Analysis of dietary patterns in the Swiss population
NFP1A and MONICA studies

Jean-Philippe Krieger

Classic approaches vs. Dietary patterns

Classic approaches:

- Single food
- Single food groups
- Single nutrients

Dietary patterns:

- A priori (hypothesis-driven): Mediterranean Index, Healthy Eating Index, ...
- A posteriori (data-driven): Principal component methods, Clustering, ...

Published menu CH data (03/2017)

Schweizer Ernährungsgewohnheiten*

Süsses, Salziges & Alkoholisches — — — —
Täglich werden rund 4 statt 1 Portion verzehrt.

Öle, Fette & Nüsse ★★★ —
Täglich werden dabei jedoch zu viele tierische Fette verzehrt.

Milchprodukte, Fleisch, Fisch, Eier & Tofu ★ — — —
Täglich werden nur 2 statt 3 Portionen Milchprodukte verzehrt, dafür zu viel Fleisch.

Getreideprodukte, Kartoffeln & Hülsenfrüchte ★★★ —
Täglich werden 2,4 statt 3 Portionen verzehrt.

Gemüse & Früchte ★★ — —
Täglich werden rund 3-4 statt 5 Portionen verzehrt.

Getränke ★★★★
Täglich werden 1-2 Liter Getränke (Wasser, Kaffee, Tee) getrunken.

*Gemäss nationaler Ernährungserhebung menuCH

Very nice... but these are mostly averages...
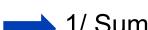Every Swiss does not eat like an average Swiss!

Principle: how to identify *a posteriori dietary patterns?*

How to find dietary patterns?

DEFINITION

Identifying dietary patterns = finding individuals that have a similar profile of answers to a nutrition questionnaire

METHODS

1/ Summarize the variability in a lower dimensional space

2/ Use these new dimensions to cluster individuals

Survey data are highly multidimensional

Each individual has answered no=0 or yes=1 to nutrition questions.

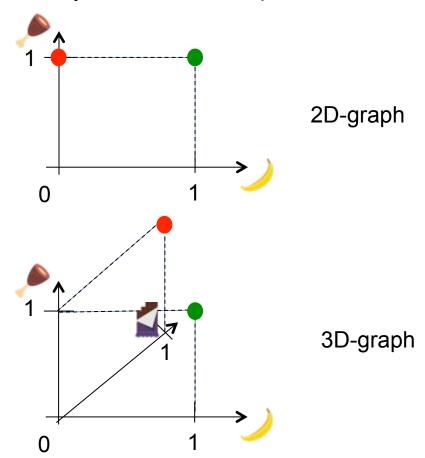**Case 1: only 2 questions.**

🍌🍖

● John (0,1)
● Helen (1,1)

2D-graph

Case 2: 3 questions.

🍌🍖🍫

● John   (0,1,1)
● Helen (1,1,0)

3D-graph

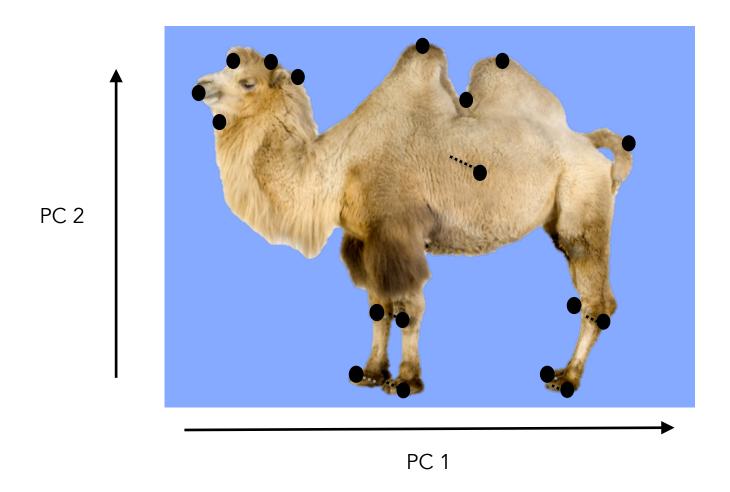**Case 3: 12 questions.**

● John   (0,1,1,........,1,0)
● Helen (1,1,0,........,0,0)

Can we summarize this highly dimensional point cloud into a lower dimensional space, so that we can graph and interpret the data?
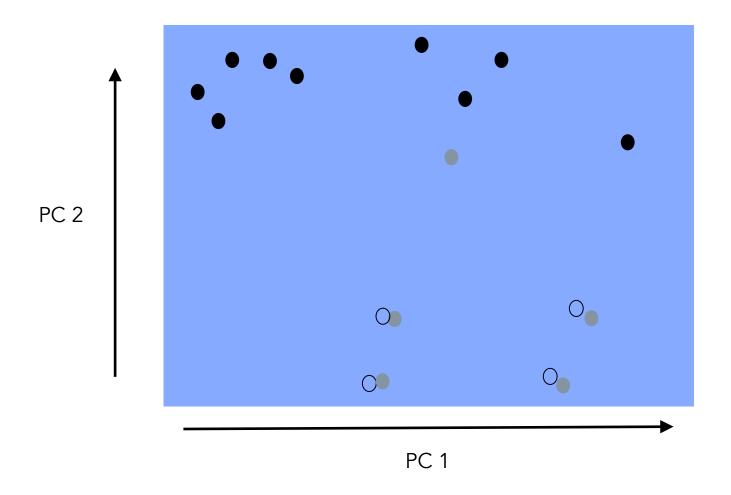
Finding principal components: example 3D>2D

Finding principal components: example 3D>2D

PC 2

PC 1

Finding principal components: example 3D>2D

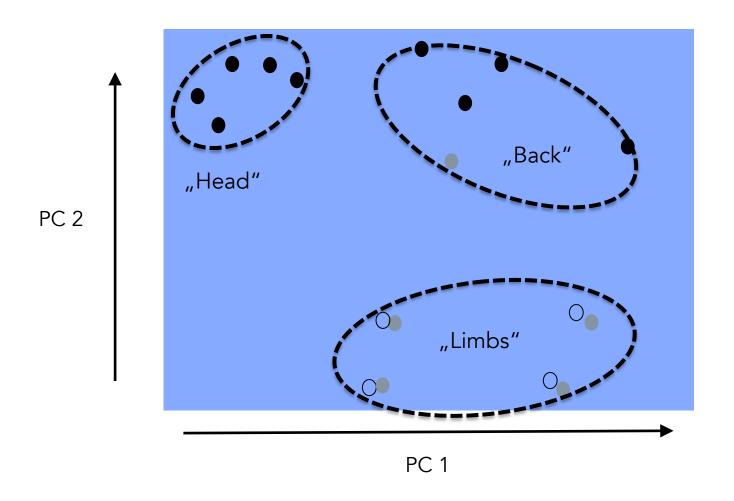# How to find dietary patterns?

<u>DEFINITION</u>

Identifying dietary patterns = finding individuals that have a similar profile of answers to the 12 food questions

<u>METHODS</u>

1/ Summarize the variability in a lower dimensional space

➡ 2/ Use these new dimensions to cluster individuals

Hierarchical clustering on principal components

Example: dietary patterns in the Swiss population (1977-1993)

Identification of a posteriori dietary patterns: an example

Data set: 4 studies (monitoring of trends and determinants of cardiovascular diseases)

N = 18,484

NRP1A (77-79) = 8631   Males = 8944
M1 (84-86) = 3324   Females = 9540
M2 (88-89) = 3304
M3 (92-93) = 3125

Age = 45.22 +/- 13.62 y

BMI = 23.84 +/- 4.00

NUTRITION: 24h recall
12 food items (y/n)
Fish / meat / sausage / vegetables / salad / fruit / chocolate / bread_dark / eggs / cheese / milk / yogurt
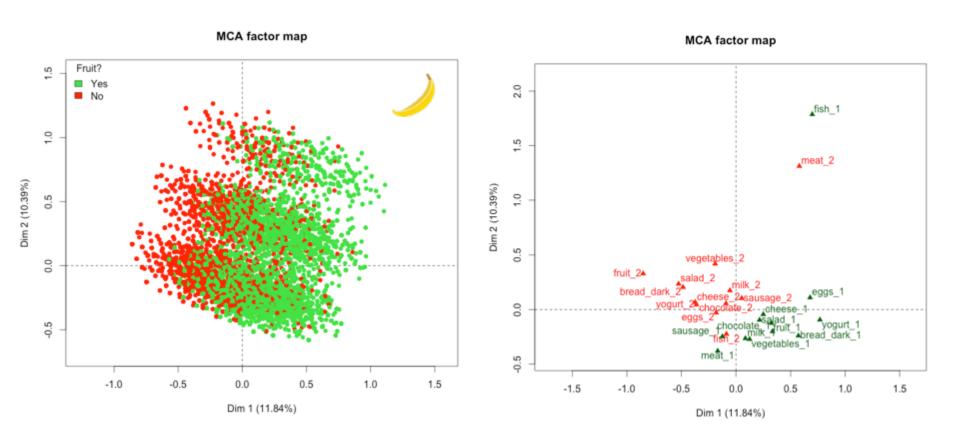
SUPPLEMENTARY:
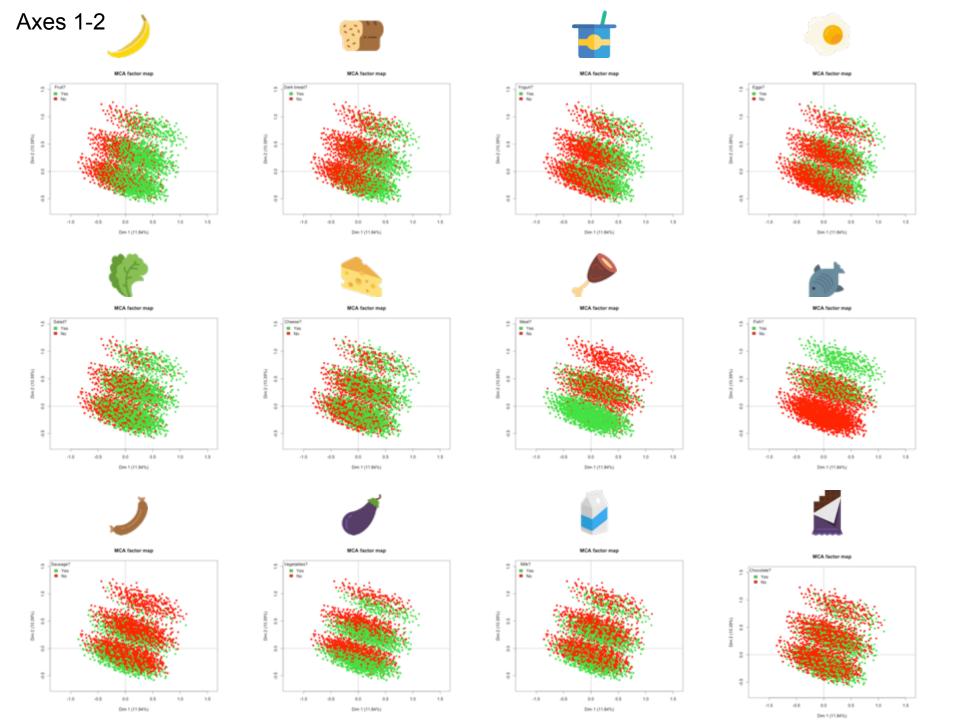## Demographics and lifestyle factors
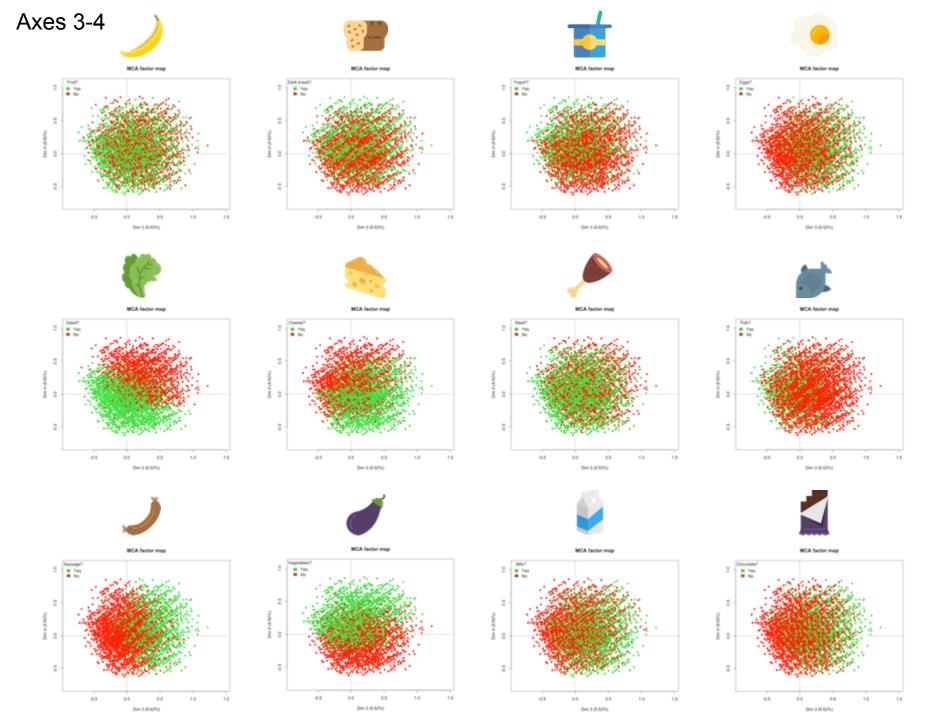Age / sex / education / BMI / Sport / Smoking / ....

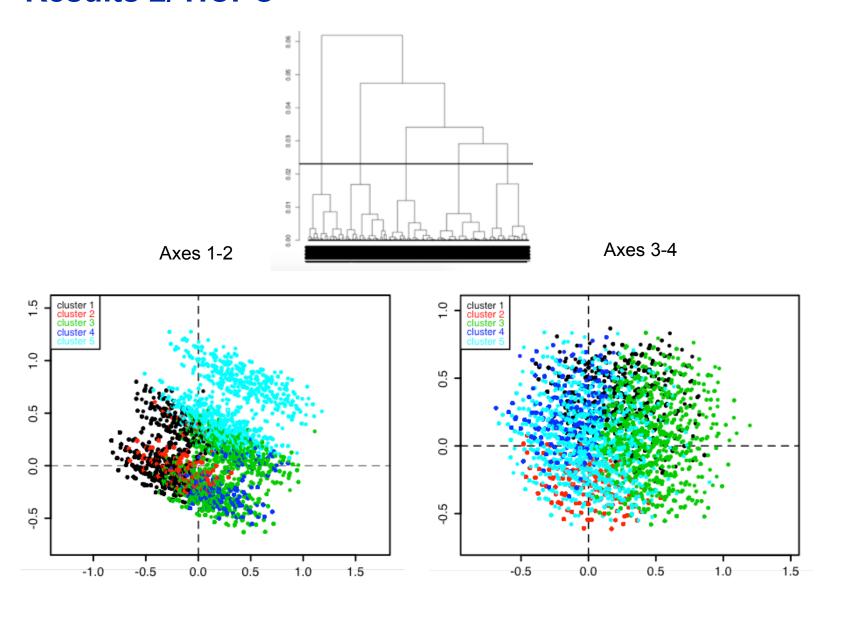# Results 1/ Multiple Correspondence Analysis
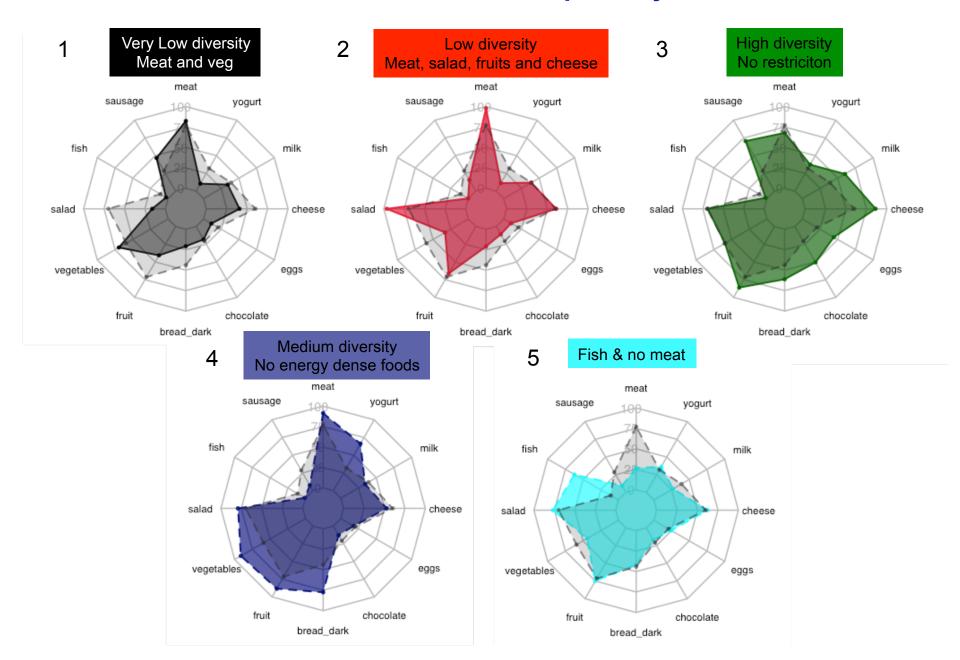
Individuals
Axes 1-2

Categories
Axes 1-2

Axes 1-2

Results 2/ HCPC

Axes 1-2

Axes 3-4
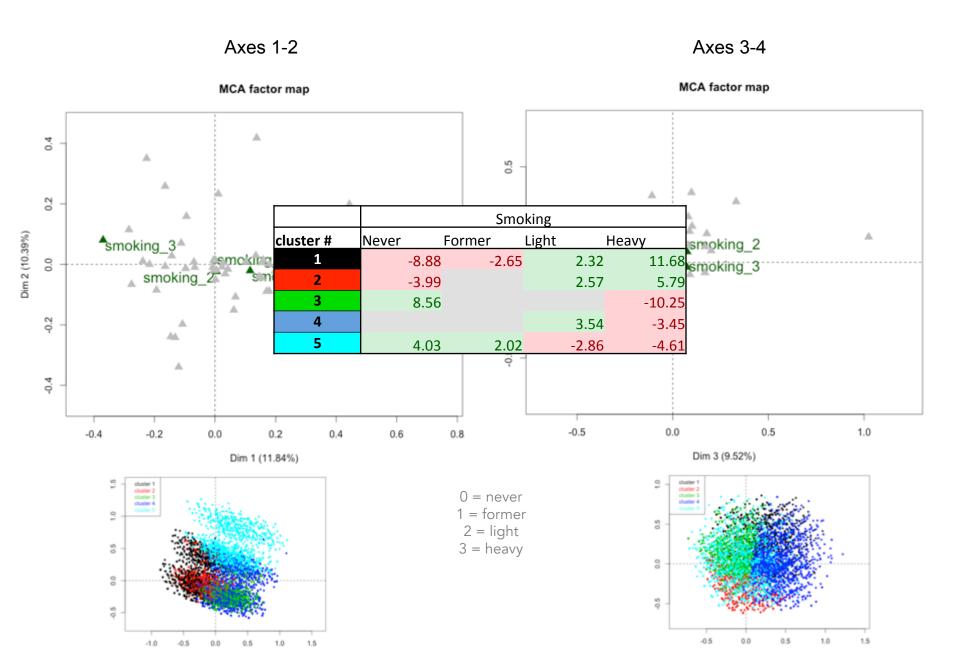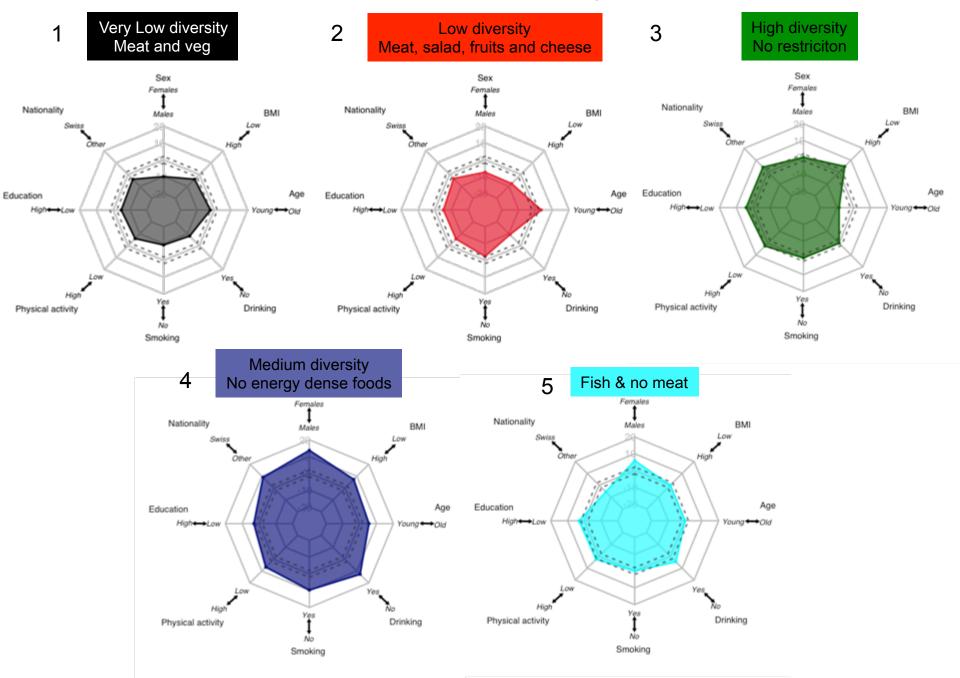
Results 2/ HCPC - % of food consumption by cluster

1 — Very Low diversity Meat and veg

2 — Low diversity Meat, salad, fruits and cheese

3 — High diversity No restriciton

4 — Medium diversity No energy dense foods

5 — Fish & no meat

Results 2/ HCPC - An example of supplementary variable

Axes 1-2

Axes 3-4

cluster #	Smoking			
	Never	Former	Light	Heavy
1	-8.88	-2.65	2.32	11.68
2	-3.99		2.57	5.79
3	8.56			-10.25
4			3.54	-3.45
5	4.03	2.02	-2.86	-4.61

0 = never
1 = former
2 = light
3 = heavy

Results 2/ HCPC – association between diet, demographics and behavior

1 — Very Low diversity: Meat and veg

2 — Low diversity: Meat, salad, fruits and cheese

3 — High diversity: No restriciton

4 — Medium diversity: No energy dense foods

5 — Fish & no meat

- MCA allows to summarize the variabilty in the available dataset (12 food items from a 24h recall among 18,000 ind).

- HCPC allowed to identify 5 clear dietary patterns on the basis of the 4 first principal components of the MCA.

- Supplementary variables allowed to find the other demographic or lifestyle factors that characterize the 5 dietary patterns.

- This approach is currently applied to the MenuCH data.