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Increasing Smoking History Documentation and Lung Cancer Screening Orders in a Primary Care Clinic

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Increasing Smoking History Documentation and Lung Cancer Screening Orders in a Primary Care Clinic

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By: Tabitha M. Caudill, BSN, RN

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Abstract

BACKGROUND: In 2018, there were approximately 234,030 new lung cancer diagnoses and 154,500 lung cancer deaths in the United States. Kentucky leads the nation in new lung cancer cases each year. The USPSTF estimates that 10% to 12% of lung cancers detected by routine screening would not have been detected until the cancer advanced; therefore, the USPSTF recommends yearly lung cancer screenings using low dose CT (LDCT) scans of the chest for patients 55 to 80 years old who have a 30 pack-year smoking history and are currently smoking or have quit within the last 15 years.

PURPOSE: The purpose of this project was to increase smoking history documentation, including pack-years, and LDCT orders for patients 55 to 80 years old who meet screening criteria in a primary care setting.

METHODS: The FOCUS-PDSA model for improvement was used to guide this quality improvement project. Four PDSA cycles using variations of prompts for screening (eg. lung cancer screening flyers and smoking history stickers on patient intake document) were conducted to identify the best strategies for increasing smoking history documentation, including pack-years and increasing LDCT orders. Retrospective and prospective chart reviews were completed for smoking history documentation and LDCT orders before and after the interventions.

RESULTS: There were no significant differences in each PDSA cycle for smoking history documentation (p=0.64) or LDCT orders (p=0.44). PDSA cycles one, two, and four showed a non-significant increase in documentation and orders. Current smokers were more likely to receive LDCT orders than former smokers who met eligibility criteria (p=0.05).

CONCLUSIONS: Findings suggest that reminders like, educational lung cancer screening flyers, and smoking history stickers could increase documentation and LDCT scan orders. More research is needed comparing lung cancer screening orders between current and former smokers.

Acknowledgements

As I am ending my time as a graduate student, there are many thanks owed. I would like to especially thank my advisor, Dr. Elizabeth Tovar, for all the guidance she has provided me throughout the past four and a half years. I could not have navigated this program with your help. You truly care about your students, and it shows. I would also like to thank my committee member Dr. Lynne Jensen. Your advice throughout this final project was so incredibly valuable, and I could not have done this without you. My third committee member, Jessica Sass was also wonderful with helping me understand the system within the clinic my project took place. Thank you for all your help.

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Dedication

I would like to dedicate this project to my husband, Andrew Caudill. I could not have completed this program without him. You truly push me to further myself and be a better person. I would also like to dedicate this to my future son, Kevin. We have not met yet, but I hope this makes you proud. I love you both very much.

Table of Contents

List of Tables

List of Figures

Increasing Smoking History Documentation and Lung Cancer Screening Orders in a Primary Care Clinic

Problem Description

Lung cancer is the leading cause of cancer-related mortality for adults in the United States (CDC, 2018). In 2018, there were approximately 234,030 new cases diagnosed and 154,500 deaths from lung cancer in the U.S. (National Cancer Institute, 2019). Current or past use of tobacco through cigarettes, pipes, and cigars is the leading risk factor for lung cancer (National Cancer Institute, 2019). Cigarette smoking is linked to 80% to 90% of lung cancer deaths in the United States and smoking makes a person 15 to 30 times more likely to be diagnosed with or die from lung cancer (CDC, 2018).

Kentucky leads the nation in new lung cancer cases each year. The incidence of new lung cancer cases in Kentucky is 96.8 per 100,000 compared to 63.0 per 100,000 nationally. In addition, the rate of lung cancer deaths per 100,000 people in the state is 64.3 compared to 40.6 nationally (U.S. Cancer Statistics Working Group, 2018). Finally, in Kentucky, the 5-year survival rate is 16.8 percent compared to 20.0 percent nationally (American Lung Association, 2018).

The United States Preventative Services Task Force (USPSTF) recommends yearly lung cancer screenings using low-dose computerized tomography (LDCT) scans of the chest for patients who are 55 to 80 years old, have a 30 pack-year smoking history, and are currently smoking

or have quit within the last 15 years. This should be discontinued when a patient has not smoked for longer than 15 years or develops a problem or illness that greatly reduces their life expectancy (Humphrey et al., 2013). The National Lung Screening Trial Team (2011) found a 20% decrease in lung cancer mortality when screening was completed by a LDCT scan, and the USPSTF estimates that 10% to 12% of lung cancers detected by routine screening would not have been detected until the cancer advanced. Therefore, the USPSTF recommends routine screenings to catch lung cancer earlier, when treatment is more effective (American Lung Association, 2018; Humphrey et al., 2013).

Despite the USPSTF recommendation for yearly screenings, screening rates remain as low as 2% across the country (Davenport, 2018). Because of a lack of uniform documentation of pack-years among current and former smokers, the national screening rate is an estimate. Documentation challenges also make it difficult to determine the screening rate for Kentucky. However, 18.1% of lung cancer cases are caught early in Kentucky, when the rate of survival is 48.8%, and 52.5% of cases are caught during the late stages of cancer, when the survival rate is only 3.2% (U.S. Cancer Statistics Working Group, 2018). Increasing lung cancer screening rates in Kentucky should increase the amount of cases caught early, therefore reducing morbidity and mortality.

Available Knowledge

There are environmental, occupational, and genetic causes for both small cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC). The risk factors for both types of lung cancers are similar. Increasing age is a risk factor but a history of or current use of tobacco through cigarettes, pipes, and cigars is the leading risk factor for both types of lung cancer (National Cancer Institute, 2019). Radon is the number one cause of lung cancer among people who do not

smoke tobacco and is overall the second leading cause of lung cancer (Environmental Protection Agency, 2018).

Other causes of lung cancer include exposure to asbestos, arsenic, chromium, beryllium, nickel, diesel exhaust, and some forms of silica (CDC, 2018; National Cancer Institute, 2019). Radiation treatments to the chest, radiation exposure from medical testing, and radiation from atomic bombs also increase a person's risk (National Cancer Institute, 2019). A family history of lung cancer also increases the risk of developing the disease. The dietary supplement, beta-carotene, is also found to increase incidences of lung cancer in smokers (CDC, 2018; National Cancer Institute, 2019)

Rationale

Research shows that the three main reasons for a low lung cancer screening rate are lack of documentation of adequate smoking histories, including pack-years asked, and lack of patient and provider knowledge about screening (Kanodra et al., 2016; Li, Chung, Wei, and Luft, 2018; Rajupet et al., 2017; Raz et al., 2018). Also, some providers disagree with screening all together due to the potentially invasive procedures that might follow a positive LDCT scan and the potential for false positives (Li, Chung, Wei, & Luft, 2018; Rajupet et al., 2017).
Identifying patients with a 30 pack-year smoking history is the first step to screening them for lung cancer and implementing smoking cessation interventions (Polubriaginof, Salmasian, Albert, & Vawdrey, 2018; Modin et al., 2016).

Davenport (2018) suggests that one of the most common reasons for low screening rates is a lack of documentation of accurate smoking histories with the number of pack-years. Many patients are aware of other screenings, such as those for breast, colon and cervical cancer, but

have never been educated about lung cancer screenings (Cardarelli et al., 2017). Many providers ask if the patient is a current smoker or former smoker, but do not ask for any specifics about when the patient started, how many packs per day they smoked and when or if they quit smoking (Albert, & Vawdrey, 2018; Modin et al., 2016). Possible reasons for this include a lack of time or, forgetfulness due to so many other necessary screenings (Raz et al., 2018; Simmons et al., 2017). Knowing a patient's smoking history will help the provider make decisions about screening and, most importantly for lung cancer prevention, implement smoking cessation interventions (Li et al., 2018).

Smoking history documentation increases with prompting interventions such as notecards or notepads with smoking history questions printed on them. Electronic reminders might also prompt discussion and documentation of a patient's smoking history (Polubriaginof, Salmasian, Albert, & Vawdrey, 2018; Modin et al., 2016). Li, Chung, Wei, and Luft (2018) suggest that lung cancer screening compliance can be increased by recording an accurate smoking history in a standardized location within the patient's health record. This would also help with recording accurate local and national screening rates.

Many patients who should be screened for lung cancer, have never heard of the recommendation, but would be receptive to it if they did (Kanodra et al., 2016). Lack of patient awareness of the specifics of the screening recommendation is a barrier to lung cancer screening because patients are less likely to think it is important, and less likely to ask their primary care provider about it (Kanodra et al., 2016; Raz et al. 2019; Wang et al., 2019). Cardarelli et al. (2017) explored patient knowledge of lung cancer screening in Appalachian Kentucky. The overwhelming majority of their participants did not know anything about lung cancer screening with an LDCT scan of the chest. Knowledge can be increased about lung cancer screenings by

displaying posters or pamphlets in the clinic waiting room, mailing postcards, or other advertisements on the Internet and in retail stores (Cardarelli et al., 2017; Fintelmann et al., 2015).

Primary care providers may also not be aware of current lung cancer screening guidelines, or they may not believe in the efficacy of the screening (Raz et al., 2018; Simmons et al., 2017; Wang et al., 2019). Providers might be ordering chest x-rays instead of LDCT scans to screen for lung cancer even though this is not recommended and has been shown to be less effective than LDCT scans (Humphrey et al., 2013; Lewis et al., 2016). While most providers view lung cancer screening as important, some do not see the effectiveness of screening due to costs, unnecessary radiation exposure, and the risk of false positives (Raz et al., 2018; Simmons et al., 2017).

While there are evidenced-based interventions available, they are not being used enough as shown by nationally low screening rates. While research suggests increasing smoking history documentation is more likely to increase screening rates, more research is needed to indicate if more patient education will increase screening rates (Modin et al., 2016). Also, more investigation is needed to find out which interventions work best to increase documentation and patient education to increase screening rates.

Specific Aims

The purpose of this quality improvement project was to increase smoking history documentation and lung cancer screening orders for patients aged 55 to 80 years old, who qualify for routine LDCT scans according to the USPSTF recommendation.

Objective 1: Evaluate the effect of various Plan-Do-Study-Act (PDSA) cycles to increase documentation of an adequate smoking history.

Objective 2: Evaluate the effect of various PDSA cycles to increase orders for LDCT among patients who qualify.

Methods

Context

This project took place at an urban family-medicine clinic in an academic medical center located in central Kentucky. The clinic provides primary care services for patients of all ages in the Commonwealth of Kentucky. The clinic has a family medicine residency-training program for physicians. This program requires first, second, and third year residents, and Doctor of Nursing Practice (DNP) students, if available, to complete a quality improvement project within the clinic every year. A quality improvement team was organized to improve the current rate of lung cancer screening orders within the clinic. The group met once a month between November 2018 and June 2019 to create a new process for increasing lung cancer screenings using the FOCUS-PDSA model for improvement. Where FOCUS stands for 1.) Find a Process to Improve, 2.) Organize a team, 3.) Clarify current knowledge, 4.) Understand the problem, 5.) Select a process to improve. Four PDSA cycles were completed between April 2019 and June 2019.

Intervention

The quality improvement team was guided by facilitators from the institution's Office for Value and Innovation in Healthcare Delivery (OVIHD). The teams used the FOCUS-PDSA model for improvement for the project process and completion. The FOCUS-PDSA model consists of two stages with individual steps to guide quality improvement initiatives. The FOCUS stage is the first stage, where an action plan is developed. The PDSA stage is the second

stage and consists of small cycles of change to implement the action plan (Center for Health Services Research, 2019).

Stage One: Develop an Action Plan

Find a Process to Improve

The quality improvement team decided to evaluate the lung cancer screening rate at the clinic. Personal experience with cancer survivors involving screening before and after cancer diagnoses inspired this project. Nationally, only about 2% of current smokers who qualify for screening, are being screened (Davenport, 2018). At the time of this project, 18% of current smokers within the clinic aged 55 to 80 years had received lung cancer screenings with LDCT within the last year. Both rates are estimates because the team was unable to determine pack-years, nationally, and within the clinic. Because of the lack of documentation of pack-years, the team had to estimate UK Family Medicine's screening rate using the number of current smokers aged 55-80 years who received screening, by the total number of current smokers in the clinic aged 55-80 years. Baseline data were impossible to find for former smokers due to lack of documentation.

Organize a Team

The quality improvement team consisted of six first through third year family medicine residents, one Doctor of Nursing Practice (DNP) student, and two family medicine attending physicians. The team was assigned through a residency education program within the clinic.

Clarify Current Knowledge

Because only 18% of current smokers aged 55-80 years are being screened with LDCT, the quality improvement team first needed to clarify the current process for lung cancer screening within the clinic. The team discussed the current process with clinical services technicians (CST) and providers, including physicians and nurse practitioners, and created a flow chart (see Figure 3). During the rooming process, the CST obtains vital signs, completes a medication reconciliation, and if needed, completes an annual review which asks safety and lifestyle questions. During the annual review, the CST only asks the patient about current and former smoking status but does not include pack-years. After the CST is finished, the provider enters the room and has twenty minutes to review the patient's chief complaint and physical exam. If there is time, the provider reviews necessary health screenings with the patient. After the appointment, the provider orders medications, testing, and screening as necessary based on the appointment.

Understand the Problem

To understand the problem, the quality improvement team created a fishbone diagram (see Figure 4) and Five Whys flowchart (see Figure 5). The fishbone diagram explored elements within the organization, tasks, technology, people, and environment that contribute to low lung cancer screening rates in the clinic. The five why's chart narrowed down reasons for low lung cancer screening rates. Both tools showed that providers and CSTs forget to ask full smoking histories including pack-years.

Select a Process to Improve

The quality improvement team decided to focus on improving the process for obtaining full smoking histories to increase the lung cancer screening rates within the clinic. The team created a specific, measurable, attainable, relevant and time bound goal. The goal, by the end of June 2019, was to increase smoking history documentation and lung cancer screening orders by three percent for patients aged 55 to 80 years old who qualify for routine LDCT scans according to the USPSTF recommendation over a three-month period.

Stage Two: Implementation of Action Plan

PDSA cycles are rapid cycles of change. First, an intervention is planned (Plan), then the intervention is carried out (Do), and the outcomes are evaluated (Study). The final step is to adopt or abandon the intervention (Act; Center for Health Services Research, 2019). The results of one cycle help to guide the process and planning for the subsequent cycles until a process is adopted. The PDSA cycles and their outcomes are described later in the results section.

Lewin's Change Theory

Prior to implementing the PDSA change model, the team considered Lewin's change theory for planning and implementing change. Changing behavior is difficult, and many theorists have analyzed steps towards making lasting change. Kurt Lewin is one theorist that describes behavioral change as a balance of forces working in opposite directions. Driving forces push people towards change, while restraining forces hinder it (Lewin, 1947). The first step in Lewin's change theory is the unfreezing stage. During this stage driving forces are encouraged to move people away from the status quo and restraining forces are discouraged. This can be accomplished by educating people about the importance of change, helping people to recognize

the need for change, and working with people for ideas for change (Lewin, 1947). During the unfreezing stage, the team spoke with clinicians in the clinic about the current process and the ways in which change could be implemented.

The second step in Lewin's change theory is the movement phase. This means movement towards a new equilibrium. This can be accomplished by helping people accept that the old way was not beneficial, and change is needed. Encouraging people to see the situation from a fresh perspective helps with this. Including people in the process can also help facilitate change. Listening to ideas, providing rationale using research, and gaining support from respected members of management provides the best scenario for Lewin's second step (Lewin, 1947). The team utilized the movement stage by implementing PDSA cycles for change and using the results of each previous cycle to guide changes to the following cycle.

The final step in Lewin's change theory is the refreezing stage. This occurs after the change is implemented to maintain the process. Without refreezing, people will likely return to the previous status quo and change will not be sustained. Placing value in the change and making sure the leader continues to encourage it is important to make the change stick. Another way of doing this is to make the change formal and part of a written policy (Lewin, 1947). The most important thing to remember is that the driving forces must be stronger than the restraining forces. Otherwise change will not occur (Lewin, 1947). Providers must change their behavior to discuss, screen, and educate about lung cancer. Once a process is established, the team could use the refreezing stage to maintain the course.

Sample

For each PDSA cycle, a convenience sample of patients seen on the dates of the cycles were used, and a convenience sample of providers present on the dates of the cycles participated. The same patients were used for pre- and post- cycle measures. Inclusion criteria for the patients were patients aged 55 to 80 years old who were current or former cigarette smokers. Inclusion criteria for the providers were providers present on a specific family-medicine team within the clinic.

Measures

Pre and post measures included demographic variables, smoking history documentation, and LDCT orders. Data collection was completed using a chart audit. Qualitative data were collected using a provider and CST survey about the interventions. Results were stored in a secure, password protected, SharePoint site that only the quality improvement team had access to.

Analysis

Descriptive statistics were used to summarize the results. Fisher's exact test for statistical significance was used to compare each PDSA intervention cycle due to the small sample size and small number of variables. The cycles were compared for statistically significant results to describe the effectiveness of one intervention versus another. The number of patients with documented smoking histories, including pack-years, was compared with each PDSA cycle. The number of LDCT scan orders for lung cancer screening were also compared with each PDSA intervention cycle. Also, the number of orders for lung cancer screening orders and smoking

history documentation with pack-years was compared pre- and post-intervention. All statistical analysis was completed using SPSS 22 (IBM Corp., 2013).

Ethical Considerations

Patients identifying data was de-identified during data collection in accordance with the Health Insurance Portability and Accountability Act (HIPAA). This quality improvement project did not pose any physical or psychological harm to patients or staff involved.

Results

PDSA Cycle One

The first PDSA cycle included two physicians and took between two and five days. A representative from the quality improvement team stapled educational flyers about lung cancer screening, by the Kentucky LEADS Collaborative, to every rooming card for every patient seen by the two participating physicians during the cycle. The rooming cards were already in use by the clinic and included the patient's current vital signs and important follow-up information. The team chose the flyer because it provides information about how to calculate pack-years, who qualifies for screening, why screening is important, and pros and cons of screening in understandable language. The patients took the rooming cards home with the flyer after the appointment. The investigator was not present for this cycle; therefore, every patient seen by the providers during the cycle was given the flyers. This way, no one who might qualify for screening would be missed. The only information given to the providers was that the flyers would be attached to the rooming cards. One physician was only in clinic for two days, and the other physician was in clinic for five days.

Results of Cycle One are shown in Figure 1. For the first cycle, smoking history documentation increased from 0% to 26.7% (p=0.10). The LDCT scan orders increased from 7% to 14.3% (p=0.99). One of the patients seen had a life-limiting illness that disqualified the patient from lung cancer screening. This patient was excluded in the LDCT scan results (n=14) but included in the smoking history results (n=15).

Table 1.

PDSA Cycle One Results

	Pre	**Post**	***p***
Smoking History Documentation	n=14	n=15	0.10
	0 (0%)	4 (26.7%)	
LDCT Ordered	n=14	n=14	0.99
	1 (7%)	2 (14.3%)	

PDSA Cycle Two

For Cycle Two, the team wanted to educate the providers and CSTs involved about the study and flyer, hoping this would increase compliance with the cycle. The second PDSA included three physicians, one nurse practitioner and four CSTs from a different team than cycle one because the providers from cycle one were not available that day. This cycle lasted for one day and the primary investigator was present the entire day to answer questions. The same lung cancer screening flyer from cycle one was stapled to rooming cards for only patients aged 55 to 80 years old. The investigator educated the providers about the purpose of the study, the flyers themselves, the importance of documenting pack-years, and ordering a LDCT for lung cancer

screening when necessary. Results of cycle two are shown in Table 2. During PDSA Cycle Two, smoking history documentation increased from 0% to 25% (p=0.47) and LDCT scan orders increased from 16.7% to 37.5% (p=0.58).

Table 2.

PDSA Cycle Two Results

	Pre	**Post**	***p***
Smoking History Documentation	n=6	n=8	0.47
	0 (0%)	2 (25%)	
LDCT Ordered	n=6	n=8	0.58
	1 (16.7%)	3 (37.5%)	

PDSA Cycle Three

In PDSA Cycle Three the team wanted to make collecting a complete smoking history easier. The same lung cancer screening flyer from cycles one and two was stapled to rooming cards for patients aged 55 to 80 years old. For this cycle, the quality improvement team created a sticker that asked specific smoking history questions. This sticker was placed on the rooming cards along with the flyers. The CSTs were educated about completing the questions on the sticker during the rooming process. The providers were given the same education as cycle two and were also shown the sticker and where to chart a complete smoking history within the electronic health record. The third PDSA cycle included three physicians, one nurse practitioner and four CSTs. The cycle lasted one day, and the investigator was present the entire day to answer questions. See Table 3 for the results of Cycle Three. There was no increase in smoking

history documentation or LDCT orders with this cycle. Because of these results, the team wanted to survey the providers and CSTs about the processes used this far.

Table 3.

PDSA Cycle Three Results

	Pre	**Post**	***p***
Smoking History Documentation	n=6	n=5	0.99
	0 (0%)	0 (0%)	
LDCT Ordered	n=6	n=5	0.99
	0 (0%)	0 (0%)	

PDSA Cycle Four

After the results from Cycle Three, the team decided to survey providers and CSTs about the process used in the previous three cycles. The survey was developed by the team and consisted of questions about the importance of lung cancer screening and the process chosen to increase screening so far (See Figure 6). Three out of eight surveys were returned. One provider and one CST agreed that lung cancer screening is very important, and they would like to continue the process chosen to increase screening. The remaining provider believed screening is very important but did not like the physical flyers on the rooming cards because they added more materials to the exam room. Considering most of the results favored the process being used, the team decided to complete Cycle Four using the flyers and smoking history stickers, hoping for a larger sample size.

The same interventions as Cycle Three were used in Cycle Four, with one addition. The CSTs showed the investigator the completed smoking history sticker after each appointment with a patient between the ages of 55 and 80 years. The fourth PDSA included two physicians and one nurse practitioner. The cycle lasted for one day and the investigator was present for the entire day to answer questions. Three patients seen did not qualify for an LDCT because of a life-limiting illness or a previous LDCT within the past year. These three patients were not included in the results for LDCT orders. The results of cycle four can be seen in Table 4. Smoking history documentation increased from 22% to 33.3% (p=0.99) and LDCT order increased from 22% to 28.6% (p=0.99).

Table 4

PDSA Cycle Four Results

	Pre	**Post**	***p***
Smoking History Documentation	n=9	n=9	0.99
	2 (22%)	3 (33.3%)	
LDCT Ordered	n=9	n=7	0.99
	2 (22%)	2 (28.6%)	

Summary of Results

Tables 5 and 6 show a summary of results from all four PDSA cycles. There was no statistically significant difference between each PDSA cycle intervention on smoking history documentation (p=0.64) or LDCT orders (p=0.44). However, while there was no difference

between PDSA cycle interventions, smoking history documentation and LDCT orders increased for every PDSA cycle except cycle three.

Table 5

Smoking history documentation including pack-years for current and former smokers by intervention

	n	Pack-Years documented	No pack years documented	*p*
PDSA Cycle 1	15	4 (26.7%)	11 (73.3%)	0.64
PDSA Cycle 2	8	2 (25%)	6 (75%)	
PDSA Cycle 3	5	0 (0%)	5 (100%)	
PDSA Cycle 4	9	3 (33.3%)	6 (66.7%)	

Table 6.

LDCT orders among current and former smokers by intervention

	n	Pack-Years documented	No pack years documented	*p*
PDSA Cycle 1	14	2 (14.3%)	12 (85.7%)	0.44
PDSA Cycle 2	8	3 (37.5%)	5 (62.5%)	
PDSA Cycle 3	5	0 (0%)	5 (100%)	
PDSA Cycle 4	7	2 (28.6%)	5 (71.4%)	

Figures 1 and 2 show the different processes providers chose for current and former smokers in all PDSA cycles combined. For current smokers, if the provider documented a smoking history, 100% of those patients received lung cancer screening orders. The results varied for former smokers. Four former smokers did not get LDCT orders even though their smoking histories were documented. Table 7 shows the difference in LDCT orders between current and former smoker results by each PDSA cycle. Cycle four showed a statistically

significant difference between former and current smokers and LDCT orders. Current smokers were more likely to receive LDCT orders than former smokers.

Figure 1.

All PDSA Cycle Results for Current Smokers

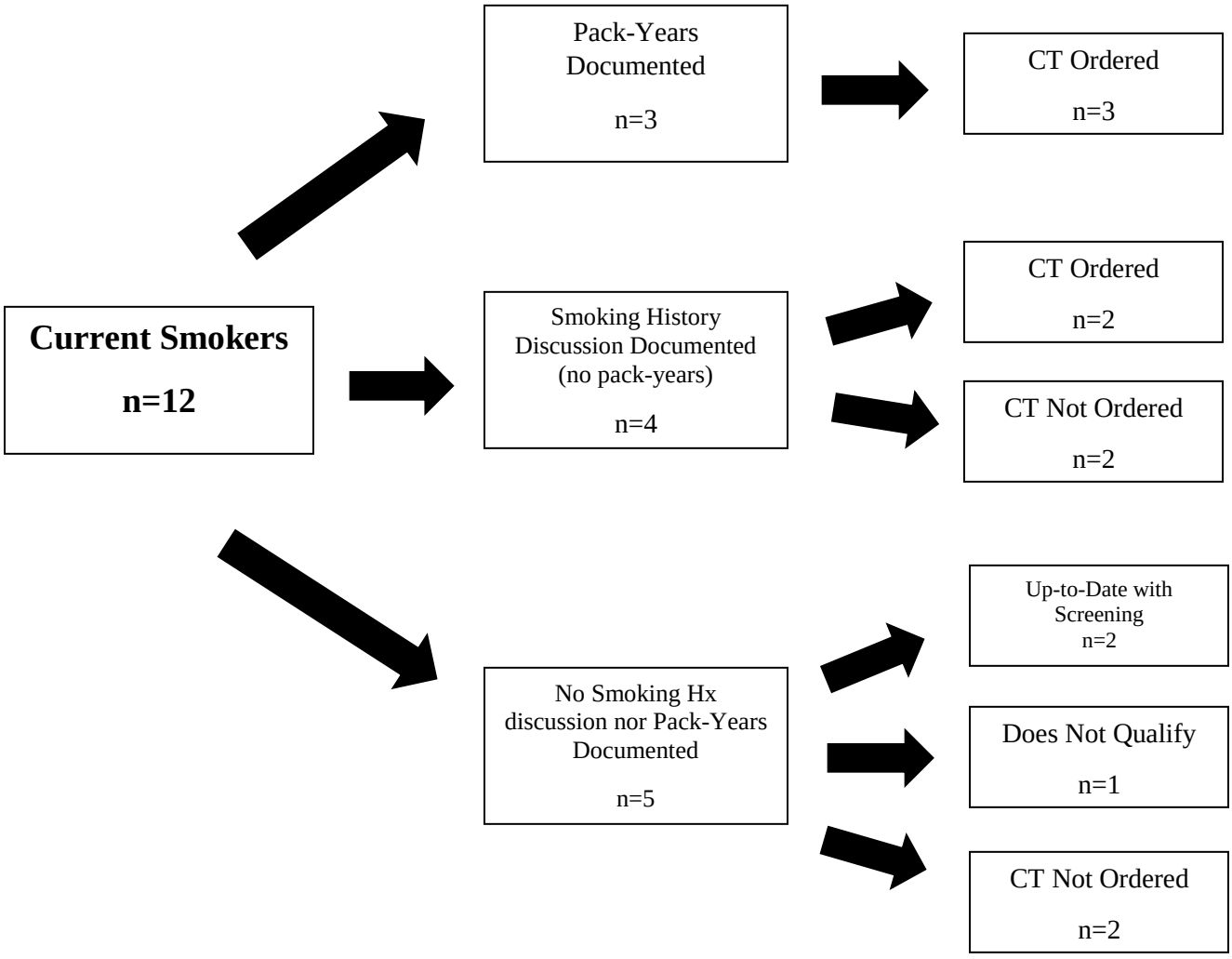

Figure 2.

All PDSA Cycle Results for Former Smokers

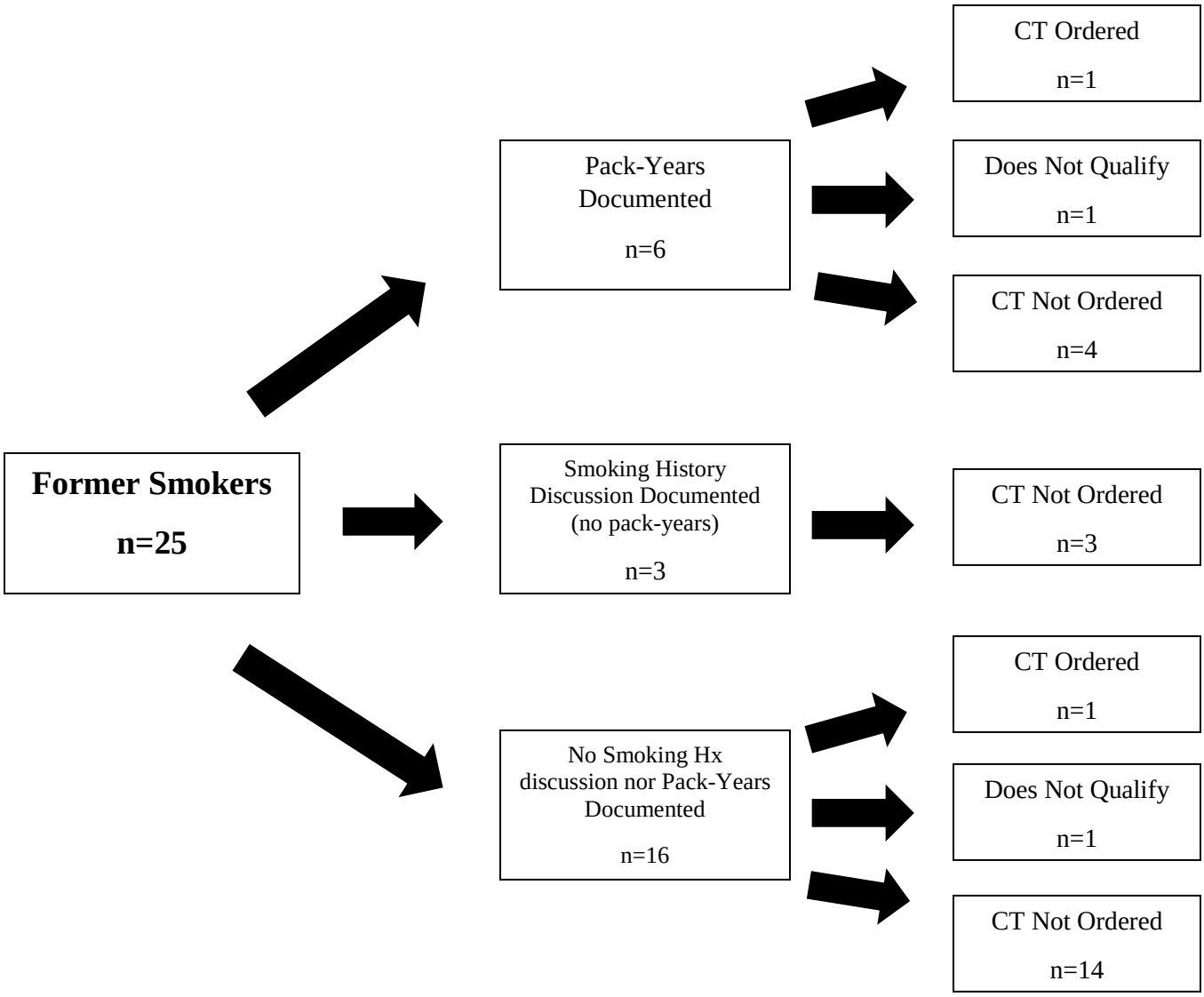

Table 7.

LDCT Orders Between Current and Former Smokers by each PDSA Cycle

	n	**Former smokers**	**Received CT orders**	**Current smokers**	**Received CT orders**	***p***
PDSA Cycle 1	14	10	1 (10%)	4	1 (25%)	0.51
PDSA Cycle 2	8	5	1 (20%)	3	2 (66.7%)	0.46
PDSA Cycle 3	5	5	0 (0%)	0	0	--
PDSA Cycle 4	7	5	0 (0%)	2	2 (100%)	0.05

Discussion

Summary

PDSA cycles one, two, and four showed a nonsignificant increase in smoking history documentation and LDCT scan orders. The third PDSA cycle yielded zero documentation or LDCT orders before and after the intervention. Provider feedback indicated strong agreement with the importance of lung cancer screening and satisfaction with the new process being trialed. The fourth PDSA cycle's intervention was the same as Cycle Three, except that the CSTs were held accountable for filling out the smoking history sticker. This suggests that accountability might contribute to better results. Interestingly, this study revealed a significant difference in LDCT orders between current and former smokers, with more LDCT orders for current than former smokers. Because there were no significant differences between PDSA cycles, the team cannot recommend a specific intervention; however, after reminders for lung cancer screening were implemented smoking history documentation and LDCT scan orders increased. More

PDSA cycles should be completed to identify the best version of the reminder and then to trial it on a larger scale.

Interpretation

Documentation of a complete smoking history is a challenge both nationally and locally. It is difficult to calculate accurate lung cancer screening rates without accurate documentation of a smoking history. Research suggests that physical or electronic reminders will not only increase documentation, but also increase LDCT scan orders for lung cancer screening (Polubriaginof, Salmasian, Albert, & Vawdrey, 2018; Modin et al., 2016). The goal of this study was to create a process for documenting adequate smoking histories for patients who qualify for lung cancer screening. Overall, documentation increased with each intervention, except PDSA cycle three. Most of the providers and CSTs surveyed were satisfied with the lung cancer screening flyers and smoking history stickers trialed. This suggests that expanding this trial for a larger sample size could yield positive results.

This study found that current smokers were more likely to receive LDCT scan orders than former smokers. These results were significant for PDSA Cycle Four. There is very little research comparing the two groups for lung cancer screening, so more research is needed to determine whether this is a true disparity, and if so, the reasons behind it so they can be addressed. The chance of dying from lung cancer is cut in half when a person quits smoking for ten years (CDC, 2019). Potentially, providers are more aware of the risks of lung cancer with current smokers, and therefore are more likely to order lung cancer screening for current smokers. It is possible that a large number of people who qualify for screening are not being screened and will suffer from potentially avoidable morbidity and/or mortality.

The third PDSA cycle showed no documentation or LDCT orders either before or after the intervention. The exact same intervention was used for PDSA cycle four and showed positive results. The only difference was that the CSTs were held accountable by showing the investigator the completed smoking history sticker. Many hand hygiene studies have suggested that compliance increases with accountability (Cantrell, 2018). When a person is required to show proof or knows that someone is watching, that person is more likely to complete necessary tasks such as hand hygiene (Johnson et al., 2014). Similar conclusions could be inferred about smoking history documentation based on the results of this study.

Recommendations

The process used to increase documentation in this study did increase smoking history documentation rates. The clinic should complete more PDSA cycles and separate the interventions to explore any differences between the flyers and smoking history stickers. Subsequent cycles should start with just the flyer, then just the sticker, and compare results. Although the sample size in this study was small, it suggests that the process for increasing documentation could work with a larger sample size. The next PDSA cycles should continue until a large enough sample size is reached to yield significant results. The clinic would also benefit from educating staff about a specific location for smoking history documentation. Part of the intervention included showing providers where to document within the electronic health record, but almost none of the providers utilized that location, making data collection and interpretation very difficult. Once documentation compliance is steadily increasing, another quality improvement initiative could focus on educating providers about documenting in one location. This would also make calculating screening rates within the clinic easier. Another

recommendation for the clinic would be to add the specific smoking history questions to the annual review so that it could be completed yearly on every patient by the CST.

Nationally and locally, there needs to be more research comparing the rates of lung cancer screenings for current and former smokers. The results of this study suggest that current smokers are more likely to receive lung cancer screening orders than former smokers. There is not much research comparing the two groups for lung cancer screening. The relative risk for lung cancer mortality decreases the earlier in life a person quits smoking tobacco. The relative risk for a person quitting smoking at age 60 is 45%, and 20% for age 50 (Halpern, Gillespie, & Warner, 1993). Former smokers do have less risk for dying from lung cancer when they have been tobacco free for ten years, but their risk is still higher than people who have never smoked tobacco (CDC, 2018). For this reason, former smokers aged 55 to 80 years who have a 30-pack-year history and have quit smoking within 15 years are recommended to receive lung cancer screening with LDCT (Humphrey et al., 2013).

Cycle Four yielded better results than Cycle Three possibly due to holding the CSTs accountable. The clinic could incorporate accountability with documentation and screening orders by auditing charts for completed smoking histories within the annual review or in the provider's notes. Electronically auditing employee charting, and emailing employees with decreased compliance, could hold clinic employees accountable, making smoking history documentation and LDCT orders more likely to be completed.

Limitations

The sample size for each PDSA cycle was small, thus the power to detect a statistically significant difference was weak. A larger sample size might yield more robust findings.

However, PDSA cycles are meant to be small cycles of change in order to recommend interventions on a lager scale. Another limitation was the short time frame the in which PDSA cycles were implemented. PDSA cycles are typically completed in small time-frames initially, but the one day duration of the intervention led to a small sample size. The next study in this clinic should take place over a longer period such as a week or two to hopefully yield a larger sample size, and thus more data for analysis. The final limitation was individual provider behavior. Providers documented differently and in different locations within the electronic health record. This made data collection difficult. Some providers did not document anything but did order lung cancer screening. While it can be assumed that a lung cancer screening discussion took place, there was no documentation of it. One possible reason for this is because it is more time consuming to chart a complete smoking history in the designated area of the electronic health record. Another reason is that providers might believe that it is tedious to chart in a specific area, if they have already charted in another section of the note. This study partially focused on increasing documentation, but more studies are needed to increase compliance with documentation.

Conclusion

Kentucky leads the nation in new lung cancer cases each year (U.S. Cancer Statistics Working Group, 2018). It is difficult to obtain accurate lung cancer screening rates both nationally, and locally because of lack of accurate documentation. This study focused on increasing smoking history documentation and increasing lung cancer screening orders. The results suggest that reminders, such as educational lung cancer screening flyers and smoking history stickers, could increase documentation and LDCT scan orders.

The clinic should continue PDSA cycles by separating the flyer intervention and smoking history sticker intervention to determine if there is a significant difference between each. Once a process is established, the chosen prompting intervention should be implemented clinic wide. There should be more research about the disparity identified between former and current smokers with lung cancer screening orders. This study showed a significant difference between current and former smokers in that current smokers are more likely to receive lung cancer screening orders. This warrants further investigation as to why current smokers are more likely to receive orders, because it is possible healthcare providers are not screening a large group of people who qualify. While current smokers are more likely to be diagnosed with and die from lung cancer, former smokers also have an increased risk of developing and dying from lung cancer (CDC, 2018). Future studies should further investigate this disparity between screening rates for smokers and non-smokers and seek to identify the most effective reminders to facilitate adequate smoking history documentation and LDCT scan orders.

Figure 3. *Flowchart for Patient Appointments*

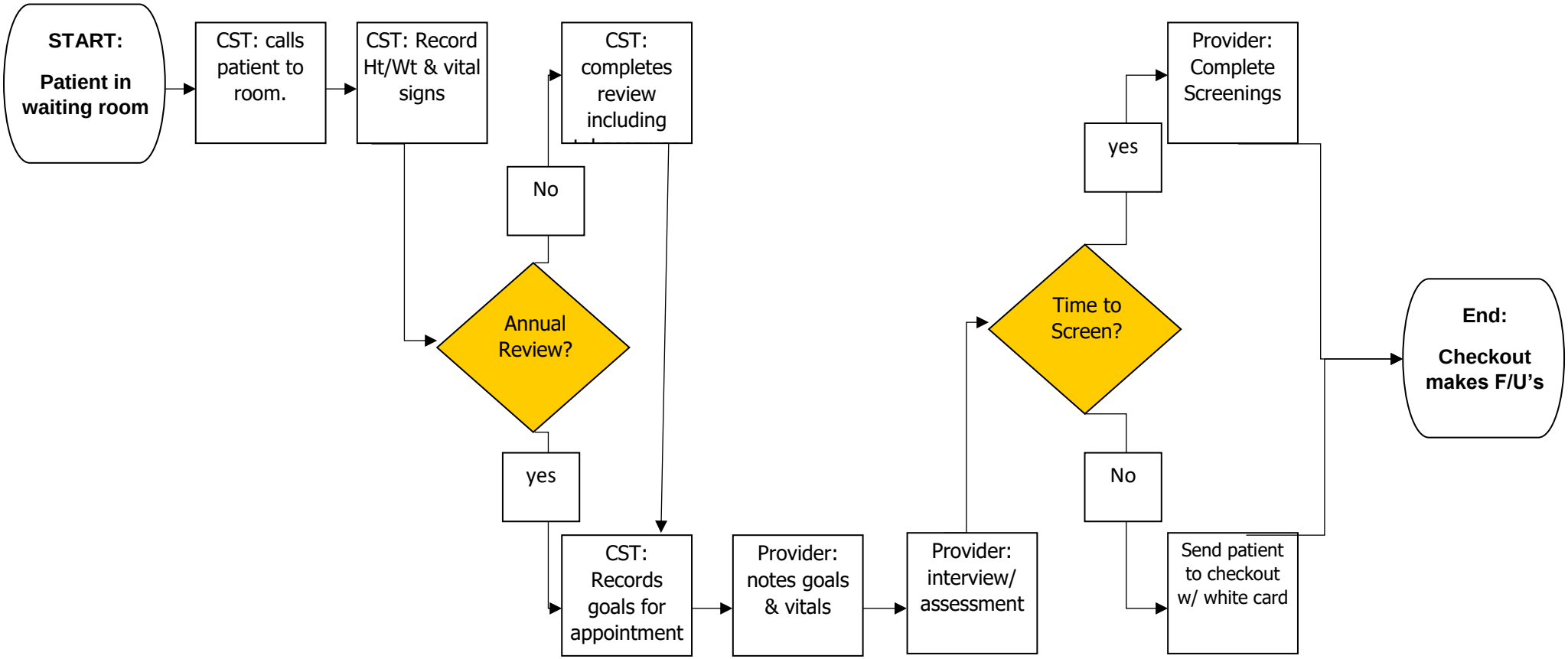

Figure 4. *Fishbone Diagram*

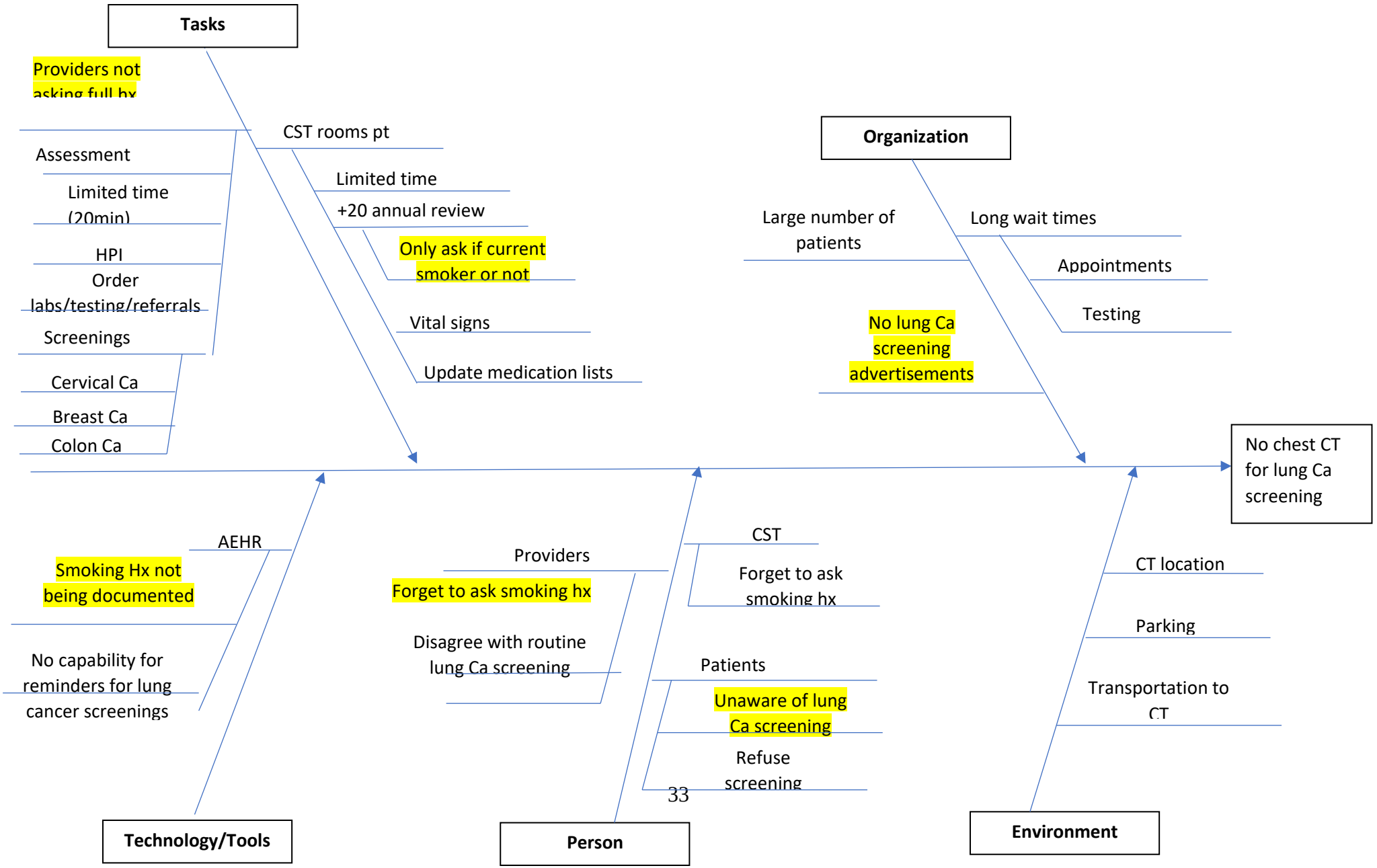

Figure 5. *Five Why's Chart*

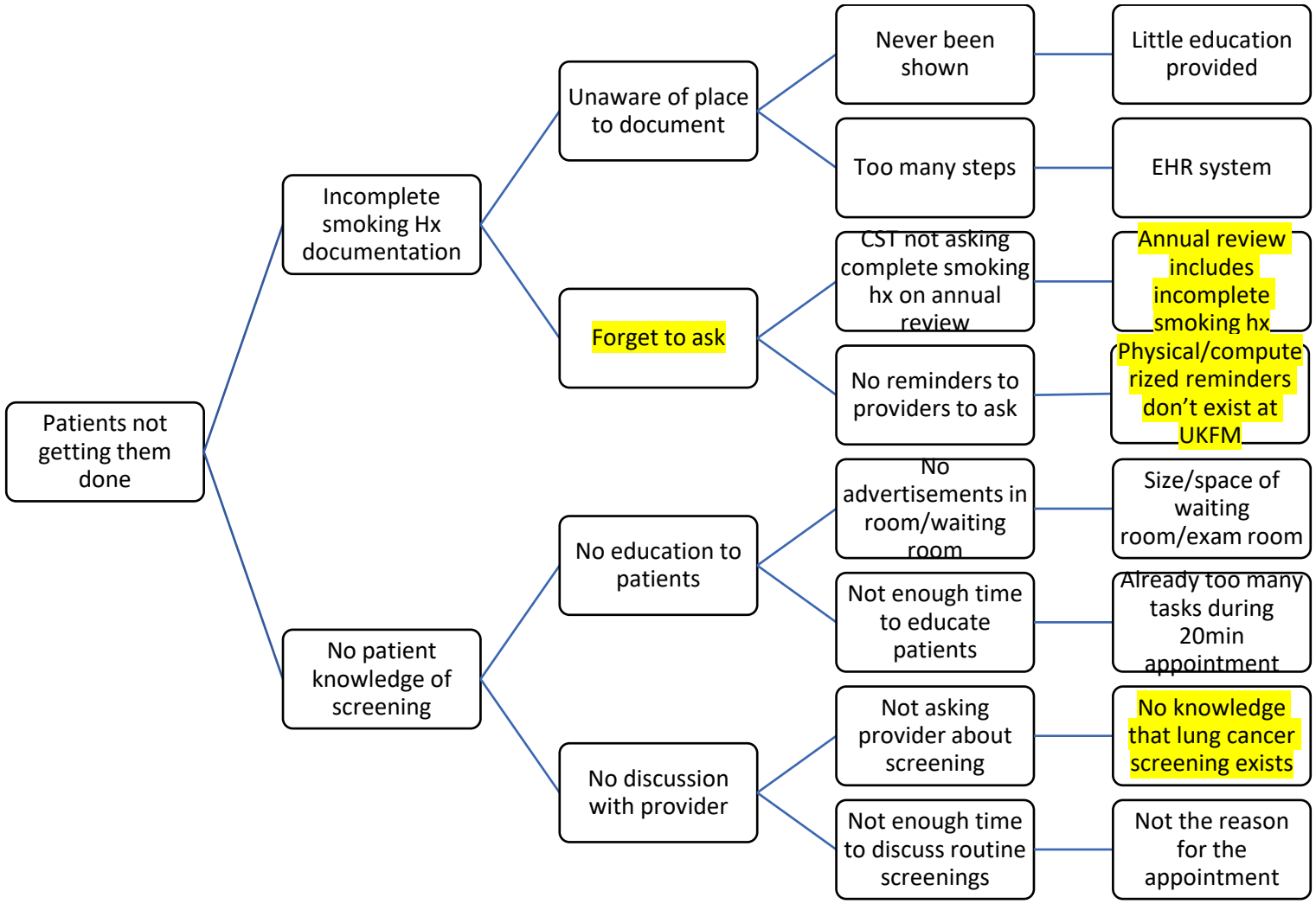

Figure 6. *Survey After Third PDSA Cycle*

How much time did it take to complete the smoking history	**Not enough time**	**The right amount of time**	**A little more time than I wanted**	**Too much time**
	Strongly Disagree	Disagree	Agree	Strongly Agree
It is important to get an accurate and up-to-date smoking history on all patients at every visit	0%	0%	66.7%	33.3%
It is important to ensure lung cancer screening is offered to all eligible patients	0%	0%	33.3%	66.7%
The lung cancer screening flyers were useful	0%	33.3%	0%	66.7%
The smoking history stickers were useful	0%	33.3%	0%	66.7%
The screening flyers should be implemented for the entire clinic	0%	33.3%	0%	66.7%
The smoking history stickers should be implemented for the entire clinic	0%	33.3%	0%	66.7%

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