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Research paper

Uncorrected ametropia in children with limited access to ocular health care

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ABSTRACT

Introduction: The primary objective of this study is to describe the refractive needs of vulnerable children according to their social security status. The secondary objective of this study is to describe the types of ametropia in this population of children with limited access to ocular health care.
Methods: Children with limited access to ocular health care were recruited. Their social security status was assessed as well as their need for optical correction. Children received an orthoptic and ophthalmological examination. The ametropia thresholds requiring optical correction were defined as follows: hyperopia if spherical equivalent (SE) $\geq$ 3D before 6 years, $\geq$ 2.25 D between 6 and 12 years, $\geq$ 1.5 D from 12 years onwards; myopia if SE $\leq$ 0.5 D; astigmatism if cylinder C $\geq$ 1D; anisometropia if sphere difference between both eyes $\geq$ 1D.
Results: Out of 83 planned patients, 60 children turned up. 51 files for children aged 1 to 14 years old were analysed. 63.2 % of children without social security required an optical correction, compared with 65.6 % of children receiving State Medical Aid (SMA) and 66.7 % of children receiving Universal Health Protection (UHP). Out of 102 eyes, SE was hypermetropic in 56.9 % of cases, myopic in 21.6 % of cases; astigmatism was present in 60.8 % of cases. Anisometropia was assessed in 27.5 % of cases. 33 children out of 51 (64.7 %) required correction with glasses.
Discussion and Conclusion: Children benefiting from SMA or UHP have similar refractive needs than children without social security, and probably greater than those of the general population. In our population there is two-thirds of patients with ametropia requiring optical correction; most of these children did not initially wear glasses, which suggests that access to ophthalmic and optical care is more difficult for vulnerable children.

1. Introduction

Access to ophthalmic and optical care in France in 2023 remains limited for vulnerable children for several reasons: difficulties to access medical appointments, administrative procedures to be entitled to health care coverage, cost of medical consultations or optical equipment partially or not reimbursed. In the United States, a few studies have focused specifically on optical care for vulnerable children. A remarkable study by Zhang et al. [1] showed that economic and social status as well as social security status were associated with unmet eye care needs in 5th grade students. Ganz et al. [2] showed that children with the most frequent eye diseases are those with the highest out-of-pocket expenses; Hudak et al. [3] showed that Medicaid status was a strong predictor for failure of amblyopia therapy. Finally, Ly et al. [4] demonstrated in a population of 1,744,805 students from Arkansas who had undergone visual screening that school districts with higher concentrations of white students, higher graduation rates and higher percentages of students on government-assisted insurance had higher rates of follow-up.

In France, to our knowledge, no study has focused on the optical needs and ametropia of vulnerable children, whose socio-economic conditions are poorer than the general population, which can result in limited access to ocular health care.

Universal Health Protection (UHP) (*Protection Universelle Maladie*, PUMA) is the basic status for anyone working or residing in France on a regular basis, regardless of income. It entitles patients to partial coverage of healthcare costs.

State Medical Aid (SMA) (*Aide Medicale d'Etat*, AME) is a social security status who was introduced in France in 2000 to give undocumented immigrants access to healthcare. To be eligible, a person must have been a resident in France for more than 3 months (this rule is not

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applicable to children for whom it is automatically granted, though it can take a few weeks…) and have resources below a certain amount (for example, for a single person in mainland France: €9,719 per year in 2023). It is granted for one year and can be renewed. It is automatically granted to minors. This scheme entitles the holder to medical consultations, surgeries, and regarding optical equipment a co-payment reimbursement of 100 % of the social security rate for frames and lenses, which does not cover though the total cost of the glasses. It must be emphasized that children's SMA is generally included in their parents' SMA, except for unaccompanied minors who may have their own social security. However, the formalities involved in taking advantage of this social security status can themselves represent an obstacle in those children.

Unlike other reimbursed healthcare products, the situation for optical corrections is particular, since the social security reimbursement rate for frames and lenses is only one-third of the selling price of up to about 200€, within a limited number of products known as "health care basket A"; the other two thirds of the cost of glasses of this "basket A" scheme is usually reimbursed either by private health insurances if the patient has one, or by the social security (if the patient's income is below a certain amount). This second option is not possible for patients with SMA status, which is an important limitation to access to optical equipment. A free-market scheme called "health care B" allows free prices of hundreds of euros or more, but a social security rate set at 15 eurocents for a complete set of spectacles.

Ametropias are refractive disorders: myopia, hyperopia, astigmatism, anisometropía; anisometropia is a significant difference in refractive formula between both eyes. Refractive errors must be corrected by glasses, contact lenses, or refractive surgery. Correcting ametropia in children is even more necessary as the visual system matures during the sensitive period of visual development in the first decade of life, when children acquire skills for the rest of their like including school acquisitions.

Little is known about the frequency of ametropias and their correction in populations of vulnerable children. Only the prevalence of ametropia in the general population in France has been studied in children aged 2 to 12 in a remarkable publication by the *Association Nationale des Jeunes Ophtalmologistes* [5]; it found 58.3 % emmetropic children (no ametropia), 17.2 % hyperopic children, 3.6 % strong hyperopic children, 15.5 % myopic children, 0.5 % strong myopic children, 4.9 % children with mixed astigmatism, and anisometropia in 5 % of the children.

Our main objective is to describe the refractive needs of vulnerable children according to their social security status by comparing their optical correction needs of children with SMA, UHP or without social security coverage.

The secondary objective of this study is to measure the frequency of ametropias and refractive needs in a population of children with limited access to ocular health care.

2. Methods

The study was approved by the Legal and Ethics Committee of *Assistance Publique Hôpitaux de Paris* (AP-HP), France.

This epidemiological study is descriptive, retrospective and monocentric. Children with limited access to medical care were referred to our hospital for visual, orthoptic, ophthalmological and refractive examinations under cycloplegia, during a dedicated day, in partnership with an optical manufacturer who could manufacture and deliver glasses on site if a refractive error was diagnosed, and glasses required.

Children requiring ophthalmologic and optical care, symptomatic or not (reduced vision felt or expressed) were recruited by social workers or associations, in the vicinity of our hospital. The operation was organized by the Project Manager of the AP-HP's *Mission Solidarité*, who contacted by e-mail partner associations, structures managing schemes which entitles health care to patients without social security, social workers, outreach teams, or school doctors and nurses, all of whom were in contact with a vulnerable population with insufficient access to general or specialized medical consultations, particularly ophthalmological, and/or to optical equipment. The recruitment target was children aged between 1 and 17, requiring an eye test, who may or may not have had one, and who may or may not have had an optical correction. All parents were asked: "Does your child currently wear glasses? If the answer was no, the following question was asked: "Has your child ever worn glasses?"

Recruiters were asked to register patients, and to provide their name, age and social security status. The children were asked to come to our hospital during a dedicated day in January 2023, by writing to their parents or the adult(s) in charge of them.

During the dedicated day, a pre-consultation was carried out by an orthoptist, with a screening oculomotor examination, a measurement of visual acuity without correction, then a dilatation with Cyclopentolate 0.5 % instilled into both eyes at different times (T): T 0 minutes, T 5 minutes, T 10 minutes, then the refractive examination was carried out between 45 and 60 minutes later by an ophthalmologist who carried out a new interview, an objective measurement of refraction with a Retinomax K5 portable auto-refractometer (Luneau Visionix®), then an anatomical examination with a slit lamp followed by a fundus examination.

The doctor then had to decide whether or not to prescribe an optical correction, and/or decide whether the child required medical follow up, in case of strabismus or suspected amblyopia, or if an anatomical anomaly was found. Eventually, opticians manufacturing lenses who were present in the hospital could produce and deliver for free optical equipment on the same day, on presentation of the medical prescription previously obtained. If the equipment required could not be manufactured immediately because it was out of the ordinary, it was planned to be manufactured and delivered to the child free of charge later.

For each consultation, the orthoptist and then the doctor completed a form compiling all the above information. Our study is based on a retrospective analysis of all these forms.

The ametropia thresholds requiring optical correction were defined as follows: hyperopia if spherical equivalent SE $\geq$ 3D before 6 years, hyperopia if spherical equivalent SE $\geq$ 2.25 D between 6 and 12 years, hyperopia if spherical equivalent SE $\geq$ 1.5 D from 12 years, myopia if SE $\leq$ 0.5 D, astigmatism if cylinder C $\geq$ 1D, anisometropia if sphere difference S between both eyes was $\geq$ 1D. The presence of phoria-tropia or tropia was noted as "strabismus".

The exclusion criteria for the study were as follows: children under 1 year of age or patients over 18 years of age (recruitment error); patients who could not be examined; no cycloplegia performed (contraindications to cyclopentolate: age less than one year or history of generalized tonic-clonic seizures); poor pupillary dilation and/or cycloplegia considered ineffective (variation in objective values of more than 0.75D between different autorefractometer measurements).

The possibilities of social security status were as follows:

1/ cover under the general scheme as part of the "Universal Health Protection" UHP (*Protection Universelle Maladie "PUMA")*
2/ "State Medical Aid" SMA *(Aide Médicale d'Etat "AME")*
3/ no health care coverage.

The private health insurance status was not collected.

3. Results

83 appointments were offered. 60 children showed up at the appointment (72.3 %). 9 patients were excluded from the analysis: six children for being less than one year old (initial recruitment error; these patients were reconvened for an eye examination with atropine eye drops instilled prior the appointment), one child for poor dilatation and uncertain cycloplegia (because the values given by the

autorefractometer varied by more than 0.75 spherical equivalent between 5 measurements on at least one eye), and two children could not be examined (Fig. 1: Study flow chart).

Demographic data and social security status are listed in Tables 1 and 2 (Table 1: demographic data; Table 2: social security status).

We analyzed the refractive needs of our population according to social security status. (Table 3: Refractive needs according to social security status)

6 patients came with a previously prescribed optical correction: 4 children among the 32 patients with UHP or SMA, and 2 children among the 19 patients without social security.

Out of the 19 patients without social security, 12 children (63.2 %) needed glasses, including 10 who either had none, no longer had any or had never had any.

Out of the 3 patients with UHP coverage, 2 children needed glasses (i.e. 66.7 %), and did not have any at the time of the consultation.

Out of the 29 patients with SMA cover, 19 (65.6 %) needed glasses, including 13 who did not, no longer had or had never worn glasses.

The distribution of ametropias in patients who received a prescription for optical correction is shown in Fig. 2 (Fig. 2: patients requiring optical correction).

Thus, according to our refractive criteria for the need for optical correction, depending on the level of ametropia and of age, 33 children out of 51 with ametropia required optical correction, i.e. 64.7 % of the cases. Of the 33 patients who received a prescription for optical correction, 28 (85 %) had never worn glasses or no longer wore them on the day of the examination.

In 24 cases the children were astigmatic. In 14 cases the children were anisometropic. In 13 cases the children were hypermetropic. In 12 cases the children were myopic.

Details of these results are shown in Table 4 (Table 4: patients requiring optical correction: detailed data).

The refractive results eye by eye are listed in Fig. 3 (Fig. 3: frequency of ametropias in our population). Out of 102 eyes, there were 22 myopic spherical equivalents $\leq$ 0.5 D; 58 hypermetropic spherical equivalents $\geq$ 0.5 D; 62 astigmatisms $\geq$ 0.5 D.

Details of these results are shown in Table 5 (Table 5: frequency of ametropia in our population: detailed data).

It should be noted that we also found 12 strabismus patients; all had a prescription for an optical correction.

We found an ophthalmological pathology in 4 cases: one case of nystagmus probably associated with microphthalmia; one case of retinal coloboma associated with nystagmus and ptosis; and two cases of papillary excavation.

Table 1
Demographic data.

Number of subjects (men / women)	51 (25/26)
Average age in years (variance)	7.7 (1–14)
Median age in years (standard deviation)	7.5 (3.6)
Average spherical equivalent in diopters (D)	1.26
Median spherical equivalent in diopters	0.75

Table 2
Social security status.

Number of subjects	51
No social security cover	19
Universal Health Protection (UHP)	3
State Medical Aid (SMA)	29

SMA: State Medical Aid (*AIDE MEDICALE D'ETAT "AME"*)
UHP: Universal Healthcare Protection (*PROTECTION MALADIE UNIVERSELLE "PUMA"*)

Table 3
Refractive needs according to social security status.

Social security cover	None	SMA	UHP
Number of children	19	29	3
Prescription of an optical correction	12	19	2
(including patients who had none/no more)	(10)	(13)	(2)
[percentage]	[63.2]	[65.6]	[66.7]
No indication for optical correction	7	10	1

SMA: State Medical Aid (*AIDE MEDICALE D'ETAT "AME"*)
UHP: Universal Healthcare Protection (*PROTECTION MALADIE UNIVERSELLE "PUMA"*)

Twelve children were re-referred for follow-up in the ophthalmology department because of suspected strabismus and/or amblyopia and/or an ophthalmological pathology.

4. Discussion

Our study found that 63.2 % of children without social security (12/19) and 65.6 % of children with UHP or SMA (21/32) needed glasses, which suggests that children with SMA or UHP require similar optical care than children without social security. The small number of children with UHP does not allow us to draw any conclusion comparing UHP or SMA on this point.

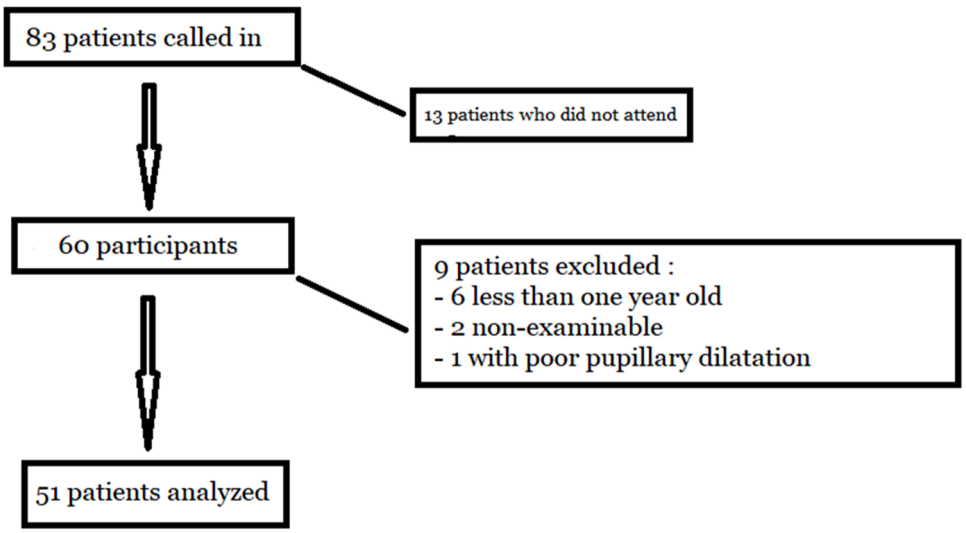

Fig. 1. Study flow chart.

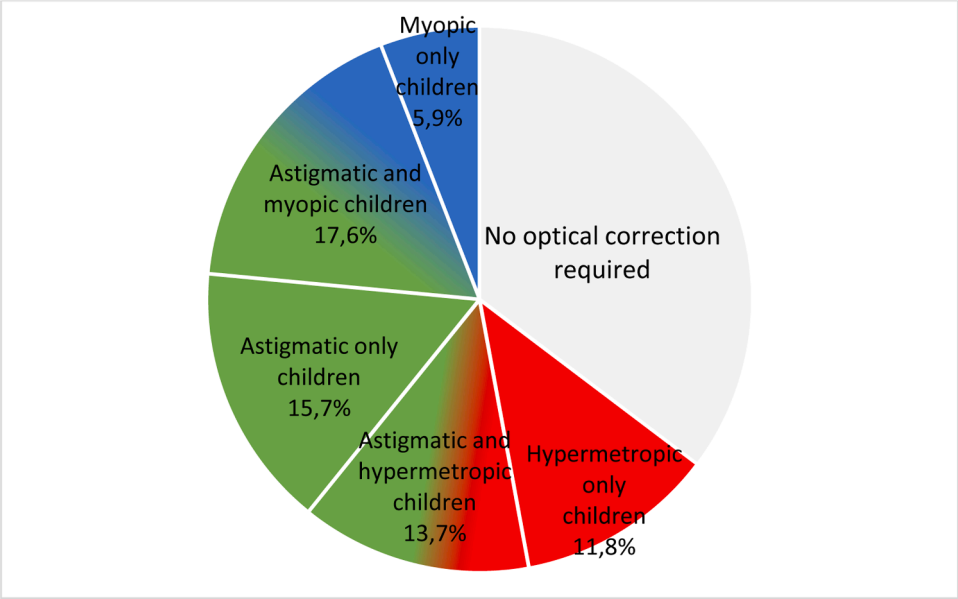

Fig. 2. Patients requiring optical correction.

Table 4
Patients requiring optical correction: detailed data.

	Patients (N, %)
All	33 (64.7)
Hypermetropic (SE)	6 (11.8)
SE ≥ 3D before 6 years	7 (13.7)
SE ≥ 2.25 D between 6 and 12 years old	
SE ≥ 1.5 D from age 12	
Hypermetropic only:	
Hypermetropic and Astigmatic:	
Myopic (SE)	3 (5.9)
SE ≤ 0.5 D	9 (17.6)
Myopic only:	
Myopic and Astigmatic:	
Astigmatic only (C cylinder)	8 (15.7)
C ≥ 1D:	
Anisometropic (difference in sphere S between the two eyes S ≥ 1D):	14 (42.4)

N: number
%: percentage of total number of patients = 51
SE: spherical equivalent; D: diopters

Our study shows that 64.7 % (i.e., almost two-thirds) of vulnerable children need an optical correction. A bias of the selection of patients may explain that this proportion is higher than the general population of children which is estimated in France as 41,7 % in children between 2 and 12 years old [5].

Our study, with its limitations, provides though data regarding ametropia in children with limited access to ocular care and this population, which hence may require optical correction and suggest that the access to ophthalmic and optical care in this population should be improved.

4.1. Regarding the definition of ametropia and the need for optical correction

The prevalence of ametropia and the need for correction depend on the thresholds used. For hypermetropia, we used age-dependent thresholds: before 6 years, between 6 and 12 years, over 6 years (ES ≥ 3D, ES ≥ 2.25D, ES ≥ 1.5D, respectively); for the other ametropias: myopia if ES ≤ 0.5 D, astigmatism if Cylinder C ≥ 1D, anisometropia if difference in sphere S between the two eyes S ≥ 1D.

The question of thresholds requiring correction remains debated; this depends on several factors such as age, the presence of an associated pathology… The 2017 report by the French Ophthalmology Society proposed, in the absence of strabismus or ophthalmological pathology: after 3 years, correction of any indirect astigmatism >1 D; under correction of half of a direct astigmatism; correction of any myopia ⟨ 1 D; correction of any anisometropia ≥ 1 D; between 1 and 3 years, correction of any hyperopia ⟩ 3 D; after 3 years, correction of any ametropia > 5 D, with under correction possible between 1 and 5 D [6].

The American Association for Pediatric Ophthalmology and Strabismus (AAPOS) and the *Association Francophone de Strabologie et d'Ophtalmologie Pédiatrique* (AFSOP) advise significantly different threshold values of ametropia [7–9], but these values are thresholds obtained in the context of screening using a non-mydriatic auto-refractometer ("photoscreener"), coupled for AFSOP with the measurement of visual acuity and a screen test, which determine a secondary ophthalmological examination under cycloplegia if thresholds for each of the 3 tests are exceeded. These values do not therefore formally indicate a prescription for optical correction.

The question of the definition of ametropia and the thresholds chosen also depends on the measurement method, and in particular on the device used. The various self-refractometers take a physical measurement, which incorporates an interpretation algorithm that will give a convex or concave value; this is why, for the same 'refraction', one device may give a measurement that will be different from 0.125, 0.25 or even 0.5 D with another device.

Cycloplegia is the basis of the definition of ametropia and true refraction on which to base the prescription of optical correction, in children and beyond; the protocol of dilatation with cyclopentolate in our study was proposed given the limited time constraints; the possibility of cycloplegia with atropine remained possible if necessary, but only secondarily; this is why insufficient dilatation or cycloplegia was one of the exclusion criteria.

Our ametropia thresholds are therefore "stricter" than the thresholds of the AFSOP screening criteria or the AAPOS amblyogenic risk factor criteria.

4.2. Regarding the prevalence of ametropia in a specific population of vulnerable children

Few French studies have examined the epidemiological data on

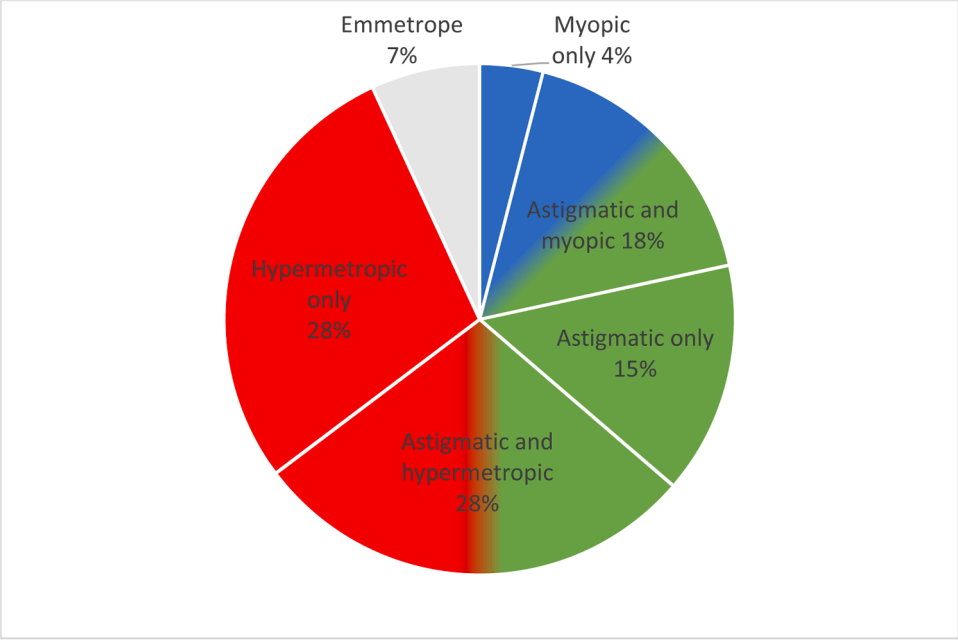

Fig. 3. Frequency of ametropia in our population.

Table 5
Frequency of ametropia in our population: detailed data.

	Eye (N, %)	Spherical equivalent (SE) in diopters (standard deviation)	Median cylinder absolute value in dioptres (standard deviation)
All	102 (100)	0.75 (3.7)	0.75 (1.2)
Astigmatic	62		1 (1.2)
Of which astigmatic only:	(60.8) 15		
Of which hypermetropic and astigmatic:	(14.7) 29		
Of which myopic and astigmatic:	(28.4) 18		
Hypermetropic ≥+0.5 D	(17.6) 58	1.81 (3.6)	
Myopic ≤ 0.5 D	(56.9) 22	-1.69 (2.2)	
Emmetrope -0.5<SE<+0.5 D	(21.6) 7 (6.9)	0.125 (0.2)	

N: number
%: percentage

refraction in children.

The PLANVUE study by Georgelin et al [10] presents results from screening campaigns in schools.

However, in this study, attention must be paid to the refractive data and thresholds, because the refractive data are derived from *photoscreener*, with thresholds of 0.25 D; the emmetropia is a "*plano*" refraction of 0 Diopters.

This population includes 515 children aged 4 to 13 years and the refraction results are as follows:

- Hyperopia: 413 children = 80 %.
- Myopia: 67 children = 13 %.
- No spherical ametropia: 13 children = 3 %.
- Antimetropia (one myopic eye, one hyperopic eye): 22 children = 4 %.
- Astigmatism in at least 1 eye: 482 children = 94 %; note that only 33 children = 6 % had no cylindrical ametropia; and eventually out of 1020 eyes = 85 % were astigmatic.

These results are interesting, even if the photoscreener measurement *is* not the "true" refraction value, and there is a flagrant overestimation of ametropias.

The ANJO study is closer to reality [5], with refraction findings with cycloplegia as follows, for recall: 58.3 % of the children are emmetropes, and 41.7 % of the children aged between 2 and 12 require optical correction: 17.2 % are hypermetropic, 3.6 % are strongly hypermetropic, 15.5 % are myopic, 0.5 % are strongly myopic, and 4.9 % have mixed astigmatism; as a reminder, this study found anisometropia (>1.5D spherical equivalent between the two eyes) in 5.0 % of the children. The thresholds chosen in this study were: strong hypermetropia above +5 D, hypermetropia between +2 and +5 D, emmetropia from -0.5 to +2 D, myopia between -6 and -0.5 D, strong myopia below -6 D.

Most recent studies focus more on myopia than on ametropias in general, in older children or even adults, the idea being maybe to propose a therapy in those cases, given the recent means of curbing myopia, which should be started early in children.

Whether they are myopic or hypermetropic, children have a high prevalence of ametropia requiring optical correction, ranging from 30 % to 40 %. Our study found a higher prevalence, of 67 %, which may be linked to selection bias and the limitations of the small sample, but which may also be linked to precarity itself.

In France, the subject of ethnic statistics, even for scientific purposes, is a very controversial subject. Studies taking this factor into account are therefore rare, and non-existent about pediatric ophthalmology. On the contrary, in the United States for example, the subject is approached and studied much more easily and thus a considerable number of studies have focused on this criterion, which is often linked to wealth or poverty. For example, a study of 9743 children aged 6 to 11 in Kansas City found a prevalence of visual anomalies in 14.1 % of *African American* children and 14.2 % of *Hispanic* children, but only 11 % of *White* children [11]; conclusion of such a study are difficult to draw, though because of the low incidence of ametropias compared to other studies. Another study of 507 children in San Diego found that 74 % of Latino patients had ametropia in at least one eye [12]. Killeen et al. [13] found that black teenagers in Michigan had significantly poorer visual acuity

than white students.

4.3. Regarding access to ophthalmic and optical care

In France, there are several obstacles to proper eye care for vulnerable children, including lack of access to an ophthalmologist and the price of glasses. In terms of access to an ophthalmologist or orthoptist (who would carry out first-line screening and manage the refraction but cannot prescribe glasses before the age of 16), there are 5794 ophthalmologists in France in 2022 and 4876 orthoptists in 2018 [14]. Given that France has a population of 67.4 million in 2020 [15], there is one ophthalmologist for 11,632 inhabitants. There are around 700,000 births per year in France in 2020–2022 (falling). If we round up the figures to 5500 ophthalmologists and 5000 orthoptists, if an entire one-year age group underwent an ophthalmological and orthoptic examination, that would mean, per professional:

- 127 ophthalmological consultations, i.e. 3 consultations per week if the doctor works 42/52 weeks;
- 140 orthoptic examinations, i.e. 3.33 examinations per week if the orthoptist works 42/52 weeks.

This lack of care can be more problematic for the pediatric population because there is also the question of the proportion of ophthalmologists who accept or not to see children, whether because they are over-specialized or simply because they want to. If one ophthalmologist in 10 agreed to see children whatever their age is, that would mean 30 consultations a week. If one ophthalmologist in 100 agreed to see children, that would be 300 consultations a week, which is probably not possible. For an vulnerable population (sometimes with added problems of access to the internet to book an appointment or a language barrier), access to ophthalmological care can be a real challenge.

Improving the access to visual care in children due to the lack of ophthalmologists or orthoptists can be addressed through a screening by paramedics of school doctors that would examine the children in schools [13] or by using smartphone-based sight test and referral system via mobile applications [16], etc.

In France with regard to the cost of glasses (if they are necessary), since the introduction of the “100 % Health” reform (Réforme 100 % *Santé*) in France on January 1st 2020, glasses equipment in the “basket A” scheme is better covered, with no out-of-pocket expenses if the patient has a supplementary private health insurance contract, or for patients entitled to the UHP scheme; but this concerns a limited list of equipment, with capped prices and potentially different quality [17].

On the other hand, the basic price for "basket B" scheme has been reduced to €0.05 per frame and each glass (i.e. a total of 15 cents), with 60 % of the cost covered by public social security, i.e. 9 centimes for a frame and two lenses.

This means that patients with public social security and private health insurance can have their glasses paid for, with no out-of-pocket expenses and no advance payment required, whether or not they are vulnerable.

Regarding the most vulnerable patients, they can benefit from UHP which can pay for the full cost of glasses with no out-of-pocket expenses in the “basket A”; the public additional scheme (“Complémentaire Santé Solidaire CSS”, i.e. a public supplementary health insurance) does not cover the “basket B”. Let’s provide an example of the costs: a frame in basket A costs €30 including VAT (value added tax) with a public social security reimbursement price is at €9). Two “type 1" lenses cost €75 including VAT each (public social security reimbursement at €22.5 each). Public social security (9 + 22.5 + 22.5) * 0.6 = €32.4 reimbursed. The €147.6 extra cost (including €16.2 co-payment) is paid by the supplementary health insurance (either private or public CSS).

Beneficiaries of the SMA can benefit from basket A rates, with 100 % of the public social security rate covered (unlike 60 % in the UHP scheme), and third-party payment. However, as they are not eligible for the CSS, they will have to pay the portion not reimbursed. Using the previous example, (9 + 22.5 + 22.5) * 1 = €54 are reimbursed by the public social security, and €126 is left to pay, which can be huge for them. As a result, recipients of SMA who do not have private health insurance will have to pay more than two-thirds of the cost of their glasses (total is 180€ in the basket A scheme = 30€+75€x2).

There are several ways of improving this situation: SMA beneficiaries should be eligible for CSS, at least for optical corrections, or the public social security rate for optical equipment should be increased for SME beneficiaries only. We are strongly in favor of such a reform, at least for children, for whom sight is essential during schooling to acquire skills that would later benefit society as a whole.

The question of cost is an issue, but it would be small compared to SMA global budget

For recall, in 2023, SMA cost 1.2 billion euros, divided into 1.14 billion euros for ordinary SMA and 70 million euros used for urgent care. In the first half of 2022, the number of ordinary SMA beneficiaries was 398480 [18]. 126€ per glasses per child each year would “only” cost 1.26 million for 10 000 children; a precise estimation of the cost is though uneasy, as the precise number of children that benefit of SMA is unknown.

In addition to the questions of the demography of ophthalmologists and the cost of the glasses, access to health care in general requires other factors which Levesque conceptualized in five dimensions: 1) Approachability; 2) Acceptability; 3) Availability and accommodation; 4) Affordability; 5) Appropriateness, corresponding to five corresponding abilities: 1) Ability to perceive; 2) Ability to seek; 3) Ability to reach; 4) Ability to pay; and 5) Ability to engage” [19].

4.4. Regarding the limitations of our study

Our study has several limitations. Firstly, the patient sample is quantitatively limited. Furthermore, no conclusion can be drawn from the data relating to UHP vs. SMA, because the number of patients with UHP is too low.

As far as the prevalence of ametropia is concerned, we cannot rule out the possibility that symptomatic children presented more frequently than asymptomatic children to the recruiters. However, symptoms of ametropia are difficult to detect, particularly under a certain age.

Eventually, regarding the number of patients, these results are difficult to transpose to the general population, but call for future screening on a larger scale, possibly in schools in disadvantaged areas.

5. Conclusion

In France, in our population of vulnerable children aged between 1 and 14, SMA beneficiaries do not benefit from better optical care than children without social security, which is probably because they must pay two-thirds of the cost of their glasses.

We believe that making SMA beneficiaries eligible for supplementary health cover, at least for optical corrections, or increasing social cover for optical equipment for SMA beneficiaries only, could help improve this situation.

Furthermore, in our population, ametropia is 1.5 to 2 times more common than in the general population, and 85 % of children who needed glasses did not wear them or no longer did. This highlights the need not only to improve eye care coverage for this population, but also to study more specifically the needs and characteristics of the most vulnerable children.

Access to eye care and optical equipment for vulnerable under children remains limited in France and can lead to visual difficulties for school-age children, in addition to any other difficulties they may encounter. Covering the cost of glasses free of charge for children without social security or who benefit from the SMA could improve the sight and lives of these future adults.

Declaration of competing interest

None.

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