

# Contact lenses purchased over the Internet place individuals potentially at risk for harmful eye care practices

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## KEYWORDS

Vision;  
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Commerce, Fairness  
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## Abstract

**BACKGROUND:** Individuals are increasingly purchasing contact lenses over the Internet. No studies exist regarding Internet purchase of contact lenses and eye care health practices.

**METHODS:** One hundred fifty-one college students were surveyed regarding contact lenses purchase category (doctor's office, store, Internet). Pearson chi-square analyses compared purchase category with responses regarding U.S. Food and Drug Administration (FDA) recommendations for purchasing contact lenses online. Analysis of variance compared contact lenses purchase category with the Time Pressure Scale (TPS). Also, correlation analyses compared the TPS with Internet eye-health statements.

**RESULTS:** Contact lens purchase categories included doctor's office (43.0%), store (55.0%), and Internet (22.5%), with individuals purchasing at multiple venues. With regard to the FDA recommendations, those who purchased contact lenses at a doctor's office more often adhered to the recommendations, whereas those who purchased contact lenses at a store or the Internet did so less often. Those who purchased contact lenses over the Internet had significantly higher TPS scores. In addition, higher TPS scores were significantly correlated with various statements regarding the Internet.

**CONCLUSIONS:** Those who purchase contact lenses via the Internet or store do not follow a number of FDA contact lenses recommendations. Also, those with higher TPS scores trust possible non-evidence-based contact lenses Internet information. Implications with regard to the Fairness to Contact Lens Consumers Act are discussed.

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Among the approximately 298 million individuals who live in the United States, about 145 million individuals depend on different forms of vision corrective lenses.<sup>1</sup> In the Beaver Dam study,<sup>2</sup> myopia was found to be most prevalent among those aged 43 to 54 years (42.9%) and decreased in prevalence among the different age groups of increasing age to as low as 14.4% among those aged 75

years or older. Hyperopia had the reverse pattern in which prevalence was the least among those aged 43 to 54 years (22.1%) and increased to as high as 68.5% among those aged 75 years or older. There are between 26 and 38 million individuals in the United States who wear contact lenses.<sup>1,3</sup> In an analysis by age category, prevalence of contact lens use included 2.2 million individuals aged 13 to 17 years, 13.2 million individuals aged 18 to 34 years, and 13.2 million individuals aged 35 to 64 years.<sup>3</sup>

The Internet can be used for a variety of reasons, including health information and support and online purchases of health products. Many individuals use the Internet to obtain

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health information. One survey conducted in 2001 found that 40% of U.S. adult Internet users used the Internet for information or advice regarding health care.<sup>4</sup> Another survey conducted in 2006 found that 79% of Internet users aged 18 to 29 years looked on the Internet for health information.<sup>5</sup> With regard to using the Internet for support, 6% of adults with Internet access used e-mail to contact a health care provider.<sup>4</sup> Also, 20% of adult Internet users used the Internet to help cope with their illness.<sup>6</sup>

Besides health information, the Internet has transformed the shopping experience. A greater percentage of U.S. Internet users report the Internet as improving their shopping ability (41%) more than the way that they obtain health information (38%).<sup>7</sup> Contrasted with a physical shopping environment, the Internet allows for the display of an unlimited variety of products that can be viewed in a short amount of time, thus attracting shoppers to buy online.<sup>8</sup> Also, purchasing contact lenses online is becoming increasingly popular. A survey conducted in 2004 indicated that for some consumers, buying contact lenses online has the important advantage of being convenient. It takes time to go to a store, and even multiple trips to a store may be necessary if the store needs to order the desired contact lens prescription. However, for people who live far from a store or have no time to get to a store, purchasing online is a convenient alternative that helps avoid these concerns.<sup>9</sup> In addition, these same concerns can apply to professional settings.

The results of a study commissioned by the Federal Trade Commission showed that, with the exception of the online seller 1-800 Contacts, online sellers of contact lenses were less likely than either hybrid (a store with both an online and offline presence) or offline stores (whether an independent eye care practitioner, optical chain outlet, mass merchandiser, or wholesale club) to sell all the available types of contact lenses. With regard to pricing, the cheapest place to purchase was a wholesale club. However, the online stores had slightly more expensive prices by approximately \$6 for all lenses and nearly similar prices by less than \$2 for toric and multifocal lenses. The purely online stores were approximately \$24 less in price than that of independent eye care practitioners.<sup>10</sup>

Although buying contacts online can be cheaper and more convenient, there are risks involved and, in general, precautions should be taken to ensure that certain Web sites are credible. There are both financial and medical risks as well. A financial risk can include dealing with a reputable company. Precautions include ensuring that the company can be trusted with the credit card information, that the order ships in a timely manner, and that customer service is readily available.<sup>11</sup> Medical risks to the consumer can include not returning regularly to an eye doctor for an eye examination and instead using a noncurrent prescription to obtain replacement contact lenses.<sup>9</sup>

We are unaware of any studies regarding purchasing contact lenses online and how online vendors address whether there is a current prescription. A possible similar situation occurs with e-pharmacies, which have been exten-

sively studied. Purchasing medications online is becoming more common. E-pharmacies are Web sites that sell both prescription and nonprescription medication. In the United States, standard health care involves examining a patient before issuing a prescription. Although prescribing without a physical examination is not illegal, it is strongly recommended by the U.S. Food and Drug Administration (FDA) not to buy from online pharmacies that offer this type of prescription.<sup>12</sup> One study found that of 190 e-pharmacies, 111 required a prescription, 54 provided a prescription upon completion of a questionnaire, and 25 did not even require a prescription at all.<sup>13</sup> E-pharmacies have professional and ethical responsibilities to provide their customers with sufficient information about the medications being purchased. However, in a study in which 104 e-pharmacy Web sites were analyzed for their content, only 60% displayed some health information, and only 42% promoted the availability of a pharmacist's advice, although for many of the Web sites it was difficult to verify if this was a registered pharmacist.<sup>14</sup> Consumers need to be aware of the potential risks involved with purchasing prescription drugs online that include possible bypassing of traditional health safeguards.<sup>15</sup> Similarly, purchasing contact lenses online can have health concerns of (1) possibly not requiring a current contact lens prescription and (2) erroneous information placed on the contact lens merchant's Web site.

Because there are now a number of choices from where to purchase contact lenses, a law called the Fairness to Contact Lens Consumers Act (FCLCA) went into effect in the United States. This law allows for different options for where consumers can purchase their contact lenses. Prescription information is still necessary for contact lens purchases; the eye doctor must provide a copy of the prescription at no charge to the patient. Further, an eye doctor cannot block release of the prescription to another party. Specifically, the law (1) requires prescription release and (2) allows for passive prescription verification. This passive prescription verification can include accepting the consumer's word regarding the prescription details if the eye doctor issuing the prescription does not reply within a certain period of time (i.e., 8 business hours).<sup>9,16</sup>

Time pressure can affect consumer purchases in multiple ways. First, time pressure can indirectly influence online consumers because they can shop independent of store hours.<sup>17</sup> Second, time pressure (having too many things to do) can cause consumers to hesitate before purchasing a product because they think that there is not enough time to adequately research the product that they are considering purchasing.<sup>18</sup> Third, time pressure can affect consumer decision making. There is a social psychological theory that an individual may have 2 different attitudes related to an object. One is an explicit attitude, which corresponds with deliberative and thought-out behavior, and the other is an implicit attitude, which corresponds with spontaneous and uncontrolled behavior. Researchers tested this theory to see which attitude prevails when purchasing a product under time pressure constraints. Participants were asked about

their explicit preferences for brand name products and generic products. They had ample time to decide if they preferred the brand name or the generic product. Using an experimental design, participants were presented with 2 products: brand name and generic. When given the opportunity and time, those who originally preferred the generic products, chose the generic product. When the same decision had to be made under time pressure, participants chose the product that they did not originally prefer.<sup>19</sup>

Our primary aim is to study whether a specific location category of purchasing contact lenses (i.e., doctor's office, store, or Internet) is related to following FDA recommendations for purchasing contact lenses over the Internet. Additionally, we studied the relationship of time pressure attitudes with a number of behaviors and beliefs regarding purchasing contact lenses over the Internet.

## Methods

### Participants and procedures

During September 2006 we surveyed 151 students from Brooklyn College of the City University of New York, a 4-year undergraduate degree-granting institution. This is an inner-city college that has students from a broad range of socioeconomic statuses ranging from those of lower to upper socioeconomic status. Participation was 100% voluntary and the sampling method was a convenience sample in which participants were approached in classes, the cafeteria, library, or other public areas of the college. Inclusion criteria were if participants were students at this college and wore contact lenses. There were no specific exclusion criteria other than not wearing contact lenses. Participants were accrued over this 1-month time period, and the individual collecting the surveys was not blind to the contact lens use status of participants. Out of an eligible consecutive 153 individuals approached, 151 responded for a response rate of 98.7%. Participants completed a questionnaire on topics related to Internet use and contact lenses, time pressure, FDA recommendations for purchasing contact lenses online, demographic items (age, sex, race/ethnicity, and college status), and other items about beliefs and attitudes toward the Internet. Informed consent was obtained, the study was HIPAA compliant, and the study was exempt from Institutional Review Board formal review and approval.

### Measures

**Contact lenses purchase location category.** Participants were asked where they purchased their contact lenses, with options of choosing "yes" or "no" to doctor's office (in person or by telephone), store (in person or by telephone), and Internet (online or by telephone). Category of purchase

was not mutually exclusive, and participants were able to choose "yes" to more than 1 category.

**Internet use questions.** With options of choosing "yes" or "no," participants were asked if they had access to the Internet and whether they discussed information found on the Internet with an eye doctor. In addition, there were 4 questions regarding Internet use and communication, with options categorized into "never" or "ever." Participants were asked if in the past year they "look on the Internet for information or advice about contact lenses or contact lens care," "use e-mail or the Internet to communicate with an eye doctor," "use e-mail or the Internet to communicate with a family member or friend about contact lenses," and if they "use e-mail or the Internet to communicate with other people who wear contact lenses and have concerns like yours." These Internet use and communication questions were modified from those used in a nationally representative Internet general health survey.<sup>4</sup> Also, participants were asked if "in the past year, have you used the Internet to find information on complications due to contact lens wear" with the option of choosing "yes" or "no."

**Time pressure scale.** The Time Pressure Scale is a valid and reliable scale in which higher scores indicate greater time pressure attitudes.<sup>20</sup> It consists of 3 items of, "I am too busy to relax," "I am often juggling my time between too many things," and "the saying, 'so much to do, so little time' applies to me." These items were measured on a Likert-style scale where 1 = strongly disagree and 5 = strongly agree. In this sample, the Cronbach alpha reliability was 0.80.

**Internet beliefs and attitudes.** Participants were asked to respond to the statements: "It takes too long to find eye information on the Internet," "I am sometimes overwhelmed by the amount of contact lens information that I find online," and "I trust *all* the contact lens information that I find on the Internet." These statements were also measured on a Likert-style scale where 1 = strongly disagree and 5 = strongly agree.

**FDA recommendations.** Respondents were asked to answer "yes" or "no" to 11 items regarding recommendations for purchasing contact lenses online that were based on content printed in the FDA Consumer Magazine and also displayed on the FDA Web site.<sup>21</sup> The items were (1) I get an eye examination at least once a year (Note: Although there are some states that allow for a prescription to be valid for 2 years, we retained the 1-year approach recommended by the FDA, as New York State law follows the 1-year prescription approach, and our survey was conducted in New York State.); (2) I have an eye care specialist check to make sure my contact lenses fit properly after purchase; (3) I have an eye care specialist check to make sure my contact lens prescription was filled properly after purchasing them;

(4) When purchasing contact lenses, I request the manufacturer's written patient information for my contact lenses, which often also includes instructions for use; (5) I check to make sure that there were no brand substitutions for my contact lens purchase; (6) Before purchasing, I make sure my contact lens prescription is current; (7) I check to make sure that the contact lenses that I ordered exactly match my prescription; (8) The place where I purchase my contact lenses asks for my eye doctor's name and contact information; and (9) I order my contact lenses from a familiar and reliable place. For these 9 items, "yes" was the desired answer. Two other items were in the reverse direction, where "no" was the desired answer and included (10) I order contact lenses even though my prescription has expired and (11) I buy contact lenses without a prescription.

**Statistical analyses.** Descriptive statistics were calculated for the demographic variables and 11 FDA recommendations. Pearson chi-square analyses were used to compare for each category of purchase the responses to the 11 FDA recommendations for purchasing contact lenses over the Internet. As relevant, either Pearson chi-square or Fisher's Exact test analyses for the 11 FDA recommendations were conducted with the smaller subset ( $n = 123$ ) of those who exclusively purchased at only 1 category. These additional analyses allowed for direct comparisons for each of the 3 purchase categories. Also, Pearson chi-square analyses were conducted by purchase location and for those who searched on the Internet for complications caused by contact lens wear. We also conducted analysis of variance (ANOVA) with the Time Pressure Scale as the dependent variable. In the first set of analyses, the independent variables were category of purchase of contact lenses that were conducted for both the overall sample and the smaller subset. In the second set of analyses, the independent variables were a number of Internet use and communication topics. Both Pearson and Spearman correlations were used to correlate the Time Pressure Scale to various beliefs toward Internet use. Alpha level for significance was at 0.05, and 2-tailed tests were used. SPSS Version 11.5 (Chicago, Illinois) was used for all analyses except for the Fisher's Exact test where Stata/SE Version 9.2 (College Station, Texas) was used.

## Results

**Table 1** shows the sample characteristics. The average age was 21 years (range, 18 to 33 years). With regard to sex, approximately half were women and half were men. Race/ethnicity was varied, where approximately three fourths were white and one fourth nonwhite. Most participants were juniors and seniors. With regard to category of purchase, 43% purchased contact lenses at a doctor's office, 55% purchased contact lenses at a store, and 22.5% purchased contact lenses over the Internet. Everyone had Internet access, whereas a very low percentage (approximately 16%) discussed Internet information with an eye doctor.

**Table 1** Sample characteristics of 151 college students who wear contact lenses

Variable	% (n)	Mean (SD)
Age (y)		21.04 (2.38)
Sex		
Women	53.6% (70)	
Men	46.4% (81)	
Race/ethnicity		
White	76.8% (116)	
Nonwhite	23.2% (35)	
Year in college		
Freshman	8.6% (13)	
Sophomore	9.3% (14)	
Junior	34.4% (52)	
Senior	37.7% (57)	
Other	9.9% (15)	
Category of purchase*		
Doctor's office	43.0% (65)	
Store	55.0% (83)	
Internet	22.5% (34)	
Internet access		
No	0.0% (0)	
Yes	100% (151)	
Discussed Internet information with eye doctor		
No	84.1% (127)	
Yes	15.9% (24)	

SD = standard deviation.

\* Not mutually exclusive.

In addition (and not shown in **Table 1**), among those who purchased contact lenses over the Internet, only 23.5% ( $n = 8$ ) discussed this information with an eye doctor. Also, 18.5% ( $n = 28$ ) purchased contact lenses at multiple location categories. In the subset of those who exclusively purchased contact lenses at 1 category, 36.6% ( $n = 45$ ) purchased at a doctor's office, 48.0% ( $n = 59$ ) at a store, and 15.4% ( $n = 19$ ) over the Internet.

**Table 2** shows the percentages of the 151 college students' beliefs regarding FDA recommendations for purchasing contact lenses over the Internet. For the 4 statements, "I get an eye examination at least once a year," "before purchasing, I make sure my contact lens prescription is current," "I check to make sure that the contact lenses that I ordered exactly match my prescription," and "I order my contact lenses from a familiar and reliable place," more than 70% had "yes" responses. For the statements, "I order contact lenses even though my prescription has expired" and "I buy contact lenses without a prescription," even though more than 70% said "no," the answers were consistent with following the FDA recommendations. For the statements regarding requesting the manufacturer's written patient information and making sure there were no brand substitutions, the respective percentages of those who said "yes" were as low as 27.8% and 35.8%.

**Tables 3, 4, and 5** show the Pearson chi-square analyses for comparing category of purchase of contact lenses with the 11 FDA recommendations for purchasing contact lenses

**Table 2** Percentages for 151 college student beliefs regarding FDA recommendations for purchasing contact lenses over the Internet

FDA item	No % (n)	Yes % (n)
I get an eye examination at least once a year.	23.8% (36)	76.2% (115)
I have an eye care specialist check to make sure my contact lenses fit properly after purchasing them.	55.0% (83)	45.0% (68)
I have an eye care specialist check to make sure my contact lens prescription was filled properly after purchase.	52.3% (79)	47.7% (72)
When purchasing contact lenses, I request the manufacturer's written patient information for my contact lenses, which often also includes instructions for use.	72.2% (109)	27.8% (42)
I check to make sure that there were no brand substitutions for my contact lens purchase.	64.2% (97)	35.8% (54)
Before purchasing, I make sure my contact lens prescription is current.	23.2% (35)	76.8% (116)
I order contact lenses even though my prescription has expired.	73.5% (111)	26.5% (40)
I check to make sure that the contact lenses that I ordered exactly match my prescription.	27.2% (41)	72.8% (110)
The place where I purchase my contact lenses asks for my eye doctor's name and contact information.	33.1% (50)	66.9% (101)
I order my contact lenses from a familiar and reliable place.	12.6% (19)	87.4% (132)
I buy contact lenses without a prescription.	77.5% (117)	22.5% (34)

over the Internet. As shown in Table 3, 4 FDA recommendations were statistically significant, and 1 approached significance when compared with those who did not purchase their contact lenses at a doctor's office. These items included getting an eye examination at least once a year, having an eye care specialist check to make sure the contacts fit properly, having an eye care specialist check that the prescription was filled properly, and to make sure that the prescription is current. These items are all consistent with following the FDA recommendation of having higher percentages for those that purchased at a doctor's office. The reverse-coded item of, "I order contact lenses even though my prescription has expired" approached significance at  $p = 0.052$  with a lower percentage and was consistent with following the FDA recommendation for those who reported that they do purchase contact lenses at a doctor's office. From a clinical perspective it is useful to see a high percentage of 86.2% for an eye examination at least once a year for those purchasing contact lenses at a doctor's office, whereas it is somewhat of concern that only 68.6% of individuals not purchasing contact lenses at a doctor's office had an eye examination at least once each year.

Table 4 shows information for those who purchased contact lenses at a store. Three of the items were significant in the direction contrary to the FDA recommendations. There were significant differences for the item, "I get an eye examination at least once a year." For those who purchased at a store, only 69.9% reported that they get an eye examination, whereas for those who did not buy at a store, a greater percentage of 83.8% reported that they do get an eye examination. Similarly, the other 2 FDA recommendations of making sure that the contact lenses "fit properly" and were "filled properly" also had significantly lower percentages for those who bought at a store than those who did not buy at a store. Besides statistical significance, these lower

percentages should be a concern for clinicians, especially for the great differences in responses for not having an eye care specialist check to ensure that the contact lens prescription was filled and fit properly.

Table 5 shows information for those who purchased their contact lenses over the Internet. Findings for 2 FDA recommendations were contrary to FDA recommendations. First, for the item, "I have an eye care specialist check to make sure my contact lenses fit properly after purchasing them," only 29.4% of those who bought over the Internet reported that they followed this recommendation. However, a much higher and significant percentage (close to 50%) existed for those who did not buy contact lenses over the Internet. Second, for the statement, "I order my contact lenses from a familiar and reliable place," only 76.5% of those who bought over the Internet reported that they followed this recommendation. However, a much higher and significant percentage (90.6%) existed for those who did not buy contact lenses over the Internet. Figure 1 shows the statistically significant items. From a clinical perspective, it is of concern that only 29.4% of those purchasing contact lenses over the Internet have an eye care specialist check to make sure that the contact lenses fit properly after purchase.

Table 6 shows information for the smaller subset of those who exclusively purchased in only 1 category. There were significant differences for the statement, "I get an eye examination at least once a year" where the percentages were highest for doctor's office, next for the Internet, and lowest for a store. The item inquiring about whether an eye care specialist checked to make sure contact lenses fit properly had significant differences with a doctor's office at the highest percentage and much lower percentages for both a store and the Internet. The item inquiring about whether an eye care specialist checked to make sure the contact lens

**Table 3** Responses to 11 FDA recommendations regarding Internet purchases of contact lenses as categorized by purchase of contact lenses at a doctor's office

FDA item	Doctor's office purchase, no (n = 86) % (n)	Doctor's office purchase, yes (n = 65) % (n)	P value
I get an eye examination at least once a year.			0.012
No	31.4% (27)	13.8% (9)	
Yes	68.6% (59)	86.2% (56)	
I have an eye care specialist check to make sure my contact lenses fit properly after purchasing them.			0.011
No	64.0% (55)	43.1% (28)	
Yes	36.0% (31)	56.9% (37)	
I have an eye care specialist check to make sure my contact lens prescription was filled properly after purchase.			0.048
No	59.3% (51)	43.1% (28)	
Yes	40.7% (35)	56.9% (37)	
When purchasing contact lenses, I request the manufacturer's written patient information for my contact lenses, which often also includes instructions for use.			0.481
No	74.4% (64)	69.2% (45)	
Yes	25.6% (22)	30.8% (20)	
I check to make sure that there were no brand substitutions for my contact lens purchase.			0.198
No	68.6% (59)	58.5% (38)	
Yes	31.4% (27)	41.5% (27)	
Before purchasing, I make sure my contact lens prescription is current.			0.048
No	29.1% (25)	15.4% (10)	
Yes	70.9% (61)	84.6% (55)	
I order contact lenses even though my prescription has expired.			0.052
No	67.4% (58)	81.5% (53)	
Yes	32.6% (28)	18.5% (12)	
I check to make sure that the contact lenses that I ordered exactly match my prescription.			0.897
No	26.7% (23)	27.7% (18)	
Yes	73.3% (63)	72.3% (47)	
The place where I purchase my contact lenses asks for my eye doctor's name and contact information.			0.378
No	36.0% (31)	29.2% (19)	
Yes	64.0% (55)	70.8% (46)	
I order my contact lenses from a familiar and reliable place.			0.559
No	14.0% (12)	10.8% (7)	
Yes	86.0% (74)	89.2% (58)	
I buy contact lenses without a prescription.			0.153
No	73.3% (63)	83.1% (54)	
Yes	26.7% (23)	16.9% (11)	

prescription was filled properly had significant differences where the percentages were highest for doctor's office, next for the Internet, and lowest for a store. For the statement, "I order my contact lenses from a familiar and reliable place," there were significant differences, where both the doctor's office and store had percentages in the 90% range while the Internet was much lower at only 68.4%. **Figure 2** shows the statistically significant items. From a clinical perspective it is useful to see a high percentage of 88.9% for an eye examination at least once a year for those purchasing contact lenses at a doctor's office, whereas it is somewhat of concern that only 67.8% of individuals purchasing at a store and 78.9% purchasing over the Internet had an eye examination at least once each year.

Also, 21.2% (n = 32) had searched on the Internet for complications caused by contact lens wear. When comparing this topic with purchase location, there were no significant differences (p = 0.26) for those who purchased at a doctor's office (16.9%) versus those who did not (24.4%), and there were no significant differences (p = 0.30) for those who purchased at a store (18.1%) versus those who did not (25.0%). However, there were significant differences for Internet use (p = 0.02) in that those who purchased contact lenses over the Internet were more likely to look on the Internet (35.3%) versus those who did not (17.1%). Similarly, in the smaller subset of those who exclusively purchased in only 1 category and who had searched on the Internet for complications caused by contact

**Table 4** Responses to 11 FDA recommendations regarding Internet purchases of contact lenses as categorized by purchase of contact lenses at a store

FDA item	Store purchase, no (n = 68) % (n)	Store purchase, yes (n = 83) % (n)	P value
I get an eye examination at least once a year.			0.045
No	16.2% (11)	30.1% (25)	
Yes	83.8% (57)	69.9% (58)	
I have an eye care specialist check to make sure my contact lenses fit properly after purchasing them.			0.015
No	44.1% (30)	63.9% (53)	
Yes	55.9% (38)	36.1% (30)	
I have an eye care specialist check to make sure my contact lens prescription was filled properly after purchase.			0.002
No	38.2% (26)	63.9% (53)	
Yes	61.8% (42)	36.1% (30)	
When purchasing contact lenses, I request the manufacturer's written patient information for my contact lenses, which often also includes instructions for use.			0.692
No	70.6% (48)	73.5% (61)	
Yes	29.4% (20)	26.5% (22)	
I check to make sure that there were no brand substitutions for my contact lens purchase.			0.429
No	67.6% (46)	61.4% (51)	
Yes	32.4% (22)	38.6% (32)	
Before purchasing, I make sure my contact lens prescription is current.			0.495
No	20.6% (14)	25.3% (21)	
Yes	79.4% (54)	74.7% (62)	
I order contact lenses even though my prescription has expired.			0.996
No	73.5% (50)	73.5% (61)	
Yes	26.5% (18)	26.5% (22)	
I check to make sure that the contact lenses that I ordered exactly match my prescription.			0.865
No	26.5% (18)	27.7% (23)	
Yes	73.5% (50)	72.3% (60)	
The place where I purchase my contact lenses asks for my eye doctor's name and contact information.			0.606
No	35.3% (24)	31.3% (26)	
Yes	64.7% (44)	68.7% (57)	
I order my contact lenses from a familiar and reliable place.			0.089
No	17.6% (12)	8.4% (7)	
Yes	82.4% (56)	91.6% (76)	
I buy contact lenses without a prescription.			0.508
No	75.0% (51)	79.5% (66)	
Yes	25.0% (17)	20.5% (17)	

lens wear (n = 26), there were significant differences (p = 0.048) where those who purchased over the Internet were more likely to search the Internet for this information (42.1%) versus a doctor's office (15.6%) or store (18.6%).

Table 7 shows comparisons of the Time Pressure Scale to items about category of purchase and to Internet use and communication preferences. With regard to category of purchase, using ANOVA analyses, those who purchased their contact lenses at a doctor's office had lower mean values on the Time Pressure Scale than those who did not, those who purchased contact lenses at a store did not have any differences in mean values on the Time Pressure Scale compared with those who did and did not, and those who purchased contact lenses over the Internet had greater mean values on the Time Pressure Scale than

those who did not. We also conducted analyses for the smaller subset of those who exclusively had 1 category of purchase (i.e., only doctor's office, store, or Internet, and excluded from the analyses those with 2 or more purchase locations such as Internet and store; data not shown in Table 7). There were significant mean differences in Time Pressure Scale scores, with those who purchased at a doctor's office having the lowest mean (mean = 9.73, SD = 2.45), those who purchased at a store the next highest mean (mean = 10.52, SD = 2.42), and those who purchased over the Internet with the highest mean (mean = 11.79, SD = 2.78). For these analyses, Bonferroni post-hoc tests showed that the doctor's office purchase location significantly differed from the Internet purchase location (p = 0.009). From a clinical perspective it is useful to see

**Table 5** Responses to 11 FDA recommendations regarding Internet purchases of contact lenses as categorized by purchase of contact lenses over the Internet

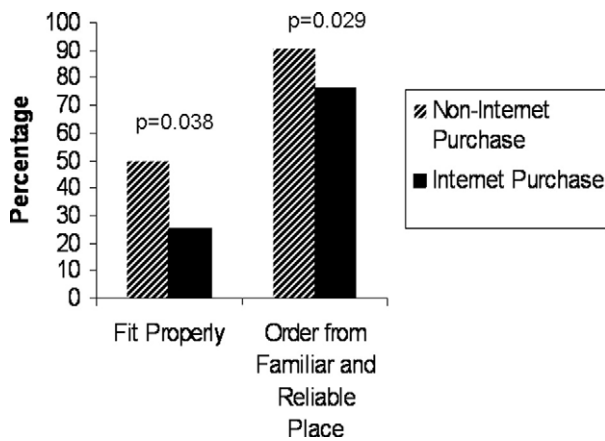
FDA item	Internet purchase, no (n = 117) % (n)	Internet purchase, yes (n = 34) % (n)	P value
I get an eye examination at least once a year.			0.961
No	23.9% (28)	23.5% (8)	
Yes	76.1% (89)	76.5% (26)	
I have an eye care specialist check to make sure my contact lenses fit properly after purchasing them.			0.038
No	50.4% (59)	70.6% (24)	
Yes	49.6% (58)	29.4% (10)	
I have an eye care specialist check to make sure my contact lens prescription was filled properly after purchase.			0.210
No	49.6% (58)	61.8% (21)	
Yes	50.4% (59)	38.2% (13)	
When purchasing contact lenses, I request the manufacturer's written patient information for my contact lenses, which often also includes instructions for use.			0.843
No	71.8% (84)	73.5% (25)	
Yes	28.2% (33)	26.5% (9)	
I check to make sure that there were no brand substitutions for my contact lens purchase.			0.199
No	61.5% (72)	73.5% (25)	
Yes	38.5% (45)	26.5% (9)	
Before purchasing, I make sure my contact lens prescription is current.			0.150
No	20.5% (24)	32.4% (11)	
Yes	79.5% (93)	67.6% (23)	
I order contact lenses even though my prescription has expired.			0.186
No	76.1% (89)	64.7% (22)	
Yes	23.9% (28)	35.3% (12)	
I check to make sure that the contact lenses that I ordered exactly match my prescription.			0.225
No	24.8% (29)	35.3% (12)	
Yes	75.2% (88)	64.7% (22)	
The place where I purchase my contact lenses asks for my eye doctor's name and contact information.			0.117
No	35.9% (42)	23.5% (8)	
Yes	64.1% (75)	76.5% (26)	
I order my contact lenses from a familiar and reliable place.			0.029
No	9.4% (11)	23.5% (8)	
Yes	90.6% (106)	76.5% (26)	
I buy contact lenses without a prescription.			0.274
No	79.5% (93)	70.6% (24)	
Yes	20.5% (24)	29.4% (10)	

that those purchasing at a doctor's office had the lowest Time Pressure Scale scores.

We also analyzed (for the entire sample) the relationship of Internet use to communication preferences. This was done to explore the phenomenon of Internet consumers who may also use the Internet to communicate about contact lens topics, minimizing traditional face-to-face or phone contact. As shown in Table 7, only those who used e-mail or the Internet to communicate with family and friends had greater Time Pressure Scale scores than those who did not use e-mail or the Internet to communicate. Internet information use, eye doctor communication on the Internet, and Internet communication with others with similar contact lenses concerns did not have significant Time Pressure Scale scores

between those who did and did not use the Internet to communicate.

We also conducted Pearson correlation analyses, correlating the Time Pressure Scale with various beliefs about the Internet. These beliefs all met the statistical normality distributions based on the skewness statistic. The item of "it takes too long to find eye information on the Internet" had a significant positive Pearson correlation ( $r = 0.17$ ,  $p = 0.039$ ) but a positive Spearman correlation only approaching significance ( $r = 0.14$ ,  $p = 0.094$ ). Percentage distribution for this item included 22.5% strongly disagree ( $n = 34$ ), 26.5% disagree ( $n = 40$ ), 45.7% neutral ( $n = 69$ ), 3.3% agree ( $n = 5$ ), and 2.0% strongly agree ( $n = 3$ ). The item of "I am sometimes overwhelmed by the amount of contact



**Figure 1** Statistically significant FDA recommendations as categorized by Internet purchase of contact lenses.

lens information that I find online” had a significant positive Pearson correlation ( $r = 0.19$ ,  $p = 0.021$ ) and also a significant positive Spearman correlation ( $r = 0.21$ ,  $p = 0.012$ ). Percentage distribution for this item included 28.5% strongly disagree ( $n = 43$ ), 28.5% disagree ( $n = 43$ ), 31.1% neutral ( $n = 47$ ), 9.9% agree ( $n = 15$ ), and 2.0% strongly agree ( $n = 3$ ). Lastly, the item of “I trust *all* the contact lens information that I find on the Internet” had a significant positive Pearson correlation ( $r = 0.20$ ,  $p = 0.016$ ) and also a significant positive Spearman correlation ( $r = 0.19$ ,  $p = 0.023$ ). Percentage distribution for this item included 39.7% strongly disagree ( $n = 60$ ), 32.5% disagree ( $n = 49$ ), 23.8% neutral ( $n = 36$ ), 2.6% agree ( $n = 4$ ), and 1.3% strongly agree ( $n = 2$ ).

## Discussion

We found that a pattern exists regarding method of contact lenses purchase and following FDA recommendations. Those who bought contact lenses at their doctor’s office followed a number of FDA recommendations more so than those who bought contact lenses elsewhere. In addition, those who bought contact lenses either at a store or over the Internet did not follow a number of FDA recommendations. We found that increasing Time Pressure Scale scores were correlated with a number of potentially harmful beliefs and attitudes about contact lens information such as trusting all information on the Internet. This is potentially harmful because not all information published on the Internet is necessarily accurate and valid.<sup>22</sup> Also, there was a pattern in which those who purchased contact lenses over the Internet had greater Time Pressure Scale scores, whereas those who bought at a doctor’s office had lower Time Pressure Scale scores. It appears that those who purchase contact lenses over the Internet are potentially placing themselves at risk, whereas those who purchase contact lenses at a doctor’s office adhere more consistently with healthy eye care practices.

We saw a pattern in which those who purchased contact lenses at a doctor’s office had higher percentages of following the FDA recommendation of getting an eye examination at least once a year than those who purchased at a store or over the Internet in both the overall sample and in the smaller subset. Regular eye examinations are essential for preventing and detecting vision problems and disorders and also for instruction or for asking questions of one’s eye doctor on proper contact lens handling and care.<sup>23</sup> Eye disorders including corneal infiltrative events<sup>24</sup> and ulcerative keratitis<sup>25-28</sup> can occur by not adhering to proper contact lens handling, care, and use. This provides concern for those who purchase contact lenses at a store or over the Internet because they may not be getting the necessary recommended eye check-up that would otherwise be scheduled if they purchased contact lenses at a doctor’s office.

Similarly, it is recommended by the FDA to have an eye care specialist check to make sure the contact lenses fit properly after purchasing them. We saw a pattern in which those who bought their contact lenses at a doctor’s office followed this recommendation more than those who bought at a store or over the Internet in both the overall sample and in the smaller subset. Although those who purchased at a doctor’s office follow this recommendation the most, the percentages are still moderate. By not following this recommendation, contact lenses consumers can be placing themselves at risk for possible mechanical trauma or complications such as eye infections. This should be a concern for eye doctors, regardless of where patients purchase contact lenses.

With regard to the FDA recommendation of ensuring that the contact lens prescription was filled properly, those who bought their contact lenses at a doctor’s office followed this recommendation more than those who bought at a store or over the Internet in both the overall sample and in the smaller subset. Again, the percentages are quite moderate even for a doctor’s office. It is quite surprising to note that a store purchase is the lowest percentage in both the overall sample and in the smaller subset. It may suggest that not only are there concerns with the “faceless” Internet but also that there are concerns with regard to traditional stores.

Regarding those who purchased contact lenses over the Internet, approximately 75% in the overall sample and approximately 68% in the smaller subset indicated that they bought from a familiar and reliable source. This was less than the approximately 90% reported for contact lenses purchased at either a doctor’s office or store. This is of concern because some Web sites are not credible,<sup>14</sup> and, even if the Web site is credible, accurate health information may not be provided.<sup>29</sup> To determine a Web site’s credibility, one should look for government or professional organization endorsements and discuss the retrieved Internet health information with one’s doctor.<sup>30</sup>

In the analyses for the overall sample when categorized by particular category versus all other categories (*see Tables 3, 4, and 5*), there were clear patterns for a greater percentage of respondents following many FDA recommendations

**Table 6** Responses to 11 FDA recommendations regarding Internet purchases of contact lenses for the smaller subset of those who exclusively purchased at only 1 category

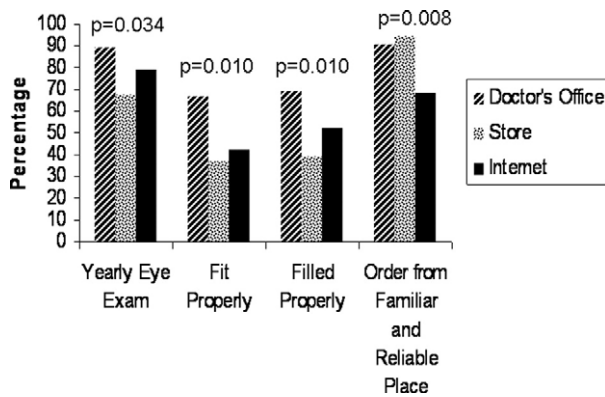
FDA item	Doctor's office purchase (n=45) % (n)	Store purchase (n=59) % (n)	Internet purchase (n=19) % (n)	P value
I get an eye examination at least once a year.				0.034*
No	11.1% (5)	32.2% (19)	21.1% (4)	
Yes	88.9% (40)	67.8% (40)	78.9% (15)	
I have an eye care specialist check to make sure my contact lenses fit properly after purchasing them.				0.010
No	33.3% (15)	62.7% (37)	57.9% (11)	
Yes	66.7% (30)	37.3% (22)	42.1% (8)	
I have an eye care specialist check to make sure my contact lens prescription was filled properly after purchase.				0.010
No	31.1% (14)	61.0% (36)	47.4% (9)	
Yes	68.9% (31)	39.0% (23)	52.6% (10)	
When purchasing contact lenses, I request the manufacturer's written patient information for my contact lenses, which often also includes instructions for use.				0.701
No	68.9% (31)	76.3% (45)	73.7% (14)	
Yes	31.1% (14)	23.7% (14)	26.3% (5)	
I check to make sure that there were no brand substitutions for my contact lens purchase.				0.167*
No	60.0% (27)	64.4% (38)	84.2% (16)	
Yes	40.0% (18)	35.6% (21)	15.8% (3)	
Before purchasing, I make sure my contact lens prescription is current.				0.210
No	13.3% (6)	23.7% (14)	31.6% (6)	
Yes	86.7% (39)	76.3% (45)	68.4% (13)	
I order contact lenses even though my prescription has expired.				0.307
No	80.0% (36)	69.5% (41)	63.2% (12)	
Yes	20.0% (9)	30.5% (18)	36.8% (7)	
I check to make sure that the contact lenses that I ordered exactly match my prescription.				0.893
No	26.7% (12)	25.4% (15)	21.1% (4)	
Yes	73.3% (33)	74.6% (44)	78.9% (15)	
The place where I purchase my contact lenses asks for my eye doctor's name and contact information.				0.983
No	35.6% (16)	37.3% (22)	36.8% (7)	
Yes	64.4% (29)	62.7% (37)	63.2% (12)	
I order my contact lenses from a familiar and reliable place.				0.008*
No	8.9% (4)	5.1% (3)	31.6% (6)	
Yes	91.1% (41)	94.9% (56)	68.4% (13)	
I buy contact lenses without a prescription.				0.671
No	77.8% (35)	78.0% (46)	68.4% (13)	
Yes	22.2% (10)	22.0% (13)	31.6% (6)	

\* Fisher's Exact test used because cell size of less than 5 for 1 cell.

for those who purchased contact lenses at a doctor's office. For both purchases at a store and the Internet, there were a few items each in the direction of not following the FDA recommendations. In the smaller subset consisting of 81.5% of the sample who exclusively purchased at one location, all 3 categories were compared directly with each other (*see Table 6*). For 4 FDA recommendations, there were statistically significant lower percentages. Both store and Internet purchases had lower percentages than a doctor's office purchase. However, for 3 of 4 of the FDA recommendations, the Internet had higher percentages than a store. Does

this indicate that purchasing contact lenses at a store is potentially harmful? The data suggest this possibility.

A few years ago, the FCLCA<sup>9,16</sup> attempted to address the issue of increasing opportunities for consumers to purchase contact lenses at places other than a doctor's office. Partly because of this law, some consumers now purchase their contact lenses from stores or the Internet. As the data from this study show, the potentially lower cost may need to be balanced with consideration for the potential disregard for FDA recommendations to help reduce the risk for harm. One aspect of the FCLCA that prevents doctors from



**Figure 2** Statistically significant FDA recommendations for the smaller subset of exclusively purchasing contact lenses at 1 location.

exclusively selling contact lenses is the passive prescription validation, which specifies that if a doctor does not reply to a request for verification of a contact lens prescription within 8 business hours, a store or Internet merchant can fill the prescription, believing that the prescription is valid. This consumer protection can be a source of potential harm. We suggest an alternative possibility. For those consumers who request their eye doctor to do so, doctors who issue eye prescriptions would be required to enter the prescription information and the date of the prescription into a secure Internet database (whether at the initial prescription date or at a later date). The consumer can then provide the password to the doctor to enter the information and/or to the merchant with whom the consumer seeks to purchase the contact lenses. Only the consumer will have the ability to change the password, which can be done over the Internet or by telephone in a way similar to phone and Internet banking. This way privacy issues will be protected. The consumer will then be able to purchase contact lenses at different places while being unable to use the passive prescription

default that can permit consumers to purchase contact lenses with expired or inaccurate prescriptions. This can enhance adherence to the FDA recommendations.

Consumers who purchased contact lenses at a doctor's office had lower scores on the Time Pressure Scale than those who did not. Those who purchased at a store showed no significant relationship to Time Pressure Scale scores, whereas those who purchased over the Internet had greater scores on the Time Pressure Scale than those who did not. In the smaller subset this pattern appeared too. It appears that those who purchase contact lenses over the Internet are quick to make decisions and take shortcuts. This may allude to the reason why they are not obtaining their recommended eye examinations. In addition, a positive correlation was found between Time Pressure Scale scores and trusting "all" contact lens information found on the Internet. One has to keep in mind that the Internet is also a marketplace,<sup>31</sup> and information that is provided on a commercial Web site is often designed to sell products and services. Similarly, the Time Pressure Scale was positively correlated with the statement "I am sometimes overwhelmed by the amount of contact lens information that I find online." We found that less than 25% of those who purchased contact lenses over the Internet discussed this information with an eye doctor; in essence very few of those who purchase contact lenses over the Internet are benefiting from advice given directly by an eye care professional and therefore may not be making appropriate choices.

Participants who used e-mail or the Internet to communicate with a family member or friend about contact lenses (13.9%) had higher scores on the Time Pressure Scale than those who did not (86.1%). Time Pressure Scale scores were not a significant factor in e-mail or Internet communication with an eye doctor or others with similar eye concerns. This suggests that those who communicate with a family member or friend may look for quick answers and not benefit from

**Table 7** The Time Pressure Scale and comparisons with category of purchase and Internet use and communication preferences

Item	No mean (SD)	Yes mean (SD)	F statistic	P value
Location of purchase				
Doctor's office	10.90 (2.68) (n = 86)	9.89 (2.73) (n = 65)	5.22	0.024
Store	10.34 (2.82) (n = 68)	10.58 (2.68) (n = 83)	0.29	0.594
Internet	10.14 (2.52) (n = 117)	11.61 (3.16) (n = 34)	8.06	0.005
Internet use and communication				
Look on the Internet for information or advice about contact lenses or contact lens care	10.33 (2.69) (n = 100)	10.75 (2.83) (n = 51)	0.77	0.380
Use e-mail or the Internet to communicate with an eye doctor	10.39 (2.77) (n = 141)	11.60 (1.96) (n = 10)	1.83	0.178
Use e-mail or the Internet to communicate with a family member or friend about contact lenses	10.25 (2.74) (n = 130)	11.86 (2.33) (n = 21)	6.48	0.012
Use e-mail or the Internet to communicate with other people who wear contact lenses and have concerns like yours	10.40 (2.75) (n = 139)	11.25 (2.56) (n = 12)	1.06	0.306

Note: SD= Standard Deviation

the expert advice of an eye doctor. This finding would be useful to clarify in future research. Our low number of those communicating by e-mail or the Internet with an eye doctor is not too different from a nationally representative study on Internet use for general health information where low rates of Internet and e-mail communication were also found.<sup>4</sup> Overall, communicating with a doctor about contact lens information or about any other health-related information is an uncommon practice. Internet and e-mail use could be beneficial and have positive influences, yet this probably does not occur for a number of reasons, including liability issues, reimbursement issues, and current attitudes of health care professionals.

We found that only those who purchased over the Internet and not those who purchased at a doctor's office or a store are more likely to look for information on the Internet about complications due to contact lens wear. This was seen in both the overall sample and the smaller subset of those who exclusively purchase at 1 location. However, it is important to keep in mind that we did not ask specifically if consumers were harmed. Also, it is possible that those who purchase contact lenses over the Internet are more likely to search for information for complications on the Internet because they view the Internet as their source for all information for contact lenses. Future research documenting complications and relating it to purchase location would be useful to clarify this topic.

One important point to keep in mind is that the survey inquired about attitudes toward purchasing contact lenses over the Internet. This would most likely measure actual behavior only for those who purchased contact lenses over the Internet. Those who purchased contact lenses at a doctor's office or store are reporting their attitudes as if they were faced by that situation. Their responses are more reflective of their current purchasing behavior (i.e., at a doctor's office or at a store) and not of actual Internet behavior.

Our study has some limitations. First, this includes only sampling of those from 1 location and not necessarily nationally representative. Second, this only reflects those from a particular age group, and those of older ages may have different responses, although the age group sampled is often defined as the core market segment for contact lens purchases.<sup>3</sup> Third, we did not inquire about location of one's primary residence and distance to one's primary eye care provider, which may be related to length of time between eye examinations and the purchase of additional lenses. However, this is likely only a slight possibility, because the college is a commuter school where most students are living at home and it is located in a very large metropolitan area with many eye care providers. Fourth, we did not inquire whether consumers had previously purchased from the place of purchase currently referenced. This may have been the reason for the nonsignificant comparisons with regard to the statement, "The place where I purchase my contact lenses asks for my eye doctor's name and contact information." Fifth, the statement, "I have an

eye care specialist check to make sure my contact lenses fit properly after purchasing them" may not have differentiated between those who made initial purchases of a new type of lens versus those who have already purchased this particular type of lens. The frequently purchased disposable lenses can have a high degree of reproducibility and may not require an eye care specialist to check for proper fit each time. However, this would not be relevant for gas-permeable lenses and other specialty lenses in which it would be very useful to go back and have the fit checked by an eye care specialist each time the lens was ordered. Sixth, access to health care may have an impact on these results, and we did not inquire about this in our survey. Seventh, it is possible that there may be different standards for eye care. Our results did not differentiate for this possibility because we did not inquire with regard to the type of location where items were purchased.

Those who purchase contact lenses over the Internet or at stores could be more at risk for unhealthy eye care practices. Eye doctors should take the time to emphasize to all of their patients about important eye care practices, especially for those who purchase contact lenses over the Internet or at stores. Also, our data suggest that there are some individuals who are not likely to regularly see an eye doctor. Therefore, there should be better monitoring of Internet stores and traditional stores that sell contact lenses to ensure that contact lenses are provided only to consumers with a valid prescription.

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