Qualitative data, for example a patient's description of how they feel, is recorded differently to quantitative data, making it more difficult to capture and analyze. Numerous barriers obstruct the use of current data records to measure processes of care. Administrative claims data, generated for the administration of payment to healthcare providers and facilities for health services, do not contain information on essential serious illness care processes. While clinical notes contain a great deal of these data, extracting it manually is time-consuming and costly. Dr Lindvall is overcoming these barriers by employing natural language processing to extract information from electronic medical records. Natural language processing (NLP) is an area of artificial intelligence, which facilitates the understanding, interpretation and manipulation of human language with computers. NLP draws from various disciplines, including computer science and computational linguistics, in the quest to bridge the gap between human communication and computer understanding. Using NLP, computers can read text, listen to speech and interpret it, measure sentiment and determine which parts are important. This makes it possible to analyze massive amounts of language-based data in a consistent, efficient and unbiased manner.

Dr Lindvall employs natural language processing to extract information from electronic medical records.
goals of care, rather than their survival. The research also aims to improve patient management of patients nearing the end of life, palliative care conversations, clarifying code status, assessment for hospice and palliative care consultation. These processes have already been accepted to be of high quality. We are ensuring that patients’ voices have been heard and documented, and that conversations about their goals take place.

measure for surgery success does not apply. Instead, providers will be able to identify whether surgeries are successful by assessing the patients’ symptoms and goals of care, rather than their survival. The research also aims to improve patient outcomes by increasing the amount of information available to physicians. Conventional data mining is an arduous task that can only cope with relatively small data sets, therefore limiting the task that can only cope with relatively easy. NLP can be applied to existing EHR data and it has the ability to process very large datasets. This enables widespread implementation of the methodology as well as facilitating low cost analysis of population-based studies. These assets have already underpinned the use of NLP to solve issues in the fields of oncology and palliative care.

THE APPLICATION OF NLP TO PALLIATIVE CARE

The researchers have developed an NLP software package that can extract information from clinical notes. NLP can harvest predefined elements from unstructured data, such as operative reports, which are then encoded into a structured dataset that can be analysed relatively easily.

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Dr Lindvall draws attention to the fact that there are currently no quality measures in place for palliative surgery. With the need to improve both the quality and the value of end-of-life care, palliative surgery is attracting attention as an area that currently lacks a robust quality metric. This measurement is necessary for the benchmarking and continuous improvement of the quality of patient care. Measures for processes of care, exemplifying the highest standards for the management of patients nearing the end of their lives already exist, but these have not been applied to palliative surgery.

MEASURING QUALITY IN PALLIATIVE SURGERY

The research team have used NLP technology to analyse the documents contained in EHRs and propose that four processes of care are applied to the field of palliative surgery: goals-of-care conversations, clarifying code status, assessment for hospice and palliative care consultation. These processes have already been accepted to be of quality metrics when managing the care of seriously ill patients. Essentially, if these four processes are performed effectively, care is considered to be of high quality.

GOALS-OF-CARE CONVERSATIONS

A goals-of-care conversation helps the clinician identify a patient’s wishes and treatment choices. Decisions that are made in the context of a life-threatening illness are influenced by the individual’s values and preferences. Understanding a patient’s goals of care enables the clinician to align the care and treatment provided for the patient with what is important to them and their family. Inspective of the treatment outcomes, palliative surgery that is not in agreement with the patient’s values depicts poor quality care. Discussing and documenting the patient’s goals of care prior to palliative surgery ought to be standard practice. It is not known, however, to what extent these discussions currently take place and are recorded in clinical practice.

CLARIFYING CODE STATUS

Patients must select a code status so that if their caregivers and loved ones can follow their wishes. Full code means that if a patient’s heart stops and/or they stop breathing, the patient will be allowed to die naturally. Comfort care means that only specific resuscitation procedures will be employed. DNR stands for ‘do not resuscitate’ and indicates that if a patient’s heart stops and/or they stop breathing, the patient will be allowed to die naturally. Comfort care means that the patient will not be resuscitated, but medical treatments promoting comfort will be provided.

Many patients with terminal cancer prefer to forego interventions and do not choose full-code status. Due to the risks involved in surgery, it is essential to clarify a patient’s preference prior to a surgical operation. For patients who have chosen limited codes, DNRs and comfort care, the American College of Surgeons states that surgeries are responsible for instigating a conversation regarding the reconsideration of code status and documenting plans to include any changes. Unfortunately, the data on compliance with these guidelines is limited.

ASSESSMENT FOR HOSPICE

More end-of-life patients are choosing hospice care and it is perceived as offering better quality care. Enrolment in hospice before death is a quality measure that if a patient’s heart stops and/or they stop breathing, the patient will be allowed to die naturally. Comfort care means that the patient will not be resuscitated, but medical treatments promoting comfort will be provided.

Patients choosing palliative surgery are opting for more aggressive treatments near end-of-life and may be less inclined to enrol in hospice. If their physician discussed their prognosis and hospice care with them, it could mean an increase in hospice utilisation and encourage earlier enrolment. Currently, administrative claims data only identifies patients that have selected hospice care. Recording when patients are offered hospice, regardless of whether they choose to use it, could account for the disparity in patients’ preferences and offer a more accurate tool for measuring hospice utilisation.

PALLIATIVE CARE CONSULTATION

Increased access to palliative care is required to deal with the needs of seriously ill patients. The American College of Surgeons recognises the valuable role played by palliative care for seriously ill patients undergoing surgical treatment. Some surgeons, however, are reluctant to use palliative care and restrict it to the elderly and critically ill patients, or those for whom death seems imminent. Patients undergoing palliative surgery already meet established criteria for the assessment of palliative care. The use of a palliative care consultation, to discuss its suitability with patients, is therefore an important process of care.

DEVELOPING THE NLP MODEL

The biggest challenge with NLP is to discuss its suitability with patients, is therefore an important process of care. The use of a palliative care consultation, to discuss its suitability with patients, is therefore an important process of care. The biggest challenge with NLP is that if a patient’s heart stops and/or they stop breathing, the patient will be allowed to die naturally. Comfort care means that the patient will not be resuscitated, but medical treatments promoting comfort will be provided.

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If my 14-year-old can check her math homework via natural language processing, we ought to use that information technology to improve patient care.
and phrases that they found to be connected to a particular process of care were then added to a key term library. A manual review of the EHR notes identified by NLP was completed to validate the key term libraries. The notes that were not identified by NLP were also reviewed.

Over time, the repetition of this process honed the NLP performance, producing the ‘gold standard’ chart review.

The performance of the NLP libraries was then compared with findings of a manual chart review of the clinician notes, procedure reports, and radiology reports of a random sample of 20 pancreatic cancer patients who underwent palliative procedures between 2011 and 2016. The researchers captured information relating to the four processes of care from the 241 notes accumulated by the 20 patients during their hospitalisation. NLP was carried out and the results were compared with findings from the gold standard chart review. The NLP libraries’ sensitivities (the proportion of actual positives that were correctly identified) ranged from 93.8% to 100%. The manual review and data entry took over 20 hours to complete, whereas the NLP search extracted the information and generated a structured dataset in just 26 seconds. Using NLP to apply these quality measures is, therefore, both practical and achievable.

WIDER IMPLICATIONS
The National Academy of Medicine highlights the need for increased access to palliative care and states that empowering patients by aligning care decisions with their personal goals is a vital health care priority. They also note that it is imperative that processes and outcomes can be measured in a meaningful way.

While some process measures for palliative medicine already exist, and may be suited to palliative surgery, their large-scale implementation has been slow. This is partly due to issues with the existing data collection methods.

NLP is limited in that it can only detect whether processes are or are not documented. The documentation of these processes, however, is intrinsic to improving quality of care. It also offers context for future conversations, so documentation must be considered a quality measure in itself.

Dr Lindvall says, “we are ensuring that patients’ voices have been heard and documented, and that conversations about their goals take place.” She continues to highlight that, “there is real data in the conversations providers have with patients, we want to make this data easily available to researchers so we can better understand patients’ experiences, see what commonalities exist among us, and work to make the most educated decisions possible.”

The research team aims to develop and validate standardised libraries of terms that will facilitate the measurement of these processes of care across medical facilities. This will enable benchmarking and continuous quality improvement. They also intend to examine the relationship between the four processes of care and subsequent treatment decisions.

Although this project focuses on palliative care and cancer treatments, Dr Lindvall believes that the NLP model is relevant to all areas of healthcare.