



Pharmacists views on participating in New Zealand's community pharmacy anticoagulation management service: a mixed-methods study

Kebede Beyene¹ · Amy Hai Yan Chan¹ · Emma Barton¹ · Shuyue Yan¹ · Sheryl Singh¹ · Apoorva Basani¹ · Johnny Voong¹ · Jeff Harrison¹

Received: 6 February 2020 / Accepted: 5 September 2020 / Published online: 13 September 2020
© Springer Nature Switzerland AG 2020

Abstract

Background Optimal anticoagulation management is key for improving outcomes. The Community Pharmacy Anticoagulation Management Service (CPAMS) has beneficial effects on anticoagulant management. However, limited research exists on pharmacists' views of CPAMS provision, particularly the perspectives of pharmacists who do not provide CPAMS. **Objectives** To explore the experience and attitudes of pharmacists who do and do not provide CPAMS, and to identify factors that may influence further uptake of CPAMS. **Setting** CPAMS providing and non-providing pharmacies throughout New Zealand. **Methods** A mixed-methods study design was employed. Separate online surveys were conducted with CPAMS providers (N=35) and non-providers (N=73) to explore their views on the service. Twelve interviews were conducted with purposively selected participants, equally distributed between CPAMS providers and non-providers, to gain further insight into the issues surrounding CPAMS provision. Quantitative data were analysed using student's *t*-test and Mann Whitney *U*-test, and thematic analysis was used for qualitative data. **Main outcome measure** Experiences of and attitudes towards CPAMS. **Results** Our survey findings demonstrated that community pharmacists have high self-efficacy and motivation to providing CPAMS, and CPAMS had increased job satisfaction amongst providers. The overwhelming majority of CPAMS providers' survey participants believed that CPAMS improves the pharmacist–patient relationship, allowing them to assist patients with other aspects of their healthcare. Most non-provider survey participants also believed that their patients would benefit from CPAMS. The two most frequently reported barriers by non-providers survey participants were remuneration and staffing of pharmacists. The interview findings fell within five overarching themes: self-efficacy, CPAMS benefits to patients, barriers to providing CPAMS, the impact of CPAMS on pharmacist–patient and pharmacist–general practitioner relationships. Overall, the current funding model, the capping on the number of enrolled patients, and staffing were the main factors perceived by interview participants preventing the further uptake and implementation of CPAMS. CPAMS non-providers are willing to provide CPAMS; the main factor preventing this is availability of contracts. **Conclusions** Overall, pharmacists have favourable experiences of and attitudes towards CPAMS and strongly supported its wider implementation. Promoting the benefits and addressing the barriers highlighted in this study may lead to wider implementation of CPAMS.

Keywords Anticoagulation management · Community pharmacy · New Zealand · Pharmacy services · Warfarin

Impacts on Practice

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s11096-020-01148-4>) contains supplementary material, which is available to authorized users.

✉ Kebede Beyene
k.beyene@auckland.ac.nz

¹ The School of Pharmacy, Faculty of Medical and Health Sciences, The University of Auckland, Private Bag 92019, Auckland 1142, New Zealand

- The community pharmacy anticoagulation management service extended the role of community pharmacists in patient care and improved their relationships with patients and general practitioners.
- Community pharmacists have high self-efficacy and motivation to providing the community pharmacy anti-

coagulation management service, and the service had increased job satisfaction amongst providers.

- There is a demand for further implementation of the community pharmacy anticoagulation management service, but the provision of contracts by District Health Boards appear not to be meeting demand.

Background

Warfarin is an oral anticoagulant important for the prevention and treatment of a range of thromboembolic conditions [1]. Warfarin has a narrow therapeutic index and its serum concentration is affected by a range of inter- and intra-individual variations [2]. Therefore, patients on warfarin require careful monitoring of the International Normalised Ratio (INR) [3]. Several different models of care have been developed for the management of patients treated with warfarin [4–7]. In New Zealand (NZ), warfarin has typically been managed by general practitioners (GPs) [8]. Patients attend their local blood collection centre or medical practice for a venous blood sample to be taken, which is then sent to a centralised laboratory for testing of the INR value. The result is later sent to the general practice and reviewed by the GP. Any dose adjustments required would then be communicated to the patient via telephone, usually by a nurse. Due to involvement of multiple parties, this model of care is somewhat fragmented. It is prone to causing delays in treatment and potential errors, resulting in sub-optimal anticoagulation control [8, 9]. Additionally, this model of care puts a considerable burden on both patients and healthcare providers, especially since treatment can be lifelong once initiated [8].

Whilst there is extensive, high-quality evidence suggesting that pharmacist-led warfarin management achieves greater patient-reported [10, 11], clinical [3, 12–14], and economic outcomes [15, 16], this model of care is most commonly based in secondary care facilities where accessibility and convenience for patients in the community may be less than ideal. To improve access and operational capacity, a community pharmacist-led model of care has been implemented in some countries, including the United Kingdom (UK) [17], Australia [18], and NZ [19]. The Community Pharmacy Anticoagulation Management Service (CPAMS), was first piloted in NZ at 15 community pharmacies between November 2010 and July 2011 [8, 19]. In the CPAMS model, community pharmacists provide point-of-care INR testing (with the device Coaguchek XS Plus or Pro) and adjust warfarin doses as needed using a decision support system INR Online (<https://www.inronline.net>). Pharmacists provide the service in collaboration with the patient's family doctor, and the doctor takes overall responsibility for the patient's management and could intervene at any time. The results of

the pilot study showed that CPAMS achieved greater anticoagulation control than GP-led warfarin management [19]. Additionally, CPAMS was highly valued by most patients, with the more streamlined process reducing potential delays in treatment, and miscommunication about warfarin dosing [8]. Pharmacists also reported high levels of satisfaction, as their clinical knowledge was better utilised [8]. GPs and practice nurses believed that the service saved their time and provided greater convenience for patients. District health boards (DHBs) are responsible for funding of CPAMS [8].

Over the 5-year period since the pilot study, there has been no data on pharmacists' perspectives and attitudes towards CPAMS. Furthermore, although CPAMS has shown to be better than the standard care [8, 19], out of 37,000 patients on warfarin treatment, only 7500 patients were enrolled in CPAMS as of December 2018 [20]. This raises the question of what the potential barriers are to the further implementation of CPAMS. One limitation of the NZ pilot study was that it did not investigate the opinions of pharmacists who do not provide CPAMS, thus, their views on CPAMS remains unknown.

CPAMS could offer alternatives to traditional laboratory-based INR testing, with the potential to maintain or improve patient convenience, satisfaction and health outcomes whilst saving time and costs [8, 19]. However, despite its availability and potential to improve patient care, CPAMS has not been widely implemented in NZ. Exploring why this is the case requires a clearer understanding of the experiences and attitudes of CPAMS providers and non-providers towards offering this service, including any concerns they may have. The purpose of this study was therefore to explore the experiences and attitudes of CPAMS providers and non-providers towards the service, and to identify the barriers to and facilitators of CPAMS provision in NZ. We anticipate that CPAMS providers and non-providers will have mixed and overlapping opinions about CPAMS. Thus, exploring the perspectives of both groups will provide a broader insight into the clinical, operational, and financial barriers to, and facilitators of, CPAMS service provision. The findings will inform strategies to improve uptake and widen the implementation of CPAMS, which can significantly increase the coverage and associated benefits of CPAMS.

Aims of the study

The aim of this mixed-methods study was to explore the views of community pharmacists that provide and do not provide CPAMS in order to (1) identify the factors influencing the uptake and wider implementation of CPAMS; (2) explore pharmacists' views and attitudes towards CPAMS; and (3) determine how pharmacists' perspectives on CPAMS have changed between the original pilot study and now.

Ethics approval

The study received ethics approval from the University of Auckland Human Participants Ethics Committee (Ref. No: 020856).

Methods

Study design

A mixed-methods study design was employed, using both quantitative and qualitative methods. The study was conducted from 22 August to 30 September 2018. The views of pharmacists on CPAMS and factors affecting its uptake are less likely to be fully understood if either a qualitative or a quantitative approach is used alone. Therefore, both qualitative and quantitative data were collected using a “sequential explanatory” mixed-methods approach [21]. We began by collecting and analysing quantitative data. Then, interviews were conducted with CPAMS providing and non-providing pharmacists.

Phase I: quantitative study

We performed a cross-sectional online survey to assess the attitudes of community pharmacists towards CPAMS. Survey questions were adapted from existing literature on pharmacists views on warfarin management services [8], and supplemented by questions specifically developed to capture issues not investigated before, such as factors affecting uptake of CPAMS. The questionnaires for both groups of participants included a series of 5-point Likert items, with higher scores indicating stronger agreement, assessing pharmacists' competence in providing CPAMS, impact of CPAMS on pharmacist–patient and pharmacist–GPs relationships, and the potential benefits of CPAMS. Additionally, questions on barriers and enablers of CPAMS and sociodemographic characteristics were included. Separate surveys were developed for CPAMS providers and non-providers (see Annex 1 and 2). To ensure content and face validity, the draft surveys were piloted on 15 individuals known to the research team that resembled participants, such as final year pharmacy students. Based on feedback from pilot testing, the questionnaire was refined to be more user-friendly, by simplifying its language. The surveys were then hosted on the Qualtrics survey platform (Qualtrics, Provo, UT).

As all CPAMS providing (N = 164) and non-providing pharmacies were invited to participate, a sample size calculation was not undertaken. CPAMS non-providers were

identified through the Healthpoint website (<https://www.healthpoint.co.nz/pharmacy/>), which has a complete list of pharmacies in NZ. The list of providers was obtained from the Central TAS Website (TAS is an organisation that provides management services to a number of health sector organisations in NZ) [20]. An email with the link to the survey and a participant information sheet was sent to pharmacies who consented to participate. A follow-up reminder email was sent out to all participants two weeks after the initial email to increase response rate. To avoid redundancy, only one person from each participating pharmacy asked to complete the survey.

SPSS v25.0 (SPSS, Inc., Chicago, IL, USA) was used for data analysis. Descriptive statistics used to summarise the data. In both CPAMS provider and non-provider surveys, the Likert items were grouped into main categories based on the research team consensus, and composite mean scores were created for each category. As the sample size was small, factor analysis could not be applied for Likert items grouping. Overall, items assessing CPAMS providers and non-providers' attitudes were grouped into three and four categories, respectively. Cronbach's alpha test was used to assess the internal consistency of the individual variables used to form each composite score, and composite scores that displayed an $\alpha \geq 0.7$ were considered to have adequate internal consistency. The Shapiro–Wilk test was used to assess whether each mean composite score was normally distributed. The independent sample *t*-test and Mann Whitney *U*-test were used to assess statistically significant differences between groups for mean composite scores, as appropriate. Two-sided *p* value < 0.05 was considered significant.

Phase II: qualitative study

All pharmacists who responded to the survey were invited to take part in a follow-up telephone interview. The interview participants were purposively sampled to represent different practice settings. All interview participants were provided with study information sheets, and informed written consent was obtained from all participants. The interviews lasted approximately 30 min and included questions about pharmacists' experiences of, and attitudes towards CPAMS, and the barriers and enablers to the uptake and further implementation of CPAMS. Separate interview guides were used for CPAMS providers and non-providers (see Annex 3). The interviews were carried out by five authors (EB, AB, SS, JV and SY) in September 2018.

All interviews were audio recorded and transcribed verbatim. Data analysis was supported by NVivo 11 software. Data were analysed following thematic analysis procedures described by Braun and Clarke [22]. To enhance reliability of the findings, five members of the research team (EB, AB, SS, JV and SY) concurrently analysed all the transcripts

adding descriptive codes. Any discrepancies in coding were resolved through discussion until a consensus was reached. Overall, the analysis process involved familiarisation with the data; coding; identification of themes and subthemes that were relevant to the aim of the study; reviewing themes; and defining and naming themes. Themes and subthemes were finalised following iterative team discussions.

Different measures were taken to ensure the rigour and trustworthiness of the qualitative study. The accuracy of transcripts was ascertained; post interview notes were written; and detailed codebooks were developed. The research team met once a week throughout the project lifespan to discuss emergent findings. We also included outlying data or negative cases. To ensure transferability of the findings ‘thick description’ of the research process was provided. To counter the risk that participants’ quotes were interpreted differently from how they were intended, two of the senior research team members (KB and JH) verified the themes and interpretations. We are interested in the potential for CPAMS to positively impact anticoagulation monitoring, and it is possible that we hold underlying positive attitudes towards the implementation of CPAMS. However, we were careful to identify negative as well as positive attitudes towards CPAMS, and we have reported these thoroughly.

Results

Phase I: quantitative study findings

CPAMS providers survey

A total of 133 CPAMS providers were invited to take part in the survey. Of these, 35 completed the survey between 22 August and 11 September 2018, providing a response rate of 26.3%. Survey participants were mostly male ($n = 19$, 54.3%), self-identified their ethnicity as NZ European ($n = 27$, 77.1%), ≥ 45 years of age ($n = 18$, 51.4%), practicing in the North Island ($n = 22$, 62.9%), and practicing pharmacy for more than 10 years ($n = 82.9\%$). Ten pharmacies had patients on the waiting list to be enrolled in CPAMS, and 5 pharmacies reported having patients who pay privately to access CPAMS (see Table 1).

The distribution of participants’ responses for the Likert items assessing attitudes towards CPAMS are presented in Table 2. Overall, participants had favourable attitudes towards CPAMS, where the mean scores for 15 out of 18 items were above 4.0 out of the possible maximum score of 5.0. The highest mean value (4.91 ± 0.28) was observed for the following three items: “Pharmacists are in a good position to effectively manage warfarin in patients”; “CPAMS saves time for patients taking warfarin”; and “Providing CPAMS has strengthened my relationship with patients.”

The mean composite scores for all three categories were also above 4.0. Males rated the impact of CPAMS on GP–pharmacist relationship higher than females (mean: 4.32 ± 0.61 vs. 3.73 ± 0.60 , $p = 0.008$). No other statistically significant differences were found in between group comparisons of composite mean scores (see Annex 4).

CPAMS non-providers survey

Of 661 CPAMS non-providing pharmacies in NZ, 649 were invited to participate in the survey. Of these, 73 completed the survey between 20 August and 11 September 2018, providing a response rate of 11.2%. More participants were male ($n = 42$, 57.4%), NZ European ($n = 41$, 56.2%), < 45 years of age ($n = 37$, 50.7%), practicing in North Island ($n = 55$, 75.3%), and practicing pharmacy for over 10 years ($n = 48$, 65.7%) (see Table 1).

Consistent with CPAMS providers, the participants had generally favourable attitudes towards CPAMS, with the mean scores for two-thirds of all Likert items rating above 4.0. The highest mean value (4.74 ± 0.44) was observed for the item “With appropriate training, community pharmacists can adequately manage warfarin therapy.” The mean composite scores for all four themes were above 3.4 (see Table 3). In group comparisons of mean composite scores, there were no significant statistical differences between groups (see Annex 5).

All CPAMS non-providers were asked about the potential enablers and barriers to providing CPAMS. The two most frequently reported barriers were profitability ($n = 31$, 43.7%) and staffing of pharmacists ($n = 25$, 35.2%). Other barriers included lack of support from GP, the layout and location of the pharmacy, lack of demand for the service, and capping of CPAMS pharmacies. With regards to enablers, over two thirds ($n = 53$, 72.6%) of participants reported that they would be motivated to provide CPAMS if it were to be reflected in an increased remuneration. Other potential motivators that were specified by participants included less GP-resistance, the ability to dedicate time outside the existing workload, and the availability of a CPAMS contract from their DHB (see Table 4).

Phase II: qualitative study findings

A total of 15 CPAMS providers and 23 non-providers agreed to participate in the qualitative interviews. Six from each group were interviewed over the phone. Eight participants were from Auckland (most populous city in NZ), the remaining participants were from provincial areas in the North Island representing service providers outside main cities in NZ. Five key themes were identified from the interviews. Illustrative quotes for each theme are presented in Table 5.

Table 1 Characteristics of CPAMS and non-CPAMS pharmacy survey participants

	CPAMS pharmacies (N = 35)		Non-CPAMS pharmacies (N = 73)	
	Frequency	Percent	Frequency	Percent
Sex				
Male	19	54.3	42	57.5
Female	16	45.7	31	42.5
Ethnicity				
NZ European	27	77.1	41	56.2
Māori	1	2.9	2	2.7
Chinese	2	5.7	10	13.7
Indian	1	2.9	7	9.6
Other	3	8.6	13	17.8
Missing	1	2.9	–	–
Age in years				
25–34 years	6	17.1	19	26
35–44 years	11	31.4	18	24.7
45–54 years	10	28.6	25	34.2
55–64 years	8	22.9	11	15.1
Pharmacy location				
North Island	22	62.9	55	75.3
South Island	13	37.1	18	24.7
Years since registration				
≤ 10 years	5	14.3	17	23.3
> 10 years	29	82.9	48	65.7
Missing	1	2.9	8	11.0
Do you have patients on a waiting list for CPAMS?				
Yes	10	28.6	–	–
No	25	71.4	–	–
Do you have patients who are paying privately for CPAMS?				
Yes	5	14.3	–	–
No	30	85.7	–	–
How many patients do you provide CPAMS for? mean (SD) = 60.2(32.49); range: 12–157				
	–	–		

Self-efficacy

Most interview participants believed that their expertise on medicines makes them well placed to provide CPAMS (Quote 1). However, one participant expressed concerns over a lack of information sharing between different health providers, which could affect warfarin dosing. Participants who did not provide CPAMS stated that they had a good enough understanding of warfarin and reported that they were willing to up-skill, to provide CPAMS, but some had concerns surrounding the regulation of service provision within community pharmacies (Quote 2). They emphasised the need for a body that overlook the service provision and the importance of on-going quality assurance in addition to the initial CPAMS providers training and accreditation process.

Impact of CPAMS on pharmacist–patient relationship

Both groups of participants believed that CPAMS provides an opportunity to build rapport with patients, largely due to the nature of a sit-down consult and spending additional one-on-one time with the patient (Quote 3). CPAMS providing pharmacists have noted that patients had become more aware of the role of a pharmacist, and their capacity to contribute to the management of their health conditions (Quote 4).

Impact of CPAMS on the GP–pharmacist relationship

Apart from improving their relationship with patients, CPAMS providers reported that CPAMS has changed some GPs attitudes towards the pharmacy profession. Participants stated that GPs located near their pharmacy believe that

Table 2 Mean and percentage distribution of CPAMS providing pharmacists' scores on items assessing attitudes towards CPAMS (N = 35)

Likert Items ^a	Mean ± SD [#]	SD	D	N	A (%)	SA (%)
Self-efficacy and confidence in INR online results [composite mean score ± SD = 4.47 ± 0.33; alpha = 0.62]						
I find it easy to obtain a blood sample from the patient's finger	4.51 ± 0.51	0	0	0	48.6	51.4
I am confident that the INR results from point of care testing are reliable	4.74 ± 0.44	0	0	0	25.7	74.3
I find it easy to use INR online	4.09 ± 0.78	0	5.7%	8.6%	57.1	28.6
The dosing recommendations obtained from INR online are clinically appropriate	3.74 ± 0.78	0	11.4%	11.4%	68.6	8.6
Pharmacists are in a good position to effectively manage warfarin in patients	4.91 ± 0.28	0	0	0	8.6	91.4
I am confident in managing my patients' warfarin treatment	4.80 ± 0.41	0	0	0	20.0	80.0
I find it difficult to make time for CPAMS because of the other demands of my work ^{bc}	1.94 ± 0.99	37.1%	42.9%	11.4%	5.7	2.9
Re-certification for pharmacists to be accredited to provide CPAMS every 2 years is unnecessary ^{bc}	3.60 ± 1.29	8.6%	14.3%	14.3%	34.3	28.6
The impact and benefits of CPAMS for patients [composite mean score ± SD = 4.80 ± 0.26; alpha = 0.66]						
By providing CPAMS, I have been able to help patients taking warfarin with other aspects of their health	4.66 ± 0.54	0	0	2.9%	28.6	68.6
Providing CPAMS increases my job satisfaction	4.74 ± 0.51	0	0	2.9%	20.0	77.1
CPAMS saves time for patients taking warfarin	4.91 ± 0.28	0	0	0	8.6	91.4
CPAMS improves warfarin adherence for patients who are enrolled	4.71 ± 0.52	0	0	2.9%	22.9	74.3
Patients in my pharmacy benefit from CPAMS	4.86 ± 0.36	0	0	0	14.3	85.7
Providing CPAMS has strengthened my relationship with patients	4.91 ± 0.28	0	0	0	8.6	91.4
I think that CPAMS should be more widely available to patients taking warfarin throughout New Zealand ^c	4.46 ± 0.95	2.9%	2.9%	5.7%	22.9	65.7
Impact on the pharmacist–GP relationship [composite mean score ± SD = 4.05 ± 0.67; alpha = 0.80]						
Providing CPAMS has improved the Pharmacist–GP relationship	4.03 ± 0.79	0	2.9%	20.0%	48.6	28.6
GPs are supportive of pharmacists providing CPAMS	3.91 ± 0.89	2.9%	2.9%	17.1%	54.3	22.9
GPs are confident with the pharmacist's ability to provide CPAMS	4.20 ± 0.68	0	0	14.3%	51.4	34.3

SD strongly disagree, D disagree, N neither agree nor disagree, A agree, SA strongly agree, SD[#] standard deviation

^aResponses for each item were presented on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree)

^bItem was reverse-scored for composite mean score calculation; composite mean score = mean (xi, xii, xiii, ...)

^cItem was excluded from composite mean score calculation due to poor correlation with other items

CPAMS produces better outcomes for patients and wanted to refer their patients to the service (Quote 5). However, it was noted that the GP willingness to refer patients to CPAMS is variable. Some CPAMS providers expressed concern that GPs are protective of their scope of practice and may not be willing to refer patients to CPAMS (Quote 6). It was noted that GP hesitancy to refer patients was more to do with potential loss of revenue for the general practice than lack of confidence in pharmacists' competency.

CPAMS benefits to patients

CPAMS providing pharmacists stated that CPAMS was beneficial for patients, largely due to convenience, reduced cost, accessibility, or fewer issues with obtaining blood (Quote 7). They also noted that CPAMS is less fragmented, commenting on how it reduces the number of health professionals that patients must repeat information to. In addition, both groups of participants commented on how CPAMS provides an opportunity to help patients with other aspects of their health within the same consultation (Quote 8). By and large,

both group of participants suggested CPAMS to be more widely available to patients taking warfarin throughout NZ (Quote 9).

Barriers to providing CPAMS

Funding

Both group of participants noted that the current funding model is based on the number of patients enrolled at each pharmacy per month, rather than the number of consults that patients require. As noted by CPAMS providers, stabilised patients do not require as many consults, but complicated patients, who may be initiated on a medication that interacts with warfarin, require additional consults. This incurs the costs of the equipment and pharmacist's time. This is unpredictable and is not incorporated into the current funding model. Participants also reported how the current funding model impacts the financial viability of CPAMS for their pharmacy (Quote 10). One CPAMS non-provider suggested

Table 3 Mean and percentage distribution of non-CPAMS pharmacists' scores on items assessing attitudes towards CPAMS (N=73)

Likert items ^a	Mean ± SD [#]	SD (%)	D (%)	N (%)	A (%)	SA (%)
Self-efficacy of non-CPAMS providing pharmacists [composite mean score ± SD = 4.40 ± 0.55; alpha = 0.86]						
I am aware of the CPAMS that pharmacists can provide	4.60 ± 0.60	0	1.4	1.4	32.9	64.4
With appropriate training, community pharmacists can adequately manage warfarin therapy	4.74 ± 0.44	0	0	0	26.0	74.0
I would be confident in providing CPAMS	4.45 ± 0.69	0	0	11.0	32.9	56.2
I would be comfortable taking patients blood	4.44 ± 0.80	0	4.1	6.8	30.1	58.9
Pharmacists are in a good position to safely provide CPAMS	4.53 ± 0.63	0	1.4	2.7	37.0	58.9
I feel that providing CPAMS is out of a pharmacists scope of practice ^b	1.66 ± 0.89	53.4	35.6	2.7	8.2	0
I would be uncomfortable providing CPAMS if I held responsibility if something were to go wrong ^b	2.3 ± 1.06	26.0	34.2	26.0	11.0	2.7
Impact of CPAMS on the pharmacist–patient relationships [composite mean score ± SD = 4.24 ± 0.69; alpha = 0.93]						
Providing CPAMS would strengthen my relationship with patients	4.32 ± 0.64	0	1.4	5.5	53.4	39.7
CPAMS increases warfarin adherence for patients who are enrolled	4.14 ± 0.81	0	2.7	17.8	42.5	37.0
Providing CPAMS would save time for patients taking warfarin	4.26 ± 0.76	1.4	0	11.0	46.6	41.1
Patients in my pharmacy would benefit from CPAMS	4.19 ± 0.86	1.4	2.7	12.3	42.5	41.1
I think that CPAMS should be more widely available to patients taking warfarin throughout New Zealand	4.30 ± 0.79	1.4	0	12.3	39.7	46.6
Practicality of and interest in providing CPAMS [composite mean score ± SD = 3.66 ± 0.86; alpha = 0.62]						
There is enough funding for CPAMS at present ^c	2.11 ± 0.92	32.9	27.4	35.6	4.1	0
It would be difficult to make time for CPAMS because of the other demands of my work ^b	2.84 ± 1.16	11.0	34.2	23.3	23.3	8.2
I am interested in becoming accredited to provide CPAMS in the future	4.16 ± 0.83	0	4.1	15.1	41.1	39.7
Pharmacists' perception on GP support [composite mean score ± SD = 3.47 ± 0.80; alpha = 0.68]						
General practitioners would be supportive of me providing CPAMS	3.55 ± 1.11	4.1	13.7	27.4	32.9	21.9
General practitioners are not confident with the pharmacist's ability to provide CPAMS ^b	2.59 ± 1.03	15.1	31.5	37.0	12.3	4.1
General practitioners would have more respect for me as a pharmacist if I provided CPAMS	3.44 ± 0.93	1.4	8.2	53.4	19.2	17.8

SD strongly disagree, D disagree, N neither agree nor disagree, A agree, SA strongly agree, SD[#] standard deviation

^aResponses for each item were presented on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree)

^bItem was reverse-scored for mean score calculation; composite mean score = mean (xi, xii, xiii, xiv, ...)

^cItem was excluded from composite mean score calculation due to poor correlation with other items

that a minimum of 60 patients are needed for the service to be financially viable for a pharmacy.

Capping

The capping on the number of patients enrolled in CPAMS per pharmacy was a common concern among the pharmacists interviewed, as this resulted in patients having to pay privately (Quote 11). Additionally, the non-CPAMS pharmacists commented on how despite the high demand for CPAMS in their pharmacy; the cap on the number of CPAMS pharmacies in particular areas is the major reason why they could not get a contract to deliver CPAMS from DHBs (Quote 12). A pharmacist working in a remote community pharmacy commented that despite the aforementioned capping of CPAMS

pharmacies, there were areas of NZ that have CPAMS pharmacies located in close proximity to each other (Quote 13).

Meeting other service demands

When asked whether time constraints made providing CPAMS difficult, most CPAMS providers stated that it was not an issue. One stated that they are able to meet other service demands if they are appropriately staffed. However, both groups of participants believed that providing CPAMS would not be viable for every pharmacy (Quote 14).

Table 4 Barriers and enables of CPAMS (N=73)

It would be difficult for the pharmacy I work in to provide CPAMS because	N	%	I would be motivated to become accredited to provide CPAMS if	N	%
It would not be profitable for the pharmacy	31	43.7	My remuneration were to increase as a result	53	72.6
There are not enough pharmacists employed to provide additional services on top of the daily workload of the pharmacy	25	35.2	I were able to dedicate time to providing the service	37	50.7
The layout of the pharmacy does not support the provision of CPAMS	17	23.9	I could get a funding contract to be able to provide the service	11	15.1
A pharmacy nearby provides CPAMS	13	18.3	Local GP would be more understanding and supportive of the service	5	6.8
No funding from DHB	10	14.1	Other	15	20.5
The pharmacy is too busy to provide CPAMS	9	12.7	Total	121	165.8
A general practice nearby provides INR Point-of-Care-Testing	6	8.5			
Lack of support from local general practice	5	7.0			
Other	6	8.5			
Total	122	171.8			

Participants could choose more than one option, so percentages exceed 100%

Data missing in two cases. Two participants did not answer question related to barriers for CPAMS

Discussion

This study is one of the first to explore pharmacists' views on CPAMS and factors affecting its uptake and further implementation in NZ. There have been very few studies that have studied pharmacists' views on CPAMS and included both the views of pharmacists who have and have not provided CPAMS. In line with previous research [19, 23], our findings demonstrated that community pharmacists have high self-efficacy and motivation to providing CPAMS. This could be due to pharmacists' belief that they are highly accessible, knowledgeable about warfarin's pharmacology and interactions as well as lifestyle factors which may influence INR levels [8, 23]. Our study found that CPAMS improved pharmacist–patient relationships, and that pharmacists found it rewarding when patients gain a deeper understanding and appreciation of their role. An improved pharmacist–patient relationship can have a positive effect on adherence to warfarin therapy and can ultimately lead to improved health outcomes [23].

The finding that CPAMS allows pharmacists to assist with other aspects of the patient's health is consistent with Shaw et al.'s study [8]. This is important, because patients taking warfarin are likely to take other medications and be at high risk of drug interactions, which can potentially be life-threatening [24, 25]. Discussing other aspects of the patient's care outside of warfarin management allows pharmacists to provide advice and recommendations. This ensures that their patients are appropriately anticoagulated, despite other products they purchase in the pharmacy or after recent health events.

In contrast with what may be commonly perceived, difficulties with meeting other service demands of the pharmacy was not the major barrier that prevented CPAMS non-providers from providing the service. However, it was expressed that pharmacist time dedicated toward complicated CPAMS patients could become an issue if it interfered with fulfilling other obligations of the pharmacy, such as dispensary services, particularly if this was not reflected in the current funding model.

Our findings indicated that there is a demand for further implementation of CPAMS, but the provision of contracts by DHBs appear not to be meeting demand. The capping of enrolments per pharmacy was perceived as a barrier that may prevent patients from accessing CPAMS. Some patients pay privately, and some pharmacies have patients on a waitlist to be enrolled. This suggests that demand for the service is exceeding provision. The current funding model for CPAMS does not also account for discrepancies in pharmacy expenditure required for complicated patients, such as pharmacist-time and equipment costs. As high-needs or complex patients who are less stable being asked to pay out of pocket or being refused access to the service, this may create disparities for those most in need of close monitoring and individualised management available through CPAMS. Further research is required to develop needs-based geospatial service zones for extended pharmacy services such as CPAMS to ensure equitable access to care.

In general, CPAMS has the potential to influence the health and well-being of a greater number of patients than it is currently being catered to. It may simultaneously reduce the workload associated with warfarin management in

Table 5 Overarching themes and supportive themes (N = 12)

Thematic category	Quote no.	Illustrative quotes
Self-efficacy	1	Pharmacists have a good understanding of the principles of warfarin I guess, and what the complications are in terms of getting the levels right and making sure the INR is in range. (Participant 1, CPAMS non-providing pharmacy, Auckland DHB)
	2	I think, pharmacists have the potential, I'm not going to say that all pharmacists are competent. Why? I think because a lot of training needs to go into place. I think it's not also just training, I think it's also regulation, once you give pharmacist the ability to do something, I feel like there should be an overlooking body to make sure everyone is doing it correctly. That is kind of the current issue with pharmacy at the moment, with all these services, is everyone on the same page? I think that pharmacists have the potential to reach that level. (Participant 4, CPAMS non-providing pharmacy, Auckland DHB)
Impact of CPAMS on pharmacist–patient relationship	3	For the people who you do not know well, through doing the INR, you get to know them very well and build a relationship that way. For people that you do know really well, it enhances the relationship because you are doing something more for them than you were before. (Participant 2, CPAMS providing pharmacy, Auckland DHB)
	4	I think that they now realise probably that pharmacists don't just count tablets and that they have a bit more knowledge than they realise. I think that they find us more valuable and more of a healthcare professional than before. (Participant 5, CPAMS providing pharmacy, Hawke's Bay DHB)
Impact of CPAMS on GP–Pharmacist relationship	5	I also hold regular PA review meetings with the doctors and they are always trying to get all of their patients onto our service, because they feel it's faster... than them managing it... GPs in this area definitely do, and it's because they know it gives their patients better outcomes. (Participant 4, CPAMS providing pharmacy, Waikato DHB)
	6	I think there are a lot of GPs out there that are very much protective their patch. They don't see the need for pharmacists to do it. There are a lot of GPs that think the pharmacists are capable. A lot of it comes down to who they've had a relationship with. (Participant 2, CPAMS providing pharmacy, Auckland DHB)
CPAMS benefits to patients	7	I mean they like the fact that they can rock up any time they want, and they don't have to make an appointment, and they don't have to sit in a waiting room with sick people, and we only take a little bit of blood. (Participant 1, CPAMS providing pharmacy, Auckland DHB)
	8	I think we are also well placed to deal with other things that might influence their therapy. In other words, other medicines or over the counter medicines. Other choices they are making and help with that factor as well. (Participant 1, CPAMS non-providing pharmacy, Auckland DHB)
	9	This is a fantastic service for customers, and it would be lovely if we could offer it to more. (Participant 3, CPAMS providing pharmacy, Auckland DHB)
Barriers to providing CPAMS	10	Sub-theme: Funding It's too expensive to run for pharmacies if you've got somebody coming in every week and unstable. It's the cost part of it. If we were covered for that, then we'll be quite okay. (Participant 5, CPAMS providing pharmacy, Hawke's Bay DHB)
	11	Subtheme: Capping The cap of number of patients we have is a little bit frustrating. There is not really a downside at all to allowing more patients in. (Participant 3, CPAMS providing pharmacy, Auckland DHB)
	12	The way that it works is that the DHB will only hand out an X number of contracts to pharmacies to do it. Currently, that limit has been reached, so it doesn't matter, if you have patients, or you hand an application to get approved, so we are now on a waiting list. One pharmacy has to surrender a contract and they need to be approved. So, it is a funding issue, there are only limited contracts because there is limited funding. (Participant 4, CPAMS non-providing pharmacy, Auckland DHB)

Table 5 (continued)

Thematic category	Quote no.	Illustrative quotes
	13	We have 50 or so patients on warfarin, 30 of which asked whether we provide CPAMS or not, but we don't have a contract...there are four pharmacies that have CPAMS, and they are all within 500 m of one another. (Participant 6, CPAMS non-providing pharmacy, Lakes DHB)
	14	Sub-theme: Meeting other service demands I think that you need to have a decent amount of staff in the pharmacy to be able to do it. I mean, you are taking up a pharmacist's variable amount of time, sometimes it can be quick and easy, but other times sorting things out will take a bit longer. Not every pharmacy can do it. (Participant 1, CPAMS providing pharmacy, Auckland DHB)

general practices for patients who are theoretically stabilised, which previous research has identified is beneficial for GPs and nurses [8]. Thus, the number of contracts the DHBs provide to pharmacies should be increased. However, not all pharmacies who want to provide CPAMS should be given a contract. Instead, the distribution of contracts by DHBs should be based on need-based commissioning, location of the pharmacy, and consideration of factors that impact on the ability of patients to access the service. For example, pharmacies in rural areas, whose patients must travel a considerable distance to access CPAMS, should be prioritised over pharmacies located near other CPAMS providing pharmacies. Additionally, the capping of the number of patients in selected CPAMS pharmacies should be removed, to allow patients on a waiting list to become enrolled. The funding model should also be revised to allow for increased remuneration in exceptional circumstances, covering the cost of additional testing for patients with complex needs. This could be based on the number of visits to the pharmacy in combination with clinical outcome measures, such as the percentage of time a patient's INR is within the target range. This would increase the funding for more complicated patients and decrease funding for stabilised patients thereby mitigating against the risk of over-servicing, whilst ensuring that funding is appropriate and reflects the pharmacy resources and time utilised for each enrolled patient. The model could potentially encourage more pharmacies to consider providing the service and make service delivery more financially viable.

Implications of findings for practice, policy, and research

With the availability of point-of-care testing (POCT), computerised decision support systems, and the expanded scope of practice, pharmacists worldwide can offer convenient anticoagulation management and help patients to improve their disease management. The CPAMS model is relatively easy for pharmacies to implement and scale up and can also serve as a model for other POCT services that could be provided in

pharmacies. In general, CPAMS has the potential to improve the efficiency of primary care system. However, to implement a safe and scalable pharmacy-based anticoagulation management service, close collaboration and partnership between CPAMS providers and other stakeholders (e.g. family doctors) is crucial. Additionally, a clear plan must be in place to select CPAMS providers to ensure easy and equitable access, and there should be reliable IT infrastructure and continuous training and support for CPAMS providers. Finally, there should be sufficient funding to cover the costs associated with the delivery of CPAMS, including the cost of equipment, software licenses, staff and training.

While the CPAMS market is substantial and growing, there has been surprisingly little research into end user perceptions of the barriers to, and facilitators of, CPAMS implementation. This knowledge gap may be preventing more widespread uptake of CPAMS, as the service may not be fully aligned with the expectations of service providers and pharmacy users. As mentioned above, lack of sufficient funding is one of the barriers for wider implementation of CPAMS. Further research is required to ascertain whether funding is an issue within particular DHBs of NZ, and whether they are willing to prioritise funding for the service. It is also essential to define more clearly the different situations and patients in which CPAMS can be beneficial. In addition, cost-effectiveness of CPAMS needs to be further investigated, particularly in the context of managing complicated patients as reported in this study.

Strengths and limitations

This study has some limitations. The survey response rate was low, with a small sample size within each participant group. This limits the generalisability of findings. However, our findings are generally consistent with previous research reports [8, 18]. Only pharmacies who had an email address available online were invited to participate in the study. There was no objective way to determine whether these email addresses were updated. Therefore, it is uncertain whether all pharmacies in NZ received an invitation.

In particular, we expect non-responders to be the ones least engaged, so the views of the CPAMS non-providers may still be skewed towards those who are more motivated. This may explain why most respondents rated CPAMS positively. Another reason for the low response rate could be that some CPAMS non-providers might have no interest to provide the service in the future, so they were less motivated in sharing their opinions. In addition, some pharmacists might be busy at work, and might not have time to complete the questionnaire. The study intended to explore perspectives held at pharmacies, rather than perspectives of individual pharmacists. However, there is no justifiable method to prevent respondents answering the survey and interview questions based on personal opinion. Despite the above limitations, this study is one of the first to explore the views of both providers and non-providers of CPAMS, and adopted a mixed-methods design, with the triangulation of data sources providing richer and more comprehensive information on CPAMS.

Conclusions

In summary, pharmacists have favourable attitudes towards CPAMS. Funding and staffing are the main factor perceived by pharmacists preventing the further uptake and implementation of CPAMS. CPAMS non-providers are willing to provide CPAMS; the main factor preventing this is availability of contracts. The capping of the number of patients enrolled per CPAMS pharmacy may also be preventing the wider uptake of the service by patients. Additionally, pharmacists expressed concern that the current funding model for CPAMS does not account for the variability in pharmacist-time, costs and resources associated with more complicated patients. Research is needed to investigate the concerns raised by pharmacists in this research indicating there may be inequitable access to high quality anticoagulation care delivered via CPAMS. In addition, further research investigating the attitudes of patients, GPs and nurses are required to provide a more comprehensive insight into factors affecting the further implementation of CPAMS in NZ.

Acknowledgements We would like to thank all the study participants.

Funding This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of interest The authors have no conflict of interest to declare.

References

- Holbrook A, Schulman S, Witt DM, Vandvik PO, Fish J, Kovacs MJ, et al. Evidence-based management of anticoagulant therapy: antithrombotic therapy and prevention of thrombosis: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest*. 2012;141(2):e152S–e184S184S.
- Baglin T, Keeling D, Watson H, British Committee for Standards in Haematology. Guidelines on oral anticoagulation (warfarin): third edition-2005 update. *Br J Haematol*. 2006;132:277–85.
- Manzoor BS, Cheng W, Lee JC, Uppuluri EM, Nutescu EA. Quality of pharmacist-managed anticoagulation therapy in long-term ambulatory settings: a systematic review. *Ann Pharmacother*. 2017;51:1122–37.
- Wilson SJ, Wells PS, Kovacs MJ, Lewis GM, Martin J, Burton E, et al. Comparing the quality of oral anticoagulant management by anticoagulation clinics and by family physicians: a randomized controlled trial. *CMAJ*. 2003;169:293–8.
- Witt DM, Sadler MA, Shanahan RL, Mazzoli G, Tillman DJ. Effect of a centralized clinical pharmacy anticoagulation service on the outcomes of anticoagulation therapy. *Chest*. 2005;127:1515–22.
- Chiquette E, Amato MG, Bussey HI. Comparison of an anticoagulation clinic with usual medical care: anticoagulation control, patient outcomes, and health care costs. *Arch Intern Med*. 1998;158:1641–7.
- Chan FW, Wong RS, Lau W, Chan TY, Cheng G, You JH. Management of Chinese patients on warfarin therapy in two models of anticoagulation service—a prospective randomized trial. *Br J Clin Pharmacol*. 2006;62:601–9.
- Shaw J, Harrison J, Harrison J. A community pharmacist-led anticoagulation management service: attitudes towards a new collaborative model of care in New Zealand. *Int J Pharm Pract*. 2014;22:397–406.
- Harper P, Harper J, Hill C. An audit of anticoagulant management to assess anticoagulant control using decision support software. *BMJ Open*. 2014;4(9):e005864-2014-005864.
- Gillani SW, Alsubaihi LI, Zaghoul HA, Ansari IA, Iqbal M, Baig MR. Compare the clinical management of warfarin among physician versus pharmacist-led coagulation clinic: structured systematic review. *Biomed Res*. 2018;29:1327–32.
- Thompson AN, Ragucci KR, Fermo JD, Whitley HP. Evaluation of patient perceptions and outcomes related to anticoagulation point-of-care testing in ambulatory care clinics. *Pharm Pract (Granada)*. 2009;7:213–7.
- Hou K, Yang H, Ye Z, Wang Y, Liu L, Cui X. Effectiveness of pharmacist-led anticoagulation management on clinical outcomes: a systematic review and meta-analysis. *J Pharm Pharm Sci*. 2017;20:378–96.
- Lee T, Davis E, Kielly J. Clinical impact of a pharmacist-led inpatient anticoagulation service: a review of the literature. *Integr Pharm Res Pract*. 2016;5:53–63.
- Elewa H, Jalali F, Khudair N, Hassaballah N, Abdelsamad O, Mohammed S. Evaluation of pharmacist-based compared to doctor-based anticoagulation management in Qatar. *J Eval Clin Pract*. 2016;22:433–8.
- Chang J, Wang C, Kang H, Shen L, Huang C. Cost-effectiveness of the pharmacist-assisted warfarin monitoring program at a Medical Center in Taiwan. *Int J Qual Health C*. 2017;29:817–25.
- Manzoor BS, Bauman J, Shapiro NL, Stamos T, Galanter W, Nutescu EA. Outcomes of systematic anticoagulation management in pharmacist and nurse specialized clinics. *J Am Coll Clin Pharm*. 2018;1:68–73.
- Ingram SJ, Kirkdale CL, Williams S, Hartley E, Wintle S, Sefton V, et al. Moving anticoagulation initiation and monitoring services into the community: evaluation of the Brighton and Hove community pharmacy service. *BMC Health Serv Res*. 2018;18(1):91.
- Jackson S, Peterson G, Bereznicki L, Misan G, Jupe D, Vial J. Improving the outcomes of anticoagulation in rural Australia: an

- evaluation of pharmacist-assisted monitoring of warfarin therapy. *J Clin Pharm Ther.* 2005;30:345–53.
19. Harrison J, Shaw JP, Harrison JE. Anticoagulation management by community pharmacists in New Zealand: an evaluation of a collaborative model in primary care. *Int J Pharm Pract.* 2015;23:173–81.
 20. TAS. Community pharmacy anti-coagulation management services. 2019. <https://tas.health.nz/dhb-programmes-and-contracts/community-pharmacy-programme/services-delivered-under-icpsa/#Community>. Accessed 30 June 2020.
 21. Creswell JW, Clark VLP. Designing and conducting mixed methods research. 2nd ed. Thousand Oaks: SAGE Publications; 2011.
 22. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol.* 2006;3:77–101.
 23. Garton L, Crosby JF. A retrospective assessment comparing pharmacist-managed anticoagulation clinic with physician management using international normalized ratio stability. *J Thromb Thrombolysis.* 2011;32:426–30.
 24. Vitry AI, Roughead EE, Ramsay EN, Preiss AK, Ryan P, Gilbert AL, et al. Major bleeding risk associated with warfarin and co-medications in the elderly population. *Pharmacoepidemiol Drug Saf.* 2011;20:1057–63.
 25. Teklay G, Shiferaw N, Legesse B, Bekele ML. Drug–drug interactions and risk of bleeding among inpatients on warfarin therapy: a prospective observational study. *Thromb J.* 2014;12(1):20.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.