

Linking data from different sources to estimate the risk of a collision when using a cell phone while driving

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Outline

- Review the methods and results of three epidemiological studies:
 - two used the case-crossover design;
 - one compared two cohorts (cell phone users vs non users)
- Strengths and weaknesses of each study
- Conclusion

Redelmeier & Tibshirani (N.E.J.M., 1997)

- **Sample:** 699 cell phone users who had a motor vehicle collision with PDO (Toronto area).
- Used the case-crossover design: linked data from subjects' statement, police reports and cell phone records.

Hazard period [T-10 to T-1]		Control day	
		On telephone	Not on telephone
Day of crash	On telephone	13	157
	Not on telephone	24	505

Redelmeier & Tibshirani (N.E.J.M., 1997)

- Case-crossover design

- Estimated **RR**:

$$157/24 = \mathbf{6.54}$$

95% C.I. (4.50, 9.99)

- Adjusted RR for intermittency driving

- Pilot survey with n=100 cases

- 65% were driving in the control period:

$$\mathbf{adj. RR: 6.54 \times 0.65 = 4.3}$$

95% C.I. (3.0, 6.5)



Laberge-Nadeau et al. (A.A.P., 2003)

- SAAQ mailed out our questionnaire to 175000 license holders of class 5 permit.
- 36 077 (20,6%) were returned to C.R.T. with signed consent form:
 - Cell phone users: 9 352 men, 3 339 women
 - Non users: 13 590 men, 9 797 women

Different data sources

- Questionnaire.
- Driver's record from the SAAQ (information on collisions reported by the police from 1996 to 2000).
- Cell phone calls (date, time , duration, outgoing or incoming, emergency call) from 1998 to 2000.
 - Bell mobilité
 - Rogers AT&T
 - Clearnet
 - Fido/Microcell

Laberge-Nadeau et al. (A.A.P., 2003)

- Average number of crashes per annum per 100 drivers, period 1996-1999:

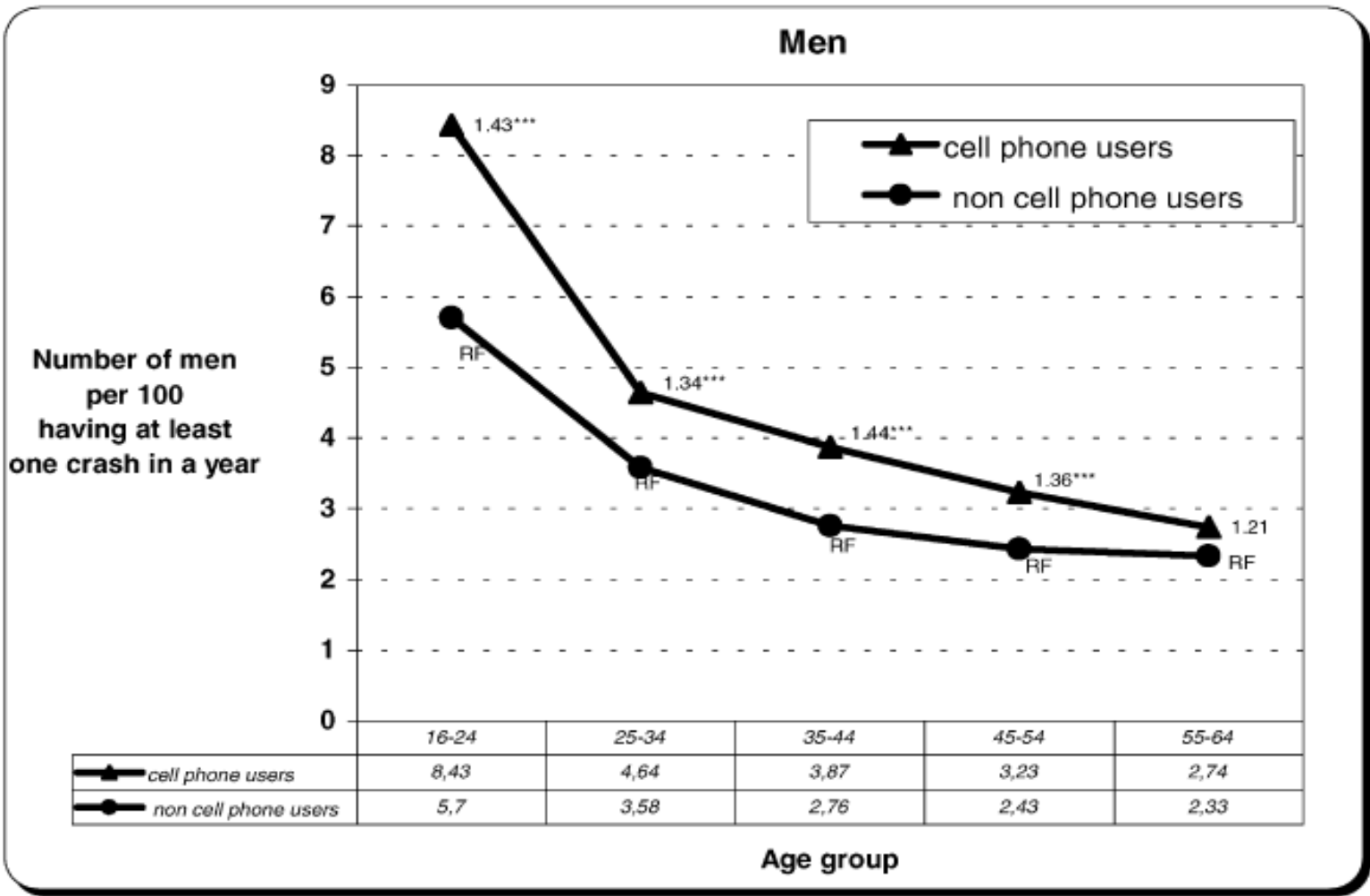
	Respondents	Non-respondents
<u>Male:</u>		
total crashes	3.46	4.36
with injuries	0.81	1.11
<u>Female:</u>		
total crashes	2.50	2.74
with injuries	0.68	0.74



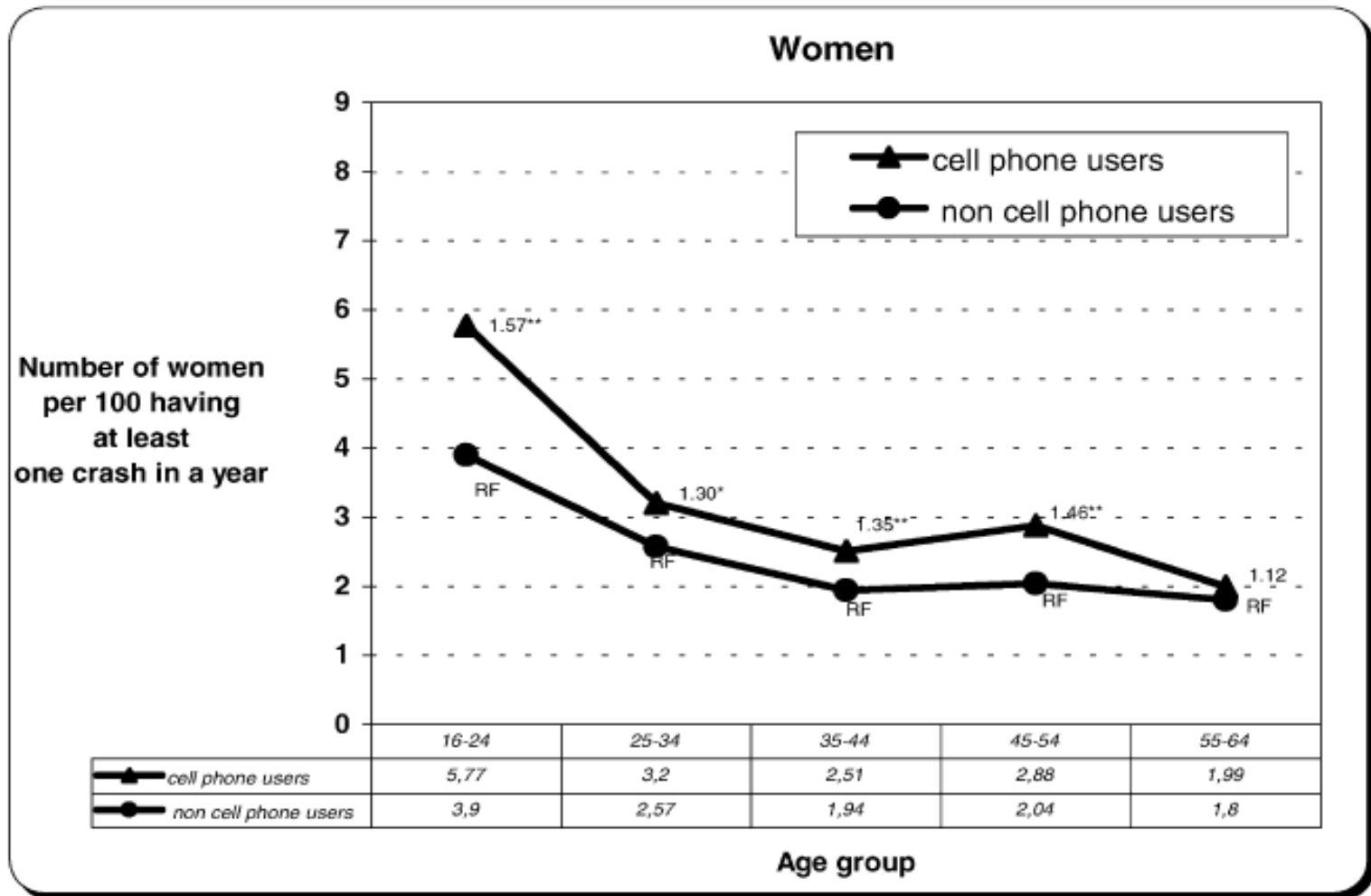
Laberge-Nadeau et al. (A.A.P., 2003)

- **Cell phone users** (data from the questionnaire)
 - Drive more often as part of their work
 - Drive more kilometres per year
 - Drive more often after 8 pm
 - Manipulate more often the radio, CD or tapes
 - Have higher education levels

Non adjusted relative risks of a collision in a year for cell phone users compared to non users



Non adjusted relative risks of a collision in a year for cell phone users compared to non users



Linking exposure data from questionnaire with SAAQ collision records to get adjusted OR of having at least one collision in a given year (cell phone users vs non users)

■ All collisions (PDO & injuries)

■ men: adj. OR = **1,11**; 95% C.I. (1,02; 1,22)

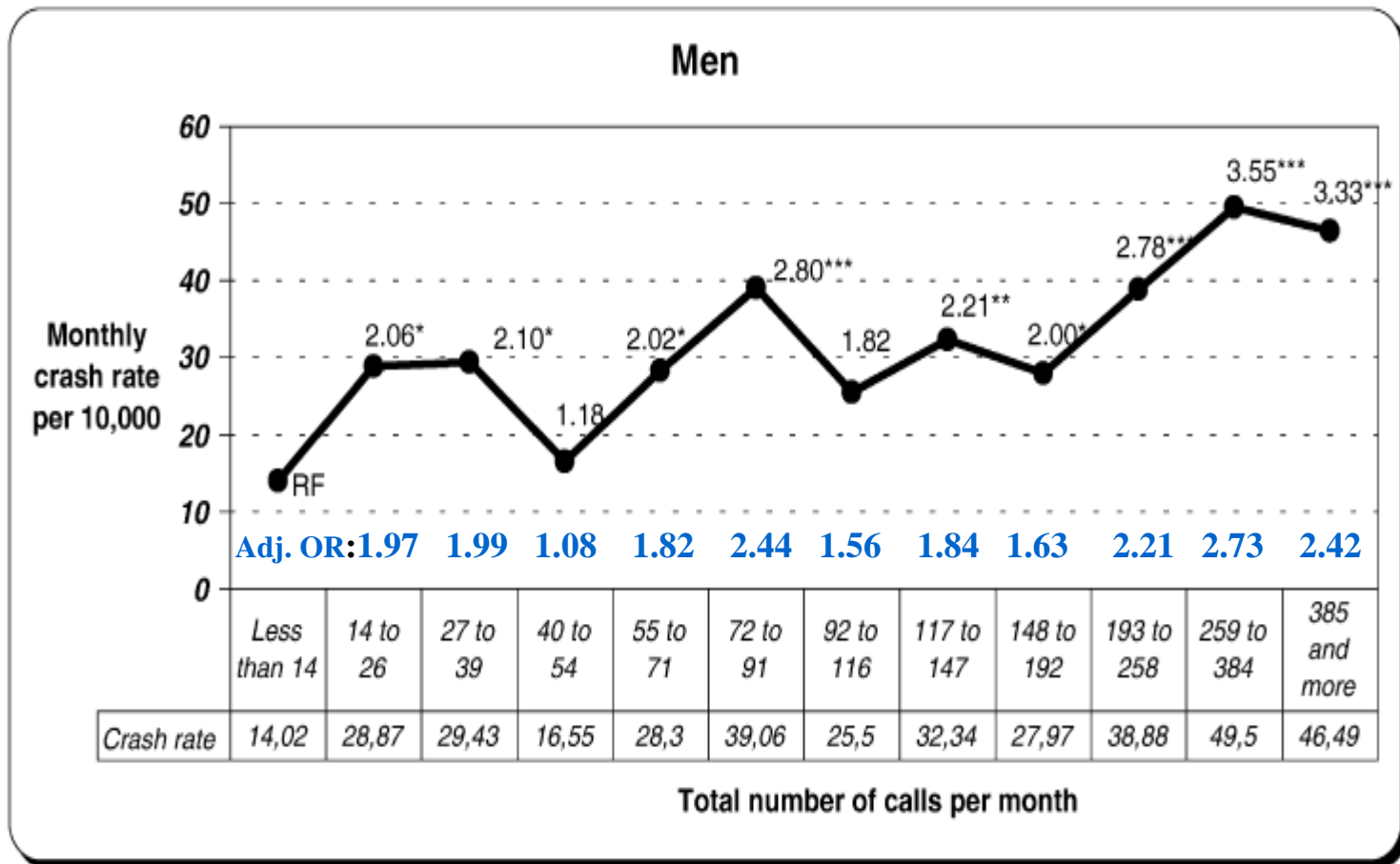
■ women: adj. OR = **1,21**; 95% C.I. (1,03; 1,40)

■ Collisions with injuries only

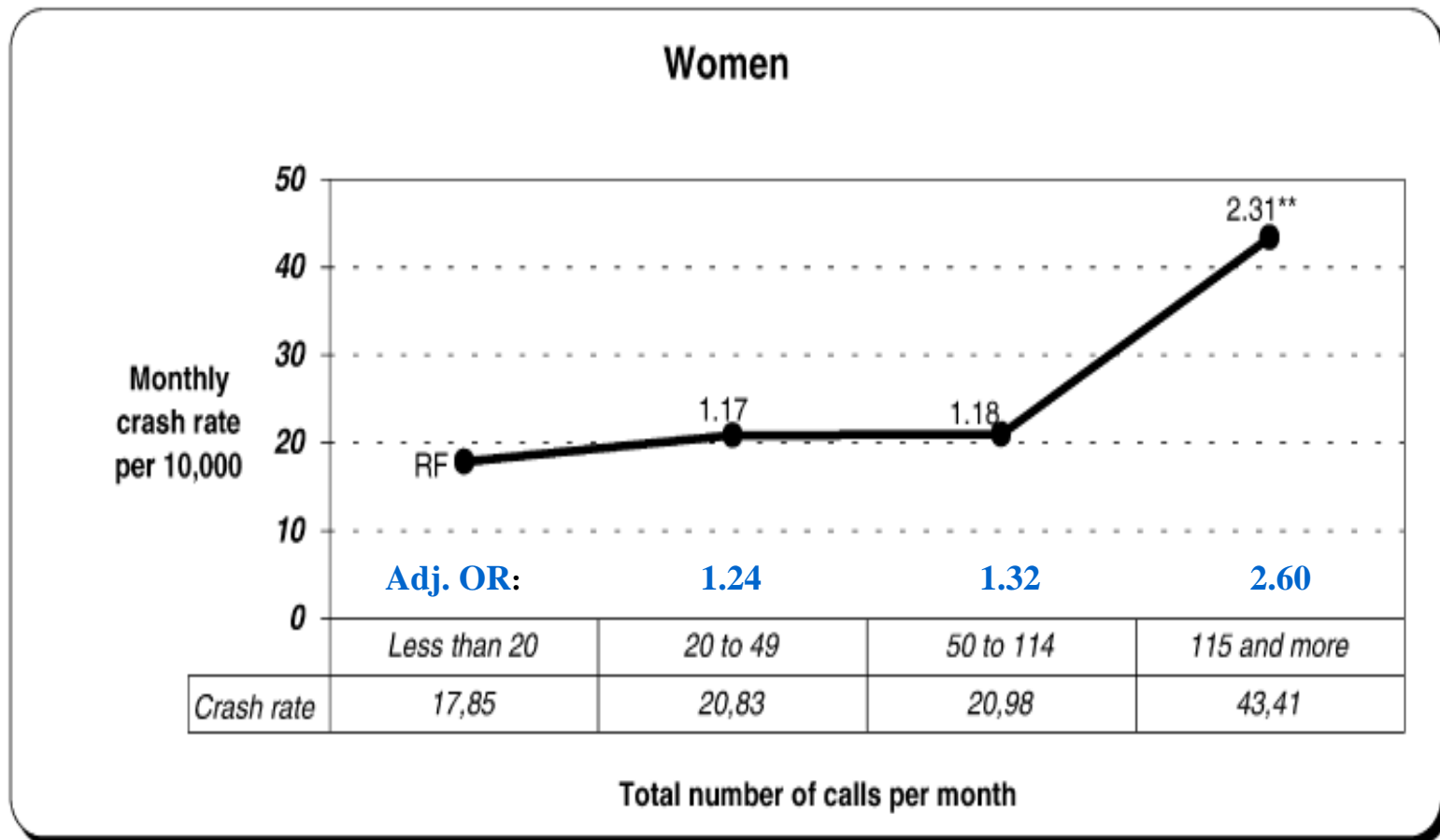
■ men: adj. OR = **1,10**; 95% C.I. (0,93; 1,30)

■ women: adj. OR = **1,30**; 95% C.I. (1,00; 1,70)

Cohort of sole users of cell phone ("dose-response" relationship)



Cohort of sole users of cell phone ("dose-response" relationship)



Re-analysis of the data from Laberge-Nadeau et al. (2003) with the case-crossover methodology

- **Sample:** 407 collisions reported by the police (292 PDO and 115 with injury) for which cell phone records were available.
- Case-crossover design:
 - RR, unadjusted for intermittency driving :
5.13 95% C.I. (3.13, 8.43)
 - (Note: 81 drivers used their cell phone in the [10-1] minutes interval prior to the reported time of the collision; 19 used their cell phone in the same interval 24 hours before)

McEvoy et al. (B.M.J. July 2005)

- **Sample:** 456 cell phone users who had a collision with injury (mild to moderate) (Perth, Western Australia).
 - cell phone activity records available
 - reported driving during the control intervals (61% of 744 drivers interviewed)
- Case-crossover design with 3 control intervals (24 hours, 72 hours and 7 days before collision):
 - linked data from drivers' interviews, medical records, and cell phone records.
 - **OR : 4.1** 95% C.I. (2.2, 7.7)

McEvoy et al. (B.M.J. July 2005)

■ Note:

- from the cell phone records, **40** of the 456 drivers used their cell phones during the hazard interval (up to 10 minutes before the collision).
- from the interviews, **32** drivers reported using their cell phones during the trip before collision.

Hand held vs hands free

Study		RR	95% C.I.
Redelmeier (1997)	Hand-held	3.9	(2.7, 6.1)
	Hands free	5.9	(2.9, 24.0)
McEvoy (2005)	Hand-held	4.9	(1.6, 15.5)
	Hands free	3.8	(1.8, 8.0)
Laberge-Nadeau (2003)	Hand-held vs Hands free	1.23	(0.86, 1.78)

Major differences between both designs

■ Case-crossover

- Use of cell phone while driving
- Self-control

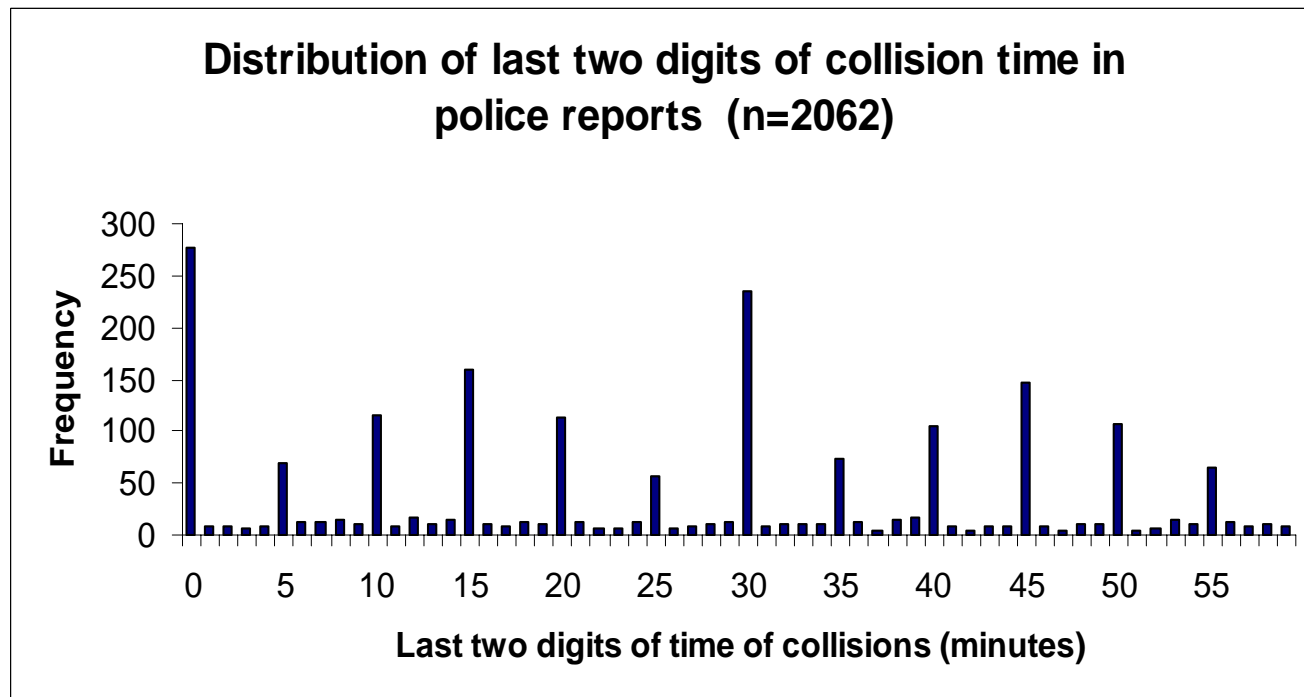
■ Two cohorts

- Overall use of cell phone vs no use (not while driving)
- Baseline differences in risk exposures between the cohorts

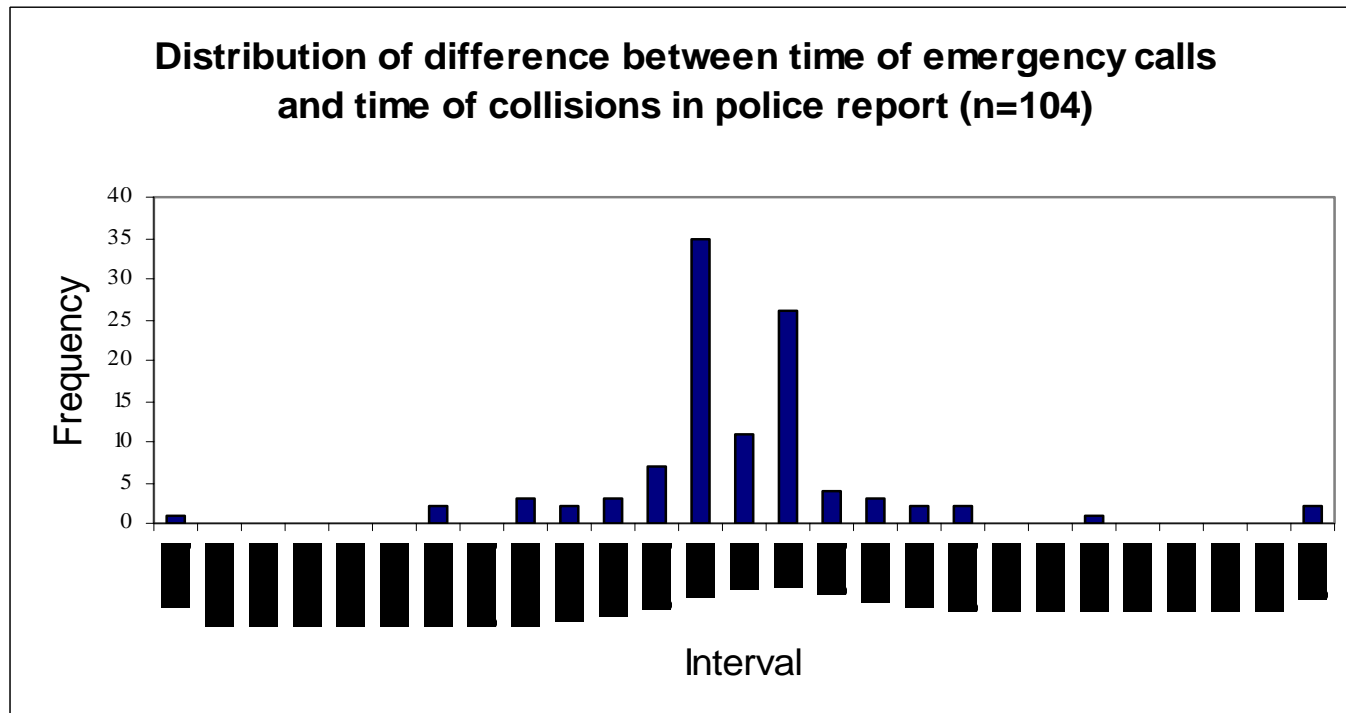
Potential problems with the case-crossover design

- Exact time of the collision is unknown
 - misclassification of a call into the at risk period when it was made or received after the collision => over estimation of the real risk.
- The choice of the length of the hazard period (e.g.: 10 minutes) for which the driver is at risk
 - a greater interval length will give a smaller RR => under estimation of the real risk.
- Information on exposure during the control period (were the cases driving?).

Time of collision in police report is an approximation and often (77% of the time) a multiple of 5 minutes.



Time of calls provided by cell phone companies are exact. Emergency calls are often made (61% of the time) before the reported time of the collision!



Conclusion

- Linking different data sources (police records, cell phone records and self reported data) is helpful to estimate the “**real association**” (not necessarily the causal relation) between the use of cell phones while driving and collisions.
- The three epidemiological studies showed a significant increased risk. The difficulty is in determining the exact magnitude of the real risk.

Conclusion

- The RR estimate from the two cohorts' comparison might be seen as an estimate of the magnitude of the public health problem:
 - the RR will increase with increasing exposure to cell phone communications by drivers.
 - it is not the relative risk of a collision when the driver is exposed to a cell phone communication.

