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전문의약품 소비자광고가 생활습관 변화에 미치는 영향에 대한 연구*

The Impact of Direct-to-Consumer Advertising of Prescription Medications on Healthy Lifestyle

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목 차

Abstract

In the U.S. where Direct-to-Consumer Advertising (DTCA) of prescription medications is permitted, spending on DTCA has been accelerating. As a result, it has been an issue of intense public policy attention regarding whether DTCA is beneficial to the public by promoting a healthy lifestyle. Most of the literature concerning DTCA focuses on its impact on demand and empirical evidence regarding its impact on health-related behavior is scant. This study uses a database of DTCAs for high blood cholesterol, hypertension, diabetes, and overweight treatment medications that have appeared in nationally circulated U.S. consumer magazines during 2000 to 2004 and the Simmons National Consumer Survey in order to compute the level of individual advertising exposure and examines whether those who are exposed to DTCA are more likely to engage in regular exercise and diet control. The study finds evidence that for those with chronic conditions, greater exposure to DTCA leads to less exercise but more diet control. By therapeutic class level, exposure to DTCA leads to less exercise for those with hypertension and who are overweight, whereas those with high blood cholesterol are more likely to engage in regular exercise. Looking into differential responses by socioeconomic status, those with less education are more likely to engage in exercise after being exposed to DTCA. The results imply that the effects of DTCA vary by therapeutic class. In order to enhance the benefits of DTCA, it is important to closely monitor the messages in DTCA and require it to include messages that promote lifestyle change should it be a part of the treatment.

전문의약품 소비자광고가 미국에서 급속도로 증가함에 따라 광고가 소비자의 생활습관 변화에 미치는 영향에 대한 관심이 커지고 있다. 전문의약품 소비자광고에 대한 대부분의 선행 연구들이 광고가 소비자 수요에 미치는

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영향에 초점을 맞추고 있는데 반해 소비자 행동 특히 건강관련 생활습관 변화에 미치는 영향에 관한 연구는 드물다. 본 연구는 2000년에서 2004년 사이의 미국 소비자 조사와 대중적인 소비자 잡지들에 실린 전문의약품 소비자광고들 중 고지혈증, 고혈압, 당뇨, 비만 치료제 광고를 데이터베이스화한 자료를 이용하여 개별 소비자 수준에서의 광고 노출을 산출하고, 규칙적인 운동, 운동 빈도, 식이 조절 행동에 미치는 영향을 선형확률모형을 이용하여 분석하였다. 본 연구 결과 고지혈증, 고혈압, 당뇨, 비만 등의 만성질환을 보유한 소비자들이 이들 치료제 광고에 노출되어 규칙적인 운동을 할 확률은 감소하는 것으로 나타났으나, 식이조절을 할 확률은 증가하는 것으로 나타났다. 개별 질환 치료제 광고 수준에서 광고 노출의 영향을 살펴본 결과, 고지혈증 보유자들의 경우 고지혈증 치료제 광고 노출이 증가할수록 주당 운동 빈도가 증가할 확률이 높아지는 것으로 나타났으나 고혈압, 비만 환자인 경우 이들 각각의 치료제 광고의 노출이 증가할수록 주당 운동 빈도와 식이 조절을 할 확률이 감소하는 것으로 나타났다. 또한 교육 수준이 낮은 소비자의 경우 광고 노출이 이들이 규칙적으로 운동을 하는데 정의 영향을 미치는 것으로 나타났다. 본 연구의 결과를 통하여 전문 의약품 소비자광고가 소비자와 관련 질환에 따라 다른 영향을 미친다는 것을 알 수 있다. 따라서 전문의약품 소비자광고가 소비자의 건강한 생활습관 향상에 도움이 되도록 하기 위해서는 꾸준한 모니터링이 중요하며, 전문의약품 소비자광고에 건강한 생활습관을 유도할 수 있는 메시지를 포함하도록 규제하는 것이 필요하다.

주제어(Key Words) : 전문의약품 소비자광고(direct-to-consumer advertising), 광고노출(advertising exposure), 건강관련 행동(health-related behavior)

I. Introduction

Changing into a healthy lifestyle plays a key role in the prevention and treatment of cardiovascular disease, one of the primary causes of death in the world (World Health Organization [WHO], 2008). There is a growing interest in public health whether advertisements can lead to change in health-related behavior. Studies show that deliberate public health campaigns lead to change in health behavior provided exposure to the message is broad and occurs repeatedly (Frosch, Suepattra, Tietbohl, & Pagan, 2011; Hornick, 2002).

Debates in public policy and public health talk about the effect of Direct-to-Consumer Advertising of prescription medications (DTCA) whether it has a positive public health effect that works as a reminder to consumers to follow the treatment regime, and change to healthy lifestyle as part of the treatment process. In fact, some DTCAs refer to lifestyle change as a way of improving health (Frosch et al., 2011). On the other hand, the opponents of DTCA argue that DTCA has a negative effect of promoting unnecessary use of prescription medications. This debate is driven because little is known about the effect of advertisements on lifestyle changes. Few studies are focused on the effect of DTCA on healthy lifestyle. Even among the few, evidence from empirical studies on whether DTCA leads to healthy lifestyle change is mixed. Iizuka and Jin(2007) find a moral hazard effect that when consumers are exposed to advertisements, they become careless about healthy lifestyles and substitute healthy lifestyle with prescription drugs. Another study by Frosch and colleagues(2011) report advertisements potentially shift consumers' perceptions of causality by suggesting that high cholesterol is primarily hereditary and therefore lifestyle change does not help in treating high blood cholesterol. Avery, Kenkel, Lillard, and Mathios(2007) find that DTCA of smoking cessation products causes smokers to quit regardless of whether or not they purchase smoking cessation products. Yang(2011a) reports that DTCA of cholesterol reducing drugs leads consumers to visit physician's office for diagnoses and increases the probability of exercising regularly. A survey of nationally representative sample of U.S. consumer reports that although DTCA has positive and negative effects on health behaviors, it encourages those of low socioeconomic status (SES) to seek preventive care (Murray, Pollack, Donelan, & Lee, 2004).

To build up on the literature, this study expands Yang (2011a) and Iizuka and Jin(2007)'s works by studying DTCA of four different chronic conditions that are closely related to cardiovascular disease and focuses on whether more exposure to DTCA is likely to result in more a healthy lifestyle, i.e., change of diet and increase in physical activities. Four classes of DTCAs are studied: high blood cholesterol, hypertension, diabetes and

overweight, where lifestyle change is essential in the treatment regime. Furthermore, this paper discusses whether the response after being exposed to DTCA is different for those of low SES in changing their lifestyles. Traditionally, those of low SES are considered hard to reach through public health campaigns (Bell, Wilkes, & Kravitz, 1999; Kaiser Family Foundation [KFF], 2001; Murray et al., 2004). Consumer advertising in mass media may potentially be a source of health information for those of low SES.

This study contributes to the literature in a few ways. First, it studies actual behavioral outcome rather than individual's belief about the effectiveness of DTCA on changing his behavior. Frosch and colleagues(2011) use a sample of those who are not diagnosed with chronic conditions and ask them about their beliefs about the effectiveness of DTCA on lifestyle change rather than observing actual behaviors. This study uses a unique survey of consumers which contains information for generating individual's media exposure and health behaviors. Second, this study uses a more direct measure of advertising exposure. To the best of our knowledge, most of the empirical studies other than Avery et al. (2007) and Yang(2011a, 2011b) have not been able to measure individual level variation in advertising exposure and instead have largely relied on aggregate measures of DTCA expenditures. Improvements such as Chou, Rashad, and Grossman(2008) use frequency of advertisements by geographic location, which assumes that individual's advertising exposure depends on the location he lives and the hours of television watching. Hence, it is not clear whether he is actually exposed to DTCA while watching television. This study links a survey data of individual's health-related behaviors with an archive of magazine advertisements. The survey also includes information on which magazines each respondent reads, which enables us to observe variation in advertising exposure at the individual level.

II. Background and Hypotheses

Advertisements of prescription medication may inform consumers of the benefits of taking the medication in treating the disease. It may or may not refer to lifestyle changes as part of the treatment. However, all advertisements tell the consumers to see the doctors and ask about the drug that they advertise. For treating high blood cholesterol, with or without being exposed to DTCA of cholesterol reducing drugs, a consumer may visit a physician's office. He may find out about his blood cholesterol level from a blood test during a regular check-up or he may simply visit the physician's office after finding out about the risk factors that are advertised in the DTCA. According to the clinical practice guideline, unless the blood cholesterol level is critically high, physicians do not prescribe medications immediately at the first visit (National Institute of Health [NIH], 2001). At the first visit, physicians advise a therapeutic lifestyle modification such as diet control and increase in physical activities. If the individual's cholesterol level is still high at the second visit, physicians may start prescribing medications. Lifestyle modification will still be required for those taking prescription medications. Examining clinical practice guidelines of other chronic conditions, it is found that the treatment process is similar. Exercise and diet control are part of the treatment even prior to the taking of prescription drugs (NIH, 1998, 2004).

As described in the introduction, few empirical studies focus on the effect of DTCA on lifestyle change. Most studies examine the impact of advertising on demand for prescriptions. Some studies examine the impact of advertising on patient's visit to the doctor's office and compliance with the treatment. Iizuka and Jin (2005) find higher DTCA expenditures are associated with increased doctor visits. Wosinska(2005) examines the impact of cholesterol lowering drug advertising on compliance with the drug therapy and finds evidence that patients who began drug therapy and were more exposed to DTCA, were more compliant. Donohue, Berndt, Rosenthal, Epstein, and Frank(2004) find that DTCA spending on antidepressants have a positive effect on the duration of antidepressant use. Meyerhoefer and Zuvekas(2008) report that DTCA increases an individual's likelihood of initiating treatment and compliance for those who are already on prescription drugs.

Among the few studies focus on the effect of DTCA on health behaviors, Avery and colleagues(2007) find that DTCA of smoking cessation products causes smokers to quit regardless of whether or not they purchase smoking cessation products. Iizuka and Jin (2007) find that DTCA of diabetes, high blood cholesterol, overweight and hypertension drugs reduce the likelihood of engaging in moderate exercise which suggests that DTCA may encourage consumers to substitute prescription drugs for healthy lifestyle. On the other hand, using micro-level data Yang(2011a) finds that when consumers are exposed to more advertisements for cholesterol lowering drugs, they are more likely to start exercising regularly. In summary, previous studies consistently report that DTCA may affect an individual's visit to the physician's office and the initiation of treatment. However, other than pharmacological treatment, it is not clear whether DTCA promotes therapeutic lifestyle change for those who have already started treatment.

In the data for this study, the fact that the individuals are aware of having chronic conditions mean that they have already visited the physician's office for blood tests and may or may not have started treatment. In this segment, there are some people who are diagnosed with the condition but are not taking prescription drugs due to a variety of reasons including that the cholesterol level is not high enough, the cholesterol level is high but does not adhere to the prescription because he cannot afford it, etc.. This study hypothesizes that DTCA may take on the role as a reminder to individuals to adhere to the doctor's advice including lifestyle change and tests the following hypotheses:

H1. Individuals with chronic conditions will exercise regularly and control diet after being exposed to DTCA.

H2. Individuals who are taking prescription medications for treating chronic conditions will exercise regularly and control diet after being exposed to DTCA.

H3. Individuals of low SES status will more likely to exercise regularly and control diet after being exposed to DTCA.

To test the first hypothesis, first the advertising exposure of prescription drugs for all four chronic conditions is summed. This is because the four chronic conditions studied are major risk factors for cardiovascular disease and thus closely related with one another. Because of that, the DTCA of one condition may have a spillover effect on consumers with another condition. Next, advertising exposures by class are tested and interacted with each corresponding chronic condition. For the second hypothesis, each DTCA exposure is interacted with whether the individual is taking prescription for the corresponding chronic condition. The third hypothesis is to check whether DTCA is beneficial to those hard-to-reach segment of the population in promoting preventive care, as suggested in Murray et al.(2004). For simplicity, in this study low SES is defined as those of less education, low income, unemployed and without health insurance. Less education is defined as those who did not graduate high school. Low income is defined as those in the first and second quintile of income distribution in the data.

III. The Data and Variables

This study combines two sources of data. One is a survey of consumers and the other is an archive of magazine advertisements. The survey data is the Simmons National Consumer Survey (NCS) collected by the Simons Market Research Bureau. It is a repeated cross-sectional survey. For this study the survey waves between 2000 and 2004 are used. The sample for each survey wave is independently drawn. The NCS employs a multi-stage stratified probability sample of all adults living in household in the U.S. except Hawaii and Alaska. The NCS provides detailed information on consumer behavior, including magazine reading and television watching habits. The data also includes information on whether the respondents have any chronic conditions, whether they use prescription medications to treat the chronic conditions, whether they exercise regularly, and control diet. These variables are the key measures to examine the empirical relationships described in the previous section. As will be described later, these magazine reading questions allow us to

generate the measure of advertising exposure which can then be linked with the other key variables.

The advertisement data is an archive of magazine advertisements that appeared in the most widely circulated consumer magazines in the U.S. The magazine set includes: *Better Homes & Gardens, Black Enterprise, Business Week, Cosmopolitan, Ebony, Essence, Family Circle, Glamour, Good Housekeeping, Jet, McCall's, Modern Maturity, Money, National Geographic, Newsweek, People, Playboy, Readers Digest, Rolling Stone, Seventeen, Sports Illustrated, Time, TV Guide, U.S. News and World Report, Vogue and Women's Day*. These magazines are selected because they are most frequently read by individuals in each demographic sector categorized by age, gender, race, income and education.

Measure of Advertising Exposure

As described in Yang(2011b), an individual's advertising exposure is calculated like the following way. In the NCS, each respondent is shown copies of the covers of over 180 consumer magazines. For each magazine, the respondent was asked whether he had read or looked at it during the previous six months, and if so, of the latest four issues on average, how many did the respondent read. The variable $Read_{im}$ is the fraction of issues of magazine *m* read by a person i. This fraction is multiplied with the number of advertisements that appeared in that magazine over the previous six months. Then all the magazines in the archive are summed up. The result is our estimate of advertising to which a person was potentially exposed to by reading the magazines in the archive. As such, the exposure to DTCA of a respondent i, $AdExp_i$, is given by:

$$AdExp_i = \sum_{m=1}^{26} Ads_m * \mathrm{Re}ad_{im}$$

This measurement approach assumes that two people who read the same number of issues of the same magazine are exposed to the same number of advertisements. This is imperfect because it is not known whether both people actually saw the advertisements. However it represents a vast improvement over previous research. Most of the studies use market-level data on advertising which requires an implicit assumption that all individuals in a given market are exposed to the same level of advertising.

Measures of Health Behaviors

The measures of whether a respondent is engaged in exercise or is trying to control his diet are derived from the following NCS questions. For exercise, each respondent is asked if he exercises regularly and how often he exercises in an average week. With respect to diet, each respondent is asked whether he controls diet.

IV. Methods

As defined in the previous section, diet control and exercise in the past year are used as the key dependent variables. It is assumed that the discrete outcomes of behaviors are related to the underlying latent variables describing the net benefits of engaging in these behaviors. It is also assumed that the underlying latent variables are linear functions of exposure to advertising and demographic characteristics of the person and his household. The general relationship can be specified as:

$$Y_i^* = \beta_0 + \beta_1 AdExp_i + \beta_2 X_i + \beta_3 AdExp_i * X_i + \beta_4 Z_i + \varepsilon_i$$

Where, X_i includes individual and household characteristics, and ε_i is an error term. Y_i^* is the latent index and separate equations are estimated for each of the behavioral outcomes. The given behavior, denoted by Y_i, is observed only if the continuous latent variable exceeds a critical threshold. Under the standard formulation, $Y_i = 1$ if $Y_i^* > 0$ and $Y_i = 0$ otherwise. The latent variable Y^* describes the net benefit of changing into healthy lifestyle. Advertising may change the expected perceived benefit of a healthy lifestyle.

Demographic characteristics, existence of chronic conditions and prescription drug taking are included in the vector of explanatory variables X as the additional possible determinants of the latent index. Interactions of DTCA exposure with demographic variables, chronic conditions, and prescription drug taking are added because it is expected advertising exposures have differential effects on those with certain demographic

characteristics, chronic conditions, and prescription drug takers.

Z_i denotes a set of dummy variables on whether the respondent has read each of the 182 magazines that are found in the NCS. With this included, our specification captures any remaining unobserved individual characteristics that may not be represented in X. The above equation is estimated by linear probability model (LPM) and maximum likelihood probit for binary dependent variables and OLS for exercise frequency. LPM is used because of its simplicity in interpreting the coefficients since we compare it's results with OLS models. The LPM has well-known limitations relative to probit and logit models, but the use of robust standard errors is an acceptable solution to the problem of heterskedasticity, and in many applied works it is still acceptable to present estimates from LPM models since it often provides good estimates of the partial effects on the response variable for the common values in the independent variable (Wooldridge, 2006). To correct the standard errors for heteroskedasticity we compute robust standard errors in all LPM models and compared the results with probit estimates.

Table 1.
Descriptive statistics of key variables

Variable	Fraction*/Mean (Standard Deviation)	
	Total	Diagnosed any one of the 4 chronic conditions
Health behaviors:		
Regular exercise	51.25	46.42
Exercise frequency/wk	1.65 (1.85)	1.51 (1.83)
Diet control	25.93	38.02
Chronic conditions:		
High blood cholesterol	10.90	42.81
Hypertension	14.88	58.45
Diabetes	5.37	21.08
Overweight	5.35	21.01
Taking Rx for:		
High blood cholesterol	7.13	28.01
Hypertension	11.98	47.08
Diabetes	3.87	15.21
Overweight	0.33	1.30
Advertising exposures:		
Sum of all chronic condition	68.23 (68.03)	78.51 (73.51)
High blood cholesterol	20.51 (27.32)	26.92 (30.86)
Hypertension	1.03 (2.92)	1.49 (3.54)
Diabetes	29.43 (26.38)	33.95 (28.97)
Overweight	17.25 (27.59)	16.15 (28.01)
N	92,690	23,589

Note. *Indicator variables: figure denotes fraction of sample

V. Results

Table 1 reports the descriptive statistics of the key variables of interest.[3)] The second and third column compares the whole sample and those who have at least one of the four chronic conditions. As reported in Table 1, a lower percentage of people with chronic conditions exercise regularly whereas a higher percentage of people with chronic conditions control diet compared to the whole sample. The mean number of exercise per week is also lower for those with chronic conditions.

Among the sample used, 10.9 percent have high blood cholesterol, 14.9 percent have hypertension, 5.4 percent have diabetes and 5.4 percent are overweight. Even if they have chronic conditions, not all of them take prescription medication. 7.1 percent report that they take cholesterol reducing prescription medications. 12 percent take prescription medication for treating hypertension. 3.9 percent and 0.3 percent take prescription medication for treating diabetes and overweight respectively.

Advertising exposures for those with chronic conditions are generally higher except for the weight loss medication advertising exposure. Interestingly, although a higher percentage of people have hypertension, the exposure to hypertension drug DTCA is less than for other classes of DTCA. Although a relatively smaller fraction of the sample has diabetes, the exposure to diabetes drug DTCA is quite high. This may be due to the fact that during the study period, hypertension drugs were not frequently advertised while the market for diabetes drug was being developed. According to Iizuka (2004), firms advertise more when a market has potential to grow and DTCA is focused on new blockbuster drugs.

1) Descriptive statistics of other variables we use are available upon request.

Table 2.
Mean of DTCA exposure by year and chronic conditions (standard deviation)

Year	High Cholesterol	Hypertension	Diabetes	Weight Control	All 4 Total
2000	16.31(20.84)	.00(.00)	36.88(28.65)	46.11(32.00)	99.30(77.38)
2001	25.91(32.41)	.11(.38)	39.53(27.76)	13.25(15.26)	78.81(71.05)
2002	17.74(22.14)	1.69(3.90)	23.02(19.58)	.42(.98)	42.87(43.86)
2003	23.12(29.43)	1.95(3.20)	29.42(23.24)	.98(2.79)	55.48(55.11)
2004	22.97(33.51)	2.88(4.52)	6.23(6.11)	.00(.00)	32.09(41.98)

To study further into the variation of advertising exposure, Table 2 reports the mean of advertising exposure for each class by survey year. Among the four conditions, DTCA exposures are more intensive in cholesterol reducing drug and diabetes drugs. Again, this may be because the markets for these drugs are potentially larger than the other two classes. The exposure to weight loss drug DTCA is the highest in 2000 which may be due to the launch of Xenical, an anti-obesity drug. It should be noted that hypertension drug DTCA exposure in 2000 and weight control drug DTCA exposure in 2004 are zero. This is because hypertension and weight loss prescription drugs were not advertised in the magazines studied. This is also observed by Iizuka and Jin(2007) that DTCA of hypertension drug expenditure by MSA level was only positive in one year.

To address the first hypothesis, Table 3 reports estimates of key variables from linear probability models.[2] Although not reported in the Tables, all the specifications include an extensive set of control variables: detailed demographics such as age, gender, family size, existence of children, race, education, income, marital status, health insurance status, existence of certain chronic conditions that are relevant to lifestyle change, total magazine readership, television watching, radio listening, smoking, survey wave dummy variables, and readership of each 182 magazines included in the NCS.

Specification (1) includes a sum of all four DTCA exposures and interaction with chronic conditions, an indicator variable of having any of the four conditions.

Table 3.
Selected coefficients: linear probability model and OLS estimates of health behaviors using the sum of advertising exposures

	Regular Exercise		Exercise Frequency		Diet Control	
	(1)	(2)	(1)	(2)	(1)	(2)
Sum Ad	.0091**	.0096*	.0149	.0242	− .0042	− .0031
	(.0040)	(.0057)	(.0153)	(.0221)	(.0036)	(.0052)
Sum Ad*chronic conditions	− .0092**	− .0095**	− .0274	− .0302*	.0394***	.0386***
	(.0047)	(.0048)	(.0179)	(.0183)	(.0046)	(.0047)
Sum Ad*low income		− .0008		− .0017		.0018
		(.0049)		(.0184)		(.0045)
Sum Ad*less education		.0192**		.0738**		− .0061
		(.0096)		(.0362)		(.0089)
Sum Ad*uninsured		.0046		.0186		− .0151***
		(.0060)		(.0226)		(.0054)
Sum Ad*employed		− .0028		− .0238		.0019
		(.0050)		(.0190)		(.0046)
Obs.	92,690	92,690	91,618	91,618	90,612	90,612
R^2	.1057	.1057	.1083	.1083	.1188	.1189

Note. Robust standard errors in parentheses; Estimates of exposure variables are divided by 10^2
***$p < 0.01$. **$p < 0.05$. *$p < 0.1$.

2) Estimates from probit models are not qualitatively different. For convenience of interpretation we only report estimates of linear probability models. The results for probit models are available upon request.

As reported in the first column, those who are exposed to DTCA are more likely to engage in regular exercise. However, the effect of DTCA exposure becomes negative for those who have any of the four chronic conditions. More specifically, the coefficients in column 1 show that exposure to ten advertisements is associated with 0.09 percentage point increase the probability of exercising regularly for those who do not have any of the four chronic conditions. For those people that have at least one of the four chronic conditions when they are exposed to ten advertisements, the likelihood of exercising regularly reduces by 0.001 percentage points. As shown in Table 3 the impact of DTCA exposure itself on diet control is not statistically significant but for those who have at least one of the four chronic conditions, the impact of DTCA exposure becomes positive. This implies that when they are exposed to more advertisements, the likelihood of controlling diet increases.

There are some variations by chronic conditions. Looking at DTCA exposures by each therapeutic class, the first and second columns in Table 4 show that exposures to cholesterol reducing drug and weight loss drug advertisements increase the propensity to exercise, whereas exposure to diabetes drug advertisements lowers the propensity to exercise. Specifically, exposure to ten cholesterol reducing drug advertisements increases the probability of exercising regularly roughly by 0.5 percentage point, and exposure to ten obesity treatment drug advertisement increases the probability of regular exercise by 0.3 percentage point for those who do not have high blood cholesterol or who are not overweight. However, for those who are overweight, the effect of obesity treatment drug advertising exposure reduces the frequency of exercise. In summary, Tables 3 and 4 suggest that those who have chronic conditions are more likely to substitute to prescription drug rather than exercising after being exposed to DTCA.

In Table 4, exposure to ten cholesterol reducing drug and obesity treatment drug advertisements increases the probability of controlling diet by 0.2 percentage points and 0.7 percentage points respectively for those who do not have these conditions. Exposure to diabetes treatment drug advertisements lowers the likelihood of controlling diet. Exposure to DTCA lowers the probability of controlling diet for those who have hypertension.

To check whether exposure to advertisements has any

Table 4.
Selected coefficients: linear probability model and OLS estimates of health behaviors using disease specific DTCA exposures and interactions with chronic conditions

	Exercise	Ex.Frequency	Diet Control
Cholesterol Ad	.0492***	.1787***	.0200*
	(.0127)	(.0485)	(.0116)
Hypertension Ad	.0878	.3372	.0066
	(.0842)	(.3231)	(.0769)
Diabetes Ad	− .0569***	− .2380***	− .0482***
	(.0173)	(.0654)	(.0156)
Obesity Ad	.0331**	.0926*	.0735***
	(.0147)	(.0560)	(.0135)
Cholesterol Ad*High cholesterol	.0095	.1006	.0252
	(.0172)	(.0660)	(.0161)
Hypertension Ad*Hypertension	− .0337	− .6713	− .5449***
	(.1360)	(.5164)	(.1230)
Diabetes Ad*Diabetes	.0052	− .0002	− .0019
	(.0240)	(.0909)	(.0237)
Obesity Ad*Obesity	− .1092	− .4177*	− .0204
	(.0673)	(.2321)	(.0662)
Obs.	92,690	91,618	90,612
R^2	.1059	.1085	.1185

Note. Robust standard errors in parentheses; Estimates of exposure variables are divided by 10^2
***$p < 0.01$. **$p < 0.05$. *$p < 0.1$

Table 5.
Selected coefficients: linear probability model and OLS estimates of health behaviors using disease specific DTCA exposures and interactions with prescription drug takers

	Exercise	Ex.Frequency	Diet Control
Cholesterol Ad	.0470***	.1741***	.0251**
	(.0126)	(.0482)	(.0117)
Hypertension Ad	.0928	.3481	.0599
	(.0830)	(.3185)	(.0764)
Diabetes Ad	− .0581***	− .2430***	− .0490***
	(.0172)	(.0653)	(.0157)
Obesity Ad	.0347**	.0989*	.0670***
	(.0147)	(.0560)	(.0136)
Cholesterol Ad*High cholesterol medication taker	.0327	.1689**	.0231
	(.0206)	(.0789)	(.0199)
Hypertension Ad*Hypertension medication taker	− .0871	− 1.0162*	− .5269***
	(.1485)	(.5514)	(.1370)
Diabetes Ad*Diabetes medication taker	.0160	.0556	.0001
	(.0281)	(.1051)	(.0270)
Obesity Ad*Obesity medication taker	− .0906	− .0708	− .1708
	(.2296)	(.8405)	(.2060)
Obs.	92,690	91,618	90,612
R^2	.1059	.1083	.1051

Note. Robust standard errors in parentheses; Estimates of exposure variables are divided by 10^2
***$p < 0.01$. **$p < 0.05$. *$p < 0.1$

differential effect on those who are taking prescription medications, Table 5 shows the results from the models that have interaction with prescription medication takers for each disease class. The results shown in Table 5 are similar to Table 4. One difference is for those who are taking cholesterol reducing drugs, DTCA of cholesterol reducing drugs motivates them to increase the number of exercise per week. However, for those who are taking high blood pressure medication DTCA has negative effect on frequency of exercise and diet control.

Finally, to examine whether response to DTCA exposure is different by SES, the results are shown in specification (2) of Table 3. Most of the interactions are not statistically significant, but consistently positive and significant effect is found on those with less education (high school drop outs) on exercise. Specifically ten exposure to DTCA increases the probability of engaging in regular exercise by roughly 0.3 percentage point for those with less education. This implies DTCA works as a reminder for those with less education to exercise regularly. For those who do not have health insurance, the exposure to DTCA lowers the probability of controlling diet. This is puzzling because we expect that the uninsured may choose to control diet rather than taking prescription medication since it is costly to acquire prescription drug if it is not covered by health insurance.

In summary, the results are mixed. Although there are some variations by therapeutic classes but for those who have chronic conditions, DTCA lowers the propensity to exercise but increase the propensity to control diet. For those with high blood cholesterol, they are more likely to exercise regularly after being exposed to DTCA. Individual having other than high blood pressure are more likely to control diet after being exposed to DTCA which imply DTCA may have a reinforcing effect in complying with the treatment.

VI. Discussion

This paper studies the effect of DTCA exposure on consumers' lifestyle change. Using a nationally representative sample of U.S. consumers and an archive of magazine advertisements, it is found that more exposure to DTCA increases the likelihood of engaging in regular exercise for those without chronic conditions, but for those with chronic conditions more exposure lead to less exercise, but more diet control. In addition, the

effect of DTCA exposure varies by therapeutic class. Exposure to DTCA leads to less exercise for those with hypertension and who are overweight, whereas those with high blood cholesterol are more likely to engage in regular exercise. Looking into differential responses by SES, those of less education are more likely to engage in exercise after being exposed to DTCA.

The results of this study are consistent with finding from previous studies as in Yang(2011a) for high cholesterol, and Iizuka and Jin(2007) that DTCA affects those with chronic conditions to exercise less. In conclusion, DTCA may have a moral hazard effect for some segment of people or a reinforcing effect of therapeutic lifestyle change on another segment of people. Consistent with Murray et al.(2004), DTCA may be beneficial for those with less education in promoting health behavior. The results from this study imply that DTCA may not be that beneficial to public, especially if it causes a moral hazard for those who have chronic conditions. However if DTCA can motivate preventive care for those hard-to-reach segment of the population, it can be beneficial.

This study contributes to the growing literature in studying the effect of DTCA on consumer's healthy lifestyle. Most of the studies have been focused on the effect of DTCA on pharmaceutical demand. However from a consumer's point of view, it is necessary to deepen our understanding on how advertisements may or may not promote health behaviors. This is important for policy makers especially in Korea where extensive debate is on-going in public as to whether they should allow the advertising of prescription drugs directly to consumers. As we see from the case in the U.S., DTCA can be a double-edged sword. If DTCA raises awareness to the public about the symptoms of diseases, availability of treatment and motivates them to start treatment by changing their lifestyle especially for those of low SES, it may be beneficial to start DTCA in Korea. In fact, most of the DTCAs in the U.S. are focused on so called "lifestyle" drugs where chronic conditions are mostly asymptomatic and the benefits of treatment are realized in the future. Hence, advertising can make conditions more salient and motivate consumers to engage in preventive behaviors such as taking a blood test. However, as we find from the results of this study, if DTCA induces those with chronic conditions to switch to prescription drug rather than exercising, providing prescription drug information directly to consumers through advertising has more downside to the public. As a result, should DTCA be allowed in Korea it is important to closely monitor the messages included in the DTCA. Moreover, if it is relevant to the treatment all DTCAs should include a mandatory message of lifestyle change.

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