NECO | New England College of Optometry

How telemedicine will shape the future of eye care delivery?

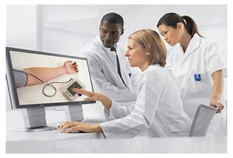
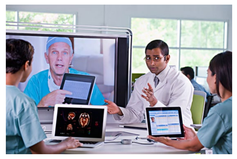
Lucille Raptis[1], Jian Zhao[2], Shiqi Hu[2], Zelin Wang[2], Xinyun Li[2], Yuchen Liu[2]

[1]New England College of Optometry, Boston, MA; [2]School of Ophthalmology & Optometry of Wenzhou Medical University, Wenzhou, China

温州医科大学附属眼视光医院
温州医科大学眼视光学院
浙江省眼科医院
Eye Hospital, WMU
School of Ophthalmology & Optometry, WMU
Zhejiang Eye Hospital

INTRODUCTION

- **Definition**: Medical care provided remotely to a patient in a separate location using two-way voice and visual communication by computer and phone.

- **Classification**: Including telemedicine, teleeduction, telemedicine information sharing, remote monitoring, etc.

- **Assistive technologies**: 5G networks, artificial intelligence, big data services
- **Main focus :** diabetic retinopathy

METHODS

- **Group discussion**

- **News reports**

- **Literatures**


Application of 5G Technology to Conduct Real-Time Teleretinal Laser Photocoagulation for the Treatment of Diabetic Retinopathy

- **Interviews**

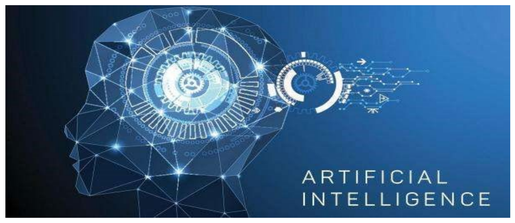
PURPOSE

- To investigate and compare the general condition of telemedicine in US and China
- To compare how individual optometrists or ophthalmologists use telemedicine at two university-based hospitals
- To promote cross-country communication on telemedicine
- To point out the challenges and anticipate future direction of telemedicine

RESULTS

Comparison1: Assistive technologies

The rapid innovation of science and technology such as AI, 5G, and smart glasses with augmented reality promotes the development of telemedicine.



In China, the hand-held slit lamp microscope, objective and quantitative computer-aided diagnosis of strabismus, and digital Visual Acuity Chart are used. While in the US, SVM Light screening is used.


Due to the differences between the two countries eye care systems, each country has its own strengths in technological development .

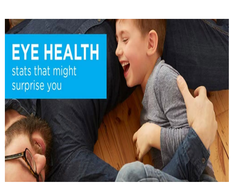
Comparison2: Current applications

Nowadays, telemedicine is widely used worldwide for screening, diagnosis, consultation, knowledge sharing , assisted surgery, and treatment.

Countries across the world have utilized digital innovations and telemedicine to tackle diabetic retinopathy, retinopathy of prematurity, age-related macular degeneration, glaucoma, refractive error correction, cataract and other anterior segment disorders.

In China, telemedicine has been used to assist in laser eye surgery.

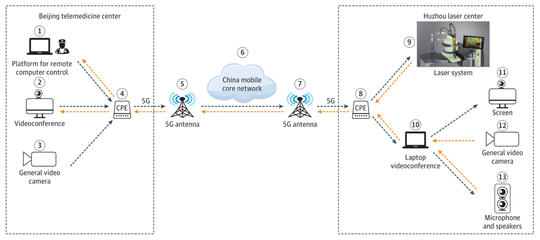
In the US, telemedicine is used in follow-up care.



***A great leap forward**: Real-time teleretinal laser photocoagulation for the treatment of diabetic retinopathy

RESULTS – CONTINUED

Figure 1. Equipment and Network Configuration for Real-Time Telephotocoagulation



Findings

- A retinal specialist in Beijing, China, performed an online 5G real-time navigated retinal laser photocoagulation procedure on 6 participants with DR located in Huzhou, China.
- All aspects of the laser procedure were done with no noticeable technology delay, and no safety issues were identified.

Meanings

- This successful procedure may pave the path for ophthalmologists to provide essential remote health care to patients with diabetic retinopathy.

Comments

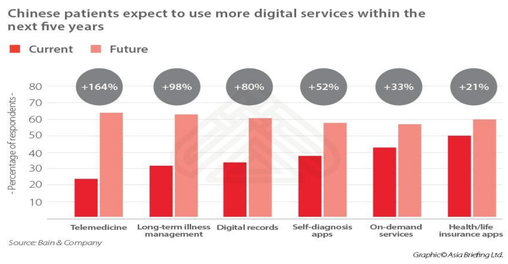
- From a patient: "It doesn't hurt, and now I can see the world with my eyes, it's no longer blurry, I can see everything clearly, it's very good, now there are many good policies for the people in the remote areas, and today my treatment is free of charge. Thanks to telemedicine."


Comparison3：2 interviews from the US and China

	WMU Dr. Zhiqiang Xu	NECO Dr. Pappavaselio
Common usage	Consultation for refractive errors, contact lenses, presbyopia etc.	Anterior segment diseases' diagnosis, treatment and follow up care
Frequency	0.5h/wk for prescription, diagnosis, follow-up	3h/wk for dry eye follow-up care
Limitations	We can only prescribe a limited range of drugs. Telemedicine is for online diagnosis and screening, further treatment is not realistic	Insurance companies may not cover it, and the elderly population cannot easily use telemedicine services.

DISCUSSION

In China, ophthalmologic telemedicine use has expanded rapidly over the last decade, providing an opportunity for assistive technologies like AI to help screen patients for diabetic retinopathy living in rural areas. While in the US, ophthalmologic telemedicine use expanded during the Covid-19 pandemic, but has since steadily declined. The two factors that serve to highlight the differences between these two countries are access to eye care in rural areas, and doctors compensation for telemedicine visits. If the telemedicine platform continues to be supported by China's government policies, we may see expanded use of telemedicine across China in the next five years with further development and improvement of AI screening technologies for diseases like diabetic retinopathy. In the US, telehealth will likely continue to be used as a form of follow-up care after a patient has been previously seen for an in-person eye exam, as insurance companies are not likely to expand the use of the platform to screen, manage, or treat posterior segment disease. However, in academia we are likely to see more research on the use of fundus photography and telemedicine to screen for diseases like diabetic retinopathy and ROP.



CONCLUSION

In conclusion, telemedicine has been a pivotal tool in the US and China, especially during the Covid-19 pandemic. Looking into the future, however, the two countries may use the service very differently. In China, expanded use of telehealth is likely as long as it is supported by government programs. Telehealth may be used to diagnose, manage, and treat many anterior and posterior forms of eye disease. In the US, telemedicine may continue to be used occasionally in follow-up care of anterior segment disease as long as insurance companies are willing to pay for it. It is unlikely that telemedicine will be used to screen, manage, or treat posterior segment disease.

REFERENCES

[1]王妍茜,王成虎,张竞月,徐曼华,彭正虹,聂业,康刚劲.人工智能应用于眼科的积极作用及其伦理问题[J].国际眼科杂志,2022,22(06):1020-1024.
[2]张满,陈有信.眼科远程医疗发展现状与前景[J].协和医学杂志,2021,12(05):755-760.
[3]徐玲,祁鹏,潘峰,韩春荣,何伟.借助便携式裂隙灯的一种远程筛查平台对社区白内障筛查的应用研究[J].实用防盲技术,2021,16(03):121-123+90.
[4]梁洁双. "互联网+"婴幼儿斜视远程诊疗模式的建立与应用价值评估[D].广州医科大学,2021.DOI:10.27043/d.cnki.ggzyc.2021.000171.
[5]Ting DSW, Pasquale LR, Peng L, Campbell JP, Lee AY, Raman R, Tan GSW, Schmetterer L, Keane PA, Wong TY. Artificial intelligence and deep learning in ophthalmology. Br J Ophthalmol. 2019 Feb;103(2):167-175. doi: 10.1136/bjophthalmol-2018-313173. Epub 2018 Oct 25. PMID: 30361278; PMCID: PMC6362807.
[6]Li JO, Liu H, Ting DSJ, Jeon S, Chan RVP, Kim JE, Sim DA, Thomas PBM, Lin H, Chen Y, Sakomoto T, Loewenstein A, Lam DSC, Pasquale LR, Wong TY, Lam LA, Ting DSW. Digital technology, tele-medicine and artificial intelligence in ophthalmology: A global perspective. Prog Retin Eye Res. 2021 May;82:100900. doi: 10.1016/j.preteyeres.2020.100900. Epub 2020 Sep 6. PMID: 32898686; PMCID: PMC7474840.
[7]Liu Y, Zupan NJ, Swearingen R, Jacobson N, Carlson JN, Mahoney JE, Klein R, Bjelland TD, Smith MA. Identification of barriers, facilitators and system-based implementation strategies to increase teleophthalmology use for diabetic eye screening in a rural US primary care clinic: a qualitative study. BMJ Open. 2019 Feb 18;9(2):e022594. doi: 10.1136/bmjopen-2018-022594. PMID: 30782868; PMCID: PMC6398662.
[8]Askarian B, Ho P, Chong JW. Detecting Cataract Using Smartphones. IEEE J Transl Eng Health Med. 2021 Apr 20;9:3800110. doi: 10.1109/JTEHM.2021.3074597. PMID: 34786216; PMCID: PMC8580365.
[9]Matta NS, Arnold RW, Singman EL, Silbert DI. Can a photoscreener help us remotely evaluate and manage amblyopia? Am Orthopt J. 2011;61:124-7. doi: 10.3368/aoj.61.1.124. PMID: 21856880.
[10]Gensheimer WG, Miller KE, Stowe J, Little J, Legault GL. Military Teleophthalmology in Afghanistan Using Mobile Phone Application. JAMA Ophthalmol. 2020 Oct 1;138(10):1053-1060. doi: 10.1001/jamaophthalmol.2020.3090. PMID: 32852513; PMCID