REVES 20

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Delimiting age brackets for the elderly population. From the derivative to principal components and cluster analysis

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“Assessing the Past, Looking to the Future”

From social security history to statistical rules about chronological age:

- The threshold of old age: 60, 65, 70, , ,
- Age brackets: [60-64], [65-69], [70-74], , ,

To longevity and functionality:

- Healthy life expectancies
- ADL criteria
- The Mexican Health and Aging Study

Basic ADL:

Walk; Bath; Eat, In & Out from bed; Toilet

Estimates of prevalence rates:

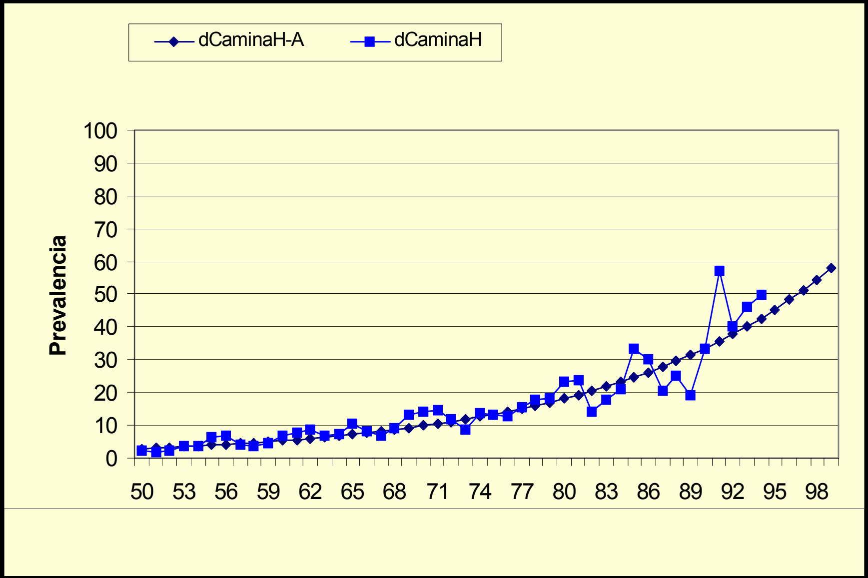
First smoothing:

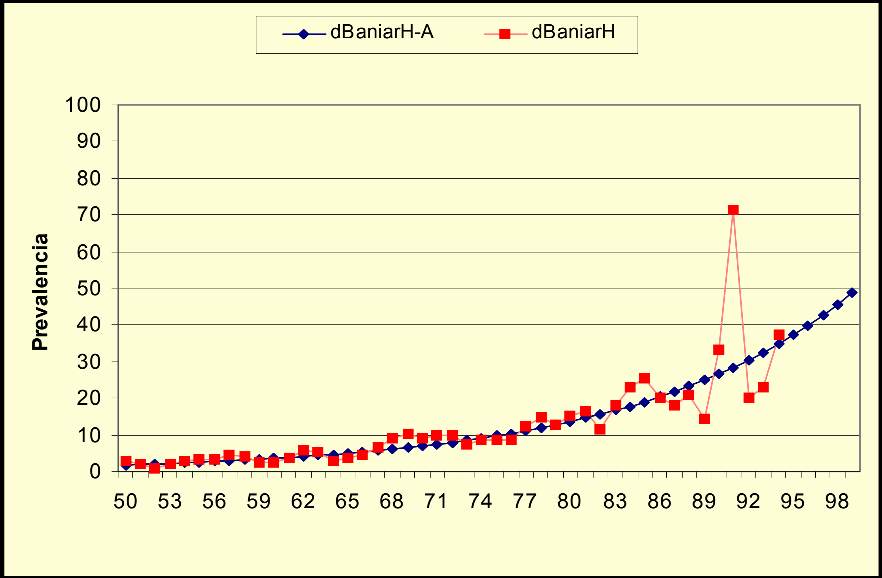
$$p_i(x) = \frac{c_i(x)+c_i(x+1)}{n_i(x)+n_i(x+1)}$$

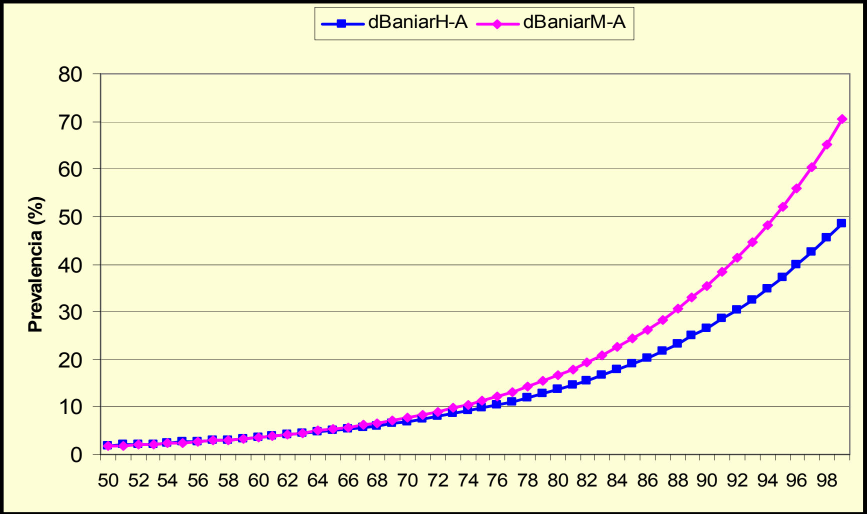
Best fit regression:

$$P_i(x) = ae^{bx}$$

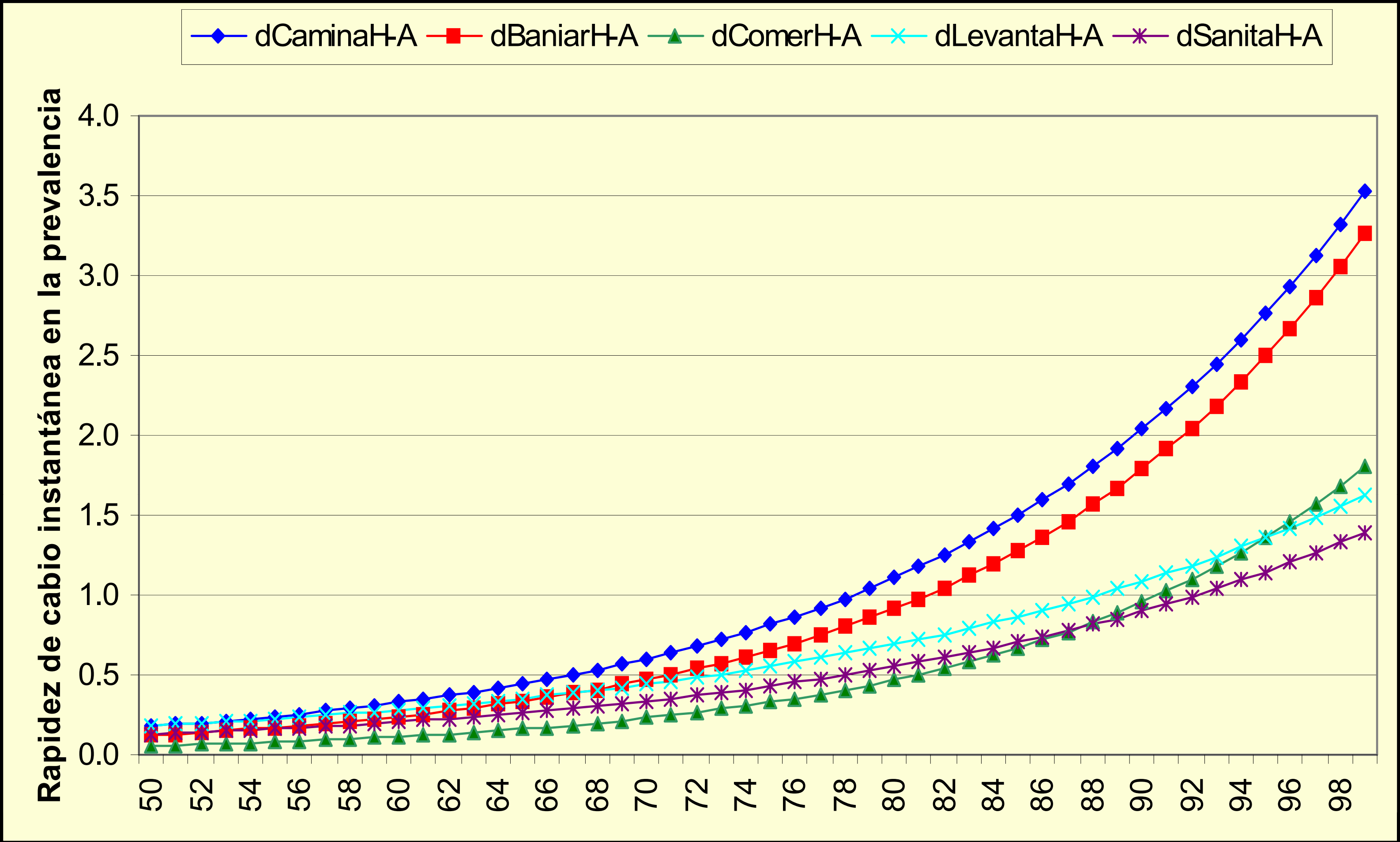
Regression estimates of $P_i(x)$







$dP_i(x)/dx \approx$ estimation of incidence



$dP_i(x)/dx$: mean rate of incindence of ADL disabilities by age group

	Walk		Bath		Eat		Bed		Toilet	
	M	W	M	W	M	W	M	W	M	W
50-59	0.2	0.3	0.2	0.2	0.1	0.1	0.2	0.3	0.2	0.2
60-69	0.4	0.5	0.3	0.4	0.2	0.2	0.3	0.4	0.3	0.4
70-79	0.8	0.9	0.6	0.9	0.3	0.5	0.5	0.7	0.4	0.7
80-89	1.5	1.7	1.3	1.8	0.7	1.1	0.9	1.0	0.7	1.2
90-99	2.7	3.2	2.5	1.3	1.3	2.4	1.3	1.7	1.1	2.2

Age brackets delimited by incidence of walking disability, by sex.

	Men	Women
0.2-0.3	50-61	50-59
0.4-0.6	62-71	60-69
0.7-1.0	72-79	70-76
1.1-1.5	80-85	77-83
1.6-2.4	86-93	84-90
2.4 +	94 +	91 +

ADL conditional probabilities

Men	Walk	Bath	Eat	Bed	Toilet
Walk	1.000	0.520	0.256	0.580	0.445
Bath	0.743	1.000	0.389	0.646	0.596
Eat	0747	0.798	1.000	0.737	0.646
Bed	0.618	0.478	0.265	1.000	0.507
Toilet	0.672	0.620	0.328	0.714	1.000

Women	Walk	Bath	Eat	Bed	Toilet
Walk	1.000	0.536	0.296	0.624	0.479
Bath	0.743	1.000	0.396	0.706	0.598
Eat	0.739	0.711	1.000	0.728	0.706
Bed	0.607	0.500	0.287	1.000	0.518
Toilet	0.652	0.585	0.387	0.719	1.000

The matrix of prevalence disfunctioning

Age	Walk	Bath	Eat	Bed	Toilet
50	$P_{50,2}$	$P_{50,3}$	$P_{50,4}$	$P_{50,5}$	$P_{50,6}$
51	$P_{51,2}$	$P_{51,3}$	$P_{51,4}$	$P_{51,5}$	$P_{51,6}$
52	$P_{52,2}$	$P_{52,3}$	$P_{52,4}$	$P_{52,5}$	$P_{52,6}$
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
100	$P_{100,2}$	$P_{100,3}$	$P_{100,4}$	$P_{100,5}$	$P_{100,6}$

Correlation matrix of standarized $P_i(x)$

Men	Age	Walk	Bath	Eat	Bed	Toilet
Age	1.000	0.9343	0.9231	0.9155	0.9614	0.9552
Walk	0.9343	1.000	0.9995	0.9987	0.9961	0.9978
Bath	0.9231	0.9995	1.000	0.9998	0.9929	0.9953
Eat	0.9155	0.9987	0.9998	1.000	0.9903	0.9931
Bed	0.9614	0.9961	0.9929	0.9903	1.000	0.9997
Toilet	0.9552	0.9978	0.9953	0.9931	0.9997	1.000

Women	Age	Walk	Bath	Eat	Bed	Toilet
Age	1.000	0.9305	0.9059	0.9018	0.9585	0.9363
Walk	0.9305	1.000	0.9979	0.9972	0.9961	0.9999
Bath	0.9059	0.9979	1.000	0.9999	0.9882	0.9966
Eat	0.9018	0.9972	0.9999	1.000	0.9867	0.9958
Bed	0.9585	0.9961	0.9882	0.9867	1.000	0.9974
Toilet	0.9363	0.9999	0.9966	0.9958	0.9974	1.000

Components, Eigenvalues and Eigenvectors

Men	Eigen value	Eigenvectors					
		Age	Walk	Bath	Eat	Bed	Toilet
1	5.8856	-0.3945	-0.4112	-0.4101	-0.4092	-0.4121	-0.4122
2	0.1137	0.8600	-0.2077	-0.2977	-0.3548	0.0491	-0.0165
3	0.0007	-0.3220	0.0132	-0.2718	-0.5011	0.5861	0.4771
4	0.0000	0.0003	-0.2015	-0.3256	0.2900	-0.4904	0.7272
5	0.0000	-0.0323	-0.5281	-0.3235	0.5795	0.4937	-0.1893
6	0.0000	-0.0054	-0.6842	0.6772	-0.1887	0.0073	0.1939

Women	Eigen value	Eigenvectors					
		Age	Walk	Bath	Eat	Bed	Toilet
1	5.8648	-0.3919	-0.4123	-0.4101	-0.4096	-0.4126	-0.4126
2	0.1342	0.8602	-0.1473	-0.3181	-0.3441	0.0907	-0.1027
3	0.0010	-0.3222	0.1991	-0.3798	-0.4597	0.6414	0.2994
4	0.0000	-0.0300	0.0013	-0.4209	0.5877	0.4143	-0.5522
5	0.0000	0.0324	0.1551	-0.6380	0.3364	-0.4162	0.5306
6	0.0000	0.0281	0.8629	-0.0473	-0.2097	-0.2554	-0.3783

Euclidean distance and hierarchical clustering

Men	6	5	4	Women	7	6	5	4
50	1	1	1	50	1	1	1	1
51	1	1	1	51	1	1	1	1
52	1	1	1	52	1	1	1	1
53	1	1	1	53	1	1	1	1
54	1	1	1	54	1	1	1	1
55	1	1	1	55	1	1	1	1
56	1	1	1	56	1	1	1	1
57	1	1	1	57	1	1	1	1
58	1	1	1	58	1	1	1	1
59	1	1	1	59	1	1	1	1
60	1	1	1	60	1	1	1	1
61	1	1	1	61	1	1	1	1
62	1	1	1	62	1	1	1	1
63	1	1	1	63	1	1	1	1
64	1	1	1	64	1	1	1	1
65	1	1	1	65	1	1	1	1
66	1	1	1	66	1	1	1	1
67	1	1	1	67	1	1	1	1
68	1	1	1	68	1	1	1	1
69	2	2	2	69	1	1	1	1
70	2	2	2	70	1	1	1	1
71	2	2	2	71	2	2	2	2
72	2	2	2	72	2	2	2	2
73	2	2	2	73	2	2	2	2
74	2	2	2	74	2	2	2	2
75	2	2	2	75	2	2	2	2
76	2	2	2	76	2	2	2	2
77	3	2	2	77	2	2	2	2
78	3	2	2	78	2	2	2	2
79	3	2	2	79	3	3	2	2
80	3	2	2	80	3	3	2	2
81	3	2	2	81	3	3	2	2
82	3	2	2	82	3	3	2	2
83	3	2	2	83	3	3	2	2
84	4	3	3	84	3	3	2	2
85	4	3	3	85	3	3	2	2
86	4	3	3	86	3	3	2	2
87	4	3	3	87	4	4	3	3
88	4	3	3	88	4	4	3	3
89	4	3	3	89	4	4	3	3
90	4	3	3	90	4	4	3	3
91	4	3	3	91	5	5	4	3
92	5	4	4	92	5	5	4	3
93	5	4	4	93	5	5	4	3
94	5	4	4	94	5	5	4	3
95	5	4	4	95	6	5	4	3
96	6	5	4	96	6	5	4	3
97	6	5	4	97	7	6	5	4
98	6	5	4	98	7	6	5	4
99	6	5	4	99	7	6	5	4

So, what?

- An exercise on estimation, principal components and clustering
- How to use it in a meaningfull way to redefine scales of functionality ?
- It requires inputs on the hierarchical nature of ADLs and the meaning of Euclidean distance for clustering