A Comparative Study of the Visual Characteristics
of Three Clinical Populations

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Introduction

This epidemiological study is one of several recent attempts to try to categorize the visual characteristics of a given population. Previous projects have revolved around the eye clinics at Ferris State College of Optometry and Jackson State Prison of Southern Michigan and their respective populations. To make better use of the data from these previous studies, however, it was hoped that eventually similar studies would be conducted at each of several different clinical rotation sites. In an attempt to help meet that goal, I spent from June until September 1982 studying yet another prison population- namely that of the Ionia prison complex. The complex consists of three main facilities- the Michigan Training Unit, the Michigan Reformatory, and the Riverside Facility. The Michigan Training Unit houses mostly young first-time offenders and resembles a high school or college campus more than it does a penal institution. Located about three-quarters of a mile from M.T.U. is the Michigan Reformatory which contains the longest cell-block in the world. It is one notch below being a maximum security prison. Jackson is a maximum security prison so the Reformatory probably houses prisoners with criminal conduct records similar to those men stationed at Jackson. Lastly, the Riverside Facility, yet a bit farther down the road, is almost like a retirement home for some of the more elderly prisoners. Most of the prisoners at the Riverside Facility were from thirty-five to sixty years of age and older. The Riverside Facility also

boasted a psychiatric ward which none of the other facilities had.
The population I thus had to deal with was slightly different from
the previously-studied Jackson population. It is my understanding
that the Jackson population did not include young juvenile first-
time offenders and probably not psychotic-crazed individuals as
they would more likely have been sent to psychiatric wards else-
where. Both populations, though, dealt entirely with males, the
majority of whom were black.

Methods

To accomplish the enormous task of studying the visual
characteristics of this prison population, I had to obtain an
unbiased sample. Had I used only patients examined by me where
procedures were consistently carried out in the same routine manner,
the sample would have been biased since the amount of time I spent
at the various facilities was unequally weighted. I thus opted
to study prisoners who had been examined by a number of different
clinicians. The records of five hundred patients seen between
1978-1982 were pulled in such a manner as to ensure an equal sampling
from the three different facilities. The records pulled were
complete eye exam records and not records of screenings that had
been conducted. This study, therefore, pertains only to those
prisoners presenting visual problems and this is a key point.
As the prisoners are filtered through the prison system, they all
undergo periodic eye screenings, but only those failing the eye
screening or requesting a full eye check-up are examined in depth.
While this may at first appear to be a flaw in the sampling system
used, it may also be considered an advantage in that the patients

examined were, for the most part, motivated and wanted to be there having their eyes examined.

The data was divided into six major categories- demographic data, sensory data, motor data, refractive data, pathological data, and data pertaining to case disposition. Each of these twenty-one pieces of data in all were obtained on each of the five hundred patients studied. The categories were arranged as follows:

I. Demographic Data
    1. Age- divided according to decades

    2. Race- Caucasian, black, Hispanic, native American, or other

II. Sensory Data
    1. Visual Acuity- normal, unilateral amblyope, bilateral amblyope, trauma-related reduced V.A., or pathological-related reduced V.A.

    2. Visual Fields- normal, traumatic scotoma, traumatic peripheral defect, pathological scotoma, or pathological peripheral defect

    3. Color Vision- normal or color defective

    4. Stereopsis- normal or reduced

III. Motor Data
    1. Extraocular Muscles- normal, strabismus, or non-strabismic binocular problem

    2. Accommodation- normal, presbyopia, or other accommodative problem

    3. Pupils- normal, essential anisocoria, or other pupillary anomaly

IV. Refractive Data
1. Spherical Equivalent- emmetropia, low myopia, medium myopia, high myopia, low hyperopia, medium hyperopia, high hyperopia or aphakia

2. Cylinder Power- no astigmatism, low astigmatism, medium astigmatism or high astigmatism

3. Cylinder Axis- with-the-rule, against-the-rule, or oblique

4. Anisometropia- no anisometropia, low anisometropia, medium anisometropia, or high anisometropia

V. Pathological Data
1. External- normal, adnexal pathology, or corneal pathology

2. Internal- normal, iris pathology, lens pathology, vitreal pathology, chorioretinal pathology, optic nerve pathology, or multiple pathology

3. Systemic- no systemic pathology, diabetes mellitus, hypertension, other systemic pathology, both diabetes and other, or both hypertension and other

VI. Case Disposition
1. Spectacles Dispensed- no spectacles ordered, spectacles ordered, other optometric treatment, or both spectacles and other optometric treatment

2. Referral- no referral, or referral for further health care

Each patient was thus classified with respect to the twenty one subcategories listed above. Each characteristic pertaining to each subcategory was recorded in digital form- eg. Age (1)=18-29 years of age, (2)=30-39 years of age, (3)=40-49 years of age etc. After these 10,500 bits of data were hand tabulated, computer software was generated for data storage and analysis using a Model I TRS 80 computer.

Results and Interpretation

The percentages in each category are shown in the accompanying tables. In each case, the percentage was figured after the unknown cases were subtracted from the known population for that category. (The unknown cases refer to those patients' files where the desired information was not available.)

Table I

Table I is a table pertaining to demographic data. A careful study of it will reveal the following points:

1. Ionia had twice as many young people as Jackson and 1.7 times as many young people as F.S.C. (young referring to the 18-29 age category).

2. Jackson had a lot more middle-aged people than either Ionia or F.S.C. (i.e., people falling in the 30-39 and 40-49 age groups).

3. F.S.C. had a lot more people from age fifty and up than did either of the prisons.

4. The Ferris Clinic consisted almost exclusively of Caucasians while both of the prisons were about two-thirds black and one-third white.

5. The population of the two prisons was all male while the sampling at F.S.C. was 42% male and 58% female.

Ionia 500
Eye Clinic Patients- population sample Jackson 350
F.S.C. 733

Note: The number of patients in each category is given only for Ionia

Table I: Demographic Data

Age (years)	Ionia #	%	Jackson %	F.S.C. %
Unknown	42			
18-29	376	82.1%	40.3%	49.0%
30-39	37	8.1%	34.6%	9.0%
40-49	17	3.7%	14.9%	9.0%
50-59	21	4.6%	9.4%	13.0%
60	7	1.5%	0.9%	20.0%

Race	Ionia #	%	Jackson %	F.S.C. %
Unknown	459			3.0%
Caucasian	16	39.0%	33.1%	97.0%
Black	25	61.0%	64.9%	
Hispanic			1.7%	
Native American			.3%	

Note: The F.S.C. population was divided only as Caucasian and
       non-Caucasian

Sex	Ionia #	%	Jackson %	F.S.C. %
Males		100%	100%	42%
Females				58%

Table II

Table II containing the sensory data shows very similar findings
for the three institutions. Even though the age groups were
quite different at the three sites, no significant differences
were found in either the visual acuity or in the visual fields.
Ionia had slightly more visual field defects than Jackson. This
could reflect the difference in sample size between the two
institutions.

The color vision data should probably not even be included
since it was tested so rarely at the prisons. This would have
been a most interesting variable to compare to F.S.C. since
there were only males at the prisons, and males tend to be much
more color defective than females.

Table II: Sensory Data

Visual Acuity	Ionia #	Ionia %	Jackson %	F.S.C. %
Unknown	7			
Normal	413	83.8%	86.0%	86.0%
Unilateral amblyopia	23	4.7%	4.9%	
Bilateral amblyopia	13	2.6%	1.4%	5.0% (some form of functional amblyopia)
Trauma-related reduced V.A.	19	3.9%	4.3%	
Pathological-related reduced V.A.	25	5.1%	3.4%	9.0% (both pathology and trauma-related reduced V.A.)

Visual Fields	Ionia #	Ionia %	Jackson %	F.S.C. %	
Unknown	357			1.0+%	
Normal	133	93.0%	97.1%	93.0%	
Traumatic scotoma	2	1.4%	0.6%	2.0+%	(scotomatus defect)
Traumatic peripheral defect	2	1.4%	0.9%	3.0+%	(peripheral depression)
Pathological scotoma	4	2.8%	0.9%		
Pathological peripheral defect	2	1.4%	0.6%		

Color Vision	Ionia #	Ionia %	Jackson %	F.S.C. %
Unknown	494			4.0%
Normal	5	83.3%		87.0%
Color defective	1	16.7%		9.0%

Stereopsis	Ionia #	Ionia %	Jackson %	F.S.C. %
Unknown	420			
Normal	55	68.8%		76.0%
Reduced	25	31.3%		24.0%

Table III

A look at the motor data in Table III reveals striking similarities between F.S.C. and the two prisons. All three institutions showed about 89.5% normality in terms of functioning of extra-ocular muscles. Ionia, however, had a slightly higher rate of strabismus than either Jackson or F.S.C.

In the area of accommodation the trends toward presbyopia varied directly with age. Ionia, being heavily populated with young people, did not have a very prevalent presbyopia problem as compared to Jackson and F.S.C. where older populations are seen more frequently. Non-presbyopic abnormalities in accommodation occurred more frequently at F.S.C. than at the prisons. This is probably due to the fact that many of the patients at F.S.C. were involved in college course work and thus had heavier demands placed on their vision.

The data on pupils is not remarkable except for the fact that more essential anisocoria was detected at F.S.C. than at the prisons.

Table III: Motor Data

Extraocular Muscles	Ionia #	%	Jackson %	F.S.C. %
Unknown	22			
Normal	429	89.8%	88.6%	90.0%
Strabismus	39	8.2%	5.7%	5.0%
Non-strabismic binocular prob-lem	10	2.1%	5.7%	5.0%

Accommodation	Ionia #	%	Jackson %	F.S.C. %
Unknown	29			
Normal	402	85.4%	64.6%	53.0%
Presbyopia	41	8.7%	26.9%	36.0%
Other accommo-dative problem	28	5.9%	8.6%	11.0%

Pupils	Ionia #	%	Jackson %	F.S.C. %
Unknown	22			
Normal	463	96.9%	96.9%	94.0%
Essential anisocoria	7	1.5%		5.0%
Other pupillary anomaly	8	1.7%	3.1%	2.0%

Table IV

Table IV containing the refractive data was the most difficult to analyze since the refractive errors were grouped differently in the three separate studies. For example, the Ionia study classified emmetropia as ±0.37D as compared to ±0.12D for the Jackson study and ±0.25D for the F.S.C. study. Also, the Jackson study utilized a straight sphere power component and not a spherical equivalent as did the other two studies. The different groupings were mixed and matched as closely as possible, however, for comparison purposes.

On the basis of spherical equivalents $\left(\frac{sphere + cylinder}{2}\right)$, [?] $sph + \left(\frac{c^{s}}{2}\right)$ Ionia displayed the highest percentage of emmetropia. This is not surprising since Ionia encompassed the youngest population. Again, however, the data is biased and the scales are tipped in Ionia's favor due to the inclusion of more lee-way here in the refractive error (±0.37D) as compared to the other two studies-(±0.12D) for Jackson and (±0.25D) for F.S.C.

All three institutions contained about 33.4% low myopes and 2.1% high myopes. Slight variations occurred in the medium ranges of myopia, but nothing of great significance.

Significant differences in the incidence of low hyperopia were found in the three groups. F.S.C. showed 10% more low hyperopia than Ionia, and Jackson showed 10% more than F.S.C.-(30% for Ionia vs. 40% for F.S.C. vs. 50% for Jackson). The extent of medium and high hyperopia at the three institutions did not vary significantly.

Cylinder power data at the three sites also showed remarkable similarity. Generally, about 33% of the patients displayed no

astigmatism, 61% displayed low astigmatism, 5.5% displayed medium
astigmatism and only 1.1% displayed a high amount of astigmatism.
Whether or not this is significant is questionable, but there
did tend to be slightly more medium and high astigmatism in the
prisons than at F.S.C. Ionia showed the largest percentage of
with-the-rule astigmatism while F.S.C. with its older population
showed the largest percentage of against-the-rule astigmatism.
The frequency of occurrence of the different types of astigmatism
within a given population was always as follows: with-the-rule
astigmatism > no astigmatism > against-the-rule astigmatism >
oblique astigmatism.

Anisometropia was the exception rather than the rule among
the three populations. If any anisometropia was displayed at all,
it tended to be of a lesser amount ($\pm 0.75D$ to $\pm 1.62D$).

Note: The refractive data (spherical equivalent and astigmatism
power) represent combined O.D. and O.S. data on 976 eyes

Table IV: Refractive Data

Spherical Equivalent	Ionia #	Ionia %	Jackson %	F.S.C. %
Unknown	24			
Emmetropia (±0.37D)	312	32.0%	7.1% (±0.12D)	10.0%
Myopia				
low (-0.50 to -2.87D)	299	30.6%	34.6%	35.0%
medium (-3.00 to -5.87D)	36	3.7%	4.3%	9.0%
high (≥ -6.00D)	21	2.2%		2.0%
Hyperopia				
low (+0.50 to +2.87D)	286	29.3%	51.7%	40.0%
medium (+3.00 to +5.87D)	13	1.3%	2.3%	3.0%
high (≥+6.00D excluding aphakes)	8	0.8%		1.0%
Aphakia	1	0.1%		

Cylinder Power	Ionia #	Ionia %	Jackson %	F.S.C. %
Unknown	24			
No astigmatism (±0.37D)	400	41.0%	29.1%	29.0%
Low astigmatism(-0.50 to -1.87D)	499	51.1%	63.1%	68.0%
Medium astigmatism (-2.00 to -3.87D)	67	6.9%	6.6%	3.0%
High astigmatism (≥ -4.00D)	10	1.0%	1.1%	

Cylinder Axis	Ionia #	Ionia %	Jackson %	F.S.C. %
Unknown	24			
No astigmatism	400	41.0%	29.1%	29.0%
W.T.R. (180°± 30°)	410	42.0%	37.1%	30.0%
A.T.R. (90° ± 30°)	222	22.8%	21.4%	30.0%
Oblique (others)	54	5.5%	12.3%	11.0%

Anisometropia	Ionia #	Ionia %	Jackson %	F.S.C. %
Unknown	16			
±0.62D	415	85.7%	88.9%	91.0% (±.87D)
±0.75 to ±1.62D	52	10.7%	7.4%	9.0%
±1.75 to ±2.62D	9	1.9%	0.0%	
≥±2.75D	8	1.7%	3.7%	

Table V

The pathological data in Table V shows that about 83.8%
of the patients at each of the eye clinics were normal with regard
to external examination. There was a trend, however, towards more
adnexal and corneal pathology in the younger age groups (as evidenced
by the higher percentages of these at Ionia). It should be noted
that the adnexal pathology included mostly benign things such as
blepharitis- at least in Ionia's case.

The data pertaining to internal examination was also surpri-
singly similar. About 81% of the patients proved to be normal.
Chorioretinal pathology was the most prevalent internal abnormality
among the three populations. At first glance it may appear that
Ionia had a lot more chorioretinal pathology than Jackson (13.0%
vs. 3.7%). However, because the Jackson study had one pathology
category involving trauma to the posterior segment of the eye,
we can assume that the majority of this 4.3% was chorioretinal
involvement and include it under our classification of chorio-
retinal pathology. We thus obtain 3.7% + 4.3% or 8.0% which
correlates quite well with the other data.

The next most common disorder among the patients was that of
lens pathology. Again Jackson may at first appear to have less
lens pathology than Ionia (2.0% as opposed to 4.6%). However,
since the investigation at Jackson documented an additional 2.6%
internal pathology involving trauma to the anterior segment, we
can assume that the majority of this is probably lenticular in-
volvement. We thus have 2.0% + 2.6% or 4.6% lens pathology for
Jackson which is the same as was found for Ionia.

Optic nerve, iris, and vitreal pathology were rare phenomena

at the prisons.

The rate of systemic pathology at both Ionia and F.S.C. was similar with both sites having approximately 15% of the patients showing abnormalities.

Table V: Pathological Data

External	Ionia #	Ionia %	Jackson %	F.S.C. %
Unknown	21			
Normal	380	79.3%	87.1%	85.0%
Adnexal pathology	55	11.5%	8.0%	9.0%
Corneal pathology	44	9.2%	4.9%	6.0%

Internal	Ionia #	Ionia %	Jackson %	F.S.C. %
Unknown	1			
Normal	392	78.6%	86.3%	78.0%
Iris pathology	4	0.8%	0.0%	
Lens pathology	23	4.6%	2.0% [1]	9.0%
Vitreal pathology	1	0.2%	0.3%	
Chorioretinal pathology	65	13.0%	3.7% [2]	11.0%
Optic Nerve pathology	4	0.8%	0.9%	
Multiple pathology	10	2.0%		

(1) also 2.6% involving trauma to anterior segment
(2) also 4.3% involving trauma to posterior segment

Systemic	Ionia #	Ionia %	Jackson %	F.S.C. %
Unknown	5			
No systemic pathology	422	85.3%		85.0%
Diabetes mellitus	6	1.2%		
Hypertension	21	4.2%		
Other systemic pathology	44	8.9%		
Both diabetes and high blood pressure	2	0.4%		
Diabetes and other	6	1.2%		
High blood pressure and other	7	1.4%		

Table VI

Table VI relates to how the case was finally handled. Data
was available for Ionia and F.S.C. only. The results at the two
sites were similar. About 64.5% of the patients at both clinics
ordered spectacles. F.S.C. has a number of "in-house" eye
clinics which Ionia does not have. These specialty eye clinics
account for the major portion of F.S.C.'s referrals for further
health care. Only about 2.0% of the patients at F.S.C. are
referred to external health care providers. This compares
favorably with the number from Ionia who are similarly referred.

Table VI: Case Disposition

Spectacles Dispensed	Ionia #	Ionia %	Jackson %	F.S.C. %
Unknown	1			
No spectacles ordered	140	28.1%		
Spectacles ordered	329	65.9%		63.0%
Other optometric treatment	24	4.8%		
Specs and other treatment	6	1.2%		

Referral	Ionia #	Ionia %	Jackson %	F.S.C. %
Unknown	3			
No referral	476	95.8%		85.0%
Referral for further health care	21	4.2%		15.0% [1]

(1) only 2.0% of these are to external health care providers

Discussion and Conclusion

In conclusion, the above data testifies to the fact that
the two prison populations are really very similar in their
visual characteristics to that of a more general non-insti-
tutionalized population. Especially well-correlated were the
sensory, motor, refractive and pathological data. This is
in spite of the fact that different sample sizes were used and
despite the fact that the three clinics tended to cater to
different age groups. The findings would imply that the
inmates at Ionia and Jackson had not been deprived of occupational
opportunities because of vision problems. Thus, if we were
hoping to find a major factor contributing to these prisoners'
incarceration, it is not accounted for via this research.

REFERENCES

1. Carter, Robert L., O.D., <u>Epidemiological Study of Patients Seen in the Primary Care Clinic at Ferris State College of Optometry</u>, 1982.

2. Salerno, Ramo Jr., <u>Epidemiological Study of Adult Male Inmates at Jackson State Prison of Southern Michigan</u>, Senior Project, 1982.