Appendix 3: Coding tree

Kugler et al: Anticipated effects of centralising complex gastrointestinal surgery in a rural area in Germany - perspective of health professionals: A qualitative study

Main Codes	**Subcodes**	**Definition**
Patient pathway oesophageal surgery	Indications	Interviewee describes indications (diseases) with which patients receive oesophageal surgery.
	Symptoms	Interviewee describes primary symptoms with which patients seek help from a doctor.
	Primary health care provider sought	Interviewee identifies the healthcare providers who typically first encounter patients who eventually undergo oesophageal surgery.
	Diagnostics	Interviewee describes which diagnostics should be performed to diagnose oesophageal disease that need oesophageal surgery and which health care providers provide them.
	Decision for therapy	Interviewee describes who, how and where makes the decision for therapy.
	Therapy	Information about treatment plans for patients undergoing oesophageal surgery, including therapy coordination, available therapy options, potential alternatives, and supplementary treatments, as well as the locations where these therapies are administered.
	Rehabilitation	Interviewees describe if (and where) patients receive rehabilitation following oesophageal surgery.
	Follow-up care (hospital)	Follow-up care including check-up visits take place in a hospital and whether it must be conducted at the same hospital where surgery was performed (specialised centre) or other whether other hospitals are acceptable.
	Follow-up care (outpatient)	Follow-up care (control visits) that take place at outpatient physicians.
	Professions/specialisation	Professions and specialisations involved in care of patients who receive oesophageal surgery.
Patient pathway pancreatic surgery	Indications	Interviewee describes indications (diseases) with which patients receive pancreatic surgery.
	Symptoms	Interviewees outline key symptoms that prompt patients to seek medical attention who may later lead to pancreatic surgery.

Main Codes	Subcodes	Definition
	Primary health care provider sought	Interviewee identifies the healthcare providers who typically first encounter patients who eventually undergo pancreatic surgery.
	Diagnostics	Interviewee describes which diagnostics should be performed to diagnose pancreatic disease that need pancreatic surgery and which health care providers provide them.
	Decision for therapy	Interviewee describes who, how and where makes the decision for therapy.
	Therapy	Information about treatment plans for patients undergoing pancreatic surgery, including therapy coordination, available therapy options, potential alternatives, and supplementary treatments, as well as the locations where these therapies are administered
	Rehabilitation	Interviewees describe if (and where) patients receive rehabilitation following pancreatic surgery.
	Follow-up care (hospital)	Follow-up care including check-up visits take place in a hospital and whether it must be conducted at the same hospital where surgery was performed (specialised centre) or other whether other hospitals are acceptable.
	Follow-up care (outpatient)	Follow-up care (control visits) that take place at outpatient physicians.
	Professions/speicialisation	Professions and specialisations involved in care of patients who receive pancreatic surgery.
Effects of minimum volume standards	Problems specific to Brandenburg	Interviewee describes problems arising due to minimum volume standards that are specific to the federal state of Brandenburg (e.g. federal state with low population density).
	Specialized and regional centres	Details on the concept of specialised and regional centres (problems, advantages, conditions, effects the concept would have on their practice).
	Less specialized centres with increasing case numbers	Interviewees anticipate minimum volume standards will lead to decreased number of specialised centres which perform surgery that will have increasing care numbers.
	Brandenburg is becoming a desert of care	Interviewees expect that with increasing centralisation, there could be fewer and fewer health services provided within the federal state of Brandenburg.
	Incentive for wrong billing / coding	Interviewee believes that minimum volume standards could lead to wrong coding of diseases and procedures to be able to be reimbursed although the hospital is not allowed to perform oesophageal/pancreatic surgery due to disincentives.

Main Codes	Subcodes	Definition
	Incentive for overuse of health services	Interviewee anticipates that minimum volume standards could provide (dis)incentives for overuse of health services (extending the indication for surgery and increase case numbers) in order to reach the minimum volume standard.
	Incentives for inappropriate treatment	Interviewee anticipates that minimum standards could provide (dis)incentives to provide inappropriate treatment (e.g. surgery in cases that should not be operated because patients are too old/too sick, or no surgery but radiation therapy instead if the hospital cannot provide the surgery itself).
	Similar therapies	Interviewee expects minimum volume standards affect other (similar) therapies that are not regulated by the minimum volume standards, e.g. because tumours can infiltrate other organ structures, the expertise for non-surgical therapies could be missing, nearby-surgeries (e.g. stomach), as well as complications and emergencies of the regulated pancreatic/oesophageal procedures that could be treated less well.
	Diagnostics	Interviewee expects minimum volume standards affect the way diagnostics are provided.
	Follow-up care	Interviewee expects minimum volume standards affect the way follow-up care is provided.
	Patients	The interviewee expects that minimum volume standards can have both positive and negative effects on patients, such as more complex patient pathways or better outcomes. They believe the impact of minimum volume standards on patients can vary depending on a range of factors, as not all patients are affected equally.
	Relatives	The interviewee anticipates that minimum volume standards may have positive and/or negative effects on patients' relatives (family, friends, neighbors etc.)
	Medical training	Interviewee anticipates minimum volume standard would affect medical training since not all surgeries are provided in all hospitals.
	Staff recruitment	Interviewee expects minimum volume standards could impact staff recruitment, e.g. due to lower attractiveness of the own hospital if it is not allowed to perform complex visceral surgery.
	Fragmentation of visceral surgery	The interviewee anticipates that the increasing implementation of minimum volume standards for various procedures in visceral surgery could result in the fragmentation of the field, ultimately leading to a situation where there are no general visceral surgeons, but rather sub-specialists.
	Economics	Interviewee expects economic effects of minimum volume standards.

Main Codes	Subcodes	Definition
	Shift of services provided	Interviewee anticipates minimum volume standards could lead to a shift of services provided at specific hospitals (i.e. if they are no longer allowed to perform complex pancreatic surgery, they may provide alternative fields of specialisation).
	Reputation / pull effects	Interviewee anticipates minimum volume standards and the subsequent exclusion from providing complex pancreatic/oesophageal surgery could negatively affect the hospital's reputation potentially causing further pull effects.
	Interdisciplinary exchange	Interviewee expects minimum volume standards can affect interdisciplinary exchange, for example, if not pancreatic surgery specialist is employed at the hospital, other professionals cannot consult with them in case of questions, and they would be missing for interdisciplinary tumour conferences.
Solutions	Being treated in Berlin or other cities	Interviewee believes patients who need pancreatic / oesophageal surgery could be treated in Berlin or other cities where hospitals provide these procedures and sees it as a possible solution.
	Services	Interviewee believes providing additional services (e.g. transportation) could be a solution to ensure patients living in the federal state of Brandenburg can receive high quality to surgeries.
	Cooperation	Interviewee believes cooperation and collaboration between hospitals is a solution to ensure high quality medical care when surgeries are centralized. Details on how cooperation could look like in future, on established cooperation, conditions etc. are also coded.
	Regionalisation	Interviewee believes regionalisation is a solution to ensure high quality medical care when surgeries are centralized; i.e. health service providers within the same region collaborate with each other; there could be one specialised centre per region with other regional hospitals cooperating with each other. This could lead to the fact the (complex) surgeries would still be provided within regions but would still be centralised to a certain degree.
	Digitalisation	Interviewee believes digitalisation represents a solution to ensure high quality medical care when surgeries are centralised.
No Solutions	Being treated in Berlin or other cities	Interviewee does not believe patients who need pancreatic / oesophageal surgery could be treated in Berlin or other cities where hospitals provide these procedures. Reasons for not seeing it as a solution are also coded.

Main Codes	Subcodes	Definition
	People living in Brandenburg want to be treated in Brandenburg	Interviewee believes people living in the federal state of Brandenburg want to be treated in Brandenburg as opposite to Berlin or other cities; e.g. because of differences in mentality.
	Services	Interviewee does not believe that offerering additional services such as transportation would be an effective solution to ensure that patients living in the federal state of Brandenburg receive high-quality surgeries.
	Cooperation	Interviewee does not believe cooperation and collaboration between hospitals is a solution to ensure high quality medical care when surgeries are centralized. Reasons for not believing in it are also coded.
	Digitalisation	Interviewee does not believe digitalisation represents a solution to ensure high quality medical care when surgeries are centralised, e.g. because digitalisation in the German health care sector is in a problematic status. Other reasons for not believing in it are also coded.
Acceptance of centralisation and minimum volume standards	Hidden strategy	The interviewee believes that there is a concealed agenda behind minimum volume standards, which are stated to improve patient outcomes but may actually serve other purposes, such as closing hospitals. The interviewee suggests that those who advocate for minimum volume standards may personally benefit from them if they work in high-volume hospitals.
	Evaluation of minimum volume standard	The interviewee accepts the implementation of minimum volume standards if they are evaluated after a certain period of time to determine whether they have improved patient outcomes. If the intended goals were not achieved, the interviewee suggests discontinuing the use of minimum volume standards.
	Further exclusion (no new hospitals)	Interviewee criticises minimum volume standards as they allow only “one direction”, i.e. exclusion of further hospitals from providing complex procedures but no new hospitals are allowed to provide those procedures.
	Higher volumes are only better on average	The interviewee believes that higher volumes generally lead to better outcomes; however, there are high-volume hospitals with poorer outcomes and low-volume hospitals with better outcomes. Therefore, they find minimum volume standards to be somewhat "unfair."
	Studies on volume-outcome relationship	Interviewee recognises evidence on volume-outcome relationship showing that higher volumes are associated with better outcomes.

Main Codes	Subcodes	Definition
	Alternatives for centralization	Interviewee suggests alternative strategies for centralisation instead of minimum volume standards, e.g. centralisation based on outcome / structural / process quality.
	Management of complications	Interviewee acknowledges complexity of managing post-surgical complications after pancreatic / oesophageal surgery for which a capable ICU-team and further specialists are needed. This means, not only the experience of the surgeon, but the full team must be specialised to a certain degree.
	Oesophageal surgery is often associated with complications	properly address these complications, a complete team and infrastructure are required. Therefore, centralising esophageal surgery appears to be a sensible approach.
	Pancreatic surgery is more often (less acceptance for centralization)	Pancreatic surgery (as opposite to oesophageal surgery) is performed more frequently; therefore smaller hospitals with lower case number also have enough experience to conduct them. Therefore, centralising pancreatic surgery seems less accepted than oesophageal surgery.
	Interdisciplinary	Interviewee acknowledges interdisciplinary team work is required to adequately perform complex pancreatic / oesophageal surgery.
	Emotion and motivation	Centralisation (i.e. change) is associated with emotions and motivation of interviewees (e.g. outpatient physicians who prefer refereeing their patients to surgeons they know rather than to a hospital far away; motivation for offering diagnostics/follow-up care if the hospital is excluded from the surgery could be low; (upcoming) exclusion from surgical care is associated with the feeling of having something taken away).
	Experience and expertise	Interviewee acknowledges a certain degree of experience and expertise is required to adequately perform complex pancreatic / oesophageal surgery
	No acceptance of the number 26	The number 26 is perceived as an odd number for a threshold for the minimum volume standard of oesophageal surgery and is therefore not well accepted, while thresholds 25 or 20 would be more acceptable.
Overall perception of minimum volume standard	Negative	Overall, interviewee has a negative view on minimum volume standards.
	Mixed	Interviewee has a mixed view on minimum volume standards (positive and negative).
	positive	Overall, interviewee has a positive view on minimum volume standards.