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4 **TITLE: THE IMPACT OF COVID-19 ON SOFT CONTACT LENS WEAR IN ESTABLISHED**
5 **EUROPEAN AND US MARKETS**

6

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23 **ABSTRACT**

24 **PURPOSE**

25 To characterise changes in soft contact lens wearing habits during the COVID-19 pandemic

26 **METHODS**

27 A detailed online questionnaire was circulated to individuals aged 40-70 years, during the period April
28 to May 2021. Data sampling took place in the United Kingdom (UK), United States of America (USA),
29 Netherlands, Germany, France, Spain and Italy. Only data pertaining to individuals who were soft
30 contact lens wearers were included. Data were extracted for questions relating to contact lens
31 wearing habits pre- and during the COVID-19 pandemic, and expectations for future lens wear beyond
32 the pandemic.

33 **RESULTS**

34 Seven-hundred and twenty-eight individuals were identified as soft contact lens wearers of which six-
35 hundred and nineteen wore a combination of contact lenses and spectacles. Most respondents
36 indicated contact lens wear times had either remained the same (57.3%) or increased (9.8%) during
37 the pandemic. The country with the greatest proportion of respondents decreasing wear time during
38 COVID-19 was the UK (45.3%), and the least in the Netherlands (20.0%). The primary cause of
39 decreased lens wear was attributed to leaving the home less often (70.0%), and the second most
40 common reason due to concerns about hygiene (10.8%). Most respondents (83.9%), however,
41 expressed a desire to return to pre-pandemic wear times once the pandemic was over.

42 **CONCLUSIONS**

43 Practitioner concerns about contact lens market recovery ought to be assuaged by the survey
44 outcomes which show most individuals to have maintained lens wear during the pandemic. In view of
45 the continued lens wear, as and when restrictions ease, ECPs may wish to encourage patients to
46 return for routine check-ups that may have been missed due to the pandemic.

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49 INTRODUCTION

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51 Since the first case was identified in December 2019, the Severe Acute Respiratory Syndrome
52 Coronavirus-2 (SARS-CoV-2) has spread globally with more than 200 million cases worldwide.
53 Initially the high reproduction rate, compounded by a lack of effective treatments, led to a crippling
54 demand upon many healthcare systems. A severe restriction of social interactions and movement
55 followed. Such 'lockdowns' generally led to a suspension of non-urgent healthcare services, which for
56 some regions included a halt to contact lens fittings.

57 The current COVID-19 status remains that of an ongoing pandemic, in the midst of which a
58 widespread vaccination programme is underway and gradually people are returning to pre-pandemic
59 activities. Yet, in some parts of the world, current circumstance bears little resemblance to pre-
60 pandemic life. Use of personal protective wear, such as face masks, remains commonplace; health
61 care practitioners are required to adapt practices by observing periods of 'fallow' time between
62 patients following any potential aerosol generating procedures (e.g. non-contact tonometry); and
63 despite the reopening of most health services, the threat of new disease variants continues to pose a
64 risk of future lockdowns.

65 The impact of the COVID-19 pandemic on the optical industry has largely manifested itself through
66 negative economic effects; delayed diagnoses and treatments for patients; and a reported increase in
67 conditions such as 'quarantine myopia', digital eye strain, and Mask Associated Dry Eye (MADE) [1-
68 4]. Such challenges have also provided the impetus for change, embodied by the rapid development
69 of new care pathways [5-7], a willingness to embrace telehealth [8-11], and the adaptable response
70 demonstrated by professional regulatory bodies. Suffice to say it has been a period of swift and
71 significant transformation.

72 Amid the initial rush to provide advice, one aspect of the optical industry which suffered from
73 misinformation early in the pandemic is the field of contact lenses. Both general media outlets and
74 public health messaging contributed to erroneous messages dissuading patients from contact lens
75 wear [12-14]. Whether such well-meant but misplaced cautionary messages had a significant
76 influence on contact lens uptake, or if counter health advice managed to placate concerns, remains
77 unknown [15-18].

78 The contact lens industry is estimated to be worth more than sixteen billion US dollars globally, with
79 the USA being the largest contributor, hence a small reduction in global contact lens wear can yield
80 significant economic effects [19]. At present, the impact of the pandemic on contact lens wear has
81 only been assessed for specific countries, with little comparative worldwide data (e.g. [16, 20-21]).
82 Given the different rates at which COVID-19 spread within countries, differences in the duration of
83 lockdowns, disparities in public messaging, and indeed, the availability and adaptability of optical
84 services, it is of interest to characterise the impact of the pandemic on contact lens wear in different
85 geographical regions.

86 Using data acquired through robust market research methods, an analysis is presented of the
87 attitudes and soft lens wearing trends pre- and during the COVID-19 pandemic. The objective of the
88 analysis was to better understand the short-term impact of the pandemic aswell as gather information

89 towards future market directions. Such information should facilitate future resource allocation and
90 help business planning for practitioners, regulatory bodies, and manufacturers.

91

92 **METHODS**

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94 A detailed non-validated online questionnaire was circulated to individuals aged 40-70 years, during
95 the period April to May 2021 to evaluate the views of presbyopic contact lens wearers and individuals
96 interested in lens wear. The project was commissioned by Menicon Co., Ltd and undertaken by an
97 international market research agency. Data sampling took place in the following countries: United
98 Kingdom (UK), United States of America (USA), Netherlands, Germany, France, Spain and Italy. The
99 intention was to include an equal ratio of contact lens users and non-users. All aspects of the
100 questionnaire were translated by a professional translation company and efforts were made to use
101 commonly understood terminology.

102 The questionnaire took approximately 15 minutes to complete.

103 Only data pertaining to individuals who were active soft contact lens wearers or had expressed an
104 interest in wearing contact lenses were included in this analysis.

105 From the broader 5-part 32 question questionnaire, data were extracted for questions relating to
106 general demographics, contact lens wearing habits pre- and during the COVID-19 pandemic, and
107 expectations for future post pandemic lens wear.

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109 **RESULTS**

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111 ***Demographics***

112 Of the 6,465 survey respondents, 2,859 did not require any form of vision correction. 2,066 of the
113 remaining 3,606 respondents were neither contact lens users nor did they express interest in future
114 contact lens use.

115 The remaining 1,540 respondents were spread approximately equally amongst the seven countries
116 (ranging from 215 to 223 respondents per country).

117 From this 1,540, 728 were soft contact lens wearers, with 109 wearers claiming to exclusively wear
118 contact lenses, the remaining 619 wore some combination of contact lenses and spectacles.

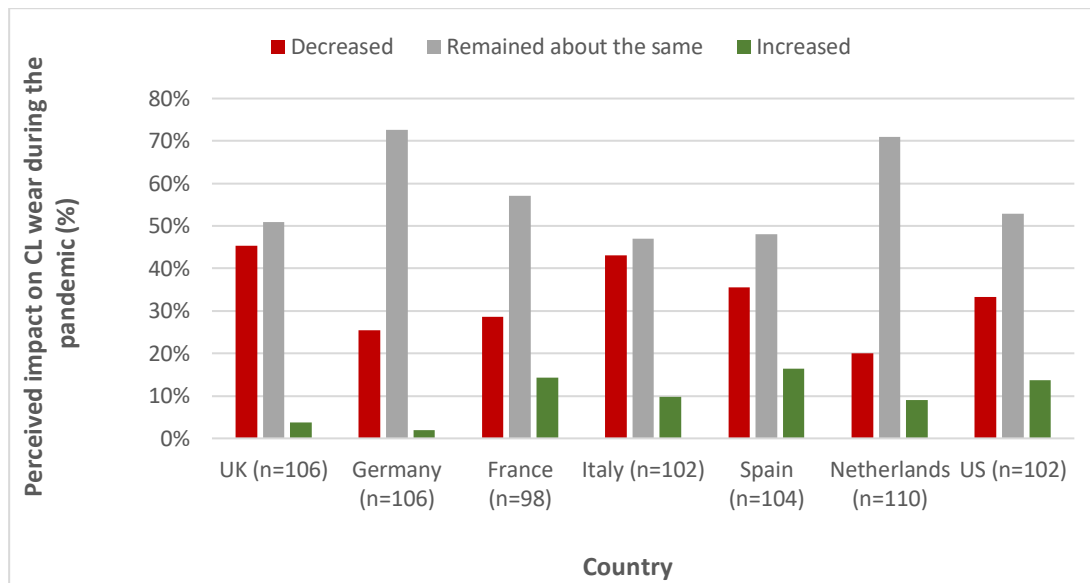
119 The rest either exclusively wore spectacles (n=758), some other form of contact lens (n=14), or a
120 combination of both (n=40). Of the soft lens wearers, 39.4% wore daily disposables; 47.8% wore daily
121 wear reusables; and 12.8% wore extended wear lenses.

122 The present study focusses on individuals wearing a combination of spectacles and soft contact
123 lenses (n=619) and those who exclusively wore contact lenses (n=109). One point of note was the
124 spread of age groups across the different countries; the data from the Netherlands was biased
125 towards the younger (40-54 year old) participants

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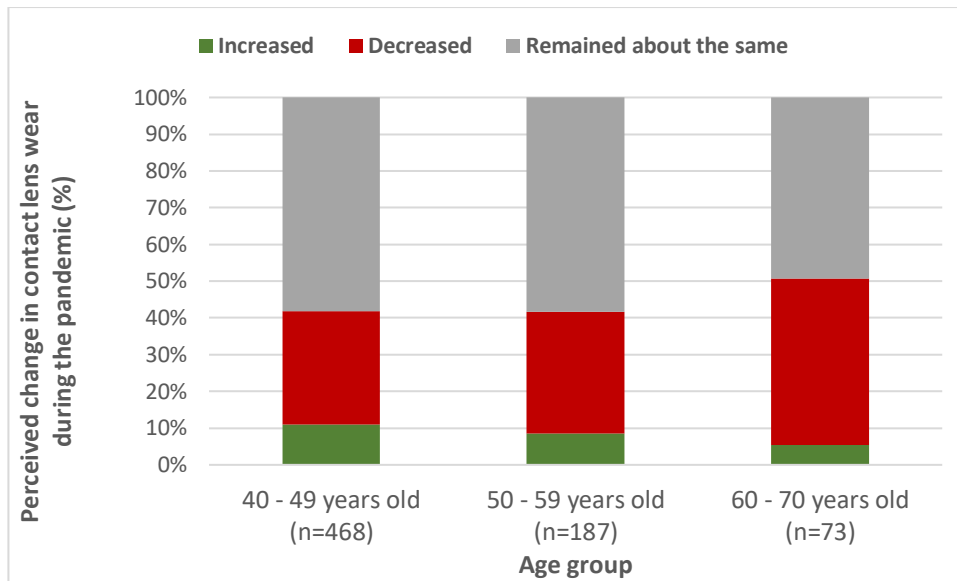
127 ***Perceived change in contact lens wear***

128 Whilst one-third (33.3%, n=240) of respondents felt their contact lens wear had decreased during the
129 pandemic, over half indicated it had remained the same (57.3%) (see Fig 1). The greatest perceived
130 decrease in wear was noted for respondents based in the UK (45.3%) and the least for those based in
131 the Netherlands (20%) (see Fig 1). In Germany and the Netherlands, more than 70% of respondents
132 indicated they had continued with similar contact lens wearing times during the pandemic.
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137 **Figure 1 Respondent perception of whether contact lens wear had increased, decreased, or**
138 **remained the same during the pandemic (n=728); individuals who wore a combination of**
139 **spectacles and contact lenses (n=619) and those who exclusively wore contact lenses (n=109).**
140

141 Of interest are potential differences in contact lens wear, during the pandemic, across different age
142 groups. A larger proportion of participants aged 60-70 years old tended to decrease contact lens
143 wear, and appeared less inclined to increase it, relative to their younger counterparts (see Fig 2).
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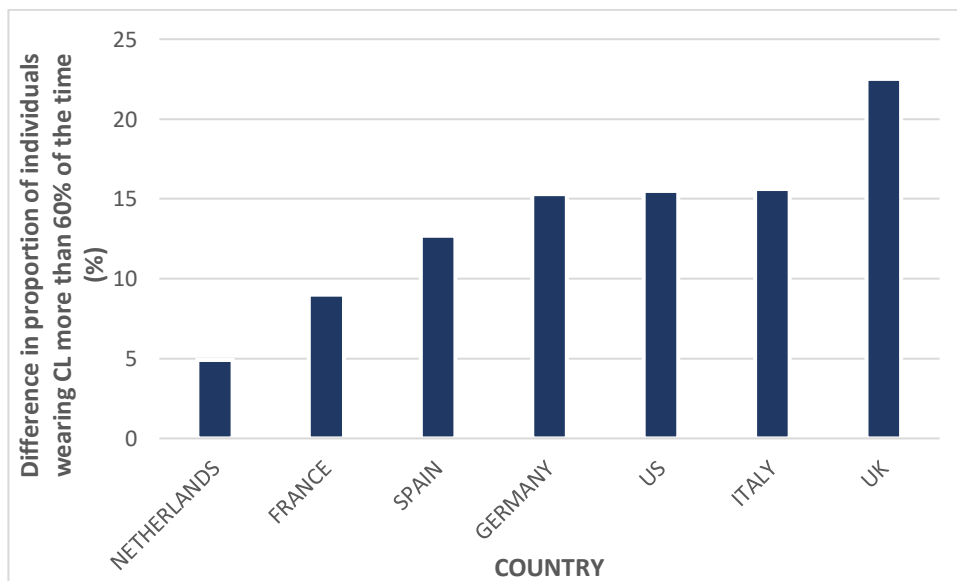
147 **Figure 2 Respondent perception of whether contact lens wear had increased, decreased, or**
 148 **remained the same during the pandemic (n=728); data for individuals who habitually wore a**
 149 **combination of spectacles and contact lenses and those who exclusively wore contact lenses**

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151 ***Pre and during pandemic changes to spec vs. contact lens wearing balance***

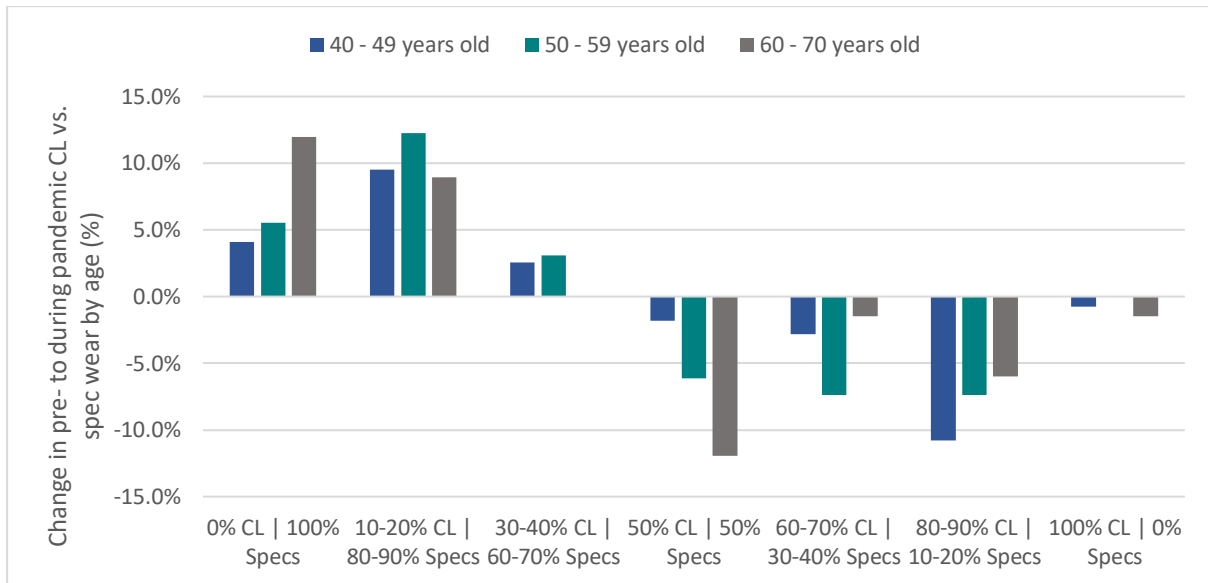
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The overall proportion of global respondents wearing contact lenses for at least 60% of the time was 59.3% (n=367/619) pre-pandemic, reducing to 45.4% during the pandemic. The greatest differences for this specific metric were found amongst respondents from the UK and the lowest for the Netherlands (see Fig 3). The balance between contact lens vs. spectacle wear on a typical day pre- and during the pandemic also showed trends by age, with the greatest shift to spectacle-only wear found amongst the 60–70-year-old age group (see Fig 4). These data do not include 109 individuals who claimed to exclusively contact lenses. The data are presented with the caveat that participants from regions such as the Netherlands were predominantly drawn from younger age groups.



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161 **Figure 3 Country specific data for the decline in proportion of respondents wearing contact**
 162 **lenses for at least 60% of the time, pre and during the COVID-19 pandemic (n=619); data for**
 163 **individuals who wore a combination of spectacles and contact lenses only.**

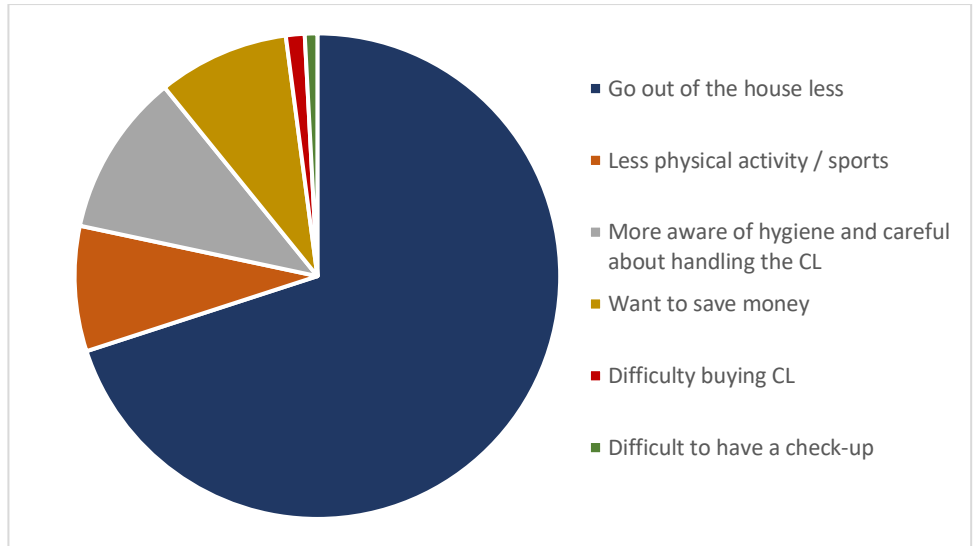


164 **Figure 4 Global age group data for the change in proportion of respondents wearing contact**
 165 **lenses vs. spectacles, pre and during the COVID-19 pandemic (n=619); data for individuals**
 166 **wearing a combination of spectacles and contact lenses. Positive/negative values denote the**
 167 **relative increase/decrease in balance of CL vs. spec wear**

169 ***Reasons for change in contact lens wear***

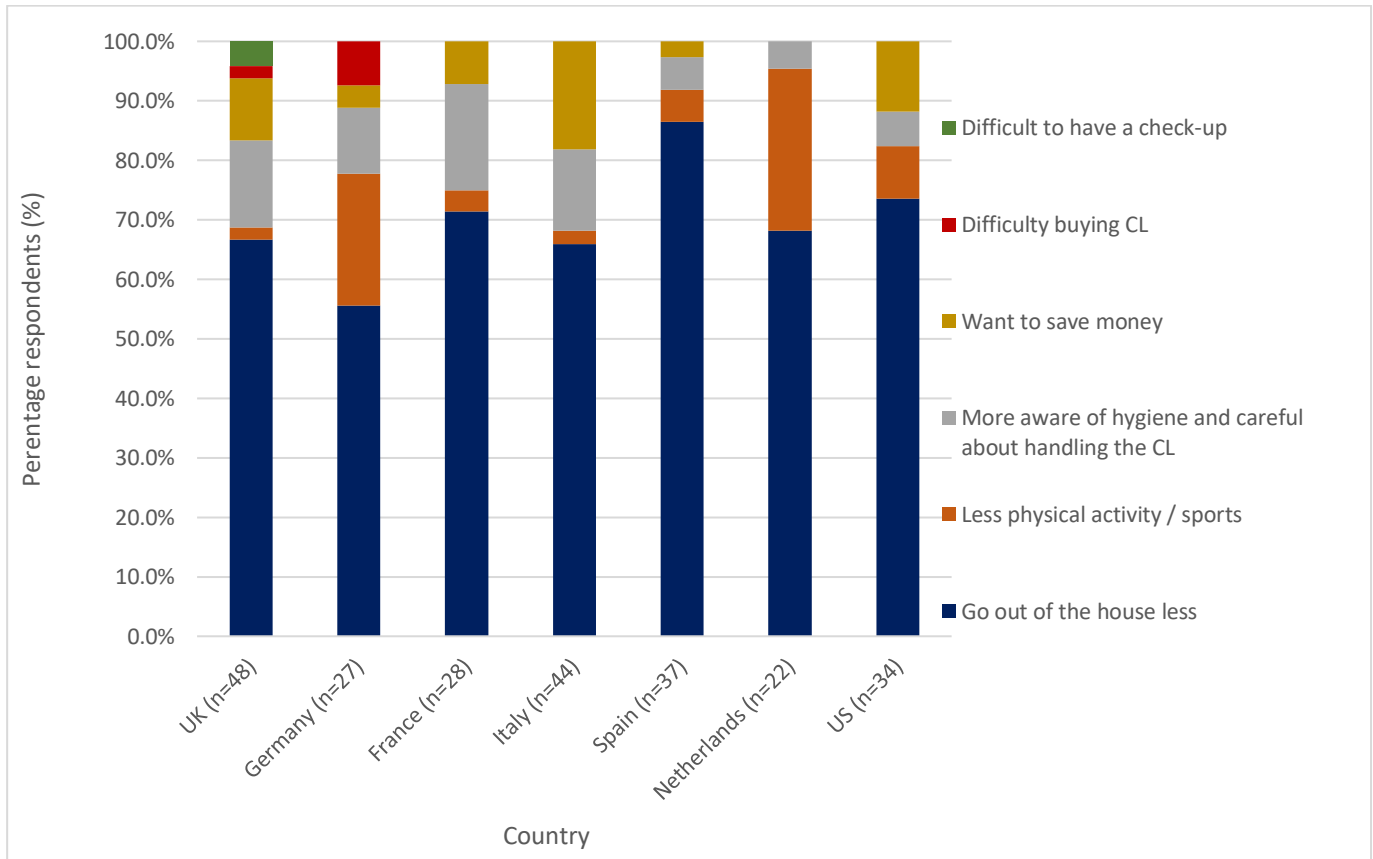
171 The overwhelming majority of respondents indicated the reason for reduction in contact lens wear
 172 during the pandemic was due to leaving the house less often (70%) (see Fig 5); this remained the
 173 most common reason even when individual country data were considered, however inter-country
 174 differences amongst reasons for reduced wear were noted.

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 176 Whilst adoption of a cautious approach due to hygiene was, on average, the second most popular
 177 reason for reducing contact lens wear, such responses were proportionately much lower (10.8%) (see
 178 Fig 6).



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Figure 5 Main reason for reducing contact lens wear during the pandemic from all respondents (n=240)



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Figure 6 Main reason for reducing contact lens wear during the pandemic from all respondents by country (n=240)

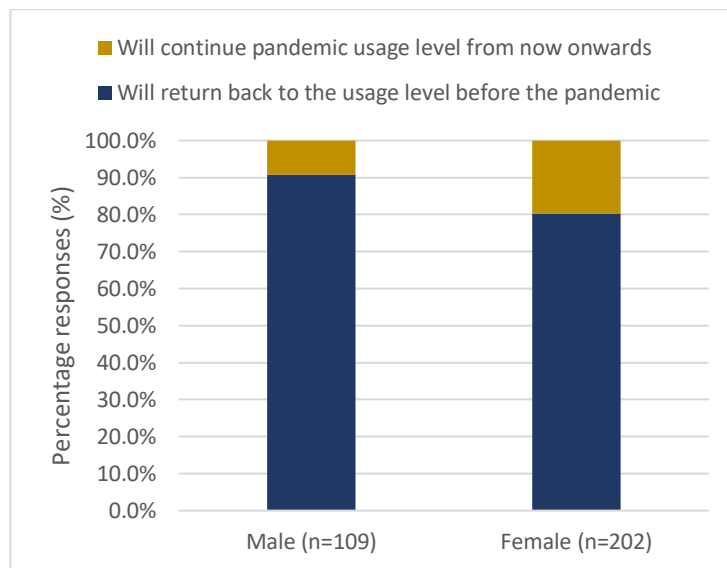
187 ***Expectations for contact lens wear post pandemic***

188 Over 80% of respondents, on average, felt their contact lens usage would return to pre-pandemic
189 levels (n=261 of 311 respondents); whilst this sentiment was also expressed across the country

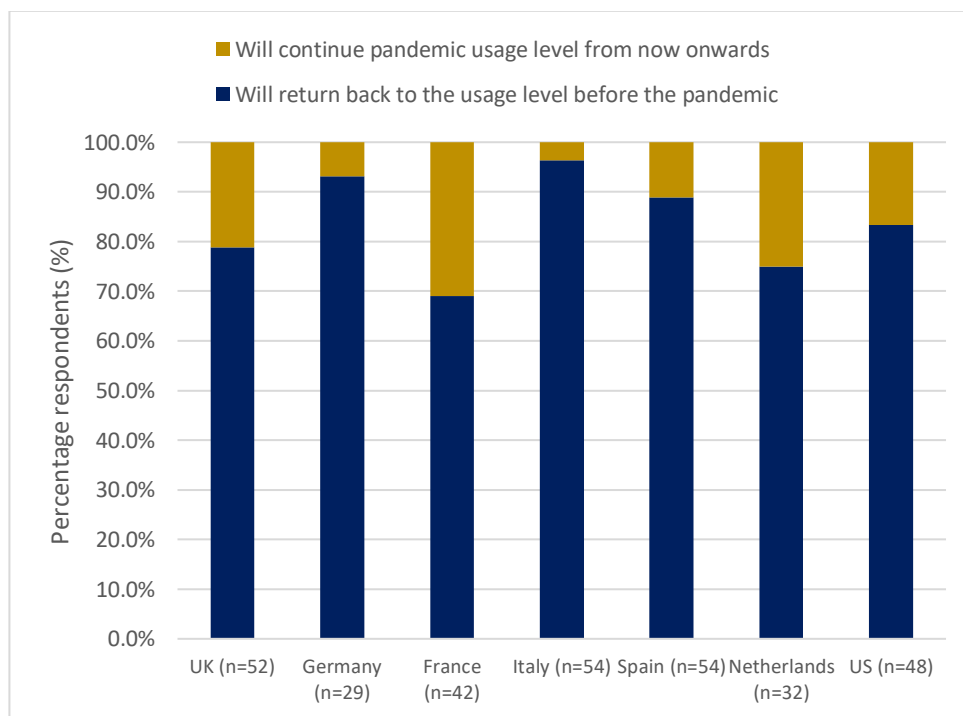
190 specific data, notably almost one-third of respondents from France felt they would maintain the level of
191 contact lens usage adopted during the pandemic (n=13 of 42 respondents).

192 When taking into consideration whether the respondents had indicated an increase or decrease in
193 contact lens wear during the pandemic, those who had increased wear were 2.7 times more likely to
194 indicate they would return to pre-pandemic contact lens wearing levels than not, yet those who had
195 decreased wear were 6.7 times more likely to indicate a return to pre-pandemic levels than not.

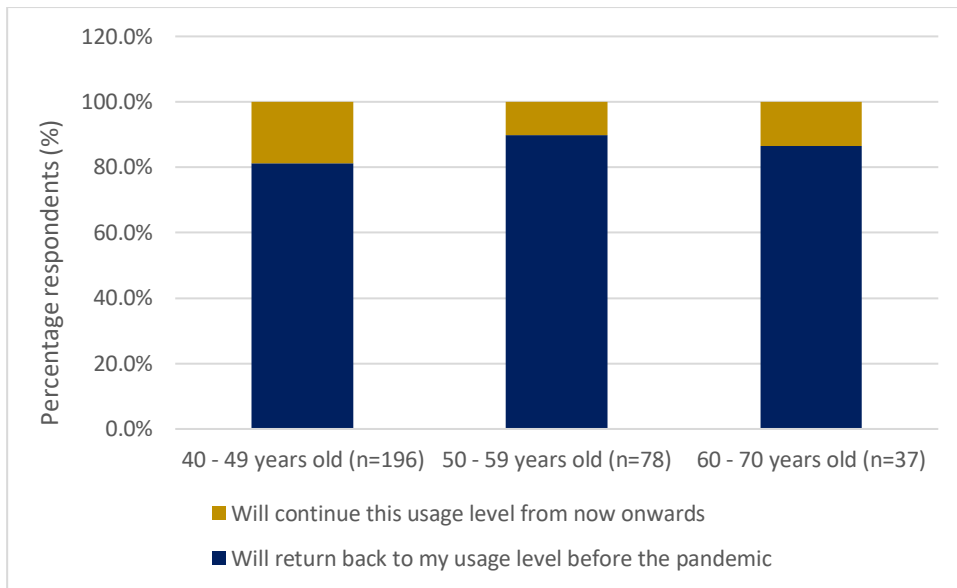
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197 An association appeared to be present between whether an individual was intending to return to pre-
198 pandemic levels of wear and country and, separately, with whether they were males/females, but less
199 clear trends were noted with age group (see Figure 7 - 9).



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201 **Figure 7 Future contact lens wearing intent amongst males and females**



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203 **Figure 8 Future contact lens wearing intent by country**



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205 **Figure 9 Future wearing intent by age group**

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207 **DISCUSSION**

208 Recent studies investigating the impact of the COVID-19 pandemic on contact lens wear have
209 primarily focused on data collection in specific countries. The present study offers new insights
210 characterising lens wear in seven key market areas that have regulated contact lens practice.
211 Encouragingly, ~67% of respondents indicated that wear times had either remained the same or
212 increased during the pandemic, however, an association between changes to wearing patterns and
213 country was noted.

214
215 Whilst it may seem logical to attribute any reduction in lens wear to fears about hygiene or increased
216 infection rate, this was seldom the case. Most individuals were simply leaving home less often, which
217 minimised the need to wear contact lenses. The findings are generally consistent with previous
218 reports undertaken earlier in the pandemic, in the UK, Ireland, Spain, Portugal, Greece and Jordan
219 where a decline in social interactions and activities/leaving home were also cited as common reasons
220 for decreasing lens wear [16]; [21-25]; [20]. Secondary concerns, however, differ both within the
221 cohort investigated and more widely. For example, Figure 6 shows a higher proportion of individuals
222 from areas such as France were worried about hygiene compared to the Netherlands (17.9% vs.
223 4.5%). Separately, a report from Spain has found a significant relationship between participants
224 concerned about risk of contact lens infection and those who ceased contact lens wear during the
225 pandemic [25]. Thus, the data cannot easily be extrapolated between different regions/countries.

226
227 The trend for older individuals to reduce contact lens wear is likely explained by the longer lockdown
228 periods, and thus fewer in-person interactions, to which older population groups were exposed.
229 These data are, however, presented with the caveat that owing to the smaller number of older
230 respondents' caution must be applied when interpreting results (Fig 2 and 4).

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THE FUTURE

In the near future, a multitude of factors could influence eye care practice and demand for services [26-27]. An indication that many respondents who decreased lens wear during the pandemic also expressed a desire to return to pre-pandemic wearing levels, offers a positive signal to those concerned about market recovery prospects [25].

Concerns about contact lens attrition aside, for individuals who continued wearing lenses through the pandemic the possibility of non-compliance and exposure to avoidable risks may have given rise to complications. There have been mixed reports on the efforts made by practitioners to communicate contact lens wearing advice during the past ~18 months [25;22]. While some investigations have reported high levels of adherence to aspects of compliance during the pandemic e.g., better handwashing, others have noted a decline, particularly amongst individuals wearing reusable contact lenses [28;22]. A pre-pandemic study of over two-hundred asymptomatic soft lens wearers found more than half of the participants to exhibit at least one undiagnosed complication when presenting for a routine check-up. In most cases the complication related to the anterior eye or contact lenses [29]. Thus, as always, an absence of symptoms does not imply an absence of complications. Such reports support the need for ECPs to take a proactive approach and encourage patients, even if asymptomatic, to attend for face-to-face routine follow ups.

Further demand for services could arise from patients seeking help for symptoms *experienced* during the pandemic, e.g., an exacerbation of digital eye strain or dry eye syndromes such as MADE [23]. Patients who continue to harbour concerns about hygiene may be tempted to avoid regular replacement lenses in favour of daily disposables [25], and those frustrated by mask induced fogging of spectacles [30]) could perhaps be more motivated to embrace contact lenses. The easing of lockdown restrictions also allows activities favouring contact lens use to recommence which could potentially increase uptake. Of course, such forecasts are speculative, but the potential for new opportunities, coupled with widespread vaccine uptake should facilitate recovery of the contact lens industry.

The data presented are not without limitations; most surveys are subject to recall-bias, but the claims by respondents that lens wear times were reduced due to fewer social interactions is a point indirectly supported by data on initial lockdown durations. Of the countries investigated, parts of the UK were exposed to the longest initial lockdown, whereas the initial lockdown period in the Netherlands was comparatively much shorter. As noted in the results, data from the Netherlands was biased towards individuals who were younger, and this may have impacted some of the responses. A further limitation is that data are restricted to individuals aged 40-70 years. The inclusion of a younger cohort may have proven a useful comparator, since they were typically considered to be at lower risk of serious complications from COVID-19 and thus were subject to fewer lockdown restrictions, their inclusion may have offered an even more optimistic outlook for the contact lens industry.

272

273 In summary, global contact lens wear times reduced for around one-third of respondents during the
274 pandemic, a reduced need to leave home was consistently cited as the key reason for this reduction.

275 Whilst some respondents may have been less inclined to maintain their level of contact lens wear
276 during the pandemic, there is strong indication that many individuals are hopeful about returning to
277 pre-pandemic wear times.

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