

Multistate Outbreak of *Acanthamoeba* Keratitis Associated with Use of a Contact Lens Solution

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Acanthamoeba Keratitis (AK)

- **Rare, potentially blinding infection of cornea**
- **Caused by free living amoeba**
 - **Ubiquitous in environment**
- **Primarily affects healthy contact lens users (CLU)**
 - **Poor hygiene practices**
 - **Contact w/ non-sterile water while using lenses**
- **Estimated incidence in US 1–2 cases per million CLU/year**



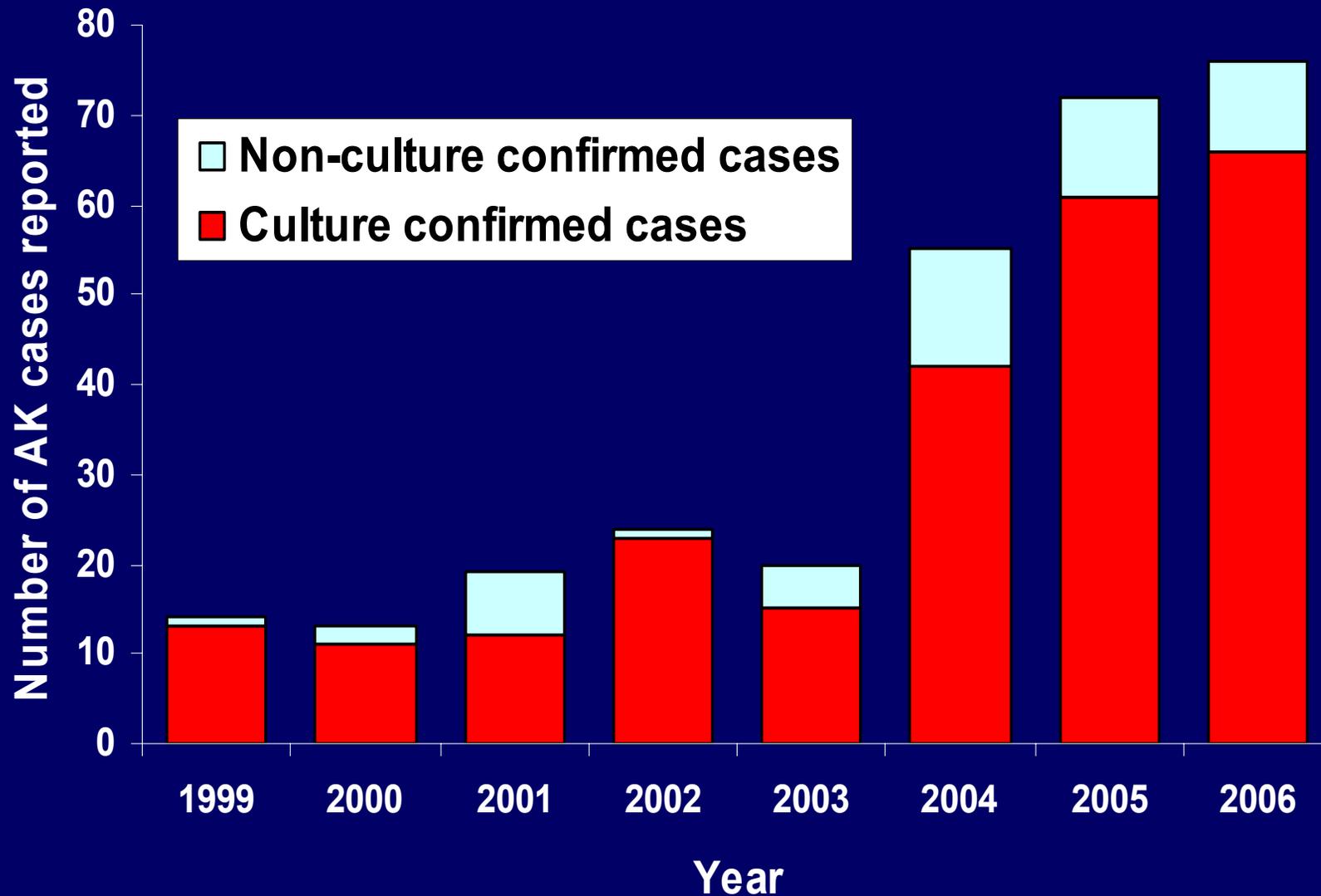
Courtesy of Dan B Jones, MD

Outbreak Background

- **May 2006: IL Dept. of Public Health notified CDC of possible increase in AK cases in Chicago area**
 - Univ. IL at Chicago conducting case-control study
- **October 2006: CDC informally contacted multiple ophthalmologists in other areas**
 - Unclear whether rise in cases nationwide
- **January 2007: CDC surveyed 22 ophthalmology centers nationwide**
 - # of cases/yr from 1999-2006



Survey of Ophthalmology Centers for AK Cases 1999–2006 (N=10)



Outbreak Investigation

- **March 16, 2007: Multistate outbreak investigation launched**
- **Objectives**
 - **Quantify and characterize increase in AK cases**
 - **Identify associated risk factors**
 - **Recommend measures to prevent new cases**



Courtesy of Dan B Jones, MD

Methods: Case Series

- **Case definition**
 - Person diagnosed with AK by an ophthalmologist
 - Symptom onset on or after January 1, 2005
 - Positive *Acanthamoeba* culture from cornea
- **Case-finding**
 - Epidemic Information Exchange (Epi-X)
 - Ophthalmology and optometry associations
 - Microbiology laboratories
 - Ophthalmology centers
- **Data collection**
 - Standardized telephone interviews with case-patients, ophthalmologists, eye care providers



Preliminary Analysis

- Compared AK case-patients to controls from 2006 *Fusarium* keratitis outbreak investigation
- *Fusarium* controls
 - N=126
 - Healthy adult CLU
 - Geographically matched to *Fusarium* cases
- Similar questionnaire used
- Preliminary analysis
 - Contact lens-related products
 - Hygiene practices, behaviors



Preliminary Results and Public Health Action

- **May 23: 46 case-patients interviewed**
 - Significant association of AK with use of Advanced Medical Optics Complete® MoisturePlus™ (AMOCMP) multipurpose solution
- **May 24: communicated preliminary results to FDA**
- **May 25: discussed results with state/ local health departments and AMO**
- **May 26: MMWR Dispatch released; voluntary recall of AMOCMP**



Methods: Case-Control Study

- Case-patients obtained from case series
- Controls
 - ≥ 12 years old with no history of AK
 - Matched by contact lens use
 - Soft, rigid, no use
 - Matched by geographic location
- Standardized telephone interviews for controls
 - Asked about behaviors and product use during one month prior to symptom onset of corresponding case-patient



Results: Case Series

221 reports
37 states and Puerto Rico



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221 reports
37 states and Puerto Rico



**158 culture-confirmed
cases reported**



Results: Case Series

221 reports
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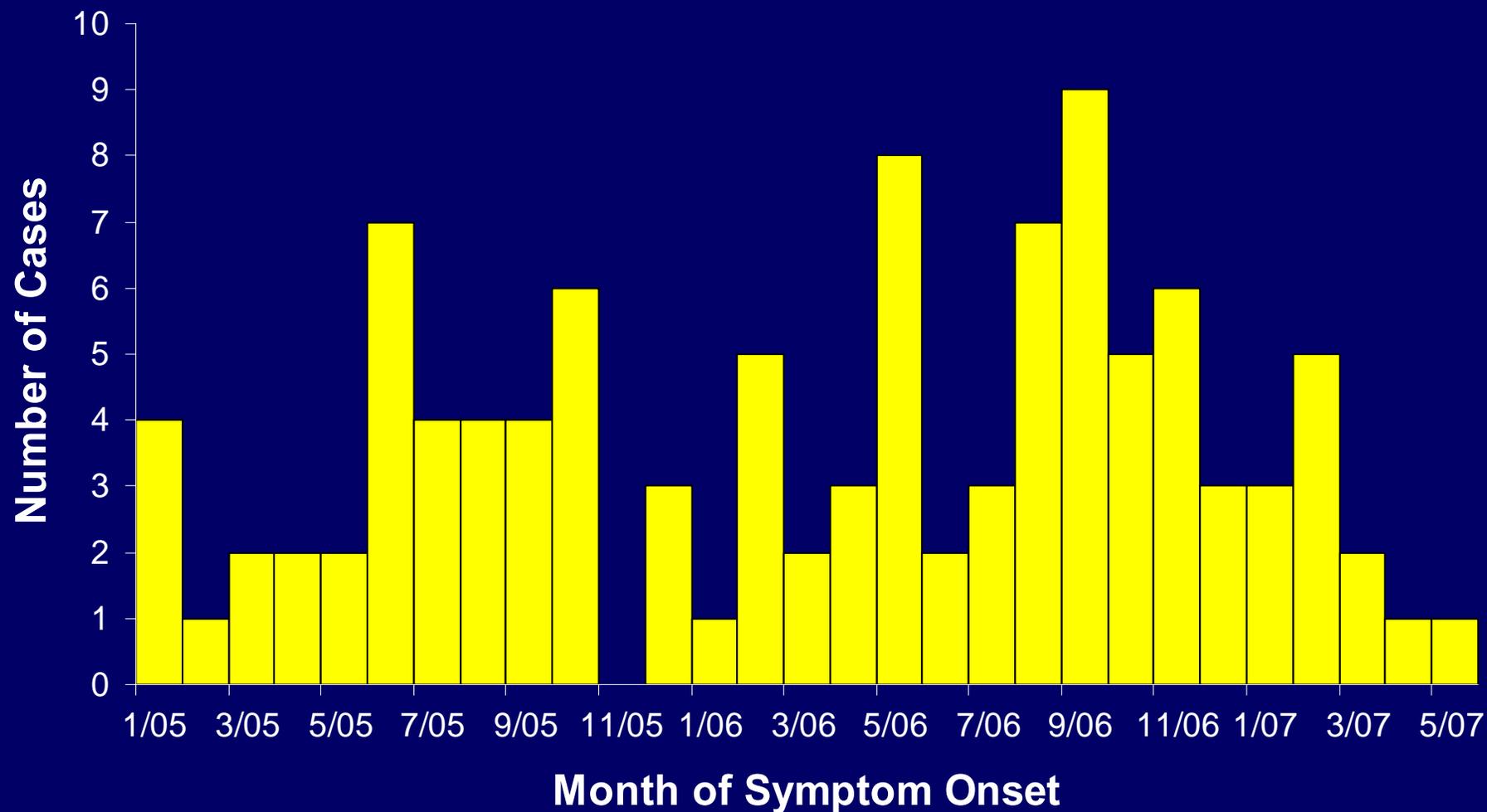
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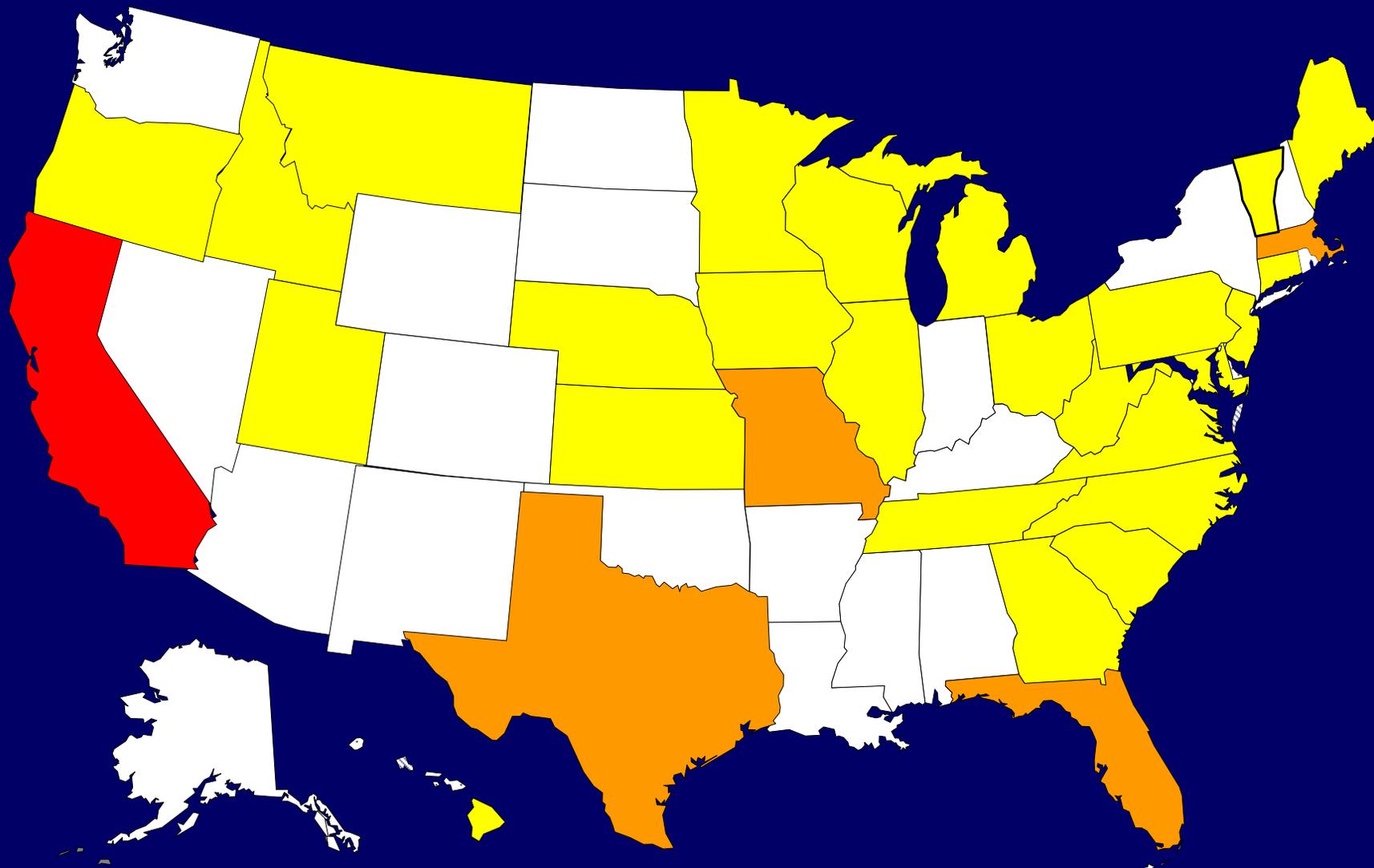
105 culture-confirmed
case-patients
interviewed



Symptom Onset of Case-Patients, N=105

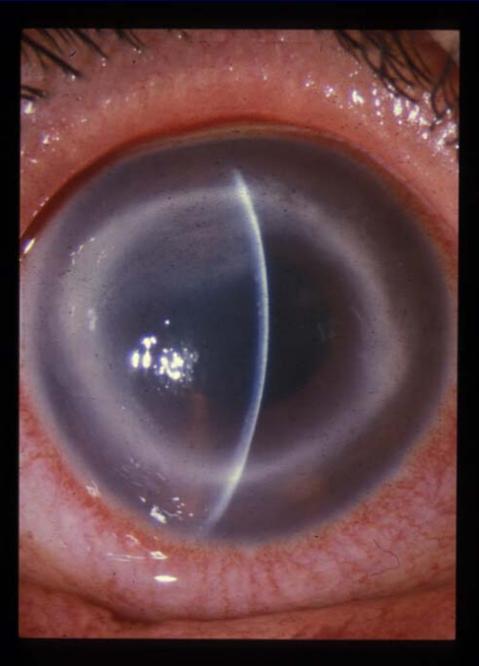


Case-Patients by State, N=105



Case-Patients, N=105

- **Demographics**
 - 36% male
 - Median age 29 years; range 12–77 years
 - 89% CLU
 - 88% used soft lenses
- **Common presenting symptoms**
 - 75% pain
 - 75% redness
 - 72% sensitivity to light
 - 69% foreign body sensation



Courtesy of Dan B Jones, MD

Case-Patients

- Time from onset of symptoms to initiate anti-*Acanthamoeba* treatment (n=80)
 - Median 49 days
 - Range 4–197 days
- Clinical outcome (n=85)
 - 28% cornea transplant performed or planned
- Current vision (n=70)
 - 33% visual acuity of 20/200 or worse with correction in affected eye



Results: Case-Control

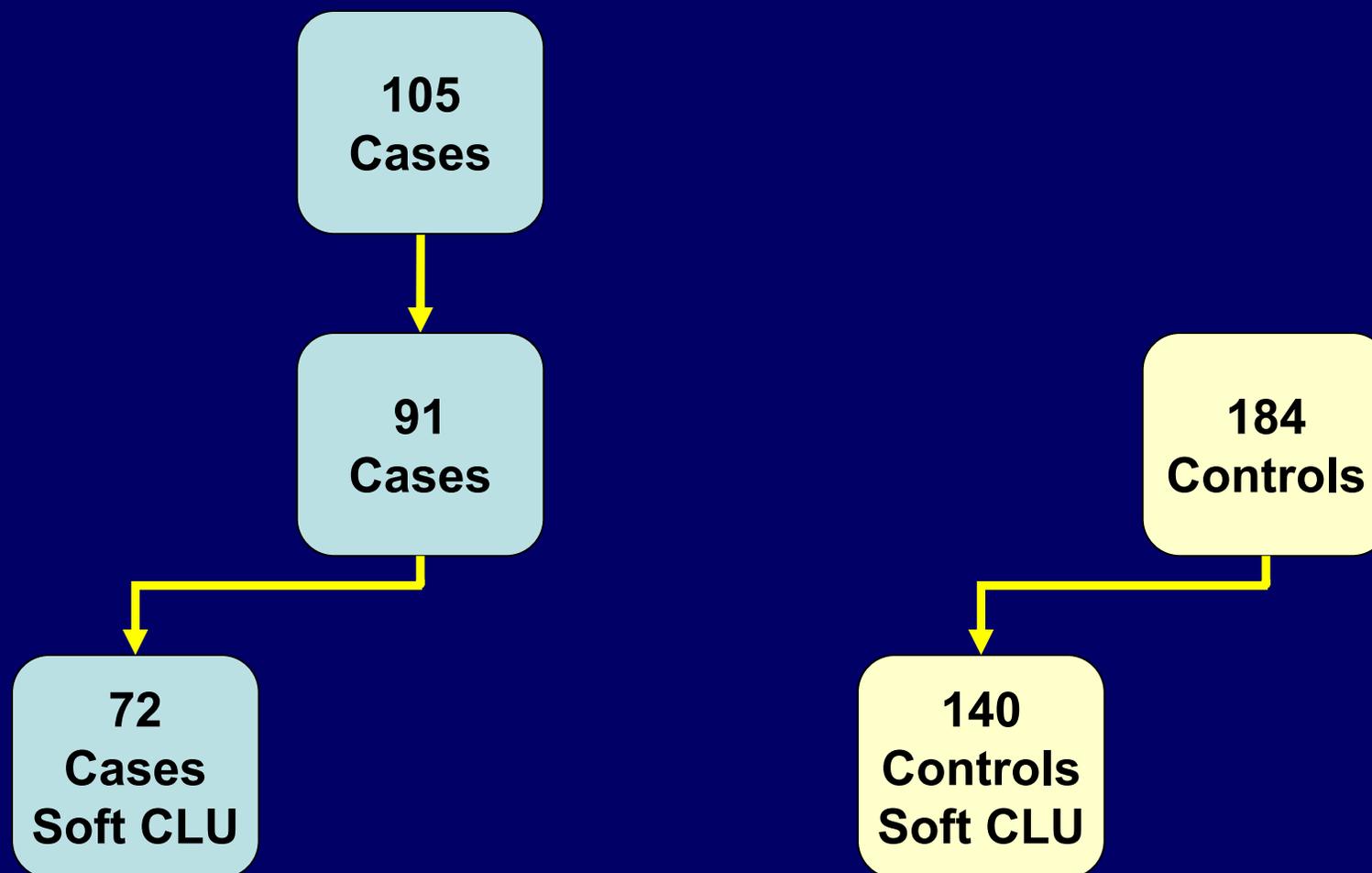
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Cases**



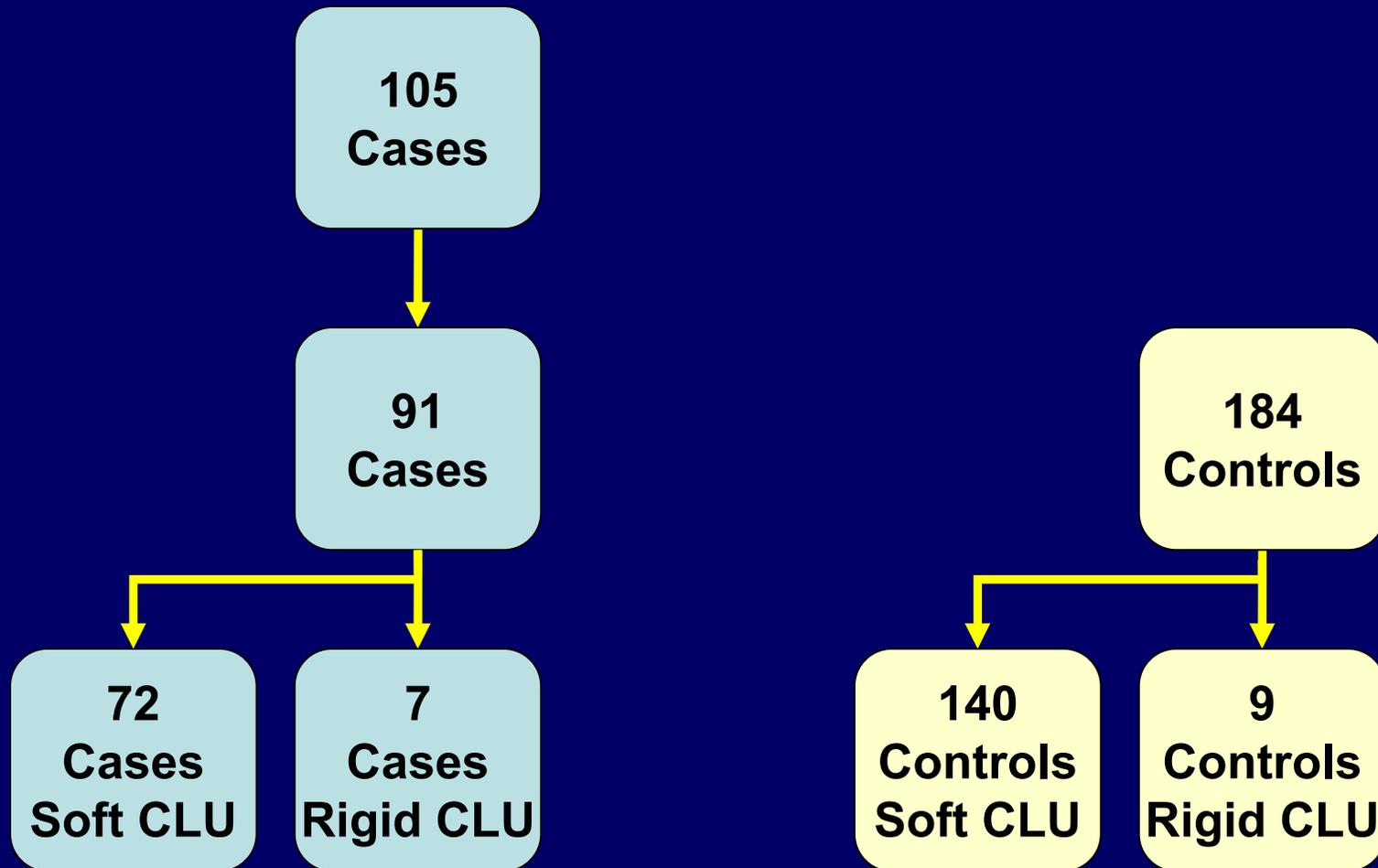
Results: Case-Control



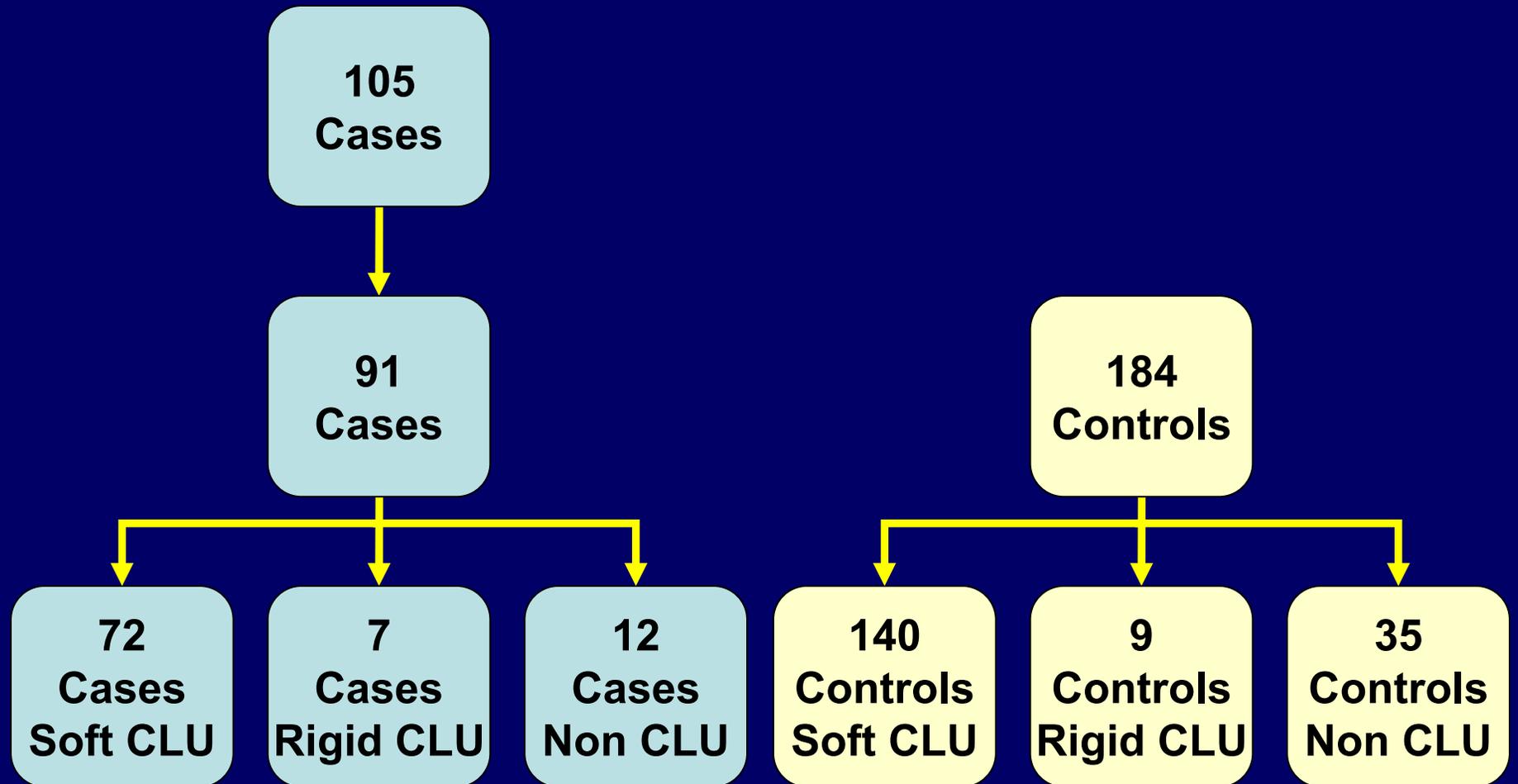
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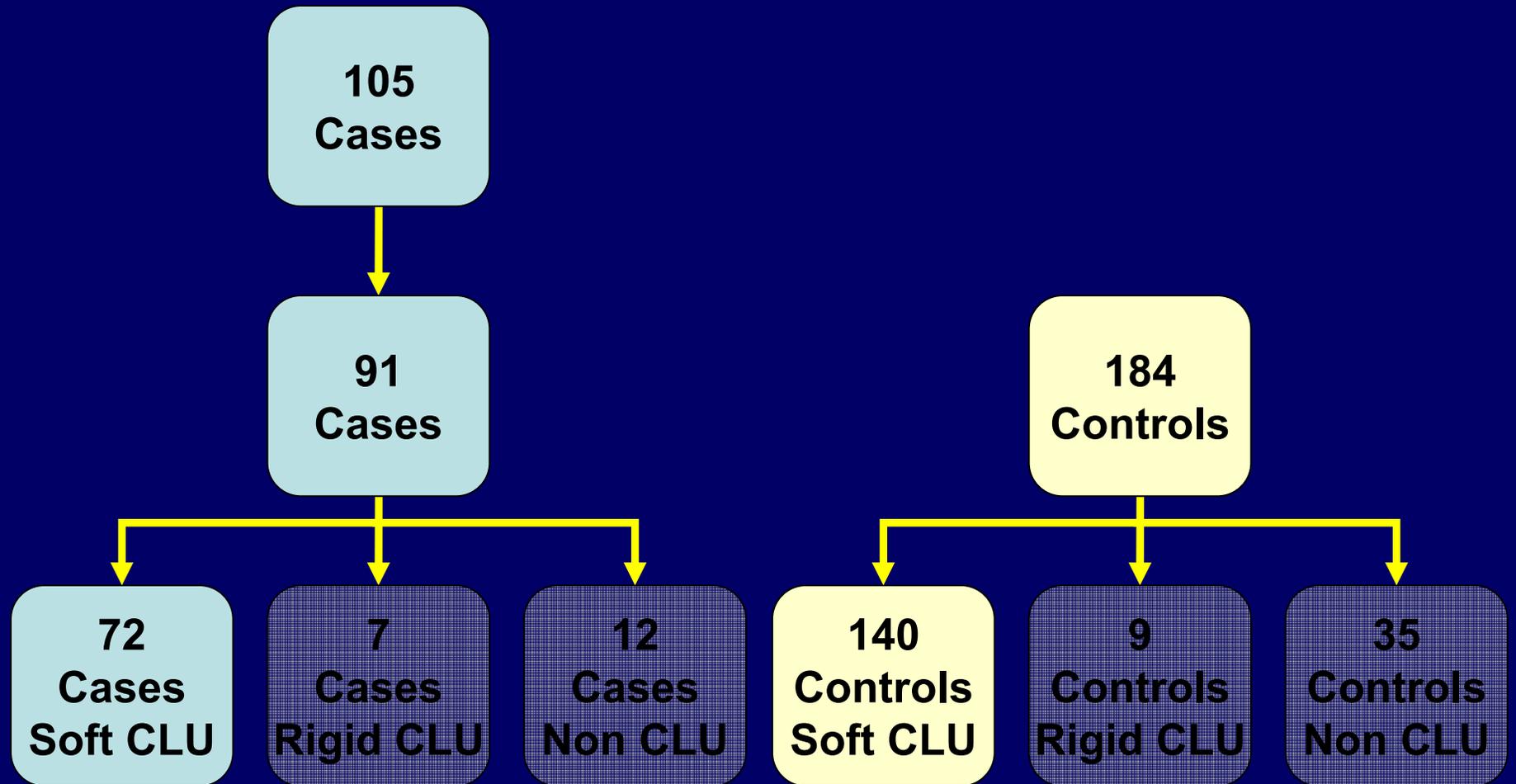
Results: Case-Control



Results: Case-Control



Results: Case-Control



Case-Control Univariate Analysis*

Variable	Cases (n=72) No. (%)	Controls (n=139) No. (%)	OR (95% CI)
Male gender	28 (39)	30 (22)	2.4 (1.3–4.6) [†]
Age<25 years	36 (50)	20 (15)	6.0 (2.8–12.4) [†]
Hispanic	11 (15)	7 (5)	12.2 (1.5–99.5) [†]
Ocular trauma	8 (11)	5 (4)	4.6 (1.2–17.8) [†]
Contact lens use ≤5 years	37 (52)	32 (23)	3.8 (1.9–7.6) [†]
Swim in lake/river with CL	9 (12)	6 (4)	3.8 (1.2–12.7) [†]
Wash face with CL	42 (59)	108 (78)	0.4 (0.2–0.8) [†]

*Soft contact lens users

[†] P value <0.05



Case-Control Univariate Analysis*

Variable	Cases (n=72) No. (%)	Controls (n=139) No. (%)	OR (95% CI)
Any use of AMOCMP	40 (56)	15 (11)	16.0 (5.6–44.6) [†]
“Topping off” solution	40 (57)	30 (23)	4.4 (2.2–8.5) [†]
Always cap solution bottle	66 (94)	103 (76)	5.2 (1.8–15.1) [†]
Clean CL at bathroom sink	21 (36)	61 (52)	0.5 (0.2–1.0) [†]
Always wash hands before inserting lenses	46 (65)	109 (78)	0.5 (0.3–1.0) [†]
CL replacement interval >1month	6 (9)	31 (23)	0.3 (0.1–0.9) [†]

*Soft contact lens users

[†] P value <0.05



Case-Control Multivariate Analysis*

Variable	Cases (n=72) No. (%)	Controls (n=139) No. (%)	aOR‡ (95% CI)
Any use of AMOCMP	40 (56)	15 (11)	16.8 (4.8–59.3)†
“Topping off” solution	40 (57)	30 (23)	2.8 (1.1–6.8)†
Contact lens use ≤5 years	37 (52)	32 (23)	2.8 (1.0–7.5)†

‡ Adjusted for age and gender

† P value <0.05

*Soft contact lens users



Non-significant Variables

- **Contact lens solutions other than AMOCMP**
- **Contact lens characteristics**
 - FDA group, silicone hydrogel, surface treated
- **Contact lens use**
 - Daily vs. extended wear
 - Hours/day and days/week
 - Ever sleep w/ lenses
- **Hygiene and disinfection**
 - Rubbing or rinsing lenses during disinfection
 - Washing hands before cleaning lenses
 - Handling lenses with wet hands
 - Hours storing lenses in case
- **Water exposure while wearing lenses**
 - Showering, bathing, swimming in pool



Discussion: AMOCMP

- **Multi-purpose solution**
 - Used for disinfecting, rinsing, cleaning and storing lenses
- **Launched in 2003**
- **No evidence of contamination**
 - 21 AMOCMP lot numbers
 - None repeated
 - Wide geographic and temporal distribution
- **Case-control study with 55 cases in Chicago area**
 - AMOCMP primary risk factor



Parallels with *Fusarium* Keratitis 2006 Outbreak

MMWR[™]

Morbidity and Mortality Weekly Report

MMWR Dispatch
Vol. 55 / April 10, 2006

Fusarium Keratitis — Multiple States, 2006

On March 8, 2006, CDC received a report from an ophthalmologist in New Jersey regarding three patients with contact lens-associated *Fusarium* keratitis during the preceding 3 months. Initial contact with several corneal disease spe-

21 (70%) were female; infection onset occurred during June 15, 2005–March 18, 2006.

Twenty-eight patients (93%) wore soft contact lenses, and two (7%) reported no contact lens use. Among contact lens

MMWR[™]

Morbidity and Mortality Weekly Report

MMWR Dispatch
Vol. 56 / May 26, 2007

Acanthamoeba Keratitis — Multiple States, 2005–2007

In May 2006, the Illinois Department of Public Health (IDPH) informed CDC about a possible increase in *Acanthamoeba* keratitis (AK) at an ophthalmology center in Illinois during the preceding 3 years. The University of Illi-

contaminated water; have minor damage to their corneas; or have previous corneal trauma are at increased risk for infection (2). Based on an analysis of cases reported to CDC during 1985–1987, the incidence of AK in the United States has

- Concurrent outbreaks of keratitis among CLU
- Multi-purpose solution implicated
 - *Fusarium*: Bausch & Lomb ReNu with MoistureLoc
 - No contamination
 - Insufficient anti-microbial efficacy
- “Topping off” solution in case common risk factor
 - Reduce anti-microbial efficacy
- Concern about safety of multi-purpose solutions

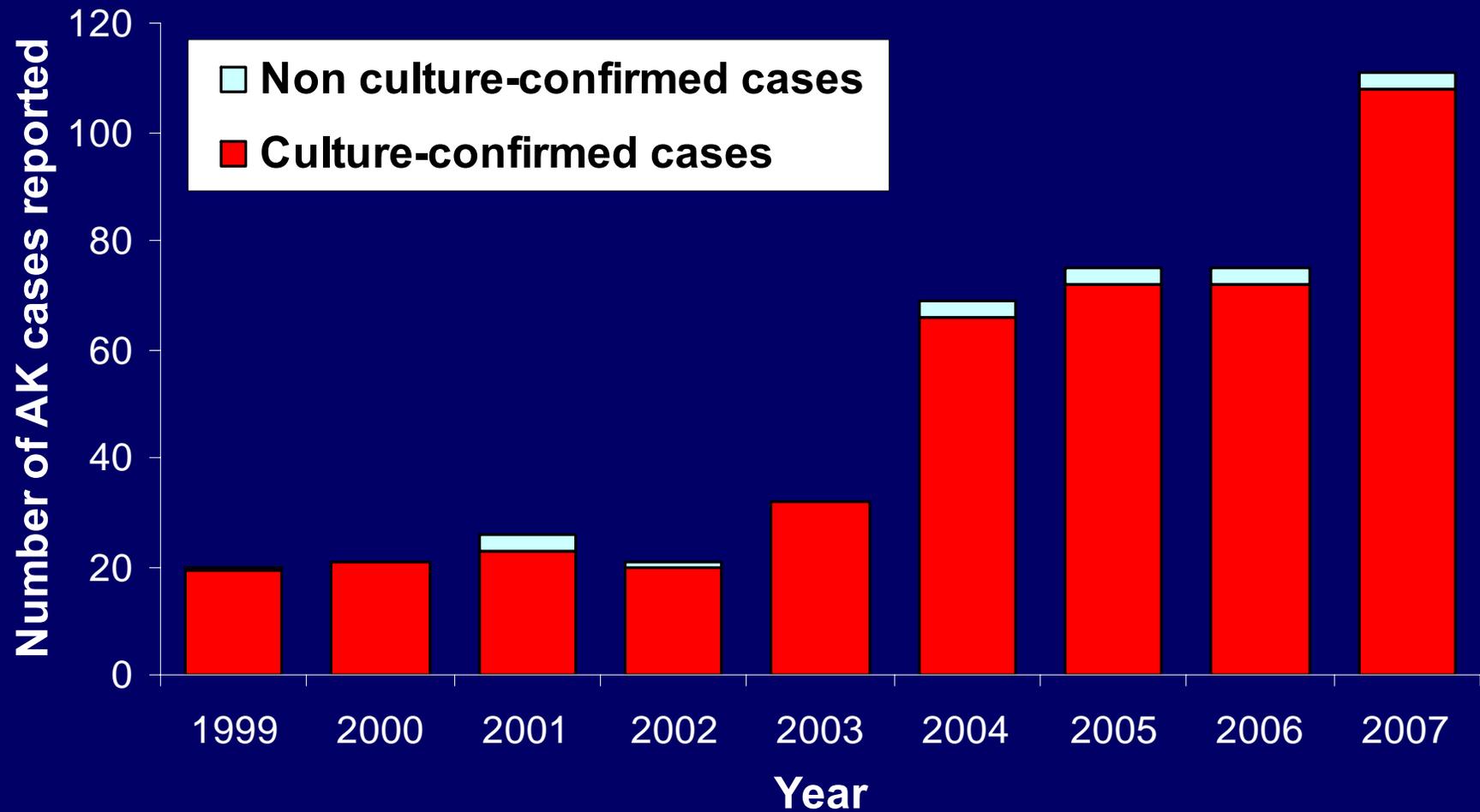


Efficacy of AMOCMP Recall

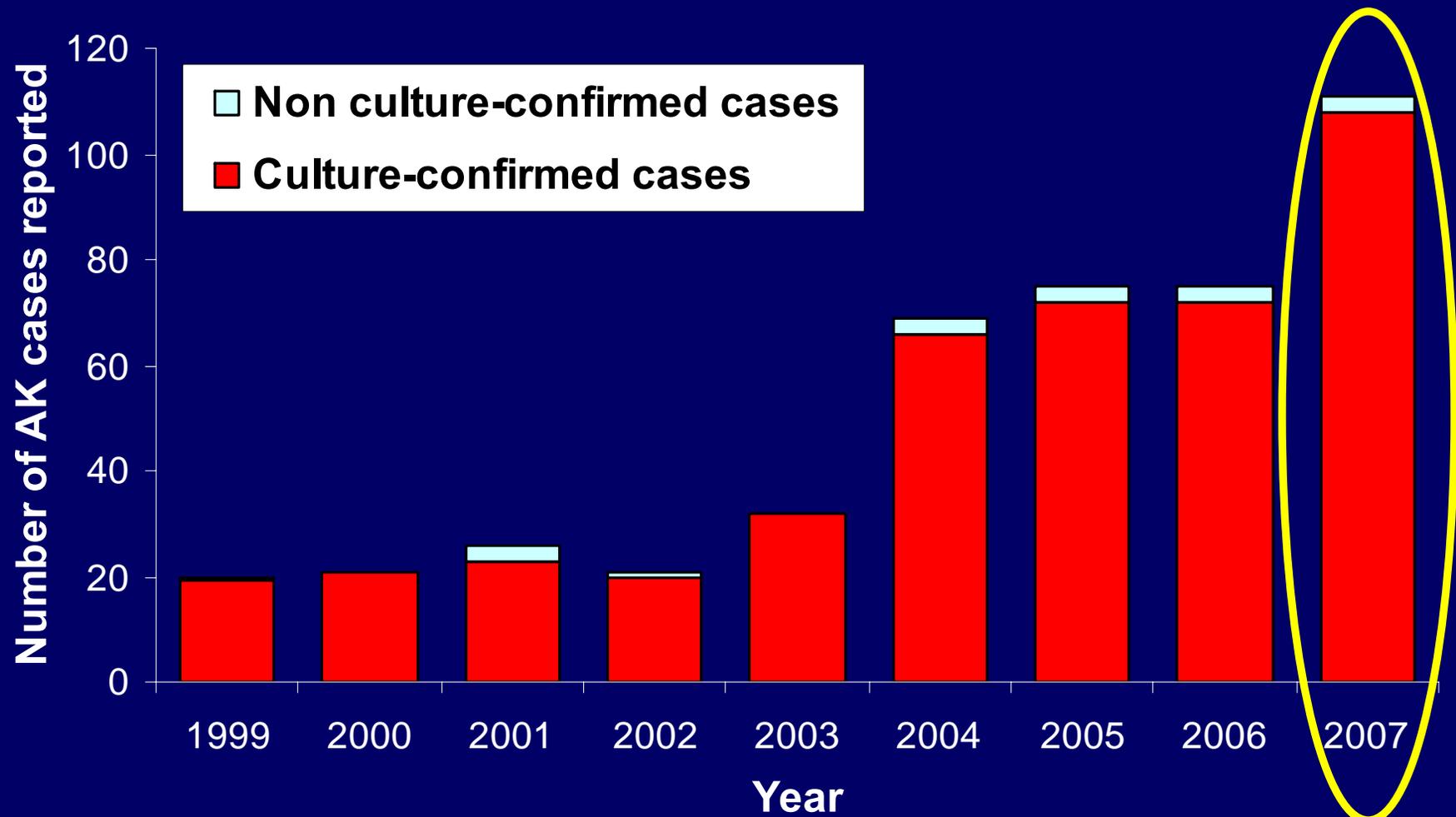
- Product recall in May 2007
- Continue to receive anecdotal reports of cases who continue to use AMOCMP
- Awareness about recall among controls
 - 45% had heard of a solution recall
 - 23% could name AMOCMP
- Challenges in recalling product with long shelf life



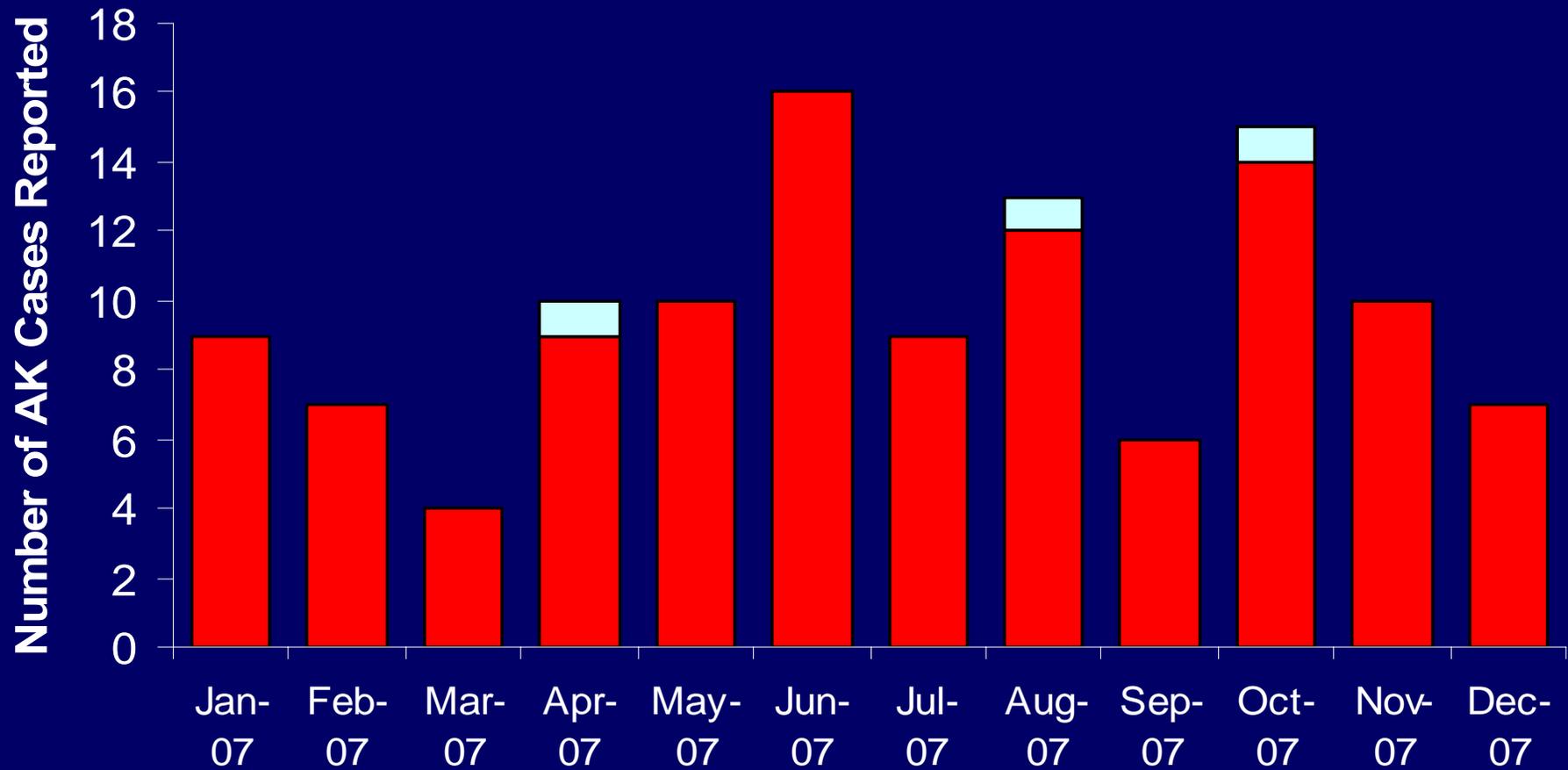
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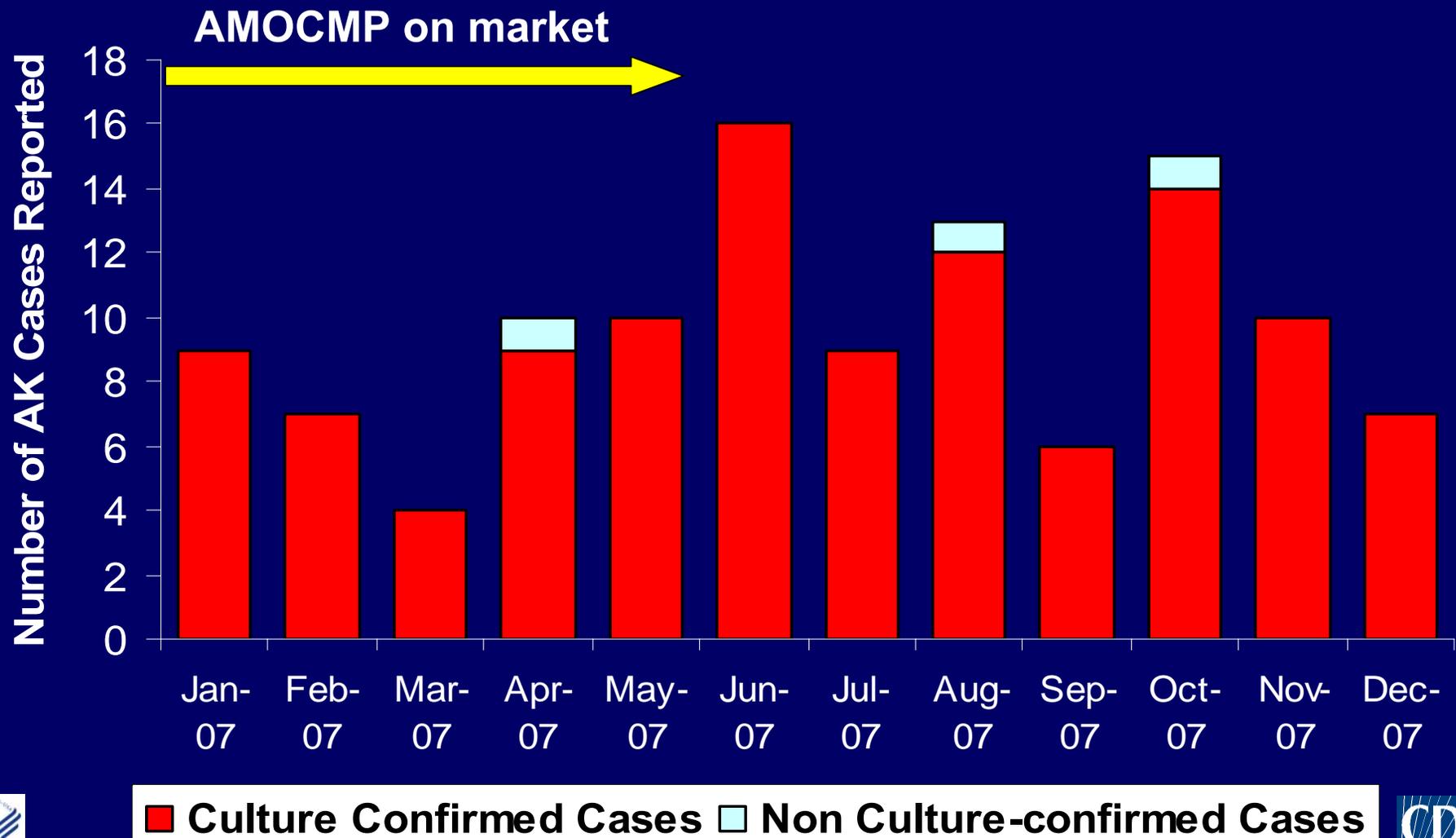
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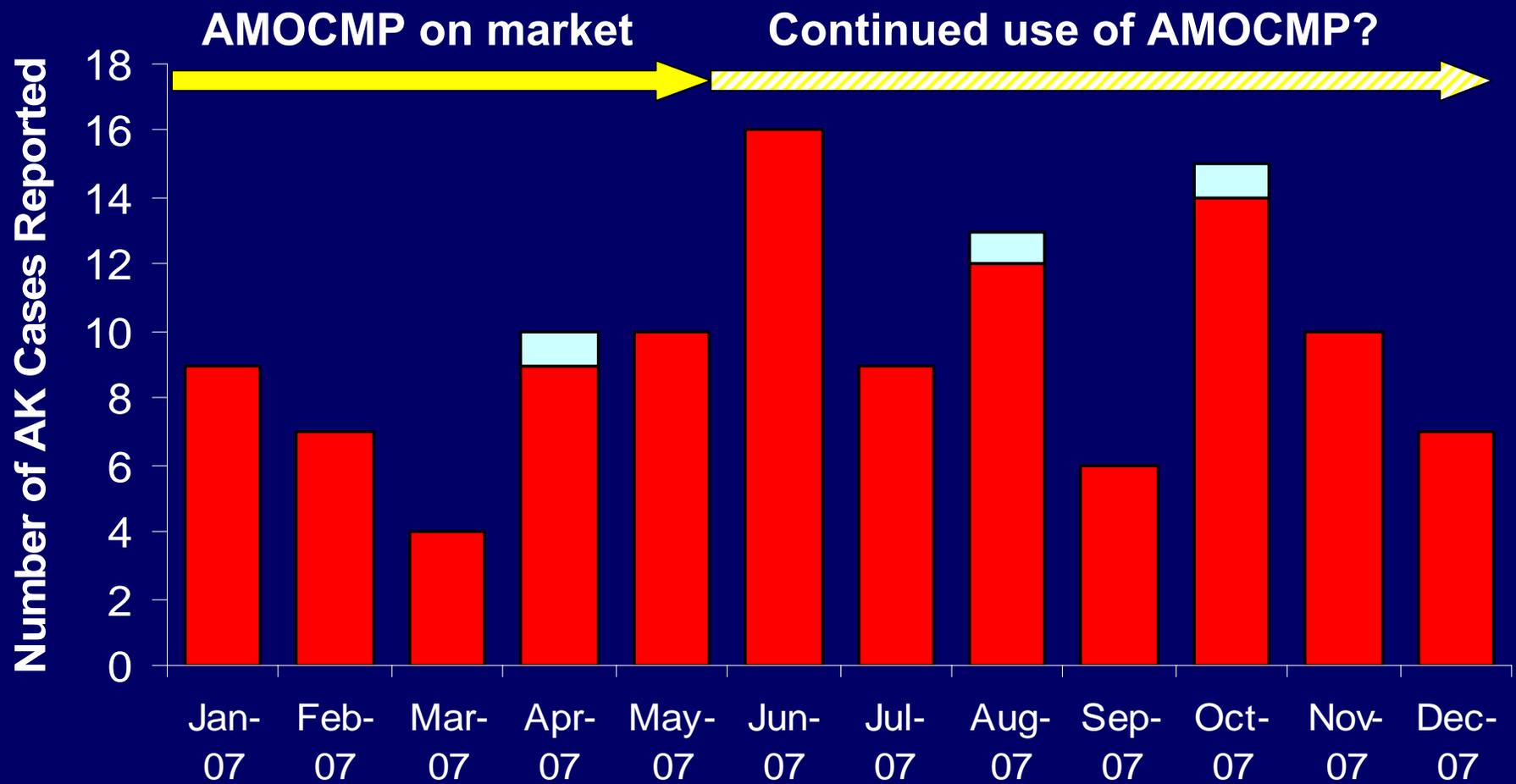
■ Culture Confirmed Cases ■ Non Culture-confirmed Cases



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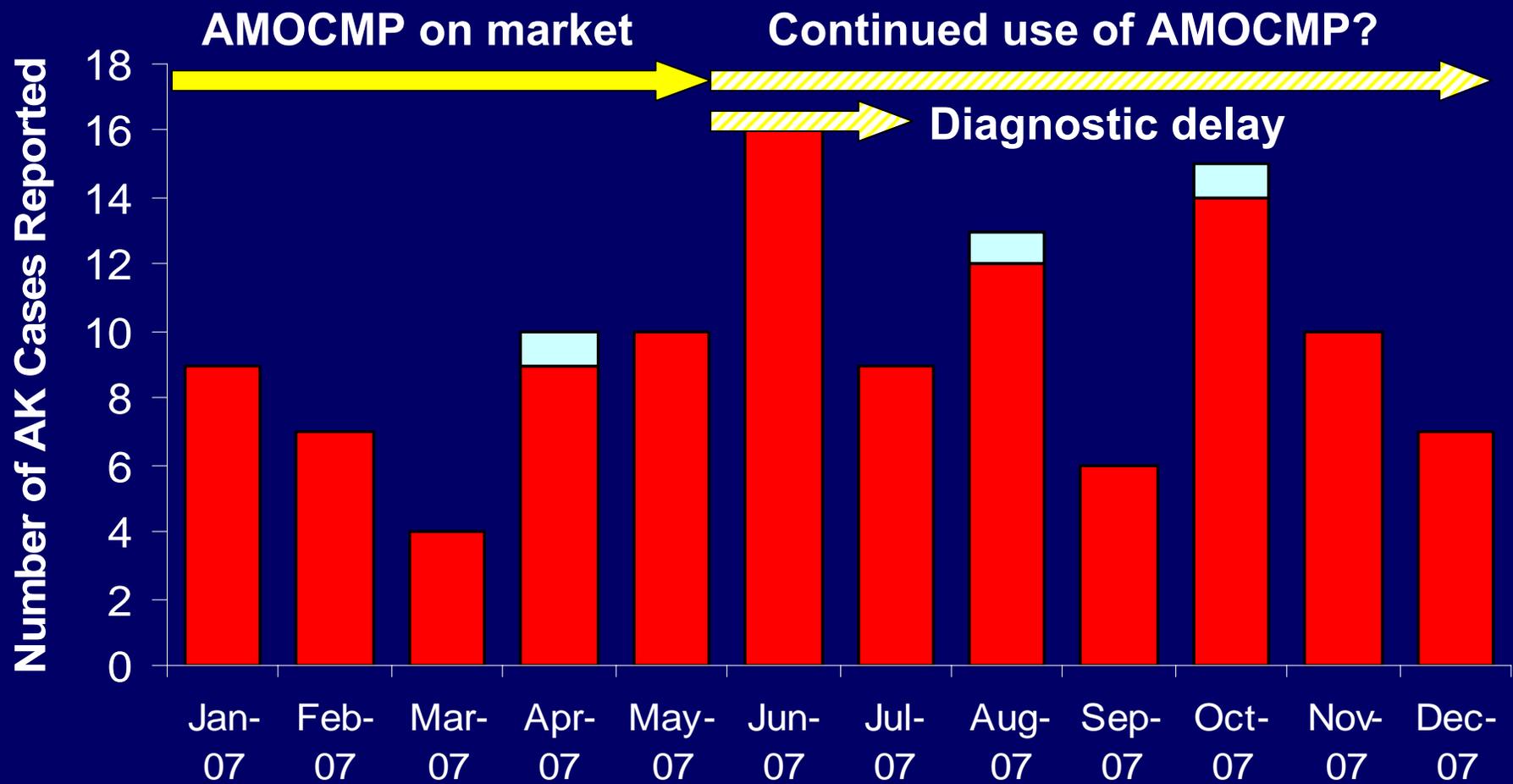
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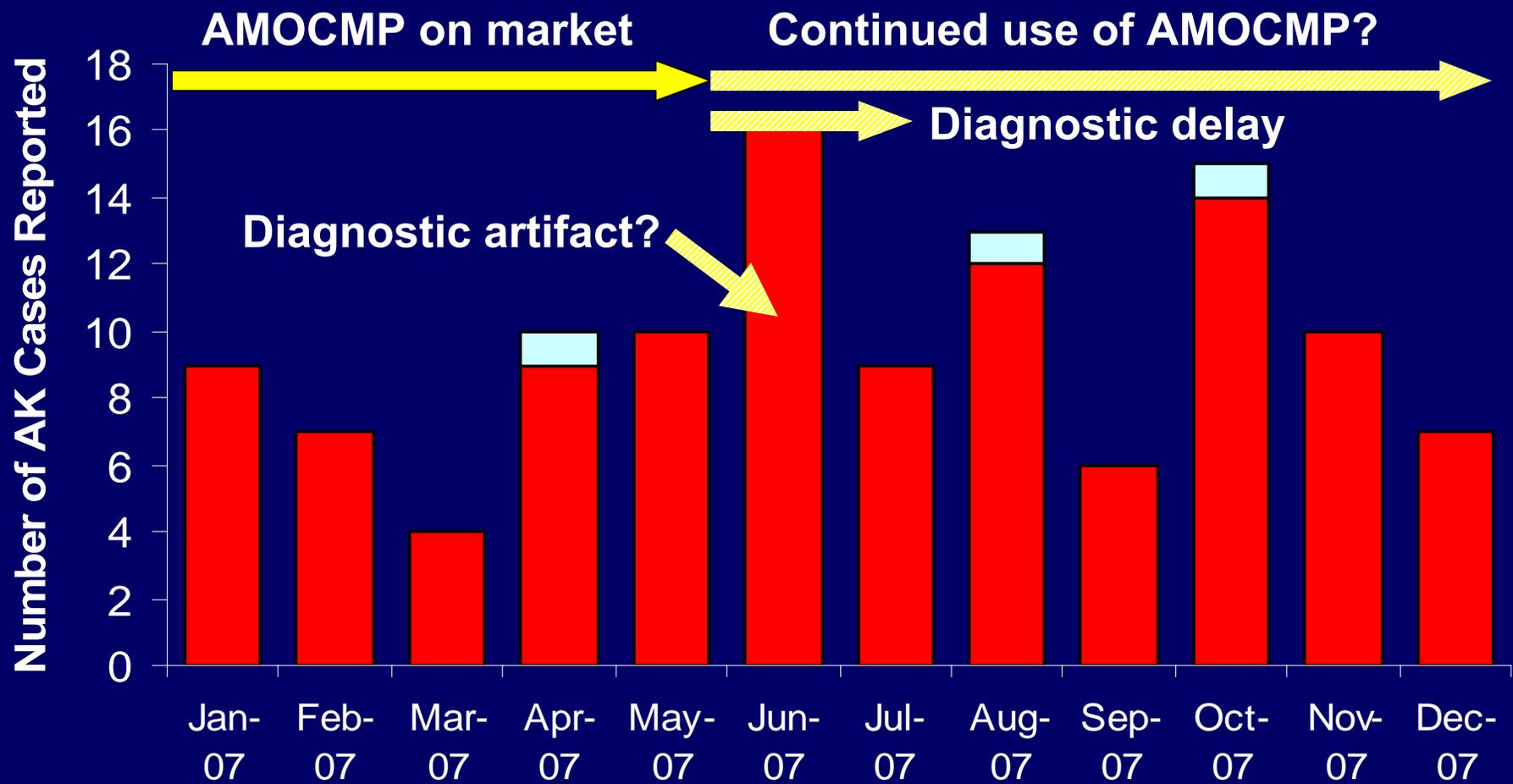
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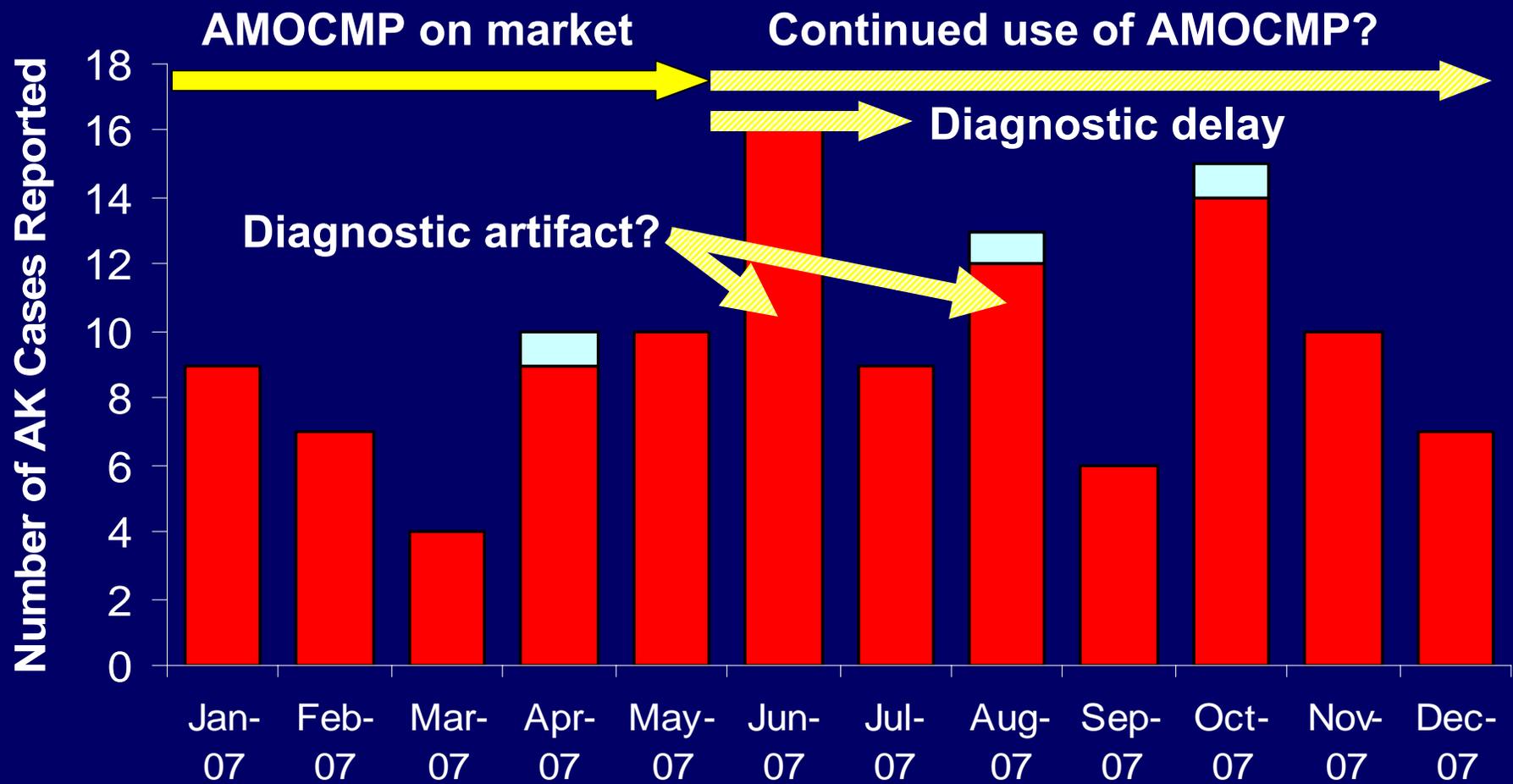
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Limitations

- Limited recollection of products used 1–2 years ago
- Reporting bias resulting from product recall
- Unable to assess role of water treatment type
 - Geographically matched cases and controls likely to be on same water system
- Unable to identify risk factors for non CLU and rigid CLU



Conclusions

- **AK case-patients almost 17 times more likely than matched controls to have used AMOCMP**
 - Validated preliminary analysis comparing AK cases to *Fusarium* controls
- **Use of existing comparison data enabled rapid public health action**
- **No evidence of solution contamination of AMOCMP**
- **Suspect insufficient anti-*Acanthamoeba* activity**
- **Other risk factors**
 - “Topping off” solution
 - Contact lens use ≤ 5 years



Recommendations

- Research anti-*Acanthamoeba* activity of AMOCMP and other solutions
- Follow-up survey of survey ophthalmology centers and laboratories for 2007 and 2008 AK cases
 - Assess impact of AMOCMP recall
- Promote healthy contact lens habits
 - No “topping off”
 - Emphasis on new contact lens users



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- **Volunteers for control interviews**



The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention

