

Investigation of Adverse Events Following Immunization (AEFIs) At a Workplace Influenza Vaccination Clinic: From Disinfectant to Dermatitis

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1st National Immunization Conference Online
March 2012

Background

- Workplace immunization clinics provide a unique opportunity for AEFI investigations since cohorts of vaccinated individuals can readily be followed-up
- In Fall 2010, Toronto Public Health (TPH) received numerous reports of adverse events following immunization (AEFIs) involving localized rashes and/or swelling that were associated with a one-day influenza vaccine clinic at a workplace

Objective

- To investigate the nature and contributing factor(s) of the AEFIs

Methods

- Retrospective review
- Information/data sources:
 - the agency that administered the vaccines
 - the workplace
 - AEFI reports completed by healthcare professionals
 - Integrated Public Health Information System (iPHIS) records
- Reported AEFIs involving rashes and/or swelling were assigned a case definition based on Brighton Collaboration criteria
- Descriptive statistical analysis was conducted using Microsoft® Excel

AEFI Case Definitions and Levels of Diagnostic Certainty for “Rash Including Mucosal Involvement” and “Swelling at or Near Injection Site” as Outlined by the Brighton Collaboration

Rash Including Mucosal Involvement

Level 1 of Diagnostic Certainty

- A skin or mucosal change (either new or an exacerbation of a previous condition) following immunization,
THAT
- consists of a clearly identified primary lesions and/or secondary skin change,
AND
- is documented with standard [dermatological] terminology,
AND
- is documented by a health care provider or other person trained in identifying mucocutaneous reactions

Level 2 of Diagnostic Certainty

- A skin or mucosal change (either new or an exacerbation of a previous condition) following immunization,
FOR WHICH
- a morphologic description has been provided (but Level 1 criteria are not met)

Level 3 of Diagnostic Certainty

- A skin or mucosal change (either new or an exacerbation of a previous condition) following immunization without morphologic description

Source: (Brighton Collaboration, 2010)

AEFI Case Definitions and Levels of Diagnostic Certainty for “Rash Including Mucosal Involvement” and “Swelling at or Near Injection Site” as Outlined by the Brighton Collaboration

Swelling at or Near Injection Site

Level 1 of Diagnostic Certainty

- Visible enlargement of an injected limb with or without objective measurement,
- AND
- assessed by a health care provider

Level 2 of Diagnostic Certainty

- Visible enlargement of an injected limb with or without objective measurement,
- AND
- assessed by any person (not specified as a health care provider)

Level 3 of Diagnostic Certainty

N/A

For all levels

Extension of swelling should be described as follows for each level of diagnostic certainty:

- Swelling clearly including injection site(s)
- Local swelling, near to, but not clearly including the injection site
- “Joint-to-joint” or “crossing-joint”

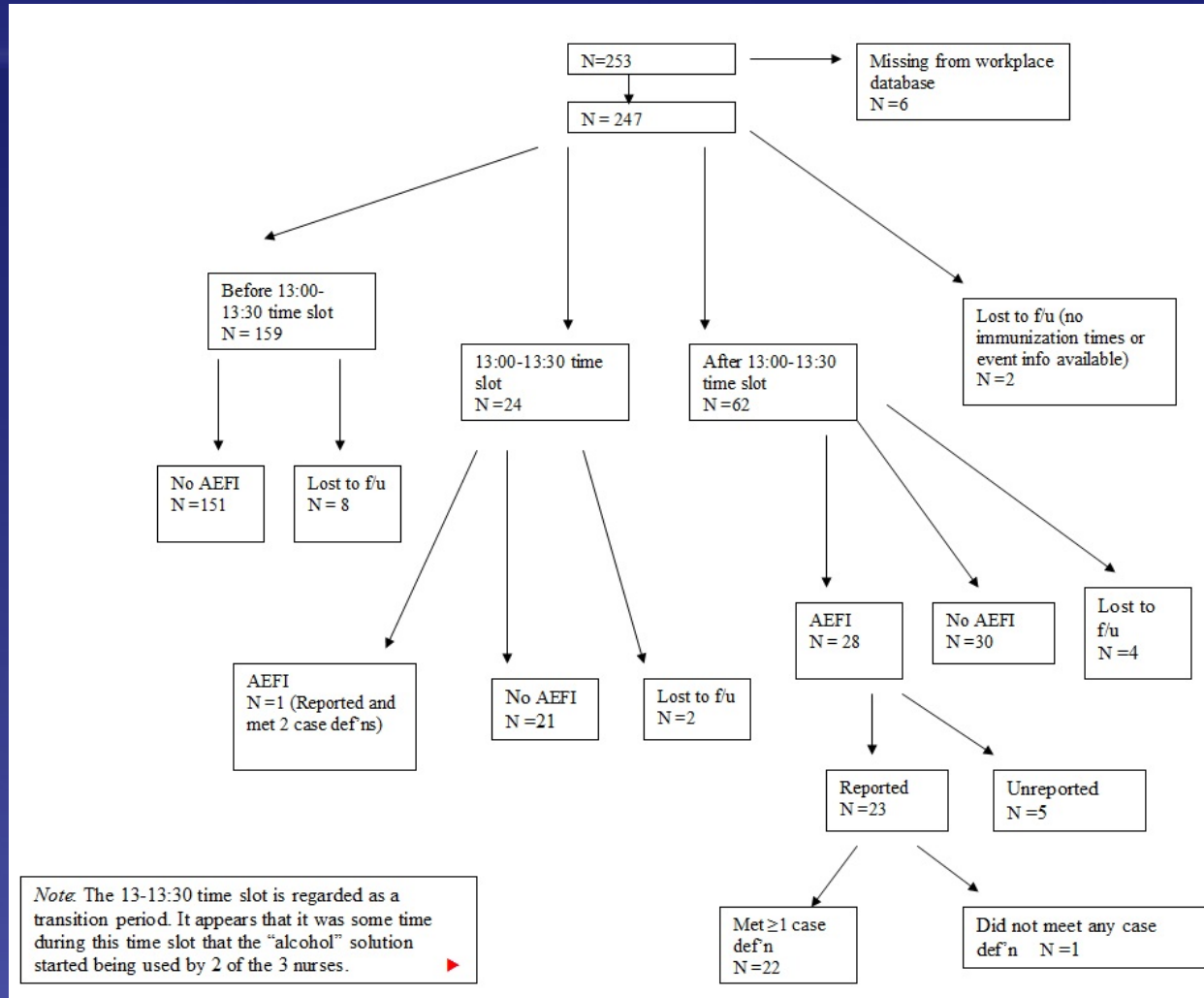
Source: (Brighton Collaboration, 2010)

Results & Discussion

a) Recall of Events at the Workplace Immunization Clinic

- At the workplace clinic, 3 nurses immunized 253 clients from 9:00-16:30
- All clients received the same influenza vaccine (Fluviral®) and lot number.
- At approximately 13:00-13:30, two nurses depleted their alcohol swab supply, and began using solution from a bottle labeled "alcohol" as a disinfectant
- No clients immunized prior to the 13:00-13:30 time period experienced an AEFI
- 24 out of 86 clients vaccinated during or after the 13:00-13:30 time period reported an AEFI

Flowchart Outlining Outcomes of 253 Clients Immunized, Including Immunization Times and Development of AEFIs



Results & Discussion

b) Details of Formally Reported AEFIs Meeting ≥ 1 Case Definition

- All 24 AEFIs occurred on the same day as the clinic, with the majority arising within approx 30 minutes of immunization
- All 24 of the affected clients had the “alcohol” solution used as a disinfectant for their skin, rather than a standard alcohol prep pad
- 23 of the 24 clients had an AEFI that met a case definition of “rash including mucosal involvement,” or “swelling at or near injection site,” or both. Thus, 26.7% (23/86) of the clients vaccinated during or after the 13:00-13:30 time slot experienced an AEFI that met ≥ 1 case definition
- Of the 23 clients who experienced an AEFI meeting ≥ 1 case definition, 15 were female and 8 were male

Results & Discussion

Gender and Case Definition Summary of 23 AEFIs Reported from Influenza Vaccine Clinic that Met ≥ 1 Case Definition

	N		
Female	15 (65.2%)		
Case Definitions	N	Level of Diagnostic Certainty	N
“Rash including mucosal involvement”	2 (8.7%)	Level 1	0
		Level 2	2 (100%)
“Swelling at or near injection site”	4 (17.4%)	Level 1	0
		Level 2	4 (100%)
Both Definitions	17 (73.9%)	“Rash” Level 1, “Swelling” Level 1	0
		“Rash” Level 1, “Swelling” Level 2	0
		“Rash” Level 2, “Swelling” Level 1	4 (23.5%)
		“Rash” Level 2, “Swelling” Level 2	13 (76.5%)

Results & Discussion

Descriptive Summary of 22 AEFIs Reported from Influenza Vaccine Clinic that Met ≥ 1 Case Definition and Had Detailed Client Information Available

	N	Median/Mean	Range
Female	14 (63.6%)		
Age (years)		40.5/40.4	15-63
Visited ER	5 (22.7%)		
Did not Visit ER	9 (40.9%)		
Not known if Visited ER	8 (36.4%)		

-1 client of the 23 who experienced an AEFI meeting ≥ 1 case definition had her age and any ER visit data missing from her AEFI report

Results & Discussion

c) Specifics Regarding the “Alcohol” Solution Used as a Disinfectant

- The solution was chemically analyzed by gas chromatography-mass spectrometry (GC-MS) for volatile organic compounds (VOCs) by CASSEN Testing Laboratories (Toronto) 5 days after the workplace vaccine clinic took place
- Based on the analysis, the solution contained approximately 66% isopropyl alcohol (isopropanol), 15% acetone, and <1% each of other VOCs

Results & Discussion

d) Potential Diagnoses for the Clients with AEFIs Meeting Case Definition

- Irritant contact dermatitis (ICD) is a likely diagnosis based on the features, rapid onset, and high prevalence of the adverse events, and the nature of the “alcohol” solution used for disinfecting
- Variation in terms of the features and severity of the clients’ adverse events is also characteristic of ICD: both endogenous and exogenous factors determine the specific reaction
- Endogenous variables:*
 - degree/length of exposure,
 - presence and depth of non-intact skin,
 - mechanical factors (e.g. pressure, friction) (Canadian Centre for Occupational Health & Safety [CCOHS], 2008)
- Exogenous variables:*
 - skin type,
 - age (the very young are more likely to experience percutaneous absorption of chemicals),
 - genetic factors (Rom & Markowitz, 2007; Wolff et al., 2008)

Results & Discussion

e) How Did Relatively Benign Chemicals Lead to the AEFIs?

- Standard alcohol prep pads used for disinfecting skin prior to injections are typically saturated with 70% isopropyl alcohol
- Some prep-pads, contain 70% isopropyl alcohol and a small amount acetone, usually 10%
- Thus, the fact that the “alcohol” solution which presumably caused the AEFIs contained only isopropyl alcohol (66%), acetone (15%), and <1% of other VOCs is somewhat surprising
- It is unlikely that the VOCs other than isopropyl alcohol and acetone would be the cause of the AEFIs. Each of these VOCs were present in minute proportions and are normal byproducts from acetone synthesis that would otherwise be present in standard acetone/alcohol prep pads.
- Possibility 1:** The higher proportion of acetone in the solution (15%) versus standard acetone/alcohol prep pads (typically 10%) led to the adverse events
- Possibility 2:** There were contaminant(s) in the solution that the laboratory did not test for. The GC-MS scan carried out strictly detects VOCs. More in-depth testing of the solution was hampered by the fact that it was an unknown product. Therefore, it was not possible to predict which other chemicals are likely to be in the solution and therefore which specific compound(s) to test for.

Conclusions

- The AEFIs that 24 of the workplace immunization clinic clients experienced were likely cases of ICD that arose from the use of the "alcohol" solution containing acetone
- Consistent, meticulous adherence to vaccine administration protocols is imperative to reduce the likelihood of AEFIs and maintain public confidence in vaccine safety

Acknowledgments

We gratefully acknowledge the following individuals for their contributions to our study:

- Suzanne Goldacker, Joanne Cameron and other staff at Toronto Public Health (TPH)
- Bryna Warshawsky (AMOH, Middlesex-London Health Unit)
- Sharon Dolman (Ministry of Health and Long-Term Care Ontario)
- staff of CASSEN Testing Laboratories in Toronto
- William Goodwin for providing technical and project design support

Special thanks to the CDC and the organizers of the 1st National Immunization Conference Online for providing us with the opportunity to share our research

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