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The Canadian Optometry Survey: Report on the Utilization of Diagnostic Pharmaceutical Agents by Canadian Optometrists

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ABSTRACT

This study represents the first national survey of optometrists in Canada. A mailed questionnaire was designed and implemented in order to discover how optometrists have reacted to the introduction of diagnostic pharmaceutical agent (DPA) legislation in Canada and to determine what variables are important predictors of DPA use. The data collected were also used to test the null hypothesis that DPA legislation does not affect the use of mydriatic/cycloplegic agents by optometrists. A stratified random sampling procedure was used to select 230 optometrists (roughly 10% of the practicing profession) for inclusion in the study. Over 90% of the subjects completed and returned the questionnaire. A statistically significant and important association was found between mydriatic/cycloplegic drug use and legislation ($p < 0.05$ and odds ratio = 2.18). Legislation, type of practice, age, and optometry school attended were all found to be associated with DPA use.

Key Words: age, cyclopentolate, legislation, questionnaire, tropicamide

One of the more dramatic changes in optometry in recent years has been the introduction of diagnostic pharmaceutical agent (DPA) legislation. In the course of conducting a literature review on optometrists and DPA use, it was discovered that a national survey of optometrists in Canada had

never been conducted and published. This study therefore represents the first national survey of this professional group to date. Because of the lack of available information on demographic and practice characteristics, one of the objectives of this research was to collect sufficient information to construct representative demographic and practice profiles of Canadian optometrists (the findings of which have been submitted for publication to the *Canadian Journal of Optometry*). A second purpose for this survey was to determine if there are any demographic and/or practice variables which are important predictors of DPA use. Because there is reason to assume that legislation is an important predictor of mydriatic/cycloplegic drug use, a hypothesis was developed to test this assumption. In order to study this hypothesis, optometrists in the three Canadian provinces without DPA legislation (Newfoundland, Quebec, and Prince Edward Island) were compared to those practicing in the remaining seven provinces. The final purpose for implementing this survey was to discover how optometrists have reacted to the introduction of DPA legislation in Canada.

METHODS

The majority of ideas and concepts used in the design and implementation of the survey instrument were adopted from five sources, all of which overlap considerably in their methodology.¹⁻⁵ The questionnaire was organized into four sections to collect demographic information, practice characteristics, pharmaceutical agent utilization data, and current views held by optometrists regarding pharmaceutical agent use. The questionnaire (copies of which are available upon request) was pretested, translated into French, and mailed as a bilingual survey to all subjects. An advance notification letter and three follow-up mailings were used to maximize

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the response rate. In addition, all participants were ensured complete confidentiality.

Subjects included in the study were selected randomly from the 1988 edition of the *Optometrist's Desk Reference* which provides an up-to-date roster of optometrists in Canada.⁶ An approximate test for two independent proportions⁷ (a two-tailed test at the 5% significance level) was used to determine the sample size necessary to test the null hypothesis that the presence of mydriatic/cycloplegic drug legislation does not affect the utilization of these agents by optometrists. A stratified random sampling procedure⁸ was used to divide the entire population of optometrists into strata representing each province. A random sample of optometrists was then selected from each stratum. Overall, this sampling procedure resulted in a sample size of 230 optometrists or slightly less than 10% of all optometrists in Canada.

In order to assess the validity of the findings regarding the association between mydriatic/cycloplegic drug use and the presence of DPA legislation, the findings were examined for alternative explanations.⁹ Specifically, evaluations of bias, chance, and confounding were examined as alternative reasons for the observed association between drug utilization and legislation. A χ^2 analysis was used as the test of statistical significance¹⁰ to determine the likelihood that sampling variability or chance could be considered an explanation for the observed association. In order to determine whether other variables in addition to legislation were also predictive of drug use (thus potential confounders to the association between legislation and drug use), a number of χ^2 analyses were performed. Each of the demographic and practice variables investigated by the questionnaire were tested for its association with mydriatic/cycloplegic drug use. In order to control for possible confounding or the possibility that the observed association was due totally or in part to other variables, a multivariate analysis was conducted using logistic regression. Logistic regression was also used to develop a model to predict which variables (demographic and practice) were important in the determination of which optometrists are most likely to use mydriatic/cycloplegic agents. Finally, a comparison was then made between the responses of optometrists who reported using mydriatic/cycloplegic drugs to those who reported never using these agents; χ^2 analyses were used to test for statistically significant differences in responses. A probability level of 0.05 was used to determine statistical significance in all cases. The majority of statistical computations were done using the SYSTAT software package¹¹ with GLIM being used for the logistic regression analysis.

RESULTS

Response Rate

During the course of the study it was discovered that 17 subjects selected for inclusion in the survey

were actually ineligible and were excluded from the analysis (Table 1). One hundred and ninety-two of a possible 213 subjects completed and returned the questionnaire, producing a response rate of 90.1%. Individual provincial response rates ranged from 82.4 to 100.0%.

Hypothesis Testing

In testing the study's hypothesis, the results of the χ^2 test (Table 2) show that there is a statistically significant association between the presence of DPA legislation and the use of mydriatic/cycloplegic drugs by optometrists ($p < 0.05$). The odds ratio associated with this finding was 2.18 and with 95% confidence the true value was determined to lie between 1.18 and 3.99. In other words, legislation is an important variable in the prediction of mydriatic/cycloplegic drug use and the association between these two variables is statistically significant.

Predictors of Drug Usage

A number of χ^2 analyses were conducted to ascertain whether the demographic and practice variables investigated by the questionnaire were also predictors of drug use. The results show that gender, level of university education, population where the practice is located, weeks practiced per year, hours practiced per week, and the time required to

TABLE 1. Summary of survey response.

	No. of Participants
Total questionnaires mailed	230
Total nonresponse	38
Ineligible respondents, excluded from analysis	
Unreachable, mail returned	5
Retired	6
Not in practice during last year	2
Randomly selected twice	1
Deceased	3
Total ineligible	17
Total response	192
Total response rate: 192/230 = 83.5%	
Adjusted response: 192/213 = 90.1%	

TABLE 2. Mydriatic/cycloplegic drug use by legislation.

	Use Drugs	Do Not Use Drugs	Total
Legislation	76 (63.9%)	43 (36.1%)	119 (100%)
No legislation	30 (44.8%)	37 (55.2%)	67 (100%)
Total	106	80	186 ^a
Test statistic	Value	DF ^b	Probability
Yates corrected χ^2	5.618	1	0.018

^a Excludes 6 subjects who did not respond to 1 or both questions.

^b DF, degrees of freedom.

travel to the nearest ophthalmologist were not predictors of drug use ($p > 0.10$) and as such were not considered potential confounders of the association between legislation and drug use. However, the variables age of the optometrist, optometry school attended, and the type of practice (group or solo) were found to be potential confounding factors ($p < 0.05$).

In order to develop a model which would be useful in predicting mydriatic/cycloplegic drug use, the above predictor variables were entered into a logistic regression analysis. When all the predictor variables were fitted into the model, the only variables which remained significant were legislation and the age of an optometrist (indicating that a correlation exists between the age of an optometrist and the variables optometry school attended and the type of practice). The further addition of interaction terms to the model (representing possible effect modifiers) did not help in the prediction of drug use. Therefore, the model which best predicts mydriatic/cycloplegic drug use contains only the variables legislation and the age of the optometrist. The corresponding odds ratio, adjusted for age, was estimated to be 2.75. With 95% confidence, the true odds ratio lies between 1.35 and 5.59. The distribution of mydriatic/cycloplegic drug use by age is shown in Table 3.

Reaction to Drug Legislation

Approximately one-half of all the respondents reported conducting cycloplegic refractions and examinations of the fundus through a dilated pupil themselves. This finding is in general agreement with the 57.0% (106 of 186 responding) who reported ever using mydriatic/cycloplegic drugs. When optometrists were asked "Under normal circumstances who would conduct a cycloplegic refraction on one of your patients?", there was a statistically significant difference between the responses of optometrists 50 years of age and older and those under age 50 years ($p < 0.05$). Just over 62% of optometrists under age 50 years reported conducting cycloplegic refractions themselves compared to only 19.1% of optometrists aged 50 years or more. A similar finding was found with respect to conducting dilated fundus examinations (DFE's). Over 55% of optometrists under age 50 years reported conducting DFE's themselves, whereas only

19.1% of optometrists aged 50 years or older reported conducting DFE's; again, this difference was statistically significant ($p < 0.05$).

It was also discovered that optometrists rarely refer patients to other optometrists for either of the above procedures (nearly 95% of respondents reported rarely or never referring these procedures to other optometrists). However, almost 60% of respondents reported at least occasionally referring patients to ophthalmologists for fundus examinations and over 25% reported at least occasionally referring patients to ophthalmologists for cycloplegic refractions.

Over 18% of all respondents indicated that cycloplegic refractions are neither performed nor referred procedures and nearly 13% reported likewise for DFE's. When this finding was examined in terms of the age of an optometrist, a greater proportion of those not performing or referring these procedures were 50 years of age or older.

Current Views

All subjects were questioned on their views regarding drug use by optometrists. The majority of respondents (55.5%) felt that DPA legislation was not adequate in the province where their practice was located; a further 27.8% had mixed feelings. Nearly 84% of optometrists felt that DPA legislation should be standardized across Canada.

All subjects were asked to rate their level of preparation for mydriatic and cycloplegic drug use. Roughly 38% of all optometrists responded that they were not very well or not at all prepared to conduct either of these procedures. Further examination of this finding, by age, revealed that there was a statistically significant difference between the level of preparation reported by those under age 50 years compared to those 50 years of age or older. Seventy-seven percent of optometrists under age 50 years reported being adequately or very well prepared to use mydriatic agents, whereas only 17.0% of optometrists aged 50 years or more rated themselves as being at least adequately prepared. Similarly, 78.7% of respondents under age 50 years reported they were adequately or very well prepared to use cycloplegic drugs in their practice, compared to only 10.6% of respondents aged 50 years and over (Table 4).

When asked if they felt adequately trained to detect peripheral fundus anomalies, only 20.4% of all optometrists thought they were; a further 51.3% reported mixed feelings. When this finding was examined by age, there again was a statistically significant difference in responses reported. Nearly 25% of optometrists under age 50 years reported feeling adequately trained to detect peripheral fundus anomalies in comparison to only 8.5% of optometrists aged 50 years or more (Table 5).

Effects of DPA Utilization on Clinical Practice

When conducting a DFE only 21.4% of optometrists who use DPA's reported always using the

TABLE 3. Mydriatic/cycloplegic drug use by age.

Age (yr)	Use Drugs	Do Not Use Drugs	Total
20-29	26 (78.8%)	7 (21.2%)	33
30-39	49 (70.0%)	21 (30.0%)	70
40-49	21 (58.3%)	15 (41.7%)	36
50-59	4 (28.6%)	10 (71.4%)	14
60-69	4 (15.4%)	22 (84.6%)	26
70 or more	0 (0.0%)	4 (100%)	4
Total	104	79	183 ^a

^a Excludes 9 subjects who did not respond to 1 or both questions.

TABLE 4. Level of mydriatic and cycloplegic drug preparation by age (percent values in parentheses).

Level of Preparation	Age <50 yr		Age 50+ yr	
	M ^a	C	M	C
Very well prepared	33 (23.4)	37 (26.2)	0 (0.0)	0 (0.0)
Adequately prepared	76 (53.9)	74 (52.5)	8 (17.0)	5 (10.6)
Not well prepared	31 (22.0)	28 (19.9)	29 (61.7)	32 (68.1)
Not at all prepared	1 (0.7)	2 (1.4)	10 (21.3)	10 (21.3)
Total ^b	141 (100)	141 (100)	47 (100)	47 (100)

^a M, mydriatic drug use; C, cycloplegic drug use.

^b Excludes 4 subjects who did not respond to 1 or both questions.

TABLE 5. Responses to the question "Do you feel adequately trained to detect peripheral fundus anomalies?"

Response	Age <50 yr	Age 50+ yr
Yes	35 (24.8%)	4 (8.5%)
No	40 (28.4%)	14 (29.8%)
Mixed feelings	66 (46.8%)	29 (61.7%)
Total ^a	141 (100%)	47 (100%)

^a Excludes 4 subjects who did not respond to 1 or both questions.

binocular indirect ophthalmoscope (B10). An addition 23.3% reported using the B10 at least occasionally, whereas the remaining 55.4% reported rarely or never using the B10 when conducting a DFE.

With respect to the length of time optometrists have used diagnostic drugs in their practices, 81.1% reported using them for less than 5 years, of whom 29.3% had used them less than 1 year. Table 6 shows the reported frequency of mydriatic/cycloplegic drug use by optometrists.

Optometrists who reported using mydriatic/cycloplegic agents were posed a number of questions. Only 8.6% of mydriatic/cycloplegic drug users felt that the use of these agents had reduced their patient load, whereas nearly 71% felt that using these agents had either no effect or had even increased the number of patients they examined. It was unclear from the responses whether the use of these drugs had increased or decreased the number of referrals made to ophthalmologists for disease management. Nearly 33% reported an increase in referrals, 25.9% reported a decrease in referrals, and the remaining 41.4% were unsure. However, a greater percentage of optometrists felt that the use of these agents increased the rate of disease detection in their practices (44.8% thought disease detection rates were increased, 24.8% thought they had decreased, and the remaining 30.4% were unsure).

Only 4 of 106 optometrists who reported using mydriatic/cycloplegic agents thought they had encountered some form of adverse drug reaction over

TABLE 6. Frequency of mydriatic/cycloplegic drug use by optometrists in Canada.

Patient Visits	No. of Optometrists		
	No legislation	Legislation	Total
0% (Never use)	37 (55.2%)	43 (36.1%)	80 (43.0%)
1–9%	25 (37.3%)	53 (44.5%)	78 (41.9%)
10–29%	5 (7.5%)	17 (14.3%)	22 (11.8%)
30% or more	0 (0.0%)	6 (5.1%)	6 (3.3%)
Total	67 (100%)	119 (100%)	186 ^a (100%)

^a Excludes 6 subjects who did not respond to 1 or both questions.

the last year (Table 7). A fifth optometrist reported "redness" after the instillation of tropicamide 1.0%. Because we consider conjunctival hyperemia a normal reaction to the use of tropicamide, this report was not included in Table 7.

Comparing DPA Users to Nonusers

A comparison was then made between the responses of all optometrists who reported using mydriatic/cycloplegic agents to all those who reported never using these agents (irrespective of DPA legislation). χ^2 analyses were used to test for statistically significant differences in responses. When questioned on the importance of various factors in preparing them for mydriatic/cycloplegic drug use, the only variable which was significantly different between the two groups was optometry school training ($p < 0.05$). Over 65% of optometrists who reported using mydriatic/cycloplegic agents felt that optometry school training was either moderately or very important in preparing them for DPA use (as opposed to only 34.8% of those not using these agents). However, the majority of all optometrists felt that continuing education workshops, lectures, independent studies, and discussions with peers were also important in preparing them for mydriatic/cycloplegic drug use.

Optometrists were also queried on factors important to their decision whether or not to use mydriatic/cycloplegic agents. Legislation was one variable that appeared to be an important factor for both groups of optometrists. Nearly 89% of all respondents indicated that legislation was either moderately or very important in their decision to use or not to use these agents. Optometrists who use diagnostic drugs reported that improved quality of care and the ability to enhance their professional image were also important factors in their decision to use diagnostic drugs. On the other hand, patient inconvenience, risk of a malpractice suit, and the provincial college of optometrists (the licensing body) appear to have been important factors to those not using these agents. And finally, the expense of drugs and equipment, the time required for the procedures, the ability to attract additional patients, and peer pressure did not appear to be important considerations to the majority of optometrists in making this decision.

TABLE 7. Number of reported adverse reactions to diagnostic agents.^a

Diagnostic Agent	Allergic Conjunctivitis	Fainting	Nausea	Mydriasis >48 h
Cyclopentolate 0.5%	0	1	1	0
Cyclopentolate 1.0%	0	2	1	1
Cyclopentolate 2.0%	0	1	1	0
Tropicamide 0.5%	1	0	1	0
Tropicamide 1.0%	1	0	0	0

^a Four optometrists reported 11 adverse reactions as follows: 1 optometrist reported 7 adverse reactions, 1 optometrist reported 2 adverse reactions, and 2 optometrists each reported 1 adverse reaction.

When the potential side effects of mydriatic and cycloplegic drugs were examined, optometrists who used these agents claimed to be better prepared to deal with angle-closure glaucoma than optometrists who did not use these agents (64.2 and 35.8%, respectively). They also claimed to be better prepared to deal with allergic conjunctivitis and fainting. All differences were statistically significant ($p < 0.05$). No differences were observed concerning potential dislocation of an intraocular lens implant, rise in blood pressure, cardiac arrest, or photophobia ($p > 0.05$). Overall, optometrists felt they were capable of dealing with a rise in blood pressure and photophobia, were not ready to deal with the dislocation of an intraocular lens implant, and were mixed in their feelings regarding cardiac arrest.

DISCUSSION

Response rates, which are an indicator of the representativeness of a sample of respondents, have been studied by a number of researchers.¹²⁻¹⁴ When deciding upon the representativeness of a study sample, researchers vary in their opinions of what constitutes an unbiased sample. This figure has been reported to range anywhere from 75 to 85% depending on the expert cited.¹⁵⁻¹⁷ Given that the overall response rate obtained by this survey was in excess of 90%, it can be stated with reasonable certainty that the bias associated with nonresponse should not pose a threat to this survey's findings. In other words, the results obtained from this survey should in fact be representative of Canadian optometrists in general.

An assessment of the validity of a study's findings should consider whether the observed association was due to alternative explanations, namely bias, chance, or confounding. Because the questionnaire was designed, pretested, and implemented according to standard procedures and the subjects were selected randomly, systematic error or bias should not pose a threat to the validity of our findings. A χ^2 analysis was used to determine the likelihood that sampling variability or chance could be considered an explanation for the observed association between legislation and drug use. A statistically significant association was found to exist between the presence of DPA legislation and mydriatic/cycloplegic drug use ($p < 0.05$). Confounding, the third possible alternative explanation, was controlled in the study by using multivariate analysis

controlling for a number of potentially confounding factors simultaneously. After having adjusted for all the potentially confounding factors there was still a statistically significant association between legislation and mydriatic/cycloplegic drug use ($p < 0.05$).

Although this study shows that an important association exists between legislation and drug use, only 63.9% of optometrists reported using diagnostic pharmaceutical agents in provinces with appropriate legislation. This indicates that there may be other variables which influence whether or not an optometrist will use diagnostic drugs. The logistic regression analysis shows that the age of an optometrist is also an important predictor of drug utilization. From Table 3 it can be seen that only 18.2% of optometrists 50 years of age or more (8 of 44) reported using diagnostic agents. This in contrast to the 69.1% (96 of 139) of optometrists under age 50 years reporting DPA use. Older practitioners (those aged 50 years or more) are significantly less likely to use DPA's than younger optometrists. Table 3 also shows a distinct decline in drug use with increasing age. One possible explanation for this finding is that before 1960 pharmacology courses were not offered as part of the optometry curricula at either of the two Canadian schools of optometry. In fact, when questioned on preparedness for drug use, the only variable that differed statistically between users and nonusers was optometry school training. Those optometrists who were not trained in pharmacology may have elected not to utilize diagnostic agents despite changes in legislation which would permit their use.

The findings from this investigation indicate that the introduction of DPA legislation in Canada has left most older practitioners ill-prepared for mydriatic/cycloplegic drug use and as a result most have elected not to use these agents in their practice. In addition to the age of a practitioner, others have suggested that geographic isolation and working in solo practice are additional risk factors for failing to keep up with changes in professional practice.¹⁸ Geographic isolation was not specifically addressed in this survey but the population where the optometrist's practice was located and the travel time to the nearest ophthalmologist (both of which may be indicators of geographic isolation) were not found to be associated with DPA use. Optometrists working in solo practice were found less likely to use diagnostic agents than optometrists working in

group practice. However, this finding simply reflects the fact that older optometrists are significantly more likely to work in solo practice than younger optometrists ($p < 0.05$). The results of this survey illustrate the importance of targeting older practitioners for additional continuing education courses. These courses should be designed to facilitate the expanding role of the optometrist in providing services to the public.

It is of interest to note that of the 106 optometrists who reported using diagnostic agents, only 4 reported experiencing adverse reactions within the past year. Four types of reactions were reported: fainting, attributed to the use of cyclopentolate; nausea, attributed to both tropicamide and cyclopentolate; allergic conjunctivitis, attributed to tropicamide; and mydriasis lasting longer than 48 h was attributed to cyclopentolate. We are unaware of any reports in the literature which have associated fainting or nausea with the use of cyclopentolate. However, fainting¹⁹ and nausea²⁰ are common anxiety reactions to ocular procedures. Furthermore, adverse systemic reactions to tropicamide are extremely rare²¹ and, as such, it is unlikely that the reporting of nausea was a direct result of its use. We are also unaware of any reports in the literature which suggest that allergic conjunctivitis could result from the use of tropicamide. However, mild transient stinging upon instillation is very commonly encountered with this drug.²² The reported duration of action of cyclopentolate is up to a maximum of 24 h. The observation of mydriasis lasting longer than 48 h may have been due to an idiosyncratic physiological response to the drug. Therefore, it is doubtful that any of the side effects reported by optometrists in this survey would actually qualify as adverse drug reactions to the use of mydriatic and cycloplegic agents.

In conclusion, the hypothesis that the presence of drug legislation does not affect the use of these agents by optometrists was rejected. This particular hypothesis was chosen for investigation inasmuch as legislation appeared to be the most obvious predictor of drug use (the sample size needed to conduct this survey was also based on the testing of this hypothesis). The results of this study show that in addition to legislation, the variables age of an optometrist, optometry school attended, and type of practice (group or solo) were found to have a statistically significant association with DPA use. When these variables were combined in a logistic regression model, it was found that legislation and the age of an optometrist were the only two variables required to predict drug use.

With the passage of time, the observed association between age and mydriatic/cycloplegic drug use will likely change. As older optometrists leave practice, there will be a commensurate rise in the proportion of optometrists who will utilize these DPA's. Because this study was conducted early in the life of pharmaceutical agent use by Canadian optometrists, it may be prudent to conduct a similar

survey in 5 or 10 years hence to see what changes have taken place in the profession.

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REFERENCES

- Berdie R, Anderson JF. Questionnaires: Design and Use. London: The Scarecrow Press, 1986.
- Dillman DA. Mail and Telephone Surveys: The Total Design Method. New York: John Wiley & Sons, 1978.
- Labaw PJ. Advanced Questionnaire Design. Cambridge: Abt Books, 1980.
- Warwick DP, Lininger A. The Sample Survey: Theory and Practice. New York: McGraw-Hill Co., 1975.
- Woodward CA, Chambers LW. Guide to Questionnaire Construction and Question Writing. Ottawa: The Canadian Public Health Association, 1983.
- Canadian Association of Optometrists. Optometrist's Desk Reference 1988. Can J Optom 1987;49(Suppl):73-112.
- Colton T. Statistics in Medicine. Boston: Little, Brown, 1974:163-8.
- Friedman GH. Primer of Epidemiology. 2nd ed. New York: McGraw-Hill Co., 1980:90.
- Hennekens CH. Epidemiology in Medicine. Boston: Little, Brown, 1987:243-323.
- Hennekens CH. Epidemiology in Medicine. Boston: Little, Brown, 1987:248-52.
- Wilkinson L. SYSTAT: The System for Statistics. Evanston: SYSTAT, 1988.
- Cartwright A. Professionals as responders: variations in and effects of response rates to questionnaires, 1961-77. Br Med J 1978;1419-21.
- Rosenfeld AA, Smith CR, Brewster W, Wenegrat AO, Haavik RDK. Increasing questionnaire responses. Letters to the editor. Am J Psychiatry 1979;136:1480-1.
- Lockhart DC. Making Effective Use of Mailed Questionnaires. San Francisco: Jossey-Bass, 1984.
- Gough HG, Hall WB. A comparison of physicians who did or did not respond to a postal questionnaire. J Appl Psychol 1977;62:777-80.
- Last JM, Maxcy-Rosenau Public Health and Preventive Medicine. 11th ed. New York: Appleton-Century-Crofts, 1980:63-4.
- Woodward CA, Chambers LW, Smith KD. Guide to Improved Data Collection in Health Care Surveys. Ottawa: The Canadian Public Health Association, 1982.
- Sanford B, ed. Strategies for Maintaining Professional Competence: A Manual for Professional Associations and Faculties. Toronto: Canadian Scholars Press, 1989:16.
- Terry JE. Diagnostic pharmaceutical agents: clinical uses. In: Terry JE, ed. Ocular Disease: Detection, Diagnosis, and Treatment. Springfield, IL: Charles C Thomas, 1984:39-77.
- Knauer CM, Silverman S. Alimentary tract and liver. In: Schroeder SA, Krupp MA, Tierney LM, eds. Current Medical Diagnosis and Treatment. Norwalk: Appleton & Lang, 1988:342.
- Newcomb RD, Ransom FG. Adverse systemic effects of ocular drug therapy. In: Bartlett JD, Jaanus SD, eds. Clinical Ocular Pharmacology. Boston: Butterworths, 1984:945.
- Yolton DP, Kandel JS, Yolton RL. Diagnostic pharmaceutical agents: side effects encountered in a study of 15,000 applications J Am Optom Assoc 1980;51:113-7.

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