

THE AVERAGE KNOWLEDGE REGARDING PROPER CONTACT LENS  
COMPLIANCE AMONG SOFT CONTACT LENS WEARERS OF PRIVATE  
PRACTICES IN MICHIGAN

by

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## ABSTRACT

*Background:* To explore the relationship between low compliance rates among soft contact lens wearers among private practices in Michigan and a lack of knowledge regarding soft contact lenses. *Methods:* Established soft contacts lens wearers (n =107-119, the range is due to some participants not answering every question on the survey) from ten private practices in Michigan completed an anonymous 10 question survey pertaining to proper compliance regarding soft contact lenses and previous patient education regarding soft contact lenses. The practices were located in the lower peninsula of Michigan in both rural and urban areas. The data from the survey was analyzed using the Chi-Square Test of Best Fit. *Results:* 7 of the 10 survey questions were statically significant, with 5 of the 7 confirming that the soft contact wearing population of private practices in Michigan understands the proper wear and care protocols of soft contact lenses. *Conclusions:* Low compliance rates among soft contacts lens wearers are not due to the lack of knowledge. Rather, low compliance rates are due to soft contact wearers knowing the proper wear and care protocols for soft contact lenses and choosing not to be compliant.

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## INTRODUCTION

Poor compliance among soft contact lens wearers is a common problem even though advancements in contact lens material and solutions have occurred. The range of non-compliance among contact lens wearers varies from 40 to 91%.<sup>1</sup> The ocular surface is placed at risk with decreased compliance in the care of contact lens. This can result in less than optimal vision, decreased wear time and a variety of eye infections. Eye infections are more prevalent among contact lens wearers as opposed to non-contact lens wearers. Some of these are contact lens related acute red eye, microbial keratitis, contact lens peripheral ulcer and infiltrative keratitis.<sup>3</sup> Poor hygiene with contact lens storage, not following recommended wear and care schedules, and exposure to non-sterile water are the main areas of non-compliance among contact lens wearers.<sup>1</sup> All these reasons may eventually lead to contact lens drop out.<sup>2</sup> Also, not washing hands prior to handling contact lenses has been linked to contact lens complications.<sup>2</sup>

There is a correlation between poor care, improper use of lenses and contact lens related complications.<sup>1</sup> Severe complications can arise from poor soft contact lens compliance such as microbial infections involving a variety of bacteria such as *Acanthamoeba*, *Pseudomonas aeruginosa*, *Serratia* and different varieties of *Staphylococci*. The more common microbe infecting contact lenses is *P. aeruginosa*.<sup>3</sup> These microbes deposit on the lens and then transfer to the ocular surface and break down the corneal epithelium. These types of microbial infections can have cause permanent reduction in vision. Studies have shown that microbes involved in a contact lens related keratitis can be traced back to the contact lens storage case.<sup>1</sup> Lack of compliance with the contact lens case can be due to poor case replacement schedules, not



filling or emptying the case completely with solution or not having a cleaning regimen with the case.<sup>4</sup> Poor replacement schedule of lenses can cause protein deposition on the lenses leading to many avoidable ocular surface diseases like giant papillary conjunctivitis. Some patients may believe they are compliant with contact lens care but studies have shown there is still some level of non-compliance.<sup>2</sup> This form of non-compliance can be over wear of lenses, improper hand hygiene, and overuse of care products. Non-compliance also is dependent on the replacement frequency of the soft contact lens.<sup>5</sup> Two week replacements are known to have the most non-compliance and the second being monthly replacement lenses. Daily replaceable soft lenses have the best compliance among the variety of replacement schedules.<sup>5</sup>

Patient education by the clinician is one of the main ways to improve compliance among soft contact lens wearers.<sup>1</sup> Lack of compliance can be due to variety of factors. One of the reasons can be due to patients not being aware of their poor compliance habits. This may be due to poor contact lens care education by the doctor or a lack of comprehension of instructions by the patient. Another reason for the non-compliance can be due to a poor understanding of the risk factors associated with poor contact lens care. A single entity has not been isolated as the sole cause for poor compliance among contact lens patients.<sup>1</sup> This study will assess if the lack of compliance among soft contact lens wearers is due to a lack of knowledge about proper compliance or if poor compliance is demonstrated even after being aware of the risk.

## METHODS

### Study Population

Eight clinical populations from eight private practices in the lower peninsula of Michigan were used as the population base. In an attempt to correlate with the demographic profile of Michigan, 10 private practices from around the state in both urban and rural areas were asked to participate, however only eight private practices returned completed surveys to the authors. Seven of the private practice had 15 participants and one private practice had 14 participants for a potential total of 119 patients. The practices were instructed that anybody could participate in the survey as long as the participants were established soft contact lens wearers. This study was approved by the Institutional Review Board at Ferris State University.

### Study Procedures

Participants were given a 10 question survey (See Figure 1) pertaining to commonly accepted compliance guidelines amongst optometric practices regarding soft contacts lens wear and care. The commonly accepted guidelines came from the *Clinical Manual of Contact Lenses* by Edward S. Bennett and Vinita Allee Henry as well as from lecture material presented in the OPTM 648 coarse, Contact Lenses I, taught at the Michigan College of Optometry in the spring semester of 2011. The practices were instructed to ask the participants to complete the survey prior to the examination by the optometrist or any patient education by any staff member so as to avoid possibly influencing responses to the survey.

## **Statistical Analysis**

The Chi-Square Test of Best Fit was used to determine if the data from each question was significantly significant. The Chi-Square Test of Best Fit was determined as the best method for analyzing the data because the data was nominal and it would allow the authors determine if the data represented expected results or if the data represented unexpected results, thus being statistically significant. The level of significance was set as of  $p < 0.05$ . Since each question had two responses for the participants to choose between (for question 10 only those who responded yes or no were used in analysis of the data, as question 10 does not pertain to daily soft contact lens wearer) the pure chance of a response being chosen was 50 percent. Therefore, the anticipated expected response for each response to each question was set to be 50 percent of the total responses for a given question.

### Figure 1 - Survey

- This survey is an attempt to understand the knowledge of soft contact lenses wearers, therefore please do not allow these questions to lead you
- Please circle an answer to these questions based solely on your current knowledge of soft contact lenses.

1. You SHOULD NOT swim in your contact lenses

True                  False

2. You SHOULD NOT shower in your contact lenses

True                  False

3. Over-wearing your contact lenses could lead to blindness

True                  False

4. You SHOULD wash your contact lens case with warm soapy water once a week

True                  False

5. You SHOULD replace your contact lens case once a month

True                  False

6. You SHOULD store your contact lenses in new solution every night rather than topping off the old solution in your contact lens case

True                  False

7. You SHOULD use your finger to rub your contact lens in the palm of your opposite hand for 10 to 20 seconds before storing the contact lens in solution overnight

True                  False

8. Were you informed on the proper replacement schedule for your contact lenses by your doctor or an office personal?

Yes                  No

9. Did your doctor or office staff inform you on why it is important to follow the replacement schedule for your contact lenses?

Yes                  No

10. Were you informed on why your contact lenses should not be slept in by your doctor or an office personal?

Yes                  No                  I have contact lenses that are safe to sleep in

**Figure 2 – Raw Data from Surveys**

Question 1: You should not swim in your contact lenses

|            | TRUE** | FALSE | Totals |
|------------|--------|-------|--------|
| Observed   | 66     | 53    | 119    |
| Expected   | 59.5   | 59.5  | 119    |
| Chi Square | 0.71   | 0.71  | 1.42   |

\*Question 2: You should not shower in your contact lenses

|            | TRUE** | FALSE | Totals |
|------------|--------|-------|--------|
| Observed   | 36     | 83    | 119    |
| Expected   | 59.5   | 59.5  | 119    |
| Chi Square | 9.28   | 9.28  | 18.56  |

Question 3: Over-wearing your contact lenses could lead to blindness

|            | TRUE** | FALSE | Totals |
|------------|--------|-------|--------|
| Observed   | 51     | 67    | 118    |
| Expected   | 59     | 59    | 118    |
| Chi Square | 1.08   | 1.08  | 2.17   |

\*Question 4: You should wash your contact lens case with warm soapy water once a week

|            | TRUE** | FALSE | Totals |
|------------|--------|-------|--------|
| Observed   | 45     | 74    | 119    |
| Expected   | 59.5   | 59.5  | 119    |
| Chi Square | 3.53   | 3.53  | 7.07   |

\*Question 5: You should replace your contact lens case once a month

|            | TRUE** | FALSE | Totals |
|------------|--------|-------|--------|
| Observed   | 70     | 48    | 118    |
| Expected   | 59     | 59    | 118    |
| Chi Square | 2.05   | 2.05  | 4.10   |

\*Question 6: You should store your contact lenses in new solution every night rather than topping off the old solution in your contact lens case

|            | TRUE** | FALSE | Totals |
|------------|--------|-------|--------|
| Observed   | 114    | 5     | 119    |
| Expected   | 59.5   | 59.5  | 119    |
| Chi Square | 49.92  | 49.92 | 99.84  |

\*Question 7: You should use your finger to rub your contact lens in the palm of your opposite hand for 10 to 20 seconds before storing the contact lens in solution overnight

|            | TRUE** | FALSE | Totals |
|------------|--------|-------|--------|
| Observed   | 84     | 33    | 117    |
| Expected   | 58.5   | 58.5  | 117    |
| Chi Square | 11.12  | 11.12 | 22.24  |

\*Question 8: Were you informed on the proper replacement schedule for your contact lenses by your doctor or an office personal?

|            | TRUE | FALSE | Totals |
|------------|------|-------|--------|
| Observed   | 119  | 0     | 119    |
| Expected   | 59.5 | 59.5  | 119    |
| Chi Square | 59.5 | 59.5  | 119    |

\*Question 9: Did your doctor or office staff inform you on why it is important to follow the replacement schedule for your contact lenses?

|            | TRUE  | FALSE | Totals |
|------------|-------|-------|--------|
| Observed   | 116   | 3     | 119    |
| Expected   | 59.5  | 59.5  | 119    |
| Chi Square | 53.65 | 53.65 | 107.30 |

\*Question 10: Were you informed on why your contact lenses should not be slept in by your doctor or an office personal?

|            | TRUE  | FALSE | Totals |
|------------|-------|-------|--------|
| Observed   | 97    | 10    | 107    |
| Expected   | 53.5  | 53.5  | 107    |
| Chi Square | 35.37 | 35.37 | 70.74  |

Critical Chi Square value for statistical significance at  $p < 0.05 = 3.841$

Critical Chi Square value for statistical significance at  $p < 0.01 = 6.635$

\*Indicates that the question is statistically significant at  $p < 0.05$

\*\*Indicates the correct answer to the question as determined by the authors

## RESULTS

A total of 10 private practices agreed to participate in this study agreeing to have 15 of their established soft contact lens wearers complete the survey; however only eight practices returned completed surveys. Therefore a total of 150 surveys were released but only 119 surveys were returned for statistical analysis. Also, some questions were not answered by all participants, therefore the sample size (n) ranged from 107-119. Raw data for results of the survey can be found in Figure 2.

Eight of the 10 questions had critical Chi-square values of at least 3.841. Therefore, they met the standards of the Chi-Square Test of Best Fit for being statistically significant at the level of significance where  $p < 0.05$  (See figure 2 for the Chi-Square Test of Best Fit for each question).

Question one, you should not swim in your contact lenses, is not statistically significant as the critical Chi-Square value was 1.42. However, 55.46% of the participants did not know the correct answer and thought it was acceptable to swim in their contact lenses.

Question two, you should not shower in your contact lenses, is statistically significant as the critical Chi-Square value was 18.56. There were significantly more false responses than true responses, which allows the authors to infer that the population at large considers it acceptable to shower in their contact lenses. Furthermore, 69.75% of the participants thought it was acceptable to shower in their contact lenses.

Question three, over-wearing your contact lenses could lead to blindness, is not statistically significant as the critical Chi-Square value was 2.17. Although this question

was not significantly significant, 56.78% of the participants did not know that over wearing contact lenses could lead to blindness.

Question four, you should wash your contact lens case with warm soapy water once a week, is statistically significant as the critical Chi-Square values was 7.07. There were significantly more false responses than true responses, which allows the authors to infer that the general population does not know that they should wash their contact lens case once a week with warm soapy water. 62.18% of the participants did not know that they should wash their contact lens case with warm soapy water once a week.

Question five, you should replace your contact lens case once a month, is statistically significant as the critical Chi-Square value was 4.10. There were significantly more true responses than false responses, allowing the authors to infer that the general soft contact lens wearing population of Michigan does know that a contact lens cases should be replaced once a month.

Question six, you should store your contact lenses in new solution every night rather than topping off the old solution in your contact lens case, is statistically significant as the critical Chi-Square value was 99.84. There were significantly more true responses than false responses, which allows the authors to infer that the population at large does know the standard protocol for replacing their contact lens solution when storing their contacts over-night. Furthermore, 95.80% of the participants knew the correct response to this question.

Question seven, you should use your finger to rub your contact lens in the palm of your opposite hand for 10 to 20 seconds before storing the contact lens in solution overnight, is statistically significant as the critical Chi-Square value was 22.23. There



were significantly more true responses than false responses, which allows the authors to infer that the general population knows how to properly clean their contact. Furthermore, 71.79% of the participants selected the correct response this question.

Question eight, were you informed on the proper replacement schedule for your contact lenses by your doctor or an office personal, is statistically significant as the critical Chi-Square value was 119.00. There were significantly more yes responses than no responses, which allows the authors to infer that the general population has been informed on the proper replacement schedule for their contact lenses. Furthermore, 100% of the participants reported that they were informed on the proper replacement schedule for their contact lenses.

Question nine, did your doctor or office staff inform you on why it is important to follow the replacement schedule for your contact lenses, is statistically significant as the critical Chi-Square value was 107.30. There were significantly more yes responses than no responses, which allows the authors to infer that the population at large has been informed on why it is important to follow the replacement schedule for their contact lenses. 97.48% of the participants indicated that they were informed in the importance of proper replacement of their contact lenses.

Question 10, were you informed on why your contact lenses should not be slept in by your doctor or an office personal, is statistically significant as the critical Chi-Square value was 70.74. There were significantly more yes responses than no responses, which allows the authors to infer that the general population does know why contacts should not be slept in. 90.65% of the participants knew indicated that they were informed on why contacts should not be slept in.

As all of the questions were analyzed using a level of significance value of  $p < 0.05$ , it is interesting to note that if the level of significance was instead  $p < 0.01$ , therefore tightening the criteria for the data to question to be considered significant some question would still be considered statistically significant. The following questions would still be considered statistically significant as their critical Chi-Square values were higher than 6.635: 2, 4, 6, 7, 8, 9, and 10.

## DISCUSSION

The survey can be broken down into two different types of questions, questions that directly addressed the knowledge of the participants, and questions that asked participants about their past education regarding soft contact lenses. Statistical analysis of the 10 survey questions confirmed that the soft contact lens wearing population of private practices in Michigan has the proper knowledge basis for the wear and care of soft contact lenses. As mentioned in the results, eight of the 10 survey questions were statistically significant. Furthermore, the majority of the time, the participants selected the correct answer for these eight survey questions. It is important to note the sample size ( $n$ ) of this survey ranged from 107 to 119, depending on the question being analyzed due to the fact that some participants did not answer every question. The authors do acknowledge that a large sample size is always desirable when conducting statistical analysis and this same survey with a larger sample size could have different statistical results.

Of the eight questions that were statically significant, five of the questions directly addressed the knowledge of the participants. Upon statistical analysis two of these five questions confirmed that the population knew the correct answer. It is

interesting to note that these two questions addressed what would usually be taught to a patient when they are first learning how to care for their lenses during insertion and removal education. Therefore most people should know the correct response. These questions addressed storing contact lenses in fresh solution every night and rubbing soft contacts in solution prior to over-night storage.

Question number four, you should wash your lens case with warm soapy water once a week was significantly significant, but the wrong response was chosen a majority of the time. A possible reason for the lack of knowledge regarding this topic is that the during an insertion and removal patient education session the main goal is to make sure the patient can confidently insert and remove a contact lens. Therefore, the washing of a lens case could be easily overlooked and not properly explained. Also during an insertion and removal patient education session, patients should be informed to only use soft contact lens solution while handling their contact lenses and avoid water. Thus, the participants could have easily assumed that water should not be used on their case.

One question that was statistically significant which allows the authors to infer that the general population does know the correct answer is in question number five, you should replace your contact lens case once a month. This question should be taught during an insertion and removal education session, but similar to the questions that were significantly significant where the wrong response proved to be statistically significant, this educational topic could easily be over-looked during an insertion and removal patient education session. Therefore, it is interesting to note that the population does know the correct response.

It should be noted that the non-statically significant questions that addressed the participants' knowledge were pertaining to issues that again could be easily over-looked during an insertion and removal patient education session. Although they are not statically significant, it should be mentioned that the majority of the participants did not know the correct response to two of these questions. 56.78% of the participants did not know that over-wearing their contact lenses could lead to blindness and 55.46% of the participants did not know that they should not swim in their contact lenses. The authors would like to note that blindness as a result of poor soft lens compliancy is a rare complication. However, it is a reality, for example an infectious corneal ulcer at the visual axis could develop. Blindness could result if not treated properly or if the ulcer does not heal properly with correct treatment.

All three survey questions that pertained to the participants' education of contact lenses were statistically significant. Furthermore, in all three questions the correct response was selected as being statically significant. One question, question number eight, were you informed of the proper replacement schedule for your contact lenses by your doctor or office personal?, had the response "yes" selection 100% of the time. Therefore, it can be concluded that the soft contact lens wearing population of Michigan does know the proper replacement schedule for their lenses, does know the importance of adhering to their replacement schedule, and does know why they should not sleep in their lenses if not fitted in extended-wear contact lenses.

There are many aspects of this study that should be taken into consideration as they could have potentially skewed the data. The authors chose to survey patients of private practices to participate in the study. Therefore, this survey represents the

knowledge of private practice contact lens wearers, and it does not represent the true demographics of all soft contact lens wearers. Often private practice patients are not patients who are shopping around for the best deals available. Rather they stay loyal to their optometrist even though exams and products may be slightly more expensive than commercial offices. Since the increased cost of exams and products often does not drive private practice patients away, it may be reasonable to presume that these patients may have a higher socioeconomic status than patients of commercial practices. It is well known that often a higher economic status correlates with an increase level of education which in the end may have played a role in the soft contact lens knowledge of the participants in this survey. Therefore, authors do acknowledge the fact that the demographics of private practice patients could have skewed the data.

Another factor that might have skewed the data that should be taken into consideration is the fact that the survey did not ask about the participants' compliancy with soft contacts. The questions of the survey only pertained to the participants' knowledge and whether they received patient education. Therefore, it is unknown if the participants were actually compliant contact lens wearers or were not compliant contact lens wearers. Thus, it cannot be definitely stated that the of soft contact lens wearers of private practices in Michigan knows the proper protocols for soft contact lens wear and care. To accurately be able correlate knowledge and compliancy, the survey should have included questions regarding the participants' compliancy.

The participants' understanding and interpretation of the survey questions along with their honesty could have skewed the data as well. For example in regards to question number six, eye care professionals know what the phrase "topping off" means,

but the general population, thus the participants, might not have known what the phrase meant. Also, prior to taking the survey, the patients were instructed to answer the questions using only their current knowledge of soft contact lenses and were asked not to let the questions lead them while making their answers. However, even though these set of instructions were given to the participants, it is impossible to know if the participants answered the questions truthfully. For example, question number five which addressed contact lens case replacement was significantly significant with the right answer chosen a majority of the time. Thus, the authors can infer that the soft contact lens wearing population of private practices in Michigan knows that a contact lens case should be replaced. However, it is impossible to know if the participants selected the right answer because they knew prior to the survey that a case should be replaced or if they allowed the question to lead them into selecting the correct response. It is possible that the participants read the question and thought that since a question was being asked about replacing a case than obviously a case should be replaced and proceeded to select the correct answer.

It is important to look at the results as a whole and apply them to clinical practice, if all the possible factors that could have skewed the data are put aside. Many questions that are important for patient safety had the wrong answer selected a majority of the time. As stated previously, a majority of the participants did not know that soft contact lenses should not be showered in, should not be worn while swimming, that over wearing soft contact lenses could lead to blindness, and that contact lens cases should be washed. As mentioned previously, these areas of contact lens compliancy do not directly relate to contact lens insertion and removal and therefore could easily be missed during a patient

education system. However it is important for optometrist to realize that aside from knowing how to insert and remove a contact lens, their patients, similar to the participants in this study, may not be fully aware of the proper protocols for using soft contact lenses. Therefore, optometrists should consider making slight changes to their patient education system to help ensure that their patients are fully informed and knowledgeable. Optometrists could consider many different ways of presenting patient education such as sending home a sheet of paper that lists the “DOs” and “DON’Ts” of using soft contact lenses. An in-office video of proper compliancy could also be shown to patients. This may stimulate a patient to pay more attention to the material being presented rather than simply listening to an optometrist or staff member speak. Another approach to patient education is presenting pictures of eye infections to patients. This could help reinforce to patients that soft contact lenses should be taken seriously as medical devices and that if not treated properly infections with possible sight treating complications could occur. Finally, as this study only surveyed established soft contact lens wearers, the authors believe it is important for optometrists not to assume that their established soft contact lens wearers know the proper protocols for soft contact use. To help increase the compliancy rates, optometrists should in one form or another provide patient education regarding the proper protocols of soft contact lens use to their established soft contact lens wearing patients annually.

The authors would like to clearly state that this survey was preformed to get to the root cause for poor compliance among the soft contact lens wearing population. This study did not investigate compliancy rates of the soft contact lens wearing population and thus this study is not reporting any new compliancy rates of the soft contact lens wearing

population. If all the possible skewing factors are not taken into consideration, it can be concluded that the soft contact lens wearing population of the private practices in Michigan has the proper knowledge regarding the wear and care of soft contact lenses. Therefore, simply not knowing can not be blamed for non-compliance. Rather, the majority of soft contact lens wearing population does in fact know the proper wear and usage of soft contacts protocols but chooses not to be compliant.

The question must be asked then, why does the population choose to be non-compliant? Are people choosing to be non-compliant because it is harder to be compliant? Is the root cause for non-compliance due to the fact that it is less expensive to be non-compliant? Perhaps, people do not understand the how severe the consequences of being non-compliant could be, as this study revealed that 56.78% of the participants did not know that the misuse of their contacts could lead to blindness. Maybe the blame can be placed on the optometrists prescribing the soft contact lenses. Perhaps, the optometrists are not being as informative as this study suggests. Although this study confirms that optometrists are informing patients of their replacement schedule, on the importance of adhering to the replacement schedule, and why they should not sleep in their soft contact lenses, the exact words and details of education to the patient by the optometrists are unknown. This study does not address why a properly informed population chooses to be non-compliant nor does it investigate what optometrists are specifically telling their patients during soft contact lens patient education session, both of these topics could be investigated in the future so as to help increase compliance rates.



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