Department of Emergency Medicine

Safe Emergency Management of Acute Ischemic Stroke: An Academic Community Hospital Decade Experience

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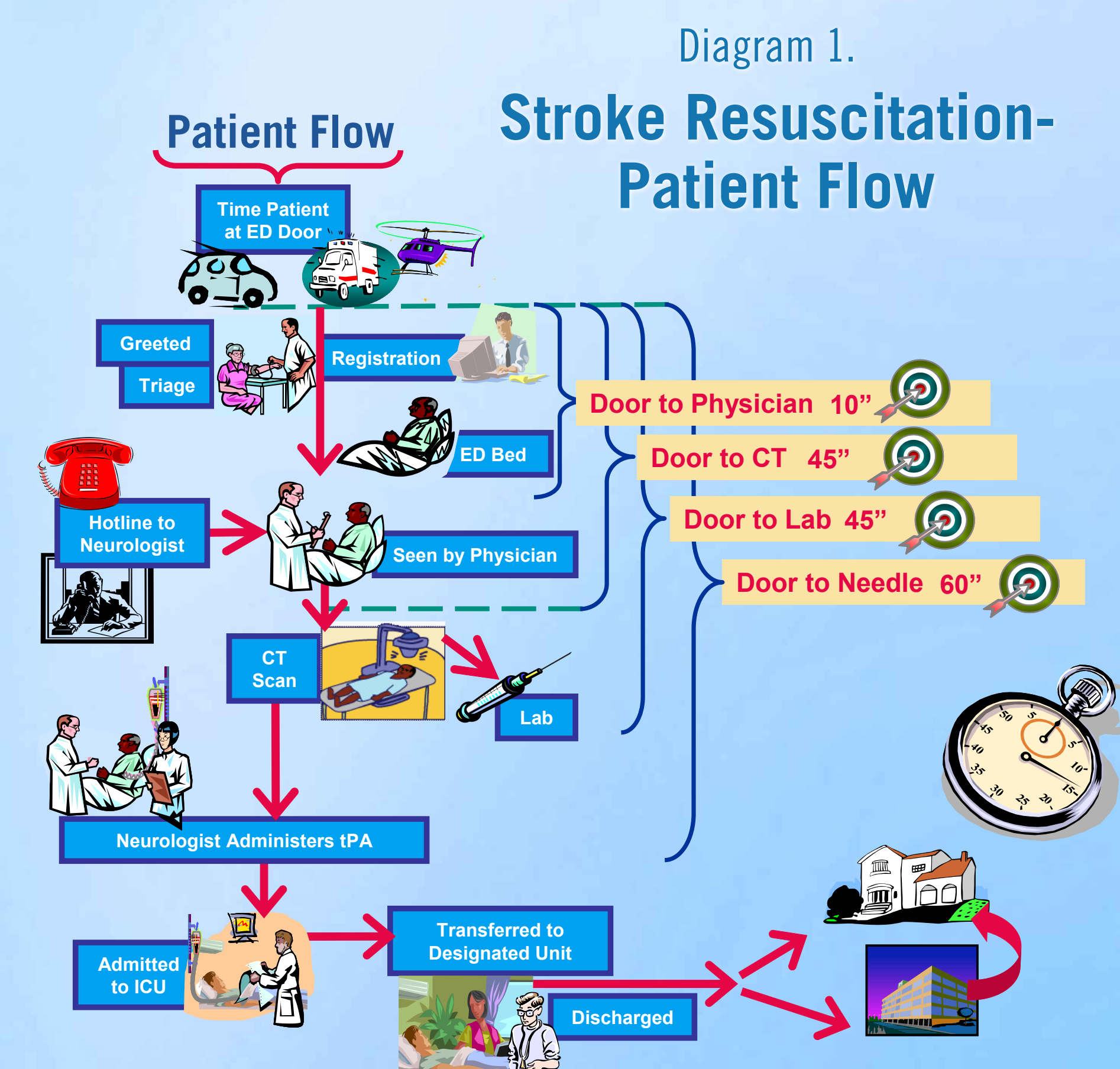Lehigh Valley Health Network, Allentown, Pennsylvania

Background

- Team based early reperfusion therapy has been shown to be efficacious in a selected subset of patients reducing long-term death and disability from acute ischemic stroke
- Less than 2% receive drug nationally because of care delivery system barriers
- Stroke care delivery models hinge on Emergency Physician response to presenting brain insults
- We created an effective stroke team by developing partnerships between ED, Neurology, & Neuroradiology physicians which improved the initiation of reperfusion therapy

Methods

- Stroke care protocols developed in 1998 (refined in 2000)
- Defined roles were established (Table 1)
- Emergency Physicians identified patients for potential reperfusion therapy (Diagram 1)
- The neurologist, available 24/7 by cell phone, would respond and direct the reperfusion intervention at the bedside
- Monitoring:
  - Oversight by a dedicated stroke coordinator
  - Monthly meetings: focused process improvement projects, and ongoing data monitoring supported system improvements
  - Ongoing staff education and training

Table 1. Partners in Care

Department	Roles
Emergency Medicine Physician	Triage patient, Initiate work-up, call Nuerospecialist
Radiology	Neuro imaging / rapid CT read
Nursing	Monitor neuro/vs, lines, foley, diagnostics
Pharmacy	Prepare and delivery tPA
Lab	Rapid processing of CBC, Chem 7, Coag Profile
Neurosurgery	Surgical evaluation for hemorrhagic stroke
Interventional Radiology	Reperfusion Therapy, diagnostic angiogram
Medical Director	Physician champion clinical oversight, strategic planning
Stroke Nurse Coordinator	Oversight of clinical coordination of care, regulatory compliance
Stroke Data Nurse	Abstract and analyze data, trend core measures

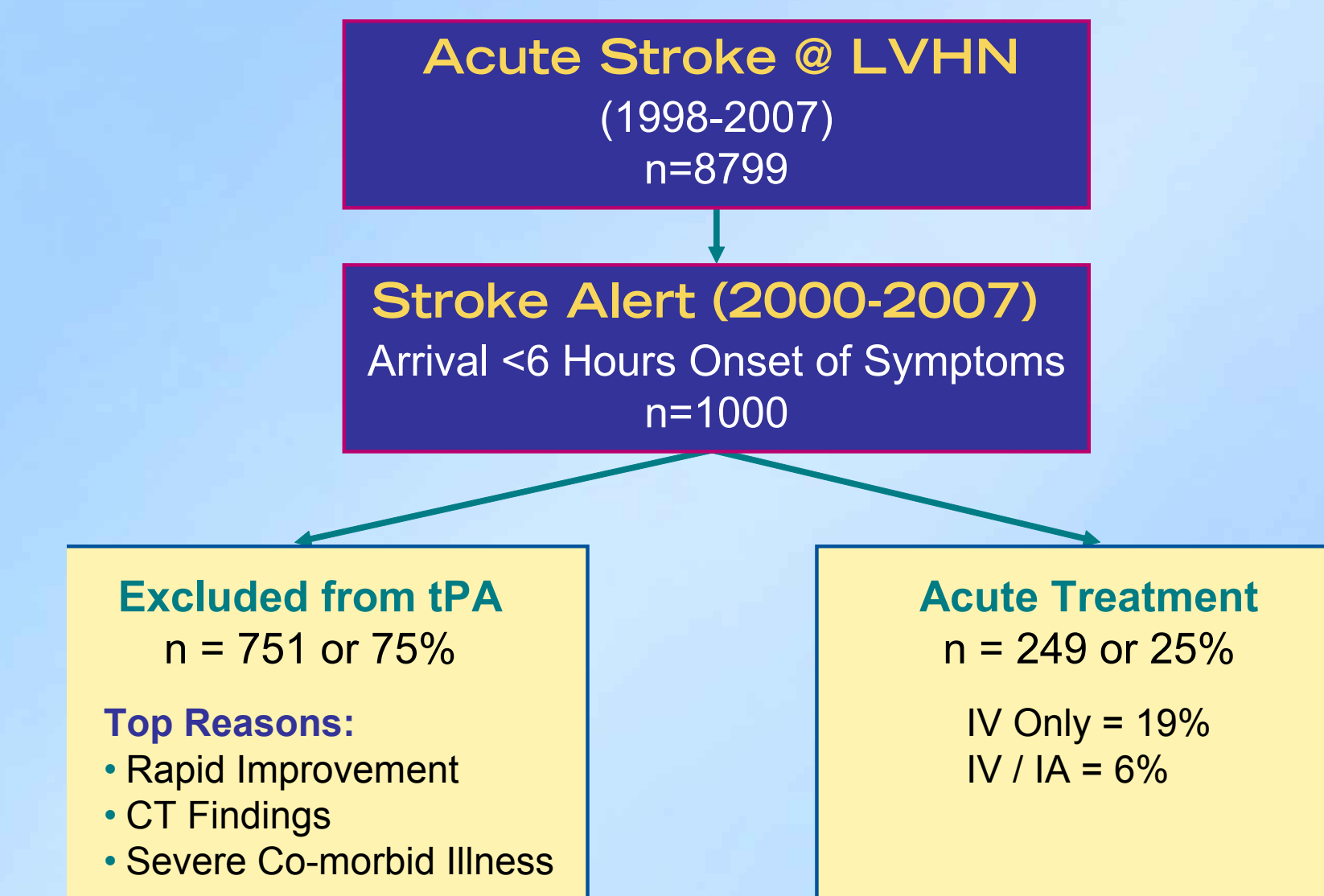## Results

Figure 1. Acute Stroke Decade Experience

Acute Stroke @ LVHN (1998-2007) n=8799
Stroke Alert (2000-2007) Arrival <6 Hours Onset of Symptoms n=1000

Excluded from tPA n = 751 or 75%
Top Reasons:
- Rapid Improvement
- CT Findings
- Severe Co-morbid Illness

Acute Treatment n = 249 or 25%
IV Only = 19%
IV / IA = 6%

Table 2. NINDS BAC Targets

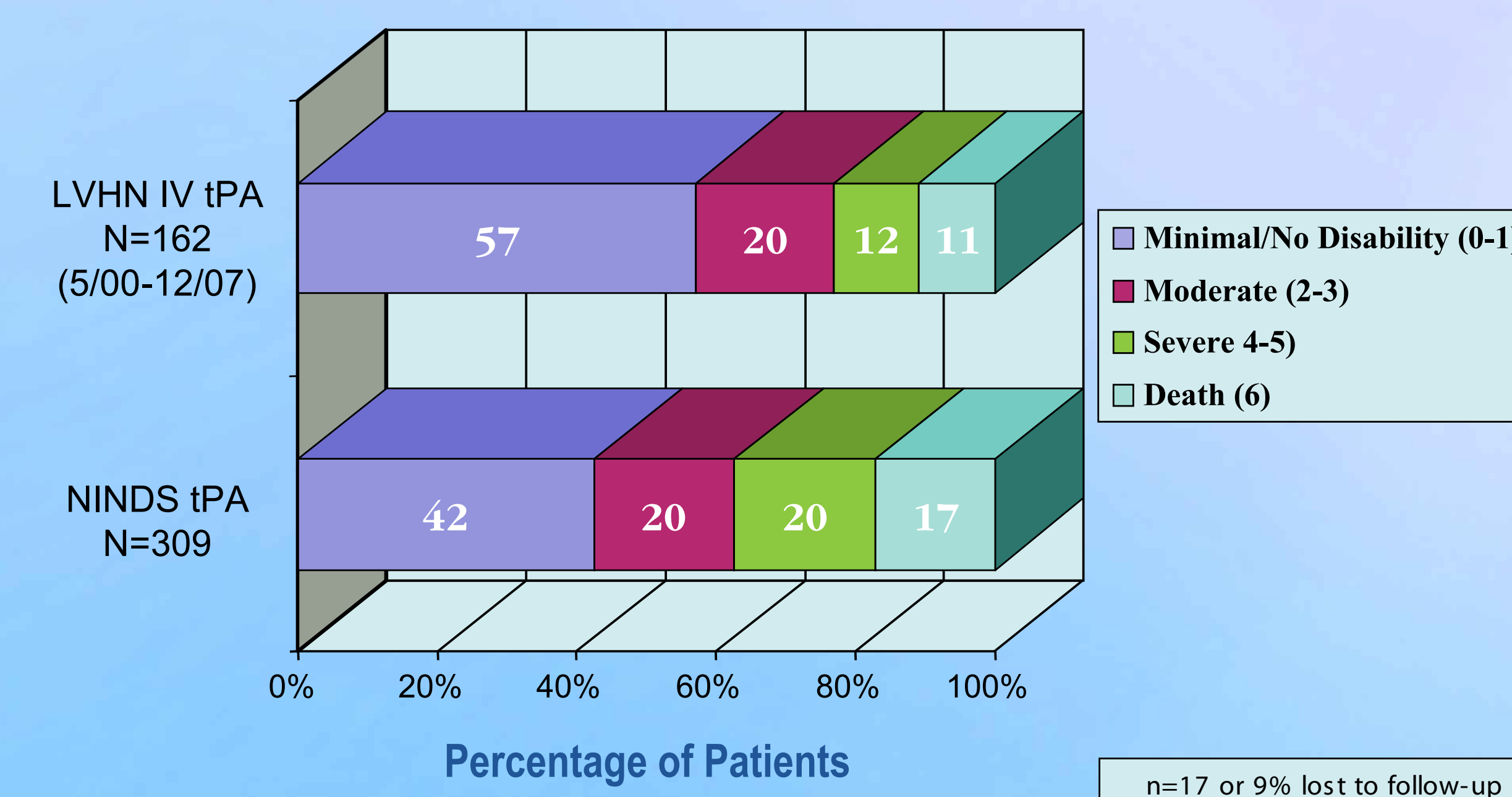| IV Intervention Group	Mean	Median
Age (25-89 yrs)	72	68
NIHSS (3-31)	12	11
Door to MD (0-85 min)	7	5
Door to CT Scan (0-113 min)	27	22
Door to Drug (35-165 min)	89	85

Figure 2. IV tPA Utilization (1996-2007)
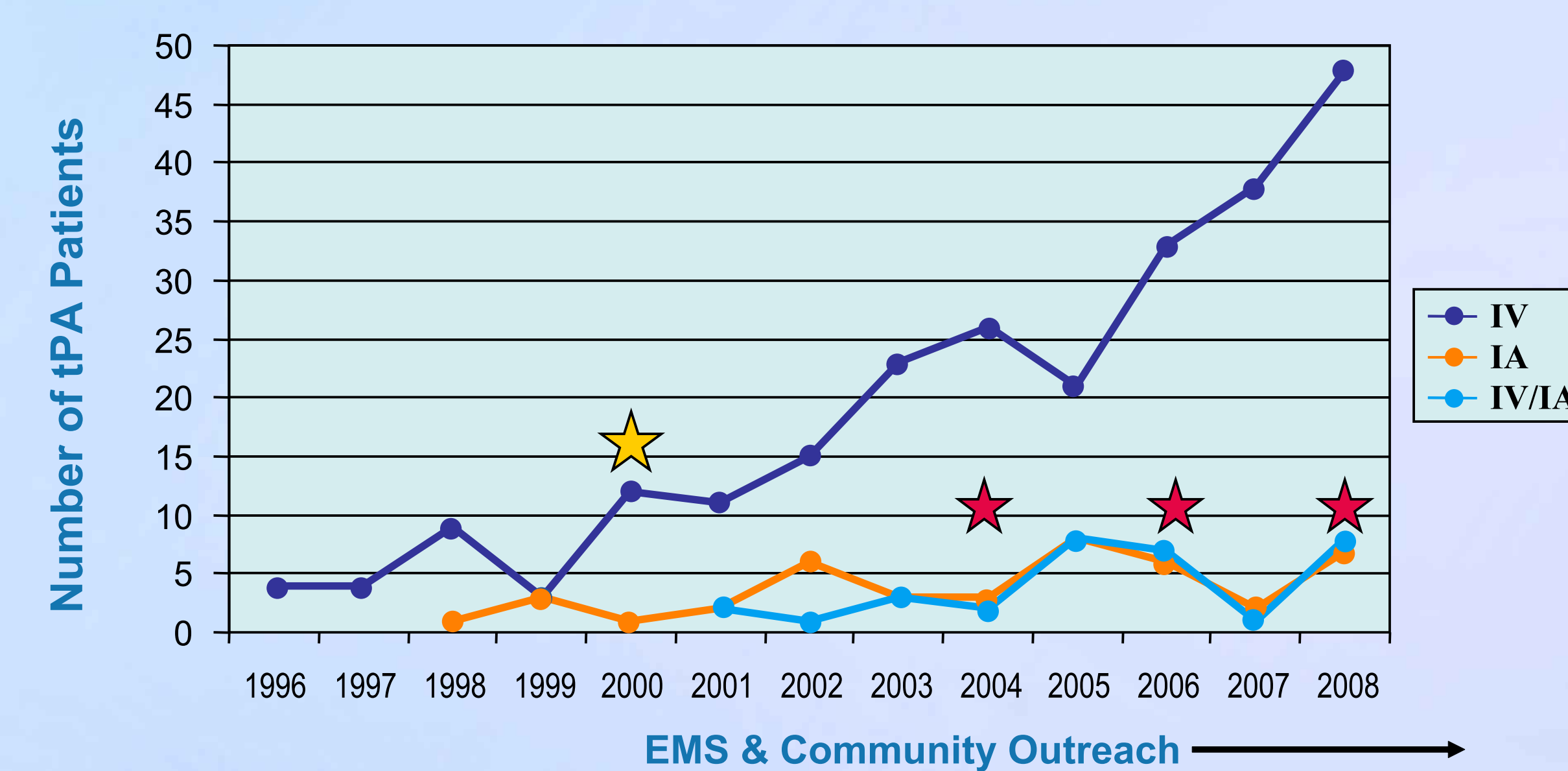
Key Interventions — Start of Stroke Alert / JC Primary Stroke Certification 2004-06-08

Take Away: Stroke Center interventions support accelerated growth of tPA use at LVHN

Diagram 1. Stroke Resuscitation- Patient Flow

Patient Flow

Door to Physician 10"
Door to CT 45"
Door to Lab 45"
Door to Needle 60"

Figure 3. Modified Rankin Scale at 90 Days

| | Minimal/No Disability (0-1) | Moderate (2-3) | Severe 4-5) | Death (6) |

LVHN IV tPA N=162 (5/00-12/07): 57, 20, 12, 11
NINDS tPA N=309: 42, 20, 20, 17

n=17 or 9% lost to follow-up

Discussion

- Improving Access to Intervention:
  - Since implementation, 25% of patients arriving <6 hours from symptom onset received an acute intervention
- Process Improvement:
  - Expediting & standardizing care promotes timely reperfusion (Table 3)
  - An ED-driven protocol is both feasible, effective, and sustainable
  - Strategically developing clinical partnerships facilitates lasting changes that impact patient care
  - Strict adherence to protocol is possible with standardized screening for tPA eligibility
- Outcomes:
  - 3% SICH in IV treated with a 6% AICH rate (Table 4)
  - 90 day mortality of 11% (Figure 3)
  - Due to small number of patients with SICH after tPA in study (n=5) ability to draw strong conclusions is limited

Table 3. Reengineering ED Care Processes

Focus of Improvement	Tools Developed
Onset of Stroke Symptoms	Regional EMS Checklist
Triage of Acute Stroke	Triage Guideline (ESI 2), Stroke Team Page
Rapid Registration	Use of pre-registered ID bands
Access to Neurology	Dedicated cell phone, 24/7 availability
Access to Neuroimaging	CT included in Stroke Team Page, rapid MRI available, 24/7, PACS
Laboratory Turnaround	POC-blood sugar, translogic tube/special stat labeling
Staff Education	Stroke Competencies-yearly, 8 hours RN, Clinical support from Stroke Coordinator
ED Resources	Easy access to protocol packets, Electronic Orders/PACS
Outcome Data	Stroke Alert Log, Stroke Performance Dashboard, GTWG
Feedback	Monthly report at ED PI committee, multidisciplinary monthly stroke team meetings
Standardizing Practice	Evidenced based ordersets, CAPOE, written clinical practice guidelines, NIHSS
Dedicated Stroke Center Resources	Stroke Coordinator, Stroke Data Nurse, Medical Director
EMS Training	Ongoing EMS outreach - Acute Stroke Class
Regional Access	Transfer Center 24/7 for inter facility transfers, 4 helicopters, Remote ICU monitored board certified Critical Care Intensivist
ICH Process	Neuro Critical Alert, rapid transfer and acceptance, focus on reversal of coagulopathy

Table 4. Analysis of IV tPA Treated

Characteristics of IV Treated (n=191)	Non Hemorrhage	SICH n=5 or 3%	AICH n=15 or 6%
Age (mean)	68	72	64
Female (%)	46%	40%	30%
Baseline NIHSS (mean)	12	11	15
Baseline (NIHSS >20	8%	20%	10%
Glucose <50 mg/dL or >400 mg/dL	1%	0	0
Platelet count <100,000	1%	0	0
PT>15 sec; INR>1.7	7%	0	13%*
Last pretreatment sBP>185mmHg	4%	0	0
Last pretreatment dBP>110mmHg	0	0	0
tPA dose > 0.9 mg/kg	0	0	0
tPA initiated > 3 hours from stroke ictus	0	0	0
Heparin use within 24 hours from tPA	0	0	0
Patients with any protocol violations	10%	0	13%*
D/C to rehab/Home	83%	40%	80%
In hospital Mortality	10%	60%	20%

* Coag studies not back at start of tPA

Conclusion

- Consistent and sustained safe utilization of IV t-PA over 10 year period is achievable with a protocol driven team approach at a community hospital Emergency Department
- Emergency Physicians can partner with Neurologists in evaluating and co-managing the resuscitation of stroke patients, screening for reperfusion therapies and thereby safely reducing delays in drug administration

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