Title: Novel Referral Pathway for Patients with New Solid Tumors Discharged from the Emergency Department: A Pilot Study

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Many patients with undiagnosed cancer have a preceding emergency department (ED) visit that has a workup concerning for cancer.[1] A diagnosis of cancer following an ED visit is associated with inferior patient-reported and clinical outcomes compared to patients that are diagnosed through routine screening.[1] Little prospective data exists describing the care for patients diagnosed with cancer from an ED visit.[1,2] Delays in time to treatment for new cancer diagnoses continue to increase, with absolute increased risk of mortality ranging from 1.2-3.2% per week in curative settings with various early-staged cancers.[3] Patients whose care was coordinated through their primary care physician experienced longer delays than patients who saw specialists directly, and in one analysis 29% of patients with lung cancer experienced a wait of 90 days or more.[4] Reasons for prolonged time to treatment are multifactorial, as delays can be experienced for tissue sampling, tumor board discussion, and staging.[5] It is currently unknown how the transitions of care from the ED impact these times.

Many patients are discharged from the ED with suspicious tumors however ensuring follow-up is usually left up to the individual ED physician. Diagnosing a possible cancer in the ED is stressful for patients and their families, meanwhile many patients are stable for ED discharge.[6] With a lack of an equitable and consistent approach to managing patients discharged from the ED with a suspicious mass, it stands to reason that many patients will experience delays in their cancer workup, which will be exacerbated by health disparities.[7,8] The frequency with which ED patients follow-up for suspicious tumors is unknown, nor has any research been performed to develop a consistent way to coordinate care for patients with likely cancer from the ED. This

work seeks to demonstrate feasibility for creating a model referral pathway for ED patients with a suspicious solid tumor who are stable for ED discharge.

With a large diversity of tumors that can be detected in the ED, ensuring a consistent way to manage patients with suspicions tumors is warranted. To address this need, at Eskenazi Hospital (>100k annual ED visits, safety-net hospital), we have created an accelerated care coordination pathway for those whose ED workups were suspicious for solid-tumor malignancies. Starting in December 2020, until May 2021, ED physicians were informed about a new outpatient referral order available in the electronic health record (EHR), called "Ambulatory Referral to E-oncology". Physicians were educated regarding the availability of this pathway via departmental e-mail. This pathway was intended for ED patients who have a newly identified lesion/mass/tumor, likely on radiographic images, but are clinically stable for outpatient discharge. This referral pathway was permitted to be used for any patient with a suspicious mass and was permitted to be used in lieu of or in addition to primary care or subspecialist referrals. Referrals for this pathway were reviewed by author AA (oncologist), and he reviewed the patient's case and coordinated the next steps of the expected patients care (order labs/imaging, refer to subspecialist, order biopsy, etc.). Then, depending on the subsequent tests or referrals made by author AA, the next steps of the patients' care, such as treatment were coordinated either by AA or subsequent referred subspecialist. Inappropriate consults were defined as patients that got admitted during that initial ED visit or for patients that already had biopsy-confirmed cancer.

This work is a retrospective chart review for patients that had an "Ambulatory Referral to E-oncology," and was exempted by the Indiana University Institutional Review Board (#2009005948). Cases were identified by the presence of the electronic referral being identified in the EHR. Deidentified data was abstracted from the EHR and imported to REDCap (Research Electronic Data Capture) by NP.[9] Baseline covariates were collected on all patients (age, gender, race, ethnicity, insurance status, social histories). The primary outcome from this cohort study was the number of biopsy-confirmed cancers determine among those referred to this pathway. Additionally, we described the cancer stage, mortality, physician that performed the biopsy to obtain a tissue sample, the time spent on the referral by the oncologist, days to E-consult, and

days to biopsy. Microsoft Excel statistical package was used for descriptive statistics. The 95% normal-approximated confidence intervals were calculated surrounding the sample proportions.

Table 1 presents the baseline demographic and outcomes data for this study. Overall, 28 patients over the 6 months had ED workups suspicious for cancer and were referred. The cohort is 42.9% female (12/28), with a median age of 55 years old. Most of the patients were white (64.3%, 18/28), with 35.7% being black (10/28), and 28.6% (8/28) identifying as ethnically Latinx. Eleven patients (39.3%) at the time of ED visit did not have insurance and were labeled as self-pay. Lastly, high rates of alcohol and tobacco use were observed with 57.1% (16/28) of patients reporting alcohol consumption, and 71.4% (20/28) reporting smoking tobacco.

After patients were discharged from the ED, the median days for the oncologist's review of the patient's case was 1 day and resulted in a median of 8 minutes per patients' case coordinating care. Patients were subsequently referred to a subspecialist (32.1%, 9/28), had an interventional radiology (IR) guided biopsy ordered (28.6%, 8/28), and 25% had advanced imaging ordered to further characterize the concerning mass (25%, 7/28). For patients that had biopsies performed (64.3%, 18/28), the median days to biopsy was 14 days, with IR performing most of the biopsies (55.6%, 10/18). Upon completion of the review of the patients' cases by the oncologist, it was determined that 3 referrals (10.7%) were inappropriate consults. Fifteen patients (53.5%) had biopsy proven cancer and had completed cancer staging, with 60.0% of patients being stage IV, and 7.1% (2/28) suffering mortality at time of chart review (30-day follow-up). Four patients (14.3%) were determined to not have malignancy after biopsy or advanced imaging (MRI). An additional 4 patients (14.3%) were lost to follow up, 2 of which that had received biopsy and were not cancer. The remainder of patients are under the care of subspecialists for either watch-and-wait (7/28, 25%) , or decided to not under-go biopsy (2/28, 7.1%) and instead just receive radiation therapy for likely lung cancer but are too high risk for biopsy.

To the author's knowledge, this is the first study to look at coordinating the care for patients with potential cancer from the ED. There exist no best practices or clinical guidelines for the management of suspicious masses in the emergency setting, instead ED physicians likely rely on clinical gestalt or systems processes on coordinating the care for these patients. This study

demonstrates feasibility for a care coordination pathway between the ED and oncologists, with 85.7% (24/28) of the patients having appropriate follow up after subsequent electronic medical record referral.

This study doesn't obviate the need for discussing care with subspecialists prior to discharge, especially for complex cases. However, this pathway safely (92.8%, 26/28 alive at follow up) transitioned patients to the next step in their cancer work-up without direct, in-the-moment communication with the outpatient team. Most of the patients had symptomatic metastatic cancer who need to be started on cancer directed therapy, and ensuring a rapid, expeditious, reliable pathway for a workup for undiagnosed cancer is needed. This pilot work suggests that emergency physicians and oncologists can build a rapid, virtual, and successful communication system whereby vulnerable and sick patients can have their care safely transitioned to the outpatient setting.

This pilot work has several limitations, with the first being that it was studying the implementation of a new referral pathway for patients with suspected cancer. First, given that NP performed all chart review, abstractor bias is a possibility, however all datapoints were objective in nature. Additionally, while it has been shown that time to treatment for patients with cancer for early-stage cancers is directly associated with a likelihood of cure, whether ED referrals reduce the time to biopsy and improve the time to treatment is uncertain.[3] Nonetheless, demonstrating feasibility of an outpatient referral pathway for ED patients with suspected cancer was the goal of this work, and with that goal, success was achieved. Additionally, ED physicians were invited to use this pathway for outpatient discharge, and thus we don't know the true rate at which patients are worked up for cancer and thus the true burden that this referral pathway would experience.

This work demonstrates feasibility for ED physicians to transition the care for patients with suspicious masses to the outpatient setting. Future work focusing on patient centered outcomes, such as mortality, will be explored. Additionally, novel interventions such as ED-observation unit-based biopsies could be arranged, especially for the most vulnerable patients, which is usually the largest hurdle toward cancer staging and definitive diagnosis.[10] In conclusion, this

work suggests ED physicians are efficient at identifying patients with likely cancer and thus needing expeditious biopsy. Additionally, this pilot work demonstrates that accelerated care coordination can be arranged through the EHR by ED physicians versus directly interfacing with outpatient providers.

Table 1. Baseline covariates and outcomes data for implementation of ED-cancer referral pathway for suspicious masses

	N = 28 (unless otherwise specified)	95% CI
Age (IQR)	55.0 (11)	
Gender (female)	12 (42.9%)	0.25-0.63
Race		
White	18 (64.3%)	0.44-0.81
Black	10 (35.7%)	0.19-0.56
Ethnicity (Latino)	8 (28.6%)	0.13-0.49
Self-pay insurance	11 (39.3%)	0.22-0.59
Alcohol Use	16 (57.1%)	0.37-0.76
Tobacco Use	20 (71.4%)	0.51-0.87
Days to consult (IQR)?	1 (1)	
Minutes spent managing E-referral (IQR)	8 (2.5)	
What did e-referral do?		
Refer to subspecialist	9 (32.1%)	0.16-0.52
Order IR guided biopsy	8 (28.6%)	0.13-0.49
Order imaging	7 (25%)	0.11-0.45
Refer to primary care physician	5 (17.9%)	0.06-0.37

Arrange oncology clinic appointment	4 (14.3%)	0.04-0.33
Order labs	2 (7.1%)	0.008-0.24
Present at tumor board	1 (3.6%)	0.001-0.18
Did patient get a biopsy? -yes	18 (72%)	0.51-0.88
Days to biopsy (IQR)?	14 (14.5)	
Appropriate Consult? -No	3 (10.7%)	0.04-0.27
Stage (n =15)		
I	2 (13.3%)	0.04-0.38
II	2 (13.3%)	0.04-0.38
III	2 (13.3%)	0.04-0.38
IV	9 (60.0%)	0.36-0.80
Not cancer	4 (14.3%)	0.06-0.32
Mortality - deceased	2 (7.1%)	0.02-0.23
Lost to follow up	4 (14.3%)	0.06-0.31

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