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How do the characteristics of breast cancer diagnostic assessment programmes influence service delivery: A mixed methods study

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Diagnostic assessment programmes (DAPs) coordinate multidisciplinary teamwork (MDT), and improve wait times and patient satisfaction. No research has established optimal DAP design. This study explored how DAP characteristics influence service delivery. A mixed methods case study of four breast cancer DAPs was conducted including qualitative interviews with health-care providers and retrospective chart review. Data were integrated using multiple approaches. Twenty-three providers were interviewed; 411 medical records were reviewed. The number of visits and wait times from referral to diagnosis and consultation were lowest at a one-stop model. DAP characteristics (rural–remote region, human resources, referral volume, organisation of services, adherence to service delivery targets and one-stop model) may influence service delivery (number of visits, wait times). MDT, influenced by other DAP characteristics (co-location of staff, patient navigators, team functioning), may also influence service delivery. While the one-stop model may be ideal, all sites experienced similar and unique challenges. Further research is needed to understand how to optimise the organisation and delivery of DAP services. Measures reflecting individual, team and patient-reported outcomes should be used to assess the effectiveness and impact of DAPs in addition to more traditional measures such as wait times.

KEYWORDS
breast cancer, diagnostic techniques and procedures, interprofessional relations, patient care team, systems integration

1 | INTRODUCTION

Cancer management requires coordinated delivery of services by different professionals, in different settings and at different time points (Brar, Look Hong, & Wright, 2014). Multidisciplinary teamwork (MDT) improves clinical and patient-reported outcomes for cancer by improving treatment decisions, and their implementation and documentation; attendance and professional diversity at joint meetings; role clarity among team members; team effectiveness and staff satisfaction; and guideline-adherent care delivery (Fleissig, Jenkins, Catt, & Fallowfield, 2006; Lamb et al., 2011; Lemieux-Charles & McGuire, 2006). MDT is frequently operationalised through multidisciplinary cancer conferences (MCCs) which improve cancer management and associated outcomes (Hayward et al., 2003; Hong, Wright, Gagliardi, & Paszat, 2010; Taylor, Shewbridge, Harris, & Green, 2013; Wright, De Vito, Langer, & Hunter, 2007). Timely diagnosis of cancer improves access to MCCs, leading to earlier treatment and a potentially better prognosis (Brar et al., 2014). Clinicians whom we surveyed suggested the need to improve MDT earlier in the cancer trajectory given numerous barriers of access to, and coordination of diagnosis (Gagliardi, Wright, Davis, Urbach, & McLeod, 2008). Similar challenges at the interface between primary and oncology specialty care have been reported elsewhere (Kekhlyudov & Latosinsky, 2010; Sussman & Baldwin, 2010). We reviewed 22 studies that evaluated MDT for cancer patients and found that none examined MDT for diagnosis (Gagliardi, Dobrow, & Wright, 2011).

Diagnostic centres or programmes can bridge the primary–specialty care interface and deliver timely, coordinated diagnostic services (Kekhlyudov & Latosinsky, 2010). In our previous research and that of others, diagnostic assessment programmes (DAPs) reduced time from referral to specialist visit and first treatment, and improved patient satisfaction with services and personal care received (Brouwers et al., 2009; Castellanos et al., 2008; Gagliardi, Grunfeld, & Evans, 2004). Recommendations issued in our jurisdiction and elsewhere to guide DAP structure and function were largely consensus based (Brouwers et al., 2009; Wilson et al., 2013). Further comparative research is needed to identify the ideal characteristics of DAPs that promote MDT and enhance the delivery of diagnostic services. This may reveal one or more optimal models for DAP design that could be broadly adopted. As a first step to prepare for future comparative research, the purpose of this study was to explore whether and how DAP characteristics influenced MDT and diagnostic service delivery. This knowledge serves as a baseline assessment of the participating centres, and could provide guidance to others for planning, evaluating or improving DAP services.

2 | METHODS

2.1 | Design

A mixed methods multiple case study was conducted involving four breast cancer diagnostic assessment programmes (DAPs), chosen because they shared the goal of coordinating diagnostic assessment for patients with suspected cancer, but varied by health region and by regional characteristics (urban, rural, remote and size of population served), factors that may have influenced DAP design (Fetters, Curry, & Creswell, 2013; Yin, 1999). A convergent mixed methods approach was used where the priority of qualitative and quantitative methods was equal; qualitative and quantitative data collection and analysis were concurrent; and qualitative and quantitative data were integrated and interpreted following analysis. Findings are reported based on Good Reporting of A Mixed Methods Study (GRAMMS) criteria (O'Cathain, Murphy, & Nicholl, 2008). Ethical review boards at participating sites approved the study.

2.2 | Qualitative analysis of DAP characteristics

A study representative at each site was interviewed to learn about DAP characteristics according to those recommended in our jurisdiction (Brouwers et al., 2009), and the type, sequence and target (goal to be achieved) timing of diagnostic services. They also provided the names and contact information of other DAP staff for additional interviews. Basic qualitative description was employed (Sandelowski, 2000). Rigour was optimised using qualitative research and reporting standards (Barbour, 2001; Clark, 2003). Purposive sampling was used to recruit participants who varied by professional role. Individuals were invited by email, and asked to sign and return a consent form prior to being interviewed. Telephone interviews were conducted by a trained research assistant. Participants were asked to describe examples of MDT, associated outcomes, facilitators and challenges, and recommendations to enhance MDT. Interviews were held from January 29 to October 15, 2013, audio-recorded and transcribed. An initial goal of five individuals from each site (one nurse, one physician, one referring physician, one other health professional and one administrative staff) was set for a minimum of 20 participants. Sampling proceeded to thematic saturation. Themes were identified using constant comparative technique (Auerbach & Silverstein, 2003). ARG, GH and the research assistant independently read transcripts to identify, define and organise themes. Data (quotes labelled by theme) were tabulated by theme and participating site.

2.3 | Quantitative analysis of diagnostic services

Eligible patients were aged 18 and older who were referred to participating DAPs for assessment of suspected primary breast cancer from January 1, 2012 to December 31, 2012. Sampling was based on 2011 referral volumes which varied across sites. From site B, C and D, 80 patients (15% of patients at site with lowest 2011 referral volume) were randomly sampled. From site A, 200 patients were randomly sampled to accommodate another study. From the initial sample of 440, patients were excluded if they were referred for a second opinion (3) or consultation only (1) rather than undergoing diagnostic assessment, had metastasis from another primary cancer (4) or recurrent breast cancer (19), or had no recorded referral date (2), leaving 411 eligible for analysis. Reporting complied with standards for observational studies (von Elm et al., 2008).

A data abstraction form was developed to collect data on the type and timing of diagnostic procedures performed after referral (Hulvat,

Hansen, & Jeruss, 2009; Pruthi et al., 2007). Data included patient demographic characteristics (date of birth, gender); type of procedure that confirmed the diagnostic result (imaging only—one or more of mammography, ultrasound and/or magnetic resonance imaging; biopsy following one or more imaging procedures—fine-needle aspiration, core or open) and results (positive for cancer, negative for cancer, still suspicious requiring follow-up). Recorded dates included: *referral* (date when referral form received by DAP), *confirmatory procedure* (date when confirmatory diagnostic procedure performed), *diagnosis* (date when finding was recorded in patient record) and *consultation* (date of meeting to discuss treatment or follow-up plan).

Four trained abstractors collected data from medical records at participating sites. Dates for all procedures were identified except for two patients (one at site B and one at site C) for whom the date of consultation was not recorded in the medical record. Data were collected between June 2013 and August 2014. Summary statistics were used to assess the proportion of patients whose confirmatory procedure was imaging or biopsy, and median number of DAP visits and wait time in days (plus interquartile range) from referral date to confirmatory procedures, diagnosis and consultation. If referral and confirmatory procedure dates coincided they were counted as one visit. ANOVA was used to compare continuous variables and the Chi-square test to compare proportions by site. The number of visits and wait times were not normally distributed, therefore these measures were compared by site using the Kruskal–Wallis non-parametric test, and we reported the Dunn's adjusted p values based on multiple comparisons between groups. Analyses were performed with IBM SPSS (*version 21*, *SPSS Statistics/IBM Corp*, *Chicago IL*, *USA*).

2.4 | Integration of findings

Data were integrated by translating coded qualitative data into counts (transformation approach); weaving the qualitative findings through the description of quantitative findings (narrative approach); and visually depicting potential associations between qualitative and quantitative findings (joint display) (Fetters et al., 2013). This enabled the assessment of coherence between qualitative and quantitative findings (confirmation, expansion and/or discordance). Integration of the findings was independently assessed by two investigators (ARG, GH) who met to discuss the findings and achieve consensus. This was refined according to review and feedback from participants and the study team.

3 | RESULTS

3.1 | Organisational characteristics

Table 1 compares organisational characteristics across DAPs. Sites were similar in terms of providing a single point of access for regional referrals, maintaining protected scheduling times for patients referred to the DAP and other operational features such as a dedicated steering or oversight committee, protocols or pathways to guide service delivery, and the collection and reporting of performance data. Apart from sampling criteria (health region, urban versus rural/remote, size of population served), sites differed in total volume of patients referred in 2012 (A 836; B 7,773; C 513; D 670), service delivery model (site A offered single-visit diagnosis), days per week of service (site C operated fewer than 5 days per week) and human resources (site A and B featured more full-time human resources compared with C and D). Sites differed in triage criteria, time to schedule first visit from referral, time to first visit, whether an additional visit was needed for biopsy, time to biopsy and whether consultation with patients to discuss the results took place in the DAP or with the referring physician. As a result target time from referral to diagnosis and to consult, and target number of total visits varied across DAPs.

3.2 | Multidisciplinary teamwork

Twenty-three individuals were interviewed (Table 2). Themes related to number and type of MDT examples, facilitators and challenges, and perceived benefits were largely similar across sites (Online Resource 1). Scheduling given staffing shortages was particularly problematic for site D (*rural–remote region*, *staffing*). Unintended consequences and suggestions to enable or enhance MDT were largely expressed by those at site A (*one-stop model*) and B (*large referral volume*).

3.3 | Patient characteristics, procedures and findings

A total of 411 medical records were reviewed (Table 3). The mean age was 56 years, and patients at site D were significantly older. More patients at site D had imaging and fewer had biopsy as the confirmatory procedure ($p < .001$). The number of patients diagnosed with cancer differed across sites, ranging from 1 (1.3%) at site D to 72 (39.3%) at site A ($p < .01$). The site D coordinator confirmed a high rate of "inappropriate referrals" that were found to be negative for cancer based on confirmatory imaging (*organisation of services*).

3.4 | Number of visits

For patients with an image-confirmed diagnosis (206, 50.1%), the median number of visits from referral to diagnosis was similar across all sites (1.0, interquartile range 1.0 to 1.0) (Table 4).

For patients with a biopsy-confirmed diagnosis (205, 49.9%), the median number of visits from referral to diagnosis was highest at site D (2.0, $p < .01$). At site D scheduling had to accommodate radiologists from elsewhere were periodically hired on a weekly basis to compensate for the lack of a local full-time radiologist (*staffing*), and the flight schedules of women who had to fly from remote communities (*rural–remote region*).

The median number of visits from referral to consultation was higher at site B (3.0, $p < .01$) compared with sites A and C. Apart from standard mammography and ultrasound, the 17 patients at site B with a median of 3.0 visits underwent additional procedures (one or more of repeat mammography, repeat ultrasound, MRI, CT of the chest or abdomen, bone scan or biopsy) on one or more visits (*organisation of services*, *service delivery targets*).

TABLE 1 Characteristics of participating DAPs

Characteristics	Participating site			
	A	B	C	D
Regional characteristics				
Health region	Urban	Urban–rural	Urban–rural	Rural–remote
Population	1.2 million	1.2 million	775,000	236,000
DAP launch date	2006	1997	2007	2007
Total patients referred in 2012	836	7,773	513	670
Diagnostic service delivery model				
Scope of care diagnostic only	Yes	Yes	Yes	Yes
Single location	Yes	Yes	Yes	Yes
Single-visit diagnosis	Yes	No	No	No
Patient risk level served	All	All	All	All
Regional access				
Single point of entry	Yes	Yes	Yes	Yes
Accepts referral from all sources	Yes	Yes	Yes	Yes
Operational features				
Days per week	5	5	2 to 3	5
Referral and triage criteria	Yes	Yes	Yes	Yes
Protected booking slots	Yes	Yes	Yes	Yes
Dedicated governance structure	Yes	Yes	Yes	Yes
Guidelines/service framework	Yes	Yes	Yes	Yes
Performance reporting	Yes	Yes	Yes	Yes
Human resources				
Medical director	P	F	P	P
Clinical director	P	P	—	—
Clinical manager	—	F	F	F
Reception/clerical/booking	F	F	P	P
Social worker	P	F	P	P
Other supportive care	F	P	P	P
Patient navigator	F	F	F	F
Nurse practitioner/advanced practice nurse	F	—	—	—
Registered nurse	F	F	P	P
Surgical oncologist	F	F	P	P
Medical oncologist	F	P	P	P
General physician	F	F	—	—
Radiologist	P	F	P	P

(Continues)

TABLE 1 (Continued)

Characteristics	Participating site A	B	C	D
Imaging technologist	P	F	P	P
Pathologist	F	F	P	P
Pathology technologist	F	P	P	P
Plastic surgeon	P	F	P	P
Total full-time staff	10	12	2	2
Target time to diagnosis*	Within 5 to 15 days for all patients	No biopsy—within 2 to 10 days; biopsy—2 to 12 days	No biopsy—within 10 days; biopsy—16 days	No biopsy—within 14 days; biopsy—35 to 49 days
Target time to consult*	Coincides with first visit for all patients	No biopsy—first visit; biopsy—9 to 22 days	No biopsy—within 10 days; biopsy—21 to 26 days	No biopsy—first visit
Target number of total visits*	1 to 2	2 to 3	2 to 3 (2 if consult with referring physician)	2 (all consults with referring physician)

F, full-time; P, part-time; *Target—refers to intended/planned according to goals/internal protocols.

TABLE 2 Interview participants

Professional role	Participating site A	B	C	D	Total
Medical director	—	019 (surgical oncologist)	—	—	1
Clinical director	—	007	—	025	2
Clinical manager	004 (NP) 002 (NP)	034 (RN)	011 (mammography technologist)	—	4
Patient navigator	004 (NP) 002 (NP)	—	012 (RN)	037 (Radiation technologist)	2
Surgical oncologist	006 (plastic surgeon)	017 (surgical oncologist)	—	—	2
NP/APN/RN	—	—	030 (RN)	—	1
Medical Oncologist	—	024	—	—	1
Radiologist	040 035	—	027	—	3
Pathologist	023	—	—	—	1
Referring Primary Care physician	—	—	033	036	2
Social worker	—	016	—	—	1
Administrator or clerk	—	015	—	—	1
General practitioner Oncologist	009	—	—	—	1
Technologist (mammography, ultrasound or MRI)	—	005	—	041	2
Total	7	8	5	4	24

NP, nurse practitioner; APN, advanced practice nurse; RN, registered nurse.

3.5 | Wait times

Table 5 reports wait times from referral to confirmatory procedure, diagnosis and consultation. The median wait time from referral to confirmatory imaging was similar across all sites (15.0 days, interquartile range 8.0–23.0).

The median wait times from referral to confirmatory biopsy (10.0 days, interquartile range 6.0–17.0), referral to biopsy-confirmed

TABLE 3 Patient characteristics, and confirmatory diagnostic procedures and findings

Patient characteristics and diagnostic findings	Participating site n (%)				Total
	A	B	C	D	
Number of patients	183	80	68	80	411
Age group (years)					
23–40	26 (14.2)	10 (12.5)	7 (10.3)	—	43 (10.5)
41–50	45 (24.6)	22 (27.5)	15 (22.1)	—	82 (20.0)
51–60	56 (30.6)	23 (28.8)	16 (23.5)	47 (58.8)[a]	142 (34.5)
61–70	35 (19.1)	14 (17.5)	22 (32.4)	30 (37.5)[a]	101 (24.6)
>71	21 (11.5)	11 (13.8)	8 (11.8)	3 (3.8)	43 (10.5)
Mean age (years)	54.4	54.9	56.3	60.2[a]	56.0
Gender					
Female	180 (98.4)	80 (100.0)	68 (100.0)	80 (100.0)	408 (99.3)
Male	3 (1.5)	0 (0.0)	0 (0.0)	0 (0.0)	3 (0.7)
Confirmatory procedure					
Imaging	62 (33.9)	48 (60.0)	26 (38.2)	70 (87.5)[a]	206 (50.1)
Biopsy	121 (66.1)	32 (40.0)	42 (61.8)	10 (12.5)[a]	205 (49.9)
Findings					
Positive	72 (39.3)[b]	16 (20.0)	24 (35.3)	1 (1.3)[a]	113 (27.5)
Negative	56 (30.6)	49 (61.3)[c]	25 (36.8)	26 (32.5)	156 (38.0)
Follow-up	55 (30.1)	15 (18.8)	19 (27.9)	53 (66.3)[d]	142 (34.5)

[a]More patients at site D were aged 51 to 60, or 61 to 70, and mean age was higher compared with other sites; more patients at site D had imaging and fewer had biopsy as the confirmatory diagnosis; fewer patients at site D were diagnosed with cancer compared with other sites, $p < .05$.
[b]More patients at site A were positive for cancer compared with site B, $p < .05$.
[c]More patients at site B were negative for cancer compared with other sites, $p < .05$.
[d]More patients at site D required follow-up compared with other sites, $p < .05$.

TABLE 4 Number of visits from referral to diagnosis and consultation

	Participating site (n patients, median number of visits from referral to end-point in days, interquartile range)				
End-point	**A**	**B**	**C**	**D**	**Total**
Diagnosis (image confirmed)	62	48	26	70	206
	1.0	1.0	1.0	1.0	1.0
	1.0 to 1.0	1.0 to 1.0	1.0 to 1.0	1.0 to 1.0	1.0 to 1.0
Diagnosis (biopsy confirmed)	121	32	42	10	205
	1.0	1.0	1.0	2.0[a]	1.0
	1.0 to 2.0	1.0 to 2.0	1.0 to 1.0	2.0 to 2.8	1.0 to 1.0
Consultation	158	17	23	1	199
	2.0	3.0[b]	2.0	3.0	2.0
	2.0 to 2.0	2.0 to 3.0	2.0 to 2.0	3.0 to 3.0	2.0 to 2.0
Target number of total visits from referral to consultation (Table 2)	1 to 2	2 to 3	2 to 3 (2 days if consult with referring physician)	2 (consult with referring physician)	

Diagnosis—date when result of confirmatory diagnostic procedure recorded in patient medical record.
Consultation—date of meeting with patient to discuss treatment or follow-up plan.
[a]Patients referred to site D had significantly more visits compared with other sites, $p < .05$.
[b]Patients at site B had significantly more visits compared with sites A and C, $p < .05$.

TABLE 5 Wait time from referral to confirmatory procedure, diagnosis and consultation

	Participating site (n patients, median wait time from referral to end-point in business days, interquartile range)				
End-point	**A**	**B**	**C**	**D**	**Total**
Confirmatory imaging procedure	62	48	26	70	206
	14.5	14.5	14.5	15.0	15.0
	8.0 to 27.0	5.0 to 22.5	9.0 to 22.0	9.0 to 21.0	8.0 to 23.0
Confirmatory biopsy procedure	121	32	42	10	205
	10.0[a]	19.0[a]	14.5[a]	38.5	13.0
	6.0 to 17.0	7.5 to 28.0	9.0 to 25.0	29.0 to 48.0	7.0 to 23.0
Diagnosis (image confirmed)	62	48	26	70	206
	15.0	15.0	14.5	21.0	17.0
	8.0 to 27.0	6.0 to 23.0	10.0 to 22.0	12.0 to 28.0	9.5 to 26.0
Diagnosis (biopsy confirmed)	121	32	42	10	205
	13.0[b]	32.0	17.0	44.5	16.0
	9.0 to 20.0	19.0 to 37.0	13.0 to 28.0	31.0 to 53.0	10.0 to 27.0
Consultation	158	17	23	1	199
	16.0[c]	40.0	23.0	84.0	18.0
	10.0 to 26.0	24.0 to 54.0	20.0 to 40.0	84.0 to 84.0	11.0 to 29.0
Target wait time from referral to diagnosis (Table 2)	6 to 16 (all patients)	2 to 10 (image) 7 to 21 (biopsy)	10 (image) 21 to 26 (biopsy)	14 (image) 35 to 49 (biopsy)	
Target wait time from referral to consult (Table 2)	First visit for all patients	First visit (image); 9 to 22 days (biopsy)	10 days (image); 21 to 26 days (biopsy)	First visit (image); referring physician (biopsy)	

Referral—date when referral form received by the DAP.
Confirmatory procedure—type of procedure used to confirm diagnosis.
Diagnosis—date when result of confirmatory diagnostic procedure recorded in patient medical record.
Consultation—date of meeting with patient to discuss treatment or follow-up plan.
[a]Significantly lower for site A compared with all other sites; and for sites B and C compared with site D, $p < .05$.
[b]Significantly lower for site A compared with sites B and D, $p < .05$.
[c]Significantly lower for site A compared with sites B and C, $p < .05$.

diagnosis (13.0 days, interquartile range 9.0–20.0) and referral to consultation (16.0 days, interquartile range 10.0–26.0) were significantly lower at site A ($p < .01$) compared with all other sites (*one-stop model*). At site A only, the time from referral to biopsy-confirmed diagnosis was lower than the time from referral to image-confirmed diagnosis, reflecting triage prioritisation criteria for higher-risk cases (*service delivery targets*).

The median wait time of 38.5 days from referral to confirmatory biopsy for 10 patients at site D was likely influenced by the mutual availability of outside radiologists and patients from remote communities (*rural–remote region*, *staffing*).

3.6 | Integration of findings

Integration of qualitative and quantitative data generated a conceptual framework that visually displays how DAP characteristics may influence MDT and diagnostic service delivery (Figure 1). Integration revealed *concordance* between qualitative and quantitative findings. Qualitative data revealed that several DAP characteristics influenced MDT including rural–remote population, workload and human resource limitations. Quantitative data, when interpreted based on qualitative findings, found that similar DAP characteristics influenced service delivery: rural–remote region, human resources, referral volume, organisation of services and one-stop service delivery model could explain differences across sites in number of visits and wait times.

Instances of *discordance* were also identified. Qualitative data identified that all sites specified service delivery targets based on triage of risk. Quantitative data showed that wait time for biopsy-confirmed diagnosis (higher-risk cases) was shorter than image-confirmed diagnosis at site A only, the one-stop service delivery model. Other sites were likely unable to adhere to, or achieve service delivery targets due to the noted challenges of rural–remote population, workload/referral volume and human resource limitations. This discordance further supports the potential relationship between DAP characteristics and diagnostic service delivery.

Integrated findings contribute to an *expansion* in the understanding of MDT in the diagnostic context. MDT was said to achieve several beneficial outcomes at the level of individual providers and teams which, in turn, enhanced the efficiency of service delivery and the patient experience by reducing wait times, and the number of visits

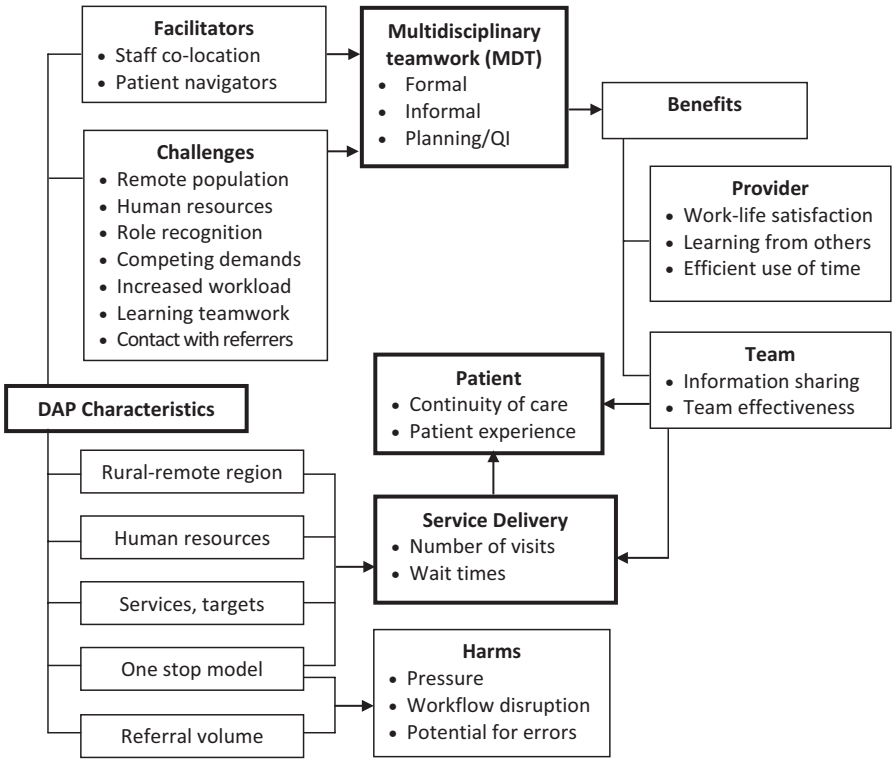

FIGURE 1 Conceptual framework of factors influencing diagnostic service delivery

needed to establish a diagnosis. This study also identified unanticipated consequences at site A and B, likely associated with the pressure of having to achieve one-stop service and provide services to a high volume of referrals.

4 | DISCUSSION

This study revealed that DAP characteristics (rural–remote region, human resources, referral volume, organisation of services, adherence to service delivery targets and one-stop service delivery model) may influence the efficiency of service delivery (number of visits, wait times). Other DAP characteristics (co-location of staff, patient navigators, team functioning) may influence MDT and team effectiveness which were also thought to influence the efficiency of service delivery (number of visits, wait times).

Previous research found that DAPs reduced wait times and improved patient satisfaction, but had not investigated the underlying mechanism (Brouwers et al., 2009; Castellanos et al., 2008; Gagliardi et al., 2004). This study's findings are unique in that they provide preliminary insight on DAP features that could be enhanced to improve service delivery including the organisation of services and MDT. This study is further distinguished from other research by the evaluation of multiple sites with differing features, and the use of a mixed methods approach to evaluate DAP design and impact in a holistic manner based on the perspectives of a variety of actors and a range of measures. In contrast, other research evaluated single sites and most commonly reported wait times only (Baliski et al., 2014; Oon et al., 2014; Royle et al., 2014). The findings are similar to those of a systematic review of health-care team effectiveness literature from 1985 to 2004 which found that the type and diversity of clinical expertise involved in team decision making largely accounted for improvements in patient care and organisational effectiveness, while collaboration, conflict resolution, participation and cohesion were most likely to influence staff satisfaction and perceived team effectiveness (Lemieux-Charles & McGuire, 2006). This suggests that measures reflecting individual provider, team and patient-reported outcomes should be used to assess the effectiveness and impact of DAPs in addition to more traditional measures such as wait times.

Operations management principles have been used to simulate a demand–supply model for a one-stop skin cancer clinic and found that by managing triage criteria, resource allocation and capacity planning, the time to treatment of new patients could be reduced by 90% with the same resources (Romero et al., 2013). While modelling may be a useful first step in identifying alternative DAP designs, real-world studies are needed to pilot the feasibility and impact of various DAP models. In this study the one-stop model required the fewest visits for diagnosis and, similar to other studies, achieved the lowest wait times to diagnosis (Brouwers et al., 2009; Gagliardi et al., 2004). Although these findings may not be surprising, there are several implications to consider. The one-stop site included in this study experienced challenges similar to those at other sites, and additional challenges unique to the one-stop model. Similarly, in a study of a rapid access prostate cancer clinic, the diagnosis of cancer increased resulting in a considerable increase in workload for surgeons (Oon et al., 2014). Moreover, the one-stop model may not be possible to implement in all settings given resource limitations or regional characteristics. Further research

is needed to understand how to optimise efficiency in DAPs that are not able to offer one-stop service.

Participants suggested that one way to improve DAP services was to optimise scope of practice. Current research on nurse navigation in the cancer care continuum largely focuses on supportive care or survivor follow-up; little research has studied the navigation content or services that should be offered (Post et al., 2015; Shockney, 2015; Wells et al., 2016). Further research is also needed to examine how DAPs can enhance patient-reported outcomes, a concept that has evolved from patient satisfaction to person-centred care (Harper, De Costa, Garrett-Mayer, & Sterba, 2015; Rathert, Wyrwich, & Boren, 2013).

Several study limitations must be noted. We may not have identified and evaluated all DAP characteristics relevant to diagnostic service delivery. Few individuals representing each profession were interviewed at each site, however, we did achieve thematic saturation within and across sites. Only four sites that diagnosed one type of cancer participated, and the sample of patients was small, thus findings may not be transferrable. Further research may confirm whether these findings are true of DAPs in other settings or for the diagnosis of different types of cancer.

In conclusion, DAP characteristics (rural–remote region, human resources, referral volume, organisation of services, adherence to service delivery targets and one-stop service delivery model) may influence service delivery (number of visits, wait times). MDT, influenced by other DAP characteristics (co-location of staff, patient navigators, team functioning), may also influence the number of visits and wait times. Insights generated by this research, captured as a conceptual framework of the factors that influence diagnostic service delivery, could be used by other to plan, evaluate and improve diagnostic services for cancer patients. While the one-stop model achieved fewer visits and a shorter wait time compared with other sites, all sites experienced similar and unique challenges. Further research is needed to understand how to optimise the organisation and delivery of DAP services.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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