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Impact of competition on profit and revenue of pharmacies in Norway

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ABSTRACT

Introduction: Since, 2001, due to the change in Pharmacy act, the accessibility to the pharmacy among public has considerably increased due to the increase in number of pharmacy owned by the chain wholesaler[1]. In terms of pharmaceutical brands, competition serves as a driving force that compel brands to make new, effective and enhanced medicines, while encouraging generic companies to provide more cost-effective alternatives[2]. In Norway, 5,200 inhabitants per pharmacy were getting services from the pharmacies irrespective of their brands in 2022.

Methodology: This thesis followed cross-sectional study design using the data related to revenue and profit of pharmacies from Statens Legemiddelverk (SLV). Whereas, total population residing in the respective municipalities from Norwegian Institute of Public Health. Analyses consist of descriptive statistics for baseline characteristics. One-way Anova was calculated for p-value. Similarly, main results were found using linear regression analysis.

Results: Competition of pharmacy was a significant predictor variable [B_{crude}= -0.395, 95% C.I= (-0.752) – (-0.038)] at 5% level, suggesting negative relationship with "profit percentage". After nullifying the confounders, the result showed that there still was significant relationship between profit percentage and competition of pharmacy [$B_{adjusted}$= -1.650, 95% C.I= (-2.611) – (-0.690)] at 5% level. Similarly, competition of pharmacy was a significant predictor variable [B_{crude}= 1,931, 95% C.I= 1.591 – 2.271] at 5% level, suggesting positive relationship with total revenue per capita. After adjusting other variable, the result showed that there still was significant relationship between total revenue of pharmacy and competition of pharmacy [$B_{adjusted}$= 2.027, 95% C.I= 1.690 – 2.364] at 5% level.

Conclusion: From this thesis it can be concluded that with the increase in competition among the pharmacies there will be less profit gained by the pharmacies. On the contrary, the positive association was observed between competition among the pharmacies and revenue per capita of pharmacies in Norway, which showed that with the increase in competition, revenue per capita will also increase.

ABBREVIATIONS

MPH	Master of Public Health
SDG	Sustainable Development Goals
OECD	Organization for Economic Co-operation and Development
LMIC	Low and Middle Income Countries
HMO	Health Maintenance Organization
SWOT	Strengths, Weaknesses, Opportunities and Threats
SLV	Statens Legemiddelverk (Norwegian Medicine Agency)
REK	Regional committees for medical and health research ethics
NSD	Norwegian Centre for Research Data
C.I.	Confidence Interval

1 INTRODUCTION

1.1 Impact of pharmaceutical company on revenue and individuals

In most cases, the presence of many competitors ensures the operation of an efficient market system where prices of products become less, and supply becomes higher till it reaches the economically efficient production point. However, this idea is challenged in case of health care system by experts, based on the well-established nature of health care market which is apparently full of market imperfections like imperfect consumer information[3]. As of 2015, almost 2 billion people globally do not have adequate access to essential medicines and supplies, and pharmaceutical industry has a significant role in reducing this inaccessibility[2]. Pharmacy systems have witnessed many changes in last twenty years and deregulation is one of the prominent changes over the period, that showed some prominent results, especially within European countries[4]. Deregulation, as the term suggests, implies to loosening of restrictions or deconstruction of regulations that were imposed on markets by government or other controlling agencies[5]. In pharmaceutical markets, deregulation is expected to result in growth in number of pharmacies, improved patient-centered services, and establishment of pharmacy chains which, in turn, could lead to the shutdown of some pharmacies, owned and operated by individuals[6].

In other words, deregulation can encourage competition in pharmaceutical markets[4], which could be beneficial for the public as it encourages companies to improve medicines or to offer cheaper alternatives[2]. Competition plays significant role as it acts as a driving force for companies to deliver services and goods of higher quality while maintaining lower price points. In terms of pharmaceutical brands, competition serves as a driving force that compel brands to make new, effective and enhanced medicines, while encouraging generic companies to provide more cost-effective alternatives[2].

Due to deregulation, pharmacies pressure to serve individuals (i.e. inhabitants per pharmacy) drastically decreased and the accessibility of pharmacy increased in most of the countries. In 2013, inhabitants per pharmacy dropped down to 7600 from 12,300 in Norway[4].

Most of the European nations, the pharmacy market is made up of independent, privately held pharmacies that are subject to strict government regulations regulating profit margins[7]. Among all expenditure, $7.5 trillion is done in the field of healthcare globally. Whereas, among all healthcare expenditures, 19% of expenditure is done in the field of medicines and supplies. As a result highest profitability (more than 20%) has been seen in this field in comparison to other health care expenditures[8]. Among all global expenditure and profitability in pharmaceutical globally, Europe obtains 23% of market share whereas Norway obtains almost 15% revenue among all European countries[8].

Pharmacies tries to serve its customer with varieties of products (such as prescription drugs, non-prescription drugs and merchandise products). The strategy related to provide the prescription only drugs varies from country to country. England, Austria, Ireland, Norway and Netherlands adopted to dispense the doctors to rural areas and provide incentives to establish the pharmacy[4]. While Norway had added up some extra features to promote the delivery of prescription drugs to rural areas and i.e. subsidy scheme for those pharmacies which made low turnover[4]. In Norway, in 2010, only 58% of the municipalities had pharmacies in them[4].

Serving an individual or customer is something that is linked with the revenue that is made by the pharmacies. In Year 2010, it was found that between 7% to 11% of total pharmacy turnover, over the counter drugs had its role while merchandise products had almost a share of a quarter in total pharmacy revenue[4]. By the end of 2021, an average of 5,262 people were found visiting each pharmacies in Norway. In Norway, people have high trust upon pharmacies and the delivery system. In 2022, almost 90% of drugs that had been dispensed were all on prescriptions. Apart from prescribed medicines by general physicians and doctors, non-prescribed medicines and other merchandise products provided more profit to pharmacies in Norway[9].

In United Kingdom, weighted share for profit of pharmacies at most 1 mile catchment area was found to have just 16.3% while within 0.25 mile was 46.9%[10]. Similarly, Norway also being one of the OECD countries, this thesis will help to identify the profitability shares among the competitor pharmacies within the same catchment area. Also, pharmacy and pharmacist are the highly accessible health care service that an individual/patients can trust[11].

1.2 Background

The Norwegian Pharmacy Act defines a pharmacy as a physically accessible place for drug sale to end-users where drug-related guidance is provided[9]. Pharmacies ensures safe deliveries of drugs to end users and contributes to supervise to correct drug use in the population. Pharmacies in Norway sells both prescribed that needs physician's prescription and over the counter drugs that doesn't need special prescription from the physicians. Majority of pharmacies except hospital pharmacies (owned by regional health authorities) are owned by private enterprises in Norway. 400-year history was changed in 2001 in Norway when the legislation related to owning pharmaceutical companies changed. In 2021, about 80% of all pharmacies had been owned by international pharmacy companies[12]. As of 2022, Norway has 1043 pharmacies countrywide and among them Apotek 1 is the leading pharmacy chain followed by Vitusapotek[13]. Pharmacy acts as a contact point to find the medicines and products that is produced at a global scale in the pharmaceutical industries. Sustainable Development Goals (SDGs) with more than 1200 partners and 250 collaborations from biopharmaceutical industries clearly emphasizes the global health progress in this 21st century[14]. In addition, 1.5% of gross domestic product is accounted by pharmaceutical spending in Organization for Economic Co-operation and Development (OECD) member countries[15].

Pharmacy plays an important role in an individual's life to be healthy. Pharmacy usually acts as first and last contact point between patient and health system[16]. Pharmacists often shows their responsibilities towards public welfare and health by providing advices on safe and rational use of medications.

Individual/ patient with undiagnosed chronic illness often visit the pharmacy for other complications until they are advised to visit health facilities. Therefore, until the best diagnosis is done, the pharmacy acts as placebo for the patients. Denmark has initiated a compliance service in pharmacies for the patients with chronic diseases that facilitates the patient with private consultation[16].

Since, 2001, due to the change in Pharmacy act, the accessibility to the pharmacy among public has considerably increased due to the increase in number of pharmacy owned by the chain wholesaler[1]. It is seen that pharmacy density per population is an important indicator to find out the geographical accessibility towards pharmacy[17].

1.3 Accessibility to the pharmacy

In recent times, patients-pharmacist interactions has changed from just dispensing medicines to patient/consumer centered medication management services including vaccination, chronic disease management and point-of-care testing[18]. Accessibility also defines the distance of pharmacy from a household where patient-pharmacist/physician interaction takes place.

A study done in England shows that within 20 min walking radius an individual can reach a general practitioner's premises. It also showed that people living in urban area has higher accessibility of pharmacy in comparison to the rural areas[19]. In America, almost 90% of public has accessibility to a pharmacy within 5 miles[11]. Whereas, there are 8.3% of counties where more than 50% of population doesn't have access within 10 miles radius[18]. In some parts of America, the accessibility of pharmacy hasn't been changed in terms of distance but the disparities of providing the services among minorities (especially in Black and Latino) has been seen[20]. If the comparison is done between develop and under low and middle income countries (LMIC), there is vast difference in number of personnel serving consumer/individual at pharmacy. For example, Germany had 6.57 staffs whereas, Congo and Zimbabwe had 0.29 and 0.93 respectively per 10,000 population.

If this comparison is done between some of the European countries, Finland had highest of 20 staffs, Sweden with 16 staffs followed by Norway and Denmark with 9 and 5 staffs respectively per 10,000 population in 2020[21].

In Norway, 5,200 inhabitants per pharmacy were getting services from the pharmacies irrespective of their brands in 2022. Among them 90% of pharmacies located in municipality level. Norwegian pharmacies seemed to be serving their consumers more carefully as a result of which trust for pharmacy in Norway is higher among individual[9].

1.4 Competition related to pharmaceutical market

In 1929, Harold Hotelling developed a model called Hotelling model of competition which is used to analyze the competition between firms that are similar but offer differentiated products within its catchment area. This model describes that products offered and proximity of different locations, taking price of product and transportation costs into account, always influence consumer's choices. Whereas, each firm tries to get customers from both perspective and keep themselves in equilibrium without providing much differentiation than others[22]. Increase in competition occurs with establishment of new firm, decreasing the transportation costs, expanding the service area and with the increase in consumer's preferences/demands and vice-versa.

The main aim of competition policy is to confirm the effective functioning of markets in order to benefit individuals of that area. However, towards the fulfillment of effective and affordable accessibility, anticompetitive practices within the pharmaceutical industry may not be better approach[2]. Competition within the health care industry benefits individual to achieve services within affordable costs, improved quality of services, and with different range of options and innovations[23]. Though there is limited access of services in terms of pharmaceutical goods, the total pharmaceutical bill in OECD countries reached to $980 billion in 2013 from $800 billion in 2011[2].

Generally, "HMO penetration" has been used as the measure of competition. This is because the data needed for calculation of HMO penetration is generally maintained and easily available at health service level. In addition, "Lerner Index" is one another way for the calculation of competition. Due to difficulty in the data related to marginal costs, this method is not so common. Also, "Network tightness index" is newer concept for competition calculation defined by Len Nichols[3].

One of the analysis done in U.S. pharmaceutical industries showed that competition and innovation has the relationship with the profitability of that firm but that competition should focus on previously unmet needs of consumers[24]. "Competitive advantage" is one area which attracts scholars and leaders working in this area. A SWOT analysis done on this area showed that firms that uses environmental opportunities and nullifies threats related to environment of that company along with avoiding firm's drawbacks has higher probability of obtaining competitive advantage compared to other industries[25].

A company always has monopoly within competition with others when it has some patents which provides huge profit to that company until patent expires. But, with the expiration of that patent, competition for the delivery to the consumers increases and price drops[26].

Norwegian competition authority (Konkurransetilsynet) is one of the agencies that regulates the competition among companies which is also undertaken by the pharmaceutical markets. According to the survey report, it says that most of the companies uses monitoring and pricing algorithms which imbalance the competition and results in over pricing that hampers the individuals[27]. Norwegian competition authority and Norwegian Directorate of Health (Helsedirektoratet) has controlled the competition in terms of prescription drugs but there is no legal regulation for non-pharmaceutical and merchandise products which provides pharmacy a higher profit[28]. Nature of competition has evolved in online market also since 2016 in Norway but the revenue generation through this platform is less compared to real visit[29].

1.5 Rationale of the study

Pharmacy and its competition is necessary to explore because it is linked with both health care delivery and business model. This is an area where there is high market demand and increasing rate of investments[30].

Exploring more in this area will help to identify whether competition impedes or promotes the availability of healthcare services and pharmaceutical drugs. In addition, researches in this area will also help to find out how consumer choice and their affordability will be affected by the pricing of services at pharmacy. Study in these aspect will also help to monitor how pharmacy density will impact on management of diseases or overall health outcomes. Apart from the consumer's point of view, it is also important to understand the trends and dynamics of market.

Consumers always want to pay less and access more. Therefore, study in this area will help to identify the accessibility and cost effective-pharmaceutical services from consumer's perspective.

1.6 Research question

This thesis aimed to find out the result for two closely related questions. Firstly, what is the association between profit percentage and competition among pharmacies in Norway? Secondly, what is the association between revenue per capita and competition among pharmacies in Norway?

2 METHODOLOGY

2.1 Study design

This thesis followed cross-sectional study design using the data related to revenue and profit of pharmacies from Statens Legemiddelverk (SLV). This thesis also obtained the total population residing in the respective municipalities from Norwegian Institute of Public Health.

2.2 Study population

For the execution of this thesis, a statistical database on revenue and profit that is yearly submitted to the Norwegian Institute of Public Health by Norwegian medicine agency was used from year 2021. Total number pharmacies was 992 whereas the municipalities that contained pharmacies were 356. Similarly, total population of Norway in year 2021 was 5.408 million.

The data was obtained from two different sources. Therefore, both data were matched keeping the municipality (Kommune) in common. This thesis used "number of staffs in pharmacy", "total revenue per pharmacy", "Profit", "Sales on prescription, non-prescription drugs" and "sales on merchandise products" for analysis from the data that was obtained from SLV. Whereas, number of population residing in respective municipalities were used from the data obtained from Norwegian Institute of Public Health. There were 356 municipalities in total out of which 218 municipalities were taken for the study. Rest of the municipalities were excluded because they either match exclusion criteria or did not match the inclusion criteria.

2.3 Variables

For this thesis, researcher identified profit percentage and revenue per capita as the main outcome variables. Profit percent was the proportion of total revenue made by the pharmacy by selling prescription drugs only. Profit percent was measured in percentage (%). Whereas, total revenue per capita was an average revenue of a pharmacy through the sales of prescription drugs, non-prescription drugs and merchandise products that is expected to be generated by an individual of that kommune. It was expressed per 1,000 Kroners. Similarly, the main predictor variable for this thesis was competition which was measured on the basis of Health Maintenance Organization (HMO) penetration. Instead of measuring it as percentage, competition of pharmacy was expressed in per 10,000 population. Both outcome variables and predictor variable were continuous variables.

To identify the real effect of predictor variable on outcome variables different confounder variables were identified by the researcher. Population density, revenue per staff, prescription per capita, non-prescription per capita, merchandise per capita and competition of unique brands were possible identified confounders. Population density is the average population of a kommune residing within each square kilometer radius of same kommune. It is expressed in per square kilometer. Revenue per staff is an average revenue of a pharmacy contributed by each employee in 2021. These both confounders were continuous variables. Prescription per capita is an average revenue of a pharmacy that is expected to be generated by the sales of prescription drugs in a kommune. Non- prescription per capita is an average revenue of a pharmacy that is expected to be generated by the sales of non-prescription drugs in a kommune. Similarly, Merchandise per capita is an average revenue of a pharmacy that is expected to be generated by the sales of merchandise products in a kommune. These three confounders were categorical variables. All confounders except population density was expressed as per 1,000 Kroners.

Other variables used in this thesis were revenue per capita, inhabitants per pharmacy, pharmacy density, quartiles of profit. Revenue per capita is an average revenue of a pharmacy through the sales of prescription drugs that is expected to be generated by an individual of that kommune. It was expressed per 1,000 Kroners. Inhabitants per pharmacy was an average population of a kommune that a pharmacy of that kommune is providing the services. Pharmacy density was an average number of pharmacy in a kommune within each square kilometer area of that kommune. Revenue per capita, inhabitants per pharmacy, pharmacy density were continuous variables for this thesis. Whereas, quartiles of profit is a categorical variable which was basically four quarters of profits that pharmacies made in year 2021 by selling prescription drugs. Where first, second, third and fourth quartiles were Less than or equal to -1,080,000; -1.080,001 to 190,000; 190,001 to 1,038,005 and More than or equal to 1,038,006 Kroners respectively.

Researcher have enlisted all the variables in appendix-I of this thesis to ensure the clarity for the readers.

2.4 Inclusion criteria

For this thesis, the pharmacies with the information on revenue and sale on prescription, non-prescription drugs along with sales on merchandise drugs were included. The municipalities with at least one pharmacy were included in this thesis.

2.5 Exclusion criteria

For this thesis, the pharmacies that only sold online and avoided physical sell were excluded. The pharmacies having no specific information on revenues and profit were excluded from this thesis. Sales of pharmaceutical products at other retail stores other than pharmacy were not included in this thesis.

In addition, some outliers that consisted strange data and had potential of over influencing the entire result were also excluded.

2.6 Ethical consideration

This thesis had undergone with the analysis of existing data and did not constitute any specific approval from the committee i.e. no ethical approval was required during availability of the data. Also, this thesis followed all the principles to maintain the ethics of scientific research.

This thesis had no data related to information of an individual. So, no 'informed consent' was needed and hence, it automatically maintained the 'respect for privacy'. Also, this thesis avoids the misinterpretation and hence, all the findings and results were presented accurately.

2.7 Study sample

In 2021, a total of 992 and 356 pharmacies and municipalities respectively were there in Norway. Among those, the pharmacies that did not had the information on the revenue generation and the municipalities that did not any pharmacy within its political boundary were kept excluded from the thesis. After the exclusion based on these two criteria, there were 221 municipalities and 918 pharmacies that constitutes the information on revenue.

Among the remaining 221 municipalities with the revenue information on pharmacies, three municipalities namely: Vestby, Kongsvinger and Flå were excluded because they were found to meet the exclusion criteria. The exclusion criteria are defined in section 2.5

Figure 1 summarized the information that is explained above. Hence, the final thesis sample which had the information on revenue and therefore got included in the thesis was 218 municipalities that consisted 915 pharmacies.

Total Pharmacies in Norway in year 2021 were 992

Total Municipalities in year 2021 were 356

Inclusion

Exclusion

Exclusion

Missing revenue information

Municipalities with revenue information of pharmacy

Municipalities without pharmacy

Municipalities and pharmacies having revenue information were 221 and 918

Three municipalities were excluded due to unusual data. Therefore, final analysable data with required information were 218 and 915 respectively
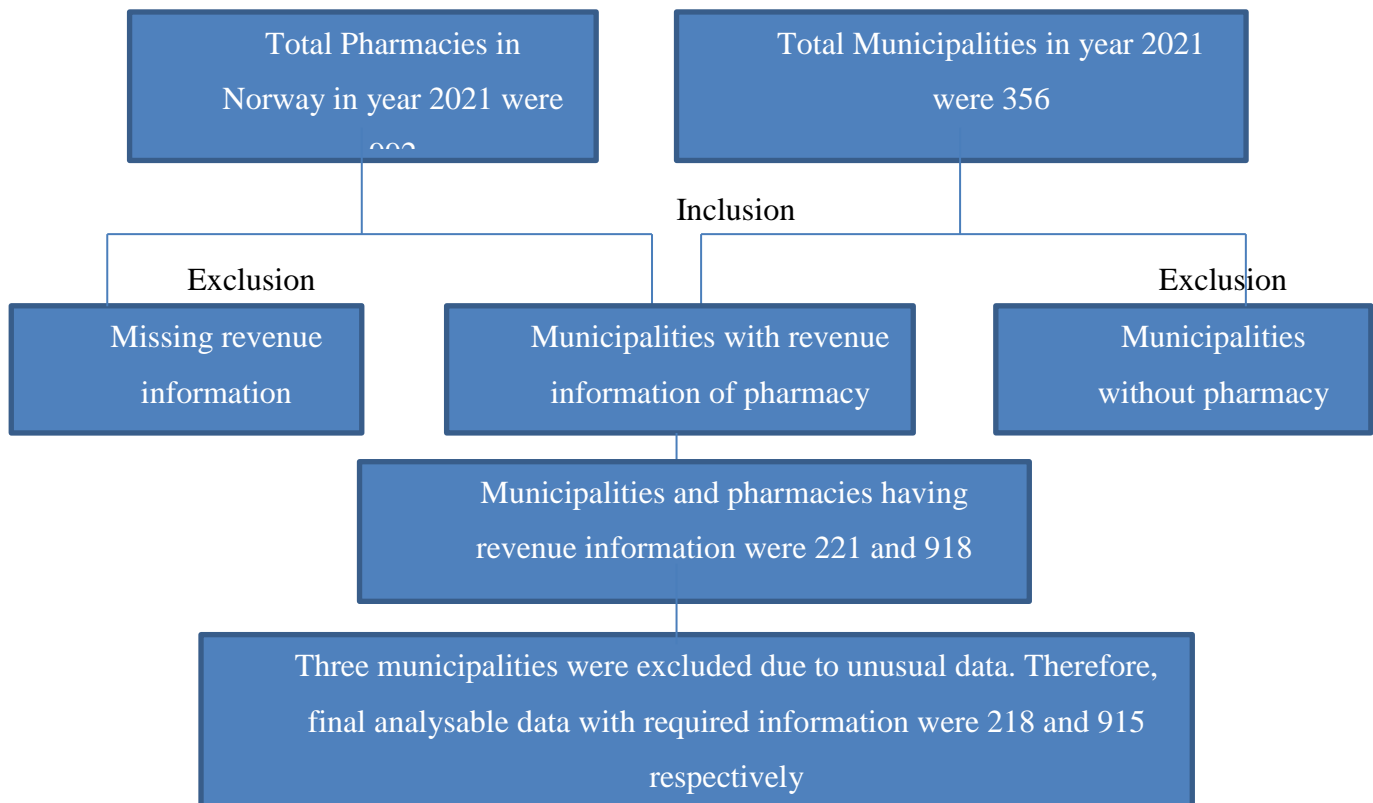
Figure 1: Flowchart for the selection of study sample

2.8 Statistical Method

All baseline characteristics of the pharmacies described in first descriptive table (table 1) are continuous variables whose mean and standard deviation were calculated. For the second descriptive table (table 2), first of all, profit was divided into quartiles (described in section 2.7.7) and then baseline characteristics of pharmacies within kommune were compared with those quartiles. One way Anova was used to calculate the p-value of those characteristics because there were more than groups to be compared.

For the results shown by linear regression analysis, there is dependent variable whose relationship is predicted through independent (predictor) variable. In table 3, the relationship between "profit percentage" and "competition" of pharmacies were examined. For that B_{crude} is the beta coefficient which showed the degree of relationship between them at 95% confidence level. In table 4, $B_{adjusted}$ is the beta coefficient which showed the degree of relationship between "profit percentage" and "competition" of pharmacies where all other probable confounders were adjusted/nullified at 95% confidence level. For the adjustment, the effect of "population density", "revenue per staff", prescription per capita", "non-prescription per capita", merchandise per capita" and "competition of unique brands" were nullified.

Similarly, in table 5, the relationship between "total revenue per capita" and "competition of pharmacy" were examined. For that B_{crude} is the beta coefficient which showed the degree of relationship between them at 95% confidence level. Similarly, in table 6, $B_{adjusted}$ is the beta coefficient which showed the degree of relationship between "total revenue per capita" and "competition of pharmacy" where all other probable confounders were adjusted/nullified at 95% confidence level. Here, only the effect of "population density" was nullified to examine the strength of relationship between dependent and predictor variables.

For the analysis of this thesis numerous statistical tools were used. Spyder (Python 3.11) was used for coding, merging the data sets from different sources and regression analysis. Statistical Package for the Social Sciences (SPSS) version 27 was used for the calculation of baseline characteristics. Also, Microsoft excel was used to perform some basic calculations.

3 RESULTS

3.1 Descriptive characteristics of pharmacies in Norway

Table 1 represents the baseline characteristics of a pharmacy in Norway. Among all pharmacies in Norway, mostly made (2.3±2.9) percent of its total revenue as profit. The average population density in year 2021 was (64.4±153) individuals per km^2. Also, (7192±2302) thousand kroner was average revenue per staff made by the pharmacies in Norway. Similarly, (209.1±2125.3) thousand kroner was the average revenue that pharmacy generated from an individual through sells of prescription drugs only. Whereas, through sells of all drugs (prescription and non-prescription) and merchandise products average total revenue per capita was (8.24±3.4) thousand kroner. In addition, average individual that a pharmacy served in year 2021 was (5199.5±2089.5). Table 1 also shows that there was (0.012±0.027) pharmacy within the area of every 1 km^2.

Table 1: Mean and Standard Deviation of baseline characteristics of a pharmacy in Norway

Characteristics (within 915 pharmacies and 218 municipalities)	Mean	Standard Deviation
Profit percentage of pharmacy (%)	2.3	2.9
Population density (per km^2)	64.4	153
Revenue per staff (1000 Kroner)	7192	2302
Revenue per capita (1000 Kroner)	209.1	2125.3
Total revenue per capita (1000 Kroner)	8.24	3.4
Inhabitants per pharmacy in a kommune	5199.5	2089.5
Pharmacy density (per km^2)	0.012	0.027

Descriptive characteristics based on the quartiles of profit gained by pharmacies in Norway (table 2) shows the descriptive analyses based on the four different quartiles of profit gained by the pharmacies in Norway. Majority of the municipalities having more than two pharmacies, made the lowest profit. Whereas, the municipalities consisting only one pharmacy earned comparatively higher profit. Most municipalities (kommune) that has competition of at least two different brands of pharmacy, made the lowest profit (Q1). However, more proportion of municipality having only one brand without any competition made higher profits for those pharmacies.

Majority of the pharmacy that generated the revenue more than 75,000,000 kroner in year 2021throgh the sales of prescription drugs in a kommune made the lowest profit. In addition, most of the pharmacies that generated the revenue less than 5,000,000 kroner in year 2021 through the sales of the drugs that did not need prescription of physician made higher profit. Also, majority of pharmacies that generated revenue more than 15,000,000 in 2021in a kommune through the sales of merchandise products made the higher profits.

Whereas, there were almost similar average number of pharmaceutical staffs that assisted pharmacies in a kommune to gain profit.

Table 2: Descriptive analysis based on the quartiles of profit gained by the pharmacies in Norway

		Profit Quartiles				P-Values
		Q1	Q2	Q3	Q4	
Total number of pharmacy in a kommune*	One pharmacy	6 (10.9)	38 (67.9)	30 (55.6)	21 (39.6)	
	2 to 4 pharmacies	26 (47.3)	14 (25)	19 (35.2)	18 (34)	<0.001
	>4 pharmacies	23 (41.8)	4 (7.1)	5 (9.3)	14 (26.4)	
Unique Brands of Pharmacy in a kommune*	One brand with no competition	12 (21.8)	44 (78.6)	34 (65.4)	25 (47.2)	
	Two brands	19 (34.5)	9 (16.1)	13 (25)	12 (22.6)	
	Three brands	13 (23.6)	2 (3.6)	4 (7.7)	5 (9.4)	<0.001
	Four brands	8 (14.5)	0	1 (1.9)	9 (17)	
	Five brands	2 (3.6)	1 (1.8)	0	2 (3.8)	
	Six brands	1 (1.8)	0	0	0	

Revenue made by selling prescription drugs in a kommune*	≤ 25,000,000	3 (5.5)	20 (35.7)	18 (33.3)	6 (11.3)	<0.001
	25,000,001- 50,000,000	6 (10.9)	23 (41.1)	17 (31.5)	15 (28.3)	
	50,000,001- 75,000,000	5 (9.1)	6 (10.7)	10 (18.5)	9 (17)	
	≥ 75,000,001	41 (74.5)	7 (12.5)	9 (16.7)	23 (43.4)	
Revenue made by selling non-prescription drugs in a kommune*	≤ 2,500,00	6 (10.9)	35 (62.5)	19 (35.2)	9 (17)	<0.001
	2,500,001- 5,000,000	7 (12.7)	12 (21.4)	20 (37)	14 (26.4)	
	5,000,001- 7,500,000	6 (10.9)	5 (8.9)	5 (9.3)	9 (17)	
	≥ 7,500,001	36 (65.5)	4 (7.1)	10 (18.5)	21 (39.6)	

Revenue made by selling merchandise products in a kommune*	≤ 5,000,000	6 (10.9)	22 (39.3)	9 (16.7)	3 (5.7)	<0.001
	5,000,001- 10,000,000	4 (7.3)	16 (28.6)	18 (33.3)	11 (20.8)	
	10,000,001- 15,000,000	6 (10.9)	5 (8.9)	10 (18.5)	7 (13.2)	
	≥ 15,000,001	39 (70.9)	13 (23.2)	17 (31.5)	32 (60.4)	
Pharmaceutical staffs in a kommune**		5.9 (1.3)	5.2 (1.6)	4.8 (2.0)	6.5 (3.2)	0.007

*Represents the category that has number of each profit quartiles and percentage in bracket
**Represents the category that has mean value of each profit quartiles and standard deviation in bracket

3.2 Results from linear regression analysis

For the calculation, thesis performed linear regression analysis. In table 3, the relationship between "profit percentage" (dependent variable) and "competition of pharmacy" (predictor variable). Therefore, the result showed that "competition of pharmacy" was a significant predictor variable [B_{crude}= -0.395, 95% C.I= (-0.752) – (-0.038)] at 5% level, suggesting negative relationship with "profit percentage". I.e. with every one unit increase in competition between the pharmacies, there would be 0.395 unit decrease in profit percentage of the pharmacies. Also, the linear regression was again performed (table 4) to nullify the effects of other variables and see whether the relationship is significant or not. After analysis, the result showed that there still was significant relationship between "profit percentage" and "competition of pharmacy" [$B_{adjusted}$= -1.650, 95% C.I= (-2.611) – (-0.690)] at 5% level. This implies that with every one unit change in competition of pharmacy, profit percentage will drop down by 1.650.

Table 3: Crude regression coefficients of "profit of pharmacy" for "competition of pharmacy" in Norway

	B-coefficient (crude)	p-value	95% C.I.
Competition of pharmacy	-0.395	0.030	(-0.752) – (-0.038)

Table 4: Adjusted regression coefficients of "profit of pharmacy" for "competition of pharmacy" in Norway

	B-coefficient (adjusted)	p-value	95% C.I.
Competition of pharmacy (predictor)	-1.650	<0.001	(-2.611) – (-0.690)
Population density	-0.001	0.378	(-0.004) – 0.002
Revenue per staff	7.170E-5	0.537	0.0001 – 0.0003
Prescription per capita	0.282	0.016	0.053 – 0.512
Non-prescription per capita	0.001	0.187	(-0.001) – 0.003
Merchandise per capita	-0.001	0.015	(-0.001) – 0.0001
Unique competition	0.939	0.013	0.199 – 1.67

Results in table 5 was also generated from linear regression analysis. In this table, it shows the relationship between "total revenue per capita" (dependent variable) and "competition of pharmacy" (predictor variable). Therefore, the result showed that "competition of pharmacy" was a significant predictor variable [B_{crude}= 1,931, 95% C.I= 1.591 – 2.271] at 5% level, suggesting positive relationship with "total revenue per capita". I.e. with every one unit increase in competition between the pharmacies, there would be 1.931 unit increase in total revenue of pharmacy. Linear regression was again performed (table 6) to nullify the effects of other variables and see whether the relationship is significant or not. After analysis, the result showed that there still was significant relationship between "total revenue of pharmacy" and "competition of pharmacy" [$B_{adjusted}$= 2.027, 95% C.I= 1.690 – 2.364] at 5% level. This implies that with every one unit change in competition of pharmacy, total revenue of pharmacy would excel by 2.027.

Table 5: Crude and adjusted regression coefficients of "total revenue per capita" for "competition of pharmacy" in Norway

	B-coefficient (crude)	p-value	95% C.I.
Competition of pharmacy	1.931	<0.001	1.591 – 2.271

Table 6: Adjusted regression coefficients of "total revenue per capita" for "competition of pharmacy" in Norway

	B-coefficient (adjusted)	p-value	95% C.I.
Competition of pharmacy (predictor)	2.027	<0.001	1.690 – 2.364
Population density	0.004	<0.001	0.002 – 0.007

4 DISCUSSION

4.1 Main Result

This cross-sectional thesis mainly had two closely related aims, the first was to investigate the association between percentage of profit and competition among the pharmacies of Norway. The second aim was to find out the association between total revenue per capita gained and competition among pharmacies in Norway for year 2021.

According to the descriptive results, average percentage of profit that a pharmacy made was (2.3±2.9) of revenue whereas average revenue generated per individual through sales of all kind of products at pharmacy was (8400±3400) kroner.

The finding from the regression analysis showed that competition within the pharmacies and percentage of profit gained was statistically significant with each other at crude level. The association became even stronger when the confounders were adjusted.

Similarly, another regression analysis between total revenue per capita and competition of pharmacies showed that this association was also statistically significant. Adjustment of confounders in this model did not affect the strength of association.

4.2 Comparison of results with similar other studies

Norway had a strict regulation prior to 1996 where placement of pharmacy as well as their number were controlled[31]. Free pricing on over the counter-pharmaceuticals was regulated in 1995 and the government investigated possibility of increasing new pharmacies in market. The investigation found that increase in number of pharmacy would lower down the prices of drugs for consumers[31]. This finding is somehow consistent with the finding of this thesis. Although the study conducted in 2014 did not talk about the decreased profit directly, we can assume that the decrease in prices eventually led to decrease in profit too.

Similarly, another European country Germany had a survey in 2008 which was done by Heinsohn, J.G., Flessa, S. This was conducted in 289 public pharmacy owners. The initial results found no significant association between number of competitors and revenue development as well as profit margin. However, when the perception of pharmacists was taken into consideration, the results changed. The perceived competitive pressure in the pharmacy market showed a significantly negative correlation with business performance, which simply meant more perceived competition led to less profit generation[32]. The initial finding was not consistent with the finding of this research. This might be contributed to a lot of different environmental and infrastructural factors, in two different countries. Also, this thesis could not calculate the association between perceived competition and business performance and hence we could not compare the second result of the study conducted in Germany with the finding of this research.

In Italy, they experienced a fall in profitability and many individual pharmacy owners were compelled to collaborate with other pharmacies after deregulation in 2017[33]. This situation is consistent with the finding of this thesis that profit and competition don't go the same direction.

There is a study that compared different aspects of pharmacy services in nine countries that included both regulated and deregulated pharmacy services. From evidence, it was understood that the number of inhabitants per pharmacy would decrease in deregulate countries while this number keeps increasing in a country with regulated pharmacy systems with no free entry in pharmacy market. Norway, being one of the deregulated countries has a number of 5199 inhabitants per pharmacy, which is less than the figure before deregulation. This indicates the increased availability of pharmacy services. However, this study shows that Norway is still among the countries with higher inhabitants per pharmacy, compared to other deregulated countries. The reason might be that, it had a lesser number of pharmacies at a starting point itself and hence growth of number seems relatively smaller. Also, the newly opened pharmacy may have been opened in urban areas where the inhabitants per pharmacy was already less[4]. This speculation can be addressed if the accessibility of

prescription only drugs could be examined in the rural areas. If the patients of rural areas are not benefitted of deregulation, then an important issue of equity stands in front of Norway that needs to be solved.

In order to combat the financial loss followed by competition, pharmacies have increased the sales of non-pharmaceutical drugs and merchandise products. In Norway, 25% of all sales was attributed to non-pharmaceutical products. Sweden had to see a lot of criticisms from public for their increased attention to beauty products and less focus on prescription medicines[4]. This is a problem that can easily be invited by decreased profitability followed by deregulation. The government is bound to examine if pharmacies are putting the sales of prescription medicines in prime focus, so that quality of pharmacy services doesn't downgrade.

A study conducted in Sweden investigated the change in the way consumers see and interact with over the counter drugs from pharmacies, after their large regulatory reform policy in 2009. This study showed the huge increase in usage of pharmacy services, especially for the purchase of over the counter drugs after the removal of monopoly in pharmacy markets by the state. Opening of many pharmacies after free market policy and increased geographical accessibility to pharmacies were reported as the factors contributing for huge increase in usage of pharmacy services[34]. From the finding of this study, we can argue that deregulation increases sales, decreases the distance between pharmacy and consumers and as a result, revenue per capita of pharmacy, increases. Hence, although the profit made by pharmacy is negatively influenced by competition as suggested by my thesis, it is important not to disregard the other factors like increased accessibility and changed purchasing behavior of consumers following competition.

A study done in South Korea to investigate the impact of deregulation on performance of retail pharmacy revealed that deregulation lowered the prices of medicines that brought a significant drop in revenue and encouraged the market exit of pharmacies that are underperforming, by increasing the competition. The finding is inconsistent with the finding of this thesis since linear regression analysis between competition and revenue had resulted that with increase in competition between pharmacies, the revenue per capita of pharmacies also increases [35]. The reason for this inconsistency in results between these two studies might be the difference in parameters like total population of the country and degree of usage of medicines and non-medicinal pharmacy products by consumers. The study in South Korea also revealed that the pharmacies that have less senior citizens as their customers are less vulnerable to competition and hence face less loss of revenue. If we analyze this in case of Norway, there are more aged people because of longer life expectancy rate of the country. Also, pharmacies sell merchandise products with higher prices that have demands in public. People are not hesitant to buy medicines and use them abundantly when in need, because of universal insurance program in Norway for all residents with national identification number. In addition, we can see the high amount of trust that people in Norway show in their health care including pharmacies. All these factors, when work together, make the pharmacy market in Norway less vulnerable to revenue loss and market exit due to underperformance, although there is a decrease in profit percentage due to competition, as the initial results of this thesis suggests.

4.3 Strengths of the study

The main strength of this thesis was its data on revenue and profit that was reported by SLV. This data can be represented as strength because tool that used for entry was online, real-time procurement and sell of all the products from pharmacies. Also, while application of taxation and reimbursement by Norwegian government, all the documents were thoroughly checked. Therefore, reassurance of the data were done before submission to Norwegian Institute of Public Health.

4.4 Weaknesses of the study

This thesis had cross-sectional study design due to which the effect of competition on profit cannot be determined in long run especially after deregulation. If the study design was longitudinal then the trend could be observed over the years and the effect of competition on profit and revenue could be compared before and after deregulation era.

This thesis did not have information of impact made my advertisements and media campaign on pharmaceutical revenue and profit. The variables like advertisement count or advertisement per year could have been added for the deep clarity of the revenue and profit.

There is a close relationship between success of pharmacy related policies and accessibility factor of pharmacies[36]. One of the major advantage of deregulation in Nordic countries including Norway is that it has increased accessibility of pharmacy services due to opening of many pharmacies at different location[37]. Although this thesis had talked about the pharmacy density, it failed to include the accessibility factor of pharmacy sector in the research due to insufficient data. For example, if it could map the exact geo-location of pharmacies and households around its catchment area, it could be a novel effort in this field.

5 CONCLUSION

From this thesis it can be concluded that with the increase in competition among the pharmacies there will be less profit gained by the pharmacies. On the contrary, the positive association was observed between competition among the pharmacies and revenue per capita of pharmacies in Norway, which showed that with the increase in competition, revenue per capita will also increase.

6 FUTURE PERSPECTIVES

This thesis could be useful for some policy makers in healthcare and individuals related to heath economics and public health as well as researchers who want to explore more on the pharmaceutical market behavior and its impact.

For the policy makers, this thesis could give insight on how to make competition healthy to benefit individuals without letting them pay more to receive the services. Also, policy makers could use this thesis as a reference on how deregulation impacted pharmaceutical market in Norway. As a result it might help to regulate some policies like regulating the prices for prescription drugs, manipulating the monopoly practices inside pharmacy industry and coverage of health insurance.

Similarly, this thesis will be beneficial for the researchers for comparative analyses between Norway and other countries or regions. In addition, impact of competition on healthcare market could be explored more and the consumer behavior can be studied further.

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APPENDIX

Appendix I: Operational definitions

Profit percentage of pharmacy: It expresses the proportion of total revenue made by the pharmacy by selling prescription drugs.

$$\text{i.e. profit} = \frac{\text{profit of pharmacy}}{\text{revenue made by pharmacy}} \times 100\%$$

Population density: It is the average population of a kommune residing within each square kilometer radius of same kommune.

$$\text{i.e. population density} = \frac{\text{population of kommune}}{\text{area of kommune}}$$

Revenue per staff: It is the average revenue of a pharmacy contributed by each employee in 2021. It is expressed in 1,000 Kroners.

$$\text{i.e. revenue per staff} = \frac{\text{total revenue of a pharmacy}}{\text{number of staff in that pharmacy}}$$

Revenue per capita: It is an average revenue of a pharmacy through the sales of prescription drugs that is expected to be generated by an individual of that kommune. It is also expressed per 1,000 Kroners.

$$\text{i.e. revenue per capita} = \frac{\text{revenue of pharmacies by prescription drugs in a kommune}}{\text{total population of that kommune}}$$

Total revenue per capita: It is an average revenue of a pharmacy through the sells of prescription drugs, non-prescription drugs and merchandise products that is expected to be generated by an individual of that kommune. It is also expressed per 1,000 Kroners.

$$\text{i.e. revenue per capita} = \frac{\text{total revenue of pharmacies by all kinds of products in a kommune}}{\text{total population of that kommune}}$$

Inhabitants per pharmacy in a kommune: it is an average population of a kommune that a pharmacy of that kommune is providing the services.

$$\text{i.e. inhibitants per pharmacy} = \frac{\text{total population of a kommune}}{\text{total number of pharmacies in that kommune}}$$

Pharmacy density: It is the average number of pharmacy in a kommune within each square kilometer area of that kommune.

$$\text{i.e. pharmacy density} = \frac{\text{number of pharmacies in a kommune}}{\text{area of kommune}}$$

Quartiles of profit: It is basically four quarters of profits that pharmacies made in year 2021 by selling prescription drugs. Where

Q1= Less than or equal to -1,080,000 Kroner

Q2= -1.080,001 to 190,000 Kroner

Q3=190,001 to 1,038,005 Kroner

Q4= More than or equal to 1,038,006 Kroner

Competition of pharmacy (HMO penetration): It is calculated by dividing the total number of pharmacies in a kommune with the total population residing in that kommune and multiplied by 10,000

$$\text{i.e. competition of pharmacy} = \frac{\text{number of pharmacies in a kommune}}{\text{total population of that kommune}} \times 10,000$$

Therefore, "competition of pharmacy" in this study was expressed in per 10,000 population

Unique competition: It is calculated by dividing the unique number of pharmacies in a kommune with the total population residing in that kommune and multiplied by 10,000

$$\text{i.e. unique competition} = \frac{\text{number of unique number of pharmacies in a kommune}}{\text{total population of that kommune}} \times 10,000$$

It is also expressed in per 10,000 population

Prescription per capita: It is an average revenue of a pharmacy that is expected to be generated by the sales of prescription drugs in a kommune. It is also expressed in 1,000 Kroners.

i.e. $\text{prescription per capita} = \dfrac{\text{revenue made by sales of prescription drugs in a kommune}}{\text{total population of that kommune}}$

Non-prescription per capita: It is an average revenue of a pharmacy that is expected to be generated by the sales of non-prescription drugs in a kommune. It is also expressed in 1,000 Kroners.

i.e. $\text{non} - \text{prescription per capita} = \dfrac{\text{revenue made by sales of non}-\text{prescription in a kommune}}{\text{total population of that kommune}}$

Merchandise per capita: It is an average revenue of a pharmacy that is expected to be generated by the sales of merchandise products in a kommune. It is also expressed in 1,000 Kroners.

i.e. $\text{merchandise per capita} = \dfrac{\text{revenue made by sales of merchandise products in a kommune}}{\text{total population of that kommune}}$