





The Psychosocial Risk Factor Impact Pathway (PRF-IP) using SimaPro software

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- Assessment of consequences resulting from the product or service system
- Characterization of short- and long-term cause-effect relations
- Covering all life cycle stages
- Results are comparable to environmental LCA (FU, SB, objectivity)
- Quantifyable indicators

Psychosocial Risk Factors Impact Pathway:

- \checkmark Attributing social impacts to the product or service life cycle
- ✓ Distinguishing impacts per each life cycle phase
- ✓ Generalizable
- ✓ Integration with SimaPro



Psychosocial Risk Factors Impact Pathway



PSYCHOSOCIAL RISK FACTORS (PRF) are "those aspects of work planning and management – and their relative social and environmental contexts – that can POTENTIALLY lead to physical or psychological damages" (Cox and Griffiths, 1995:69)

Life cycle phase	Description
Goal and scope	Evaluation of possible social impacts of a product or service, considering the whole life cycle. Functional unit, System boundary, Time boundary, Cut-off criteria.
Life Cycle Inventory	Technical data (primary or secondary sources): tasks, hours, working conditions, living conditions. Conditions. Odds ratio (measure of the intensity of association) from scientific literature.
Life Cycle Impact Assessment	Psychosocial Risk Factors impact pathway: accounting the hours of exposure to specific risks for all life cycle phases, with different degrees of intensity.
Interpretation	Discussion of results, comparisons, inferring recommendations.



Moderate

1.3<OR<1.7

Meaning of Odds Ratio

- The OR is a statistical measure of the intensity of the association between two variables
- It's the ratio between the odds of exposure for people with a disease and the odds of exposure for healthy people.

No association

OR=1

• It's a retrospective study

Negative

association 0<OR<1

Example: an OR of 2 means there is a 100% increase in the odds of an outcome with a given exposure.

Weak

1<OR<1.3

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 $ODDS \ RATIO = \frac{a \times d}{b \times c}$

Very strong

OR>8

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Strong

1.7<OR<8





1ETHODOLOGY

	Stakeholder group	Category of working condition	Working conditions	Category of health risk	Health risk	Odds Ratio	Reference
	Workers	Chemicals exposure	Bleach exposure	Respiratory	Asthma	1.41	Lemire et al., 2020
7	Workers	Chemicals exposure	Deltamethrin exposure	Cancers	Myelodysplastic syndromes	1.67	Avgerinou et al., 2017
	Workers	Chemicals exposure	Dyeing clothes	Cancers	Bladder cancer	4.63	Risch et al., 1988
	Workers	Psychological conditions	Effort reward imbalance	Metabolic	Metabolic syndrome	1.14	Schmidt et al., 2015
	Workers	Dusts exposure	Exposure to organic textile dusts	Respiratory	Asthma	1.5	Zhang et al., 2019
	Workers	Chemicals exposure	Exposure to trichloroethylene	Cancers	Renal cancer	1.3	Moore et al., 2010
	Workers	Chemicals exposure	Herbicides exposure	Cancers	Myelodysplastic syndromes	2.27	Avgerinou et al., 2017
	Workers	Others	Night shift work	Deficiencies	Vitamin D deficiency	1.4	Park et al., 2020
	Workers	Chemicals exposure	Organophosphates insecticides exposure	Neurological	Parkinson Disease	1.8	Elbaz et al., 2009
	Workers	Chemicals exposure	Organophosphates insecticides exposure	Cancers	Non-Hodgkin's lymphoma	2.11	Fritschi et al., 2005
	Workers	Economic	Poor incomes	Cardiovascular	Stroke	2.45	Min et al., 2017
	Workers	Economic	Poor incomes	Cardiovascular	Myocardial infarction	2.68	Min et al., 2017
	Workers	Physical conditions	Sedentary posture	Musculoskeletal system	Low Back Pain	1.34	Gupta et al., 2015
	Workers	Physical conditions	Standing posture	Musculoskeletal system	Neck - shoulder pain	1.15	Hildebrandt et al., 2001
	Workers	Psychological conditions	Temporary employment	Psychological	High level of stress perceived	1.6	Domenighetti et al., 1999
	Workers	Psychological conditions	Temporary employment	Musculoskeletal system	Back or low back Pain	2.00	Domenighetti et al., 1999
	Workers	Psychological conditions	Temporary employment	Psychological	Lower self esteem	2.9	Domenighetti et al., 1999
-	Workers	Others	Textile and tayloring workers	Neurological	Systemic sclerosis	2.00	Bovenzi et al., 2004
	Workers	Others	Textile factory work	Respiratory	Breathless	9.4	Zele et al., 2020
	Workers	Physical conditions	Total body vibrations	Musculoskeletal system	Sciatic Pain	3.9	Bovenzi and Betta, 1994
	Workers	Physical conditions	Uncomfortable postures	Musculoskeletal system	Low Back Pain	2.49	Hildebrandt et al., 2001
-	Residential population	Chemicals exposure	Maternal residential exposure to agricultural pesticides	Birth defects	Atrial septal defects	1.7	Rappazzo et al., 2016
	Residential population	Chemicals exposure	Maternal residential exposure to agricultural pesticides	Birth defects	Hypertrophic pyloric stenosis	1.71	Rappazzo et al., 2016
	Residential population	Chemicals exposure	Maternal residential exposure to agricultural pesticides	Birth defects	Tracheal esophageal fistula/ esophageal atresia	1.98	Rappazzo et al., 2016
	Residential population	Chemicals exposure	Maternal residential exposure to agricultural pesticides	Birth defects	Hirschsprung's disease	2.22	Rappazzo et al., 2016
	Residential population	Chemicals exposure	Residential (maternal) agricultural neonicotinoid exposure	Birth defects	Anotia/ microtia	3.00	Carmichael et al., 2015
	Residential population	Chemicals exposure	Residential proximity to pesticide application (high exposure): azole antifungals	Cancers	Childhood Acute Lymphoblastic Leukemia	3.9	Rull et al., 2010
	Residential population	Chemicals exposure	Residential proximity to pesticide application (moderate exposure): organophosphates	Cancers	Childhood Acute Lymphoblastic Leukemia	1.6	Rull et al., 2009
>	Residential population	Others	Rural residence	Neurological	Amyotrophic Lateral Sclerosis	1.25	Kang et al., 2014
	Consumers	Chemicals exposure	Non organic food diet during pregnancy (Fruits)	Birth defects	Hypospadias in offspring	1.08	Schultz Christensen et al., 2013
	Consumers	Chemicals exposure	Non organic food diet during pregnancy (Vegetables)	Birth defects	Hypospadias in offspring	1.1	Schultz Christensen et al., 2013





- Substances	Substance /	Default unit
- Raw materials	00-2,4-D (herbicide) - high use	hr
- Airborne emission	00-Chlorpyriphos & Deltamethrin on olive trees	hr
Waterborne emiss	00-Citrus chemicals exposure (fertilizers and pesticides)	hr
- Final waste flows	00-Copper Oxicloride exposure	hr
- Emissions to soil	00-Deltamethrin exposure	hr
Non material emis	00-Effort-reward imbalance	hr
Social issues	00-Farming occupation	hr
Economic issues	00-Fertilizers exposure	hr
	00-Fungicides exposure 1	hr
	00-Fungicides exposure 2+	hr
	00-Glyphosate and sun exposure	hr
	00-Glyphosate exposure > 10 days/year	hr
	00-Glyphosate exposure > 2 days/year	hr
	00-Herbicides exposure	hr
	00-Herbicides exposure 1	hr
	00-Herbicides exposure 2-4	hr
	00-Herbicides exposure 5+	hr
	00-High exposure to pesticides (\$15 years; (>0.018 mg/m3)	hr
	00-High physical demand and heavy manual labour	hr
	00-High psychological demand (quantity of work, intellectual requirements, time constraints)	hr
	00-Insecticides exposure	hr
	00-Insecticides exposure 1	hr
	00-Insecticides exposure 2-4	hr
	00-Insecticides exposure 5+	hr
	00-Living with an agricultural worker	hr
	00-Long working hours >8 to 9 hours/day	hr
	00-Low maternal Folic Acid intake and carbamates exposure 3 months before or after conception	hr
	00-Low maternal Folic Acid intake and chlorpyrifos exposure 3 months before or after conception	hr
	00-Low maternal Folic Acid intake and organophosphates exposure 3 months before or after conception	hr
	00-Low maternal Folic Acid intake and pyrethroids exposure 3 months before or after conception	hr
	00-Maternal exposure to animal manure during the 5 years preceding the index child's birth	hr

Step 1 - Inventory of working and living conditions







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General	Cha	aracterisation	Damage assessment
Name	Y	Version	
PRF Beta		0 09	
Structure ☑ Damage assessment	Normalisation	□ Weighting	Addition
Comment			
WA - Weak Association MA - Moderate Association SA - Strong Association VSA - Very Strong Associa	on		
-			

Step 2 - Creation of a new LCIA method

Conservat

PRF impact pathway using SimaPro: PRF beta





MA - Generic

SA - Generic

VSA - Generic

General

Unit

Exposure

Exposure Exposure

Exposure Exposure

Exposure

Exposure

Exposure

Exposure

Exposure

Exposure

Exposure

Characterisa	tion	Damage assessment			
Compartment	Subcompartn	Substance /	CAS numbe	Factor	Unit
Social	1	00-High psychological demand (quantity of work, intellectu		1	Exposure / hr
Social		00-Physical workload		1	Exposure / hr
Social		00-Repetitive tasks		1	Exposure / hr
Social		00-Sedentary posture		1	Exposure / hr
Social		00-Sitting		1	Exposure / hr
Social		00-Total Boby Vibrations (tractor driving)		1	Exposure / hr
Social		00-Vibration manual tools (hands and arms)		1	Exposure / hr

Step 3 - Listing all possible risk factors and their association with living and working conditions





	Damage ca
	Workers -
	Workers - N
	Workers - S
	Workers - V
	Residential
	Residential
0	Residential
2	Residential
Д	Consumers
σ	Consumers
3	Consumers
	Consumers
S	
<u> </u>	
2	
Q _	
1.1	
1	
Ľ	

General		Characterisa	ation	Damage assessment		
e category	Unit	Impact category	Factor	Unit		
s - Weak Assc	1	WA - Hearing damag	1	1 / Exposure		
s - Moderate /	1	WA - Gastric cancer	1	1 / Exposure		
s - Strong Asse	1	WA - Cardiovascular	1	1 / Exposure		
s - Very Strong	1	WA - Metabolic syndi	1	1 / Exposure		
ntial Pop - Wea	1	WA - Sciatic Pain	1	1 / Exposure		
ntial Pop - Mo	1	WA - Back Pain	1	1 / Exposure		
ntial Pop - Strc	1	WA - Neck and Shoul	1	1 / Exposure		
ntial Pop - Very	1	WA - Upper Limbs	1	1 / Exposure		
ners - Weak As	1	WA - Lower self estee	1	1 / Exposure		
ners - Moderat	1	WA - Psychological d	1	1 / Exposure		
ners - Strong A	1	WA - High level of str	1	1 / Exposure		
ners - Very Stro	1	WA - Disability	1	1 / Exposure		
		WA - Osteoarthritis	1	1 / Exposure		
		WA - Cutaneous mela	1	1 / Exposure		
		WA - Non-Hodgkin's	1	1 / Exposure		
		WA - Renal cell carcir	1	1 / Exposure		
		WA - Parkinson Disea	1	1 / Exposure		
		WA - Numbness	1	1 / Exposure		
		WA - Muscle weaknes	1	1 / Exposure		
		WA - REM sleep beha	1	1 / Exposure		
		WA - Colorectal carci	1	1 / Exposure		
		WA - Myelodysplastic	1	1 / Exposure		
		WA - Childhood brair	1	1 / Exposure		
		WA - Amyotrophic La	1	1 / Exposure		
		WA - Asthma	1	1 / Exposure		

Step 4 - Creation of damage categories for each stakeholder group classified according to the degree of intensity, and their impact categories

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Outputs to technosphere: Products and co-products	Amount	Unit	Quantity	Allocation W	laste type	Category	Comment	
Pest Control Calabria	1	hr	Time	100 %		Agri\Social T	hemes	
Add line								
Outputs to technosphere. Avoided products	Amount	Unit	Distribution	SD2 or 2SD	Min	Max	Comment	
Add line								

			Inputs						
Inputs from nature	Subcompartment	Amount	Unit	Distribution	SD2 or 2SD	Min	Max	Comment	
Add line									
Inputs from technosphere: materials/fuels		Amount	Unit	Distribution	SD2 or 2SD	Min	Max	Comment	
Add line									
Inputs from technosphere: electricity/heat		Amount	Unit	Distribution	SD2 or 2SD	Min	Max	Comment	
Add line									

Step 5 - creation of life cycle processes

			Outputs						
Emissions to air	Subcompartment	Amount	Unit	Distribution	SD2 or 2SD	Min	Max	Comment	
Add line									
Emissions to water	Subcompartment	Amount	Unit	Distribution	SD2 or 2SD	Min	Max	Comment	
Add line									
Emissions to soil	Subcompartment	Amount	Unit	Distribution	SD2 or 2SD	Min	Max	Comment	
Add line									
Final waste flows	Subcompartment	Amount	Unit	Distribution	SD2 or 2SD	Min	Max	Comment	
Add line									
Non material emissions	Subcompartment	Amount	Unit	Unit Distribution	SD2 or 2SD	Min	Max	Comment	
Add line									
Social issues	Subcompartment	Amount	Unit	Distribution	SD2 or 2SD	Min	Max	Comment	
00-Total Boby Vibrations (tractor driving)		1	hr	Undefined					
00-Pesticides, insecticides, exposure		1	hr	Undefined					
00-Noise and vibrations		1	hr	Undefined					
00-Temporary employment		1	hr	Undefined					
00-Pesticide exposure		1	hr	Undefined					
00-Copper Oxicloride exposure		0,33	hr	Undefined					
00-Organophosphates insecticides exposure		0,33	hr	Undefined					
00-Insecticides exposure	2	0,66	hr	Undefined	2	8		5	



Results examples

SimaPrc

with

PRF



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- COnclusions
- Epistemologically in line with environmental LCA
- Impacts are referred to the life cycle of a product or service
- Possibility to include positive impacts
- Speed up the evaluation process with SimaPro
- Possibility to easily convert the functional unit (e.g. from litre to hectare, kg, etc.)
- Extendable to more stakeholders groups
- Understandable results, easily communicable











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