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ORIGINAL ARTICLE

Nationwide evaluation of pancreatic cancer networks ten years after the centralization of pancreatic surgery

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Abstract

Background: Due to centralization of pancreatic surgery, patients with pancreatic cancer are treated in pancreatic cancer networks, composed of referring hospitals (Spokes) and an expert center (Hub). This study aimed to investigate I) how pancreatic cancer networks are organized and II) evaluated by involved clinicians.

Methods: Two online surveys were sent out between January–May 2022. Part I was sent out to the surgical network directors of all hospitals of the Dutch Pancreatic Cancer Group (DPCG). Part II was sent out to all involved clinicians in the Hubs-and-Spokes networks.

Results: There was a large variety between the 15 networks concerning number of affiliated Spokes (1–7), annual pancreatoduodenectomies (20–129), and use of a service level agreement (SLA) (40%). More Spoke clinicians considered the Spoke the best location for diagnostic workup (74% vs 36%, $P < 0.001$). Only 30% of Spoke clinicians attended the Hubs multidisciplinary team meeting frequently. More Hub clinicians thought that exchange of patient information should be improved (37% vs 51%, $P = 0.005$).

Conclusion: A large variety in Dutch pancreatic cancer networks was observed concerning number of affiliated Spokes, use of SLAs, and logistic aspects of network care. Improvement of network care concern agreements on diagnostic workup, use of SLA, Spoke participation in the MDT, and patient information exchange.

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Introduction

In 2011, centralization of pancreatic surgery was implemented in the Netherlands through the application of volume norms.¹ Centralization in hospitals performing at least 20 pancreatic resections was deemed necessary as it was shown to be associated with lower in-hospital mortality rates and improved long-term survival.^{2–4} As a result, health services for patients with pancreatic cancer are now delivered through a so-called “Hubs-and-Spokes” system.⁵ This system is characterized by pancreatic expert centers (Hubs) that exclusively perform pancreatic surgery and have a specialized multidisciplinary team (MDT), and affiliated, non-pancreatic centers (Spokes) which provide other elements of pancreatic cancer care such as parts of diagnostic workup, chemotherapy or best supportive care. In case a patient is suspected of pancreatic cancer in a Spoke, the patient is referred to the affiliated Hub for further diagnostic workup and treatment advice. Patients with pancreatic cancer may therefore receive diagnostic workup and treatment in more than one hospital. In this context, it is crucial that the Hubs and Spokes closely collaborate to ensure that patients receive the right care at the right time and place, and to warrant an adequate and efficient patient pathway. Previous studies of the Dutch Pancreatic Cancer Group (DPCG), a national multidisciplinary collaboration of clinicians involved in Dutch pancreatic cancer care,⁶ have focused on aspects of pancreatic cancer network care, such as outcome variation between centers within a Hubs-and-Spokes network. In the early days of the networks, patients diagnosed with pancreatic cancer in a Hub were significantly more likely to undergo pancreatic surgery compared to patients who were diagnosed with pancreatic cancer in a Spoke.⁷ This has changed over time as shown in a recent study reporting that the probability of pancreatic cancer resection does not differ based on the hospital of diagnosis.⁴ Nevertheless, patients diagnosed in a Hub were found to have a better median overall survival than patients diagnosed in a Spoke. The authors suggested that this might be a consequence of differences between centers in the likelihood of receiving adjuvant chemotherapy, which would also depend on referral patterns and network agreements.^{4,8} Although these studies present valuable knowledge, they do not provide information about how pancreatic cancer networks are organized since centralization and the initiation of a Hubs-and-Spokes system took place. This is relevant since network care may substantially impact quality indicators in pancreatic cancer care and impact patient experiences. There is currently a lack of literature in health services research and network care in pancreatic cancer.⁹

The aim of this survey study is therefore to investigate current organization of pancreatic cancer care in a Hubs-and-Spokes system in the Netherlands, with regard to set-up, logistics, and arrangements on referral, diagnostic workup, and treatment. A second aim is to investigate how clinicians involved in pancreatic cancer care evaluate the current organization.

Methods

Statement of ethics

Ethical approval from an institutional review board was not required. Clinicians were informed about the goals of the survey, its duration and data storage. Informed consent of the participants was implied when entering the survey. Participants were anonymized. The study protocol was reviewed and approved by the scientific committee of the DPCG.⁶

Study design, population and context

This was an online survey study composed and reported according to the Checklist for Reporting Results of Internet E-Surveys.¹⁰ The survey period was from January 2022–May 2022. The survey consisted of two parts: Part I focused on our primary aim and Part II investigated our secondary aim.

Part I was sent to all pancreatic cancer network directors of the Hubs in the Netherlands. These network directors were identified based on their previous role as local principal investigators of the PACAP-1 trial, a study evaluating the nationwide implementation of a best practice program.¹¹ The survey included questions about arrangements with affiliated Spokes ([Appendix A; MITUCASA Part I](#)).

Part II was sent to all clinicians involved in pancreatic cancer care, in both the Hubs and Spokes. The clinicians included surgeons, medical oncologists, gastroenterologists, radiologists, radiation oncologists, and case-managers or specialized nurses. The survey was composed of questions about network care, as well as statements requesting clinicians to indicate their level of agreement (1–5 Likert scale) ([Appendix A; MITUCASA Part II](#)).

Survey development and procedure

The surveys were constructed by JH and MS, and critically reviewed by the other authors. Based on consensus, questions were added or modified. Both surveys were divided in three main categories: 1) ‘Referral and diagnostic workup’; 2) ‘Multidisciplinary team meeting’ and 3) ‘Treatment and Follow-up’. Part II also included four items regarding continuity of care, derived from the Nijmegen Continuity of Care Questionnaire (NCQ).¹² Part I of the survey was composed of 46 questions, Part II of 49 questions. Questions were multiple choice, checkbox or open. The order of questions was not randomized, as questions were adaptive and had a logical sequence. Questions were re-read multiple times by JH, LD and MS and evaluated by the co-authors to rule out any ambiguity. The survey was tested for technical functionality by LD and MS before fielding. Survey invitations were sent by email. Additionally, survey Part II was advertised via the newsletter of the DPCG. Respondents could review and change their answers while filling out the survey and were shown a progress bar (% completed). Some questions required a response before the survey could be continued. Non-responders were sent weekly reminders by email or were contacted by phone. No external incentives were provided.

Multiple responses were avoided because each respondent could only respond once to an email invitation. However, we did not use IP addresses of participants to identify potential multiple entries. The survey was composed and sent via Survey Monkey® (Momentive Inc., San Mateo, California, USA).

Statistical analysis

For each survey, the participation rate and completion rates were reported. Descriptive statistics for continuous variables were presented in mean and standard deviation or median and interquartile range. Categorical variables were presented in numbers and percentages. Comparative statistical analyses were performed using the Student's T-test, Chi-squared test or Fisher-Freeman-Halton exact test. For comparisons between networks, ANOVA with post-hoc Bonferroni correction was performed. $P < 0.05$ was considered statistically significant. All statistical analyses were performed in IBM SPSS version 27 (IBM, Armonk, New York, USA).

Results

Respondents

Part I was completed by all approached surgeons ($n = 15$, 100%). Part II was filled out beyond the first page by 238/262 respondents (participation rate: 91%). Of these, 112 respondents (47.1%) were clinicians from Spokes and 126 respondents

(52.9%) were clinicians from Hubs. The clinicians included 92 gastroenterologists (38.7%), 58 medical oncologists (24.4%), 32 surgeons (13.4%), 15 radiologists (6.3%), four radiation oncologists (1.7%), and 37 case managers or specialized nurses (15.5%). Median number of respondents per network was 16 (IQR 10.75–21.25). Of all 262 respondents, 210 fully completed the survey (completion rate: 80.2%).

Organisation of pancreatic cancer networks (Part I)

An overview of the characteristics of the 15 networks is provided in Table 1 and Fig. 1. Eleven networks indicated to directly communicate with the general practitioner for <20% of the patient, three networks indicated they never directly communicate and one network communicated directly in 20–50% of the patients.

Referral and diagnostic workup

Eleven networks mostly used a digital referral letter to refer patients to the Hub, of which six networks used a referral template. Two networks used an online portal to refer patients, one network mostly used phone, and one network mostly used fax for patient referral. Fax was used as an additional referring method by six networks. After referral to the Hub, thirteen networks preferred to first discuss the patient in the MDT prior to a visit to the outpatient clinic, while two networks actually preferred to first meet the patient in the outpatient clinic.

Table 1 Overview of characteristics per pancreatic cancer network

Network	Number of Spokes	Number of PDs ^a per year	SLA	Uniformity in agreements (one for all)	Template for referral	Management team pancreatic network	Most used communication method within network	HPB hotline	Frequency of MDT (per week)	Number of patients discussed in MDT (per meeting)	Method of transfer of medical imaging	Estimated % multicenter treatment
1	5–6	65	✓	✗	✗	✓	Videocall during MDT	✓	1	20	Digital portal	50–<75%
2	3–4	35	✗	✓	✗	✗	Fax	✗	1	4–7	Digital portal	50–<75%
3	3–4	40	✓	✓	✗	✗	Text messaging ^b	?	2	8	Digital portal	≥75%
4	1–2	40	(–)	✓	✓	✓	E-mail	✓	1	30	Digital portal	≥75%
5	>7	145	(–)	✗	✓	✓	Telephone call	✓	2	10–12	Digital portal	≥75%
6	5–6	60	✗	✓	✓	✓	Telephone call	✗	1	18	Digital portal	≥75%
7	>7	129	✓	✗	✓	✓	Telephone call	✗	1	32	Other	50–<75%
8	5–6	45	✓	✓	✗	✓	Videocall during MDT	✗	1	5	Digital portal	≥75%
9	3–4	50	✗	✗	(–)	✗	E-mail	✓	2	10	Digital portal	50–<75%
10	1–2	20–30	✓	✓	✓	✓	Text messaging ^b	✗	2	3–5	Digital portal	50–<75%
11	1–2	23	✗	✓	✗	✓	Telephone call	✓	1	6	Digital portal	?
12	1–2	30	✓	✓	✗	✓	E-mail	✗	1	4	Digital portal	25–<50%
13	3–4	50	(–)	✗	✓	✗	?	✓	1	10	Other	10–<25%
14	>7	50	✗	✗	✗	✓	Telephone call	✓	1	10	Digital portal	≥75%
15	>7	60–70	✗	✗	✗	✗	E-mail	✓	1	25–30	Digital portal	50–<75%

^a PDs: pancreatoduodenectomies are specified in questionnaire as pylorus preserving pancreatoduodenectomy, pylorus resecting pancreatoduodenectomy and classic Whipple surgery.

^b SMS, Whatsapp, SILO HPB: hepatopancreatobiliary, MDT: multidisciplinary team, SLA: service level agreement ✓ = yes, ✗ = no, ? = I do not know, (–) = No SLA or standardized format for referral (yet) but some agreements have been written down.

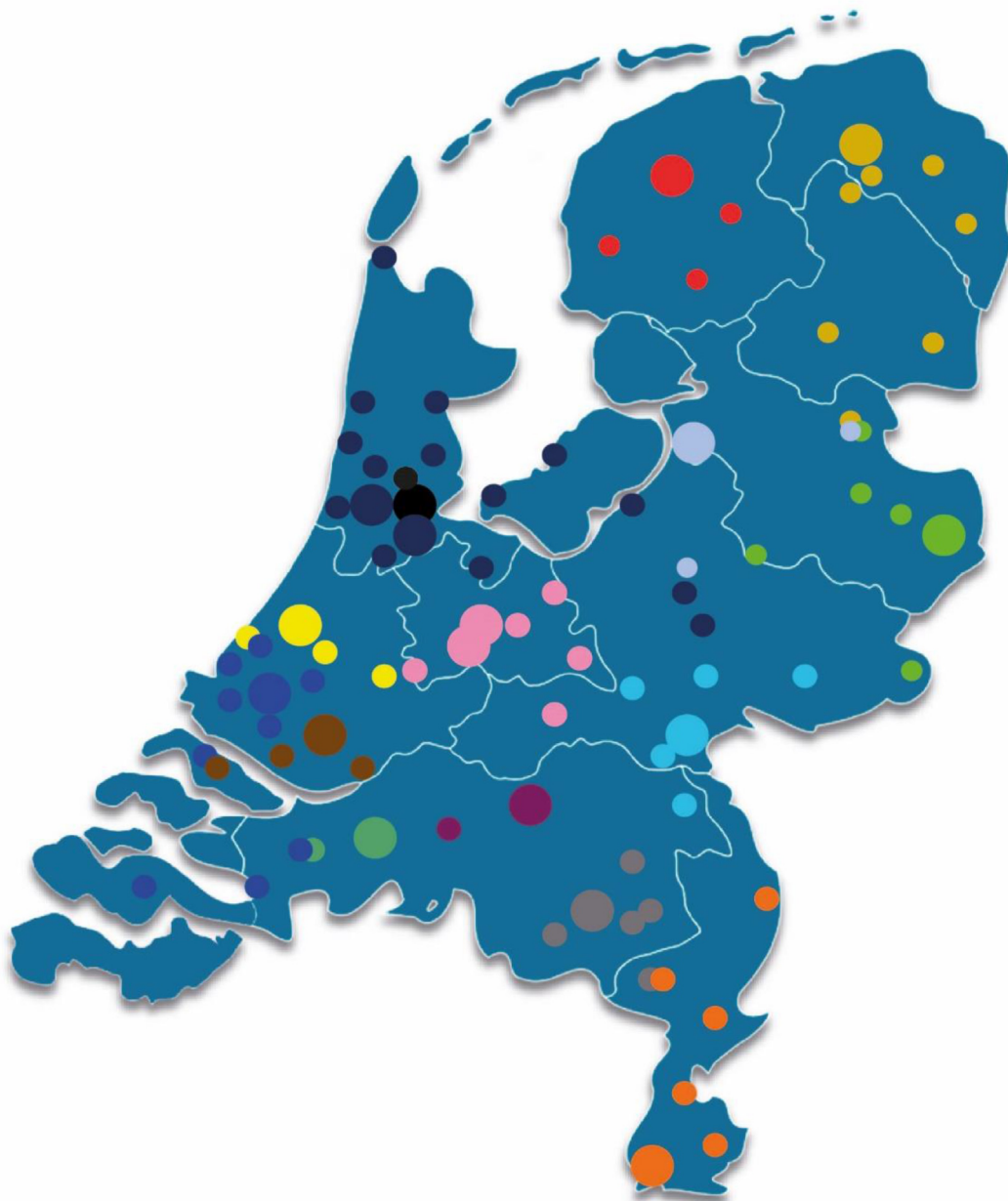


Figure 1 Illustration of the Hubs-and-Spokes network of pancreatic cancer care in the Netherlands Dots with the same colour belong to one pancreatic cancer network. The larger dot represents the expert pancreatic center (Hub) and the smaller dots the referring non-expert centers (Spokes). Additionally, Spokes may sometimes refer patients to Hubs outside their network (with different colour).

Multidisciplinary team meeting

In seven networks, Hub clinicians would join an MDT meeting organized by the Spokes, with five networks joining ≥ 4 times per month. The percentage of patients who were discussed in the Hubs' MDT meeting and thereafter visited the Hubs' outpatient clinic varied considerably between networks. Two networks reported that $<25\%$ of patients discussed in the MDT were seen in

the outpatient clinic, while this was $25 < 50\%$ in two networks, $50 < 75\%$ in five networks, $75 < 90\%$ in four networks and $90-100\%$ in two networks. The MDT treatment advice was mostly communicated via a digital letter in six networks, via post mail in five networks, via email in one network. Two networks indicated that the Spoke clinician would become informed about the treatment advice by joining the MDT.

Treatment and Follow-up

Treatment for pancreatic cancer, except for pancreatic surgery, could be provided by the Hubs as well as by the Spokes. Radiotherapy was mostly provided by the Hub, i.e. in 11 networks. Chemotherapy was generally administered in the Spokes, at least in 12 networks. The majority of the Hub surgeons (80%) indicated that more than 50% of all curatively treated patients were treated in both a Hub and Spoke. Agreements on the lead clinician existed in six networks, were absent in five networks, and unclear in three networks. All networks had a physician assistant or case manager who supported the patient and provided coordination of care.

Evaluation of pancreatic cancer networks (Part II)

Referral and diagnostic workup

Fig. 2 shows the responses of clinicians from the Hubs and Spokes on statements concerning referral and diagnostic workup. Most Spoke and Hub clinicians indicated it was clear for the Spokes which information should be provided to the Hub to adequately refer the patient (97% vs 76.9%, $P < 0.001$). However, more Hub clinicians disagreed with this statement (0% vs 11.6%, $P < 0.0001$). As compared with Spoke clinicians, more Hub clinicians suggested that the referral process within the network (10% vs 34.5% vs, $P < 0.001$) and the Hub-and-Spoke collaboration should be improved (20% vs 37.8%, $P = 0.006$). Spoke clinicians indicated that diagnostic imaging should be performed by the Spoke, including CT ($n = 96$, 96%), MRI ($n = 71$ (71%)), EUS ($n = 62$, 62%) and ERCP ($n = 77$, 77%) (Fig. 3). A significantly lower percentage of Hub clinicians indicated that CT ($n = 91$, 75.2%), MRI ($n = 54$, 44.6%), EUS ($n = 20$, 16.5%) and ERCP ($n = 33$, 27.3%) should be performed by the Spoke ($P < 0.001$).

Multidisciplinary team meeting

Among Spoke clinicians, 39.8% ($n = 39$) felt invited to join the Hub's MDT to present the patient, as opposed to 38.8% ($n = 38$) of clinicians who did not feel invited. The remaining 21.4% ($n = 21$) held a neutral view. The majority of the Spoke and Hub clinicians (68.4% and 81%, respectively) considered the attendance of the Spoke clinician at the Hub's MDT valuable ($P = 0.149$) (Fig. 4). Despite this shared opinion, a considerable proportion of both Spoke (61.3%) and Hub clinicians (48.3%) indicated that Spoke clinicians do not frequently attend the MDTs. The majority of the Spoke ($n = 65$, 66.3%) and Hub clinicians ($n = 67$, 57.8%) were satisfied with the communication of the MDTs treatment advice. Spoke clinicians (64.3%, $n = 63$) viewed the MDT advice to be clear and unambiguous. Twenty-nine per cent of the Hub clinicians ($n = 35$) indicated that they were frequently uncertain whether they possessed the most recent information of the patient during the MDT, while 44.5% ($n = 53$) disagreed with this statement and felt adequately informed. More than 50% of Hub clinicians indicated that the exchange of patient information within the network should be

improved, which was significantly higher than the Spoke clinicians (36.8% vs 50.8%, $P = 0.005$). Concerning diagnostic investigations, a considerable percentage of Hub clinicians (46.5%, $n = 54$) indicated that diagnostic workup frequently needed to be repeated by the Hub because of inadequate quality of the primary diagnostic procedure or because it was out-of-date. Diagnostic procedures that were estimated to be most frequently repeated were the abdominal CT-scan (50.9%), followed by EUS (21.6%).

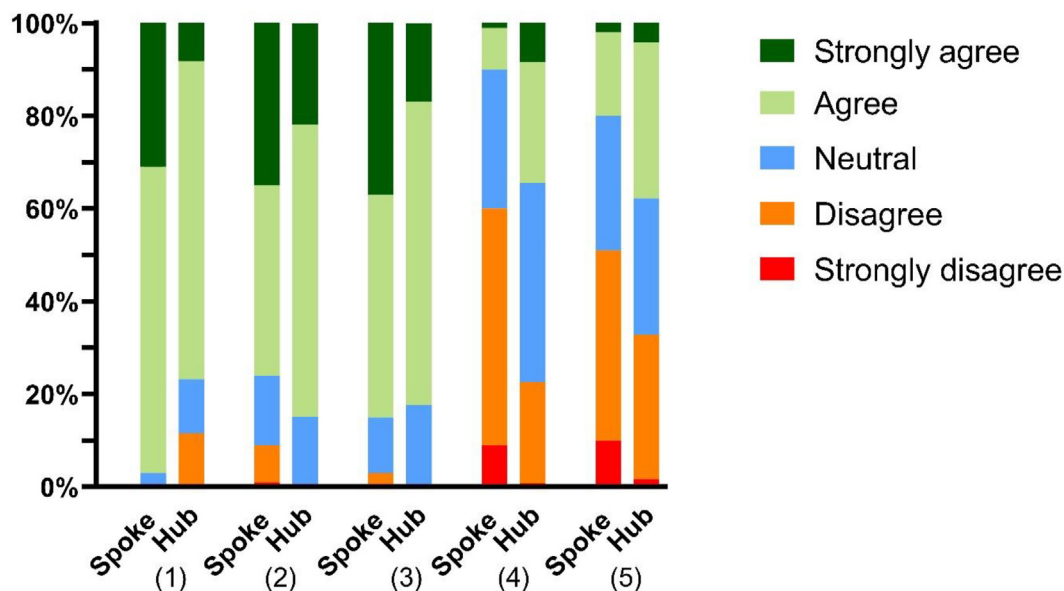
Treatment and continuity of care

Most Spoke and Hub clinicians thought it was immediately clear after the MDT meeting where the patient would undergo neoadjuvant chemo(radio)therapy (68.4% vs 62.6%, $P = 0.792$), pancreatic surgery (91.5% vs 94.8%, $P = 0.593$), adjuvant chemotherapy (64.2% vs 63.5%, $P = 0.513$) and palliative therapy (84.2% vs 70.4%, $P = 0.135$). It was considered clear who would be the lead clinician in that specific treatment phase (74.8% vs 67%, $P = 0.221$). Thirty-one per cent of Hub clinicians ($n = 36$) indicated they have difficulties keeping an oversight of a patient undergoing multicenter treatment, as opposed to 23% Spoke clinicians ($n = 23$, $P = 0.098$). When asked whether patients with pancreatic cancer find it difficult to keep this oversight, a significantly higher proportion of Hub clinicians agreed (20% vs 38.2%, $P = 0.006$). Most Spoke and Hub clinicians (72.7% and 73%, respectively) do not prefer to provide all treatment in one center (see Fig. 5). Continuity of care was evaluated similarly by the Hub-and-Spoke clinicians (Table 2), although there was a statistically significant difference between the evaluation for the connectedness of care (NCQ3, mean difference 0.194, $P = 0.02$). Mean NCQ-scores for NCQ-1, NCQ-2 and NCQ-4 differed significantly between the networks (Table 3). No statistically significant or clinically relevant differences were found in mean scores between networks with or without an SLA.

Discussion

This national survey study demonstrates that 10 years after centralization of pancreatic surgery in the Netherlands, there are 15 pancreatic cancer care networks, each with considerable differences in size and organization. In only a minority of networks, SLAs have been established. Although clinicians from Hubs and Spokes were generally positive towards current organization of network care, there were also points for improvement. Key areas for improvement include agreements concerning the diagnostic workup, e.g. at which site and accuracy of required investigations, participation of Spoke clinicians in the Hub's MDT and exchange of patient information.

There are some interesting contradictions in the results of the survey. First, 60% of the pancreatic networks had no SLA and 60% had no standardized referral format. This finding is in contrast with the requirements set out by the Dutch federation of Oncology Networks (SONCOS), which states that all oncology



Statements:

- (1) "It is clear which information must be provided to Hub for adequate referral"
- (2) "It is easy to reach the Hub"
- (3) "It is easy to refer a patient to the Hub"
- (4) "The referral process in our network should be improved"
- (5) "The collaboration between the Spoke and Hub should be improved"

Figure 2 Responses to statements concerning referral of pancreatic patients within the network by clinicians from the Spokes (n = 100) and Hubs (n = 121).

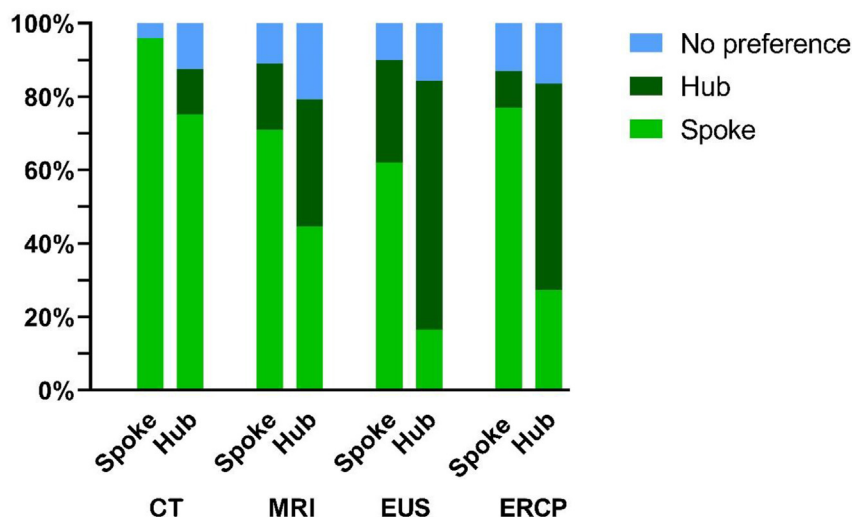
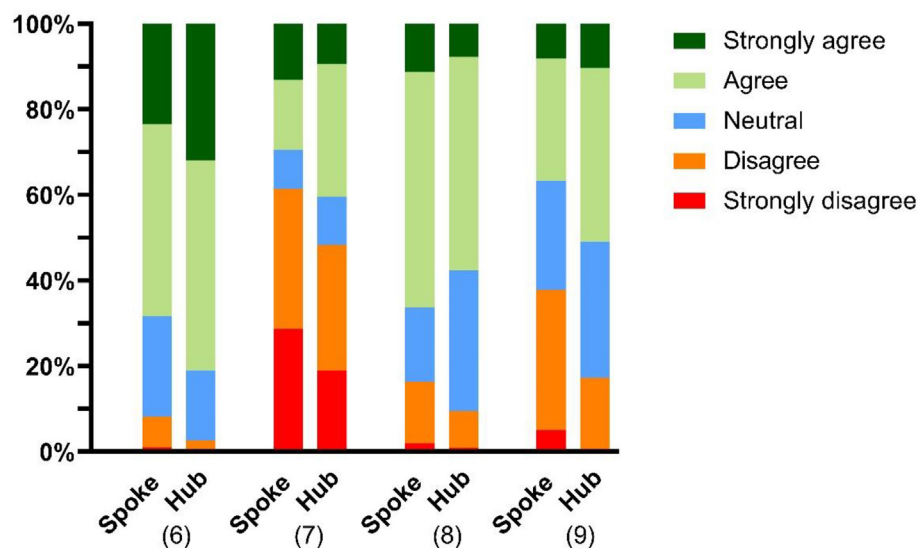


Figure 3 Responses to "Within the network, which center is best able to perform the following diagnostics?" from Spoke clinicians (n = 100) and Hub clinicians (n = 121).

networks should have an SLA.¹³ Second, despite the generally accepted view that attendance of the Spoke clinician at the Hub's MDT has additional value (Spokes 68%, Hubs 81%), only a minority of the Spoke clinicians (30%) indicated to attended the

MDT meeting of the Hub. Moreover, approximately 40% of the Spoke clinicians did not feel invited. A point for improvement would therefore be to increase the attendance of the Spoke clinicians by actively and repetitively inviting them for the MDT. A



Statements:

(6) "During the MDT meeting, the attendance of the Spoke clinician to present the patient has additional value"

(7) "The Spoke clinician frequently attends the MDT to present the patient"

(8) "I am satisfied about the way the MDT treatment advice is communicated to the Spoke"

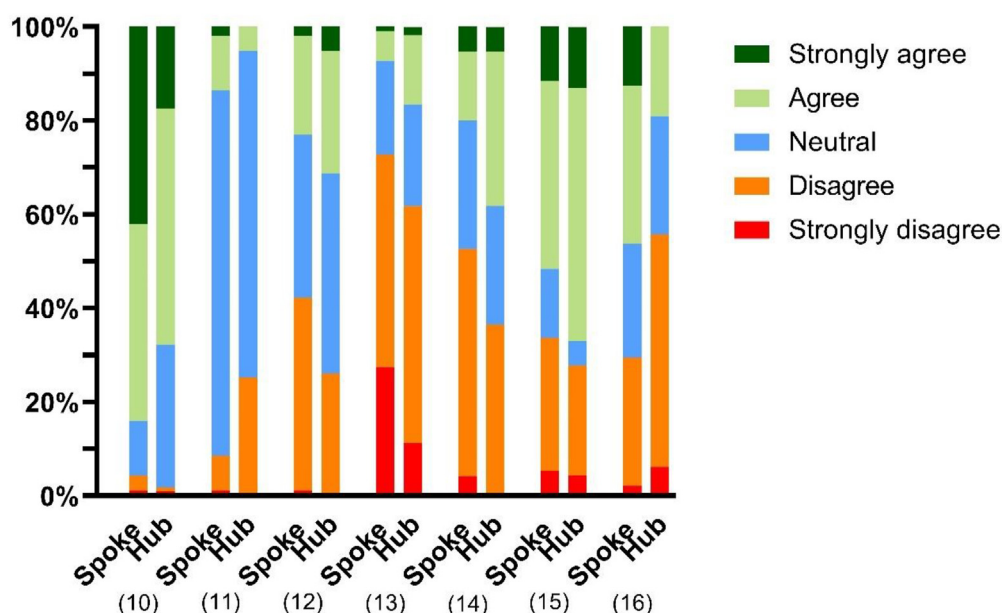
(9) "The exchange of patient information between the Spoke and the Hub should be improved"

Figure 4 Responses to statements concerning the MDT by Spoke clinicians (n = 98) and Hub clinicians (n = 116).

previous qualitative study on the barriers and enablers for attending pancreatic MDT meetings reported that barriers were timing of the MDT meeting (e.g. end of the day where spare time is sacrificed) and competing clinical commitments.¹⁴ Enablers are therefore to hold the MDT meeting during working hours and provide time and resources to join the MDT. Thirdly, there was a vast discrepancy in views between Hub-and-Spoke clinicians on where to perform certain diagnostic investigations. Most Spoke clinicians indicated that the Spoke hospital is best able to perform MRI, EUS and ERCP, while only a minority of the Hubs agreed. This lack of consensus probably results in a large practice variation within networks, possibly also in repeats of diagnostic investigations. Almost half of the Hub clinicians indicated that the Spoke diagnostic investigations were frequently repeated by the Hub because they were insufficient or outdated. The view that diagnostic investigations are frequently repeated is in line with the results of a Dutch registry-based study on diagnostic workup in pancreatic cancer, where it was reported that 47% of all diagnostic investigations is repeated in the Hub.¹⁵ Agreements on diagnostic investigations within the network, together with the dissemination of knowledge and audits concerning protocol-based imaging in the Spoke and the use of standardized reporting templates for CT scans or EUS, could be means to establish an efficient diagnostic workup and better comparability of results

across institutions.^{16–18} This national survey study has several limitations. First, there is a risk of non-response bias.^{19,20} A specific selection of clinicians could have participated in the survey, e.g. those who are interested in pancreatic network care, whereas clinicians who are indifferent to network care may have not. Second, we have gathered information about pancreatic cancer networks based on perceptions of respondents. These perceptions may differ from actual clinical practice. A strength of this survey study is that it provides information on aspects of pancreatic cancer care in the Netherlands which were not previously described. Registry-based studies on behalf of the Dutch Pancreatic Cancer Group^{4,7,8,15} frequently describe certain treatment trends or differences between Hub and Spokes which cannot be explained by data alone. This survey study provides a background with contextual information in which these results can be interpreted. A second strength is that this survey was constructed by a multidisciplinary project group with clinicians from different networks, allowing for a more comprehensive survey.

Hub-and-Spoke clinicians seem to be positive towards a multicenter aspect to pancreatic cancer care. However, there are points for improvement that become visible in this study, such as the use of SLAs, involvement of Spoke clinicians in the MDT and improved exchange of patient information. These improvements



Statements:

- (10) "I prefer the situation in which patients receive adjuvant chemotherapy in the Spoke"
 (11) "Patients undergoing adjuvant chemotherapy in the Spoke are more likely to complete adjuvant chemotherapy than if they were to receive this in the Hub"
 (12) "I think it is difficult to keep an oversight on the patient's treatment if the patient receives treatment in the Hub as well as in the Spoke"
 (13) "I strongly prefer patients undergoing all treatment in one center in stead of spread over different centers"
 (14) "In my experience, patients find it difficult to keep an oversight when they are treated in different centers (which treatment, which hospital, which doctor or care provider)"
 (15) "Including patients in clinical trials is more of a task for the Hub"
 (16) "Informing patients about palliative treatment options is more of a task for the Spoke"

Figure 5 Responses to statements concerning the treatment phase by Spoke clinicians (n = 95) and Hub clinicians (n = 115).

are, in our view, pivotal as optimally functioning pancreatic cancer networks are a necessary prerequisite for centralization of care to become a success. Optimizing network care and improved

collaboration across regions has also become a priority for the Dutch Ministry of Health.²¹ An additional important aspect of network care is the patient perspective. Multicenter care is highly

Table 2 Continuity of care (NCQ-score) as evaluated by Hub-and-Spoke clinicians and within networks

NCQ item	Spoke clinicians (n = 94)		Hub clinicians (n = 115)		P-value ^b	Networks (n = 15)			
	Mean ^a	SD	Mean ^a	SD		Mean ^a	Min	Max	P-value ^c
NCQ 1 "We transfer information very well to each other"	3.66	0.770	3.51	0.654	0.138	3.62	3.08	4.14	0.006
NCQ 2 "We work together very well"	3.89	0.679	3.77	0.578	0.170	3.86	3.40	4.43	0.000523
NCQ 3 "The care we provide is very well connected"	3.87	0.572	3.68	0.629	0.022	3.79	3.38	4.14	0.061
NCQ 4 "We always know very well from each other what we do"	3.28	0.860	3.28	0.779	0.988	3.35	2.77	4.14	0.008

^a NCQ score is expressed in a 1–5 Likert scale: 1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree.

^b Independent T-tests.

^c Oneway ANOVA with Bonferroni correction.

Table 3 Continuity of care (NCQ-score, 1-5 Likert scale) and grading¹⁻¹⁰ per pancreatic cancer network

Networks	NCQ1 ^a		NCQ2 ^a		NCQ3		NCQ4 ^a		Grade ¹⁻¹⁰ Organisation of pancreatic care in Hub		Grade ¹⁻¹⁰ Organisation of pancreatic care in Spoke ^a		Grade ¹⁻¹⁰ Organisation of pancreatic care in Network ^a	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	3.39	0.92	3.83	0.61	3.83	0.62	3.45	0.82	8.11	0.58	7.94	1.00	7.89	0.76
2	3.67	0.58	4.00	0.00	4.00	0.00	3.04	0.88	8.00	0.00	8.33(H)	1.16	8.33(H)	1.16
3	4.14(H)	0.38	4.43(H)	0.54	4.14(H)	0.69	3.53	0.74	8.29	0.76	7.86	0.69	8.29	0.76
4	3.67	0.50	4.11	0.60	4.00	0.50	2.77	0.73	8.33(H)	0.71	7.89	0.60	8.33(H)	0.71
5	3.46	0.74	3.82	0.61	3.75	0.52	3.78(H)	0.44	7.86	0.93	7.61	0.83	7.68	0.61
6	3.37	0.60	3.42	0.69	3.47	0.84	3.13	0.84	7.53(L)	0.91	7.59	1.00	8.24	0.75
7	3.82	0.73	4.06	0.56	4.06	0.43	3.28	0.83	8.18	0.73	7.32	1.25	7.42	0.84
8	3.87	0.35	4.13	0.35	3.87	0.35	4.14	0.38	8.27	0.59	7.87	0.74	8.27	0.59
9	3.68	0.57	3.82	0.50	3.77	0.61	3.33	0.58	7.86	0.56	7.59	0.67	7.68	0.65
10	3.50	0.54	3.50	0.54	3.38(L)	0.52	3.44	0.81	7.63	0.52	6.38	0.74	7.38	0.52
11	3.45	0.82	3.64	0.67	3.55	0.52	3.32	0.84	7.82	0.60	6.91	0.83	7.36(L)	0.92
12	4.13	0.35	4.00	0.54	3.88	0.64	3.63	0.92	8.13	0.64	7.38	0.52	8.00	0.00
13	3.81	0.73	4.06	0.57	3.94	0.57	3.41	0.71	7.81	0.54	7.31	0.60	7.56	0.51
14	3.27	0.80	3.40(L)	0.83	3.53	0.83	2.89(L)	0.74	7.67	0.72	7.27(L)	0.70	7.40	0.74
15	3.08(L)	0.86	3.69	0.48	3.62	0.51	3.07	0.80	7.85	0.56	7.31	0.75	7.62	0.77

^a Statistically significant differences between networks (P < 0.01) (H) – highest of all networks, (L) – Lowest of all networks.

accepted if this positively affects quality of care, while not negatively affecting a well-functioning care pathway, continuity and accessibility of care.²² Currently, there is a lack of studies on how network care may affect the experienced continuity of care. This should be addressed in future studies. Based on this survey study, we have constructed Good Practice Recommendations for pancreatic network care (Supplementary materials). We recommend clinicians involved in pancreatic cancer care to consult these recommendations. These recommendations may also prove valuable to other countries, depending on whether centralization of pancreatic surgery has been implemented.

In conclusion, this survey study on Hub-and-Spoke pancreatic cancer networks demonstrates that there is a large variety in the pancreatic cancer networks in the Netherlands, concerning number of affiliated Spokes, use of SLAs, standardized referral formats and logistic aspects of network care. Hub-and-Spoke clinicians seem to be generally positive concerning network collaboration but also indicate certain points for improvement. These mainly concern agreements on diagnostic workup in the network, use of SLAs, participation of Spokes in the MDT and exchange of patient information.

Authors contributions

Study concept and design: Hopstaken, Stommel. *Data acquisition and analysis:* Hopstaken *Data interpretation:* All authors *Manuscript preparation:* Hopstaken, Daamen, Stommel *Critical revision:* All authors.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.hpb.2023.07.904>.