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The cost-effectiveness of smoking cessation services provided by General Dental Practice, General Medical Practice, pharmacy and NHS Stop Smoking Services in the North of England

Cost-effectiveness, smoking cessation services, provider, NHS

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Abstract

Objectives: To compare the cost-effectiveness of smoking cessation services in General Dental Practice (dental), General Medical Practice (GMP), pharmacy and NHS Stop Smoking Services (NHS SSS) from the perspective of the provider and the perspective of the NHS. *Methods:* Retrospective monitoring data from NHS Bradford were accessed for any client attending a smoking cessation advisor within one of four commissioned smoking cessation services delivered by and within dental, GMP, pharmacy and NHS SSS (July 2011 - December 2011). The treatment outcome of interest was 'quits' (effectiveness) and costs were assessed using incremental cost-effectiveness ratios (ICER) which compared each service setting against usual care (NHS SSS). All data were analysed using SPSS 19. *Results:* For verified quits, only pharmacy services showed a lower mean cost per client and a higher proportion of CO verified quits than the other services. For both verified and self-reported quits dental services showed a slightly higher proportion of quits than NHS SSS, however the mean cost per client was higher (£278.38 for an increase in quits of 1%). The GMP services were dominated by the NHS SSS, in as much as they were both less effective (a smaller proportion of quits and more expensive). This finding also holds true when we compared GMP services and pharmacy services. *Conclusions:* From the perspective of the service provider and the NHS, the service considered to be 'cost-effective' when compared to 'usual care' (NHS SSS) were pharmacy services. This research has identified variations in service costs and effectiveness of services through the analysis of a pragmatic dataset. Given the exploratory nature of this research further research should explore the impact of service/location selection on uptake and cessation rates.

Introduction

The annual costs for smoking related diseases are rising and have more than doubled in the last 20 years from £1.5 billion in 1991 in England[1] to an estimated cost to the NHS of approximately £2.7-5.2 billion in 2010, equivalent to 5.5% of the total NHS budget[2]. Reducing uptake of smoking and tobacco use and the cessation

of those who currently use tobacco has been clearly identified as a priority worldwide[3].

The most influential series of Public Health legislative changes addressing smoking in Great Britain was initiated through the White Paper, 'Smoking Kills' (1998)[4]. It outlined how policy and financial investment could reduce smoking in the general population and was one of the first comprehensive documents released by the Government to address smoking prevalence. Amongst its many tobacco control strategies was the introduction of a specialist NHS Stop Smoking Services (NHS SSS). In Britain, smoking cessation services have primarily been provided by the NHS SSS specialists, although more recently these services are being commissioned across a number of other providers such as General Medical Practitioners (GMP), pharmacies and, most recently, by staff from General Dental Practices (dental). The mix of services and models of delivery have been suggested to provide clients with easier to access to smoking cessation services[5] and are guided by the annually updated National Framework[6]. It is generally considered that smoking cessation interventions are a cost effective way to save and prolong life[4, 7-12], research into the cost-effectiveness of provision across different settings is needed to explore the value of expanding provision outside of the dedicated NHS SSS.

The aim of this study is to compare the cost-effectiveness of smoking cessation services across dental, GMP, pharmacy and NHS SSS from the perspective of the NHS.

Material and Methods

The study used retrospective data collected from smoking cessation services across Bradford Metropolitan Borough in the North of England. Bradford is a multi-culturally diverse population whose economic landscape was severely compromised during the recession in the late 20th Century; there remains areas of poor health status and this is evident when comparing morbidity and mortality in this location to England as a whole[13].

The smoking cessation services across the region consist of NHS SSS and cessation services delivered within dental, GMP and pharmacy settings by dedicated and trained smoking cessation advisors, within each setting the services could be delivered by either GMPs, nurses, healthcare assistants, pharmacists and pharmacy advisors, dental nurses or receptionists. Each commissioned service receives smoking cessation training in compliance with standards laid out in the National Framework to enable them to deliver advice and support to their clients[5]. The intervention consists of individual behavioural counselling, typically supporting the client over a 12-week period (pre- and post-quit) together with the offer of pharmacotherapy. Services are remunerated for their work using a Payment by Results (PbR) scheme or by a block contract (BC)[14]. The commissioned service must submit all records relating to client contacts using monitoring forms[5] which capture socio-demographic and treatment outcome information (quit: CO verified (carbon monoxide) and self-reported, lost to follow-up, not quit). CO verification involves the client breathing into a device and their exhaled CO level is recorded, it is widely used as a method of 'quit' status validation[5].

Each service is expected to achieve between 35%-70% quitters per quarter. If the quit rates fall outside of these boundaries the commissioner of the service must investigate the reasons behind the variation. At the upper boundary quit rates of >70% are exceptional and maybe due to clerical error; where rates are lower than 35% further support is given to advisors through additional training[5].

The smoking cessation service monitoring data were accessed retrospectively for this study. Data for all clients attending NHS smoking cessation services in NHS Bradford within any of the four service settings between July-December 2011 were included.

Given the differences in contracting arrangements between providers we present two analyses. The first analysis describes the time spent by advisors in each of the services and the associated cost to the providers of the advisors' time. The second analysis presents the costs to the NHS of the smoking cessation provision. For dental and pharmacy services this represents the payment made to them by the NHS based on PbR plus pharmacotherapy costs. Costs were calculated using the following contractual and financial arrangements: £40 reimbursement per person who was recorded as a CO verified quit, £30 per person quit who was recorded as without CO verification or self-reported quit and £15 per person who was recorded as 'lost to follow up'. GMPs were commissioned using a 'block contract' (BC) which equated to £18 per contracted hour and assumed 30 clients would be seen per annum for each contracted hour. A quit rate of between 35%-70% should be achieved; anticipated quit rate between 11-21 clients for each contracted hour per

annum. For the NHS SSS the costs represented the advisors' time and the pharmacotherapy.

Using the latter scenario above, a cost-effectiveness analysis was undertaken from the perspective of the NHS. The analysis used incremental cost-effectiveness ratios (ICERs). ICERs are the ratio of the change in costs relative to the change in benefits and are calculated using the following formula: $(C_1 - C_2) / (E_1 - E_2)$. Within the equation, C_1 and C_2 represent the mean cost by setting for usual care (NHS Stop Smoking Services) against the alternative (dental, GMP or pharmacy). E_1 and E_2 represent the proportion of quitters per setting (effectiveness) for usual care (NHS Stop Smoking Services) versus the alternative (dental, GMP or pharmacy).

The data recorded by the advisor outlined each contact with client together with pharmacotherapy prescribed; this was used to calculate the total cost of the advisors time for each client. The contact time for each appointment was based on contractual agreements with the commissioner. From the perspective of the NHS, costs, including pharmacotherapy, were obtained from national sources and a price year of 2011 used, no discounting was necessary given the duration was less than 12 months[15]. Details are given in Tables 1 and 2.

Missing pharmacotherapy data was identified for clients attending the GMP service. The reason for these missing data was due to the GMP system not requiring the types of pharmacotherapy to be recorded (this was optional). The GMP system only required a response of whether the client had received pharmacotherapy; yes or no. The missing data was found in 23% (N=319) of client record entries, a mean

pharmacotherapy cost was therefore calculated using the number of appointments attended by GMP clients and an average cost of pharmacotherapy (from GMP clients only), this mean cost for pharmacotherapy was applied to GMP clients with missing data.

In addition, the GMP dataset quit status did not differentiate between CO verified or self-report. A 'quit' status was applied to all clients who had quit and this accounted for 242 (17.5%) of the client database for GMPs (due to how the database was set up), therefore GMP services were excluded from scenario 1 and used within scenario 2 data where the data analysed assumed they were (1) CO verified; and (2) self-report combined ('quit') to enable a comparison across the settings using this generic 'quit' measure.

Sensitivity analyses were carried out to account for uncertainty in cost estimates by changing the cost pharmacotherapy by 20%. The value of 20% is essentially arbitrary given there was no historical data to draw on. However, it was considered likely to represent any uncertainty that might exist.

All data were analysed using SPSS 19. Ethical approval was obtained for this study from The National Research Ethics Service in the UK (REC reference: 05/Q1202/104).

Results

Smoking cessation service data identified 2,534 records of persons who attended smoking cessation services between July 2011 - December 2011 in Bradford, UK. Of

our sample, 1,182 (47%) were male, age ranged from 16-87 (mean 41.18 years). The client group were also categorised according to their 'deprivation status' which was generated from their postcode information using the Index of Multiple Deprivation (IMD). The minimum IMD score was 2.87 ('least deprived') and a maximum score of 81.07 ('most deprived') with a mean score of 38.03, these scores were clustered into quintiles ('least deprived' N=501, 'less deprived' N=505, 'average' N=510, 'more deprived' N=507 and 'most deprived' N=511). Clients from the most deprived IMD quintile (13%) attended dental settings the least, followed by pharmacy (12%), NHS SSS (15%) and the greatest proportion of clients from the most deprived quintile attended GMP services (26%). Clients categorised as 'least deprived' were more likely to attend dental and pharmacy services. The data showed that 55% of the sample attended GMP services (N=41 venues, N=95 advisors), 31% attended NHS SSS (N=46 venues, N=9 advisors), 11% attended pharmacy services (N=14 service venues, N=22 advisors) and 3% attended general dental practices (N=3 venues, N=3 advisors). The analysis undertaken made the assumption that all clients received a one-to-one service.

Cost to the provider

The costs of the advisor time for provision of smoking cessation advice across all settings are shown in Table 3. The highest mean cost for advisor time was within NHS SSS (£51.93), the lowest in pharmacy (£28.90). However, the range of costs were wide, indicative of the wide range of number of sessions attended. As might be expected there was a statistically significant correlation observed between the mean number of sessions and cost (ANOVA, p=0.01). For all the providers with the exception of NHS SSS, there is also a contractual payment for provision of the

service. This is shown in Table 4. The payment exceeded the cost of the advisors time for dental providers and GMP providers.

Costs to the NHS

The cost to the NHS (Table 4) was made up of the cost of the contractual payment (paid to the service providers) and cost of pharmacotherapy for all services with the exception of NHS SSS. For NHS SSS, a service provided by the NHS, the cost included pharmacotherapy plus the advisors time. From the table we can see that pharmacy services had the lowest cost per client (£100.20). However, cost per quit was lowest for NHS SSS (£248.30).

Incremental Cost-Effectiveness Ratio by setting

We used the cost to the NHS to calculate the ICERs using two scenarios; firstly only verified quits; and secondly verified and non-verified quits. The calculations compared each of the providers with the NHS SSS.

For verified quits (scenario 1), pharmacy services showed a lower mean cost per client and a higher proportion of CO verified quits than the other services. No figures were available for CO verified quits for GMP services and so they were excluded from this analysis.

For both verified and self-reported quits, whilst dental services show a slightly higher proportion of quits than NHS SSS, the mean cost per client was higher. The GMP services were dominated – by the NHS SSS, in as much as they are both less

effective (a smaller proportion of quits and more expensive). This finding also holds true when we compared GMP services and pharmacy services.

Sensitivity analysis

There were 319 clients within the GMP setting with missing pharmacotherapy data (these data were not entered into client records but clients were noted as receiving pharmacotherapy). A sensitivity analysis was undertaken and the pharmacotherapy increased and decreased by 20%, this did not alter the results – the ICER remains dominated. Similarly a second sensitivity analysis in which all the pharmacotherapy costs were inflated and deflated by 20% did not alter interpretation of the results.

Discussion

There is an increasing requirement for cost-effectiveness analyses to support the development of services to ensure public monies are used appropriately[15]. The utility of smoking cessation services has been established through cost-effectiveness analyses where smokers who accessed NHS SSS in conjunction with pharmacotherapy were up to four times more likely to quit smoking (when compared to those who quit without professional support)[16, 17]. Smoking cessation interventions have also been assessed to be a cost effective way to save and prolong life[4, 7-12]. However, research in understanding which service setting provide the most effective support to smokers to quit is in its infancy. Previous comparative cost-effectiveness analyses have used data from only two service settings (pharmacy: one-to-one interventions and NHS SSS: group interventions)[18, 19]. The findings from both comparative studies[19] showed that pharmacy services were less expensive and provided a cost effective intervention when compared to usual care

(NHS SSS). Boyd *et al* (2009)[19] calculated costs of £53.31 per four-week quitter in a pharmacy setting versus £338.54 (NHS SSS) and Bauld *et al* (2011) £79 per 52-week quitter (pharmacy) and £368 (NHS SSS)[18]. These studies are not directly comparable to the present research principally because they were conducted at different times and they compared group versus one-to-one interventions. However, they do demonstrate that cost effective smoking cessation interventions can be delivered by professionals in other healthcare settings rather than NHS SSS only. The present comparative cost analysis identified costs to the provider and to the NHS for four service settings: dental, GMP, pharmacy and NHS SSS, this is the first time such an analysis has been undertaken.

For any publicly funded smoking cessation service inherent in its remit should be the reduction of health inequalities. Offering smoking cessation on a universal basis is unlikely to achieve this as suggested by the 'inverse care law'[20]. Within the traditional delivery model in England 'demand' dictates delivery and placement of services rather than 'need', therefore those with the greatest health inequalities will access services in lower proportions to those who need it the least. Despite dental and pharmacy smoking cessation services which were sited in areas of high need and social deprivation, our analysis indicated that clients categorised as 'least deprived' were more likely to attend these providers for smoking cessation support. Although all smoking cessation services were open to all, it is likely that only those accessing dental services for treatment would be aware of the smoking cessation service, this however is unlikely to apply to pharmacy services as they require no registration. Todd *et al* (2014) whose research suggested that a 'positive pharmacy care law' may be operation found pharmacy services to be accessible especially for

households in the most deprived areas of England[21]. Further research is necessary to investigate why there is a low uptake of more deprived clients in these services as highlighted by Todd *et al* (2014); although pharmacy services can be considered as available and easily accessible, this does not necessarily translate into service uptake.

The strength of this research lies in the pragmatic utilisation of an existing dataset that contains a wealth of information; this research demonstrates that further analysis of existing data could support service development. It should be acknowledged however, a possible drawback of using retrospective data. These include using a dataset for purposes other than why they were originally and the ability to reduce sample selection bias through randomisation is not available. Any deficits within the dataset could impair the internal and external validity of the research findings especially when considering the risk of correlating unobserved variables to outcomes[22]. Geneletti *et al* (2009)[23] suggests that 'self-selection' within retrospective analyses could also pose an issue as participants are volunteers and therefore may not reflect wider society. One possible impact of this could be the over or underestimation of ICERs, to mitigate this sensitivity analyses were undertaken[15, 24] to restore confidence in the robustness of the results gained from this retrospective dataset. One-way sensitivity analyses were undertaken to address uncertainty by inflating and deflating selected component values to demonstrate their impact within the model (the time the advisor spends with the client to deliver the counselling session and the cost of pharmacotherapy in a GMP setting were subjected to such an analysis). These additional analyses showed that the cost-effectiveness outcome did not alter.

Within this study the number of clients using smoking cessation services provided within dental and pharmacy settings forms only a small proportion of the total population using smoking cessation services in Bradford. Whilst this reflects the provision of these services by providers in Bradford, and in England more widely, caution should be exercised given the small numbers accessing these services compared to more traditional settings. The ratios of provision is in line with NICE guidance where the focus of smoking cessation services being commissioned within GMP services predominates[14]. The study is also limited in that data was collected in a single geographic location, Bradford. Bradford is typically classified within the 20 most deprived areas in England and has a more diverse ethnic population than the UK as a whole; thus the results may not be generalisable to other geographic areas. Across the country a standardised approach is taken to training ensuring consistency of training to ensure clinical and data management can be regulated as much as possible.

Use of retrospective data has a number of limitations. For example, no details were given in the dataset of the duration of appointments. The contact time for each appointment was based on contractual agreements with the commissioner. However, appointment times may vary between providers or individuals. Our analysis assumed that the contracted time was adhered to. It would be of interest if this was further explored in future prospective research.

The research gathered data from July–December 2011, seasonal variations in service uptake may be in effect here. Historically, service uptake by clients is lower in summer months with increased uptake of smoking cessation services and

pharmacotherapy sales during winter months (possibly due to New Year resolutions)[25]. However, there was a spike in client attendance at smoking cessation services in the summer of 2007, this has been linked to the change in legislation stemming from the Health Act (2006) which prohibited smoking in certain premises in England (this came into effect July 2007) and the introduction of Varenicline to the GMP dispensing formulary. Whilst there may be seasonal variations, it is not possible to predict whether those attending between January and June were a more motivated group and therefore more likely to quit.

There may be selection bias in operation as GMP services universally offer smoking cessation services whereas pharmacy and dental services were commissioned based on smoking prevalence, service capacity and location. This might have over inflated the quit rates in dental and pharmacy setting as they were placed in areas of deprivation and high need but conversely research shows that those who are more deprived also seek preventative services less frequently[20, 26]. It should also be noted that service choice of the clients was in operation, therefore a client could choose to access a service dependent on their needs. There is no available research which documents the patient journey and therefore it is not possible to isolate where clients had previously received smoking cessation advice. This research has assumed that services are mutually exclusive and therefore results are comparative, however it is essential to balance this view with possibility that multiple services may have supported one client to quit and therefore allocating a treatment outcome to one service alone may underplay the role that other services have had on that client's outcome.

As outlined earlier, each commissioned service received smoking cessation training in compliance with standards laid out in the National Framework to enable them to deliver advice and support to their clients[5]. However, whilst the training and protocol are standardised, there may be differences in the levels of skills of those delivering the service and in client perceptions to them; as well as the context within which the original smoking cessation advice was given. For example, is a GMP's advice perceived to have more weight than a pharmacist's especially if given in the context of a consultation regarding a medical problem? Considerations around the competence of the advisor may impact on the treatment outcome and to date there is no research evidence on the background of the advisor and the potential impact on treatment outcome. Questions such as, are nurses more effective in supporting clients to quit as they have medical training and work with patients on other health issues when compared to a pharmacy assistant or dental nurse? These are questions for future research but should acknowledge when interpreting the research within this present analysis. We should also acknowledge a possible cluster effect based on the effectiveness of advisors which could increase the standard errors. Whilst the use of retrospective data and the relatively small number of clients using smoking cessation services provided within dental and pharmacy setting does not allow us to address these questions, they should be considered in future research.

Within this research, from the perspective of the NHS, pharmacy services were considered cost-effective, dental services had high quit rates and high costs and GMP services lower quits and lower higher costs when compared to usual care (NHS SSS). For the service provider, payment from the NHS for providing the smoking cessation service exceeded the costs of the advisors time, with the

exception of the pharmacy services; which is interesting given the payment system is the same in both. However, the results should be approached with caution given the relatively small sample sizes (and for the reasons already outlined). It is of note that dental services had higher pharmacotherapy costs and this is due to the use more than one pharmacotherapy product being used in combination, for example, gum and patches. Stead *et al* (2008)[27] found combining nicotine patches with another form of NRT was more effective than a single type of NRT and this in part could explain the higher quit rates seen in dental settings. When considering the role of remuneration, more research is required to assess if payment by results produces greater numbers of quitters than block contracts on a wider scale. Consideration to the impact on effectiveness based on contractual arrangements such as PbR and block contract should be considered in future research.

A trade-off between costs and effects may be a useful consideration when commissioning services, however other benefits should be considered such as facilitating access to a service, for example for hard to reach groups, then higher costs may be acceptable. This research has identified variations in service costs and effectiveness of services through the analysis a pragmatic dataset. Given the exploratory nature of this research, further research should explore the impact of service/location selection on uptake and cessation rates.

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Table 1: Service costs for the provider

Advisor's role	Advisor cost/ hour (£)	Cost source*	1st appointment 30 mins (£)	2nd appointment 20 mins (£)	Subsequent appointments 10 mins (£)
Receptionist/ Dispensing assistant/Senior pharmacy assistant/ Healthcare assistant	20.00	[28], p145	10.00	6.66	3.33
Clinical support worker	24.00	[28], p145	12.00	8.00	4.00
GMP nurse/ Dental hygienist/ Pharmacy technician/NHS SSS advisor	33.00	[28], p146	16.50	11.00	5.50
GMP nurse/NHS SSS specialist	44.00	[28], p192	21.90	14.60	7.30
Pharmacist/Senior NHS SS specialist	48.00	[28], p138	24.00	16.00	8.00

*Unit costs were derived from: Curtis L. Unit Costs of Health and Social Care 2012. Kent: Personal Social Services Research Unit, 2012 [29].

Table 2: Pharmacotherapy costs

Nicotine replacement therapy (NRT)	Price (£)
Nicotine 1.5mg lozenges sugar free, 60 tablets	8.93
Nicotine 10mg inhalation cartridges, 6 cartridges	4.46
Nicotine 10mg inhalation cartridges with device, 42 cartridges	14.65
Nicotine 10mg/16hours transdermal patches, 7 patches	9.97
Nicotine 15mg/16hours transdermal patches, 7 patches	9.97
Nicotine 1mg/dose oromucosal spray sugar free, 13.2ml	11.48
Nicotine 21mg/24hours transdermal patches, 7 patches	9.97
Nicotine 25mg/16hours transdermal patches, 7 patches	9.97
Nicotine 2mg lozenges sugar free, 72 lozenges	9.97
Nicotine 2mg medicated chewing gum sugar free, 96 pieces	8.26
Nicotine 2mg sublingual tablets sugar free, 100 tablets	13.12
Nicotine 4mg lozenges sugar free, 72 lozenges	9.97
Nicotine 4mg medicated chewing gum sugar free, 96 pieces	10.26
Nicotine 500micrograms/dose nasal spray, 10ml	13.40
Nicotine 5mg/16hours transdermal patches, 7 patches	9.97
Nicotine bitartrate 1mg lozenges sugar free, 96 lozenges	9.12
Bupropion 150mg modified-release tablets, 60 tablets	41.76
Varenicline 1mg tablets, 28 tablets	27.30
Varenicline 500microgram tablets, 56 tablets	54.60

Source: NHS Electronic Drug Tariff [30]

Table 3: Cost to providers of advisors time

	Appointments mean (range)	Cost	Clients	Total costs (£)	Mean costs (£)	SE (£)	Range (£)
Dental	3.30 (7)	Advisor time	69	2,362.25	34.24	2.36	10.00-77.00
GMP	2.88 (12)	Advisor time	1383	46,727.55	33.79	0.30	10.00-91.25
Pharmacy	3.13 (10)	Advisor time	286	8,264.75	28.90	1.07	10.00-124.00
NHS SSS	3.89 (21)	Advisor time	796	41,333.45	51.93	0.90	21.90-136.00

Table 4 Costs to the provider and to the NHS

			Costs to the provider (£)		Costs to the NHS (£)			
	Clients	**Quits**	**Itemisation**	**Advisor time – payment (£)**	**Itemisation**	**Payment + pharmacotherapy(£)**	**Cost per client (£)**	**Cost per quit (£)**
Dental	69	31	Payment (PbR)	2,480.00	Payment (PbR)	2,480.00		
			Advisor time	2,362.25	Pharmacotherapy	9,218.88		
			Total	**117.75**	Total	**11,698.88**	**169.54**	**377.38**
GMP	1383	277	Payment (BC)	89,388.00	Payment (BC)	89,388.00		
			Advisor time	46,727.55	Pharmacotherapy	82,250.82		
			Total	**42,660.45**	Total	**171,638.82**	**124.11**	**619.63**
Pharmacy	286	108	Payment (PbR)	7,730.00	Payment (PbR)	7,730.00		
			Advisor time	8,264.75	Pharmacotherapy	20,931.10		
			Total	**-534.75**	Total	**28,661.10**	**100.21**	**265.38**
NHS SSS	796	356	Payment	00.00	Advisor time	41,333.45		
			Advisor time	41,333.45	Pharmacotherapy	47,088.94		
			Total	**41,333.45**	Total	**88422.39**	**111.08**	**248.38**

Table 5 Incremental Costs Effectiveness Ratios (Perspective of the NHS)

Setting	Percentage of quits	Mean cost per person (£)	Mean Cost per quit (£)	ICER versus NHS SSS (cost/1% of quits)
Scenario 1: CO verified quit				
NHS SSS	31.66% (252/796)	111.08	350.88	n/a
Pharmacy	36.36% (104/286)	100.21	275.58	-2.31
Dental	33.33% (23/69)	169.54	508.65	35.00
GMP	No figures available			
Scenario 2: CO verified and self-reported quit combined ('generic' quit measure)				
NHS SSS	44.72% (356/796)	111.08	248.38	n/a
Pharmacy	37.76% (108/286)	100.21	265.38	6.96
GMP	20.03% (277/1383)	124.11	619.63	Dominated
Dental	44.93% (31/69)	169.54	377.38	278.38