Outcomes of a 12-month patient-centred medical home model on patient activation and self-management behaviours among primary care patients presenting with chronic diseases in Sydney, Australia.

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Abstract

Background: Patient activation is an important precursor not only for effective self-management of chronic comorbidity but also to empower patients in actively making decisions concerning their health. Studies report that increased activation in terms of high patient activation measure (PAM) scores are associated with increased patient engagement with the health care system, better compliance to treatment protocols, and improved health outcomes. This study aims to evaluate outcomes of Patient-Centred Medical Home model called 'WellNet' on activation levels of patients with multimorbidity in general practices across Sydney, Australia.

Methods: A total of 636 patients consented to participate in the WellNet program delivered across six general practices in Northern Sydney, Australia. The WellNet treatment comprised of a team-based care with General Physicians collaborating with trained Chronic Disease Management care coordinators. After a comprehensive assessment, the care team designed patient-tailored care plan with self-management support and care navigation according to the level of risk and health care needs. Level of patient activation was measured using the validated PAM 13-item scale at baseline and follow-up. A case-series design was employed to determine significant differences between baseline and 12-months using General Linear Models. Multiple imputation was used to compute missing follow-up scores using Markov Chain Monte Carlo (MCMC) algorithm known as fully conditional specification (FCS). Multivariate regression models were employed to identify significant predictors of activation at follow-up.

Results: Of the 626 patients, 420 reported their PAM levels at follow-up. The adjusted model showed significant mean difference in PAM scores of 6.5 (95%CI 5.0-8.1; p-value<0.001) after controlling for baseline covariates. Multivariate regression models determined that older age (OR = -0.14; 95% CI -0.28, -0.01), baseline activation score (OR = 0.48; 95% CI 0.37, 0.59), and private insurance (uninsured patients) (OR = -3.41; 95% CI -6.50, -0.32) were significant predictors of patient activation at follow-up.

Conclusion: The WellNet study is the first of its kind in Australia to report on changes in the activation and self-management among patients with multimorbidity. PCMH has the potential to improve patient activation and engagement which can lead to long-term health benefits and sustained self-management behaviours.

Background

The prevalence of multiple chronic conditions has become increasingly common and presents significant burden to healthcare systems in Australia and worldwide [1, 2]. Recent advances in medicine and technology have resulted in increased life expectancy which has inadvertently contributed to the growth of ageing population surviving with increased years of disabilities and accumulation of chronic comorbidities [3, 4]. The Australian National Health Survey (NHS) 2017-18 data shows that chronic disease prevalence increased with age, with 80% of Australians aged 65 years and above having one or more chronic conditions [5]. There is well-documented evidence of multimorbidity associated with increased risk of mortality [6], reduced functional status and quality of life [7], and increased health service utilisation [8, 9]. Furthermore, patients presenting with multimorbidity are often recipients of fragmented care as healthcare systems, including Australia, still remain largely configured to management of single diseases, thereby lacking coordination and continuity of care [10]. Contrarily, there is sound evidence suggesting that collaborative approaches in primary care are associated with effective management of chronic illnesses [11, 12].

Management of complex comorbidity requires effective care delivery with emphasis on patient-tailored self-management treatment strategies for better patient outcomes [11]. In view of this, Patient-centred medical home (PCMH) model has proven to be one of the effective chronic care models that facilitates continuity of care through comprehensive, coordinated approach whilst aiming to improve patient engagement and self-management behaviours configured to individual needs [13, 14]. There is increasing evidence on the effectiveness of PCMH model in improving patient activation and self-management of chronic diseases, leading to better quality of health and health utilisation outcomes [15–17]. However, the feasibility and effectiveness of PCMH model remain unclear in Australian primary care practices.

In the past decade, there has been increased advocacy towards patient engagement and self-management of chronic disease/s [18, 19]. The level of activation and ability to self-manage conditions play an important role in patient's overall health and wellbeing, especially for those presenting with multimorbidity [20, 21]. There is a growing body of evidence indicating that patients who are actively engaged in their healthcare have improved self-reported and clinical outcomes [22–24]. In addition, patients with high activation levels are often empowered through shared decision-making with their GPs and are reported to have better compliance to treatment regimens and lower hospital admissions compared to patients with lower activation scores [25, 26].

Understanding an individual's level of activation enables physicians to provide patient-tailored care according to the risk and complexity of healthcare needs [27]. The Patient activation measure (PAM) as a tool to evaluate patients' skills, knowledge, and confidence to manage their own health has been increasingly used and has shown profound benefits to both providers and patients [28]. Although chronically ill patients generally report low activation and have increased risk of hospitalisation [25], patient activation can be modified through effective education and training [29]. Despite the growing advocacy towards patient activation, there is relatively little information about activation and self-management outcomes among patients presenting with chronic illnesses in Australia. Therefore, the aim of this study is to evaluate the outcomes of a 12-month PCMH model on patient activation among high risk primary care patients presenting with multimorbidity in Sydney, Australia.

Methods

WellNet program and study design

Sonic Clinical Services (SCS) designed a 12-month chronic disease management (CDM) program called 'WellNet' which aims to provide GP led, multidisciplinary team-based care for patients with one or more chronic conditions. This enhanced primary care program is built upon the principles of PCMH and guided by evidence based, best practice models of clinical care to deliver a patient-centric care that is configured to individual risk and complexity levels (John et al, 2019, unpublished article).

We used a case-series design to evaluate the effectiveness of WellNet program in improving clinical and self-reported outcomes among primary care patients enrolled in six general practices in Northern Sydney, Australia. A written informed consent was obtained from the participants who enrolled in the 12-month study. A detailed description of the program design and evaluation are reported elsewhere (John et al, 2019, unpublished article).

Participants

Patients aged 40 years and above with one or more chronic condition/s who had consulted a GP three times in the previous two years were contacted either through letter invites or GP referrals and were assessed for eligibility.

Further details of the eligibility, recruitment outcomes, and data collection are reported elsewhere (John et al, 2019, unpublished article). Of the 636 consenting participants, 626 reported their baseline PAM score and were included in this study. The flowchart of patient recruitment outcomes is shown in Fig. 1.

WellNet intervention

The 12-month WellNet program is designed to integrate GPs with specially trained CDM Care Coordinators (CC) within each of the six participating GP practices [30]. On entry to the program the team of GPs and CCs undertake a range of validated risk and disease severity assessments, including the PAM, to determine the patient's baseline health status and wellbeing. The information gathered from these assessments is then used to formulate an individualised CDM plan in consultation with the patient. Included in the care plan are patient driven health goals; modifying and training core skills to self-manage symptoms and medications; improving diet and physical activity; and reducing smoking and alcohol consumption [30]. The care plan includes, and is shared with, all relevant members of the care team. Ongoing support to increase knowledge and understanding and maintain positive behaviour change, monitoring of progress towards health goals and assistance to access health and social care are provided through a combination of in-practice and telephone contacts.

The WellNet program also includes "GoShare", an intuitive online platform enabling digital sharing of evidence-based patient-relevant education materials in a user-friendly manner to achieve maximum impact. Patients' access to the materials and understanding are monitored and assessed through self-reported surveys. The care coordinators focus on low adherence to usage or understanding, so that issues can be resolved. Furthermore, patients are also offered a mobile application, called 'MediTracker', which links directly to the clinical records held at the practice, providing access to information such as current medications, pathology results, diagnoses and immunisation status [30]. This is intended to encourage and empower patients to play an active role in their chronic disease care management.

PAM-13 item version, exploratory variables and outcome measures

Patient activation was measured with the use of the validated PAM-13 item version developed by Hibbard et al [28]. PAM-13 is a self-reported questionnaire composed of 13 items relating to patients' beliefs about healthcare, knowledge about their health condition, and confidence in managing health related tasks. Responses range from 13–52 which are then converted to scores with a theoretical range 0 to 100, based on calibration tables, with higher scores indicating high levels of activation. The raw scores were converted into four levels of activation of Level 1 – not believing activation is important; Level 2 – Lacking knowledge or confidence in self-management of health; Level 3 – Beginning to take action; and Level 4 – Taking action but require support in maintaining positive behaviour change. Each of these levels reveals insights into a range of health-related characteristics, including behaviours and outcomes [28]. In addition, determining baseline scores allow MDT to determine the best approach to engaging and educating patients and thus improving self-management skills and confidence.

PAM scores were recorded at the start and completion (12 months) of the WellNet program. Aligned to the outcome of patient activation, demographic information of age, gender, type and number of chronic conditions, private health insurance status, and total program contacts were analysed in this study.

The primary outcome of interest for this study was increase in the mean PAM score between baseline and 12-months after controlling for potential covariates. Secondary objectives are as follows: 1) To assess if there are

significant differences in the levels of PAM at baseline and 12-months; 2) To explore significant predictors of change in patient activation over time.

Data analysis

Descriptive statistics for continuous variables using mean and standard deviation (SD) and percentages for categorical measures are presented in Table 1. One-way analysis of variance (ANOVA) was conducted to test for significant differences in means between one or more groups whereas Pearson's chi-square test was conducted to evaluate significant differences in the baseline and follow-up PAM levels. Additionally, t-tests and chi-square test were performed to determine any significant difference between completers and non-completers.

Table 1

Patient characteristics by level of patient activation at baseline

Variable	Total	PAM Level 1	PAM Level 2	PAM Level 3	PAM Level 4	Activation score Mean (SD)
All participants	626 (100)	121 (19.1)	236 (37.7)	138 (22.0)	131 (20.9)	57.5 (13.1)
Age in years, Mean (SD)*	68.8 (12.9)	70.4 (12.5)	70.5 (12.9)	66.0 (12.9)	67.0 (12.4)	-
Median age group						
≤ 70 years	318 (50.8)	60 (18.9)	107 (33.6)	80 (25.2)	71 (22.3)	58.2 (13.3)
> 70 years	308 (49.2)	61 (19.8)	129 (41.9)	58 (18.8)	60 (19.5)	56.8 (12.8)
Gender						
Males	313 (50.0)	62 (19.8)	121 (38.7)	69 (22.0)	61 (19.5)	57.1 (12.9)
Females	313 (50.0)	59 (18.8)	115 (36.7)	69 (22.0)	70 (22.4)	58.0 (13.3)
History of co-existing conditions						
Cardiovascular disease	214 (34.2)	44 (20.6)	91 (42.5)	41 (19.2)	38 (17.8)	55.7 (11.4)
Respiratory disease	181 (28.9)	39 (21.5)	64 (35.4)	44 (24.3)	34 (18.8)	57.3 (13.5)
Diabetes	307 (49.0)	62 (20.2)	112 (36.5)	71 (23.1)	62 (20.2)	57.1 (12.0)
Musculoskeletal disorders	267 (42.7)	58 (21.7)	98 (36.7)	54 (20.2)	57 (21.3)	57.5 (13.5)

Data presented as N (%) unless specified otherwise

Variables reported as percentages were tested with chi-square analyses and variables reported as means and standard deviations were tested with ANOVA.

*p-value < 0.05

**p-value < 0.001

Variable	Total	PAM Level 1	PAM Level 2	PAM Level 3	PAM Level 4	Activation score Mean (SD)
Mental illness	127 (20.3)	34 (26.8)	48 (37.8)	29 (22.8)	16 (12.6)	54.2 (11.4)
Cancer	92 (14.7)	15 (16.3)	35 (38.0)	21 (22.8)	21 (22.8)	57.3 (13.1)
Number of co-existing conditions, Mean (SD)	1.9 (0.9)	2.1 (1.0)	1.9 (0.9)	1.9 (0.9)	1.7 (0.9)	-
Insurance status**						
Private	398 (68.7)	60 (15.1)	152 (38.2)	89 (22.4)	97 (24.4)	59.0 (13.8)
Uninsured	181 (31.3)	50 (27.6)	74 (40.9)	34 (18.8)	23 (12.7)	54.1 (10.4)
Total program contacts						
≤ 11 contacts	320 (51.1)	64 (20.0)	119 (37.2)	74 (23.1)	63 (19.7)	57.4 (13.4)
> 11 contacts	306 (48.9)	57 (18.6)	117 (38.2)	64 (20.9)	68 (22.2)	57.7 (12.8)
Clinical measures						
Systolic Blood Pressure (mmHg), Mean (SD)	138.8 (19.1)	138.6 (23.1)	138.3 (17.7)	139.4 (19.5)	139.3 (17.3)	-
Diastolic Blood Pressure (mmHg), Mean (SD)	75.9 (18.2)	74.3 (19.5)	76.2 (16.8)	76.2 (18.0)	76.4 (19.6)	-
Body Mass Index Kg/m2, Mean (SD)	29.9 (7.3)	31.2 (10.1)	29.3 (6.1)	30.1 (6.6)	29.6 (6.5)	-
Glycated Haemoglobin (%), Mean (SD)*	6.8 (1.4)	7.1 (1.3)	6.8 (1.3)	6.9 (1.8)	6.4 (1.1)	-

Data presented as N (%) unless specified otherwise
Variables reported as percentages were tested with chi-square analyses and variables reported as means and standard deviations were tested with ANOVA.
*p-value < 0.05
**p-value < 0.001

Variable	Total	PAM Level 1	PAM Level 2	PAM Level 3	PAM Level 4	Activation score Mean (SD)
High Density Lipoprotein Cholesterol (mmol/L), Mean (SD)	1.3 (0.4)	1.3 (0.4)	1.3 (0.4)	1.3 (0.4)	1.4 (0.4)	-
Low Density Lipoprotein Cholesterol (mmol/L), Mean (SD)*	2.7 (1.1)	2.6 (1.2)	2.6 (1.0)	2.8 (1.1)	2.9 (1.1)	-
Total Cholesterol (mmol/L), Mean (SD)*	4.8 (1.4)	4.8 (1.6)	4.6 (1.2)	5.0 (1.3)	5.2 (1.4)	-
Triglyceride (mmol/L), Mean (SD)	1.6 (1.1)	1.6 (0.9)	1.7 (1.2)	1.7 (1.1)	1.6 (1.3)	-
Data presented as N (%) unless specified otherwise						
Variables reported as percentages were tested with chi-square analyses and variables reported as means and standard deviations were tested with ANOVA.						
*p-value < 0.05						
**p-value < 0.001						

Primary analysis includes completers only model (Model 1) of those who reported both baseline and follow-up scores, and an imputed model (Model 2) which imputed missing follow-up PAM scores using Markov Chain Monte Carlo (MCMC) algorithm known as fully conditional specification (FCS) [31]. For multiple imputation, 25 imputed datasets were created, and pooled estimates were reported. Adjusted mean difference between baseline and follow-up was measured using General Linear Model (GLM) repeated measures to control for baseline differences and other potential covariates. In addition, multivariate linear regression models were conducted to determine the predictors of change in activation scores over time. Internal consistency of pre and post PAM-13 items in this study were evaluated using Cronbach's alpha. R and SPSS (version 25) statistical software were used to conduct all the analyses. Significance level was set as 0.05 and all statistical tests were two-sided.

Results

Baseline patient characteristics and activation levels

The sociodemographic characteristics and chronic disease prevalence of the study sample by baseline PAM levels are presented in Table 1. The mean age of the patients was 69 ± 13 years with equal gender distribution. The study patients had a mean number of 2 ± 1 co-existing chronic condition with diabetes (49%), musculoskeletal disorder (43%), and CVD (34%) as the most prevalent of chronic conditions. In addition, more than two-thirds (69%) of patients had private insurance and almost half (49%) of the patients had more than 11 out of a possible 14 program contacts in the 12-month program.

No significant difference was observed between patients who completed and those who withdrew from the 12-month program. In addition, results of the one-way ANOVA and chi-square tests showed no significant differences by PAM levels with exception for age, private health insurance (PHI) status, and some clinical measures.

Furthermore, the internal consistency of baseline and follow-up PAM in this study was good with Cronbach's alpha coefficients of 0.90 and 0.91 respectively.

Primary outcome - change in mean PAM scores

Of the 626 patients who reported their baseline PAM, 420 (67%) reported PAM levels at program completion. Within-group analysis between baseline and follow-up showed significant improvement in mean PAM scores with a mean difference (unadjusted) of 6.8 (95% CI 5.39 to 8.25, p-value < 0.001). After adjusting for potential confounders, the adjusted model (Model 1) showed a significant mean difference of 6.6 (95% CI 5.03 to 8.06, p-value < 0.001). Following the imputation for missing follow-up PAM scores, the adjusted imputed model (Model 2) showed increased mean difference of 8.6 (95% CI 7.52 to 9.71, p-value < 0.001) (Table 2).

Table 2
Repeated measures ANCOVA (main and imputed model)

Variable	**Main model (Model 1) (N = 420)**		**Imputed model (Model 2) (N = 626)**	
	Unadjusted mean difference (95% CI)	**Adjusted mean difference (95% CI)**	**Unadjusted mean difference (95% CI)**	**Adjusted mean difference (95% CI)**
PAM score	6.82 (5.39, 8.25)**	6.55 (5.03, 8.06)**	8.11 (5.40, 10.82)**	7.95 (6.85, 9.04)**
**p-value < 0.001				

Baseline vs follow-up PAM levels

Cross-tabulation between baseline and follow-up showed significant differences in PAM levels with increase for 43% and decrease for 10% of patients (p-value < 0.001) (Table 3). More specifically, patients in the WellNet program reported positive change in the PAM levels by significantly increasing from the order of least activated levels (9.2% from Level 1; 24% from Level 2; and 39.2% from Level 3) to the most activated Level 4 at follow-up (p-value < 0.001) (Table 3).

Table 3
A cross-tabulation table of patient activation levels pre- and post-intervention

Post				
Pre	PAM Level 1 (least activated)	PAM Level 2	PAM Level 3	PAM Level 4 (most activated)
Level 1	14 (18.4)	31 (40.8)	24 (31.6)	7 (9.2)
Level 2	12 (7.8)	63 (40.9)	42 (27.3)	37 (24.0)
Level 3	1 (1.0)	10 (10.3)	48 (49.5)	38 (39.2)
Level 4	0 (0.0)	13 (14.0)	9 (9.7)	71 (76.3)
Data represented as N (%)				

Predictors of change in PAM scores at follow-up

Results of the multivariate regression analyses predicting patient activation levels over 12-month follow-up are presented in Table 4. Age, PHI status, and baseline PAM score were found to be significant predictors in both Models 1 and 2. Increase in patient's age (B = − 0.14, p = 0.043) and uninsured patients (B = − 3.41, p = 0.033) were found to have decreased PAM scores at follow-up. Conversely, increase in baseline PAM score (B = 0.48, p < 0.001) was significantly associated with higher follow-up PAM scores (Table 4). The significant predictors and trends observed in the imputed model (Model 2) were consistent with Model 1.

Table 4
Predictors of patient activation scores at 12-month follow-up (main and imputed model)

Predictors	**Main model (N = 420)**		**Imputed model (N = 626)**	
	B	**p-value**	**B**	**p-value**
Age	-0.14 (-0.28, -0.01)	0.043	-0.13 (-0.23, -0.04)	0.006
Insurance status: Uninsured	-3.41 (-6.50, -0.32)	0.033	-3.27 (-5.40, -1.15)	0.003
Baseline PAM score	0.48 (0.37, 0.59)	< 0.001	0.43 (0.36, 0.51)	< 0.001
B – unstandardized beta coefficient (slope)				

Discussion

This study employs GP data in demonstrating the effectiveness of a 12-month enhanced primary care model in improving the levels of activation and self-management behaviours among patients presenting with one or more chronic conditions in primary care settings across Northern Sydney, Australia. Primary care is well established as the forefront of care delivery in Australia, however research with use of primary care data is low. Moreover, GP practice activity in Australia shows that the management rate of chronic conditions was 55 per 100 encounters and that 96% of encounters among patients aged 65 years and above had one or more chronic conditions [32].

Validation of PAM scores by Hibbard et al and Fowles et al indicate that an increase in PAM score by 4 points is considered clinically meaningful and is associated with improved self-management behaviours [33–35]. The 12-month WellNet intervention resulted in both statistically significant and clinically meaningful improvement in PAM scores with adjusted mean differences in activation score of 6.5 after controlling for potential confounders. There is also evidence showing that each point increase in PAM scores is associated with 2% reduction in hospitalisation and 2% improvement in medication adherence [36]. In the secondary outcome analyses, there was a statistically significant difference observed between baseline and follow-up PAM levels where 43% of study patients experienced transition from a lower PAM level to higher PAM level post-intervention. The effect of PCMH care in improving self-management behaviours in patients is consistent across several other studies [37, 38].

In the multivariate regression analyses, older age, PHI, and baseline PAM scores were significant predictors in both main (non-imputed) and imputed models. Increase in years of age as a significant determinant of reduced activation is consistent with findings of studies by Blakemore et al and Overbeek et al [39, 40]. It is reported that older adults have limited self-management skills as a result of having greater number of chronic conditions which are often associated with poor quality of life, reduced functional status and increased disabilities [39, 41].

Consistent with the above study findings, WellNet group observed a higher mean number of co-existing chronic conditions among patients who were over the median age of 70 years compared to those who were less than or equal to 70 years.

PHI status was a strong predictor of change in activation levels where uninsured patients were associated with significantly lower activation compared to privately insured patients. This may be due the reason that patients with PHI coverage may have better access to healthcare in terms of choice of providers and shorter waiting times for treatment compared to those without PHI [42, 43]. Furthermore, this study is also consistent with findings of studies by Chubak and Rijken et al which have shown that patients who were activated at baseline had improved activation scores over time [44, 45].

This study has several strengths and limitations. To our knowledge, The WellNet program is the first of its kind in Australia to study the effectiveness of a PCMH model in improving levels of activation and self-management among patients with multimorbidity using GP data. In addition, the program strengths include large sample size, comprehensive data collection by trained healthcare professionals, and longitudinal measurement rendering determining predictors of change in PAM scores. In terms of study limitations, whilst the WellNet study included a well-matched comparison group based on age, gender, type and number of chronic conditions, the PAM scores were recorded only among the treatment group and therefore limiting analyses to within-group rather than between-group comparison with standard primary care (comparison group). In addition, some key socio-demographic and socio-economic variables were unavailable for assessment reducing the ability to identify other predictors of change in patient activation.

Conclusion

Patient activation is an important precursor not only for effective self-management of chronic comorbidity but also to empower patients in actively making decisions concerning their health. The integration of GPs and trained CDM coordinators is important to provide individualised care for patients presenting with multiple chronic conditions. This study demonstrates effectiveness of an enhanced primary care model in improving patient activation and self-management outcomes over 12-months. Patients who participated in the WellNet program achieved both statistically significant and clinically meaningful improvements in PAM scores. Findings of this study emphasises the need to increase support for older and uninsured patients in managing their health and healthcare needs. Future research should seek to evaluate the long-term effects and cost-benefits of increased activation in this cohort. Furthermore, more research is needed to determine disease-specific interactions on patient activation levels. This will render re-designing the level of care to where it is most needed.

Abbreviations

ANOVA
Analysis of variance
CC
Clinical coordinator
CDM
Chronic disease management
CI

Confidence interval
CVD
Cardiovascular disease
FCS
Fully conditional specification
GLM
General linear models
GP
General practitioner
MCMC
Markov Chain Monte Carlo
MDT
Multidisciplinary team
NHS
National Health Survey
PAM
Patient Activation Measure
PCMH
Patient Centred Medical Home
PHI
Private health insurance
SCS
Sonic Clinical Services
SD
Standard Deviation
SPSS
Statistical Package for the Social Sciences

Declarations

Ethics approval and consent to participate

The study was reviewed by the Western Sydney University Human Research Ethics Committee (REDI Reference: H12215). Written informed consent was obtained from the study participants.

Consent for publication

Not applicable

Availability of data and materials

Data contained in the WellNet cohort will not be made available to the general public.

Competing interest

JRJ and KT have no competing interests. AJ is employed by SCS as the Operational Manager Integrated Care and is responsible for the implementation of WellNet. However, SCS and WellNet partners had no control or influence over the decision to submit the final manuscript for publication.

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Authors' contributions

JRJ, KT, and AJ contributed to data acquisition, data analysis, and reporting of the findings. JRJ, KT, and AJ were involved in drafting and critical revision of the manuscript. All authors read and approved the final version of the manuscript.

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Figures

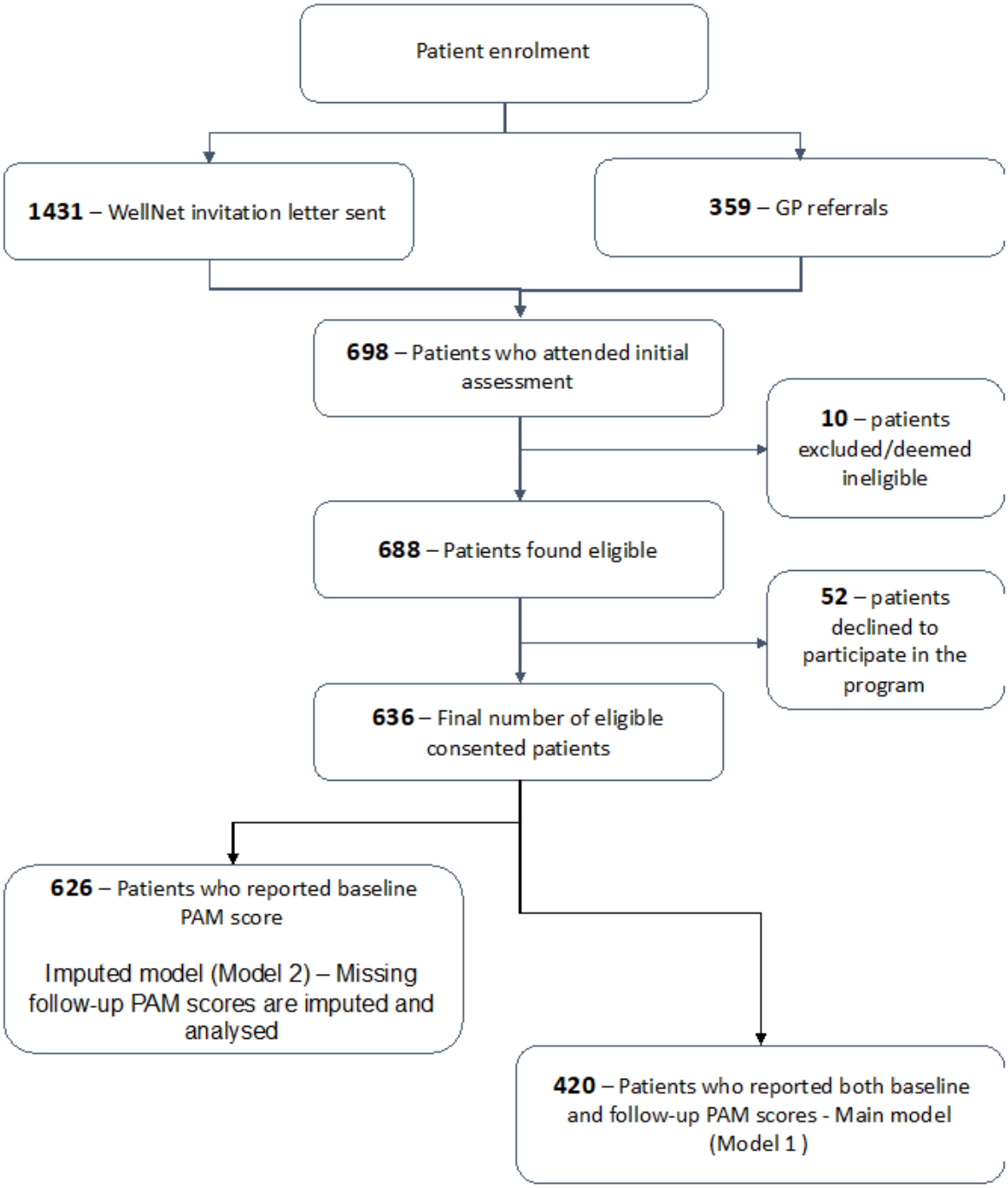

Figure 1

Flowchart of patient enrolment