

Cost differentials of dental outpatient care across clinical dentistry branches

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ABSTRACT

Background: Dental care presents affordability issues in Central & Eastern European transitional economies due to lack of insurance coverage in most countries of the region and almost complete out-of-pocket payments by citizens. **Objective:** Real world estimates on cost differentials across clinical dentistry branches, ICD-10 diagnostic groups and groups of dental services. **Methods:** Prospective case-series cost analysis was conducted from the patient perspective. A six months time horizon was adopted. Sample size was 752 complete episodes of treatment in 250 patients, selected in 2012/2013 throughout several specialist state- and private-owned dental clinics in Serbia. All direct costs of dental care were taken into account and expressed in Euros (€). **Results:** Mean total costs of dental care were € 46 ± 156 per single dentist visit while total costs incurred by this population sample were € 34,424. Highest unit utilization of services belongs to conservative dentistry (31.9%), oral surgery (19.5%) and radiology (17.4%), while the resource with the highest monetary value belongs to implantology € 828 ± 392, orthodontics € 706 ± 667 and prosthetics € 555 ± 244. The most frequently treated diagnosis was tooth decay (33.8% unit services provided), pulpitis (11.2%) and impacted teeth (8.5%), while most expensive to treat were anomalies of tooth position (€ 648 ± 667), abnormalities of size and form of teeth (€ 508 ± 705) and loss of teeth due to accident, extraction or local periodontal disease (€ 336 ± 339). **Conclusion:** Although the range of dental costs currently falls behind EU average, Serbia's emerging economy is likely to expand in the long run while market demand for dental services will grow. Due to threatened financial sustainability of current health insurance patterns in Western Balkans, getting acquainted with true size and structure of dental care costs could essentially support informed decision making in future.

Keywords

Health economics, Costs, Dental care

INTRODUCTION

Global reach of oral health care demand for resources and its need for investment came to public attention mostly in past two decades [1,2]. In the European socioeconomic milieu huge budget impact of clinical dentistry was recognized in the early 1990s [3]. It bears particular financial burden for Central & Eastern European transitional economies due to poor insurance coverage in most countries of the region and huge contribution of out-of-pocket payments by ordinary citizens [4]. This is the case with most middle to high-income post-2004 EU members, CIS and Western Balkans countries [5-8]. Dental medicine has extraordinary high demand for services, compared to clinical

medicine disciplines mostly due to frequent acute conditions and adverse events of interventions [9-10]. Childhood preventive and conservative dentistry bears particularly sensitive impact in projected long term costs of care [11]. Additional complexity comes to the table with diversity of reimbursement strategies applied on dental care in major markets across the globe [12]. These were occasionally leading to severe disparities in access to dental care as was the case in juvenile population in the US [13-15].

This study presents one of the pioneering attempts in broader Balkan region to assess real costs of these services in the field and describe resource use patterns and differentials across clinical dentistry branches, ICD-10

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diagnostic groups as well as across particular dental services. We have selected the emerging market of Serbia on grounds of being largest Western Balkans market presenting wider regional setting [8]. Its health care sector shares common legacy with most of the region and faces similar challenges in terms of health care provision and financing [16]. Therefore costs and resource use patterns of dental care in Serbia will likely be similar to the ones in neighbour markets as well [17]. According to authors best knowledge so far there have been very few economic analysis on dental care from the South-Eastern European region published in major languages. Authors believe that reliable knowledge on market demand for dentist services and its budget impact across clinical disciplines, might substantially improve informed decision making on resource allocation.

METHODS

In a prospective case series design, costs analysis has been conducted through the bottom-up approach, adopting the patient perspective and six months time horizon. Sample size was 752 complete episodes of treatment in 250 patients, selected in 2012 and 2013. The institutional framework where services were provided consisted of ten dental facilities in total: five specialist dental clinics belonging to two large traditional state-owned universities and five private-owned dental clinics. University associated facilities were: Childhood and Prevention Dentistry Clinic, Jaw Orthopaedics Clinic, Endodontics and Tooth Disease Clinic, Oral Surgery Clinic belonging to the Faculty of Dentistry Belgrade University, northern Serbia as well as Teaching Clinic of Dentistry Department at The Faculty of Medical Sciences, University of Kragujevac located in central Serbia. Selected private-owned dental clinics were two GP clinics and one specialised in prosthetics, located in the capital of Belgrade, and two GP clinics located in the southern Serbian city of Kraljevo. Services were provided by dentist GPs with licence to independent practice, as well as mature specialist dentists. Such choice of target facilities and dentists is justified by eliminating regional variations in routine clinical practice while encompassing three distinct geographic locations within the country [18]. Another aim of such facilities selection was to diminish otherwise relevant impact of ownership structure to clinical decision making [19]. Single episode of treatment included all repeated dentist visits as well as imaging and laboratory diagnostics consumed, related to the key dental condition being the main cause

of treatment [20]. These conditions were further stratified and observed through the ICD-10 diagnostic codes assigned to them [21]. There were no inclusion criteria limiting the age, sex or medical background heterogeneity of the patients. The only exclusion criteria were people suffering from acute dental conditions requiring emergency care or intensive unit admission within the hospital setting. The purpose of such approach was to provide highest possible diversity of patient sample distribution across clinical disciplines [22]. All data on resource use were acquired via structured questionnaire in Serbian language, filled in by the attending dentists. Survey heading inquired on basic demographics and clinical background, clinical facility in charge and attending dentist background. The rest of the formulary was actually precise and complete list of all dental materials, surgical and imaging diagnostics consumables, pharmaceuticals and implant materials used in routine clinical practice. These lists were occasionally adapted and expanded in specialty clinics due to variety of dental services offered. Each attending dentist together with nursing technician assign to him/her were asked to thoroughly fill in exact amounts of consumables spent and/or frequency of examinations, interventions provided to the particular patient. The same formulary was used for repeated visits by the same patient as long as these were related to treatment of initially diagnosed disorder.

Current official pricelists adopted by The Dentist Chamber of Serbia and clinical facility in charge of each particular episode of treatment, were applied to calculate the costs. Patient diagnosis data were extracted out of patient files and handled anonymously. Data were collected alongside ordinary care without any impact of study protocol to the patterns of routine clinical practice. Due to the fact that patients were not subject to any additional examinations or study – related interventions and were not even interviewed, according to GCP guidelines, study should not be required ethical committee's approval [23].

All direct costs of dental care were taken into account (dentist examinations, radiology imaging and surgical procedures, pharmaceuticals, dental materials and implant acquisition costs etc). Costs were expressed in Euro (€) according to the official exchange course of The National Bank of Serbia in respective years [24].

RESULTS

Sample size of the study was 752 treatment episodes. There were 250 patients proces-

sed in 10 clinical facilities. Mean total direct costs of dental care were € 46 ± 156 per single dentist visit while total costs incurred by this population sample was € 34,424 (Table I). Mean total cost per patient was € 138.

Unit frequency of dentist visits across clinical disciplines were: 240 in Conservative

dentistry treatment episodes (31.9%), 147 in Oral surgery (19.5%), 131 in Radiology/Diagnostic Imaging (17.4%), 82 in Parodontology and Oral Medicine (10.9%), 72 in Endodontics (9.6%), 47 in Pediatric and preventive dentistry (6.3%), 19 in Prosthodontics (2.5%), 11 in Orthodontics (1.5%), and 3 in Implantology (0.4%) (Table I).

Clinical Dentistry Branch/Discipline	Number (%)	€/pts (M ± SD)	95% CI for mean	Total cost (€)
Conservative dentistry	240 (31.9)	20 ± 10	19-21	4,811
Oral surgery	147 (19.5)	24 ± 38	18-30	3,529
Radiology/Diagnostic Imaging	131 (17.4)	7 ± 6	6-8	908
Parodontology and oral medicine	82 (10.9)	28 ± 35	20-36	2,302
Endodontics	72 (9.6)	17 ± 18	14-20	1,228
Pediatric and preventive dentistry	47 (6.3)	18 ± 10	15-21	851
Prosthodontics	19 (2.5)	555 ± 244	437-673	10,549
Orthodontics	11 (1.5)	706 ± 667	258-1,154	7,761
Implantology	3 (0.4)	828 ± 392	-147-1,802	2,484
Total	752 (100)	46 ± 156	35-57	34,424

Table I. Cost matrix – distribution across clinical dentistry branches/disciplines

ICD-10 Diagnosis groups	Number (%)	€/pts (M ± SD)	95% CI	Total cost (€)
K05.0 Acute gingivitis	48 (6.4)	19 ± 7	17-21	910
K05.3 Chronic periodontitis	57 (7.6)	25 ± 41	14-36	1,424
K02 Dental caries	254 (33.8)	18 ± 7	17-19	4,521
K01.1 Impacted teeth	64 (8.5)	25 ± 21	20-30	1,595
Z01.2 Dental examination	4 (0.5)	9 ± 0	9-9	36
K04.4 Acute apical periodontitis of pulpal origin	10 (1.3)	20 ± 22	4-36	201
K04.0 Pulpitis	84 (11.2)	14 ± 9	12-16	1,159
K04.5 Chronic apical periodontitis	25 (3.3)	31 ± 37	16-47	783
K04.1 Necrosis of pulp	19 (2.5)	19 ± 44	-2-41	369
K08.1 Loss of teeth due to accident, extraction or local periodontal disease	31 (4.1)	336 ± 339	212-460	10,415
K03.1 Abrasion of teeth	1 (0.1)	23 ± 0	0-0	23
S02.5 Fracture of tooth	21 (2.8)	18 ± 15	11-25	374
K04.7 Periapical abscess without sinus	4 (0.5)	10 ± 5	2-17	39
K08.3 Retained dental root	55 (7.3)	12 ± 15	8-16	660
K03.6 Deposits (accretions) on teeth	4 (0.5)	16 ± 5	9-23	64
Z29.9 Prophylactic measure, unspecified (Fluoride application)	22 (2.9)	17 ± 10	13-22	380
K05.2 Acute periodontitis	18 (2.4)	11 ± 7	8-15	202
K03.7 Posteruptive colour changes of dental hard tissues	6 (0.8)	61 ± 37	22-99	365
K10.3 Alveolitis of jaws	3 (0.4)	7 ± 4	-3-17	21
Q38.1 Ankyloglossia (short frenulum)	1 (0.1)	52 ± 0	0-0	52
K07.3 Anomalies of tooth position	12 (1.6)	648 ± 667	224-1,071	7,771
K04.6 Periapical abscess with sinus (Sinus proccidens/tooth in sinus)	2 (0.3)	203 ± 275	-2,266-2,673	407
K03.1 Abrasion of teeth	5 (0.7)	327 ± 440	-218-873	1,637
K00.2 Abnormalities of size and form of teeth	2 (0.3)	508 ± 705	-5,827-6,842	1,015
Total episodes of dental care	752 (100)	46 ± 156	35-57	34,424

Table II. Costs distribution across episodes of care – most frequent ICD-10 diagnostic entities in clinical practice

Nevertheless highest cost per patient belongs to other disciplines of clinical dentistry such as Implantology € 828 ± 392, Jaw Orthopedics € 706 ± 667, and Protetics € 555 ± 244 (Table I).

Most frequently treated ICD-10 diagnostic groups in these patients were tooth decay (33.8% unit services provided), pulpitis (11.2%) and impacted teeth (8.5%) (Table

II). Most expensive to treat were some other diagnostic groups such as anomalies of tooth position (€ 648 ± 667), abnormalities of size and form of teeth (€ 508 ± 705), and loss of teeth due to accident, extraction or local periodontal disease (€ 336 ± 339) (Table II).

Top most costly treatment methods applied to patients were: fixed braces upper and lower jaw (€ 1,286 ± 18), surgical implant installa-

Dentist Medical Service	Number (%)	€/pts (M ± SD)	95% CI	Total cost (€)
Ultrasonic descaling and removal of soft deposits	64 (8.5)	19 ± 7	17-21	1,217
Removal of soft deposits	2 (0.3)	14 ± 6	-44-72	27
Treatment of periodontal pockets	12 (1.6)	49 ± 47	19-79	590
Composite in posterior teeth	176 (23.4)	20 ± 6	19-21	3,481
Surgical extraction of impacted wisdom teeth	38 (5.1)	30 ± 16	25-35	1,141
OPT footage	67 (8.9)	10 ± 6	8-11	658
RTG footage	73 (9.7)	4 ± 2	4-5	328
Therapy of deep cavities without fillings	10 (1.3)	10 ± 1	9-11	98
Composite in anterior teeth	42 (5.6)	17 ± 4	16-19	729
Endodontic therapy infected pulp	8 (1.1)	28 ± 21	10-46	224
Endodontic therapy uninfected pulp	33 (4.4)	21 ± 11	17-24	682
Local application of the drug - Toxavit®	22 (2.9)	11 ± 4	10-13	251
Application of medicament between sessions	8 (1.1)	9 ± 1	9-10	75
Abscess drainage and irrigation	5 (0.7)	7 ± 4	2-12	34
Surgical implant installation	3 (0.4)	828 ± 392	-147-1,802	2,484
Extraction of milk teeth	3 (0.4)	9 ± 0	9-9	27
Extraction of permanent teeth	58 (7.7)	13 ± 6	11-14	743
Glass ionomer restorative	9 (1.2)	20 ± 6	16-25	182
Trial test vitality	1 (0.1)	5 ± 0	0-0	5
Upgrade fractured tooth-composite	3 (0.4)	36 ± 16	-3-76	109
Sealing of dental fissures	20 (2.7)	17 ± 11	12-22	344
Extraction of residual root	39 (5.2)	14 ± 17	9-20	549
Fluoridation of teeth (local application of fluoride)	2 (0.3)	18 ± 0	18-18	36
Resection of the root canal obturation with orthograde	10 (1.3)	64 ± 40	35-92	637
Surgical removal of tooth	2 (0.3)	56 ± 39	-293-406	113
Outpatient teeth whitening	3 (0.4)	94 ± 5	81-107	283
Surgical release of impacted canine teeth	2 (0.3)	87 ± 5	40-135	175
Curettage of inflamed tooth cup after tooth extraction	2 (0.3)	9 ± 0	9-9	18
Upgrading the treated endodontic tooth using dental poles	3 (0.4)	33 ± 12	3-62	98
Veneers	4 (0.5)	27 ± 0	27-27	109
Flap surgery	1 (0.1)	262 ± 0	0-0	262
Frenectomy	1 (0.1)	52 ± 0	0-0	52
Fixed braces upper and lower jaw	6 (0.8)	1286 ± 18	1,267-1,305	7,716
Sinus lift and artificial bone	1 (0.1)	398 ± 0	0-0	398
Metal-ceramic crowns cast + upgrade	2 (0.3)	533 ± 470	-3,693-4,759	1,066
Metal-ceramic crowns	5 (0.7)	753 ± 250	443-1,063	3,764
Upper and lower denture	6 (0.8)	441 ± 5	436-446	2,645
Two partial acrylic dentures	1 (0.1)	447 ± 0	0-0	447
Two partial skeleton dentures	3 (0.4)	730 ± 0	730-730	2,189
Upper and lower total denture	1 (0.1)	219 ± 0	0-0	219
Upper and lower partial acrylic dentures	1 (0.1)	219 ± 0	0-0	219
Total	752 (100)	46 ± 156	35-57	34,424

Table III. Costs distribution across most frequent dentist services in clinical practice

tion (€ 828 ± 392), metal-ceramic crowns (€ 753 ± 250), two partial skeleton dentures (€ 730 ± 0), metal-ceramic crowns cast + upgrade (€ 533 ± 470), two partial acrylic dentures (€ 447 ± 0), upper and lower denture (€ 441 ± 5), sinus lift and artificial bone (€ 398 ± 0), flap surgery (€ 262 ± 0), upper and lower total denture (€ 219 ± 0), and upper and lower partial acrylic dentures (€ 219 ± 0) (Table III).

An in depth cost data related to ICD-10 diagnostic codes of conditions treated as well as across particular dental services offered, are presented in the Tables I-III.

DISCUSSION

According to official release by the Republic Health Insurance Fund in Serbia, public expenditure on dental services has been decreasing mostly steadily from € 51,131,383 in 2007 to € 41,505,573 in 2012 (latest accessible release) [25]. As opposed to this trend, during the same period of time overall public expenditure on health has slightly increased from € 1,813,552,586 in 2007 to € 1,847,971,776 in 2012 but essentially reaching plateau level [26]. Decrease of public expenditure on dentistry services that happened across six years time span was almost 19%. We should be aware that this change happened during period when total healthcare spending in the country remained stable or exhibited slow growth pattern [8,16]. Opposed trend of public spending on health care services is certainly not following oral diseases incidences which are not optimistic particularly with regards to huge prevalence pool of common tooth decay, paradontosis, and associated conditions [27]. Market demand for these services is likely to remain strong in this area in the long term as well [28]. The essential issue that arises is difficulty of access to dentist's services because of rather limited affordability to the common citizens because of reliance to out-of-pocket financing [29-31]. This will particularly be the case with more demanding conditions to treat requesting surgical approach or implanting permanent artificial teeth supporting structures [32]. Expected consequence of neglected oral health is likely tooth loss [33]. Clinical risk of spreading of late recognized and mistreated infection to the neighbouring soft tissues presents the issue of its own [34]. Furthermore, much anticipated consequence of authorities' lack of attention to this field of clinical medicine, is the so called boomerang effect. Low-income society members who were initially denied preventive and primary care services will ultimately end up

as an inpatients suffering from severe dental conditions originating from these simple initial diagnosis [35-37]. As was the case with our patient sample, most frequent clinical conditions were tooth decay, pulpitis and impacted teeth in decreasing order of appearance. At that stage, they will likely consume substantial value of laboratory and imaging diagnostics and need oral surgery and anesthesiology specialist services as well as more nursing care [38]. This was exactly the case with the most expensive treatment episodes noticed in this study such as implantology, jaw orthopedics and protetics cases. In line with this highest unit utilization of services in our sample belonged to disciplines of conservative dentistry, oral surgery and radiology. These ultimately hospital services for the inpatients, according to the local legislative and funding framework will have to be reimbursed. Some of the most expensive conditions to treat we observed were anomalies of tooth position, abnormalities of size and form of teeth and loss of teeth due to accident, extraction or local periodontal disease. Significant opportunity costs such as patient's lost productivity, absenteeism and decreased quality of life are obvious consequences of such funding policy [39-40].

Limitations

Variety of dental general and specialty care facilities were selected in order to have a balanced representation of public and private dental sector in Serbia. Nevertheless sample size remains rather small. This was the case because dentists' compliance in academic non-sponsored research in the region is rather low as well as due to budget constraints of the study. Nevertheless study does not attempt to generalize its findings to the national level but to point out deep differences in budget impact of certain clinical disciplines. Patient selection leans towards more clinical (treatment) group rather than visiting patterns of the general population. Therefore we may assume that our results are thus rather more indicative of costs of dental care for patients suffering from more severe disorders. Future research on dental health economics should target broader patient population in Western Balkans region while providing far more ambitious insight into clinical course of illness related to resource use and costs of care.

CONCLUSIONS

Dental care bears particular financial burden for Western Balkan transitional economies due to its lack of insurance coverage in most countries of the region and almost complete

out-of-pocket payments by citizens. Extraordinary high demand for services, compared to most clinical medicine branches, frequent acute conditions and adverse events contribute to this burden. Although range of these costs currently falls behind EU average, Serbia's emerging economy is likely to expand in the long run while market demand for dentist services will grow. Additional obstacle to provision of accessible dental care is current trend in public expenditure on dentistry decreasing one-fifth in 2007-2012 time span.

This fact bears particular weight because total public expenditure on health remained rather stable during this time. Rather serious societal investment into preventive dentistry would highly likely yield long term fruits for the community both in terms of oral health and cost savings [41-43]. Due to threatened financial sustainability of current health insurance patterns in Western Balkans, knowledge on true size and fine structure of dental care costs could essentially support evidence based resource allocation in future.

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