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Research Article

Low Vision Service Activities Review and Use of the Electronic Health Record

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Abstract

Aim: The aim of this study was to describe two years activities in a low vision rehabilitation center based on a multidisciplinary approach by means of a new Electronic Health Record (EHR) in order to highlight the benefits.

Methods: Clinical and functional data of patients assessed at our low vision center were collected and analyzed retrospectively through the use of nLIFE, a new EHR. nLIFE is easily customizable to follow different needs and scenarios. nLIFE is updated with different modules including advanced search ability. Eye disease, National Eye Institute 25 item Visual Function Questionnaire (VFQ-25), Best Corrected Visual Acuity (BCVA), Contrast Sensitivity (CS), Fixation stability, Microperimetric retinal sensitivity, Reading Speed (RS) and aids prescribed were evaluated. All data came from different modules and tools and were processed in an ad-hoc database.

Results: A total of 420 EHRs of patients who attended the low vision center between January 2015 and December 2016 were included in the analysis. Mean age was 66.7 years (SD 20.7). Age related Macular Degeneration (AMD) was the most frequent disease with a prevalence of the atrophic one. BCVA was collected for 593 eyes with a mean of 0.89 (± 0.34) LogMAR and CS was 0.76 (± 0.41) LogC. Three hundred eight patients underwent a specialized psychological assessment. Moreover, 259 subjects completed the VFQ-25. Glare and reading were the most frequent demands.

Conclusion: EHR appears to be a valid tool for supporting clinicians. nLIFE is based on the state of the art of web technology with the possibility to receive data from different sources and multidisciplinary modules. It can review clinical and research data locally or through Internet and by using all device type.

Keywords: Age related macular degeneration; Depression; Electronic health record; Glare; Multidisciplinary team; Reading

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Background

Low vision is defined as any form of visual impairment due to different chronic eye diseases not correctable by eyeglasses or surgery; patients have a visual acuity less than of 20/60 or a visual field inferior of 60° in the better eye. World Health Organization in 2014 estimated that 285 million people worldwide had vision impairment; 39 million people are blind and 246 were low vision [1].

Visual disability negatively impacts on daily life activities. Visually impaired became unable to perform many Activities of Daily Living (ADLs) such as reading, recognizing faces, watching television and driving resulting in a poor quality of life. According to some author's findings, visual impairment has an effect on psychological status and quality of life and it can be related to feelings of inadequacy and higher level of depressive symptoms [2-5]. Based on clinical and psychological features of visually impaired, an holistic and multidisciplinary approach should be recommended. Our National Center of Services and Research for the Prevention of Blindness and Rehabilitation of Visually Impaired, IAPB Italia onlus, has a multidisciplinary team including psychologist, ophthalmologist, orthoptist, orientation and mobility teacher and expert in tiphlology. As our standard procedure, first of all the psychologist approaches the patient focusing on psychological status and personal demands. A complete ophthalmological examination is performed subsequently.

Considering patient's residual visual function and needs, a customized rehabilitation program is defined. Therefore, patients can start with the devices training sessions supported by the orthoptist in order to identify and correctly use magnifying aids.

In the recent years, our team adopted an Electronic Health Record (EHR), a digital version of patient's paper charts implemented with several tools, in order to achieve specified improvement in patient care delivery, provide more effective methods of communicating and sharing information among multidisciplinary team and better manage patient medical records as reported by other authors [6-10]. The EHR is based on an electronic medical database that resides on a web server (Figure1). Therefore, inside of an integrated health system, the EHR adoption can impact on the improvement of clinical care and research quality. Before EHR adoption our center used paper charts to collected clinical data divided in specific sections considering the different professional roles.

The aim of this study was to describe two years activities in our low vision rehabilitation center based on a multidisciplinary approach using an EHR in order to highlight the benefits of the tool and its impact on clinicians care delivering.

Methods

The retrospective review was carried out in 420 patients with low vision who attended the National Centre of Services and Research for the Prevention of Blindness and Rehabilitation of Visually Impaired, IAPB Italia Onlus, in Rome from January 2015 to December 2016. Patients were referred to our centre to attend a low vision rehabilitation program in order to cope with visual disability affecting daily

life activities. Patients had a Best Corrected Visual Acuity (BCVA) between 1.5 LogMAR (Logarithm of the Minimum Angle of Resolution) and 0.5 LogMAR and/or a visual field less than 60% according to Italian classification of low vision (Law 138/2001).

Figure 1: The architecture of the web-based electronic health record.

Visually impaired patients who had access to our low vision centre were informed by our staff about the likelihood of using their own clinical data for research purposes and they gave their informed consent. Clinical and functional data of patients were collected and analyzed retrospectively through the use of nLIFE, a new EHR developed by Nidek Technologies. nLIFE is easily customizable to follow different needs, scenarios from stand-alone configuration to big networks. It can communicate with different devices and automatically import the results of specific exams as microperimetry or visual field analyzer (Figure 2). The filling of information is divided on several sections in order to properly fit different kind of medical data. nLIFE is updated with different modules including advanced search ability and scheduling of resources to implement a full field approach to medical data management (Figure 3).

Figure 2: nLIFE is easily customizable to follow different needs, scenarios from stand-alone configuration to big networks.

As standard procedure, low vision assessment begins with psychological interview. The psychologist investigates patients' psychological status and demands, motivation to start with the vision rehabilitation intervention, grief stage of disease and National Eye Institute 25 item Visual Function Questionnaire (VFQ-25). If necessary, the patient is supported by the psychologist during the whole rehabilitation pathway.

All patients underwent complete ophthalmic evaluation including BCVA using the Early Treatment Diabetic Retinopathy Study (ETDRS) charts (Precision Vision, Woodstock, IL, USA, IL) and recorded as logMAR at a distance of 4 meters, Slit-lamp examination, binocular ophthalmoscopy and Contrast Sensitivity (CS) measured with Pelli-Robson charts (Precision Vision, Woodstock, IL, USA, IL) adding +1 spherical diopters to the best distance correction expressed as LogC (Logarithm of Contrast), fixation stability and retinal sensitivity analyzed with the microperimeter MP1 (Nidek Technologies, Padua, Italy). Fixation stability was classified according to Fujii Classification [11] and Bivariate Contour Ellipse Area (BCEA) encompassing 1 SD, 68.2% was performed. The area of the ellipse was calculated in degrees with Steinman's technique [12]. MP1 retinal sensitivity was automatically imported by the tool. After the multidisciplinary meeting, the team discussed the rehabilitation approaches to help people with difficulties expressed. Therefore, every patient participates to low vision training sessions. Patients who were trained to restore reading, during the last training were tested and Reading Speed (RS) with the most appropriate low vision aid was evaluated. RS was calculated as words per minute (counting the number of corrected words during 1 minute) on an Italian Newspaper text printed in a 9-point Times New Roman typeface. Patients were asked to read as quickly as possible. Once completed the rehabilitation training program; patients received the prescription of low vision devices. All data came from different modules and tools and were processed in an ad-hoc database (Figures 4A & 4B). According to inclusion criteria, nLIFE advanced research tool allowed to save and export the database into an excel file. A survey was conducted among the operators of the multidisciplinary team, in order to describe the user experience of nLIFE during practice activities. Every question was related to specific aspect about user approach, organization of information, usability, customization and support experience. About the question related to a satisfaction evaluation, the indicator was given by ten point scale, in which 1 means not satisfied at all and 10 means very much satisfied (Table 1).

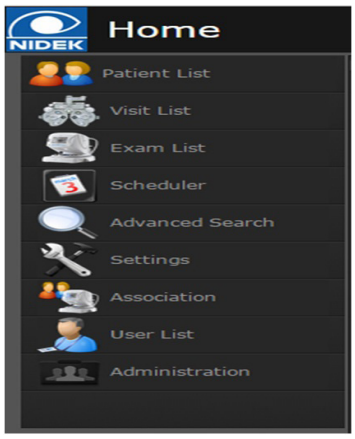


Figure 3: nLIFE is updated with different modules including advanced search ability and scheduling of resources to implement a full field approach to medical data management.

Results extracted by the EHR were indicated descriptively (mean values, standard deviations (SD) median, range).

Results

A total of 420 EHRs of patients who attended the National Center of Services and Research for the Prevention of Blindness and Rehabilitation of the Visually Impaired between January 2015 and December 2016 were included in the analysis (Graph 1). One hundred ninety

four patients were rehabilitated in 2015 and 226 in 2016 for a total of 4648 health services. Mean age of the whole sample was 66.7 years (SD 20.7 and range 18-99) with a high percentage (114 subjects = 27%) of the age group falling between 76-85. Graph 2 shows the distribution for age.

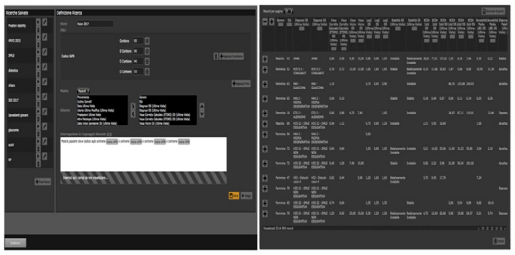
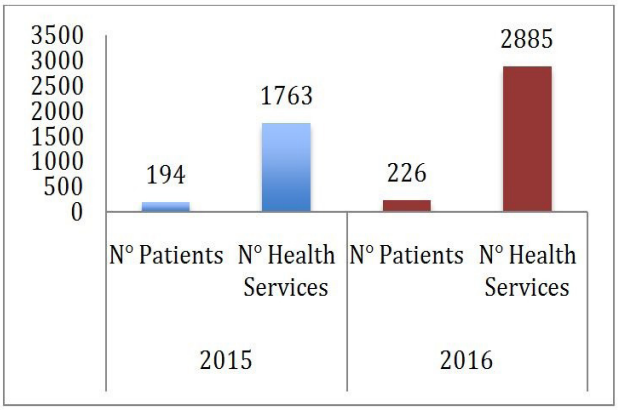


Figure 4A Figure 4B

Figure 4: Figure 4A, 4B shows all data came from different modules and tools and were processed in an ad-hoc database. According to inclusion criteria, nLIFE advanced research tool allows to save and export the database into an excel file.

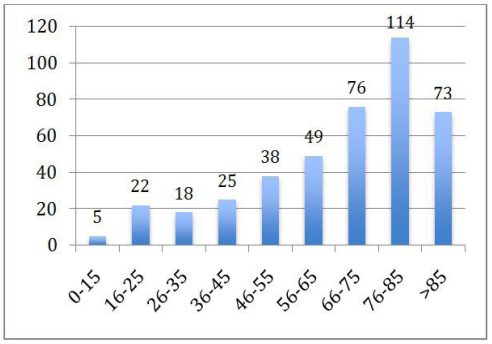
1. Daily practice experience (Overall approach With EHR, usability of the system, easiness of use)
1 2 3 4 5 6 7 8 9 10
2. Clarity of user interface (Information organization, tabs division, pathology selection)
1 2 3 4 5 6 7 8 9 10
3. Approach with patient chart and visit information (easiness to find records and related visit)
1 2 3 4 5 6 7 8 9 10
4. Learning Curve (Different approach to electronic records and related filling to follow doctror's need)
1 2 3 4 5 6 7 8 9 10
5. Quality of support and company interaction (Interaction with the comapny in order to follow and discuss doctors request)
1 2 3 4 5 6 7 8 9 10
6. Main advantage about nLife implementation and use (more than one answer is accepted)
1.Avoiding paper 2.Better clinical data organizatio n 3.Increase patient flow 4.Possibility of information seeking 5.Device connection for exam reviewing 6. Other
7. Main difficulty about nLife implementation and use (more than one answer is accepted)
1. None 2. Increase visit time 3. Interface approach 4. Seeking information 5.Other...
8. Integration with existing clinical software product (appointment, arrivals, report sharing)
1 2 3 4 5 6 7 8 9 10
9. Integration with existing device (data acquisition, exam review)
1 2 3 4 5 6 7 8 9 10
10. Application reactivity (Access to patient or exam data, download time, responsiveness
1 2 3 4 5 6 7 8 9 10

Table 1: Experience and satisfaction survey.

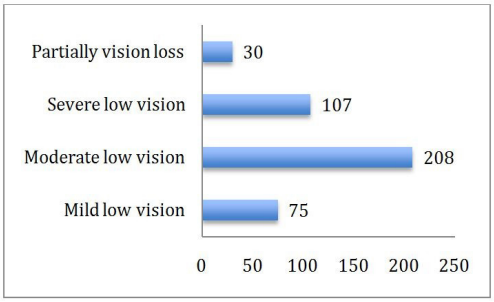


Graph 1: Distribution of both patients assessed and health services during 2015 and 2016.

According to the Italian low vision classification (Law 238/2001), we classified patients on the basis of their residual vision. Graph 3 shows the distribution of patients for range vision loss: 208 (50%) patients had a moderate low vision, 107 (25%) had severe low vision, 75 (18%) mild low vision and 30 (7%) partially vision loss.



Graph 2: Distribution (number: Y axis) of visually impaired patients evaluated.



Graph 3: Distribution of patients according to the Italian low vision classification.

Table 2 shows the principal diagnosis of all participants.

Disease	N°	%
AMD	171	41
Hereditary retinal dystrophies	61	15
Degenerative myopia	55	13
Glaucoma	28	7
Other retinal disorders	12	3
Diabetic retinopathy	22	5
Disorders of optic nerve and visual pathways	31	7
Albinism	8	2
Cataract and corneal disorders	6	1
Other	26	6

Table 2: Low vision causes distribution among visually impaired who attended our low vision centre.

The leading cause of visual impairment among our patients was Age related Macular Degeneration (AMD) with a prevalence of the atrophic type: 113 patients (66%) were affected by the atrophic form and 58 (34%) by the exudative one.

Functional outcomes

BCVA was collected for a total of 593 eyes with a mean of 0.89 (± 0.34) LogMAR. Further analysis permitted to identify BCVA for the best eye with a mean of 0.73 (± 0.20) LogMAR and the worse one 1.08 (± 0.41) LogMAR. Mean contrast sensitivity was 0.76 (± 0.41) LogC in the best eye and 0.75 (± 0.57) LogC in the worse one. Two

hundred sixty four 264 eyes were tested to microperimetry. Fixation analysis showed a relatively unstable fixation in 43% (115) eyes, stable in 32% (84) and unstable in 25% (65). Bivariate Contour Ellipse Area (BCEA) encompassing one standard deviation (1 SD 68.2% fixation points) had a mean of 5.6°2 (± 4.1). Mean retinal sensitivity was 4.6 dB (± 3.41).

Psychological outcomes

Three hundred eight patients underwent a specialized psychological assessment, including both evaluation of grief stage and motivation for rehabilitation (Table 3).

EyeDisease	Grief stage				
	Acceptance	Depression	Denial	Anger	Regret
AMD	46	53	1	8	20
Hereditary retinal dystrophies	21	10	4	7	2
Degenerative myopia	16	16	1	3	5
Glaucoma	8	3	1	4	4
Other retinal disorders	2	3	1	6	0
Diabetic retinopathy	3	11	1	1	2
Disorders of optic nerve and visual pathways	9	4	1	1	4
Albinism	4	2	0	1	0
Cataract and corneal disorders	1	2	0	0	1
Other	9	5	1	0	0

Table 3: Shows the grief stage in accordance to eye disease.

During the first psychological assessment, the grief stage was defined. One hundred-nine subjects (35%) presented depressive symptoms while others 119 (39%) reported to have accepted their eye disease. Regret was found in 38 (12%) patients, anger in 31 (10%) and denial in 11 (4%). Patients were also scheduled by both eye disease and grief stage as reported in table 3. Most of the patients (48%) between those who were classified with depression symptoms had a diagnosis of AMD. Moreover, 259 subjects completed the VFQ-25 and items mean and SD were reported in table 4.

A total of 258 patients underwent to psychological counseling and support during their vision rehabilitation pathway.

Rehabilitation data

Low vision devices prescribed were 520. The most prescribed low vision devices in order to reduce glare were photo selective spectral lenses. In order to read newspaper print, video-magnifiers were necessary for 107 patients, whereas hand-held magnifiers for 84 and spectacle magnifiers for 38. Mean reading speed was 59.1 (± 42.7) words/minute (Tables 5&6).

The Experience and Satisfaction Survey

Graph 4 and table 7 shows the results of the survey in which the multidisciplinary staff were asked about the experience they had with the EHR and their satisfaction.

Discussion

We describe for the first time, to our knowledge, the use of an EHR in a low vision service. It has been demonstrated that EHR offers clinicians several advantages including improved productivity, better disease management, care coordination and patient safety with the evidence of a data base collection improved quality. On the other hand the lack of time for the accuracy of patient record content and the need for adequate learning and support are considered as disadvantages for the HER diffusion [13,14].

The use of EHR in different medical settings and particularly into ophthalmic practices has been limited and it has been reported that only the 34% of ophthalmology units have adopted an EHR system into the practice [8,9] in comparison to 50% of all physicians, maybe related to the particular needs of ophthalmic evaluation as drawing the ocular fundus or writing the refractive correction. We believe that all the learning difficulties for the use of the tool should be overcome also for epidemiological data analysis in consideration of the evolving need of changing population demographics, where the number of patients with visual impairment who need to access to the low vision rehabilitation center will increase. Moreover low vision rehabilitation is a sub-specialty of ophthalmology that required different professional figures involved in a multidisciplinary team as the ophthalmologist, orthoptist, psychologist, orientation and mobility teacher, with an ever-increasing impact on the concepts of research, education, and services for the visually impaired patient. The Electronic Health Record appears to be a valid tool for supporting clinicians in our multidisciplinary approach in order to collect high amounts of data, consult the different evaluations, increase patient engagement, build shared models and standardization across institutions, create new knowledge and facilitate personalized care. Moreover, the ability to combine vast amounts of data allows cross-sectional research. The low vision multidisciplinary approach involves medical and surgical care, acquisition and interpretation of imaging, high-volume documentation coming from different tools and based on numerical, text-based and imaging-based documentation.

Our study has found that in a multidisciplinary context the staff questionnaire on users' experience reported a good daily practice experience, a satisfying clarity of user interface, approach with patient chart and visit information and integration with existing devices.

nLIFE is based on the state of the art of web technology with the possibility to receive data from different sources and different modules. The EHR was set in order to be a web and technology devices (Computer, tablet, smart phone, etc.) based on multiple disciplines information system that collects, stores and displays patients' data. The EHR has been efficacious in improving quality of practice for reviewing clinical and research data locally or through internet and by using all type of devices. The multidisciplinary team was currently able to share exams and images directly from devices to the EHR by electronic upload. The advance search ability tool allowed to extract and export functional and clinical data in an excel sheet automatically and quickly. Moreover the multidisciplinary team was able to interact on the EHR at the same time. The use of the paper medical chart would not allow a quick extrapolation and rapid clinical processing of a large number of data. The tool reduced the operators' error likelihood during data entry in the database and it allowed matching the items of the evaluation performed by the various professionals of the multidisciplinary team.

We easily analyzed a large number of data coming from the health records of 420 visually impaired patients reviewing 2 years activity of our low vision centre.

VFQ-25 Items	GH	GV	OP	NA	DA	Vssf	Vsmh	Vsrd	Vsd	D	CV	PV
Mean	43.38	25.60	52.77	23.31	23.36	37.44	26.18	30.79	31.78	1.56	34.94	14.15
SD	27.22	16.96	70.67	20.16	20.89	59.74	22.20	25.14	30.59	7.35	40.25	23.40

Table 4: Means and standard deviations of the VFQ 25 items.

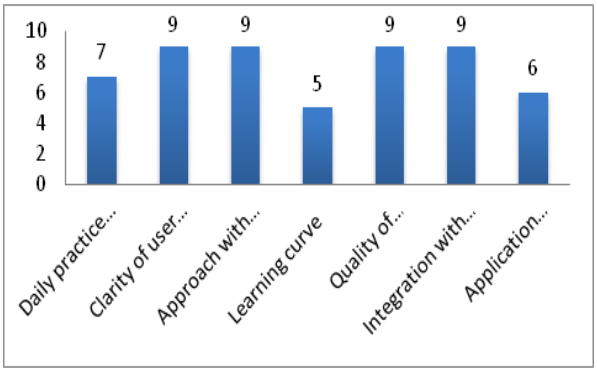
GH: General Health; GV: General Vision; OP: Ocular Pain; NA: Near Activities; DA: Distance Activities; Vssf: Vision specific social functioning; Vsmh: Vision specific mental health; Vsrd: Vision specific role difficulties; Vsd: Vision specific dependency; D: Driving; CV: Color Cision; PV: Peripheral Vision.

Needs	N°	%
Outside glare	228	24
Reading	213	22
Distance/ watching TV	149	15
Inside glare	114	12
Writing	56	6
PC	48	5
Using mobile phone	47	5
Home activities	38	4
Orientation and mobility	32	3
Knitting	25	2
Hobbies (bricolage, playingcards…)	16	2

Table 5: The patient's needs.

Aids	N°	%
Photoselective spectral lenses	190	36
Video magnifiers	107	21
Refractive error correction	81	16
Hand-heldmagnifier	84	16
Spectacle magnifier	38	7
Telescopes	14	3
Screen magnifier /Screen reader	6	1

Table 6: Low vision devices prescribed.



Graph 4: The graph shows the mean of the answers given by multidisciplinary staff.

As reported by World Health Organization (WHO), visual impairment is highly prevalent in the worldwide and is expected to increase rapidly as the population ages [1,15,16]. Aging diseases as AMD seem to be the most common causes of low vision in the developed countries [17,18]. Our review highlights that the most of our patients (27%) had an age between 75 and 86 years, confirming the impact of the advancing age between low vision patients and the most frequent cause of low vision between our patients was AMD with a greater prevalence of the atrophic form respect to the exudative one. The other causes of low vision were represented by hereditary retinal dystrophies and pathological myopia. Matched data analysis, interestingly, showed the effect of the eye disease on the psychological status. A depression status was found more frequent in patients with a diagnosis of AMD and diabetic retinopathy compared to the other low vision causes. On the other hand, a more acceptance status revealed other visual impaired conditions such as hereditary retinal dystrophies, glaucoma and optic nerve disease. As previously described vision impairment compromises quality of life and limits social interaction and independence [19]. Most older persons with vision loss due to aging disease, reported poorer levels of functioning in ADLs, symptoms of depression and poor motivation to start with a visual rehabilitation program [20-26]. Elderly people with low vision are unable to perform ADLs, resulting in a psychological burden.

Main advantage about nLIFE implementation and use	Avoiding paper	Possibility of information seeking	Device Connection for exam reviewing
Main difficulty about nLIFE implementation and use	Increase visit time		
Integration with existing clinical software product	Not applicable		

Table 7: Shows the answers of the staff on the sixth, seventh and eighth question given on the survey.

The analysis of the VFQ25 revealed that our patients expressed poor functioning in "Near activities", "Distance activities", "Vision specific mental Health", "Peripheral vision" items, reflecting their own difficulties and demands. Near activity included reading ability that was the most important goal for patients examined and it was requested by 51% of the whole sample. In order to restore reading ability, a relevant number of video magnifiers CCTV (Closed Circuit Television) were prescribed. The visual acuity reduction, the high prevalence of people with AMD, who need a strong enlargement, could explain the large number of CCTV that allows reading with high level of magnification. Moreover, glare caused by scattering of light within the eye is a great deal for the patients resulting in eye discomfort and impaired visual functioning and it was another important demand expressed by our subjects. The rehabilitation solution was the use of the photo selective spectral lenses. Another important factor to be considered is the need for visually impaired to improve distance viewing and watching television and just the refractive error correction was the most suitable prescribed low vision aid for far in order to enhance the image and improve functional vision. This analysis has a limitation that should be considered: the sample size was actually small for some estimation about clinical and functional data.

Conclusion

In conclusion, during the last years, EHR was adopted for improving quality of practice and research in a low vision multidisciplinary setting. It seems to be a valid tool in order to improve and enhance quality of care of low vision patients and research activity. Advanced search tool could be a more effective method to easily review patient's information and to improve the ability of clinicians to manage and analyze clinical data. Our results and experience suggest the use of the EHR within a vision rehabilitation centre, based on a multidisciplinary team, as an instrument to enhance patient's quality of care and multiple professional's research activities.

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