Serious road injuries

Estimating the annual number of serious road injuries in the Netherlands.

Henk Stipdonk

SWOV
INSTITUTE FOR
ROAD SAFETY RESEARCH

Serious road injuries Definition

- In EU & IRTAD
  - MAIS3+

- In the Netherlands:
  - Inpatients **and** MAIS2+

Serious road injuries
Impact

Severity of the casualty	DALY's
Fatalities	42.4 %
Serious road injuries	38.0 %
Emergency dpt visits	18.1 %
General practitioner visits	1.4 %
Material damage only	0.0 %

Serious road injuries
Matching police and hospital data

- Police data :
  - Crash factors, no reliable injury data

- Hospital data
  - Injury data (ICD9/ICD10 -> MAIS)
  - Public road crash/other road crash/other accident
  - No reliable crash/vehicle data

->Probabilistic matching procedure and subsequent estimation of the number of serious road injuries

SWOV
INSTITUTE FOR
ROAD SAFETY RESEARCH

Matching procedure: variables

- Find records with the same values for the matching key variables
- Police records: Hospital records
  - Crash date/time   ↔   Date/hour of admission
  - Hospital name   ↔   Province of hospital
  - Date of birth   ↔   Date of birth
  - Gender   ↔   Gender
  - Police severity   ↔   -
  - -   ↔   Accident type (E-code)

Matching procedure: steps

- Find records in both databases that describe the same casualty
  - Link both files
  - Find reliable/true matches → intersection
- Describe/count remaining files
- Estimate cases that are not reported in either database
- Total = intersection + police remainder + medical remainder + not reported

SWOV
INSTITUTE FOR
ROAD SAFETY RESEARCH

Matching procedure: distance function

For each of the variables used in the linking procedure a distance function has been defined
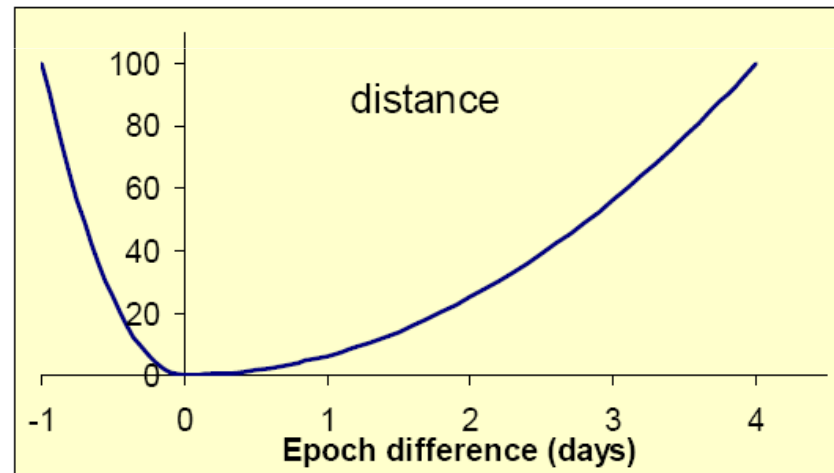
eg: time(epoch) difference of police reported crash and hospital admittance

1. Epoch-difference (the difference between accident and hospital entry (date/time)

$$a_{ij} = 100 * (\alpha_i - \beta_j)^2/16 \text{ if } \alpha_i \geq \beta_j;$$
$$a_{ij} = 100 * (\alpha_i - \beta_j)^2 \text{ if } \alpha_i < \beta_j;$$

Figure 24: Dependence of distance to the difference in time.

In which α_i is the epoch of hospital entry and β_i the epoch of the accident, both expressed in days. This distance is constructed in such a way that it equals 100 for a time difference of -1 and +4 days.

Matching procedure: selectivity

Similarities and differences between records are expressed in a distance. The smaller the distance the more equal the records are.

key	police	hosp1	hosp2	Distance P-h1	Distance P-h2
date	22-1-2002	23-1-2002	23-1-2002		
hour	23	2	3		
minute	35				
Epoch	37278,98	37279,08	37279,13	0,06	0,13
Birth	**23-3-1980**	23-4-1980	**23-3-1980**	44	0
Gender	**Male**	male	male	0	0
Region	5	5	6	0	50
Ecode		812	813	0	0
Severity	6=hospitalised			0	0
Distance				44,06	50,13

The preferred pair in this example is the one with the correct region, but an acceptable typing error in the date of birth.

SWOV
INSTITUTE FOR ROAD SAFETY RESEARCH

Matching procedure: decision

- Selectivity = the difference in distance with the **next best** match
- Pairs having small distance and high selectivity are believed to be correct matches
- 110.000 links produce 60.000 matches

Table 82: Frequencies of distance and selectivity classes for matched records in Dutch police and hospital databases (1997-2003, excluding fatalities and day treatment).

		selectivity class					
		0-10	10-30	30-80	80-130	130+	Total
distance class	0-0.1	244	47	1.306	13.467	17.956	33.020
	0.1-35	64	26	373	3.118	4.312	7.893
	35-55	349	147	5.510	9.850	396	16.252
	55-100	1.909	1.094	5.329	2.547	581	11.460
	100-160	7.356	5.033	4.851	502	8	17.750
	160-220	15.295	5.570	1.555	3	0	22.423
	220+	1.198	835	153	2	0	2.188
	Total	26.415	12.752	19.077	29.489	23.253	110.986

Serious injuries
Estimation of actual number

Let P_M and P_N be the probabilities that a crash is reported by the police (M=motorized crash, N = not motorized crash)

Let p_1 and p_2 be the probabilities that an M-crash is not reported as such in the hospital registration

Let q_1 and q_2 be the probabilities that an N-crash is not reported as such in the hospital registration

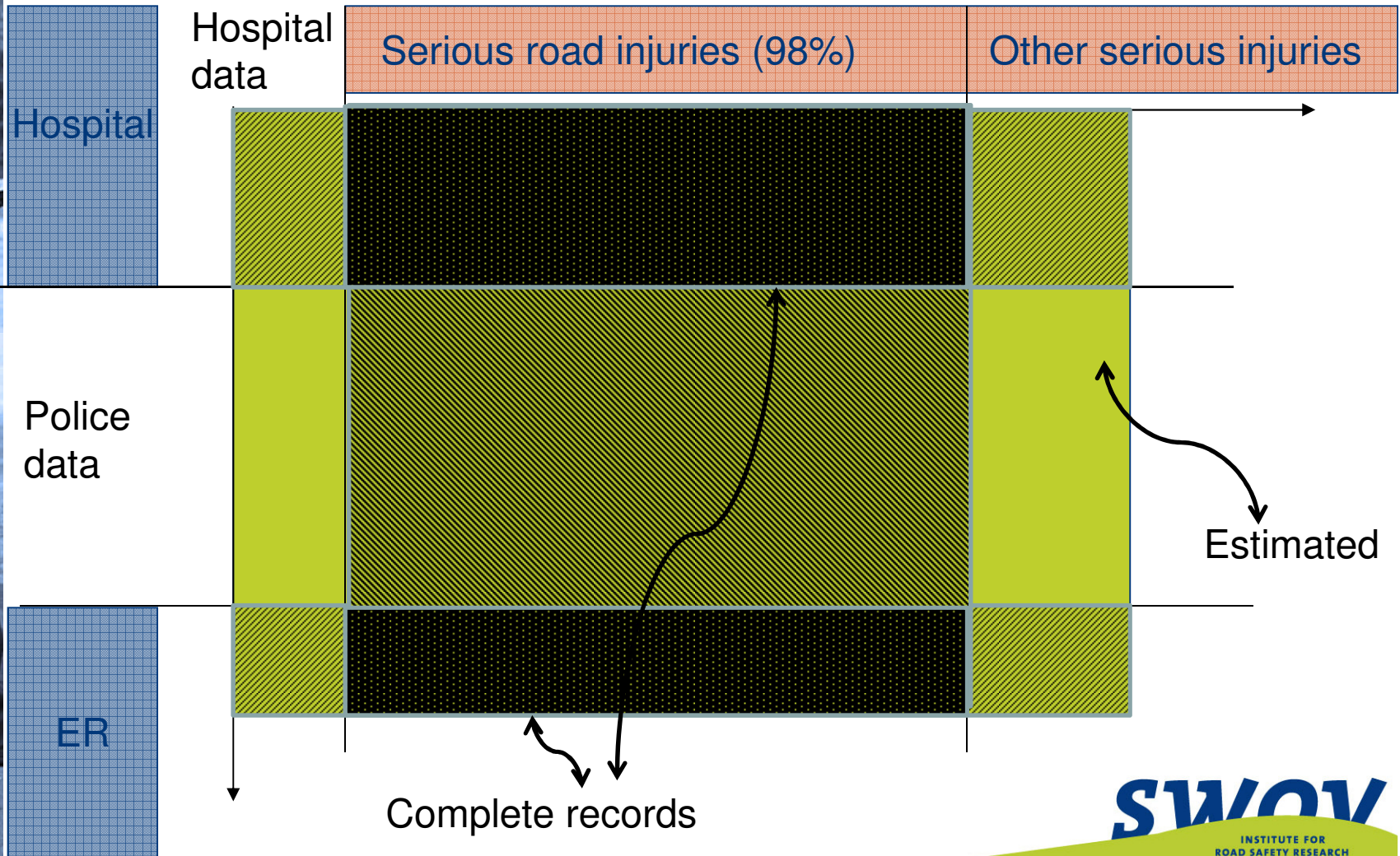|		Hospital			
		Not Mot crash	Not crash	Motorized crash	Sum
Police	Mot.	$P_M p_1$	$P_M p_2$	$P_M(1-p_1-p_2)$	P_M
	Not M	$P_N (1-q_1-q_2)$	$P_N q_2$	$P_N q_1$	P_N
Not Police	Mot	$(1-P_M) p_1$	$(1-P_M) p_2$	$(1-P_M)(1-p_1-p_2)$	$1-P_M$
	Not M	$(1-P_N)(1-q_1-q_2)$	$(1-P_N) q_2$	$(1-P_N) q_1$	$1-P_N$

See "annals of epidemiology" for further details

Estimation of actual number

		LMR			
		Crash without motor vehicle	Crash with motor vehicle	No Traffic crash	**SUM**
In BRON	Motor vehicle crash	$M \cdot P_M \cdot a_1$	$M \cdot P_M \cdot (1 - a_1 - a_2)$	$M \cdot P_M \cdot a_2$	$M \cdot P_M$
In BRON	Crash without motor vehicle	$N \cdot P_N \cdot (1 - b_1 - b_2)$	$N \cdot P_N \cdot b_1$	$N \cdot P_N \cdot b_2$	$N \cdot P_N$
Not in BRON	Motor vehicle crash	$M \cdot (1 - P_M) \cdot a_1$	$M \cdot (1 - P_M) \cdot (1 - a_1 - a_2)$	$M \cdot (1 - P_M) \cdot a_2$	$M \cdot (1 - P_M)$
Not in BRON	Crash without motor vehicle	$N \cdot (1 - P_N) \cdot (1 - b_1 - b_2)$	$N \cdot (1 - P_N) \cdot b_1$	$N \cdot (1 - P_N) \cdot b_2$	$N \cdot (1 - P_N)$
SUM		N_{LMR}	M_{LMR}	*Other*$_{LMR}$	$N+M$

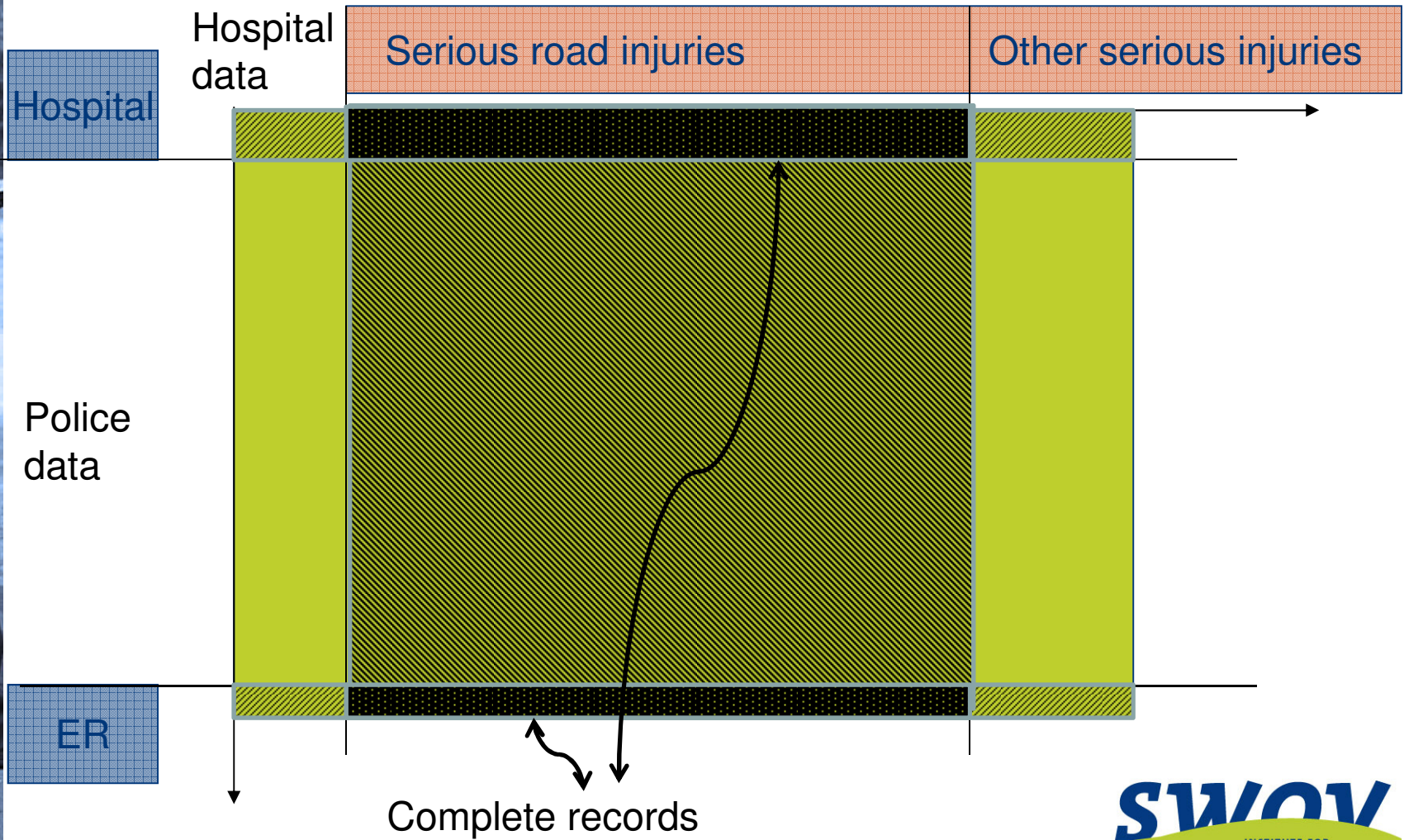The issue is how to estimate the (two) non-shaded cells

Serious injuries
Estimation of actual number

Hospital data

Serious road injuries (98%) | Other serious injuries

Hospital

Police data

ER

Estimated

Complete records

SWOV
INSTITUTE FOR
ROAD SAFETY RESEARCH

Serious injuries
Available data since 2010

Hospital data

Serious road injuries

Other serious injuries

Hospital

Police data

ER

Complete records

SWOV
INSTITUTE FOR
ROAD SAFETY RESEARCH

For more research results

Reurings & Stipdonk
Annals of epidemiology 21 (9) 648-653, 2011

For more information
WWW.SWOV.nl

Fact Sheets
Road safety data,
Reports
Sustainable safety

Henk.Stipdonk@SWOV.nl