitional care, as well as in populations that are medically underserved.

INTRODUCTION

SIGNIFICANCE

This study's two aims are to elucidate how a transitional care program alters the PAM score, and to understand how the PAM score is linked to readmission risk. Interventions that improve the quality of transitions from the in- to out-patient milieu have been shown to decrease readmissions. Yet, such interventions are not well studied in populations such as the uninsured, Medicaid-insured patients, and patients without regular outpatient care that may have unique constellations of factors that predispose them to readmissions. If patient's self-confidence in their ability to manage their own health care is linked to risk of readmission, then improving health activation levels could be a target to decrease readmissions. Additionally, we will determine if improved transitional care is an efficacious method to improve people's PAM score. Lastly, we aim to gain greater understanding of the natural history of the PAM in a patient population has been shown to have lower levels of activation, but in which patient activation has not been studied extensively.

BACKGROUND

PATIENT CENTERED HEALTH CARE

An important element of health reform is a re-orientation toward patient-centered care. The interdependence between environment, personal characteristics and health behaviors[4] dictate that this restructuring must include both the health-care system as a whole, and the role of the patient within that system. On a systemic level, health care delivery must be re-organized to more effectively support patients. Transitional care improvements reflect efforts aimed at creating a more integrated delivery system that is easier for patients to navigate and less prone to systemic causes of medical error. Defined as "a set of actions designed to ensure the coordination and continuity of care received by patients as they transfer between different locations or levels of care[9] ", improvements in transitional care have been shown to increase quality and decrease hospital readmissions. [8,9,10,11,16,17, 30,31] On an individual level, patients are increasingly being viewed as the "source of control", as actively engaged consumers of health-care goods. [6,39] Patients must be empowered to take an active role in managing their own health. Yet all people have different levels of capacity to care for themselves, and therefore require different levels of support from their health care providers.

This call for patient-centered care is echoed in the Chronic Illness Care Model, which recognizes that the primary caregivers for the chronically ill are the patients themselves, and their families. The Chronic Illness Care, conceptualized by Von Korrf et al model is built on collaboration between health care providers and patients. The patient's task in this model is self-care as defined by continued engagement in healthy activities, adherence to health regimens, pro-active communication with physicians, and self-monitoring of health status. Performance

1

of self-care requires patient motivation and self-confidence.[39]   Successful collaboration between patient and provider has been shown to be effective in improving medical, functional and emotional outcomes. Von Korrf is careful to point out that all patients are different; they have different needs and disparate levels of motivation and readiness to manage complex health problems and complex health systems. As important as the role of the patient is, it is the provider's responsibility to assess patient's capacity to care for themselves, and to partner with patients at a level appropriate to their needs and capabilities.

Patients must be empowered to be the "source of control" and to take on the formidable challenge of self-management. This system that has fostered dependence on health care providers and other "experts" must now share power and responsibility with patients and their families. This capacity to manage one's own health has been conceptualized by Hibbard et al as "Patient Activation", defined as the "belief that the patient has an important role in self-managing care, collaborating with providers, and maintaining their health. Possession of the knowledge to manage their condition, maintain functioning, and prevent health declines; and possession of the skills and behavioral repertoire to manage their condition, collaborate with their health providers, maintain their health functioning, and access appropriate and high-quality care". [22] This group also developed the Patient Activation Measure, a 13- item survey designed and subsequently validated to measure activation levels. The survey was created through expert consensus panels, patient focus groups, pilot testing then validated through a national phone survey of 1,515 employed participants over the age of 45, of whom 88 percent where white. They interrogated the reliability through Rasch person and test-retest assesments. Criterion validity was analyzed through interview of 10 pilot participants by three different physicians whose classifcations were compared with Cohen's kappa score, additionally they found associations between PAM score and health "consumeristic" behaviors, such as using quality information to select providers, as well as lower health utilization, and better health outcome measures. [22]

PATIENT ACTIVATION
The Patient Activation Measure consists of thirteen questions that reflect patient self-reported capacity to succeed in the domains of activation. These six domains are: 1] the ability to self-manage symptoms and other problems; 2] to engage in activties that maintain functioning and reduce health declines; 3] to be involved in treatment and diagnostic decsions; 4] to collaborate with providers; 5] select providers and provider organizations based on performance or quality; 6] to navigate the health care system 21. The final PAM score, based on the thirteen questions, then places the patient in one of four stages of activation. PAM developers suggest that those at the lowest level of activation, Stage one, believe that they as patients should be involved in their own health care.   Those at Stage two also have the confidence and knowledge to take action, such as how to take

2

their medication and when to seek help. Stage three reflects the ability to actually take action to maintain lifestyle changes or handle their symptoms alone. The last stage indicates that even when under stress, the patient is confident and able to continue with their health care regimen.

These four stages are develeopmental. In other words, belief and knowledge must come before the more developed stages that require more activation. As patients grow in activation they begin to endorse skills and confidence, at first in their providers, and then at later stages, in themselves and their ability to keep their illness from interfering in their lives.[22]

Higher patient activation measures are associated with improved health behaviors, clinical indicators of health, and more efficient healthcare utilization.   The PAM score has been shown to be significantly correlated with preventive behavior such as screening and immunizations, [14, 18, 19] with other healthy behaviors including healthy diet, exercise and seeking out health information, [14,18, 19,20] and with better self-management of chronic illness.[14,18,29,34] In patients with chronic illness, the PAM score was also linked to clinically relevant indicators such as blood glucose and lipid levels,[3,14,29,34] as well as improved outcomes in heart disease, multiple sclerosis, chronic obstructive pulmonary disease, cancer, hypertension, HIV, asthma and diabetes.[33,35,37,40] Lastly, high PAM scores are predictive of lower health care utilization including fewer emergency department visits, and hospital admissions.[14] Patient activation has been described by Hibbard et al as related to concepts such as health literacy, and self-efficacy but contend that activation is a broder concept that encompasses many of these elements.[22] The PAM was developed and validated in employed, privately insured patients who were largely white. As important as this focus on the individual's engagment in their own health, the scope of reform must also be systemic.

TRANSITIONAL CARE AND READMISSIONS

One major target of systemic reform is improved care coordination, including improved care transitions. Improving care transitions has been shown to decrease readmissions and cost of care, and as such are the focus of many health system improvement projects. As patients move from the inpatient to outpatient settings, poor quality transitions may result in costly readmissions, medication discrepancies, adverse clinical events, and patient poor satisfaction with care. [29] Transitional care ensures health care continuity during this vulnerable time to "avoid preventable poor outcomes among at-risk populations, and promote the safe and timely transfer of patients". [30] Due to the many potential healthcare improvements from improved transitions the Affordable Care Act of 2010 made transitional care a priority through inclusion of multiple provisions that allocate billions of dollars towards innovation, dissemination, and implantation of transitional care programs.[30]

3

Legislators hope that these reforms may reduce costly hospital readmissions. One in five Medicare beneficiaries is readmitted to the hospital within 30 days of discharge, leading to an estimated 17.4 billion dollars a year in unplanned readmissions.[13,24] There is evidence that some re-hospitalizations are avoidable, and that interventions to improve the quality of care transitions may decrease the rates of readmission.[5,12,39] But care transition improvement programs are costly; most US hospitals that developed and implemented such projects subsequently cancelled them due to prohibitive costs.[3]

A tool to assess readmission risk could help identify patients who would benefit most from high resource interventions, making these interventions more efficient, effective and feasible. Many have tried to develop readmission risk prediction models, yet most models have poor predictive ability.[25] It has been suggested that models consisting of administrative, demographic and clinical variables would be improved with the addition of social and environmental factors such as access to care, social support and substance abuse. Additionally, models tailored to those with unique constellations of need, such as the medically underserved, might have more powerful predictive capabilities.[25] Variables that are linked to readmission and easy to measure upon admission could act as a metric to allocate resource-intensive interventions.

Despite the promise of transitional care for improved healthcare delivery, many interventions so far have resulted have had less impact on readmissions than was expected. In a recent analysis of 43 interventions, only 16 of the 43 were randomized and only five of those 16 trials showed statistically significant improvement in 30-day readmission rates.[15] In addition to randomization and adequate power to detect differences between control and intervention groups, these successful interventions included multiple elements such as a case manager, patient education and coaching, post-discharge follow-up and outpatient care, as well as careful risk stratification of each participant for individualized tailoring of the intervention.

Activation could serve two functions in care transitions- it could influence readmission risk and it could be a modifiable target for transitions interventions. If baseline activation levels are linked to readmission, the PAM could be one component of readmission risk prediction tools. Additionally, if activation can be improved in the peri-discharge period, and that improvement is linked to decreased readmissions, then measures to increase activation would be an important element of transition programs. Yet, there is little published data demonstrating the performance of the PAM within the context of care transitions.[1]

Given the unique needs and restrictions that medically underserved populations face, it is important to better understand the natural history of PAM scores in this more vulnerable population. People who are publically insured or uninsured face

4

barriers to accessing health care resources, and managing chronic illness, that those with private insurance do not.[29,36] Additionally, those who are older, less educated, have lower incomes, and people with Medicare or Medicaid have lower PAM scores.[19]

The Care Transitions Innovation (C-TraIn) study at Oregon Health and Science University evaluated the effect of a multicomponent transitional care intervention for medically underserved patients on high-cost utilization and quality of life.[11] Patients were enrolled shortly after hospital admission, and completed an in-person survey with research personnel that included the Patient Activation Measure. The PAM was then repeated at the time of a follow-up phone survey that was administered 30 days after hospital discharge. We evaluated whether PAM scores predicted likelihood of readmission, and if the Care Transition Innovation improved the PAM score relative to usual care.

METHODS

This study is a secondary analysis of a clustered randomized controlled trial. The protocol for the parent study and results for separate research questions will be published separately.[11]

INTERVENTION DESIGN

C-TraIn consists of four main components including (1) transitional nursing care, including home visits for highest risk patients; (2) pharmacy care that includes patient education, medication reconciliation, guidance to inpatient providers to encourage low-cost medications, and provision of 30 days of medications after discharge for those without prescription drug coverage; (3) post-hospital primary care linkages; (4) and explicit efforts at system integration through monthly quality improvement meetings. Implementation and evaluation of C-Train was funded by OHSU, including funding for nurse and pharmacy care, and payment to community partners for primary care for those uninsured patients who lacked a usual source of care.[11]

The C-TraIn intervention was in addition to usual care, which, at the time of the study, included routine inpatient and outpatient care. Inpatient care was delivered by medical teams (consisting of a hospital medicine attending physician, a resident physician and an intern, as well as two to three medical students), an inpatient nurse, an inpatient nurse care manager, and a social worker. Inpatient care did not include any explicit transitional care coaching, home visits, follow-up calls, pharmacy consultation, or explicit linkages with outpatient care. If a patient did not have a usual source of primary care, he or she received a list of 14 area low-cost or free clinics, though access to these clinics was not guaranteed and was often limited.

PARTICIPANTS

To be eligible, patients were hospitalized on one of the 7 inpatient treatment teams (including five general medicine teams, a clinical hospitalist team, or cardiology) and had to: (1) be uninsured or low-income publicly insured (Medicaid; Medicare/Medicaid; or Medicare without supplemental insurance and ≤200% poverty level), (2) reside in one of three metro-area counties (Multnomah, Washington, Clackamas), (3) be community dwelling (ie not from a long-term care facility), (4) have access to a working telephone (participants could list a friend or shelter phone), (5) speak English, (6) be HIV negative (HIV+ patients were eligible for overlapping transitional care resources), (7) have no disabling mental illness (as characterized by active psychosis or active suicidal ideation) or severe cognitive deficits, (8) have no plans to enter hospice.

DATA COLLECTED

In addition to administrative data on utilization and mortality, participants completed surveys at enrolment and 30-days post discharge with the help of study personnel.

6

Administrative data included health care utilization, admission and discharge dates and diagnoses. For the primary C-Traln study, the predictor variable was the intervention status and the primary outcome measures were 30-day readmission, and ED utilization post-discharge. Secondary outcome measures were transitional care quality as measured by the Care Transitions Measure[9] and mortality rates. Additional survey questions included information of prior utilization, access to care and medications, insurance status, housing status, employment, patient satisfaction and the Patient Activation Measure.   Data used to inform this analysis, which will be discussed below, included the PAM data, as well as some of the administrative and survey information.

VARIABLE DESCRIPTION
Variables analyzed in this study were collected during the enrollment survey or from the electronic medical record. The variables collected through survey included race/ethnicity, highest school grade completed, depression as measured by the PHQ-2 (Appendix 3), social support score (Appendix 3), whether the patient had a usual source of primary care, marginal housing, illegal drug use, current tobacco use, prescription drug use, and whether or not the patient had trouble taking medication. Chart review provided gender of the patient and the Charlson index, which predicts a patient's 10-year mortality based on comorbidities and age; high scores indicate greater predicted likelihood of mortality (range 0-32; 32 indicates an 85% chance of mortality in one year).

Verbal consent was obtained from patients during the index admission to collect baseline data collection, as well as a phone interview 30 days post-discharge. Administrative data was collected from the OHSU electronic medical record system EPIC using the OCTRI Research Data Warehouse (RDW) (IRB # 4076). All regulatory guidelines and policies applicable to the RDW were followed. The study protocol was approved by the OHSU institutional review board (# 6208).

DATA ANALYSIS
Descriptive statistics were generated for each allocation group, as well as to compare those who did and did not complete the 30-day follow up interviews. We hypothesized that low baseline PAM scores would be associated with higher rates of readmission (Figure 1). To measure this relationship, the baseline PAM scores were dichotomized based on the clinical assignments of numerical PAM scores of 1-100 as levels 1-4. Levels 1 and 2 were defined as "low" [defined by PAM scores of 1-55.1], and levels 3 and 4 designated as "high" [defined as PAM scores of 55.2-100]. Odds of readmission comparing those with low and high baseline PAM scores were then calculated using univariable logistic regression, followed by multivariable logistic regression controlling for the clinically relevant covariates race, gender, trouble taking medication, depression, level of illness as determined by Charlson index and social support score. We also included an interaction between allocation group and baseline PAM score to allow for the possible differential effect

7

of the C-TraIn intervention on the relationship between baseline PAM scores and readmission.

We also hypothesized that the C-TraIn intervention would improve PAM scores relative to usual care (Figure 2). We first compared the 30-day mean change in PAM score between the allocation groups using Student's t test. This was followed by linear regression analysis adjusted for the same covariates as listed above.

Diagnostics were completed to confirm that the models satisfied regression assumptions. The logistic regression models were also evaluated for discriminative ability through generation of a receiver-operating characteristic curve and calculation of the area under the curve. The α-level was set at 0.05, and all analyses were conducted using STATA 11.0.

Figure1: Relationship between baseline PAM and readmission
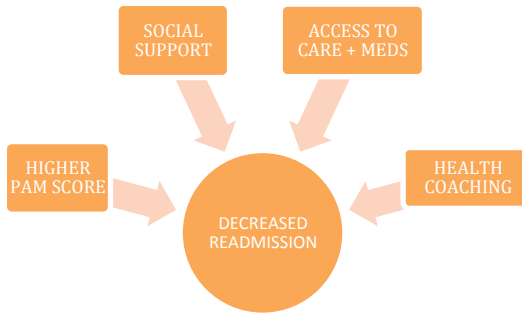
Figure 2: Relationship between C-TraIn intervention and increased PAM score
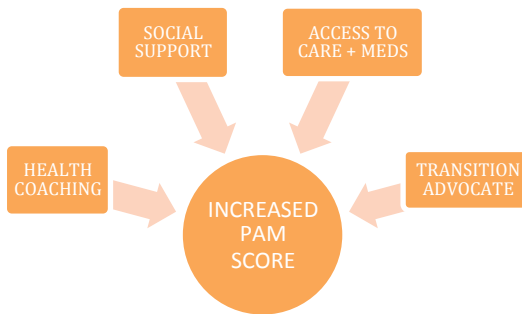
SAMPLE SIZE AND POWER ANALYSIS
To complete power analysis for the first hypothesis, we compared a number of estimated proportions of readmission between those with low PAM scores and high PAM scores. If roughly 25% of those with low PAM and 15% of those with high scores were readmitted, using an alpha-level of 0.05, the power to detect a difference between the two groups is 0.77. The power was estimated at .85 if the proportions were 20% and 10% respectively. If we estimated that those with low PAM scores would be readmitted 22% of the time, and those with high scores 15%, the power decreased to 0.59 (Lenth 2006-9).

RESULTS

Of the 2270 patients screened for enrollment from November 2011 to January 2012, 422 were consented 382 were enrolled, 209 were allocated to a medical team providing the C-TraIn intervention, and 173 were allocated to a control team. Of the 382 participants enrolled, 293 (74%) completed 30-day phone follow up surveys. 254 of these participants completed both baseline and 30-day PAM surveys. Reasons for exclusion and drop-out can be found in Appendix 1. Descriptive statistics were generated for the allocation groups [Table 1], as well as to compare those who completed both baseline and 30-day interviews with those who only completed the baseline interview [Table 2]. Among those who did not complete the follow-up PAM, there were significantly greater levels of self-reported alcohol use, and fewer participants with a usual source of care as compared to those who completed both PAM surveys.

PAM Score Association with 30- Day Readmission

Of the 382 enrolled, 98 (56/209 or 25% of those allocated to the intervention group and 42/173, or 24% in the control group) patients were readmitted within 30 days. To test whether baseline PAM score was associated with 30-day readmission, we performed both univariable and multivariable logistic regression. The final model included the clinically relevant variable as seen in Table 3. The intervention did not affect 30-day readmission based on analysis of the interaction between dichotomized PAM score and allocation group, so this interaction term was not included in the final model [p-value = 0.763]. The univariate logistic regression demonstrated no significant association between PAM score and 30-day readmission [Table 3]. But the multivariate model revealed that for those with low PAM scores, the odds of readmission was roughly 40% less for those who were admitted with high PAM scores compared to those with low scores. In both univariate and multivariate analysis, the odds of readmission were significantly greater for women than men. In simple univariate analysis, there was an 8% increase in predicted odds of readmission for each increased point of the Charlson Index, but the significance of this association was not maintained when all of the other variables were controlled for.

Randomization and Change in PAM score over 30 days

Our second hypothesis was that the C-TraIn intervention would improve PAM scores relative to usual care. Univariate linear regression did not demonstrate a statistically significant difference in the change of PAM scores over 30 days between those who received the transitional care intervention and those who did not [Table 4]. The linear regression model was then adjusted for depression, trouble taking medication, social support score, race, gender and level of illness; this adjusted analysis did not reveal an association between allocation group and change in PAM score, nor was any other variable in the model associated with

9

change in PAM score. The mean scores decreased a small amount in both groups over the 30 days- controls decreased by 1.4 points and the intervention group by 2.9.

DISCUSSION

Patient activation has been identified as a key component of successful care transition programs[7] and as a readmission risk stratification tool.[17] Yet little is known about PAM performance during transitions, or in medically underserved populations. Our research indicates that the PAM may help predict readmissions, but demonstrated that the a multi-component care transitions intervention did not affect PAM scores.

PAM AS A PREDICTOR OF READMISSION RISK

There are a few important reasons it may be useful to know that low patient activation is a readmission risk factor. It might help explain some of the gaps within existing readmission risk prediction models, and incorporating the PAM may improve these models. Additionally, the PAM may be an important measure for transitional programs in order to select those patients that would most benefit from transitional interventions: either those with low PAM, because they may need most support, or those with high scores who can successfully engage in coaching interventions.

PAM AS A MEASURE OF TRANSITIONAL CARE QUALITY

PAM scores did not change over 30 days despite an intensive transitional care intervention, suggesting that the PAM may not be a sensitive quality metric for hospitals or care transitions interventions. This may be because activation is hard to change in this population. Those with depression have PAM scores that are comparatively resistant to change compared to those who are not depressed,[20] and our population had high levels of depression as well as other psychosocial challenges.

Another possible explanation is the PAM is resistant to change over this period of time, or hard to change in the peri-discharge period when people are not at their usual level of health or activation. Alternatively, it may be that our intervention did not sufficiently target patient activation.

The PAM has yet to be validated in the medically disadvantaged, who may have unique barriers to successful medical self-management. There is evidence that those who are older, have lower incomes, do not have private insurance, have less education, and who are not white have lower PAM scores.[17] However, no study has explicitly validated the PAM in people with lower socioencomic status.

Additionally, the constructs that comprise activation may be overshadowed by more pressing barriers to health. In the setting of unstable housing, lack of transportation and food insecurity, the possession of belief, knowledge and skill for self-management may more difficult to target for improvement. And activation may be eclipsed by these barriers in terms of health outcomes in people facing daunting barriers such as those above.

11

Perhaps the PAM was not influenced by the C-TraIn intervention because activation is not be modifiable over a short time. The question of whether activation is modifiable has been raised by others. In one study, a largely white population with regular outpatient care were randomized to 6 weeks of empowerment training. After 6 weeks, there was minimal, but significant, improvement in PAM scores in the intervention group. After 6 months however, the improvement in PAM was similar for the intervention and controls.[20] This 6 week time frame was also in the context of a stable outpatient clinic and not during a transitional time of recovery from acute illness.

Lastly, the C-TraIn intervention was not designed to improve activation. Its explicit targets were patient education, outpatient medical home linkage and improved cross-site communication.

STUDY LIMITATIONS AND STRENGTHS
This study has several limitations. Our results may have not have external validity given it was a single-center study, and was done in a strictly-defined population. This was addressed by comparison of our data with state-wide health-care utilization data, that included admissions to all Oregon, and two Washington state, hospitals. This database was limited in that it did not contain data on ED utilization or any patient cosidered under observation. Information bias may have also played a role in that much of the survey data was self-reported. As much data as possible was confirmed through chart review. Additionally there could have been analysis bias in that those who finished both PAM surveys and those who only finished the first were different in terms of alcohol use and having a usual source of care. Lastly, the number of those readmitted in those with low and high baseline PAM scores were very similar, making the power to detect a difference between the two groups smaller than the expected 0.80, making our model more labile.

CLINICAL IMPLICATIONS FROM THIS RESEARCH
Patient activation and care transitions are considered important elements of the current health reform push, particularly for the most vulnerable patients.[14,30] Based on our findings, we suggest that the PAM may be useful as a tool to identify those at highest risk of readmission, and as a tool to determine who might most benefit from improved transitional care. Yet, given the PAM's stability over a 30-day period even in the setting of an intensive multi-component transitional intervention, the PAM may not be a good performance metric for hospitals or care transition programs.

FUTURE DIRECTIONS
There are three major directions that future research might follow.   Firstly, we suggest further investigation into the PAM as a readmission predictor. Questions arise such as: how well does it perform compared to other models, how well does it

12

work when added to existing models, does low or high baseline PAM indicate need for increased support in order to avoid subsequent readmissions. Second, further research into the modifiability of patient activation is suggested by these results. It would interesting to know what the time course of modification is, how long it might last, what interventions are most effective in improving PAM.   Lastly, this research supports others' interest in validating this instrument in the medically underserved. Despite much data showing that those in medically underserved group have lower PAM scores, it is not yet clear that the PAM, in its current form, is an accurate reflection of activation in the medically disadvantaged, or if activation is linked to health outcomes. Health care providers might benefit greatly from a tool that could leverage change for those with low socioeconomic status given the difficulty for health providers to address other barriers like social support, housing, and transportation.

TABLES

Table 1: Descriptive statistics of the control and intervention groups (n= 382)

VARIABLE	CONTROLS	INTERVENTION
GENDER [% males, (n/N]	59 (100/169)	59 (121/204)
RACE [%, (n/N)]		
WHITE	76.1 (131/172)	68.4 (143/209)
AFRICAN-AMERICAN	8.7 (15/172)	10 (21/209)
OTHER	15.1 (26/172)	21.5 (45/209)
HIGHEST SCHOOL GRADE [%, (n/N)]		
ELEMENTARY	4.6 (8/173)	4.3 (9/208)
SOME HIGH SCHOOL	11.5 (20/173)	15.3 (32/208)
COMPLETED HIGH SCHOOL	32.4 (56/173)	33.1 (69/208)
SOME COLLEGE	38.1 (66/173)	34.1 (71/208)
COMPLETED COLLEGE	13.2 (23/173)	13.4 (28/208)
CHARLSON INDEX [mean, (SD), N]	2.24 (3.24, 173)	2.27 (3.00, 209)
HEALTH INSURANCE		
% WITH NONE, (n/N)	38 (65/171)	43.1 (90/209)
SOCIAL SUPPORT SCORE [mean, (SD), N]	14.3 (4.37, 170)	14.5 (4.21, 205)
DEPRESSION [% positive, (n/N)]	72.0 (124/172)	76.5 (160/209)
HAS CURRENT USUAL SOURCE OF CARE [%, (n/N)]	73.4 (127/173)	79 (164/208)
MARGINAL HOUSING [%, (n/N)]	32.7 (56/171)	27.2 (56/206)
ALCOHOL USE [%, (n/N]	32.5 (55/169)	30.8 (63/204)
ILLEGAL DRUG USE [%, (n/N]	42.4 (73/172)	44.7 (93/208)
PRESCRIPTION DRUG MISUSE [%, (n/N)]	9.8 (17/172)	10 (21/208)
CURRENT TOBACCO USE [%, (n/N]	29.6 (51/172)	31.7 (66/208)
BASELINE PAM SCORE [Mean, (SD), N]	57.8 (11.49, 173)	56.9(10.8, 209)
BASELINE PAM SCORE RANGE	24.3 - 82.8	32.2- 100

Table 2: Descriptive statistics comparing group that completed both PAM surveys and those that only completed baseline PAM survey

VARIABLE	COMPLETED ONLY BASELINE	COMPLETED BOTH	P-VALUE
GENDER [% Male, (n/N)]	60 (75/125)	59 (146/248)	0.91
RACE [% ,(n/N]			
WHITE	72 (91/127)	72 (183/254)	0.71
AFRICAN AMERICAN	11 (14/127)	8.6 (22/254)	
OTHER	17.3 (22/127)	19.2 (49/254)	
DEPRESSION [% positive, (n/N]	80 (101/127)	72 (183/254)	0.14
HIGHEST GRADE COMPLETED [%, (n/N)]			0.82
GRADES 1-8	3.1 (4/127)	5.1 (13/254)	
SOME HIGH SCHOOL	13 (16/127)	14.1 (36/254)	
GRADE12/GED	32.2 (41/127)	32.6 (83/254)	
COLLEGE 1-3 YRS	36 (46/127)	35.8 (91/254)	
COMPLETED COLLEGE	15.7 (20/127)	12.2 (31/254)	
CHARLSON INDEX [MEAN, SD, N]	2.12 +/- 3.3 (128)	2.34 +/- 3.0 (254)	0.46
INSURANCE			
% WITH NONE (n/N)	45.6 (58/127)	38.3 (97/253)	0.19
SOCIAL SUPPORT SCORE [MEAN, SD,N]	14.0 +/-4.56 (125)	14.61 +/- 4.23, (250)	0.47
CURRENT TOBACCO USE [%, (n/N)]	33.5 (43/128)	29.3 (74/252)	0.41
HAS CURRENT USUAL SOURCE OF CARE [%, (n/N]	66.1 (84/127)	81.5 (207/254)	0.00*
MARGINAL HOUSING [%, (n/N)]	34.4 (43/125)	27.3 (69/252)	0.10
ALCOHOL USE [%, (n/N)]	38.4 (48/125)	28.2 (70/248)	0.03*
ILLEGAL DRUG USE [%, (n/N)]	45.6 (58/127)	43 (108/253)	0.59
PRESCRIPTION DRUG MISUSE [%, (n/N)]	10.1 (13/128)	0.10 (25/252)	1.00
BASELINE PAM SCORE [MEAN] (SD, N)	58.5 +/-10.1 (128)	56.75 +/-11.53 (254)	0.15

Table 3: Association between PAM score and 30-day readmission

VARIABLE (referent)	30 DAY READMISSION OR (95% CI)	P-value	OR (95% CI)	P-value
	UNIVARIATE		MULTIVARIATE	
DICHOTOMIZED PAM SCORE (low)	0.67 (0.42-1.08)	0.10	0.57 (0.34- 0.96)	0.04*
ALLOCATION GROUP (control)	1.14 (0.72- 1.81)	0.58	1.06 (0.65-1.74)	0.81
DEPRESSION (not depressed)	0.99 (0.59-1.70)	0.99	1.23 (0.68-2.21)	0.49
TROUBLE TAKING MEDICATION (negative)	0.96 (0.60-1.53)	0.87	1.03 (0.62-1.69)	0.90
SOCIAL SUPPORT SCORE (0/low)	0.99 (0.95-1.05)	0.93	0.98 (0.92-1.04)	0.45
RACE				
Black (referent)				
White	0.79 (0.37-1.70)	0.55	0.70 (0.31-1.56)	0.46
Other	0.66 (0.29-1.62)	0.37	0.59 (0.22-1.53)	0.27
GENDER (male)	1.62 (1.01-2.58)	0.05*	1.69 (1.03-2.77)	0.04*
CHARLSON INDEX (0/low)	1.08 (1.01-1.16)	0.02 *	1.05 (0.98-1.14)	0.15

Table 4: Association between allocation group and change in PAM score over 30 days

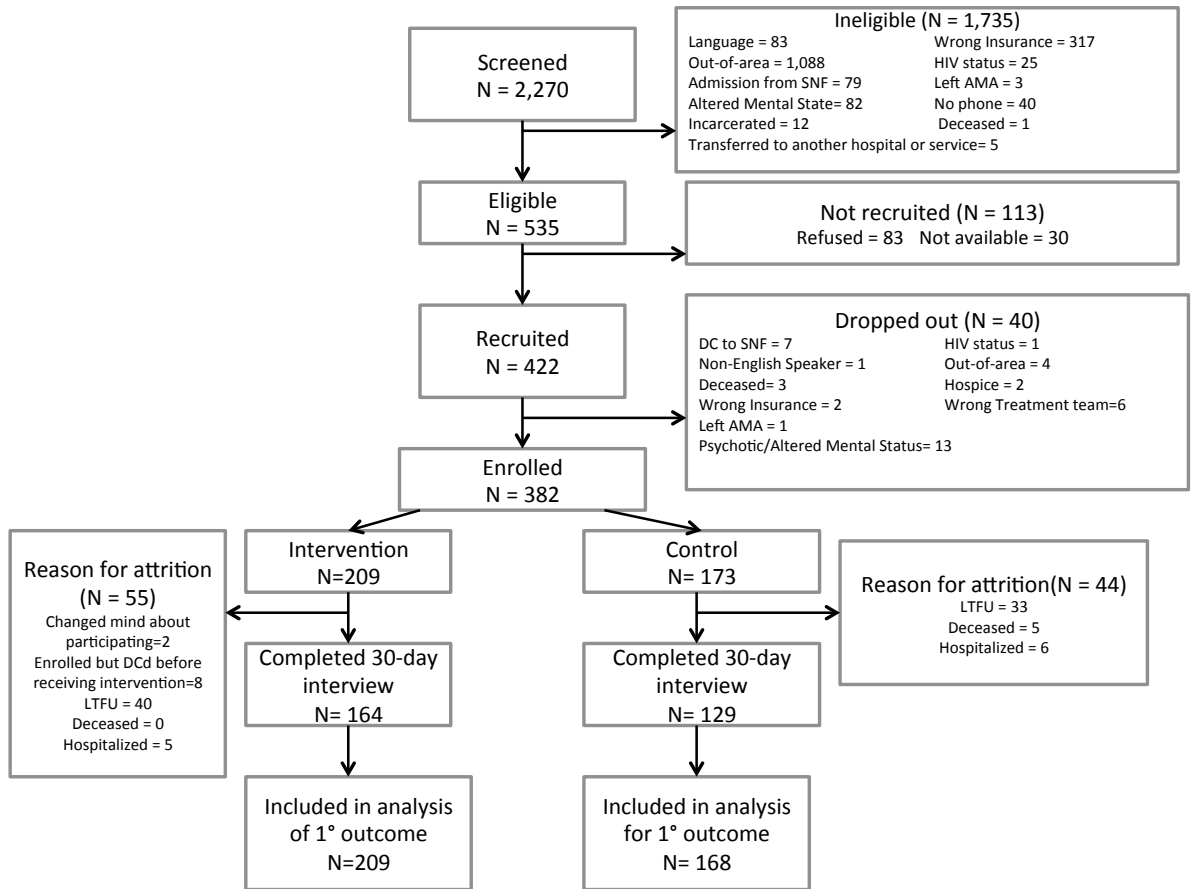| VARIABLE (referent)	β -COEFFICIENT (95% CI)	P-VALUE	β -COEFFICIENT (95% CI)	P-VALUE
	SIMPLE LINEAR REGRESSION		MULTIVARIATE LINEAR REGRESSION	
RANDOMIZATION (controls)	-1.48 (-4.69-1.72)	0.37	-1.06 (-4.36-2.22)	0.52
DEPRESSION (negative)	0.535 (-3.02-4.09)	0.77	0.38 (-3.33-4.09)	0.84
TROUBLE TAKING MEDICATION (negative)	0.55 (-1.53-2.63)	0.61	-1.27 (-4.64-2.11)	0.461
SOCIAL SUPPORT SCORE (0/low)	0.30 (-0.07- 0.68)	0.12	0.32 (-0.08- 0.72)	0.12
RACE (Black)				
White	-1.65 (-7.39-4.08)	0.57	-1.91(-7.94-4.10)	0.53
Other	-3.28 (-9.81-3.24)	0.32	-2.56 (-9.37-4.23)	0.46
GENDER (male)	-0.91 (-4.20-2.37)	0.58	-1.20 (-4.61- 2.20)	0.49
CHARLSON INDEX (0/low)	0.06 (-0.46- 0.59)	0.81	.09 (-0.48-0.65)	0.12

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APPENDICES:

1. PATIENT ENROLLMENT

Screened
N = 2,270

Ineligible (N = 1,735)
Language = 83   Wrong Insurance = 317
Out-of-area = 1,088   HIV status = 25
Admission from SNF = 79   Left AMA = 3
Altered Mental State= 82   No phone = 40
Incarcerated = 12   Deceased = 1
Transferred to another hospital or service= 5

Eligible
N = 535

Not recruited (N = 113)
Refused = 83   Not available = 30

Recruited
N = 422

Dropped out (N = 40)
DC to SNF = 7   HIV status = 1
Non-English Speaker = 1   Out-of-area = 4
Deceased= 3   Hospice = 2
Wrong Insurance = 2   Wrong Treatment team=6
Left AMA = 1
Psychotic/Altered Mental Status= 13

Enrolled
N = 382

Reason for attrition
(N = 55)
Changed mind about participating=2
Enrolled but DCd before receiving intervention=8
LTFU = 40
Deceased = 0
Hospitalized = 5

Intervention
N=209

Control
N= 173

Reason for attrition(N = 44)
LTFU = 33
Deceased = 5
Hospitalized = 6

Completed 30-day interview
N= 164

Completed 30-day interview
N= 129

Included in analysis of 1° outcome
N=209

Included in analysis for 1° outcome
N= 168

2. VARIABLE DESCRIPTION

VARIABLE NAME	VARIABLE DESIGNATION	SURVEY PROMPT
1. Race/ethnicity	CATEGORICAL (Black = referent, White and Other)	"What race do you consider yourself to be?"
2. Gender	DICHOTOMOUS (Male = referent, Female)	Collected from medical record
3. Highest school grade	CATEGORICAL (never/ only kindergarten = referent, grades 1-8, grades 9-11, grade 12 or GED, college:1-3 years, college 4 years or more, refused)	"What is the highest grade or year of school you completed?"
4. Depression	DICHOTOMOUS (negative = referent, positive)	Composite score of PHQ-2 (Appendix 3)
5. Social support score	CONTINUOUS (Lower values indicate lower perceived social support)	Composite score of Social Support Survey (Appendix 3)
6. Source of usual care	DICHOTOMOUS (no = referent, yes)	"Is there a place you usually go to when you need medical care?"
7. Marginal housing	DICHOTOMOUS (no = referent, yes)	"Is your current living situation other than owning/renting?"
8. Illegal drug use	DICHOTOMOUS (no = referent, yes)	"Have you ever used drugs such as heroin, cocaine, ecstasy or methamphetamine in your lifetime?"
9. Current tobacco use	DICHOTOMOUS (no = referent, yes)	"Are you currently a cigarette smoker?"
10. Prescription drug misuse	DICHOTOMOUS (no = referent, yes)	"Have you ever used prescription pain medication such as vicodin, oxycodone, Percocet or dilaudid for the experience or feeling it caused?"
11. Trouble taking medication	DICHOTOMOUS (no = referent, yes)	"Outside of the hospital, do you have trouble taking your medications as described by your doctor?"
12. Charlson Index	CONTINUOUS	Collected from medical record

3. Social Support Survey and PHQ2 Depression scale question

Who accepts you totally, including your worst and your best points? (you do not need to tell us names, just the number of people) *(accepted)*
How satisfied are you with this source of support on a scale of 1 - 6 with 1 being very dissatisfied, and 6 being very satisfied? *(accept_satisfd)*
Who can you really count on to tell you, in a thoughtful way, when you need to improve in some way? *(counton)*
How satisfied are you with this source of support on a scale of 1 - 6 with 1 being very dissatisfied, and 6 being very satisfied? *(counton_satisfd)*
Who do you feel truly loves you deeply? *(love)*
How satisfied are you with this source of support on a scale of 1 - 6 with 1 being very dissatisfied, and 6 being very satisfied? *(love_satsifd)*
DEPRESSION SCREENING PHQ2 **READ:** **Over the past two weeks, how often have you been bothered by any of the following problems?**
Have Little interest or pleasure in doing things? *(phq2_1)*
Feeling down, depressed, or hopeless? *(phq2_2)*
Total Point Score *(phq2_total)*