



Evaluating the Effectiveness of Split-Flow Models in Reducing Emergency Department Overcrowding: Insights from a Benchmark Analysis of 39 Italian EDs

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	Public Independent Trusts	Local Health Authority	Private Hospitals	Total
N.	5	18	4	27
%	18%	67%	15%	100%

Types of ED

	DEA I Livello	DEA II Livello	PS	Totale
N.	20	14	5	39
%	51%	36%	13%	100%

Agenda

- ✓ Data outlook
- ✓ Statistical analysis

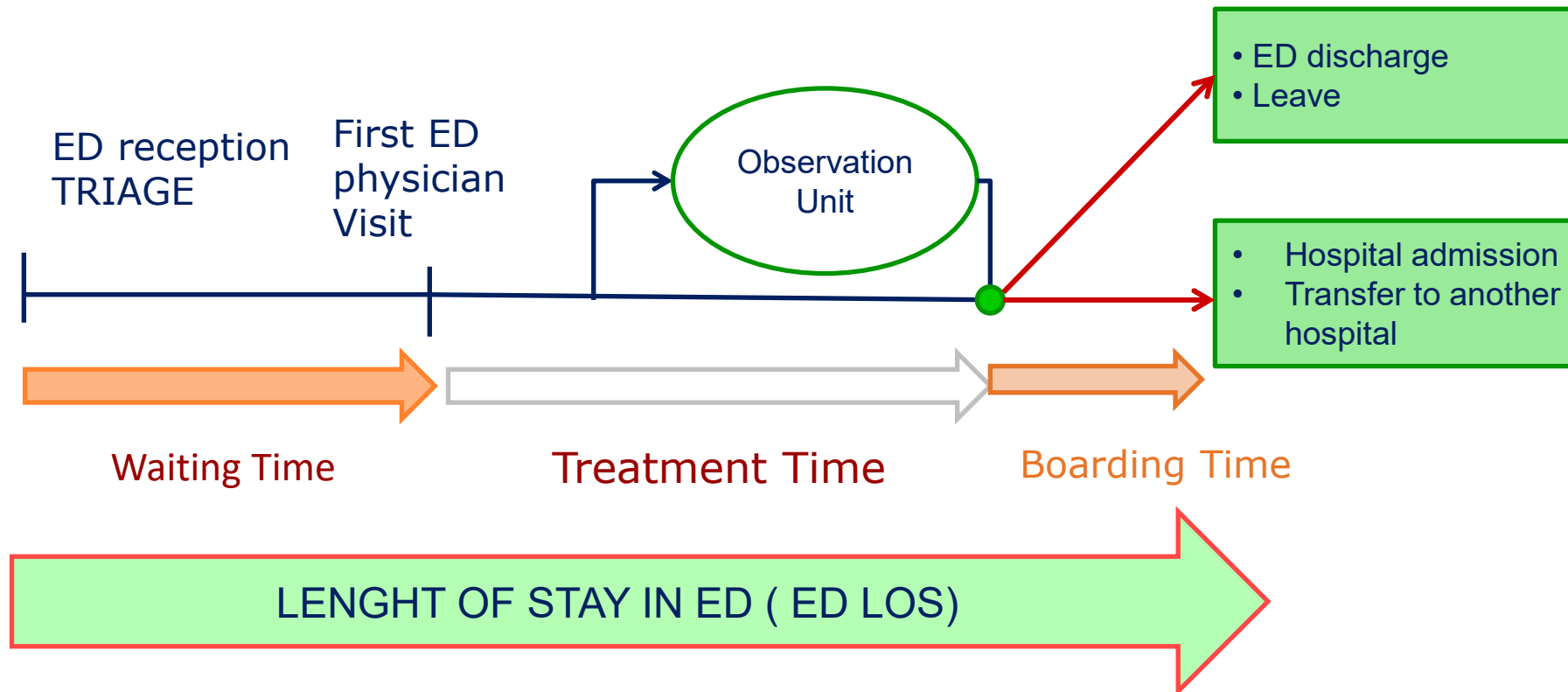
Methodology

- ✓ Data analysis
 - ➔ Source: data flow routinely transmitted by each emergency facility to the Italian Ministry of Health (EMUR-PS).
- ✓ Survey consisted of 39 dichotomous (yes/no) questions grouped into four thematic sections:
 1. General information on the facility and staffing;
 2. Management of patient flow within the ED, with a focus on the implementation of split-flow models;
 3. Management of hospital admissions originating from the ED (i.e., coordination between ED and inpatient departments);
 4. Information and communication flow systems.

Statistical analysis

- ✓ Student's T-test and Chi-square tests were run to study the possible association between ED performance indicators and the use of “split-flow” models.
- ✓ Specifically, we tested the associations between:
 - ➔ presence of an external first-aid point nearby the facility and proportion of non-urgent (white-code) cases,
 - ➔ presence of an ambulatory care unit dedicated to minor codes within the ED and median length of stay of non-urgent (white-code) arrivals
 - ➔ Adoption of fast track model and ED length of stay
 - ➔ adoption of models for the management of elderly patients and average ED length of stay

Patient flow in Emergency Department (ED)



The situation of EDs analyzed in a snapshot

INPUT / DEMAND

INTERNAL PROCESSES

OUTPUT

The ED fulfills a function of necessity-based medicine

There is variability in ED LOS

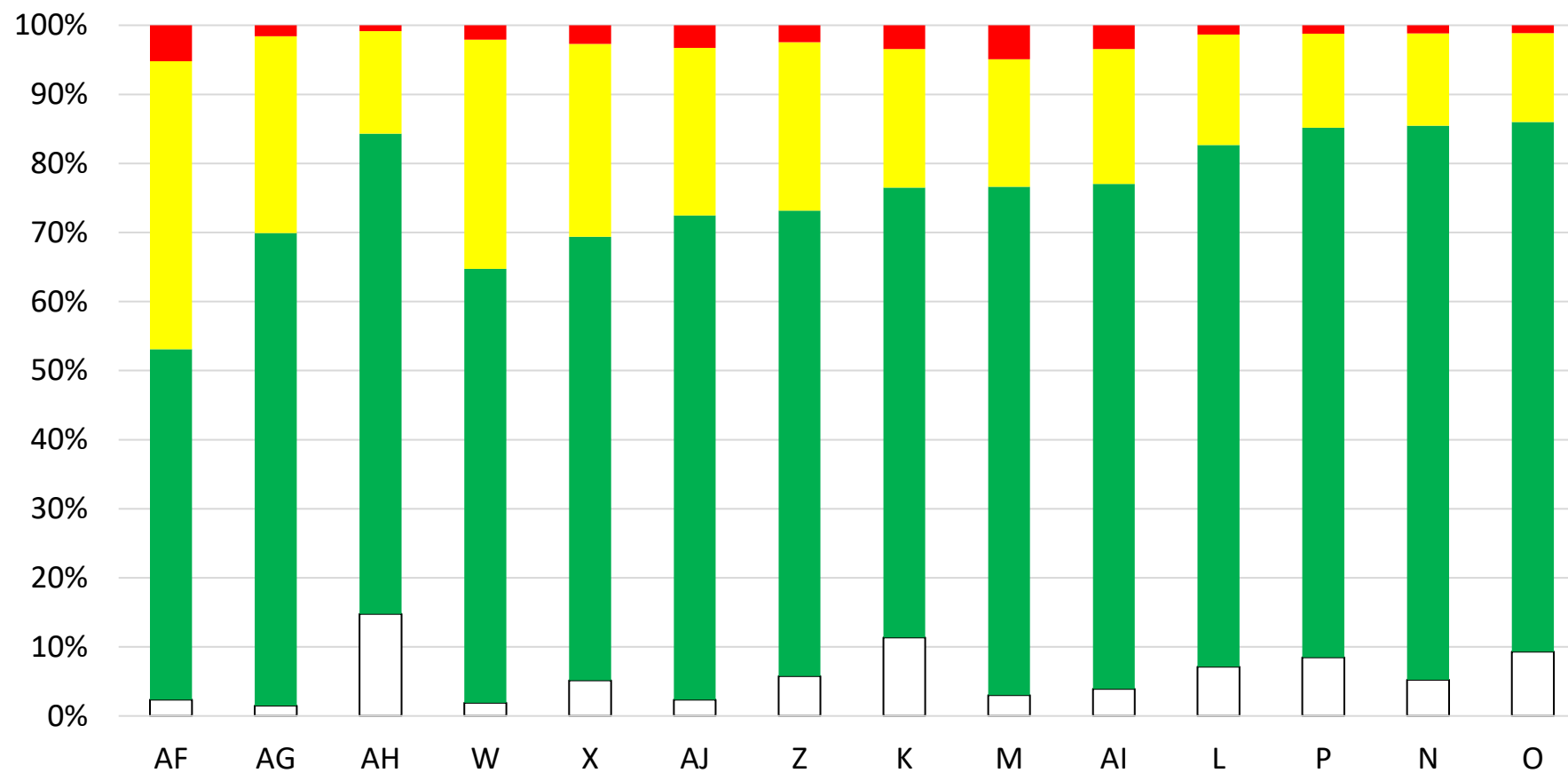
Boarding

Well-known variability in number of arrivals:

- (i) Peak on Mondays
- (ii) Peak from 9.00 to 10.00

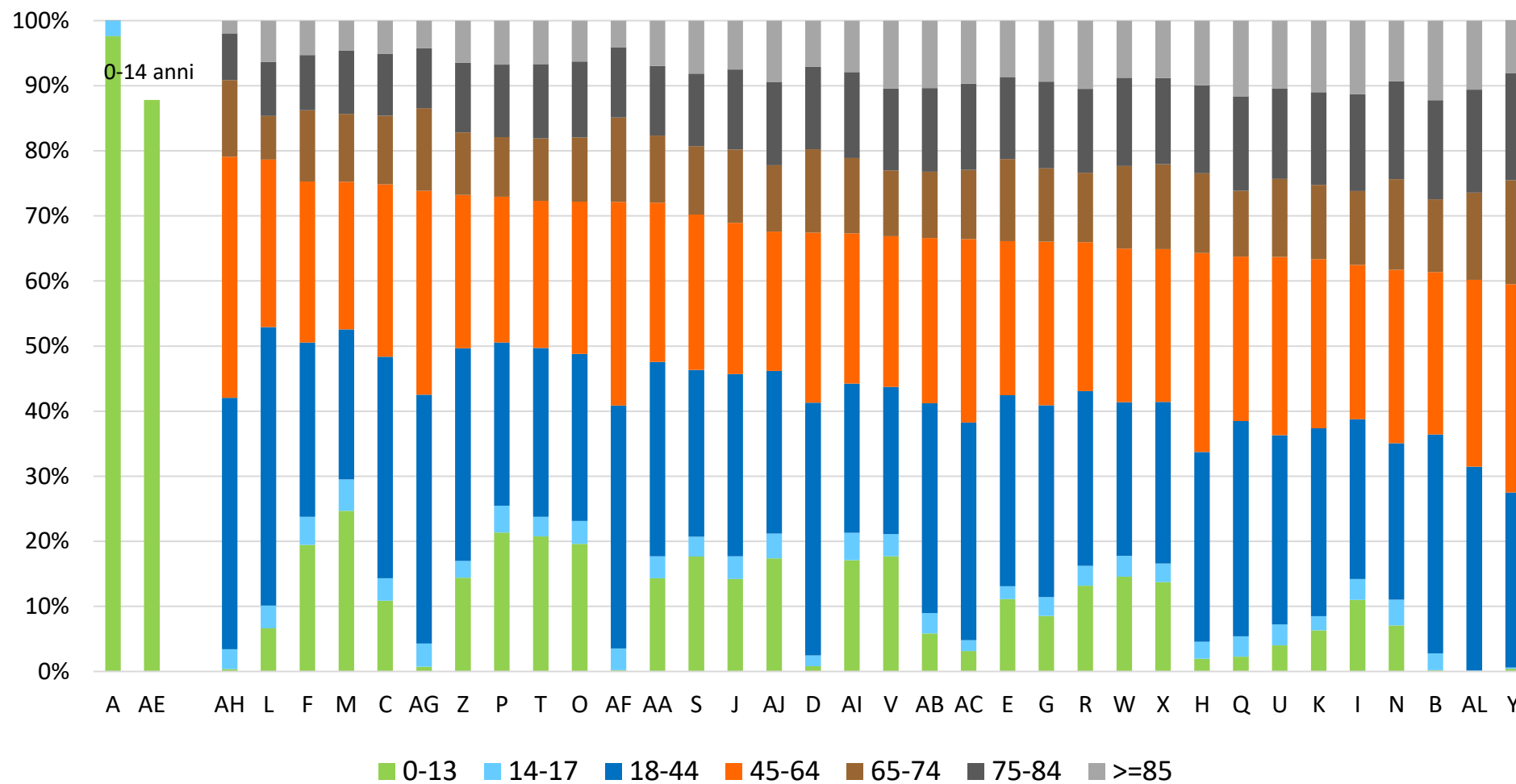
Elderly patients stay longer and have a higher probability of hospital admission

Patients admitted in inappropriate setting



DATA -
INPUT

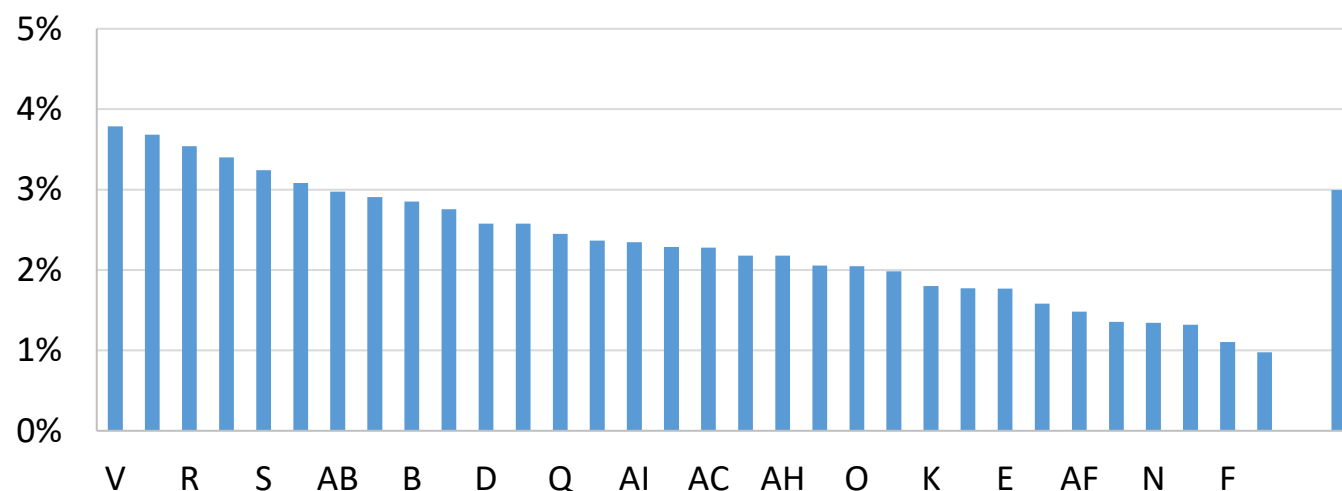
Priority color	Maximum Waiting Time	Description
RED	Immediate	Condition with failure of at least one vital function. Most critical, resuscitation
YELLOW	15 minutes	Condition with a high risk of progression to the failure of at least one vital function. Critical, urgent
GREEN	60-90 minutes	Less urgency without risk for clinical worsening. Semiurgent
WHITE	120 minutes	Not urgent cases. Have an alternative path care (not in the ED)



DATA -
INPUT

Patients that go to the ED at least 4 times in a year

On average 2.3% (max 3.8% and min. 1%)



40% Psychiatric agitation + psychiatric disorders

18% Altered level of consciousness, bizarre behavior, social problems

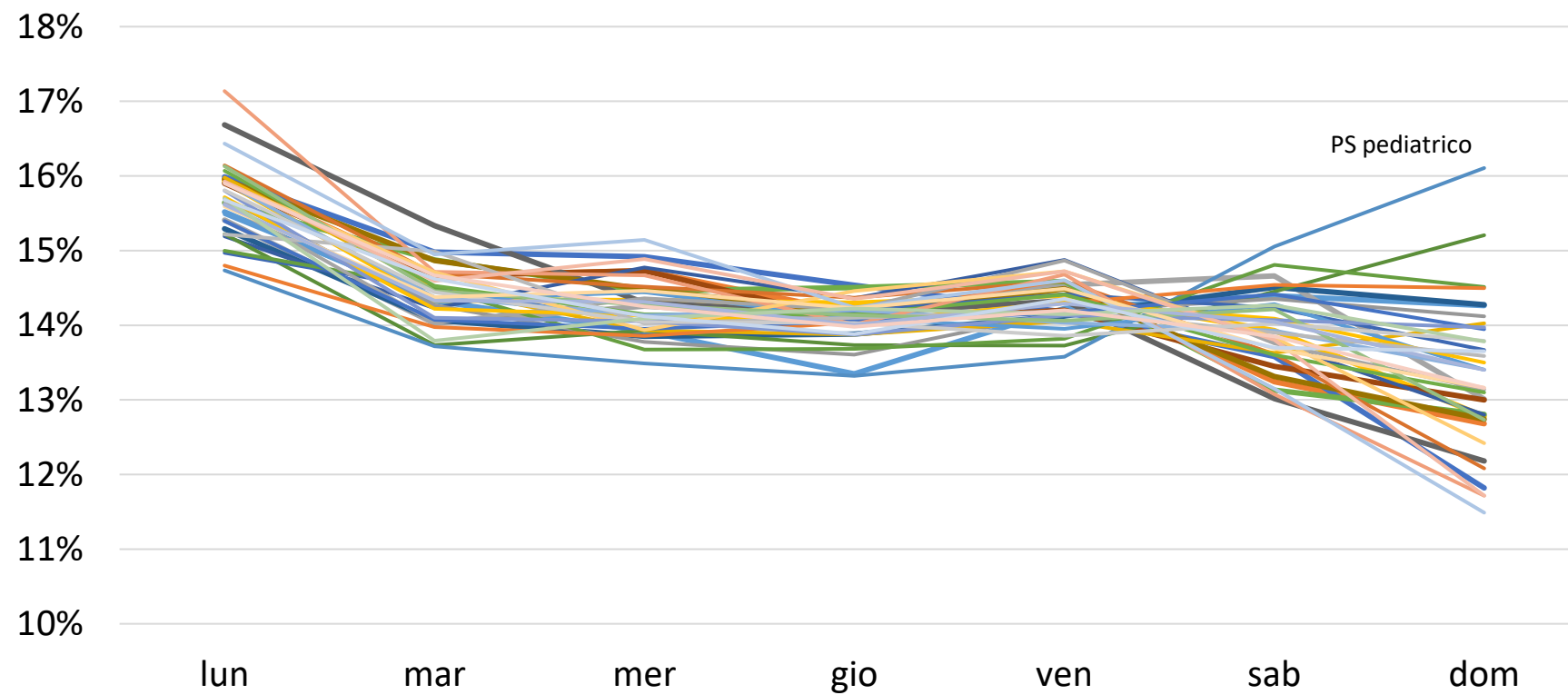
15% Substance abuse/intoxication, psychomotor agitation

45% Between intoxications, psychiatric disorders, and nervous system disorders

18% Between substance abuse/intoxication and anxiety/panic attacks

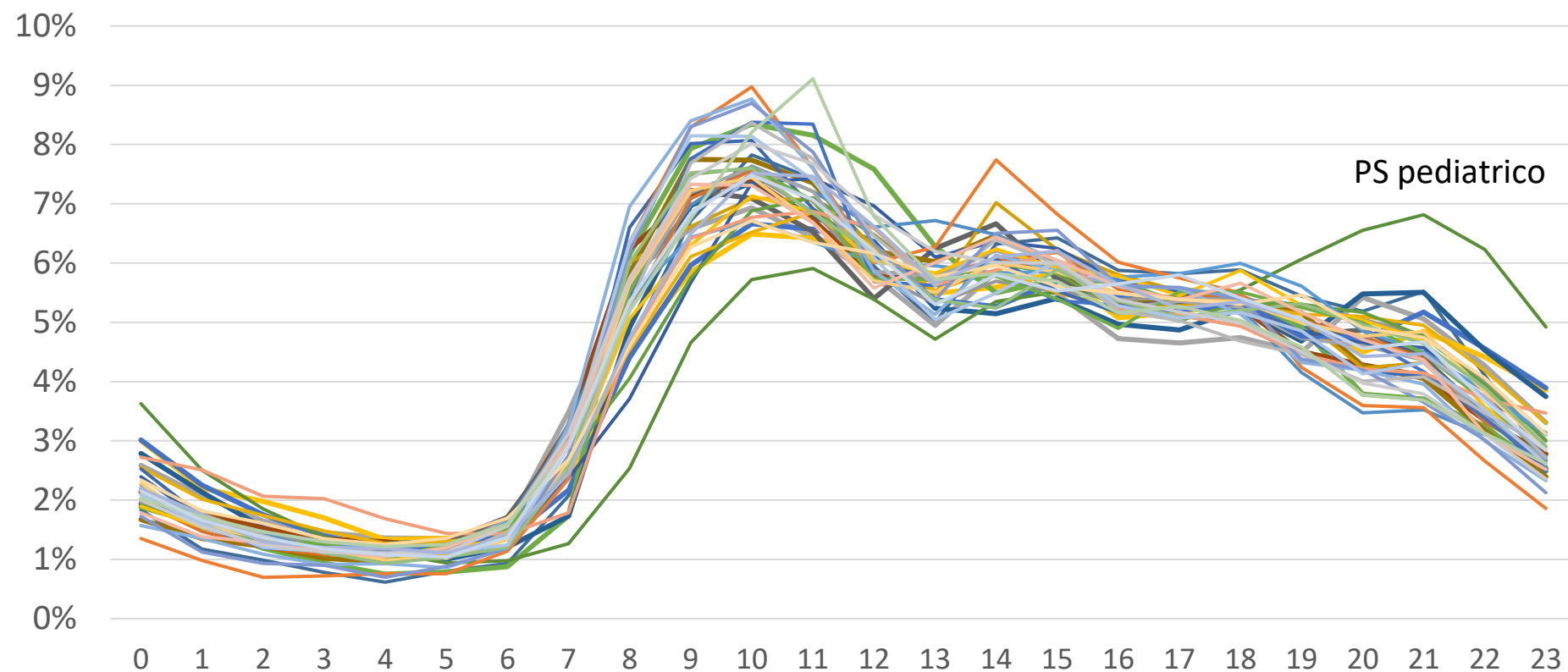
DATA -
INPUT

Daily distribution of ED arrivals



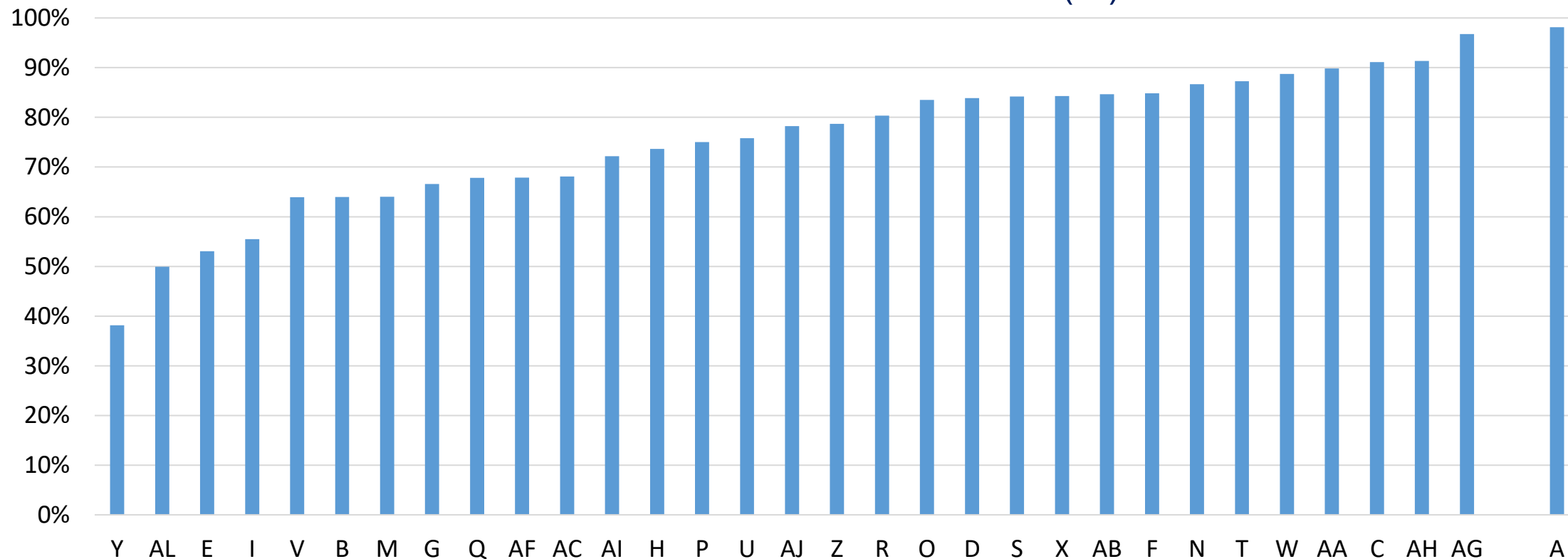
DATA -
INPUT

Hourly distribution of ED arrivals

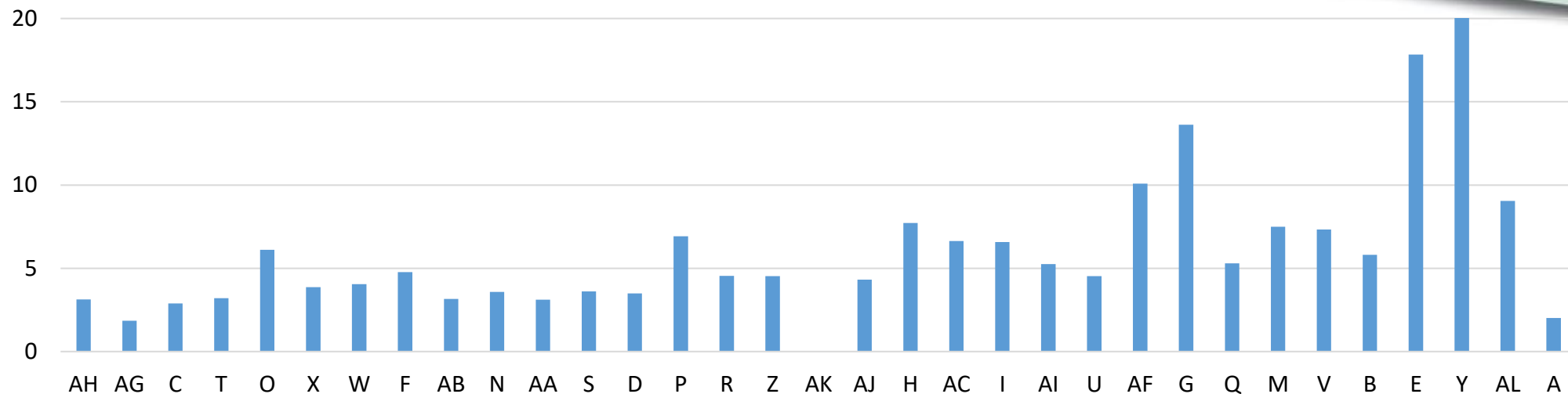


DATA -
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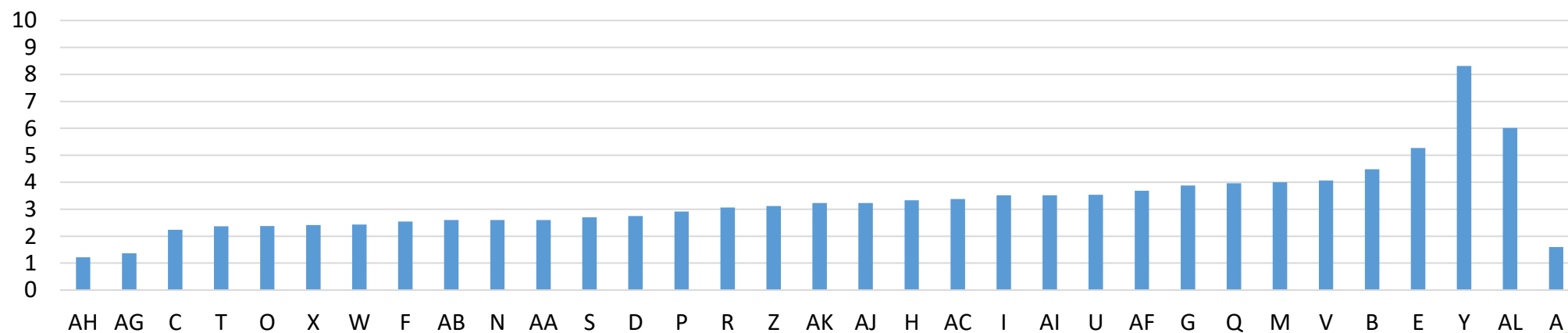
ED cases with LOS lower than 6 hours (%)



mean

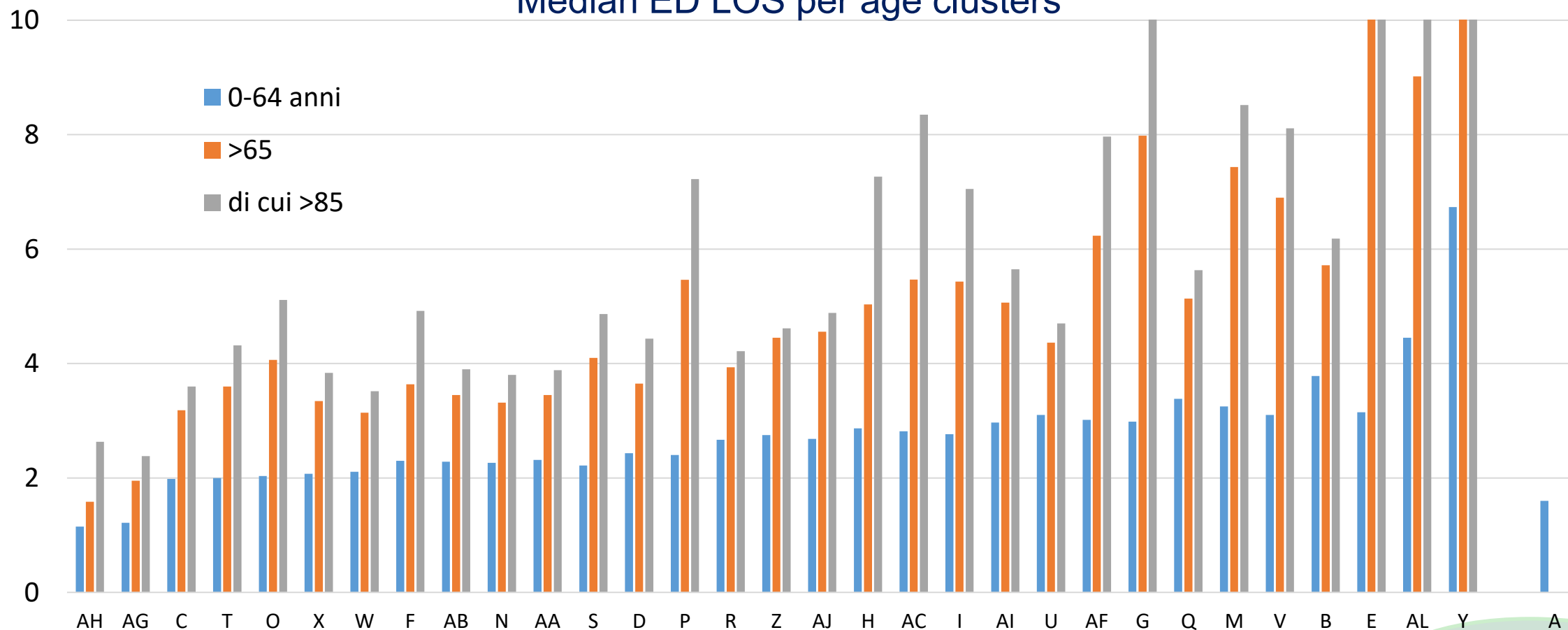


median



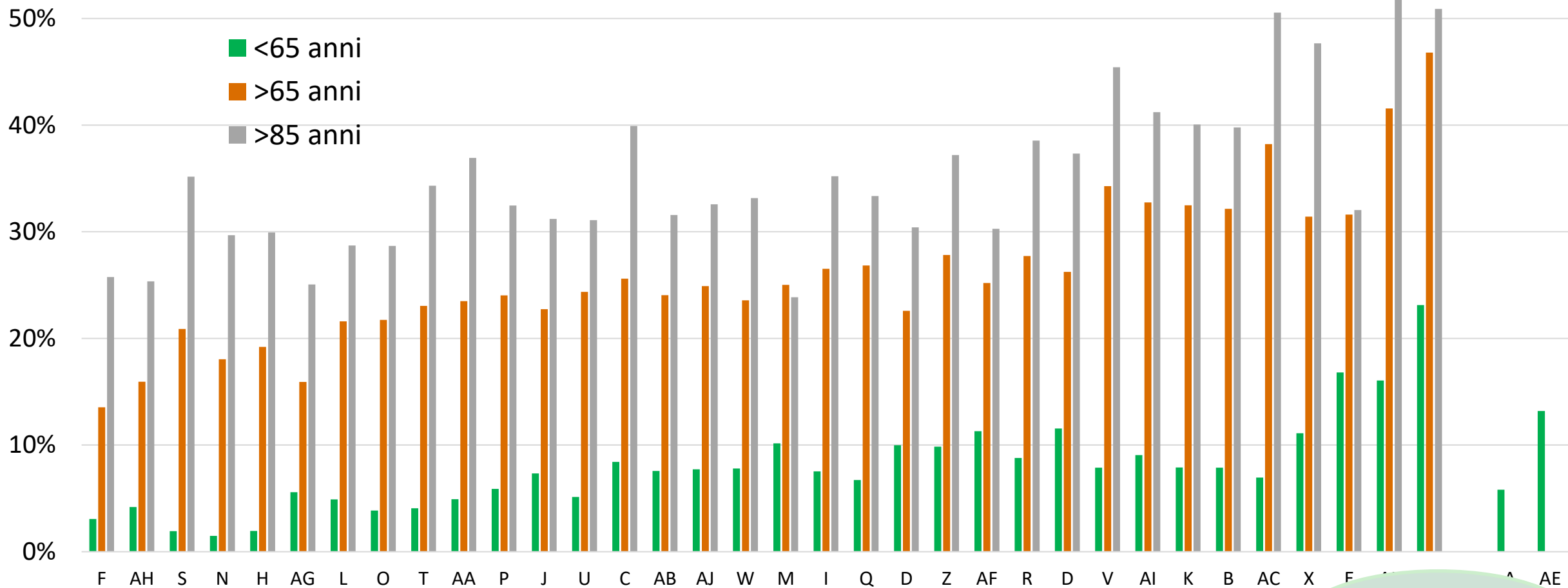
DATA -
PROCESS

Median ED LOS per age clusters



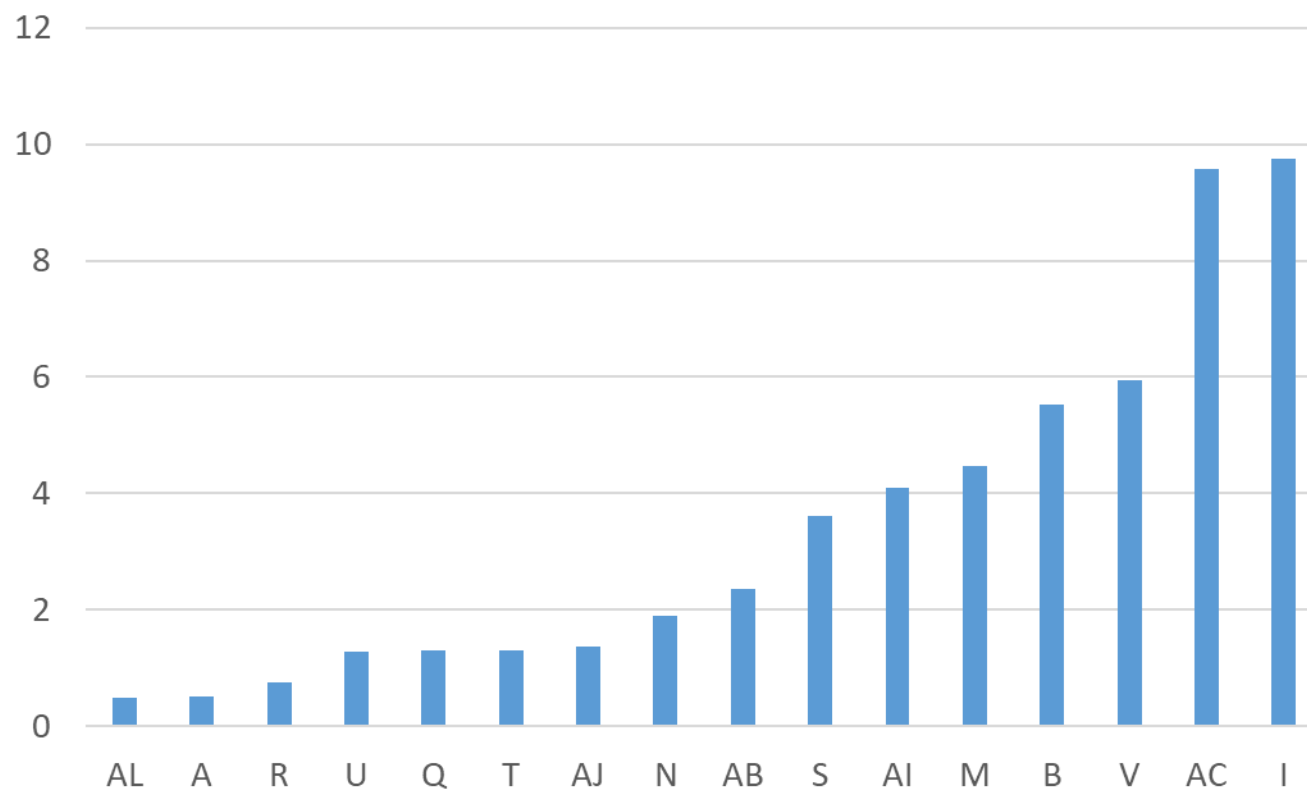
DATA -
PROCESS

Hospital admissions for age clusters



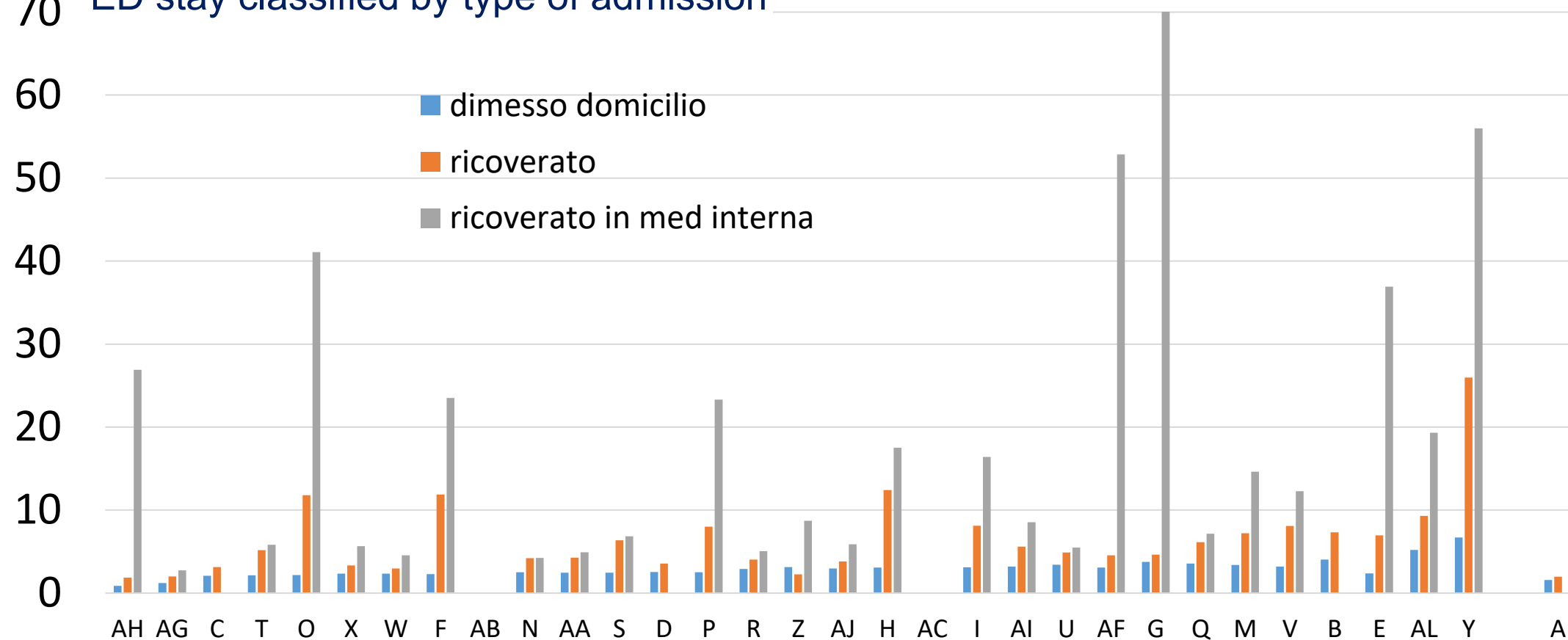
DATA -
PROCESS

Boarding

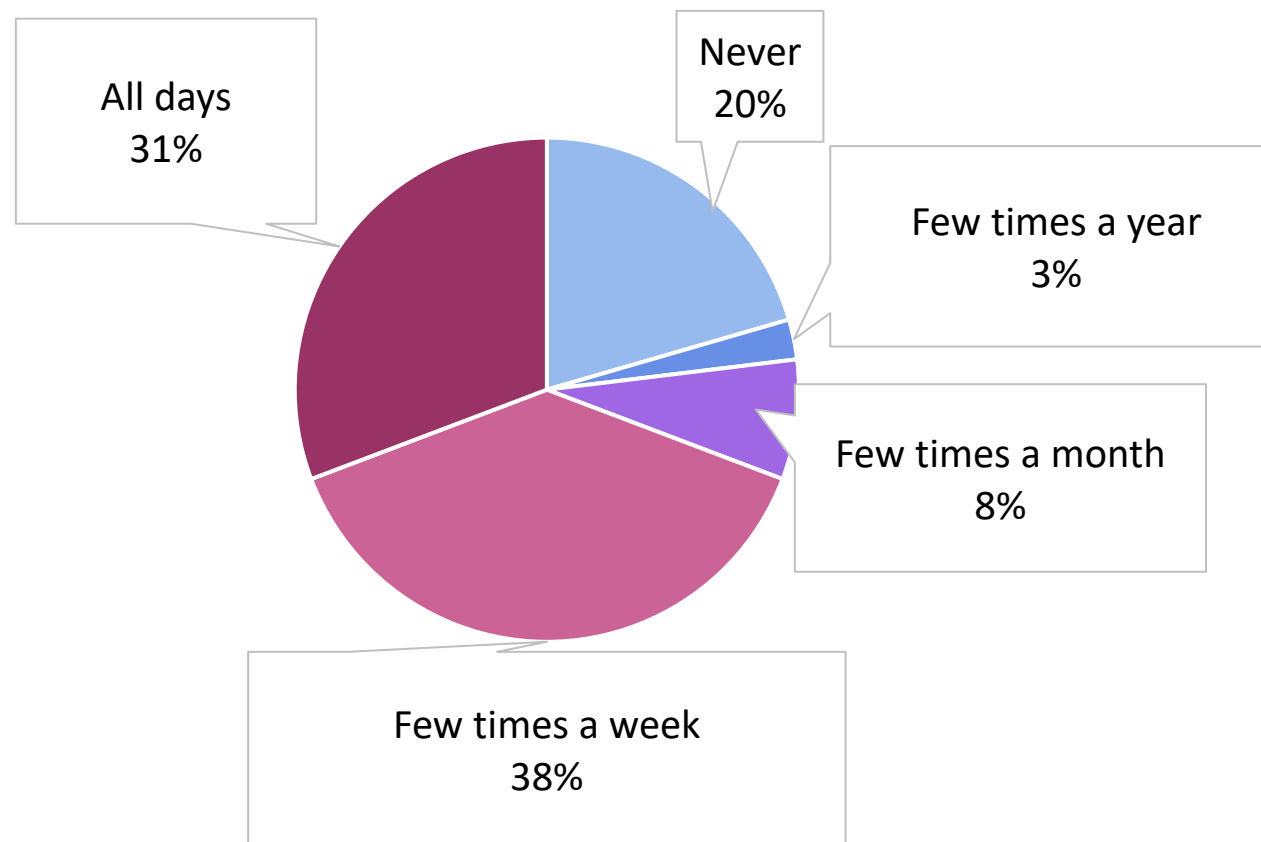


DATA -
OUTPUT

70 ED stay classified by type of admission



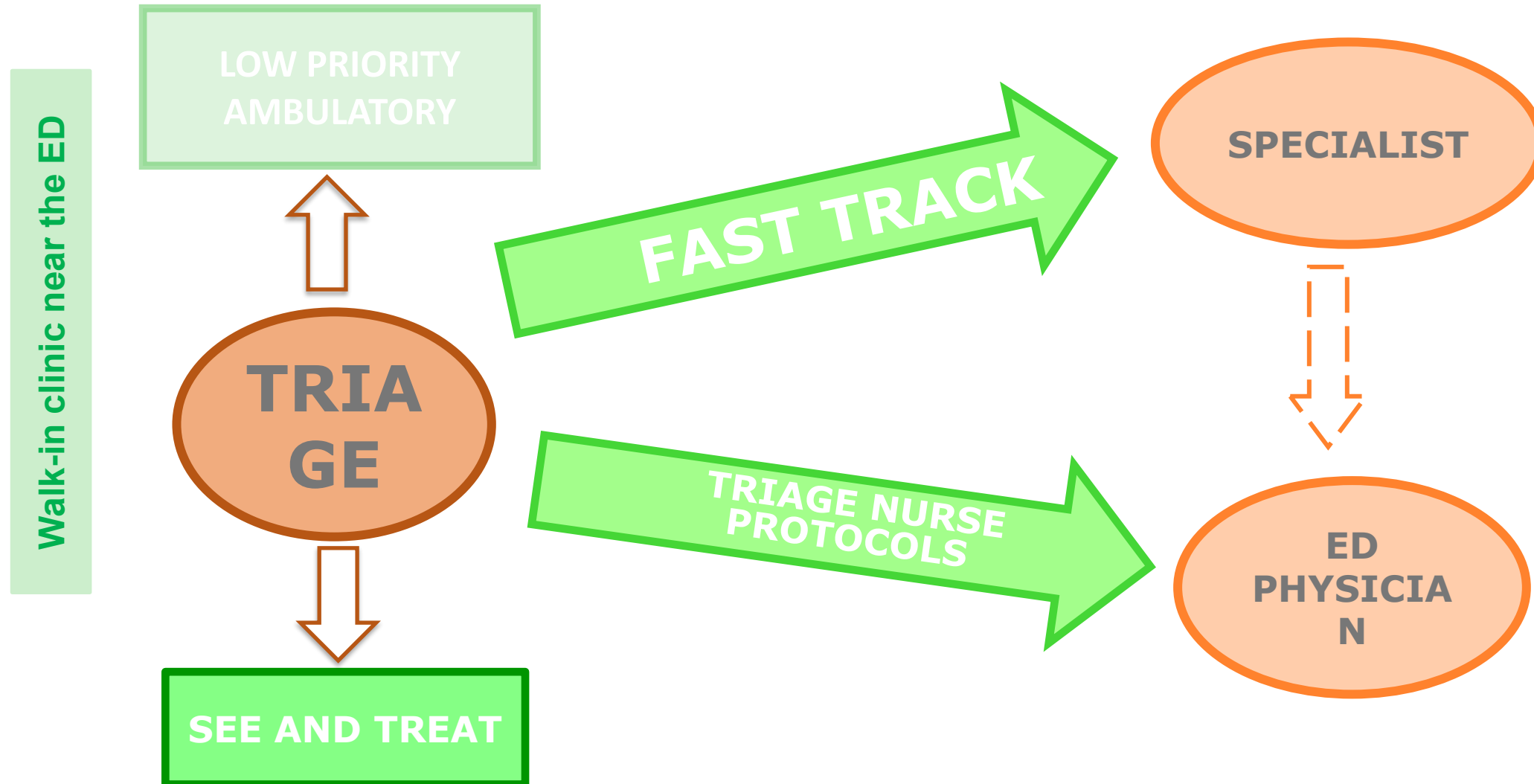
Frequency of inappropriate settings



DATA -
OUTPUT

- ✓ Patients' streaming: directing specific patient groups to tailored care pathways.

The Impact of Hospital management of low priority cases



Results of statistical analysis 1/2

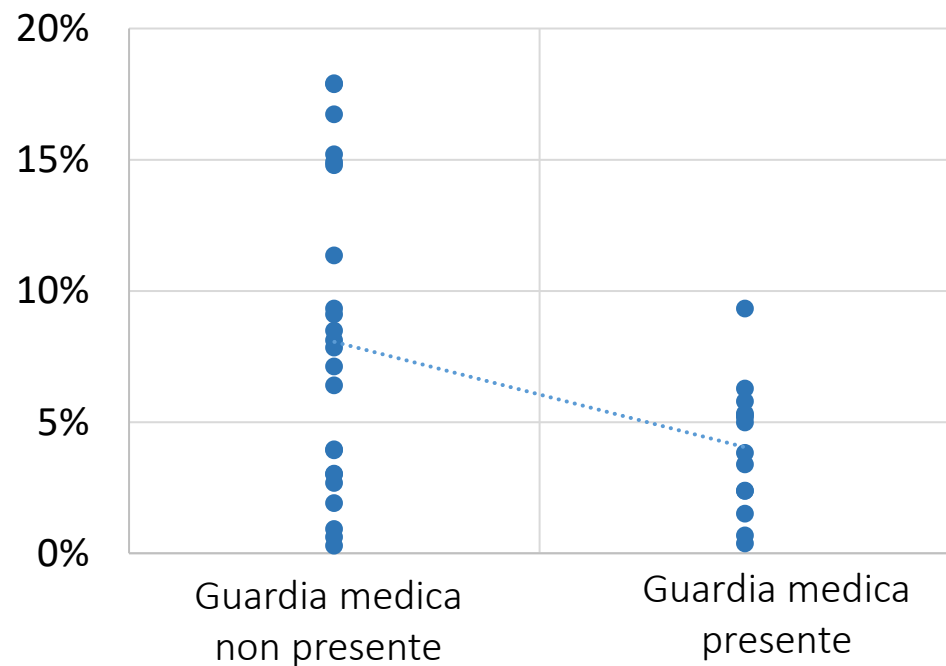
- ✓ **Dependent variable:** time spent in the Emergency Department
- ✓ **WHAT APPEARS TO BE EFFECTIVE**
- ✓ Separate pathways for the management of lower priority codes, such as:
 - ➡ Wall-in clinics located nearby;
 - ➡ a dedicated minor codes Lab;
 - ➡ a fast track system.
- ✓ Solutions designed for frail elderly patients, such as:
 - ➡ a fragility score;
 - ➡ an interdepartmental geriatrician.

Results of statistical analysis 2/2

WHAT DOES NOT APPEAR TO BE EFFECTIVE

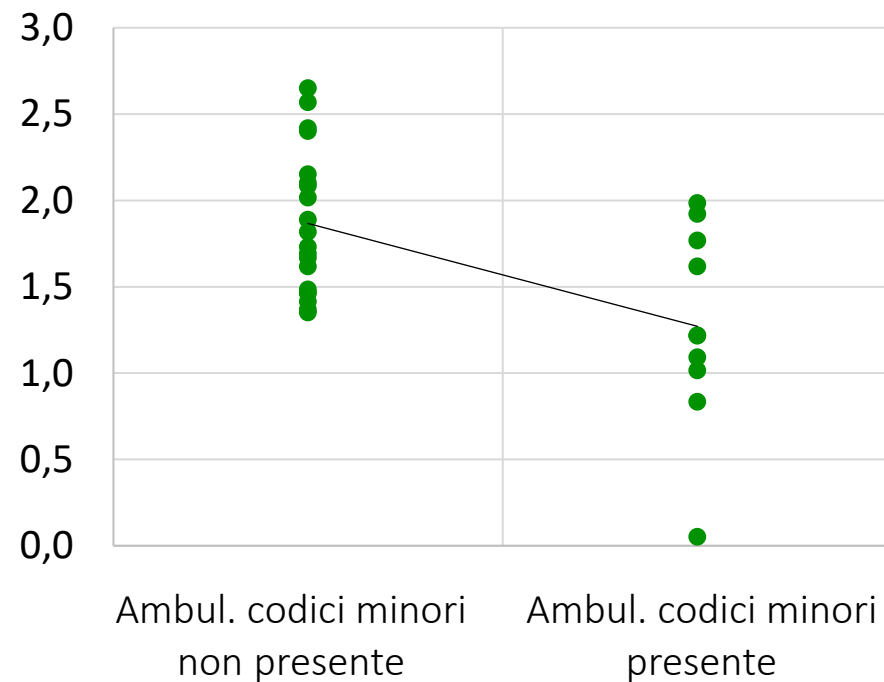
- ✓ Logistical and organizational solutions aimed at eliminating the boarding issue, such as:
 - ➔ discharge room;
 - ➔ admission unit;
 - ➔ "cingolo" model.
- ✓ Technological innovations, such as visual management.
- ✓ **NOTE:**
 - ✓ The meaning and actual level of implementation of the various solutions
 - ✓ The effect of confounding variables (e.g., hospital characteristics and catchment area)

Presence of a walk-in clinic near the ED and percentage of white-code cases



	Guardia medica Non presente	Guardia medica presente	
PS	1 0,28%	2 4,32%	
DEA1	11 6,92%	8 3,57%	
DEA2	11 9,90%	4 4,85%	
tot	23 8,05%	14 4,04%	p-value<0,05

Ambulatory dedicated to white codes and ED LOS



		Ambulatorio non presente	Ambulatorio presente	
PS	n	2	1	
		1,84	1,62	
DEA1	n	11	5	
		1,75	1,02	
DEA2	n	8	4	
		2,37	1,49	
tot	n	21	10	
		2,00	1,27	p-value<0,05

The impact of fast track on ED LOS

Codici bianchi non OBI: ore di permanenza per fast track (da accesso a dimissione)							cod. bianco non OBI: % permanenza <6 ore			
FAST_TRACK	N	media	mediana	min	max	sd	FAST_TRACK	num	denom	%
No fast track	1343	5,6	3,9	0,0	88,0	6,8	No fast track	881	1.343	65,60%
Sì fast track	2123	1,8	1,2	0,0	172,5	4,4	Sì fast track	2.073	2.123	97,64%
Total	3466	3,3	1,8	0,0	172,5	5,7				
Codici verdi non OBI: ore di permanenza per fast track (da accesso a dimissione)							cod. verde non OBI: % permanenza <6 ore			
FAST_TRACK	N	media	mediana	min	max	sd	FAST_TRACK	num	denom	%
No fast track	18010	7,4	5,8	0,0	164,8	9,3	No fast track	9.329	18.010	51,80%
Sì fast track	16992	1,8	1,4	0,0	139,9	2,6	Sì fast track	16.675	16.992	98,13%
Total	35002	4,7	2,8	0,0	164,8	7,4				

Differences statistically significant

Elderly patients at ED

Soluzioni organizzative per tipo struttura

tipo	N	frailty score	Gray Code	Interdepartmental Geriatric
PS	4	1	1	1
DEA1	20	2	1	1
DEA2	13	5	5	5
Total	37	8	7	7

Over 65: ore permanenza media per tipo struttura

tipo	N	Mean	Stand dev
PS	4	4,0	0,7
DEA1	16	4,7	3,7
DEA2	10	6,8	3,2
Total	30	5,4	3,4

Δ = median ED LOS over 65 - median ED LOS under 65

	Group	Frailty score			Gray Code			Interdepartmental Geriatric		
		N	Δ anziani adulti	<i>p-value</i>	N	Δ anziani adulti	<i>p-value</i>	N	Δ anziani adulti	<i>p-value</i>
Tutti i codici	No	7	3,2	*	6	3,0	<i>ns</i>	7	3,2	*
	Sì	3	1,6		4	2,3		3	1,7	
Codici azzurri	No	3	3,9	**	4	3,3	<i>ns</i>	2	4,6	*
	Sì	2	1,1		1	0,9		3	1,6	
Codici arancioni	No	3	3,6	<i>ns</i>	4	3,2	<i>ns</i>	2	5,0	*
	Sì	2	1,2		1	0,5		3	1,1	

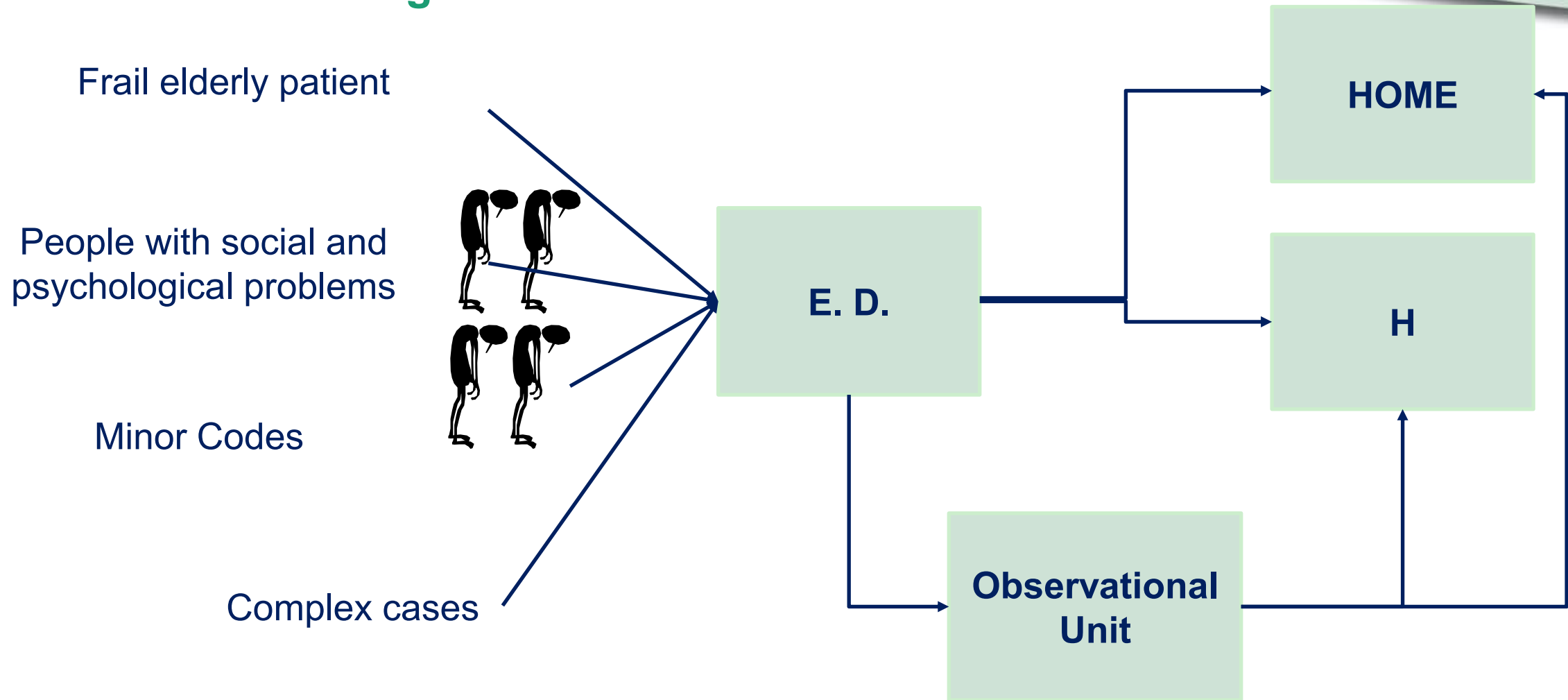
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ok

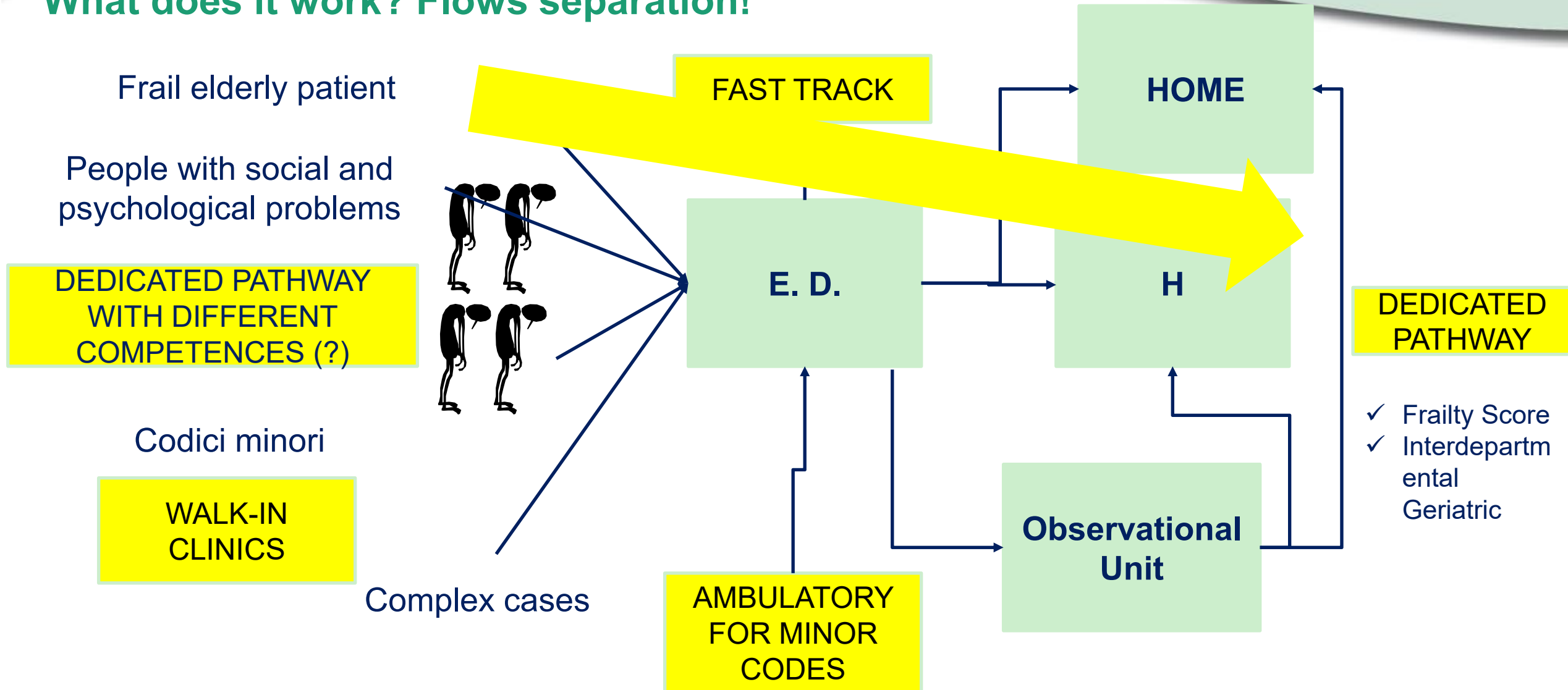
* Level of confidence 5%

** Level of confidence 10%

Patient flows' management at ED



What does it work? Flows separation!



The problems at ED are a signal of a community that is not taking in charge

- ✓ Long ED LOS and high hospital admission rate for elderly
- ✓ People with social and psychological problems
- ✓ Peak of arrivals on Monday