The Quality & Management of Penicillin Allergy Labels in a Pediatric Birth Cohort

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BACKGROUND

- 5.4 % of children are labeled as penicillin allergic in the community[1]
    - >90 % of children do NOT have a type 1 hypersensitivity reaction[2]

- Children receive penicillin allergy labels (PALs) at a young age[1]

- PALs influence antibiotic prescribing and are associated with poor clinical outcomes[3]

- Questions: Who places PALs? Do allergy tabs provide accurate risk classifications of allergy? Where are children with suspected adverse drug events managed? How are PALs managed in the community?

OBJECTIVE

- Determine the quality of penicillin allergy labels among children in a pediatric birth cohort

- Describe how pediatric penicillin allergy labels are managed in the community

METHODS

Study Population
- Birth Cohort of 334,465 children: 1st 2 weeks, 2nd apt in first year, meet censor criteria
- 18,015 with PALs during 10-year study period
    - 500 randomly-selected children; retrospective chart review of PALs and notes

Table 1. Penicillin Allergy Risk Classification Definitions.

Risk Classification	Definition
Not Allergy	Family history, isolated diarrhea, patient has tolerated drug
Low Risk	Maculopapular rash >24 hrs into course, no hives/pruritis/swelling
Moderate or High Risk	Hives, maculopapular rash <24 hrs into course, pruritis, anaphylaxis or angioedema, wheezing or other respiratory symptoms
Severe Risk*	Severe cutaneous reactions (erythema multiforme, serum sickness)
Unable to Classify	Unspecified rash characteristics or timing, no documentation noted

- Categorical data reported as frequencies, continuous variables as median (IQR)

- Kappa statistic measure of agreement

RESULTS

Table 2. Basic Demographics of Children with PAL in Birth Cohort and Sub-Population.

	PAL in Birth Cohort n = 18 015	Retrospectively Reviewed n = 500
Sex-Female	8 331 (46.2 %)	231 (46.2 %)
Race & Ethnicity		
Hispanic	3 234 (18.0 %)	90 (18.0 %)
Non-Hispanic Asian	1 009 (5.6 %)	26 (5.2 %)
Non-Hispanic Black	1 651 (9.2 %)	49 (9.8 %)
Non-Hispanic White	10 689 (59.3 %)	300 (60.0 %)
Other or Missing	1 432 (7.9 %)	35 (7.0 %)
Chronic Condition-Yes	1 319 (7.3 %)	32 (6.4 %)
Organization		
Texas Children's Pediatrics	10 434 (57.9 %)	250 (50 %)
Children's Hospital of Philadelphia	7 581 (42.1 %)	250 (50 %)
Median Age at Censor Date, years (IQR)	5.7 (3.5, 8.1)	6.0 (3.5, 8.1)
Median Age at PAL Placement	1.3 (0.9, 2.3)	1.4 (0.9, 2.2)

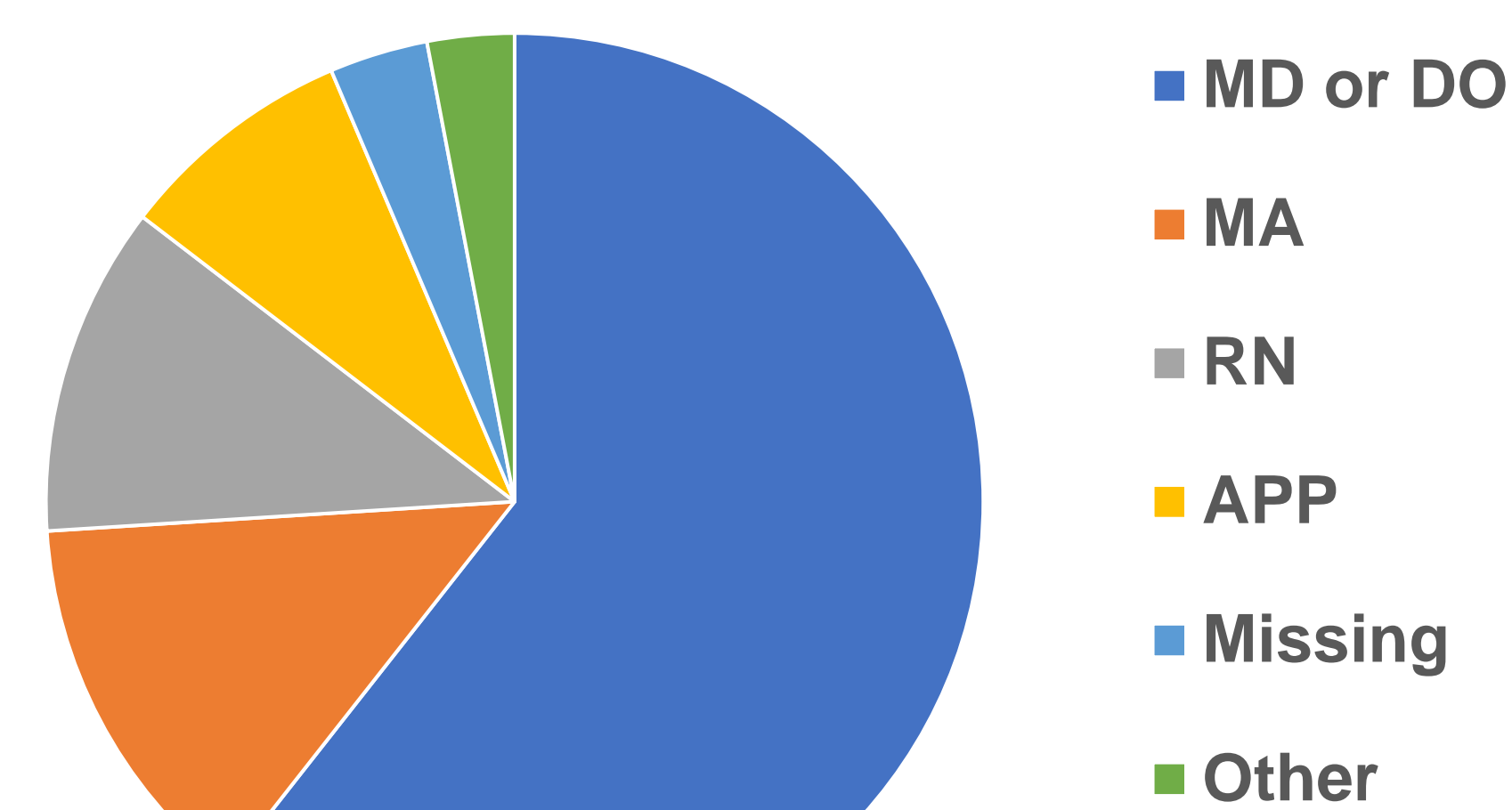**Figure 1. Credentials of Providers Placing PALs.**

- MD or DO
- MA
- RN
- APP
- Missing
- Other

Figure 2. Reactions Listed in PAL*

- Rash
- Hives
- Not Listed
- Nausea/Vomiting
- Diarrhea
- Anaphylaxis or Shortness of Breath
- Other
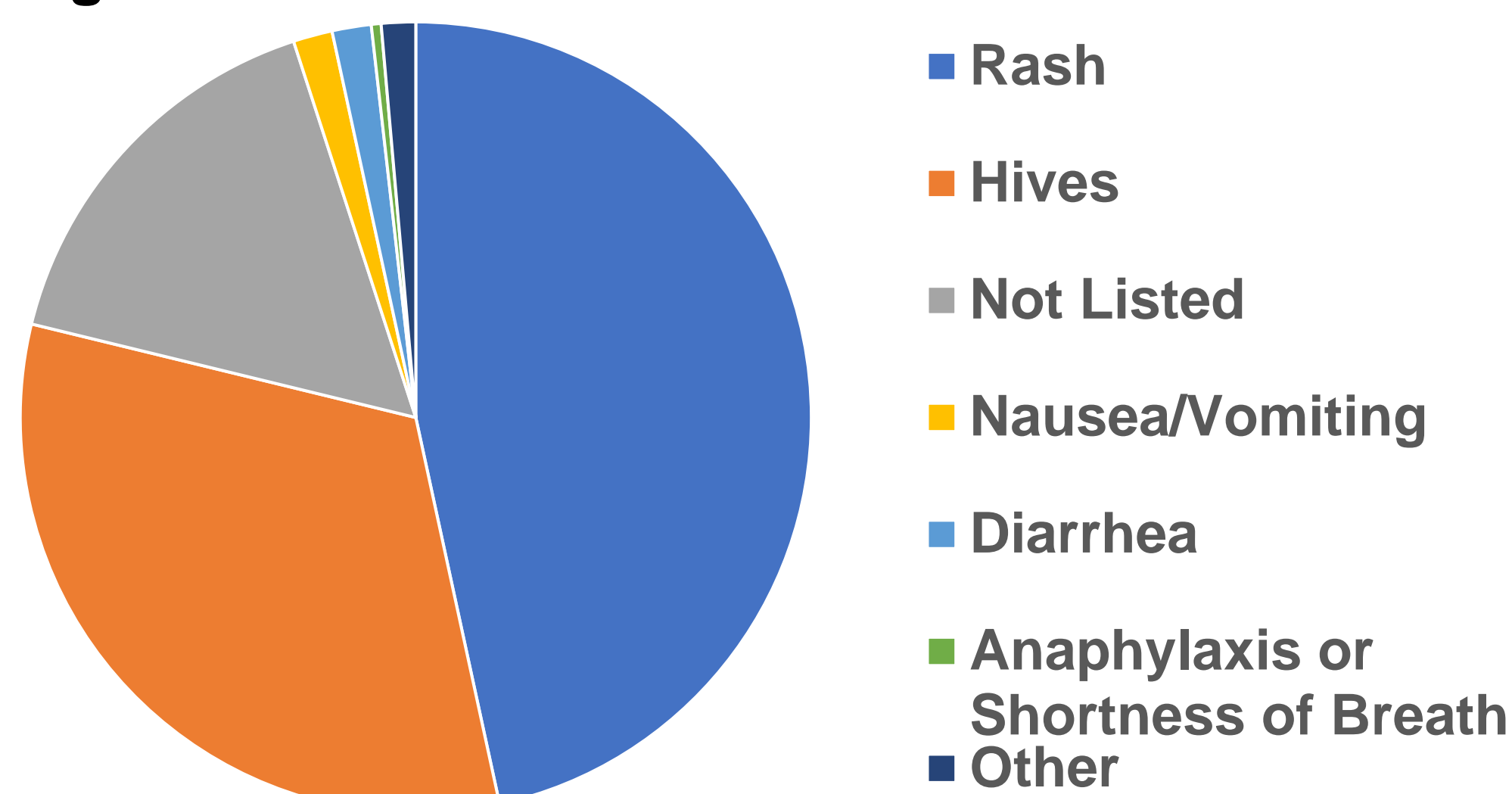
Figure 3. Highest level encounter within 7 days of adverse reaction.**

- Telephone
- Primary Care Clinic
- Urgent Care
- Emergency Department
- Hospitalization
- Unknown
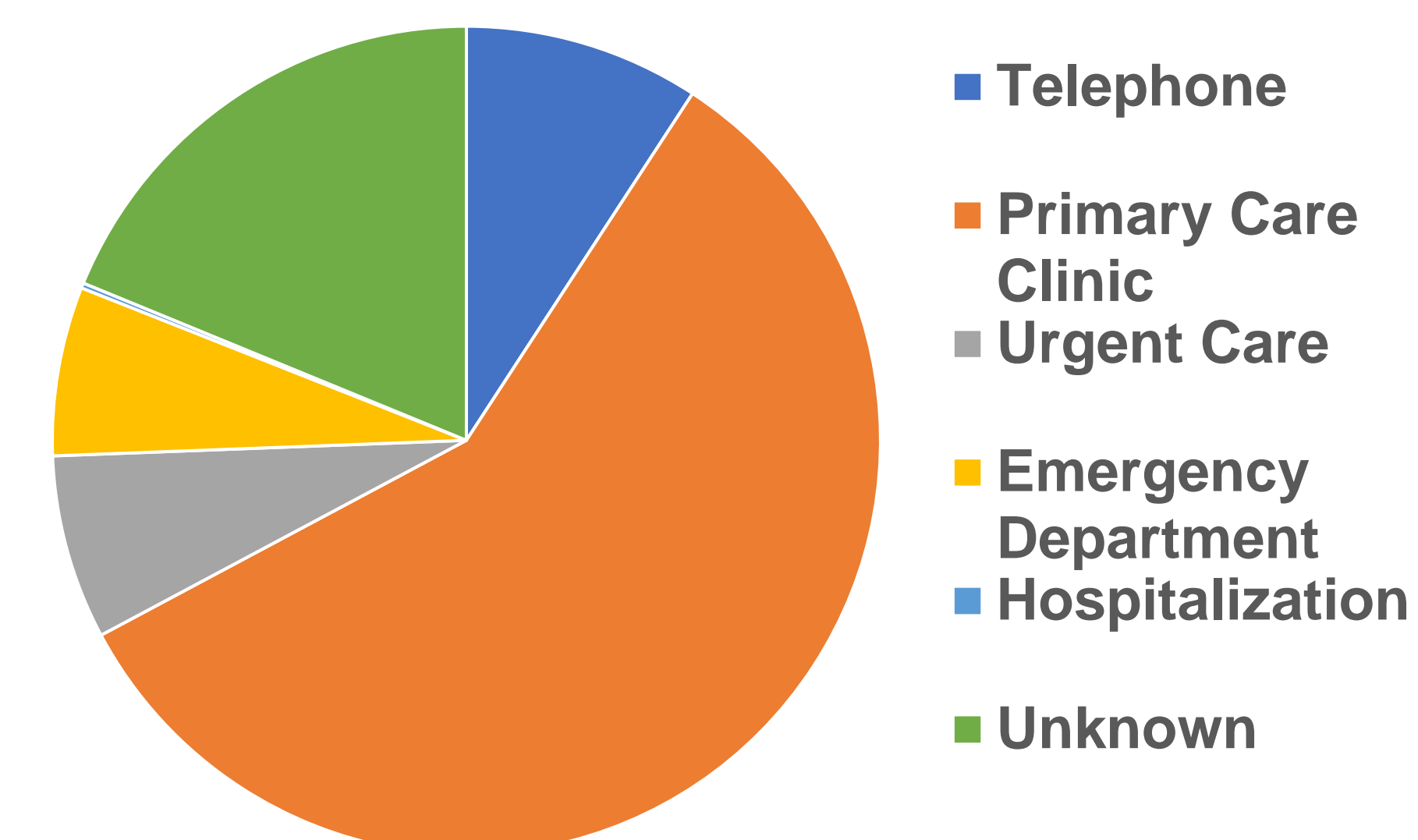
**Reaction not described in 68/300 (13.6%) notes.

Median number of days into antibiotic course adverse reaction started = 6 (IQR 3, 8).

329/500 (80.2 %) seen by PCP within 7 days of reaction.

*Comments listed in 165/500 (33%) PALs.

Severity or reaction type mentioned in 14 % PALs.

RESULTS (CONTINUED)

Table 3. Agreement of Risk Classification Between PAL & Notes

	Risk Classification	Risk Classification by Notes*					
		Severe Cutaneous	Moderate or High	Low	Not Allergy	Unable to Classify	Total n (%)
Risk Classification by PAL	Severe Cutaneous	17	1	0	0	2	20 (4.0 %)
	Moderate or High	7	131	20	7	23	188 37.6 %
	Low	0	1	11	1	0	13 (2.6 %)
	Not Allergy	0	0	1	23	5	29 (5.8 %)
	Unable to Classify	5	44	126	14	61	250 (50.0 %)
	Total n (%)	29 (5.8 %)	177 (35.4 %)	158 (31.6 %)	45 (9.0 %)	91 (18.2 %)	500

Kappa statistic = 0.36 (+/-0.02)

Table 4. Management of 500 Children with Penicillin Allergy Labels

	n (%)
Referred to Allergist for Penicillin Allergy Evaluation	84 (16.8 %)
Seen by Allergist	54 (10.8 %)
Penicillin Skin Test Completed and Passed	27/27 (100 %)
Oral Challenge Passed	25/25 (100 %)
Delayed Reaction to Oral Challenge	1/25 (4.0 %)
De-Labeled	69 (13.8 %)
After Evaluation by Allergist	26/54 (48.1 %)
No Evaluation by Allergist (De-Labeled In Community)	43/446 (9.6 %)
Re-Labeled	2/69 (2.9 %)
Receive Penicillin After De-Labeling	49/69 (71.0 %)
Tolerated Penicillin After De-Labeled	46/49 (93.9 %)

CONCLUSION

- PALs are often ambiguous and do not agree with prior documentation
- Children are rarely referred to an allergist or de-labeled in the community
- Future work: improve PAL documentation, increase access to allergy care

REFERENCES

1. Taylor M, Joerger T, et al. Factors Associated with Penicillin Allergy Labels in Electronic Health Records of Children in 2 Large US Pediatric Primary Care Networks. *JAMA Net Open.* 2022;5(3): e222117.
2. Vyles D, Adams J, Chiu A, Simpson P, Nimmer M, Brousseau DC. Allergy testing in children with low-risk penicillin allergy symptoms. Pediatrics. 2017;140(2):e20170471
3. Lucas M, Arnold A, Sommerfield A, et al. Antibiotic Allergy Labels in Children Are Associated with Adverse Clinical Outcomes. *J Allergy Clin Immunol Pract.* 2019;7(3):975-982.