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## ORIGINAL ARTICLE

# Opportunities and threats to contact lens practice in Spain

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### KEYWORDS

Survey;  
questionnaire;  
Clinical practice;  
Management;  
Marketing;  
Regulation

**Objective:** An international survey evaluated the opportunities and threats related to contact lens practice reported by eye care professionals worldwide. This study reports on the results specifically found in Spain and how these compare with those from other regions of the world.

**Methods:** A questionnaire was distributed to eye care practitioners around the world through professional associations. The questionnaire consisted of 9, 5 and 12 questions about opportunities, interventions, and potential threats related to contact lens practice, respectively.

**Results:** A total of 2,408 responses were obtained from practitioners worldwide, of which 436 responses were obtained from Spanish practitioners. Spain was found among the regions with the highest perception of opportunities (median: 6.5/10) along with Australasia, North America, Europe, and South America. Spanish (median: 7.3/10), along with South American practitioners, also reported the highest perception of threats. Continuously updating of knowledge/skills, recommending contact lens wearing options to potential patients, creating an efficient recall system for follow-up examinations and being competent in managing contact lens-related complications were reported as important interventions for contact lens practice growth by Spanish eye care practitioners.

**Conclusions:** Spain is one of the regions in the world with the highest perception of both opportunities and threats regarding future contact lens practice. As such, Spanish practitioners consider it important to continuously update knowledge/skills and to recommend and educate patients on the benefits of contact lens wear. Online sales were found to be one of the most important concerns reported by both Spanish and eye care practitioners worldwide.

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## Introduction

The World Health Organisation (WHO) has reported that refractive errors are the leading cause of visual impairment and the second most common cause of visual loss worldwide.<sup>1</sup> Spectacles lenses represent the most popular form for correcting refractive errors. However, contact lenses offer great advantages for correcting refractive errors in comparison to spectacle correction in both adults<sup>2–4</sup> and children<sup>5,6</sup> such as improved self-perception and satisfaction with contact lens correction as well as unrestricted field of view and the absence of prismatic peripheral field distortion. It is estimated that there are approximately 140 million contact lens wearers worldwide,<sup>7</sup> accounting for an estimated global contact lens market in 2021 of US\$9 billion, of which about one third corresponds to the US market alone.<sup>8</sup> In 2021, soft lenses were estimated to account for 86% of all contact lenses fitted worldwide, with the majority of these lenses produced in silicone hydrogel materials (74%).<sup>9</sup> Although the prescription of rigid corneal lenses has been decreasing over the last few decades, the overall prescription of gas permeable lenses has remained constant over time due to the increase in scleral and orthokeratology lens fittings (22% and 19% of all rigid contact lens fittings performed worldwide in 2021, respectively).<sup>9</sup> Despite continuous developments in contact lens materials and designs,<sup>10,11</sup> it is estimated that approximately 20% of contact lens wearers stop wearing lenses each year,<sup>12</sup> with contact lens discomfort, particularly towards the end of the day, being the leading cause of contact lens wear discontinuation.<sup>11,13</sup> The latter has limited the growth of the contact lens industry as the number of patients who discontinue contact lens wear is relatively equivalent to the number of new contact lens wearers coming into the market each year.<sup>14</sup>

Despite contact lenses can provide safe and effective vision correction for patients when prescribed by a qualified eye care practitioner (ECP), increasing number of contact lenses wearers purchase lenses online without practitioner supervision. Failing to wear, clean, disinfect, and store contact lenses as indicated by a qualified ECP can lead to serious eye infection and complications.<sup>15</sup> It has been estimated that the increase in internet sales of contact lenses has led to a five-times greater risk of developing severe and significant corneal inflammatory events.<sup>16</sup> Therefore, the increase in online sales of contact lenses poses a threat to both patients and ECPs worldwide. The latter has resulted in a diversity of opinions regarding the future of contact lens practice. To better understand future opportunities and threats to contact lens practice, a questionnaire was distributed to ECPs worldwide between 2019 and 2020. In this study, daily disposable contact lens wear for conventional use, development of better biocompatible materials, multifocal contact lens for the correction of presbyopia, and myopia control management with contact lenses were reported as major opportunities for contact lens practice growth, whereas lack of regulation of contact lens sales, especially online, was reported as a constant threat. Besides, ECPs confirmed the need to develop and update their professional knowledge and skills, particularly with

regards to the management of contact lens-related complications.<sup>17</sup> This study provides an in-depth evaluation of the results obtained from Spanish practitioners and how these results compare with those reported by ECPs from other regions of the world.

## Methods

### Study design and data collection

The methods used in this study have been described in detail elsewhere.<sup>17</sup> In brief, a survey was developed by the lead study authors after multiple discussions to seek demographics characteristics, type of practice, and practitioners' point of view on the future of their contact lens practice over the next five years. All international study co-authors were invited to provide comments and inputs to the survey as per the situation in their respective countries. The final survey consisted of nine questions about opportunities (i.e., 1. Managing irregular cornea; 2. Multifocal contact lenses for presbyopes; 3. Myopia control; 4. Orthokeratology for myopia correction; 5. Daily disposable for occasional wear; 6. Diagnostic, therapeutic and bionic lenses; 7. Cosmetic lenses; 8. Biocompatible materials to improve comfort; and 9. Custom soft contact lenses to control aberrations and enhance visual acuity), five about interventions (i.e., 1. Continuously updating knowledge/skills of practitioners; 2. Educating parents about the benefits for children to wear contact lenses; 3. Being competent in managing contact-related complications; 4. Making contact lenses more affordable to patients (especially daily disposable contact lenses); and 5. Marketing contact lens practice on social media), and twelve about potential threats (i.e., 1. Lack of regulation; 2. Contact lenses available online without practitioner supervision; 3. Contact lens prescriptions available via digital devices; 4. Clinics without proper instrumentation; 5. Incompetent practitioners; 6. Refractive surgeries; 7. Negative myths about contact lenses among the general public; 8. Advances in the spectacle industry; 9. Commoditization of contact lenses (i.e., not considered as medical devices); 10. Drop out from contact lens wear due to discomfort/dryness; 11. Contact lens-related infections; and 12. Unfavourable industry policies) related to contact lens practice. Each question was rated on a 0 to 10 point-scale where "0" means no concern at all and "10" represents maximum concern. As the survey was designed to quantify the rating for each opportunity, threat and intervention, it included a closed list of items to be assessed. However, at the end of the survey participants were encouraged to share additional comments. The anonymized questionnaire was constructed in English and then translated in six different languages (i.e., Spanish, Italian, French, Korean, Russian, and simplified Chinese). The survey was disseminated through social media and communication platforms (i.e., LinkedIn, Facebook, and WhatsApp) and email to ECPs worldwide. In Spain, the survey was distributed by email by the General Council of the Spanish Opticians-Optometrists to all registered Optician-Optometrists in the country. The results obtained from ECPs worldwide were grouped into six large regions (i.e., Asia, Australasia, Europe [without Spain], North America,

South America, and Middle East) for analysis and comparison with Spain. Additionally, differences in opportunities, interventions and threats with regards to the type of practice in which Spanish practitioners work were also assessed, as well as the potential influence that years of contact lens fitting experience and number of contact lens fittings performed per month might have on the potential opportunities, interventions and threats reported by Spanish practitioners.

### Statistical analysis

Statistical analyses were performed using SPSS 25.0 software (SPSS Inc., Chicago, Illinois, USA). The Kolmogorov-Smirnov Test of normality was used to assess whether the study variables were normally distributed. As all variables were found to be non-normally distributed, the Kruskal-Wallis and Mann-Whitney U tests were used for analysing differences between regions as well as differences in opportunities, intervention and threats reported by Spanish practitioners with regards to the type of practice, and the Spearman's rank correlation coefficient was used for assessing whether the opportunities, interventions and threats reported by Spanish practitioners were influenced by the years of contact lens experience and the number of contact lens fittings performed per month. To evaluate statistical significance, a threshold of  $p \geq 0.05$  was used. For conciseness, only significant comparisons are reported.

## Results

### Subjects' demographics

A total of 2,408 responses were obtained from ECPs from 72 countries across the world: Africa 3.6% ( $n = 87$ ), Asia 32.1% ( $n = 773$ ), Australasia 2.5% ( $n = 60$ ), Europe 35.2% ( $n = 848$ ), Middle East 10.6% ( $n = 256$ ), North America 7.0% ( $n = 169$ ), and South America 8.9% ( $n = 215$ ).<sup>17</sup> Of these, 436 came from Spanish practitioners. All of the respondents from Spain were optometrists, of which 93.9% ( $n = 410$ ) reported working in optometry practices [Local retail chain: 4.3% ( $n=19$ ); Stand-alone practice/independent practice: 70.9% ( $n=309$ ); National or regional retail chain: 18.5% ( $n=81$ ); Cooperative practices: 0.2% ( $n=1$ )], 1.1% ( $n=5$ ) in hospitals, 4.6% ( $n=20$ ) in a university setting and 0.2% ( $n=1$ ) in industry. The mean age of the Spanish optometrists who participated in the study was  $42.2 \pm 10.4$  years (range: 22-70). The majority were female (61.9%,  $n=270$ ); male respondents accounted for about one third (36.2%,  $n=158$ ); and a few participants did not report their gender (1.8%,  $n=8$ ). Spanish ECPs reported having an average length of contact lens-working experience of  $20.8 \pm 24.4$  years (inter-quartile range (IQR): 16; range: 1-31). The average ( $\pm$  standard deviation (SD)) number of new contact lens fittings undertaken per month by Spanish practitioners in naïve contact lens wearers was reported to be  $6.8 \pm 6.3$ , with most contact lenses fitted to these patients being spherical, toric and multifocal designs of soft contact lenses (Fig. 1). Spanish practitioners

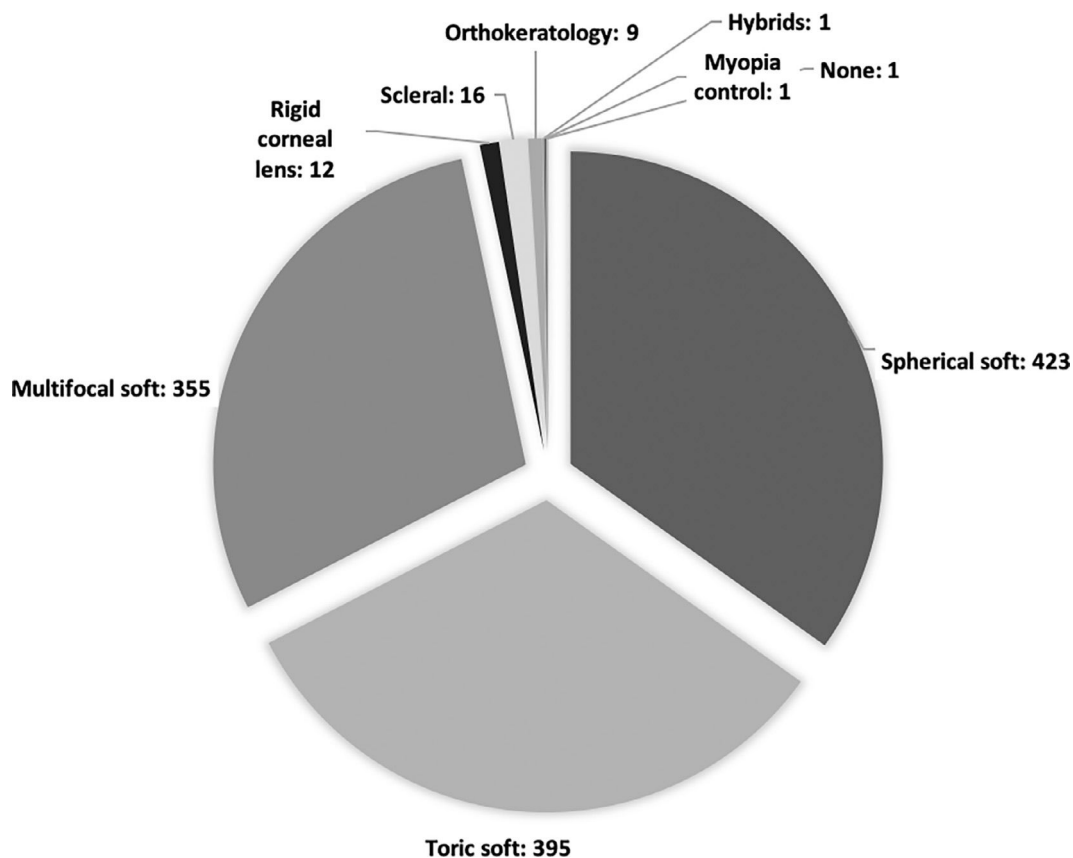
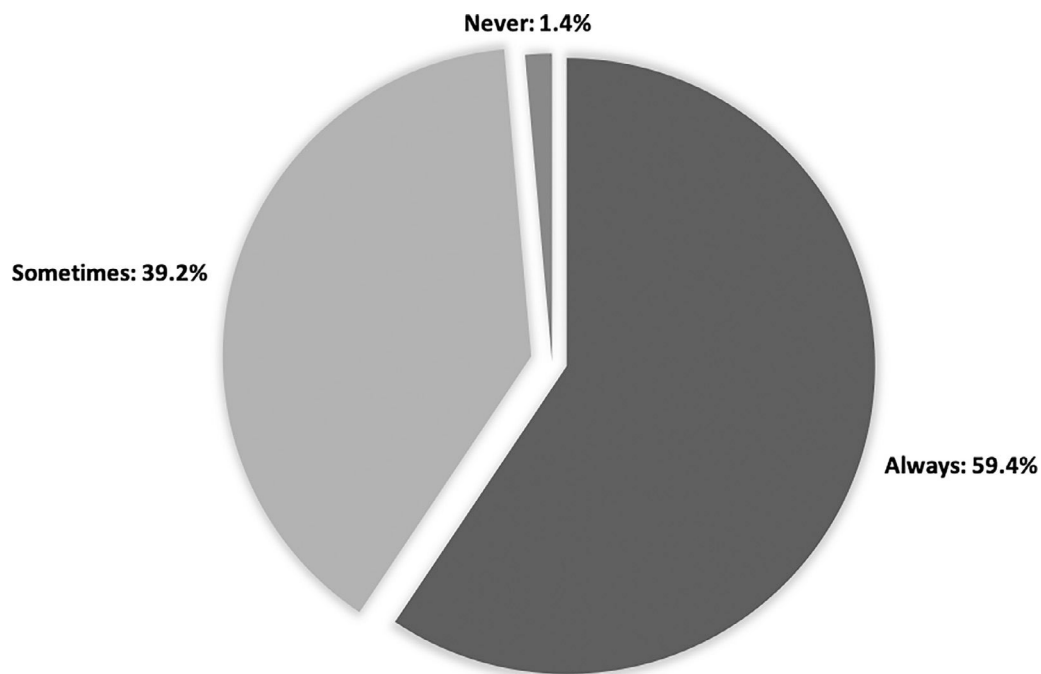


Fig. 1 Types of lenses fitted by Spanish eye care practitioners in an average month to naïve contact lens wearers.



**Fig. 2** How often do you encourage potential contact lens patients who have no apparent contraindications to consider contact lens wear?

consider themselves proactive in fitting contact lenses (median: 8/10; range: 0-10). Around 80% of Spanish ECPs reported encouraging potential contact lens patients with no apparent contraindications for lens wear to consider contact lenses (Fig. 2). Thirty-eight percentage of Spanish practitioners indicated that they perceived their clinical practice in the next 5 years as uncertain, 15.5% as worrying, and 7.7% as very worrying. Only 33.2% and 5.7% perceived it as promising and very promising, respectively.

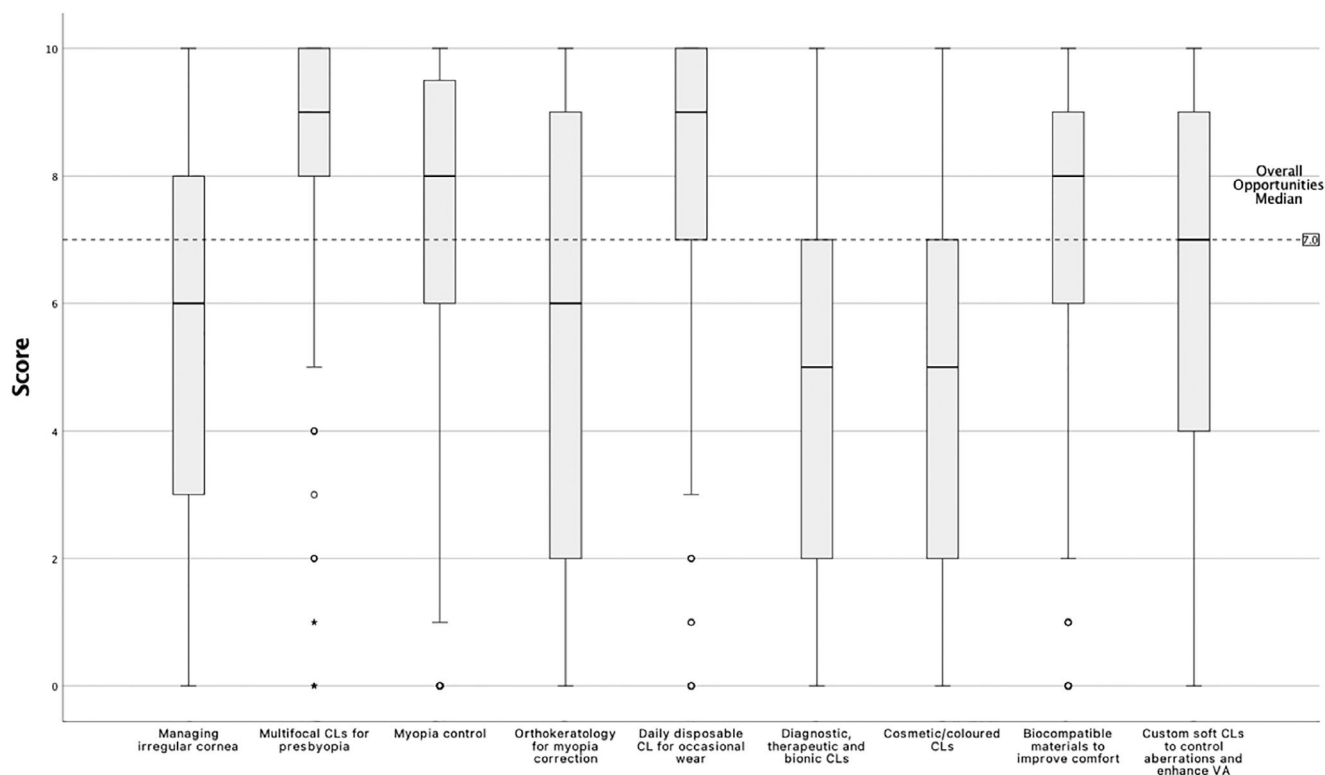
### Potential opportunities

In Spain, daily disposable contact lens for conventional use and multifocal contact lens for presbyopes were perceived by practitioners as the most promising developments in contact lens practice for the near future (median: 9/10 in both cases). In contrast, cosmetic contact lenses and diagnostic, therapeutic and bionic contact lenses were perceived as the least favourable developments for future contact lens practice (median: 5/10 in both cases) (Fig. 3). Significant differences were found between Spain and the rest of the world regions assessed with regards to the perception of promising opportunities for future contact lens practice ( $p=0.02$ ). Spanish practitioners reported a greater perception of promising opportunities in contact lens practice (median: 6.5/10) in comparison with African (median: 5.7/10;  $p=0.003$ ), Middle Easter (median: 6/10;  $p=0.005$ ) and Asian practitioners (median: 6.3/10;  $p=0.02$ ), but no significant differences were found between Spanish and Australasian, North American, European and South American practitioners (all  $p>0.05$ ). More specifically, Spanish practitioners reported managing irregular corneas with contact lenses as a significantly lower potential opportunity than African and Middle Easter practitioners (both  $p\leq 0.05$ ). Spanish practitioners

rated the use of multifocal contact lenses for presbyopes, myopia control lenses, biocompatible materials to improve comfort and custom soft contact lenses to control aberrations and enhance visual acuity as significantly higher opportunities for contact lens practice than African, Asian and Middle Easter practitioners (all  $p\leq 0.008$ ). The use of orthokeratology contact lenses for myopia correction was perceived as a greater opportunity for contact lens practice by Spanish practitioners in comparison with African and Middle Easter practitioners (both  $p<0.001$ ). Daily disposable contact lenses for occasional wear were perceived as a greater opportunity for contact lens practice by Spanish in comparison with African and Asian practitioners (both  $p<0.001$ ). In contrast, cosmetic lenses were perceived as a less favourable opportunity for contact lens practice by Spanish practitioners in comparison with African, Asian and Middle Easter practitioners (all  $p<0.001$ ).

Significant differences were found in the perception of opportunities with regards to the type of optometric practice ( $p=0.002$ ). Spanish practitioners who work in a hospital setting reported a lower perception of opportunities (median: 5.8/10) compared to those working in a stand-alone practice/independent practice (median: 6.3/10;  $p<0.001$ ), university setting (median: 6.2/10;  $p=0.014$ ) or in national or regional retail chains (median: 6.4/10;  $p<0.001$ ) (Table 1). Additionally, practitioners who work in local retail chains also reported a lower perception of opportunities (median: 6/10) compared to those working in a stand-alone practice/independent practice (median: 6.3/10;  $p=0.025$ ) or in national or regional retail chains (median: 6.4/10;  $p=0.007$ ) (Table 1).

Although statistically significant, it is unlikely that years of contact lens fitting experience was correlated with the overall perception of promising opportunities for future

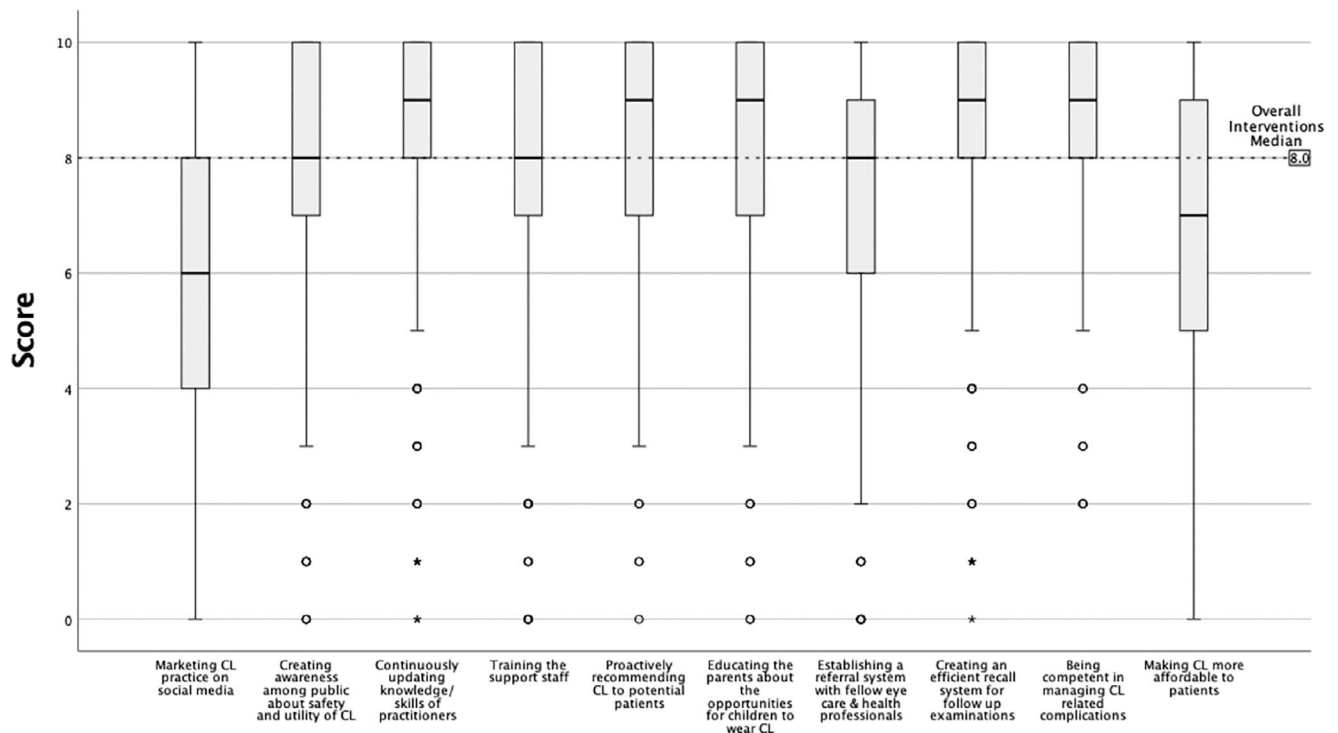


**Fig. 3** Average scores of potential opportunities for future contact lens practice (rated from 0 [lesser] to 10 [greater]) reported by Spanish practitioners. Box = 1 standard deviation, line = median, whiskers = 95 % confidence interval, o = extreme values and \* = outliers. CL, Contact lens; VA, Visual acuity.

**Table 1** Statistical results (p-values) of the differences in perceived potential opportunities with regards to the type of working practice.

	Hospital			Local retail chain	
	Stand-alone practice/ independent practice	University	National or regional retail chain	Stand-alone practice/ independent practice	National or regional retail chain
Managing irregular cornea	> (p=0.007)	= (p>0.05)	> (p<0.001)	< (p<0.001)	= (p>0.05)
Multifocal contact lenses for presbyopes	< (p<0.001)	< (p<0.001)	< (p<0.001)	< (p<0.001)	< (p<0.001)
Myopia control	< (p<0.001)	= (p>0.05)	= (p>0.05)	< (p<0.001)	= (p>0.05)
Orthokeratology for myopia correction	= (p>0.05)	= (p>0.05)	< (p=0.019)	= (p>0.05)	= (p>0.05)
Daily disposable CLs for occasional wear	< (p<0.001)	< (p<0.001)	< (p<0.001)	> (p=0.030)	< (p=0.015)
Diagnostic, therapeutic and bionic lenses	> (p<0.001)	= (p>0.05)	> (p<0.001)	> (p=0.018)	= (p>0.05)
Cosmetic lenses	> (p<0.001)	< (p<0.001)	< (p<0.001)	< (p<0.001)	= (p>0.05)
Biocompatible materials to improve comfort	< (p<0.001)	= (p>0.05)	< (p<0.001)	= (p>0.05)	> (p<0.001)
Custom soft CLs to control aberrations and enhance VA	< (p=0.010)	< (p=0.009)	= (p>0.05)	< (p=0.002)	< (p=0.015)

CLs, contact lenses; VA, visual acuity; =, Similar levels of potential opportunities; >, higher levels of potential opportunities; <, lower levels of potential opportunities.



**Fig. 4** Average scores of potential interventions (rated from 0 [lesser] to 10 [greater]) reported by Spanish practitioners. Box = 1 standard deviation, line = median, whiskers = 95 % confidence interval, o = extreme values and \* = outliers. CL, Contact Lens.

contact lens practice reported by Spanish practitioners ( $r=0.045$ ;  $p=0.026$ ). More specifically, fitting experience was unlikely to be correlated, despite statistical significance, with the perception of opportunities related to managing irregular cornea ( $r=0.106$ ;  $p<0.001$ ), multifocal contact lenses for presbyopes ( $r=0.185$ ;  $p<0.001$ ), myopia control lenses ( $r=0.082$ ;  $p<0.001$ ), cosmetic lenses ( $r=0.269$ ;  $p<0.001$ ), biocompatible materials to improve comfort ( $r=0.155$ ;  $p<0.001$ ) and custom soft contact lenses to control aberrations and enhance visual acuity ( $r=0.095$ ;  $p<0.001$ ). Although statistically significant, it is also unlikely that the number of contact lens fittings performed per month was correlated with the perception of promising opportunities related to the overall perception of future contact lens practice ( $r=0.223$ ;  $p<0.001$ ). More specifically, the number of fittings per month was unlikely to be correlated, despite statistical significance, with the perception of opportunities related to managing irregular cornea ( $r=0.286$ ;  $p<0.001$ ), multifocal contact lenses for presbyopes ( $r=0.082$ ;  $p<0.001$ ), myopia control ( $r=0.177$ ;  $p<0.001$ ), orthokeratology for myopia correction ( $r=0.184$ ;  $p<0.001$ ), diagnostic, therapeutic and bionic lenses ( $r=0.187$ ;  $p<0.001$ ), biocompatible materials to improve comfort ( $r=0.130$ ;  $p<0.001$ ) and custom soft contact lenses to control aberrations and enhance visual acuity ( $r=0.180$ ;  $p<0.001$ ).

### Potential interventions

Spanish practitioners considered it important to update knowledge skills; to proactively recommend the use of contact lenses to potential patients; to educate parents about

myopia control methods; to create an efficient recall system for follow-up examinations; and to be able to manage ocular-related complications associated with contact lens wear (median: 9/10 in all cases). In contrast, the use of marketing campaigns in social media and making contact lenses more affordable to patients were perceived as less relevant interventions (median: 6/10 and 7/10, respectively) (Fig. 4).

Significant differences were found between Spain and the rest of the regions with regards to potential interventions ( $p<0.001$ ). Overall, Spanish practitioners reported a greater perception of potential interventions (median: 8.1/10) in comparison with Middle Easter (median: 7.8/10;  $p=0.04$ ) and North American practitioners (median: 7.7/10;  $p=0.007$ ); lower perception of interventions in comparison with South American practitioners (median: 8.8/10;  $p<0.001$ ); and no significant differences in the perception of potential interventions in comparison with Australasian, African, European and Asian practitioners (all  $p>0.05$ ). Making wearers aware of the importance of safe contact lens wear was reported as a more and less relevant intervention by Spanish practitioners in comparison with North American and South American colleagues, respectively (both  $p<0.001$ ). Constant updating of knowledge/skills, creating an efficient recall system for follow-up examinations and managing contact lens-related complications were reported as more relevant potential actions by Spanish practitioners in comparison with Middle Easter and North American colleagues, but less relevant in comparison with South American practitioners (all  $p<0.05$ ). Staff training was considered less important by Spanish in comparison with South American practitioners ( $p<0.001$ ). Recommending contact lenses to potential patients as well as educating parents about the

**Table 2** Statistical results (p-values) of the differences in perceived potential interventions with regards to the type of practice.

	Hospital			National or regional retail chain		
	Stand-alone practice/independent practice	Local retail chain	National or regional retail chain	Stand-alone practice/independent practice	Local retail chain	University
Continuously updating knowledge/skills of practitioners	< (p=0.003)	< (p=0.053)	< (p<0.001)	= (p>0.05)	= (p>0.05)	> (p=0.025)
Educating the parents about children to wear CLs	< (p<0.001)	= (p>0.05)	< (p<0.001)	= (p>0.05)	> (p=0.001)	> (p=0.008)
Being competent in managing CL-related complications	< (p<0.001)	= (p>0.05)	< (p<0.001)	= (p>0.05)	> (p=0.004)	> (p=0.002)
Making CLs more affordable to patients (especially DD CLs)	= (p>0.05)	= (p>0.05)	= (p>0.05)	> (p=0.002)	= (p>0.05)	= (p>0.05)
Marketing CL practice on social media	= (p>0.05)	< (p=0.042)	> (p=0.012)	> (p=0.002)	= (p>0.05)	> (p=0.026)

CLs, contact lenses; DD, daily disposable; =, Similar levels of potential interventions; >, higher levels of potential interventions; <, lower levels of potential interventions.

benefits of contact lens wear in children were reported as more and less interesting interventions by Spanish in comparison with Middle Eastern and South American practitioners, respectively (all  $p<0.001$ ). Making contact lenses more affordable to patients and using social media for marketing contact lenses online were found as less attractive interventions by Spanish in comparison with Middle Eastern and South American practitioners (all  $p\leq 0.01$ ).

Significant differences were found in potential interventions with regards to the type of optometric practice ( $p<0.001$ ). Spanish practitioners who work in a hospital setting reported a lower perception of potential interventions (median: 7.8/10) compared to those who work in a local retail chain (median: 8.0/10;  $p=0.021$ ), in a national or regional retail chain (median: 8.3/10;  $p<0.001$ ) or in a stand-alone practice/independent practice (median: 8.1/10;  $p=0.002$ ). Additionally, practitioners who work in national or regional retail chains reported a higher perception of potential interventions (median: 8.3/10) compared to those working in a stand-alone practice/independent practice (median: 8.1/10;  $p=0.006$ ), university practice (median: 7.9/10;  $p=0.001$ ) or in a local retail chain (median: 8.0/10;  $p=0.019$ ) (Table 2).

No significant correlation was found between the years of fitting experience and overall potential interventions reported by Spanish practitioners ( $r=-0.019$ ;  $p=0.354$ ). Although statistically significant, it is unlikely that the number of fittings performed per month was correlated with the overall perception of potential interventions ( $r=0.144$ ;  $p<0.001$ ). More specifically, the number of fittings performed per month by Spanish practitioners was unlikely to be correlated, despite statistical significance, with the perception of potential interventions related to continuously updating practitioner's knowledge/skills ( $r=0.120$ ;  $p<0.001$ ), educating parents about the possibility for

children to wear contact lenses ( $r=0.133$ ;  $p<0.001$ ), being competent in managing contact lens-related complications ( $r=0.116$ ;  $p<0.001$ ), making contact lenses more affordable to patients (especially daily disposables) ( $r=0.041$ ;  $p<0.001$ ), and marketing contact lens practice on social media ( $r=0.102$ ;  $p<0.001$ ).

### Perceived threats

Significant differences were found in the perception of threats between Spain and the rest of the regions assessed, with the exception of South America ( $p<0.001$ ). Overall, Spanish practitioners reported a greater perception of threats (median: 7.3/10) in comparison with Middle Eastern (median: 6.2/10;  $p<0.001$ ), North American (median: 6.3/10;  $p<0.001$ ), African (median: 6.7/10;  $p=0.002$ ), Asian (median: 6.9/10;  $p<0.001$ ), Australasian (median: 6.0/10;  $p<0.001$ ) and European practitioners (median: 6.5/10;  $p<0.001$ ). In Spain, practitioners reported to be very concerned about threats related to the lack of regulation, contact lenses being available online without professional supervision, and contact lens prescriptions being available via digital devices (median: 10/10 in all cases); these three threats were reported to be more concerning by Spanish practitioners in comparison with practitioners from the other regions assessed, with the exception of South American practitioners (Table 3). Technological advances in ophthalmic lenses and ocular infections caused by contact lens wear were perceived as less worrying threats (median: 5/10 in both cases) (Table 3).

Significant differences were found in perceived threats with regards to the type of optometric practice ( $p=0.039$ ). Spanish practitioners who work in a university setting reported a lower perception of threats (median: 6.6/10) compared to those working in a stand-alone practice/

**Table 3** Statistical results (p-values) of the differences between Spain and the rest of the regions assessed in perceived threats.

	Spain					
	Africa	Asia	Australasia	Europe	Middle East	NorthAmerica
Lack of regulation	> (p<0.001)	> (p<0.001)	> (p<0.001)	> (p<0.001)	> (p<0.001)	> (p<0.001)
CLs available online without professional supervision	> (p<0.001)	> (p<0.001)	> (p<0.001)	> (p<0.001)	> (p<0.001)	> (p=0.000)
CL prescriptions available via digital devices	> (p<0.001)	> (p<0.001)	> (p<0.001)	> (p<0.001)	> (p<0.001)	> (p=0.042)
Clinics without proper instrumentation	= (p>0.05)	> (p<0.001)	> (p=0.001)	= (p>0.05)	> (p<0.001)	> (p=0.003)
Incompetent practitioners	= (p>0.05)	> (p=0.028)	> (p<0.001)	< (p=0.032)	> (p<0.001)	> (p=0.000)
Refractive surgeries	= (p>0.05)	= (p>0.05)	> (p<0.001)	> (p<0.001)	= (p>0.05)	> (p=0.000)
Negative myths about CL among public	= (p>0.05)	< (p=0.006)	> (p<0.001)	= (p>0.05)	= (p>0.05)	> (p=0.000)
Advances in spectacle industry	< (p=0.027)	< (p<0.001)	> (p<0.001)	> (p=0.013)	< (p<0.001)	> (p=0.001)
Commoditization of CL (i.e. not considered as medical device)	> (p<0.001)	> (p<0.001)	> (p=0.002)	> (p<0.001)	> (p<0.001)	> (p=0.000)
Drop out due to discomfort/dryness	> (p<0.001)	> (p<0.001)	> (p=0.012)	= (p>0.05)	> (p<0.001)	= (p>0.05)
CL-related infections	> (p=0.005)	= (p>0.05)	> (p<0.001)	= (p>0.05)	= (p>0.05)	> (p=0.000)
Unfavourable industry policies	= (p>0.05)	> (p=0.001)	= (p>0.05)	> (p=0.004)	> (p<0.001)	> (p=0.001)

CL, contact lenses; =, Similar levels of perceived threats; >, Spanish practitioners reported significantly higher levels of perceived threats; <, Spanish practitioners reported significantly lower levels of perceived threats.

independent practice (median: 6.9/10; p=0.014) or in national or regional retail chains (median: 6.9/10; p=0.020) (Table 4).

Although statistically significant, it is unlikely that fitting experience was correlated with the overall perception of threats reported by Spanish practitioners (r=0.064; p=0.002). More specifically, the number of years of fitting experience was unlikely to be correlated, despite statistical

significance, with the perception of threats related to the lack of regulation (r=0.192; p<0.001), contact lenses being available online without professional supervision (r=0.108; p<0.001), contact lens prescriptions being available via digital devices (r=0.115; p<0.001), clinics without proper instrumentation (r=0.058; p=0.005), incompetent practitioners (r=0.067; p<0.001), commoditization of contact lenses (r=0.158; p<0.001), drop out due to discomfort/

**Table 4** Statistical results (p-values) of the differences between the different types of practice in perceived threats.

	University	
	Stand-alone practice/ independent practice	National or regional retail chain
Lack of regulation	< (p<0.001)	< (p=0.003)
CLs available online without professional supervision	< (p<0.001)	< (p<0.001)
CL prescriptions available via digital devices	< (p<0.001)	< (p=0.003)
Clinics without proper instrumentation	< (p=0.023)	= (p>0.05)
Advances in spectacle industry	< (p=0.032)	= (p>0.05)
Commoditization of CL (i.e. not considered as medical device)	< (p<0.001)	< (p=0.004)
Drop out due to discomfort/dryness	= (p>0.05)	= (p>0.05)
CL-related infections	> (p=0.002)	= (p>0.05)
Unfavourable industry policies	< (p<0.001)	= (p>0.05)

CL, contact lenses; =, Similar levels of perceived threats; >, Spanish practitioners reported significantly higher levels of perceived threats; <, Spanish practitioners reported significantly lower levels of perceived threats.



dryness ( $r=0.096$ ;  $p<0.001$ ), unfavourable industry policies ( $r=0.107$ ;  $p<0.001$ ), negative myths about contact lenses among the general public ( $r=-0.079$ ;  $p<0.001$ ), advances in the spectacle industry ( $r=-0.080$ ;  $p<0.001$ ) and contact lens-related infections ( $r=-0.077$ ;  $p<0.001$ ). Although statistically significant, the number of fittings performed per month was unlikely to be correlated with the overall perception of threats ( $r=0.042$ ;  $p=0.040$ ). More specifically, the number of fittings performed per month was unlikely to be correlated, despite statistical significance, with perceptions of threats related to clinics without proper instrumentation ( $r=0.056$ ;  $p=0.006$ ), incompetent practitioners ( $r=0.095$ ;  $p<0.001$ ) and negative myths about contact lenses among the general public ( $r=0.048$ ;  $p=0.004$ ).

## Discussion

This study assessed how Spanish practitioners perceive future contact lens practice, particularly with regards to its opportunities, interventions and threats, and how such perceptions compare with that from other regions of the world.

The relatively large response to the survey obtained in Spain and that all questionnaires received from Spain were completed by optician-optometrists is attributed to the survey being distributed by email by the General Council of the Spanish Opticians-Optometrists to all registered Optician-Optometrists in the country (approximately 17,000). In Spain, Optician-Optometrists are the primary eye care professionals with competencies to diagnose refractive errors and prescribe and dispense optical interventions. It is possible that practitioners with more interest in continuous education and more proactive and enthusiastic to contact lens practice were more likely to respond to the survey, thus introducing some potential bias in the responses obtained in this study relative to the average Spanish optometrist.

Spain, together with Australia, Europe, North America, and South America are the regions in the world which perceive contact lens practice as having the most opportunities for the future. That Spanish practitioners perceive future contact lens practice promising may be related to the relatively high rate of specialty contact lens prescribing found in Spain, including myopia control and orthokeratology contact lenses.<sup>18</sup> In fact, a survey found that Spain is the country in the world reporting the highest proportion of myopia control fits to minors – close to 35% of all contact lenses fitted to patients aged 6 to 17 years from 2018 to 2020<sup>18</sup> – and this might be related to increasing prevalence rates of myopia both in Spain<sup>19,20</sup> and worldwide;<sup>21</sup> increasing number of contact lenses becoming specifically approved for reducing myopia progression in different parts of the world, including Spain; as well as to increasing number of guidelines to best prescribe treatment options for myopia control in clinical practice.<sup>22,23</sup> Similarly, that Spanish practitioners reported higher perceived opportunity with the prescription of myopia control contact lenses (median: 8/10) in comparison with orthokeratology contact lenses for refractive correction (median: 6/10) might be attributed to the same latter reasons, as well as increased cost and discomfort, particularly during the initial adaptation to orthokeratology lens wear, to the patient, and lack of access to specialised equipment and training for fitting these lenses by ECPs.<sup>24</sup>

Multifocal contact lenses for presbyopes and daily disposable soft contact lenses for occasional wear were reported as the most promising perceived opportunities for practice growth by Spanish practitioners (both median: 9/10), as well as by ECPs from other parts of the world. That multifocal contact lenses for presbyopes were perceived so promising is probably related to increased population ageing in western, developed countries. Recent estimations indicate that presbyopia currently affects 1,800 billion people worldwide and this number is expected to increase to more than 2,000 billion by 2030.<sup>25</sup> In fact, the use of multifocal contact lenses has increased substantially in the last two decades, probably as a result of improved contact lens materials and designs as well as manufacturing methods,<sup>9</sup> thus providing greater satisfaction to patients, particularly in comparison with monovision contact lens wear.<sup>26,27</sup> That daily disposable lenses for occasional wear were perceived so promising is probably related to population lifestyle changes and the increased safety of this contact lens type in comparison to other modalities of lens wear,<sup>28</sup> particularly during times of COVID-19 pandemic where there is increased fear of developing ocular-related complications associated to the disease,<sup>29,30</sup> despite there is currently no evidence to suggest an increased risk of contracting COVID-19 through contact lens wear compared to spectacle lens wear or that spectacle lens wear provides protection against COVID-19 or other viral diseases.<sup>31</sup>

In contrast, the lenses reported to have the lowest overall promising opportunities were cosmetic/coloured and diagnostic, therapeutic and bionic contact lenses (both median: 5/10). However, cosmetic/coloured contact lenses were rated higher by Spanish, Asian (median: 7/10) and Middle Eastern practitioners (8/10) in comparison with the other regions assessed ( $p<0.001$ ). A recent survey found that cosmetic contact lenses are relatively popular in Asian countries such as China and Singapore.<sup>9</sup>

The opportunities that diagnostic, therapeutic and bionic contact lenses render were perceived similarly by all regions (overall median: 5/10), with the exception of South America that rated them higher in comparison with the other regions (median: 7/10) ( $p<0.001$ ). That diagnostic and therapeutic lenses<sup>32</sup> were reported to represent a relatively low potential opportunity might be related to limited professional competencies to fit and prescribe such lenses by ECPs from certain parts of the world. Currently, there are no bionic contact lenses commercially available and this might explain why these lenses are not yet perceived to offer potential opportunities for contact lens practice.

All potential interventions were rated relatively high by Spanish practitioners (median score  $\geq 8/10$ ), with the exception of marketing contact lenses through social media and making contact lenses more affordable to patients (median: 6/10 and 7/10, respectively) (Fig. 4). More specifically, Spanish practitioners considered it important to update knowledge skills; to proactively recommend the use of contact lenses to potential patients; to educate parents about myopia control methods; to create an efficient recall system for follow up examinations; and to be able to manage ocular-related complications (median: 9/10 in all cases). International initiatives, such as the International Myopia Institute white papers on myopia<sup>33</sup> and the Contact Lens Evidence-Based Academic Reports<sup>34</sup> have been recently

conducted to raise practitioner knowledge and awareness in most of these areas of potential intervention. That Spanish practitioners perceived marketing campaigns in social media and making contact lens more affordable to patients as less relevant interventions might be related to the relatively low profit margins associated to the prescription and sale of contact lenses. Furthermore, Spanish practitioners do not typically charge contact lens fitting fees to patients as these are normally incorporated in the prescription and sale of contact lenses.

Lack of regulation, contact lenses available online without professional supervision, and contact lenses prescriptions being available via digital devices were reported as the most concerned threats by Spanish practitioners as well as by those from the other regions assessed. Internet purchasers of contact lenses are more likely to be male, have fewer annual eye exams, and purchase more hydrogel soft contact lenses instead of silicone hydrogel contact lenses, in comparison with those purchasing soft contact lenses from ECPs.<sup>35</sup> Another study found that Spanish contact lens wearers purchasing contact lenses online are more likely to initiate lens wear on their own and without the intervention of an ECPs, and to have less frequent eye examinations.<sup>36</sup> Spanish contact lens wearers who purchase lenses online are also likely to have increased water exposure, use contact lenses and lens cases beyond the recommended replacement time, and reuse care solutions.<sup>36</sup> Although major reasons for buying contact lenses online are likely to be convenience and reduced price, these users are more likely to ignore recommended hygiene habits thus increasing the probability of risky contact lens-related behaviours. In Spain, as well as in the other regions, contact lens drop out due to discomfort/dryness was reported a major threat (median: 7/10). Approximately 40% of soft contact lens wearers report suffering from contact lens discomfort, of whom 25% report experiencing mild to severe symptoms resulting in reduced wearing times.<sup>37,38</sup> Furthermore, it has been estimated that following 3 years of contact lens wear, between 10% and 50% of lens wearers permanently discontinue lens wear as a result of increased discomfort.<sup>37</sup> Despite significant developments of new lens materials and designs, as well as the increased availability of daily disposable contact lenses, contact lens-related discomfort, particularly towards the end of the day, remains a major challenge for future contact lens practice.<sup>11,13</sup> Contact lens-related infections were perceived as less threatening both in Spain and in the other regions (median: 5/10). The latter might be related to the relatively low incidence of infectious keratitis associated with contact lens wear, which has been estimated to range between 1 and 20 per 10,000 lens wearers in daily disposable and planned overnight soft contact lens wear, respectively.<sup>39</sup>

Spain and South America were the regions in which practitioners reported greater concern regarding unfavourable industry policies (median: 8/10 in both cases). The latter, in turn, might be related to practitioners' perceived threats regarding the lack of regulation leading to contact lenses being purchased online without ECPs supervision. In contrast, refractive surgery and improvements made by the spectacle industry were reported as minor threats both in Spain and in the rest of the regions (both median: 5/10). This finding is consistent with a study which found that offering contact lenses to spectacles wearers naïve to contact

lens wear can improve the selection and purchase of spectacles as well as increase the likelihood of purchasing contact lenses.<sup>40</sup>

That Spanish practitioners who work in a hospital setting reported a lower perception of opportunities and interventions compared to practitioners working in stand-alone/independent practices or retail chains as well as that Spanish practitioners working in a university setting reported a lower perception of threats compared to those working in retail practice might be related to the type of work performed in one setting vs. the other; while ECPs in a hospital and university setting predominately deal with clinically-related issues, ECPs in practice also handle commercially-related matters. The number of years of fitting experience and fittings performed per month were unlikely to be associated with the perception of opportunities, interventions and threats. The latter was somehow surprising as previous knowledge and experience is known to impact perception.<sup>41,42</sup>

In conclusion, this questionnaire about opportunities, interventions and threats regarding contact lens practice in Spain and its comparison with those from other regions of the world found that Spain is one of the regions in which ECPs perceive greater opportunities about the future practice of contact lenses. Multifocal contact lenses for presbyopes, myopia control contact lenses, daily disposable soft contact lenses for occasional lens wear, and biocompatible materials to improve comfort were reported as the major opportunities by Spanish and ECPs worldwide. Most potential interventions were rated relatively high by Spanish and practitioners worldwide, with continuously updating knowledge/skills of practitioners and marketing contact lenses through social media being reported as the most and least attractive interventions, respectively. Lack of regulation, contact lenses being available online without ECPs supervision, and contact lens prescriptions being available via digital devices were reported as the most concerning threats by Spanish practitioners as well as by those from the other regions of the world.

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Jacinto Santodomingo-Rubido is a full-time employee of Menicon Co., Ltd. The authors alone are responsible for the content and writing of the paper.

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