Follow up of incidental pulmonary nodules on computed tomography pulmonary angiography

Darya Yermak, Narinder S. Paul, Kaveh G. Shojania, Peter Cram, Janice L. Kwan

CSIM Annual Meeting
October 27th, 2016

UHN Toronto General & Western Hospital Foundation

UNIVERSITY OF TORONTO

Background

- Computed tomography pulmonary angiography used for the diagnosis of pulmonary embolism often reveal incidental findings, such as pulmonary nodules.
- Although the majority of these nodules are benign, the Fleischner Society has developed guidelines that identify nodules that are at high-risk for being malignant and therefore, require follow-up imaging.
- At present, there is limited understanding of how frequently incidental pulmonary nodules are missed and/or overlooked by clinical care teams, particularly in the Canadian context.

Methods

- Retrospective cohort study
- **Inclusion criteria:**
  - All patients who had CTPAs ordered from the emergency department (ED), inpatient units, and outpatient clinics at Toronto General and Western Hospitals between September 1st, 2014 and August 31st, 2015

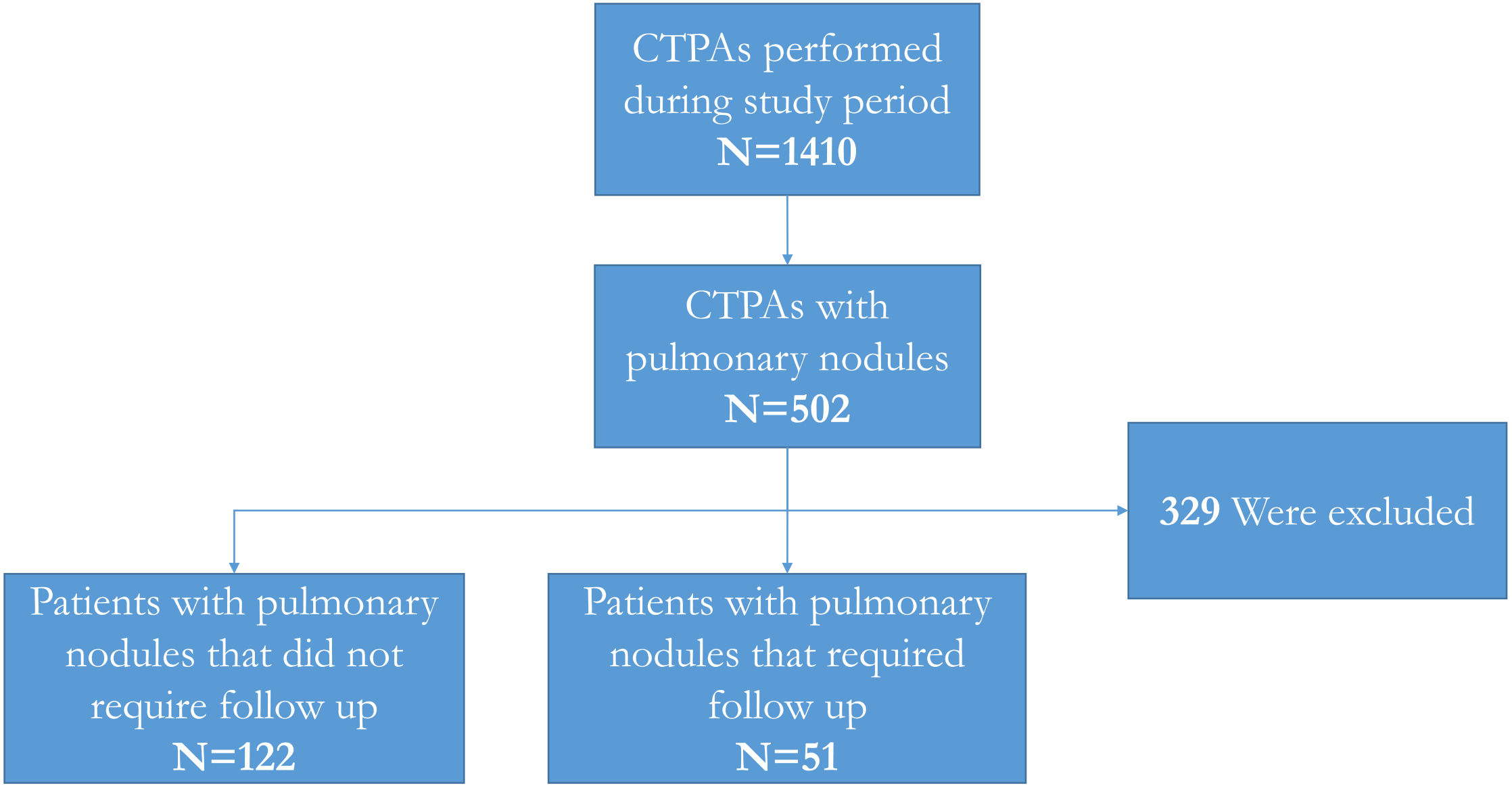
Methods

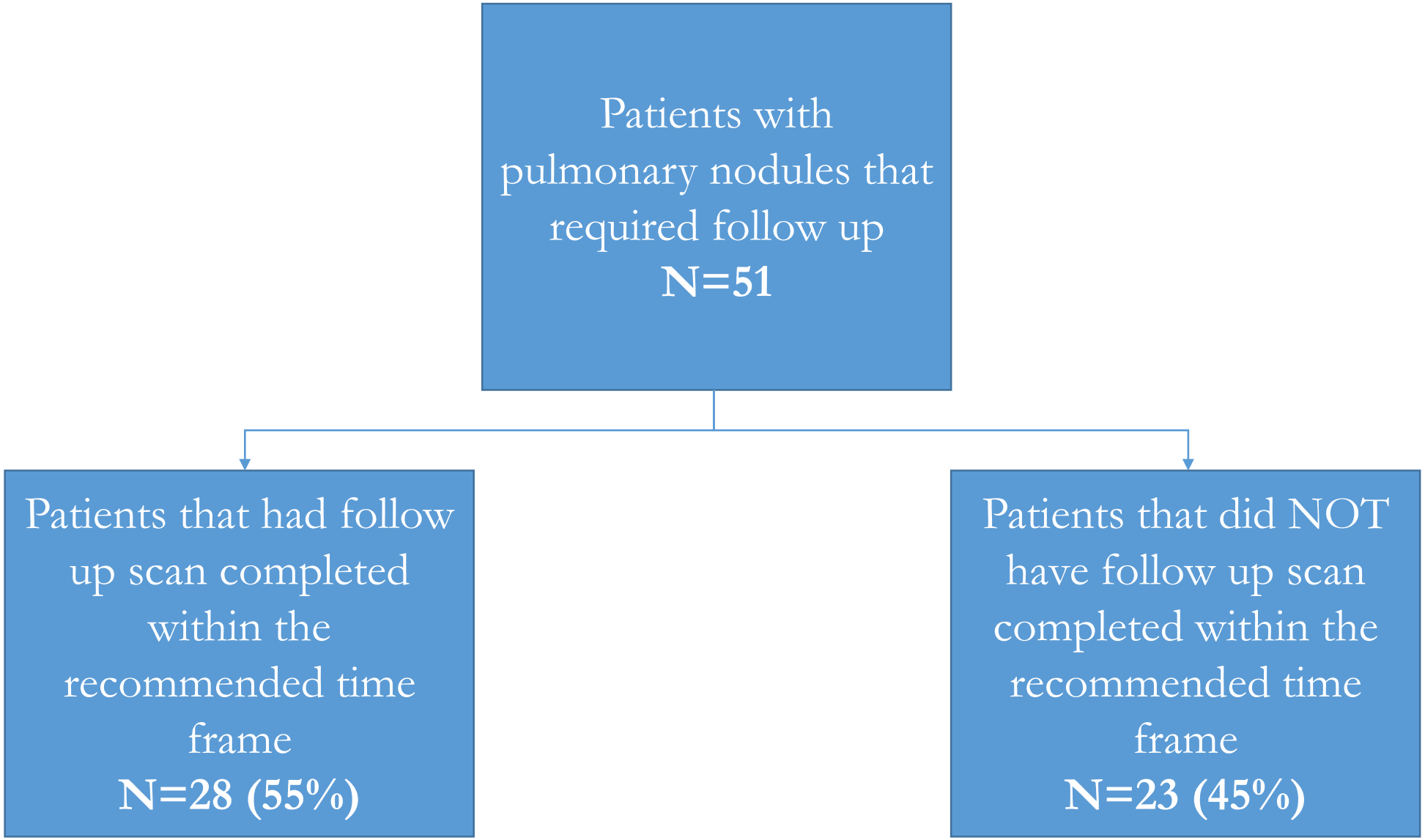
- **Exclusion criteria:**
  - Had nodules with characteristics suggestive of alternate diagnoses other than lung malignancy
  - Had an active malignancy
  - Lived outside of the Greater Toronto Area
  - Were identified as palliative
  - Died within the follow up period
  - Left against medical advice
  - Became critically ill during a follow up period

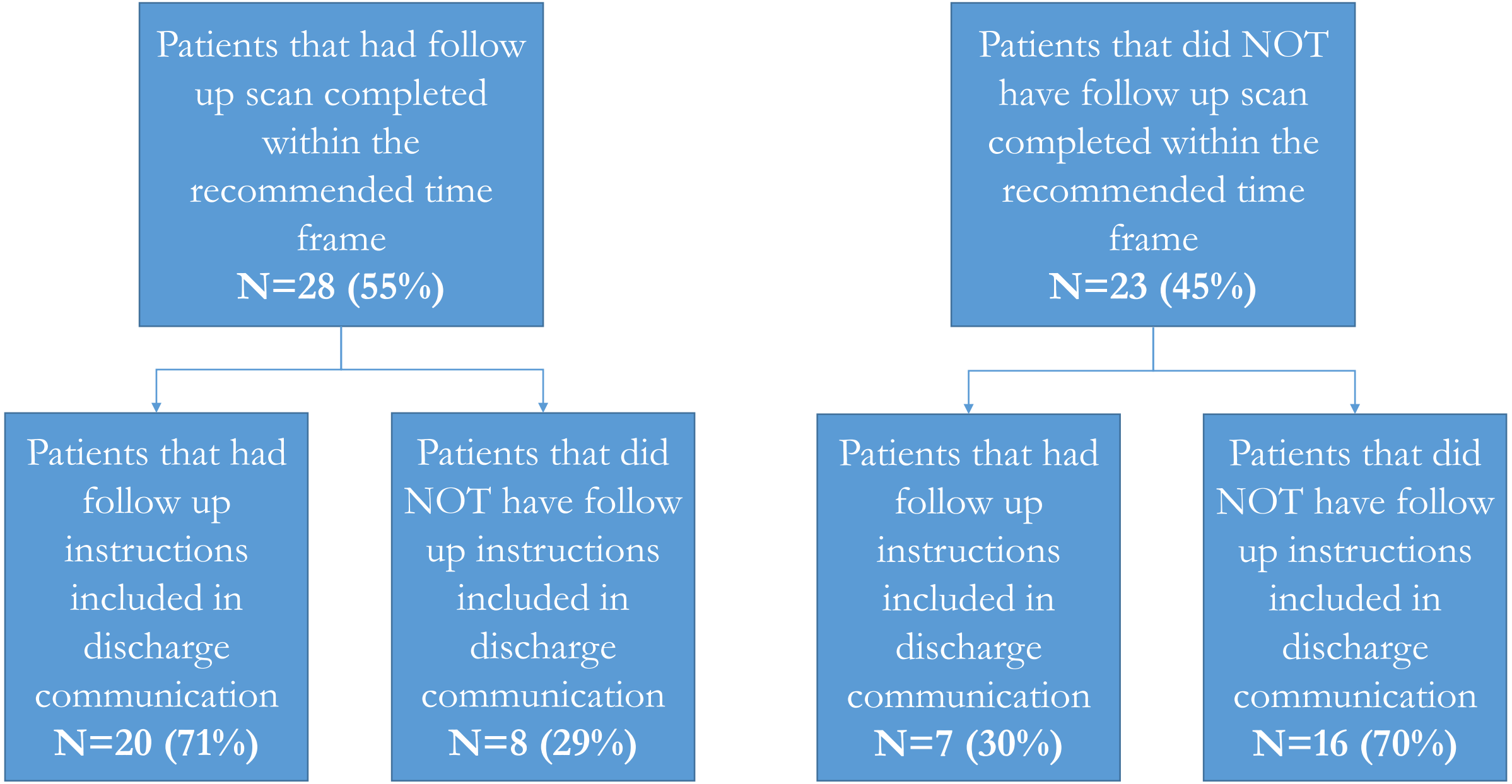
Methods

- **Primary outcome** was the proportion of CTPAs with nodules requiring follow-up that had follow-up scans completed within the suggested time frame.
- Nodules were deemed to require follow-up if explicitly stated in the radiology report.
- The relationship between categorical groups was determined using a chi-2 test.

Study flowchart and outcomes




Patients with pulmonary nodules that required follow up
N=51
Patients that had follow up scan completed within the recommended time frame
N=28 (55%)
Patients that did NOT have follow up scan completed within the recommended time frame
N=23 (45%)


Patients that had follow up scan completed within the recommended time frame
N=28 (55%)
Patients that had follow up instructions included in discharge communication
N=20 (71%)
Patients that did NOT have follow up instructions included in discharge communication
N=8 (29%)
Patients that did NOT have follow up scan completed within the recommended time frame
N=23 (45%)
Patients that had follow up instructions included in discharge communication
N=7 (30%)
Patients that did NOT have follow up instructions included in discharge communication
N=16 (70%)

Descriptive statistics by nodule follow up status

Characteristic	Patients with pulmonary nodules with follow up completed within recommended time frame	Patients with pulmonary nodules with follow up NOT completed within recommended time frame	P value
Variable	**n=28**	**n=23**	
Age (y), mean+/-SD	63.3 +/- 14.9	69.0 +/- 11.3	
Gender			0.92
Female	15 (53.6%)	12 (52.2%)	
Male	13 (46.4%)	11 (47.8%)	
Never smoked			0.24
Yes	6 (21.4%)	2 (8.7%)	
No	18 (64.3%)	14 (60.9%)	
Unknown	4 (14.3%)	7 (30.4%)	
COPD			0.57
Yes	10 (35.7%)	10 (43.5%)	
No	18 (64.3%)	13 (56.5%)	

Descriptive statistics by nodule follow up status

Characteristic	Patients with pulmonary nodules with follow up completed within recommended time frame	Patients with pulmonary nodules with follow up NOT completed within recommended time frame	P value
Lung nodule			0.34
Single	5 (17.9%)	2 (8.7%)	
Multiple	23 (82.1%)	21 (91.3%)	
Department			0.66
ED	12 (42.9%)	7 (30.4%)	
Inpatient	14 (50.0%)	14 (60.9%)	
Outpatient	2 (7.1%)	2 (8.7%)	
Hospital			0.92
TGH	15 (53.6%)	12 (52.2%)	
TWH	13 (46.4%)	11 (47.8%)	
Discharge instructions			0.0035
Yes	20 (71.4%)	7 (30.4%)	
No	8 (29.6%)	16 (69.6%)	

Discussion

- Only 55% of incidentally noted pulmonary nodules concerning for malignancy received appropriate follow up as recommended by radiology. The low rate of follow up may be due to several factors:
  - Lack of continuity of care between departments and health care professionals.
  - More active issues that brought a patient into the hospital getting appropriately prioritized, making follow up of incidental findings more easily missed.
  - Information overload for clinicians at all levels, making remembering follow up of an asymptomatic finding more challenging.

Discussion

- Including follow-up recommendations in the discharge communication was associated with increased rate of timely follow-up, highlighting that the discharge communication remains a vital link between tertiary care and primary health care provider.

Discussion

- **Limitations:**
  - Our study included only two hospitals, therefore, the findings may not be generalizable to other sites.
  - Follow up recommendations relied on radiologist's appropriate application of Fleischner Society guidelines.
  - Follow up scans performed outside the Greater Toronto Area (GTA) would not have been captured; we tried to overcome this by excluding patients living outside of the GTA.

References

- Blagev DP, Lloyd JF, Conner K, et al. Follow-up of incidental pulmonary nodules and the radiology report. *J Am Coll Radiol.* 2014; 11(4): 378–383.
- Graber ML. The incidence of diagnostic error in medicine. *BMJ Qual Saf.* 2013; 22: ii21–ii27.
- Singh H, Hirani K, Kadiyala H, et al. Characteristics and predictors of missed opportunities in lung cancer diagnosis: an electronic health record-based study. *Journal of Clinical Oncology.* 2013; 28(20): 3307-3315.
- Singh H, Thomas E, Mani S, et al. Timely follow-up of abnormal diagnostic imaging test results in an outpatient setting: are electronic medical records achieving their potential? *Arch Intern Med.* 2009; 169(17): 1578-1586.