Tooth loss and denture status: results of the 6th German Oral Health Study (DMS • 6). Online Appendix

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ABSTRACT

Objectives: The German Oral Health Study (DMS) is a series of consecutive studies designed to assess the oral health status of adults, seniors, and children in Germany. DMS is a major program of the Institute of German Dentists (Institut der Deutschen Zahnärzte) with the aim to produce health statistics for Germany. Tooth loss, edentulism, and prosthetic care have considerable socioeconomic significance; it is the aim of this paper to report findings on these aspects.

Method and materials: The survey combines interviews and clinical examinations. Previous DMS studies focused primarily on tooth loss, edentulism, and prosthetic care. In the DMS • 6 survey, the condition of removable dentures and need for adjustments were additionally recorded, as well as necessary repair measures that were grouped according to their complexity (chairside or laboratory).

Results: The prevalence of edentulism decreased considerably compared to that in the Fifth German Oral Health Study (DMS V) in 2014. Among younger adults (35- to 44-year-olds), the prevalence of edentulism was negligible, with an average of 26.6 teeth present. The younger senior group (65- to 74-year-olds) had an average of 19.3 teeth; the prevalence of edentulism was 5%, which is a reduction of > 50% compared to 2014 (12.4%). Lower education status was an important prognostic factor for tooth loss. Owing to the low prevalence of edentulism in younger adults, removable dentures were not prevalent in this age group, whereas combined fixed–removable dentures were most frequently used in seniors. Regarding the type of denture, a shift towards fixed as well as implant-supported types was observed. Of the removable dentures, 50% to 60% were in a very good or good clinical condition. Problems were mainly identified with simple acrylic dentures. Nonetheless, participants' satisfaction with removable dentures was extremely high, and the dentures were used almost continuously.

Conclusion: The most important finding in this study is the continued significant decline in the prevalence of complete edentulism among seniors that suggests a further reduction in edentulism in the future with an estimate of around 4% in 2030. The shift observed in primary prosthetic care from removable to fixed prostheses as well as the increasing prevalence of implants placed are positive developments. The data revealed further compression of morbidity compared to DMS V. Complete edentulism declined, and fixed partial dentures, including implant-supported prostheses, were increasingly used. Lower education status was an important predictor for tooth loss.

KEYWORDS: dental care, dental prostheses, dentists, DMS 6, edentulous mouth, epidemiology, tooth loss

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Supplemental Table A1: Epidemiologic description and treatment of missing teeth in younger adults (35- to 44-year-olds) and younger seniors (65- to 74-year-olds) by gender and education groups (including 95% confidence intervals)

35- to 44-year-olds						
	Total	**Gender**		**Education group**		
		Male	Female	Low	Medium	High
n	927	459	467	80	408	383
Full dentition (base 28 teeth, prevalence)	56.3% (53.1; 59.5)	57.1% (52.5; 61.6)	55.3% (50.8; 59.7)	27.5% (18.5; 37.2)	51.3% (46.4; 56.1)	68.3% (63.3; 72.6)
Edentulism (base 32 teeth, prevalence)						
- Maxilla only	0.1% (0.0; 0.5)	0.2% (0.0; 1.0)	0.0% (NA)	0.7% (0.1; 5.4)	0.1% (0.0; 0.6)	0.0% (NA)
- Mandible only	0.2% (0.0; 0.7)	0.1% (0.0; 1.0)	0.3% (0.0; 1.0)	2.1% (0.5; 7.3)	0.0% (NA)	0.0% (NA)
- Total	0.1% (0.0; 0.5)	0.1% (0.0; 1.0)	0.0% (NA)	0.7% (0.1; 5.4)	0.0% (NA)	0.0% (NA)
Number of missing teeth (base 28 teeth) *Of which:*	1.4 (1.2; 1.5)	1.4 (1.2; 1.6)	1.4 (1.2; 1.6)	3.3 (2.2; 4.3)	1.5 (1.3; 1.7)	0.8 (0.7; 1.0)
- Not replaced	0.9 (0.8; 1.0)	0.9 (0.8; 1.1)	0.9 (0.8; 1.0)	1.7 (1.1; 2.3)	1.0 (0.8; 1.1)	0.6 (0.5; 0.7)
- Replaced by pontics	0.2 (0.2; 0.3)	0.2 (0.1; 0.3)	0.2 (0.2; 0.3)	0.6 (0.3; 0.9)	0.3 (0.2; 0.4)	0.1 (0.1; 0.2)
- Replaced by removable dentures	0.1 (0.0; 0.2)	0.2 (0.0; 0.3)	0.1 (0.0; 0.2)	0.9 (0.0; 1.8)	0.1 (0.0; 0.2)	0.0 (0.0; 0.0)
- Replaced by implants	0.1 (0.1; 0.2)	0.1 (0.1; 0.1)	0.1 (0.1; 0.2)	0.1 (0.0; 0.2)	0.2 (0.1; 0.3)	0.1 (0.0; 0.1)
Percentage of missing teeth that have been replaced (%)	28.1 (24.2; 32.0)	25.1 (19.6; 30.6)	30.9 (25.3; 36.4)	36.4 (25.1; 47.6)	29.4 (23.6; 35.1)	24.1 (17.2; 30.9)
65- to 74-year-olds						
	Total	**Gender**		**Education group**		
		Male	Female	Low	Medium	High
n	797	375	422	158	367	230
Full dentition (base 28 teeth, prevalence)	6.7% (5.1; 8.5)	7.9 (5.4; 10.7)	5.5 (3.7; 8.2)	3.9 (1.7; 7.4)	4.3 (2.5; 6.8)	13.4 (9.5; 18.6)
Edentulism (base 32 teeth, prevalence)						
- Maxilla only	10.8% (8.8; 13.1)	12.2 (9.2; 15.6)	9.4 (7.0; 12.7)	20.1 (14.6; 26.2)	11.0 (8.2; 14.8)	3.2 (1.4; 6.1)
- Mandible only	7.2% (5.6; 9.2)	8.1 (5.6; 11.0)	6.4 (4.3; 9.0)	12.8 (8.5; 18.1)	6.4 (4.1; 9.2)	3.3 (1.4; 6.1)
- Total	5.0% (3.7; 6.7)	6.4 (4.3; 9.2)	3.8 (2.2; 5.8)	8.8 (5.4; 13.6)	5.0 (3.0; 7.5)	1.9 (0.6; 4.2)
Number of missing teeth (base 28 teeth) *Of which:*	8.7 (8.2; 9.3)	8.8 (7.9; 9.6)	8.7 (7.9; 9.5)	11.4 (10.1; 12.8)	9.1 (8.3; 10.0)	5.7 (4.8; 6.5)
- Not replaced	2.0 (1.8; 2.2)	2.0 (1.7; 2.3)	2.0 (1.8; 2.3)	2.5 (2.0; 3.0)	2.0 (1.7; 2.3)	1.5 (1.2; 1.7)
- Replaced by pontics	1.5 (1.4; 1.7)	1.4 (1.2; 1.6)	1.7 (1.5; 1.9)	1.3 (1.0; 1.5)	1.6 (1.4; 1.9)	1.5 (1.2; 1.8)
- Replaced by removable dentures	4.5 (3.9; 5.0)	4.6 (3.7; 5.5)	4.3 (3.6; 5.1)	7.2 (5.7; 8.6)	4.9 (4.0; 5.8)	1.6 (1.0; 2.3)
- Replaced by implants	0.7 (0.6; 0.8)	0.8 (0.6; 1.0)	0.6 (0.5; 0.8)	0.5 (0.3; 0.7)	0.6 (0.5; 0.8)	1.0 (0.7; 1.4)

	Total	Male	Female	Low	Medium	High
Percentage of missing teeth that have been replaced (%)	63.8 (61.1; 66.4)	61.7 (57.6; 65.7)	65.7 (62.3; 69.0)	65.8 (60.7; 70.9)	65.2 (61.4; 69.0)	59.7 (54.2; 65.2)

Data are presented as unweighted numbers (n) and weighted percentages or weighted means (with 95% confidence intervals). One gender-diverse individual is included in the total column, but not in the gender categories.

Table A2a: Primary prosthetic treatment in younger adults (35- to 44-year-olds) by gender and education groups (including 95% confidence intervals)

	Total	Gender		Education group		
		Male	Female	Low	Medium	High
n	927	459	467	80	408	383
Primary prosthetic treatment (prevalence): Total dentition						
Fully dentate (no gaps, no dentures)	38.5% (35.4; 41.7)	40.6% (36.2; 45.3)	36.2% (32.1; 40.7)	14.4% (8.0; 22.7)	35.6% (31.0; 40.3)	48.2% (43.0; 53.1)
≥ 1 untreated gap, no dentures	19.0% (16.6; 21.6)	21.2% (17.7; 25.3)	17.0% (13.7; 20.4)	30.6% (21.6; 40.9)	18.3% (14.9; 22.4)	15.8% (12.4; 19.8)
≥ 1 one crown restoration	25.9% (23.1; 28.8)	23.6% (19.8; 27.6)	28.3% (24.4; 32.4)	21.6% (13.5; 30.7)	26.6% (22.5; 31.1)	25.6% (21.4; 30.2)
≥ 1 fixed denture (i.e., bridge/implant)	15.1% (12.9; 17.5)	12.8% (9.8; 16.0)	17.3% (14.1; 20.9)	27.2% (18.5; 37.2)	17.6% (14.2; 21.6)	10.4% (7.5; 13.7)
≥ 1 removable partial denture	1.3% (0.7; 2.2)	1.7% (0.8; 3.3)	1.0% (0.4; 2.3)	4.0% (1.0; 9.1)	1.9% (0.9; 3.7)	0.1% (0.0; 0.7)
≥ 1 complete denture	0.2% (0.0; 0.7)	0.2% (0.0; 1.0)	0.3% (0.0; 1.0)	2.1% (0.5; 7.3)	0.1% (0.0; 0.6)	0.0% (0.0; 0.0)
Primary prosthetic treatment (prevalence): Maxilla						
Fully dentate (no gaps, no dentures)	50.9% (47.7; 54.1)	54.0% (49.4; 58.6)	47.6% (43.2; 52.2)	28.7% (19.5; 38.4)	48.9% (43.9; 53.6)	59.4% (54.4; 64.2)
≥ 1 untreated gap, no dentures	16.6% (14.3; 19.1)	17.4% (14.1; 21.0)	15.9% (12.7; 19.3)	21.4% (13.5; 30.7)	16.8% (13.5; 20.8)	14.2% (11.0; 18.0)
≥ 1 one crown restoration	20.2% (17.8; 23.0)	16.8% (13.6; 20.6)	23.6% (20.0; 27.6)	22.1% (14.5; 32.0)	18.4% (14.9; 22.4)	21.2% (17.2; 25.4)
≥ 1 fixed denture (i.e., bridge/implant)	11.1% (9.2; 13.3)	10.1% (7.5; 13.0)	12.2% (9.5; 15.4)	22.6% (14.5; 32.0)	14.4% (11.3; 18.1)	5.1% (3.1; 7.6)
≥ 1 removable partial denture	1.0% (0.5; 1.8)	1.5% (0.7; 3.0)	0.5% (0.1; 1.3)	3.0% (1.0; 9.1)	1.4% (0.5; 2.7)	0.1% (0.0; 0.7)
≥ 1 complete denture	0.2% (0.0; 0.7)	0.2% (0.0; 1.0)	0.3% (0.0; 1.0)	2.1% (0.5; 7.3)	0.1% (0.0; 0.6)	0.0% (0.0; 0.0)
Primary prosthetic treatment (prevalence): Mandible						
Fully dentate (no gaps, no dentures)	54.3% (51.2; 57.6)	55.8% (51.2; 60.3)	52.7% (48.2; 57.2)	33.2% (23.6; 43.4)	51.0% (46.1; 55.9)	63.3% (58.4; 68.1)
≥ 1 untreated gap, no dentures	17.7% (15.3; 20.2)	20.6% (17.1; 24.6)	15.1% (12.2; 18.6)	33.0% (23.6; 43.4)	17.8% (14.2; 21.6)	11.8% (8.9; 15.4)
≥ 1 one crown restoration	18.6% (16.3; 21.3)	15.9% (12.8; 19.6)	21.3% (17.8; 25.2)	15.7% (8.9; 24.0)	21.0% (17.1; 25.1)	17.2% (13.6; 21.2)
≥ 1 fixed denture (i.e., bridge/implant)	8.3% (6.7; 10.2)	6.3% (4.3; 8.7)	10.2% (7.7; 13.1)	11.9% (6.2; 19.9)	9.2% (6.7; 12.3)	7.5% (5.1; 10.3)
≥ 1 removable partial denture	0.9% (0.4; 1.6)	1.2% (0.6; 2.7)	0.5% (0.1; 1.3)	4.0% (1.0; 9.1)	1.0% (0.3; 2.3)	0.1% (0.0; 0.7)
≥ 1 complete denture	0.2% (0.0; 0.7)	0.1% (0.0; 1.0)	0.3% (0.0; 1.0)	2.1% (0.5; 7.3)	0.0% (0.0; 0.0)	0.0% (0.0; 0.0)

Data are presented as unweighted numbers (n) and weighted percentage values (with 95% confidence intervals). A person with diverse gender is included in the total column, but not in the gender assignment. One gender-diverse individual is included in the total column, but not in the gender categories.

Supplemental Table A2b: Primary prosthetic treatment in younger seniors (65- to 74-year-olds) by gender and education groups (including 95% confidence intervals)

	Total	Gender		Education group		
		Male	Female	Low	Medium	High
n	797	375	422	158	367	230
Primary prosthetic treatment (prevalence): Total dentition						
Fully dentate (no gaps, no dentures)	1.1% (0.6; 2.1)	1.4% (0.5; 2.8)	0.7% (0.2; 1.9)	1.6% (0.5; 4.4)	0.6% (0.1; 1.8)	1.7% (0.6; 4.2)
≥ 1 untreated gap, no dentures	4.4% (3.1; 6.0)	5.8% (3.9; 8.6)	3.0% (1.6; 4.9)	3.8% (1.7; 7.4)	4.9% (3.0; 7.5)	1.3% (0.4; 3.6)
≥ 1 one crown restoration	16.9% (14.5; 19.7)	20.3% (16.6; 24.6)	13.7% (10.6; 17.3)	10.3% (6.7; 15.6)	13.5% (10.2; 17.3)	29.5% (23.7; 35.7)
≥ 1 fixed denture (i.e., bridge/implant)	47.8% (44.3; 51.3)	43.4% (38.4; 48.3)	52.0% (47.2; 56.9)	40.0% (32.9; 47.0)	49.3% (43.9; 54.4)	51.8% (45.5; 58.6)
≥ 1 removable partial denture	19.1% (16.5; 21.9)	17.7% (14.2; 21.8)	20.3% (16.6; 24.4)	25.0% (19.0; 31.5)	20.0% (16.1; 24.4)	13.4% (9.5; 18.6)
≥ 1 complete denture	10.8% (8.8; 13.1)	11.4% (8.5; 14.8)	10.2% (7.6; 13.5)	19.3% (14.1; 25.6)	11.8% (8.7; 15.4)	2.3% (0.9; 4.9)
Primary prosthetic treatment (prevalence): Maxilla						
Fully dentate (no gaps, no dentures)	3.3% (2.2; 4.7)	4.9% (3.1; 7.4)	1.9% (0.9; 3.7)	3.9% (1.7; 7.4)	2.6% (1.3; 4.6)	4.0% (2.0; 7.3)
≥ 1 untreated gap, no dentures	6.1% (4.5; 7.8)	7.6% (5.4; 10.7)	4.6% (2.9; 7.0)	5.9% (3.3; 10.3)	7.3% (4.8; 10.2)	1.9% (0.6; 4.2)
≥ 1 one crown restoration	25.5% (22.5; 28.6)	26.9% (22.6; 31.4)	24.2% (20.2; 28.5)	15.5% (10.8; 21.3)	22.4% (18.2; 26.9)	38.8% (32.7; 45.5)
≥ 1 fixed denture (i.e., bridge/implant)	38.8% (35.4; 42.2)	34.0% (29.4; 38.8)	43.3% (38.5; 48.1)	35.3% (28.7; 42.5)	39.0% (34.1; 44.3)	42.2% (35.7; 48.7)
≥ 1 removable partial denture	16.6% (14.1; 19.3)	15.8% (12.4; 19.6)	17.3% (13.9; 21.3)	22.3% (16.5; 28.6)	17.7% (14.0; 22.0)	11.1% (7.6; 16.0)
≥ 1 complete denture	9.8% (7.9; 12.0)	10.8% (8.0; 14.2)	8.8% (6.3; 11.8)	17.2% (12.2; 23.1)	11.0% (8.2; 14.8)	1.9% (0.6; 4.2)
Primary prosthetic treatment (prevalence): Mandible						
Fully dentate (no gaps, no dentures)	3.4% (2.3; 4.8)	3.3% (1.9; 5.5)	3.4% (2.0; 5.5)	3.2% (1.4; 6.7)	2.2% (1.1; 4.3)	6.1% (3.7; 10.1)
≥ 1 untreated gap, no dentures	10.9% (8.9; 13.2)	13.1% (10.1; 16.8)	8.8% (6.3; 11.8)	12.4% (8.0; 17.5)	12.3% (9.2; 16.0)	5.4% (3.0; 9.0)
≥ 1 one crown restoration	22.8% (19.9; 25.7)	24.3% (20.2; 28.7)	21.3% (17.5; 25.4)	20.2% (14.6; 26.2)	19.3% (15.5; 23.8)	32.8% (27.1; 39.4)
≥ 1 fixed denture (i.e., bridge/implant)	40.5% (37.2; 44.0)	36.4% (31.7; 41.2)	44.4% (39.7; 49.3)	30.1% (23.5; 36.8)	42.2% (37.2; 47.5)	45.4% (38.8; 51.8)
≥ 1 removable partial denture	18.0% (15.4; 20.7)	17.2% (13.8; 21.3)	18.7% (15.0; 22.6)	26.9% (21.0; 33.9)	18.9% (15.0; 23.2)	9.2% (5.8; 13.4)
≥ 1 complete denture	4.5% (3.2; 6.1)	5.7% (3.7; 8.3)	3.4% (2.0; 5.5)	7.2% (4.1; 11.6)	5.2% (3.2; 7.8)	1.1% (0.2; 2.9)

Data are presented as unweighted numbers (n) and weighted percentage values (with 95% confidence intervals). A person with diverse gender is included in the total column, but not in the gender assignment. One gender-diverse individual is included in the total column, but not in the gender categories.

Supplemental Table A3: Prosthetic treatment in younger adults (35- to 44-year-olds) and younger seniors (65- to 74-year-olds) by gender and education groups (including 95% confidence intervals)

	Total	Gender		Education group		
		Male	Female	Low	Medium	High
35- to 44-year-olds						
n	927	459	467	80	408	383
Fixed dentures (prevalence)						
- on natural teeth	39.7% (36.6; 42.9)	34.7% (30.4; 39.2)	44.7% (40.3; 49.2)	51.3% (40.1; 61.0)	42.9% (38.3; 47.9)	34.6% (29.9; 39.5)
- Partial crowns/inlays	9.6% (7.8; 11.6)	7.2% (5.0; 9.8)	11.9% (9.3; 15.2)	4.9% (1.6; 10.8)	9.7% (7.1; 12.9)	10.9% (8.0; 14.2)
- Full crowns	31.7% (28.7; 34.7)	27.2% (23.4; 31.6)	36.0% (31.8; 40.5)	42.0% (31.2; 51.8)	33.5% (29.1; 38.3)	27.3% (22.9; 31.8)
- Bridges	10.0% (8.1; 12.0)	8.9% (6.5; 11.8)	11.0% (8.4; 14.0)	24.2% (15.5; 33.3)	11.6% (8.6; 14.8)	5.9% (3.8; 8.5)
Removable dentures (n)	12	No differentiation by gender or education was made for removable dentures in 35- to 44-year-olds due to the small number of cases				
- Acrylic partial denture	6					
- Cast framework partial denture	4					
- Combined fixed-removable partial denture	2					
- Hybrid denture	0					
- Complete denture	3					
Implants (prevalence)	7.1% (5.6; 8.9)	6.0% (4.1; 8.5)	8.2% (6.0; 11.0)	5.7% (2.3; 12.4)	9.0% (6.5; 12.0)	5.3% (3.4; 7.9)
- with fixed dentures	7.1% (5.6; 8.9)	6.0% (4.1; 8.5)	8.2% (6.0; 11.0)	5.7% (2.3; 12.4)	9.0% (6.5; 12.0)	5.3% (3.4; 7.9)
- with removable dentures	0.0% (0.0; 0.0)	0.0% (0.0; 0.0)	0.0% (0.0; 0.0)	0.0% (0.0; 0.0)	0.0% (0.0; 0.0)	0.0% (0.0; 0.0)
Number of implants per patient with implants	1.7 (1.4; 2.1)	1.7 (1.1; 2.2)	1.7 (1.3; 2.2)	1.7 (0.4; 3.0)	2.0 (1.5; 2.5)	1.4 (0.9; 1.9)
65- to 74-year-olds						
n	797	375	422	158	367	230
Fixed dentures (prevalence)						
- on natural teeth	79.7% (76.8; 82.4)	77.8% (73.2; 81.5)	81.5% (77.4; 85.0)	67.3% (59.8; 73.4)	78.5% (74.0; 82.6)	93.4% (89.9; 96.3)
- Partial crowns/inlays	24.2% (21.3; 27.3)	23.4% (19.4; 27.9)	24.9% (20.9; 29.3)	11.0% (7.1; 16.2)	22.1% (17.9; 26.6)	39.8% (33.5; 46.4)
- Full crowns	71.7% (68.6; 74.8)	68.0% (63.3; 72.5)	75.3% (71.0; 79.3)	60.5% (53.0; 67.1)	70.0% (65.0; 74.6)	85.6% (80.4; 89.7)
- Bridges	51.7% (48.2; 55.2)	44.1% (39.2; 49.0)	59.0% (54.1; 63.6)	47.1% (39.8; 54.2)	54.3% (49.0; 59.5)	50.8% (44.1; 57.2)
Removable dentures (prevalence)	19.6% (16.9; 22.5)	20.8% (17.0; 25.0)	18.4% (15.0; 22.5)	30.4% (24.2; 37.6)	20.9% (16.8; 25.3)	8.9% (5.8; 13.4)
- Acrylic partial denture	3.6% (2.4; 5.0)	2.7% (1.5; 4.9)	4.4% (2.7; 6.7)	4.5% (2.1; 8.2)	3.3% (1.7; 5.4)	3.2% (1.4; 6.1)
- Cast framework partial denture	7.7% (6.0; 9.7)	9.4% (6.7; 12.5)	6.1% (4.1; 8.7)	7.9% (4.5; 12.3)	9.9% (7.2; 13.5)	4.5% (2.3; 7.9)
- Combined fixed-removable partial denture	15.1% (12.8; 17.8)	13.5% (10.3; 17.1)	16.7% (13.3; 20.5)	23.4% (17.5; 29.7)	15.6% (11.9; 19.5)	7.7% (4.7; 11.8)
- Hybrid denture	0.2% (0.1; 0.8)	0.5% (0.1; 1.6)	0.0% (NA)	0.0% (NA)	0.0% (NA)	0.8% (0.2; 2.9)
- Complete denture	10.8% (8.8; 13.1)	11.4% (8.5; 14.8)	10.2% (7.6; 13.5)	19.3% (14.1; 25.6)	11.8% (8.7; 15.4)	2.3% (0.9; 4.9)
Implants (prevalence)	23.2% (20.4; 26.2)	22.7% (18.7; 27.0)	23.7% (19.8; 28.0)	18.6% (13.6; 24.9)	20.7% (16.6; 25.0)	30.3% (24.5; 36.6)

- with fixed dentures	20.3% (17.5; 23.1)	19.5% (15.6; 23.5)	21.0% (17.3; 25.2)	11.7% (7.6; 16.9)	18.9% (15.0; 23.2)	28.5% (22.9; 34.7)
- with removable dentures	2.9% (1.9; 4.2)	3.2% (1.7; 5.2)	2.7% (1.4; 4.6)	6.9% (4.1; 11.6)	1.8% (0.7; 3.5)	1.9% (0.6; 4.2)
Number of implants per patient with implants	3.1 (2.7; 3.4)	3.5 (2.8; 4.1)	2.7 (2.3; 3.1)	2.7 (2.1; 3.3)	3.0 (2.5; 3.6)	3.4 (2.6; 4.2)

Data are presented as unweighted numbers (n) and weighted percentages or weighted means (with 95% confidence intervals). One gender-diverse individual is included in the total column, but not in the gender categories.

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