



AN ENHANCED MODEL FOR ASSESSING CHOKING RISK IN CHILDREN FOR CONSUMER PRODUCTS

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Clinical & Epidemiological Features

- Description of the main characteristics of the FB
- Help in management of the FB

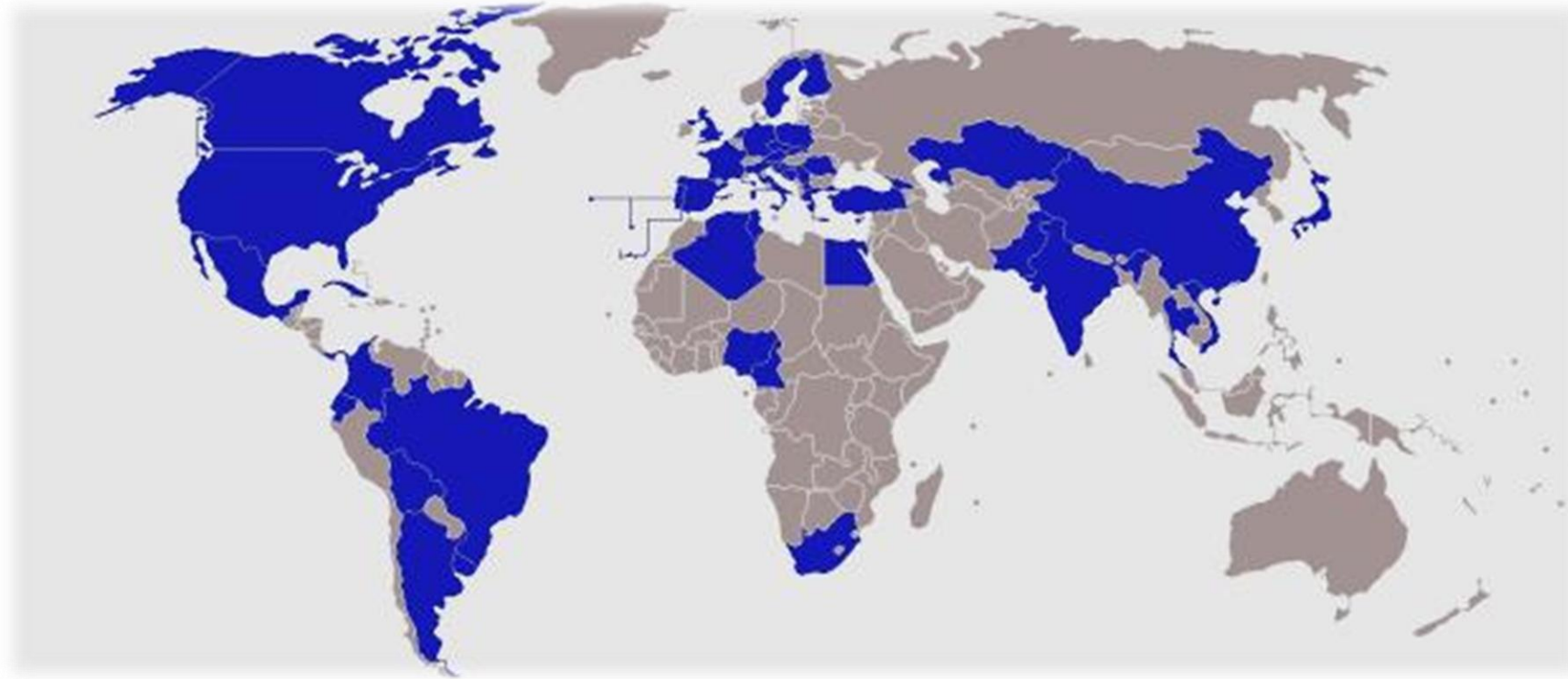
Risk assessment

- Main goal is to estimate risks posed by objects: target of the SS project

Prevention

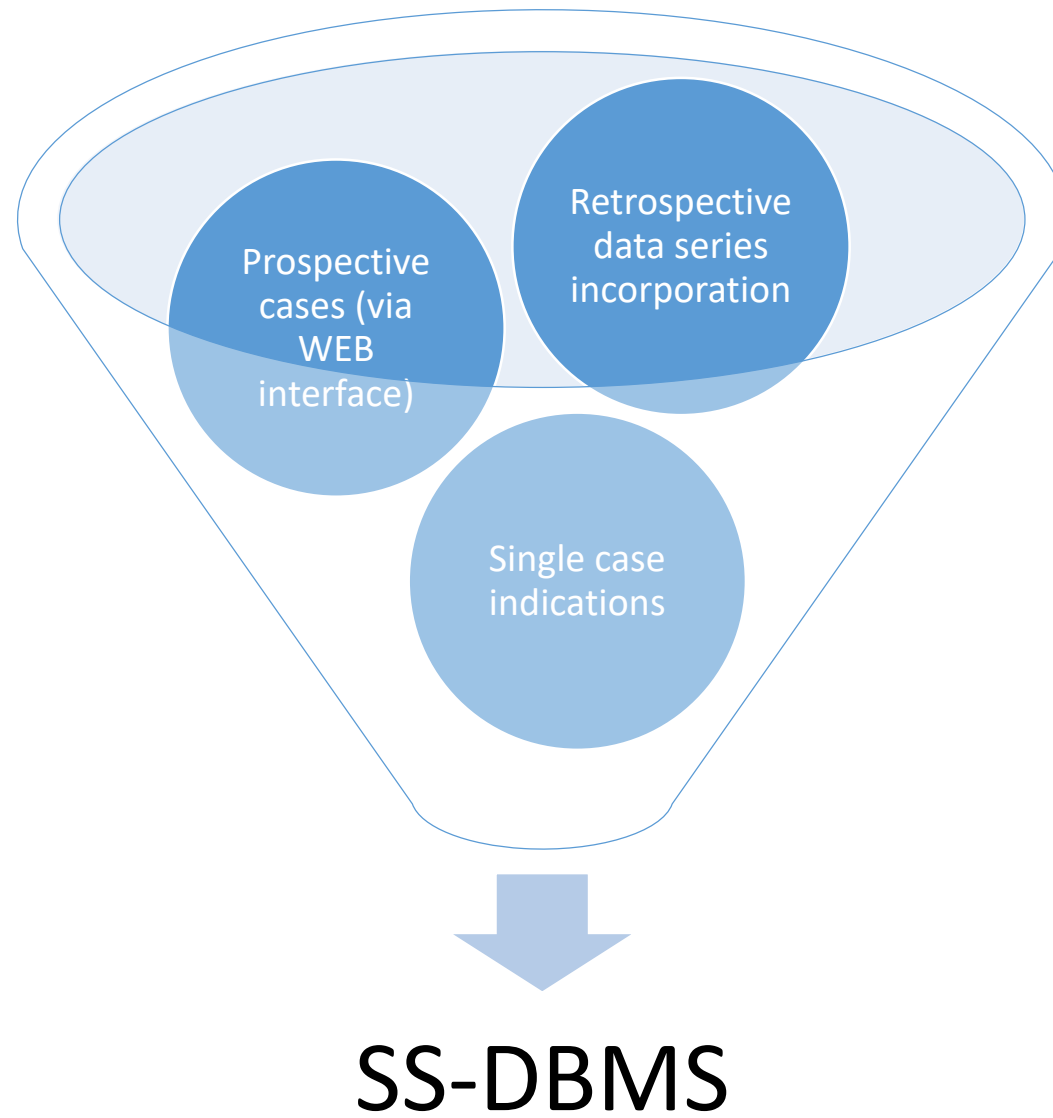
- Some risks are unavoidable: need for prevention

The Susy Safe DataBase



At 2019 29440 injuries

- + about 13000 from the Italian Ministry of Health
- + 366 MagDb data



Surveillance: Object characteristics

Regulation: Brand identification

	Size <3mm	Size >3mm
Conforming	90	77
Rigid	23	0



Technical LEGO from the right lung

Desperate need for details

fbTypeSpecify ▾	fbTypeSpecify ▾	fbBrand ▾	shape ▾	size1 ▾	size2 ▾	size3 ▾	consistency ▾
ruota		giocattoli lego	3D	0	0	0	Rigid
pallina		geomag	Spherical	2	0	0	Rigid
pallina		geomag	Spherical	2	0	0	Rigid
pallina		geomag	Spherical	3	0	0	Rigid
pallina		geomag	Spherical	4	0	0	Rigid
pallina		geomag	Spherical	3	0	0	Rigid
pallina		geomag	Spherical	3	0	0	Rigid
pallina		geomag	Spherical	3	0	0	Rigid

Precision + Reliability + Liability issues

Issues with SS-BDMS

Facts	Consequences	Action
Voluntary collection of data, no random sample	Difficulties in estimating incidence/prevalence	IDB-like estimator based on area coverage
Non-emergency MDs cooperating Difficulties in data coding (ICD9-CM)	Difficulties in estimating mortality	Integration with newspapers clippings information
Incomplete object measurements	Geometric solid approximation in risk assessment	Data enhancement for known objects (e.g.: coins)
Unknown object shapes	Missing information block in risk assessment	Stochastic data augmentation
Brand identification	Reliability of indications	Reformulate the question



SS Enhanced Data Model Structure (SS-EDMS)

Targeted at risk assessment

SS-EDMS Setup

	Core Data	Object Specific data	Data Enhancement	Stochastic Data augmentation
SS record structure	Data as coming form the clinical records by physicians	Data characteristics expressed in their own language / with reference to the local situation	Data on shape, dimensions, ... as recalled by literature / internet search	Reconstruction of the probability distribution of basic objects characteristics
	Derived by SS data collection system		SS labs @UniPD	

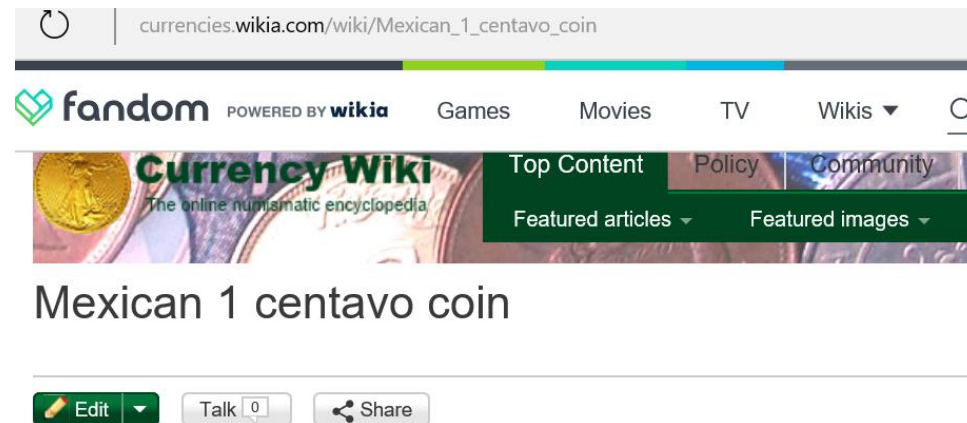
Data enhancement

Clinically collected information



“1 centavo en la laringe de una chica”

Mexico



Measurements and composition	
Mass	Click to [hide]
	<ul style="list-style-type: none">8 g (1863)^[1]9.5 g (1864)^{[2][3]}8.9 g (1869-1897)^{[2][4]}2 g (1882-1883, 1950-1969)^{[2][5][8]}2.61 g (1899-1905)^{[2][6]}3 g (1905-1949)^{[2][7]}1.5 g (1970-1973)^[9]
	Click to [hide]
	<ul style="list-style-type: none">26.5 mm (1863)^[1]25 mm (1864, 1869-1897)^{[3][4]}16 mm (1882-1883)^[5]19.5 mm (1899-1949)^{[6][7]}16 mm (1950-1969)^[8]13 mm (1970-1973)^[9]
	Click to [hide]
	<ul style="list-style-type: none">Copper (1863, 1864, 1869-1897)^{[1][2][3][4]}Cupronickel (1882-1883)^{[2][5]}Bronze (1905-1949)^{[2][6][7]}Brass (1950-1973)^{[2][8][9]}
	Appearance

Data augmentation

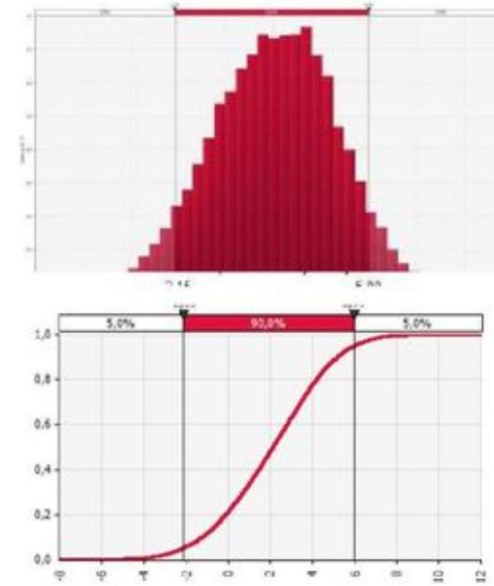
“Semilla de girasol en el bronchio derecho”



Measurements taken on 20-200 semillas



Reconstruction of the Empirical Distribution Function of dimensions



Monte Carlo simulation

Generation of weighted dimensions of the semilla for inclusion in the risk analysis

The risk engine: Bayesian Model



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Web-based tool for injury risk assessment of foreign
body injuries in children

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V = object characteristics
(volume, shape, ...)

C,M = child characteristics
(age, gender, ...)

$$P(I|V, C) \approx P(V|I_{SS}, C) \times P(I_{SS}|I, C, M) \times P(I|C) \times P(V)^{-1}$$

Susy Safe

Registration
coverage

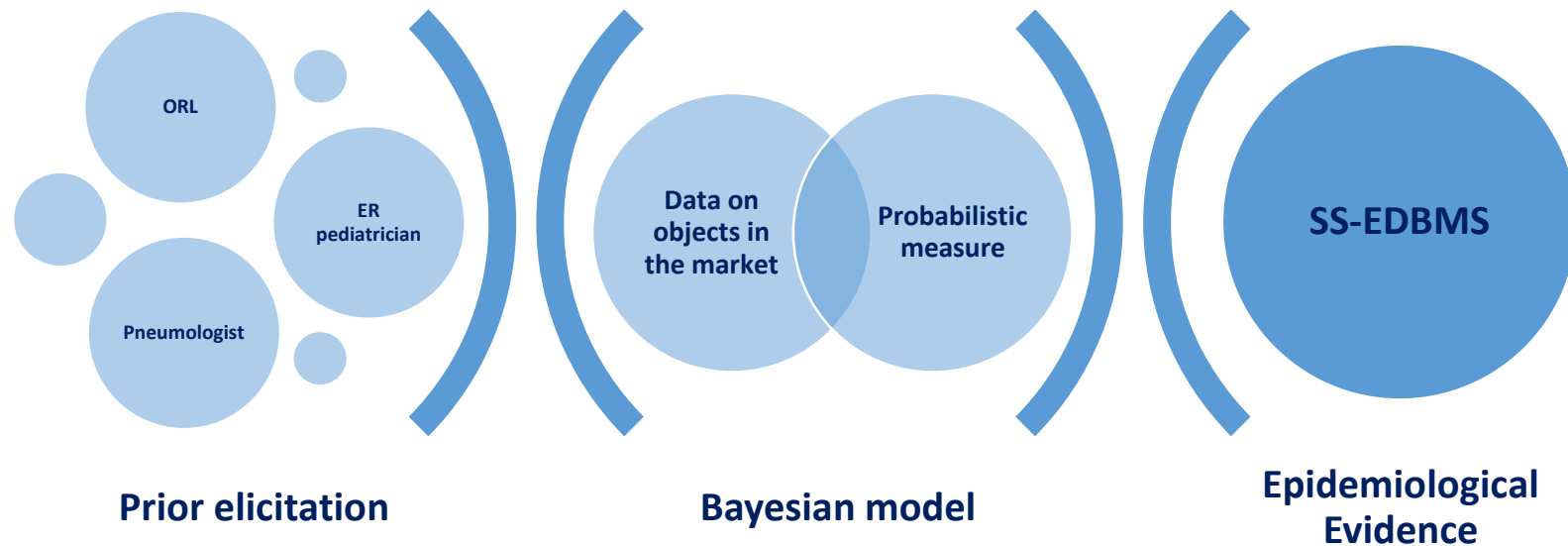
ICD
records

...



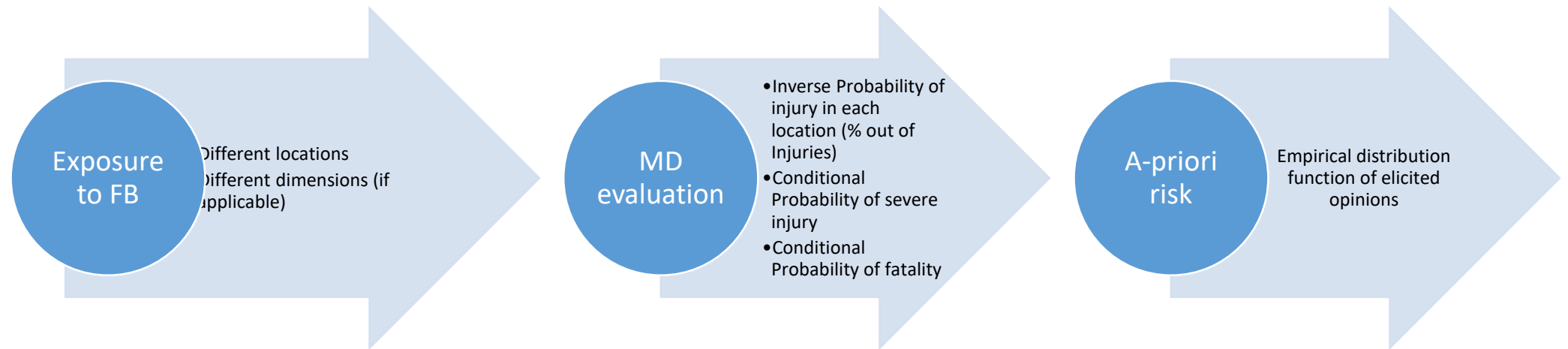
Integration of medical competences

$$P(I) = \int P(I | V, C) P(V, C)$$



Prior Elicitation process

- Participating MD from different specialties are involved
- About 15 MD are cooperating on a stable basis



Coding of Foreign Bodies

The foreign bodies are coded using the Combined Nomenclature (CN) v. 8

Automatic re-coding into IDB-Eurostat and NEISS-CPSC standard

Code	Description
00000000	Bead, pearl
25170000	Pebbles, gravel, broken or crushed stone, for concrete aggregates
36050000	Matches (excl. pyrotechnic articles of heading 3604)
40160000	Articles of vulcanized rubber (excl. hard rubber)
48180000	Toilet paper and similar paper, cellulose wadding or webs of cellulose fibers, of a kind used for household or sanitary purposes, in rolls of a width not exceeding 36 cm, or cut to size or shape
71130000	Articles of jewelry and parts thereof, of precious metal or of metal clad with precious metal
71180000	Coin, incl. legal tender (excl. medals, jewelry)
73180000	Screws, bolts, nuts, coach screws, screw hooks, rivets, cotters, cotter pins, washers (including spring washers) and similar articles, of iron or steel
73190000	Sewing needles, knitting needles, bodkins, crochet hooks, embroidery stiletos and similar articles, for use in the hand, of iron or steel; safety pins and other pins of iron or steel, not elsewhere specified or included
85050000	Electromagnets (excl. magnets for medical use)
85230000	Discs, tapes, solid-state non-volatile storage devices, 'smart cards' and other media for the recording of sound or of other phenomena
93060000	Bombes, grenades, torpedoes, mines, missiles, Cartridge
95030000	Tricycles, scooters, pedal cars and similar wheeled toys; dolls' carriages; dolls; other toys; reduced-size ('scale') models and similar recreational models, working or not; puzzles of all kinds
96060000	Buttons, press-fasteners, snap-fasteners and press studs, button molds and other parts of these articles
96080000	Ballpoint pens; felt-tipped and other porous-tipped pens and markers; fountain pens, stenograph pens and other pens; duplicating stylus; propelling or sliding pencils; pen-holders, pencil-holders and similar holders; parts (including caps and clips) of the foregoing articles, other than those of heading 9609
96090000	Pencils (other than pencils of heading 9608), crayons, pencil leads, pastels, drawing charcoals, writing or drawing chalks and tailors' chalks
96150000	Combs, hair-slides and the like; hairpins, curling pins, curling grips, hair- curlers and the like, other than those of heading 8516, and parts thereof

Enhanced Data Structure Model

Bayesian Beta-Binomial model

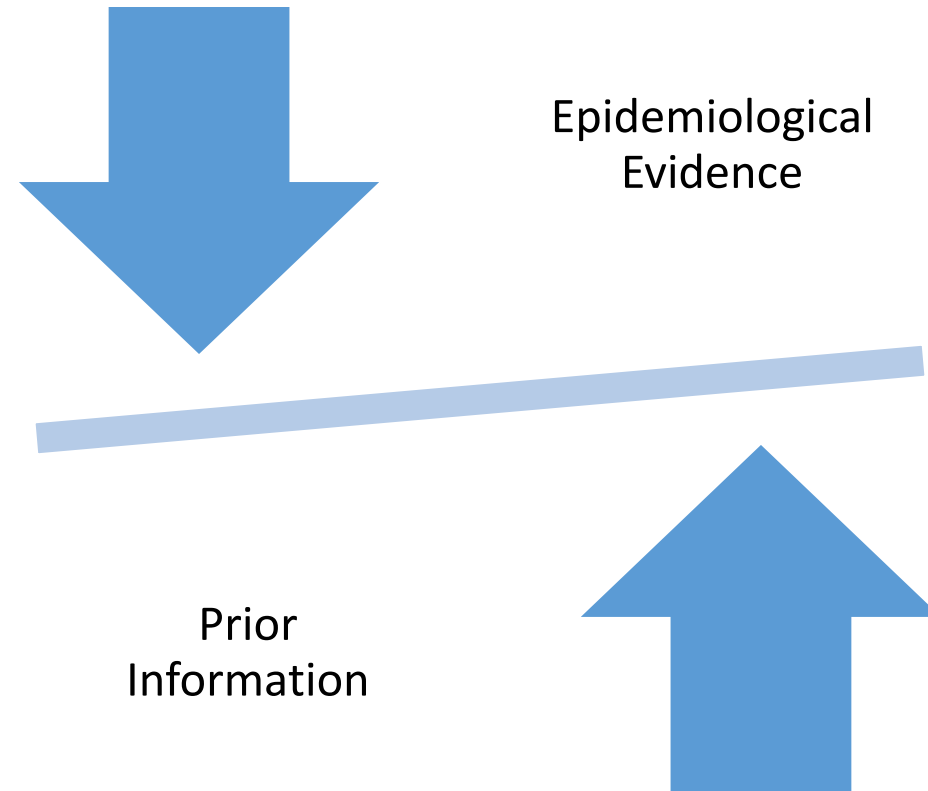
has been implemented to compute the risk of a severe injury

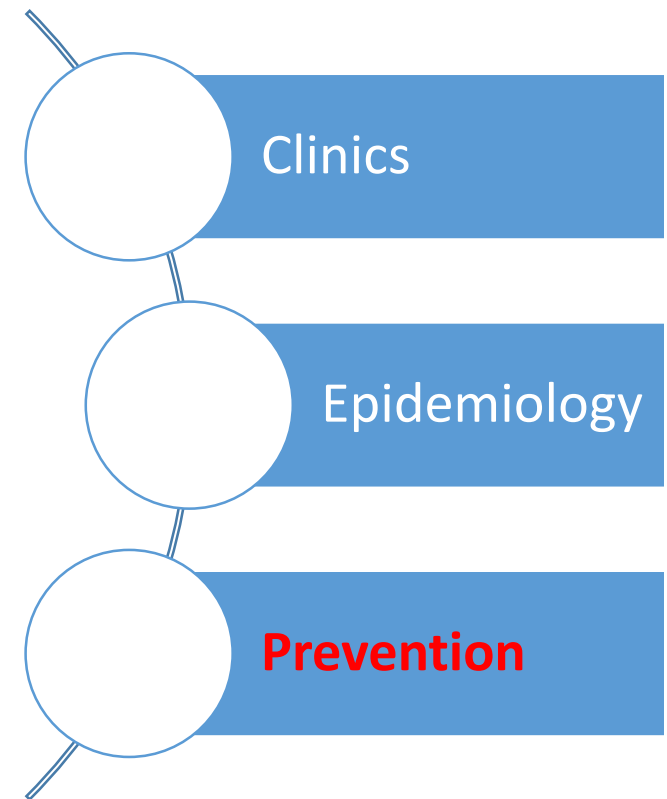
Vague (Uniform distributions) and weakly informative (Beta distribution with parameters < 1) prior have been considered.

Conditional risk (median of the posterior distribution by FB type and age class of injured children) has been reported along with 95% credible interval.

Product type	<36 months			36-59 months			≥60 months		
	N	%	Risk % (95%CI)	N	%	Risk % (95%CI)	N	%	Risk % (95%CI)
00000000	474	20.60%	4 (2.5-6.1)	511	28.80%	4.0 (2.5-6.1)	225	14.30%	7.6 (4.6-11.5)
25170000	235	10.20%	9.0 (5.8-13.0)	150	8.50%	2.8 (0.9-6.2)	89	5.70%	8.0 (3.6-14.8)
36050000	1	0.00%	29.5(1.2-83.5)	-	-		3	0.20%	16.2(0.6-60.1)
40160000	66	2.90%	3.3(0.7-9.4)	58	3.30%	2.0(0.2%-7.9)	96	6.10%	4.3(1.4-9.5)
48180000	51	2.20%	6.2 (1.7-14.7)	30	1.70%	3.9(0.4-14.5)	79	5.00%	0.3(0.0-3.1)
71130000	82	3.60%	12.3(6.5-20.6)	67	3.80%	12.1(5.6-21.2)	103	6.50%	6.0(2.5-11.6)
71180000	911	39.70%	17(14.6-19.5)	565	31.90%	13.7(10.9-16.7)	584	37.10%	13.2(10.6-16.0)
73180000	74	3.20%	13.7(7.1-23.0)	40	2.30%	7.8(2.2-18.4)	13	0.80%	1.6(0.0-16.9)
73190000	31	1.40%	61(44.4-77.1)	6	0.30%	34.3(8.0-71.5)	10	0.60%	11.3(1.0-38.3)
85050000	8	0.30%	14.2(1.3-46.1)	10	0.60%	2.2(0-21.3)	21	1.30%	10.1(2.0-27.1)
85230000	2	0.10%	9.5(0.0-66.3)	-	-		-	-	
95030000	195	8.50%	7.2(4.3-11.4)	207	11.70%	4.9(2.5-8.5)	147	9.30%	6.2(3.1-11.0)
96060000	83	3.60%	6.2(2.3-12.7)	66	3.70%	6.3(2.0-13.8)	26	1.70%	12.0(3.4-27.8)
96080000	25	1.10%	32.3(16.3-51.3)	16	0.90%	19.6(5.8-42.3)	76	4.80%	56.4(45.2-67.2)
96090000	51	2.20%	0.4(0.0-4.6)	42	2.40%	2.8(0.3-10.3)	102	6.50%	4.0(1.3-9.0)
96150000	7	0.30%	43.3(14.4-76.2)	4	0.20%	73.6(28.3-97.1)	1	0.10%	84.3(14.0-99.9)

A dynamic system for risk estimation





THANKS!

