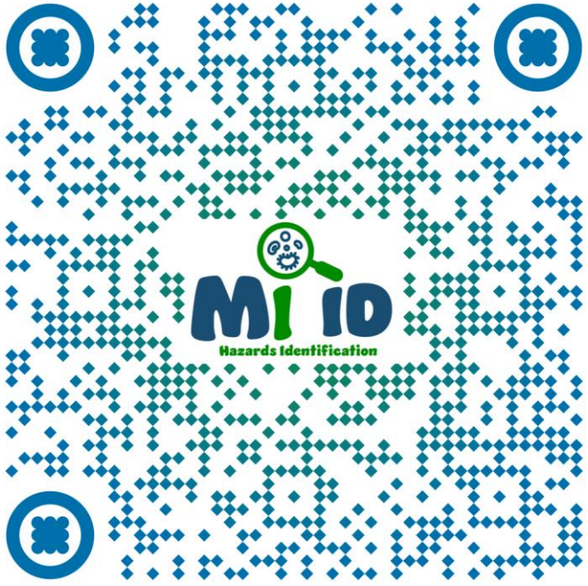
Microbial Hazards Risk Ranking

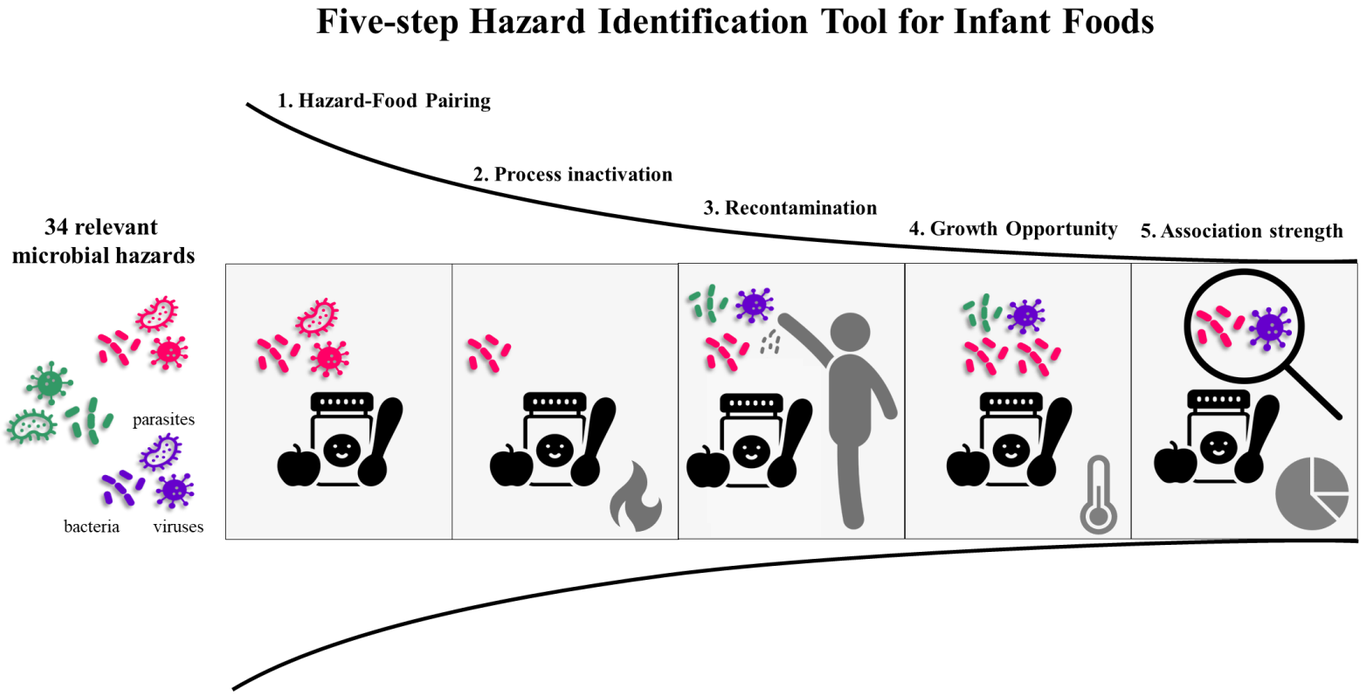
MiRA

WAGENINGEN
UNIVERSITY & RESEARCH

Hazard Identifcation is done prior to risk ranking to identify most relevant hazard in the selected foods

MI ID
Hazards Identification



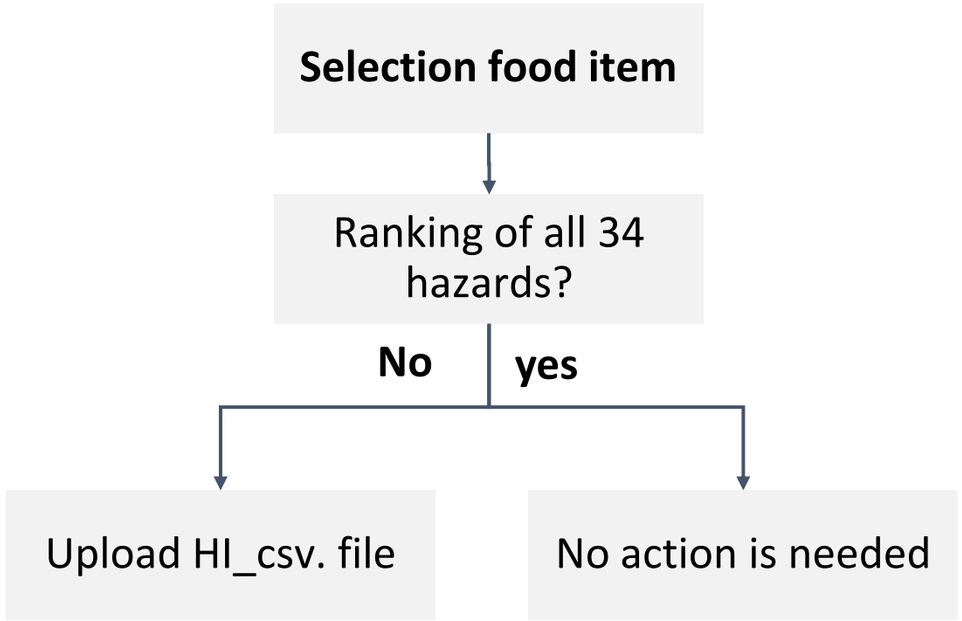


The Eight Risk Ranking Steps

MiRA
Risk Ranking

Food parameter: Select food item

User's input



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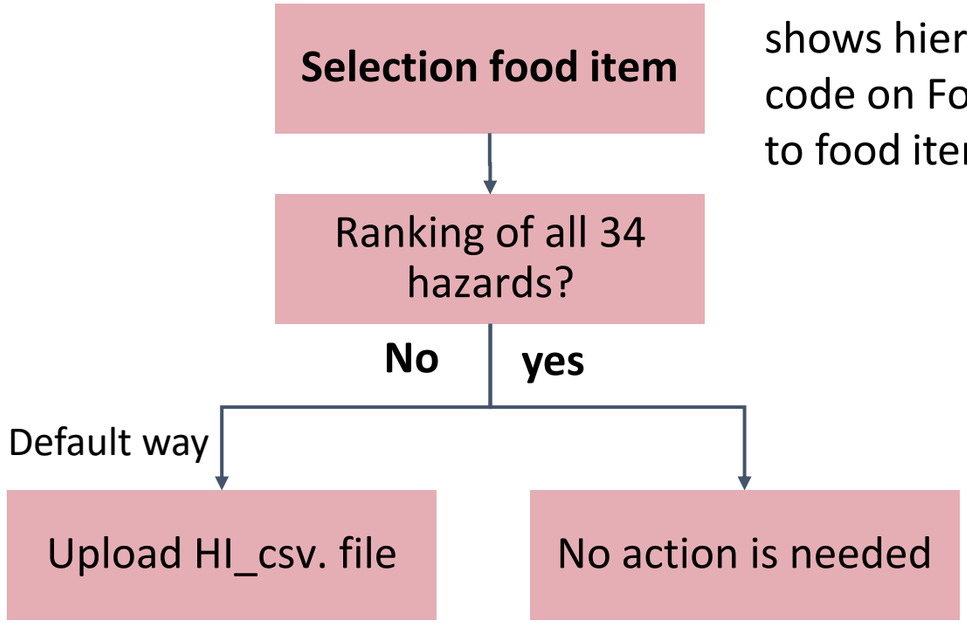

shows hierarchy & code on FoodEx2 next to food item

Provide link to MiID

https://foodmicrobiologywur.shinyapps.io/Microbial_hazards_ID/

Food parameter: select food composition

User's input

Food composition

Factors	Tick relevant
High fat	□ yes
Low Aw (0.5-0.9)	□ yes
Dry product (aw < 0.5)	□ yes
pH < 4.5	□ yes
4.5 < pH < 4.8	□ yes
pH > 10	□ yes
Neutral	□ yes

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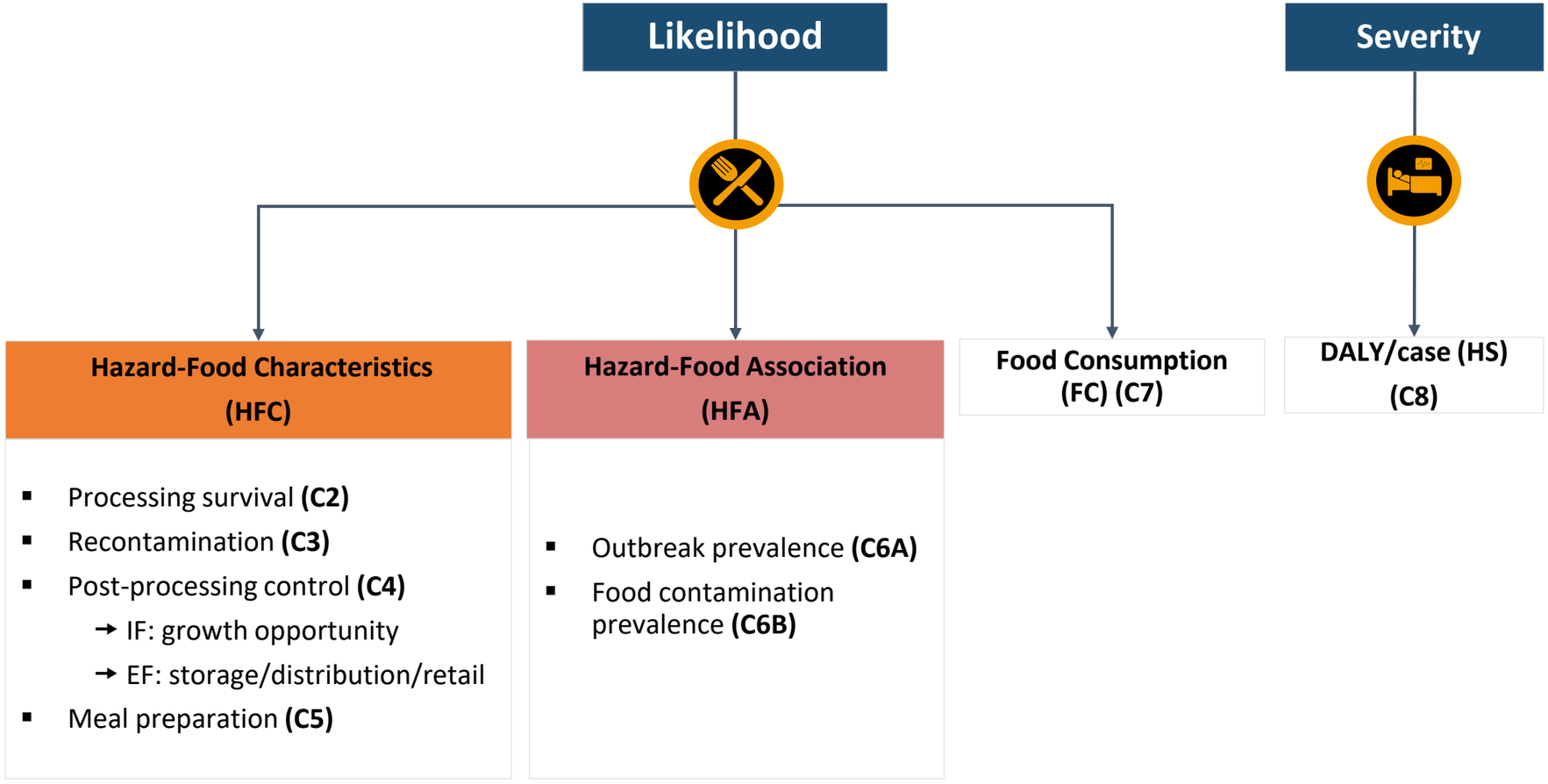
Food composition

This step influences the inactivation efficacy of the selected processing techniques in the next input

1. Check processing techniques of factory parameter
2. Take the corresponding value

MiRA Risk Ranking

Risk Ranking Criteria



Factory parameter: C2➔ processing techniques

User's input

Techniques

Thermal inactivation

- Pasteurizaiton
- Boiling
- Sterilization

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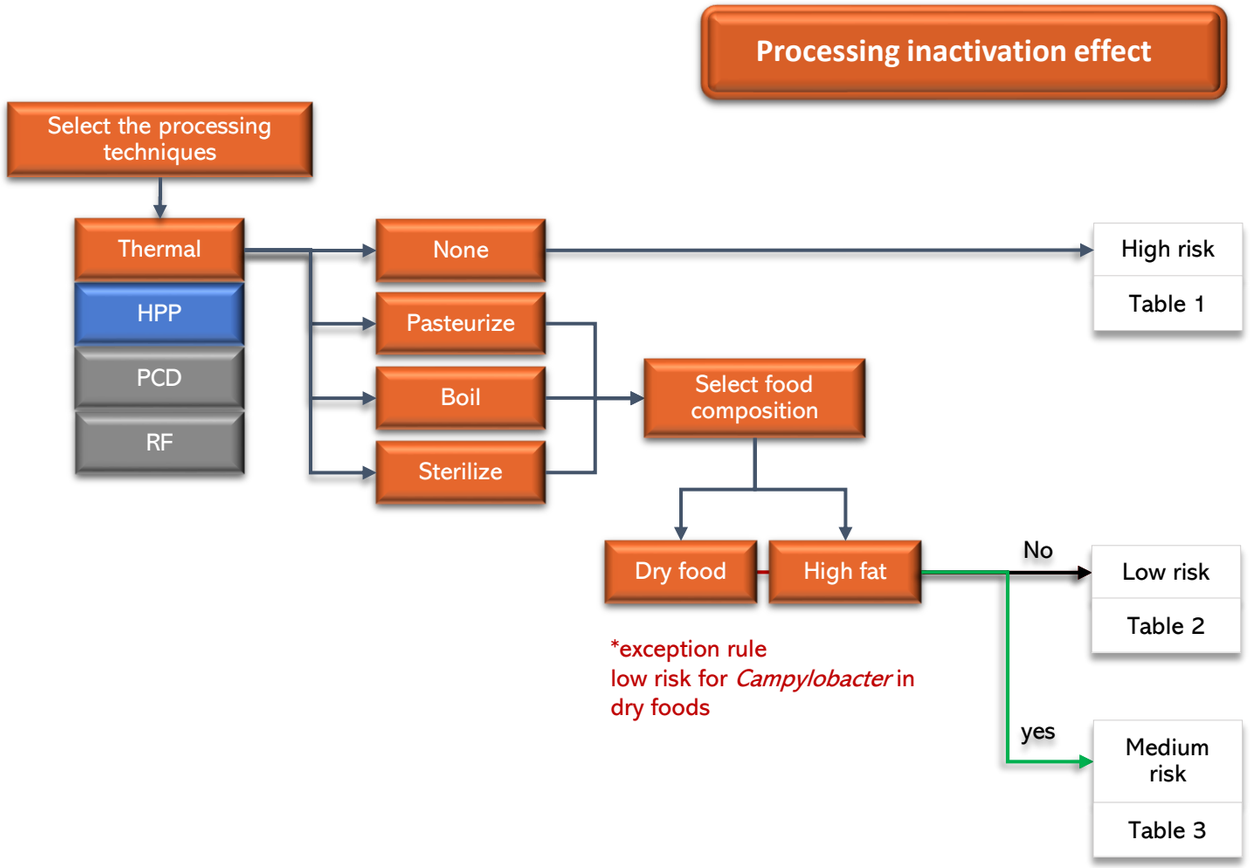
Techniques + food composition

Factors	Tick relevant
High fat	□ yes
Low Aw (0.5-0.9)	□ yes
Dry product (aw < 0.5)	□ yes
pH < 4.5	□ yes
4.5 < pH < 4.8	□ yes
pH > 10	□ yes
Neutral	□ yes

Step 2_PE: relevant values in column H, I, or J is used. Display information on columns K &L based on the factory parameter selection

When more than 1 factor is relevant, select the highest value

Decision tree



Risk value	Score
1E-20	1
1E-18	1
1E-12	1
1E-10	2
1E-8	2
1E-6	2
1E-5	2
1E-4	3
1E-3	3
1E-1	4
1	4

Table 1

Hazard group	No inactivation
Vegetative bacteria	1
Virus	1
Vegetative parasites	1
Parasite cysts	1
Heat-resistant virus	1
Bacterial spores	1
Bacterial toxin	1

Table 2

Hazard group	Pasteurization	Boiling	Sterilization
Vegetative bacteria	1E-6	1E-10	1E-20
Virus	1E-6	1E-10	1E-20
Vegetative parasites	1E-6	1E-10	1E-20
Parasite cysts	1E-05	1E-10	1E-20
Heat-resistant virus	1E-03	1E-10	1E-20
Bacterial spores	1	1E-03	1E-12
Bacterial toxin	1	1E-03	1E-12

Table 3

Hazard group	Pasteurization	Boiling	Sterilization
Vegetative bacteria	1E-4	1E-8	1E-18
Virus	1E-4	1E-8	1E-18
Vegetative parasites	1E-4	1E-8	1E-18
Parasite cysts	1E-3	1E-8	1E-18
Heat-resistant virus	1E-1	1E-8	1E-18
Bacterial spores	1	1E-1	1E-10
Bacterial toxin	1	1E-1	1E-10

Factory parameter: C3➔ Recontamination

User's input

Sources	Tick relevant
Aseptic processing	□ yes
Wet environment	□ yes
Dry environment	□ yes
Addition of dry herbs or spices	□ yes
Addition of dry vitamins	□ yes
Addition of other dry ingredients	□ yes
Human cross-contamination	□ yes

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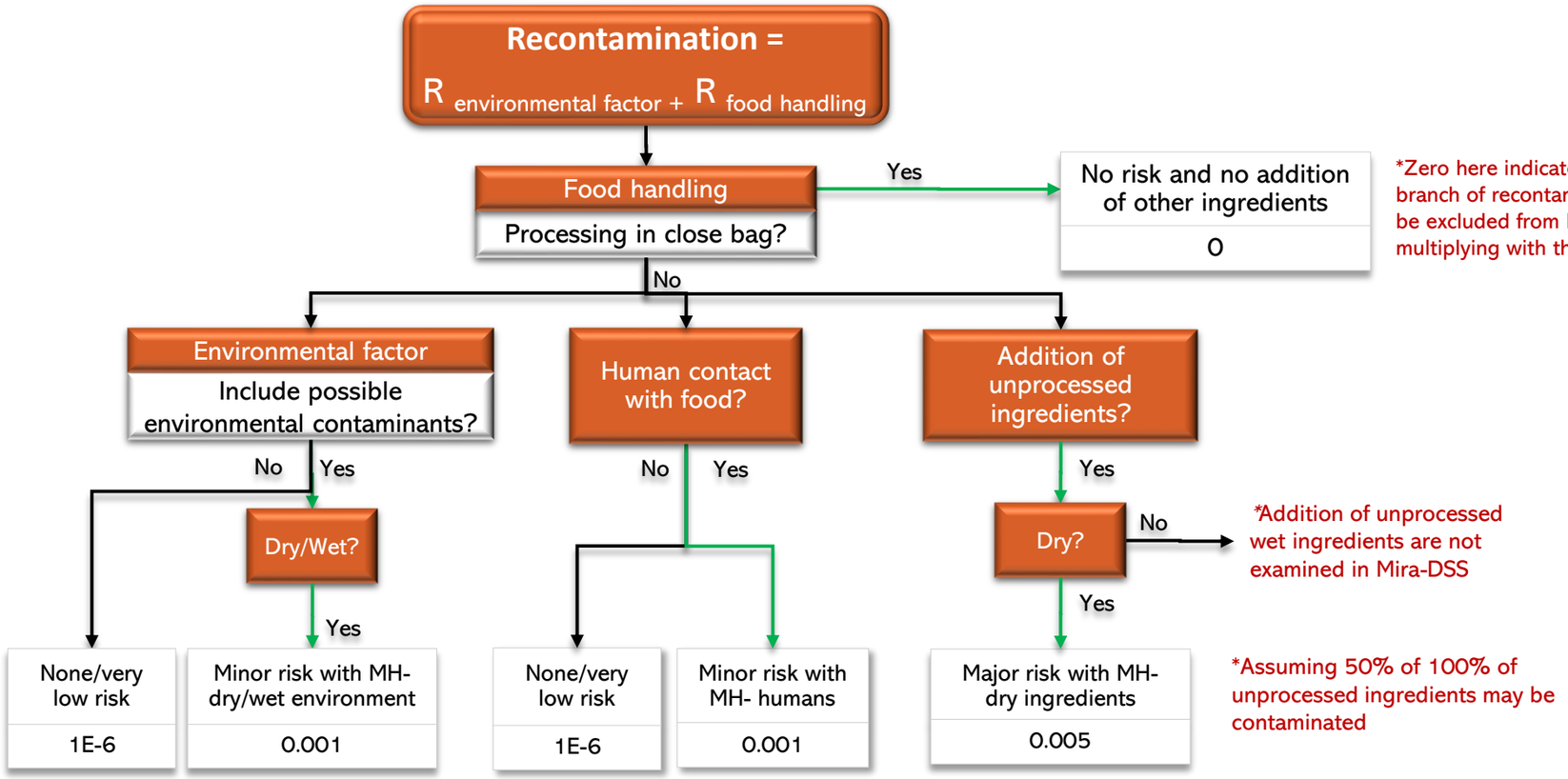
Sources	Tick relevant
Aseptic processing	□ yes
Wet environment	□ yes
Dry environment	□ yes
Addition of dry herbs or spices	□ yes
Addition of dry vitamins	□ yes
Addition of other dry ingredients	□ yes
Human cross-contamination	□ yes

Step 3_RP: pick the relevant columns and **add** the numerical values assigned for EF & RF

Decision tree

Category of dry ingredients	Risk of recontamination for relevant hazard
dry spices	0.5
other dry ingredients	0.05
dry vitamins	0.005

Risk value	Score
1E-6	1
0.005	2
0.05	3
0.5	4
0	0



*Zero here indicates the entire branch of recontamination will be excluded from RR instead of multiplying with the value zero

*Addition of unprocessed wet ingredients are not examined in Mira-DSS

*Assuming 50% of 100% of unprocessed ingredients may be contaminated

Distribution parameter: C4 ➔ Conditions during storage/distribution/retailing

User's input

Storage/distribution/retail	Tick relevant
Room temperature	□ yes
Refrigeration (1-4°C)	□ yes
Frozen (0°C)	□ yes
Potential temperature abuse	□ yes

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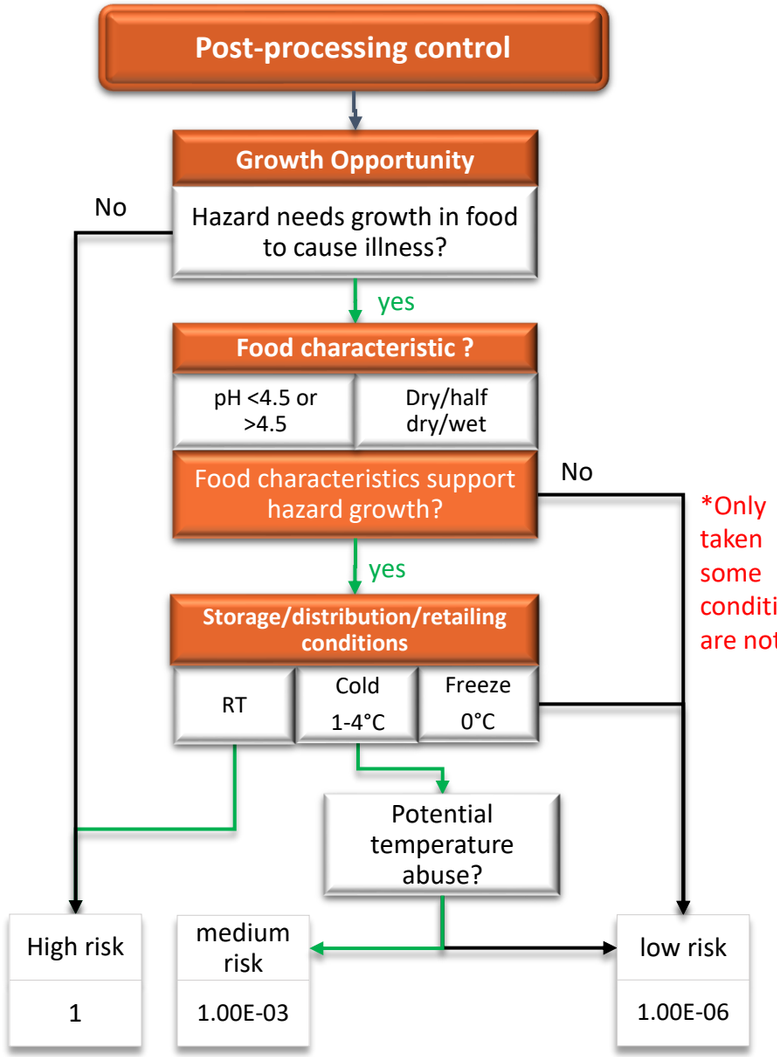
Storage/distribution /retail	Tick relevant	Food composition filled by user	Cardinal parameter
Room temperature	□ yes	Take data in food parameter	Compare with cardinal parameter in Supplementary Table X, & take the estimated likelihood in step 4_ PPC2
Refrigeration (1-4°C)	□ yes		
Frozen (0°C)	□ yes		
Potential temperature abuse	□ yes		

Decision tree

Risk value	Score
1E-6	1
1E-3	2
1	3



*Only yes/no growth in food characteristics is taken into consideration, with exceptions for some strains that can otherwise grow in the conditions they cannot grow are
are not taken into consideration

Distribution parameter: C5 ➔ Meal preparation at household

User's input

Meal preparation	Tick relevant
Ready to eat	□ yes
Ready to heat <70°C	□ yes
Ready to cook > 70°C	□ yes

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Step 5_MP: pick the value in the relevant columns E, F or G

Hazard group	RTE	RTH <70°C	RTC >70°C
Vegetative bacteria	1	1E-2	1E-4
Virus	1	1E-2	1E-4
Vegetative parasites	1	1E-2	1E-4
Parasite cysts	1	1E-1	1E-03
Heat-resistant virus	1	1	1E-02
Bacterial spores	1	1	1
Bacterial toxin	1	1	1

Decision tree

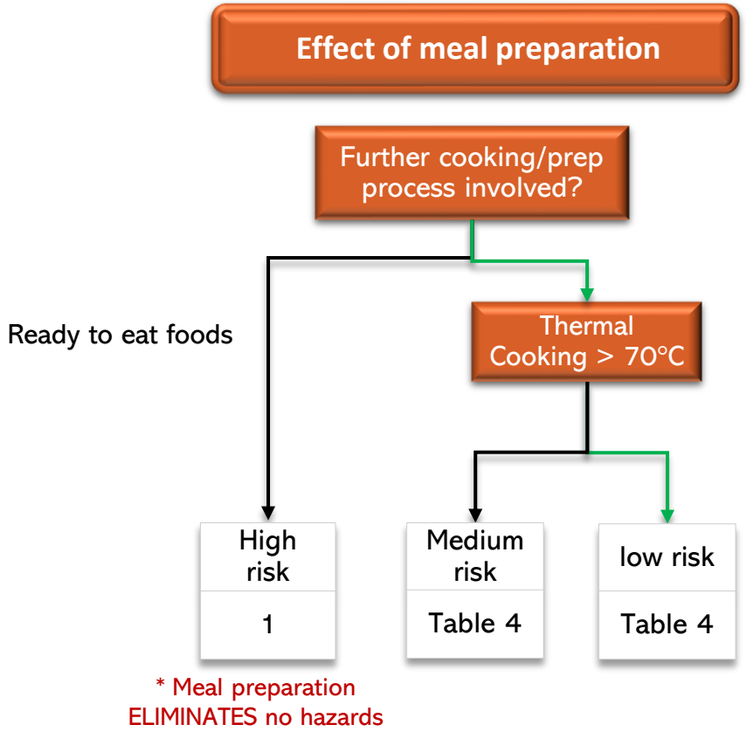

Table 4

Hazard group	Cooking <70C	Cooking >70C
Vegetative bacteria	1E-2	1E-4
Virus	1E-2	1E-4
Vegetative parasites	1E-2	1E-4
Parasite cysts	1E-1	1E-03
Heat-resistant virus	1	1E-02
Bacterial spores	1	1
Bacterial toxin	1	1

Risk value	Score
1E-4	1
1E-3	1
1E-2	2
1E-1	3
1	4

C6, C7 and C8: Prevalences, Consumption and Severity data

User's input

Parameter	Criteria
Food	item Composition Acidity

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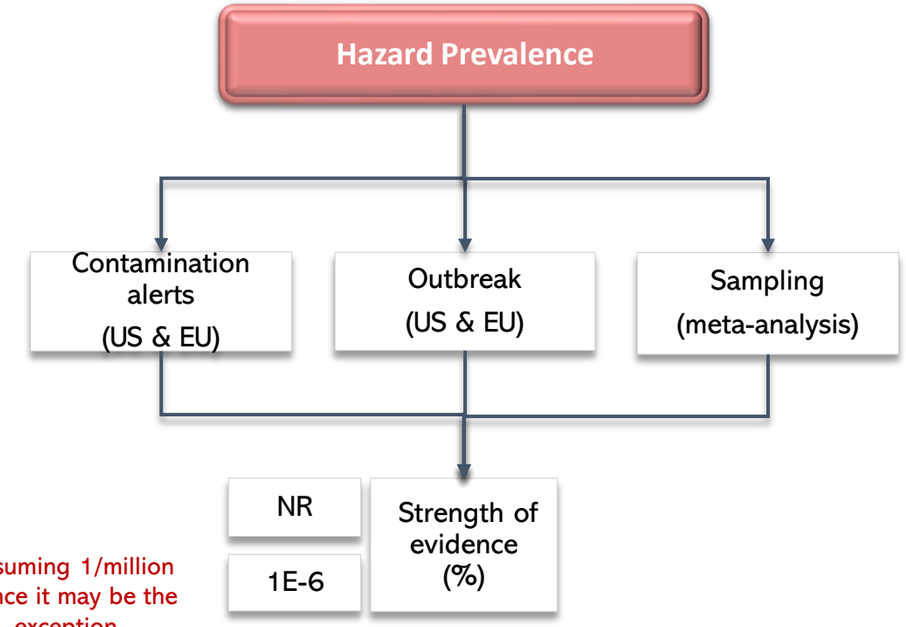
Based on user's input in step 1, display the respective data column in Step 6_HFA4th root, Step 7_FC and Step8_HS values

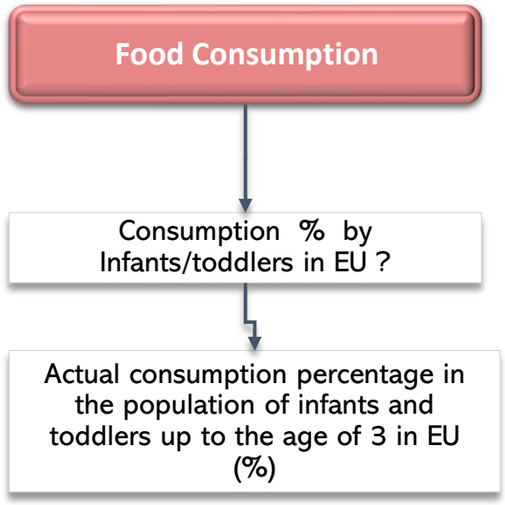
Show total ranking of results in a Table

Show total ranking of results in a plot

Decision tree



*Assuming 1/million chance it may be the exception

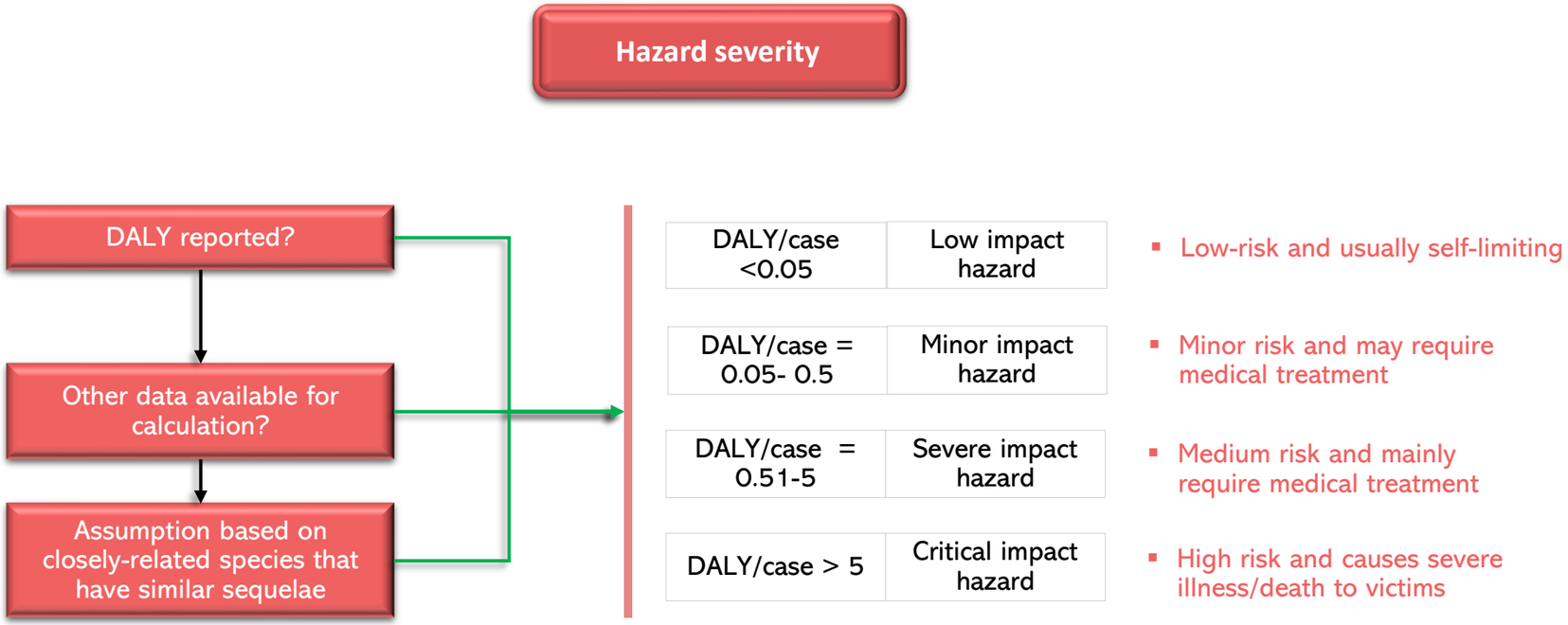


Prevalence percentage	Risk value	Score
NR	0.000001	1
< 1%	<0.01	2
1-10%	0.011-0.1	3
10.1 - 40%	0.101 - 0.4	4
> 40%	> 0.4	5

Consumption percentage	Risk value	Score
NR	0.000001	1
< 1%	<0.01	2
1-10%	0.011-0.1	3
10.1 - 40%	0.101- 0.4	4
> 40%	> 0.4	5

Decision tree

Risk value (DALY/case)	Score
< 0.05	1
0.05-0.5	2
0.51-5	3
> 5	4



User input and default data in Mira DSS

User's input

Parameter	Criteria
Food	Composition: pH; $a_{w;}$ fat content
Factory	**C2** Processing techniques **C3** Recontamination
Distribution	**C4** Storage, distribution and retail conditions **C5** Meal preparation

Default data

Parameter	Criteria
C6 Prevalence - Outbreak - Contamination	Default value is automatically added into the calculation
C7 Food consumption	
C8 Severity	

Total Risk Aggregation

$$\mathbf{Total\ Risk} = (\mathbf{C2} + \mathbf{C3^b}) * \mathbf{C4} * \mathbf{C5} * (\mathbf{C6A} * \mathbf{C6B})^{\frac{1}{n}} * \mathbf{C7} * \mathbf{C8}$$

- If food composition = high fat AND dry product ➔ C2: Take the highest value

- If more than one recontamination category is selected, then

➔ C3 recontamination= C3a + C3b + C3n...

- n = 4 in Mira- DSS referring to the total of 4 sources used to derive the prevalences of a hazard in the selected food. Check publication for details