Adoption, Sustainability, and Safety of an Outpatient Management Pathway for Acute, Low-Risk Pulmonary Embolism

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BACKGROUND/OBJECTIVE

- Outpatient management of low-risk pulmonary embolism (PE) is supported by robust safety data from multiple clinical trials[1] and guideline recommendations from nearly all relevant professional organizations[2]
- Nonetheless, adoption by Emergency Department (ED) providers has been modest, with multiple recent studies indicating that most PE patients are still being hospitalized, even when they meet widely accepted low-risk criteria[3,4]
- Most prior efforts to implement practice change have achieved only modest success[5,6,7,8], leading to our **central hypothesis** – that engaging stakeholders to identify local barriers to practice change and leveraging formal implementation science frameworks will result in greater adoption, maintenance, and generalizability of an outpatient management pathway
- Our **objective** was to assess the key outcomes (adoption, implementation, sustainability, and safety) of an outpatient management pathway for low-risk PE patients during 12-month "implementation" and "post-implementation" periods

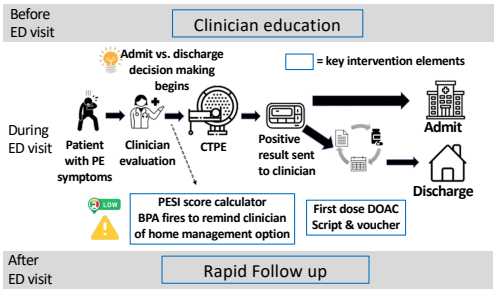
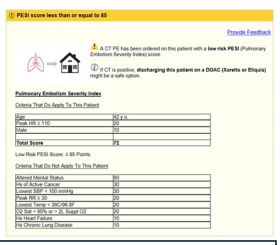


Figure 1. Schematic of the four-component intervention: 1. Providers were educated via a series of presentations at EM faculty meeting, residency conference, etc., **2.** A BPA (see screenshot to the right) was used to "nudge" providers when ordering a CTPE on a patient with a low-risk PESI score, **3.** a smart set facilitated ordering of the first dose of DOAC and a script with voucher to ensure coverage and lack of co-pay, and 4. a rapid access clinic was set up to ensure follow up appointments within 7-10 days.



METHODS

- To define barriers to outpatient management of low-risk PE, we conducted structured interviews with ED attendings, residents, and physician assistants
- Based on common themes, we designed a **four-component intervention** (**Fig 1**):
  1. **Clinician education**
  2. A **"nudge"** – i.e., best practice alert – based on an automated PESI-score calculator embedded in the EMR
  3. A **smart order set** including first dose of DOAC, DOAC script, and voucher to ensure 30-days of free medication
  4. Dedicated **outpatient follow up** at the Frankel Cardiovascular Center (CVC) within 7-10 days of the ED visit
- The intervention was developed at a single site, tertiary academic medical center over a 12-month **"implementation period"**, then actively promoted and supported during a 12-month **"post-implementation period"**, followed by a 12-month **"maintenance period"**, during which the pathway elements were left in place, but no longer actively promoted or supported by the implementation team
- **Outcomes**:
  - **Adoption** – the proportion of low-risk PE patients (PESI ≤ 85) discharged from the ED during implementation & post-implementation periods
  - **Maintenance** - % discharge during the maintenance period
  - **Appropriateness** – proportion of low-risk PE admissions in which hospitalization justified
  - **Implementation** -the use of various pathway elements and
  - **Safety** – return to ED within 30 days, bleeding complications, recurrent venous thromboembolism (VTE), and death. Outcomes based on search of Care Everywhere and MiHIN databases.
- **Statistics:** Student's t-test (continuous variables) or Fisher's exact test (categorical variables) with post hoc pairwise comparisons

ADOPTION & MAINTENANCE

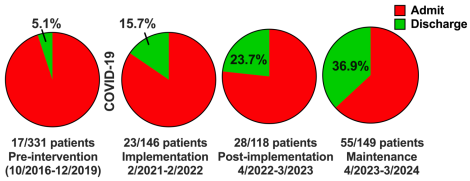


Figure 2. Adoption and maintenance of the outpatient management pathway. Prior to intervention, only ~5% of acute PE patients with PESI ≤ 85 were managed as outpatients. This increased approximately 3-fold to 15.7% (p<0.001) during the implementation year, during which structured interviews were conducted and the 4-component intervention was designed. Outpatient management continued to increase over the next two years, with the highest proportion, 36.9%, seen in the maintenance year (p<0.05 vs. all other time periods). The period between 1/2020 and 3/2021 was not analyzed due to concerns that practice patterns may have been different during the early months of the COVID-19 pandemic.

APPROPRIATENESS

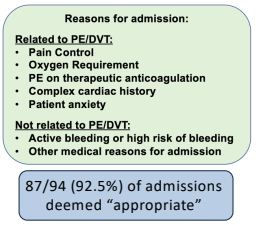


Figure 3. Analysis of low-risk PE admissions. Each low-risk PE case admitted during the maintenance period was reviewed by two ED physicians and judged on the need for hospitalization. In > 90% of cases, both reviewers agreed that admission was appropriate. As shown, the most common reasons were presence of Hestia criteria.

IMPLEMENTATION

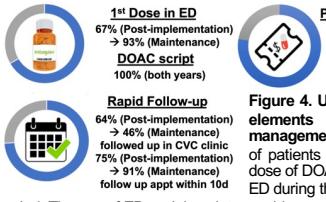


Figure 4. Use of the individual elements of the outpatient management pathway. >90% of patients received both a first dose of DOAC and a script in the ED during the maintenance period. The use of ED social work to provide prescription assistance (a voucher for 1 month of free meds) declined significantly from 75% (21/28 patients) to 46% (26/55), p<0.01, reflecting less uncertainty re: medication coverage. Likewise, use of the CVC follow up clinic declined from 64% (18/28) to 46% (26/55), p=0.34, although there was an increase in the proportion of patients who had a follow up visit within 10 days, from 75% (21/28) to 91% (50/55), p<0.05.

SAFETY

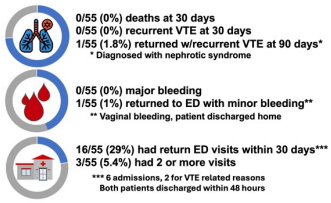


Figure 5. Safety outcomes. Similar to prior studies[8], the 55 low-risk patients discharged from the ED had during the maintenance period had relatively few complications, with no mortality or recurrent VTE, no episodes of major bleeding, and only 2 readmissions for VTE related issues, despite a relatively high rate (~30%) of 30 day return visit to the ED. One patient, who had a recurrent PE within 90 days, was subsequently diagnosed with nephrotic syndrome, the presumed cause of his DOAC failure. One patient returned with minor bleeding but was subsequently discharged.

CONCLUSIONS

- A four-component intervention, designed using insights from structured interviews with ED providers, significantly increased outpatient management in patients with acute PE with low-risk PESI scores
- Outpatient management was not only sustained, but actually increased significantly during the maintenance period
- Most pathway elements were highly utilized
- Outpatient management was overall safe, but nearly 30% of discharged patients returned to the ED within 30 days. Only 2 patients were readmitted for reasons related to their initial PE or associated DVT.

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