



# CLASSIFICATION OF DECOMPRESSION ILLNESS BY CLUSTER ANALYSIS



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## INTRODUCTION

- ❖ Cluster analysis classifies observations into naturally occurring groups independent of a *priori* assumptions.
- ❖ We tested the hypothesis that cluster analysis can be applied to DCI manifestations.
- ❖ A previous study using principal component analysis found poor correlation of traditional DCI classifications (AGE, DCS-1, and DCS-2) with expected manifestations (1).

## METHODS

- ❖ Data included 1,929 DCI cases (1368 male, 561 female, mean age 38) with 25 possible manifestations reported by 80 chambers to the Divers Alert Network (DAN) from 1998-2002.
- ❖ The optimal number of clusters was determined by a 2-step cluster analysis (2).
- ❖ Principal manifestations in a cluster were defined as those that occurred in more than 50% of all cases.

## RESULTS

- ❖ Four clusters were identified:
  - ❖ Cluster 1: 16% (300 cases).
  - ❖ Cluster 2: 38% (741 cases).
  - ❖ Cluster 3: 17% (333 cases).
  - ❖ Cluster 4: 29% (555 cases).
- ❖ Table 1 lists manifestation frequencies from most to least common.
  - ❖ Numbness and pain were most frequent.
  - ❖ Cardiovascular and tinnitus were least frequent.
  - ❖ Distributions of manifestations in clusters are also shown.
- ❖ Table 2 shows manifestations by their percentages of occurrence in all cases.

Table 1. Cluster and manifestation frequencies.

Total	Manifestation	Cluster 1	Cluster 2	Cluster 3	Cluster 4
1003	Numbness	0	690	201	112
935	Pain	300	337	137	161
740	Paresthesia	0	555	161	24
306	Malaise	0	0	301	5
258	Muscular Weakness	2	0	256	0
248	Skin Sensitivity	0	140	79	29
195	Fatigue	0	40	37	118
168	Dizziness	0	35	35	98
157	Headache	0	28	25	104
142	Confusion	0	22	42	78
123	Paralysis	0	7	113	3
122	SkinRash/Mottling	0	18	21	83
96	Nausea	0	22	13	61
92	Dyspnea/Chokes	0	10	32	50
60	Incoordination	0	15	23	22
53	Vision	0	10	16	27
52	Muscular Problems	0	12	13	27
47	Vertigo	0	7	10	30
43	Unconsciousness	0	2	12	29
37	Abnormal Sensations	0	7	11	19
36	Bladder - Bowel	0	1	35	0
22	Local Swelling	0	4	1	17
16	Hearing Loss	0	0	2	14
4	Cardiovascular	0	1	2	1
4	Tinnitus	0	1	0	3

Table 2. Cluster and manifestation percentages.

Manifestation	% Cluster 1	% Cluster 2	% Cluster 3	% Cluster 4	% Total
Numbness	0	69	20	11	100
Pain	32	36	15	17	100
Paresthesia	0	75	22	3	100
Malaise	0	0	98	2	100
Muscular Weakness	1	0	99	0	100
Skin Sensitivity	0	56	32	12	100
Fatigue	0	21	19	61	100
Dizziness	0	21	21	58	100
Headache	0	18	16	66	100
Confusion	0	15	30	55	100
Paralysis	0	6	92	2	100
Skin Rash/Mottling	0	15	17	68	100
Nausea	0	23	14	64	100
Dyspnea/Chokes	0	11	35	54	100
Incoordination	0	25	38	37	100
Vision	0	19	30	51	100
Muscular Problems	0	23	25	52	100
Vertigo	0	15	21	64	100
Unconsciousness	0	5	28	67	100
Abnormal Sensations	0	19	30	51	100
Bladder - Bowel	0	3	97	0	100
Local Swelling	0	18	5	77	100
Hearing Loss	0	0	13	88	100
Cardiovascular	0	25	50	25	100
Tinnitus	0	25	0	75	100

## DISCUSSION

- ❖ Except for pain, principal manifestations were mutually exclusive among clusters.
    - ❖ Pain occurred in all clusters:
      - ❖ 32% pain in Cluster 1, 36% in 2, 15% in 3, 17% in 4.
    - ❖ Secondary manifestations could be present in several clusters.
  - ❖ Cluster 1: almost all were pain-only.
  - ❖ Cluster 2: largely mild neurological (75% numbness, 69% paresthesia, 56% skin sensitivity).
  - ❖ Cluster 3: mostly spinal (99% muscular weakness, 98% malaise, 97% bladder-bowel, 92% paralysis, 50% cardiovascular).
  - ❖ Cluster 4: largely cerebral (most serious 6 of 15 manifestations included 88% hearing, 67% unconsciousness, 64% nausea, 64% vertigo, 55% confusion, 54% dyspnea-chokes, 51% vision).
- ❖ Clusters did not correspond to the traditional DCI diagnoses AGE, DCS-1, and DCS-2.
  - ❖ Are clusters prognostic of therapeutic outcome?
  - ❖ Survival analysis may help answer this question (3, 4).

## REFERENCES

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