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Free, online videos for distance learning in medical genetics



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Equipping the current and future healthcare workforce with knowledge of genetics and genomics poses significant challenges (Campion et al., 2019). These challenges have been compounded by the recent outbreak of COVID-19, with social distancing having eliminated in-person education ranging from medical school classes (Rose, 2020) to national meetings (American College of Medical Genetics, 2020a). This situation, while unfortunate, has showcased the need for quality distance learning (Weiner, 2020).

Online videos are an attractive option for medical education at a distance. Their advantages over traditional educational modalities (e.g. textbooks, in-person lectures) include the potential to reach learners all over the world, on-demand, and to be free of charge (Tackett et al., 2018). When compared with text-based online resources (e.g. UpToDate, GeneReviews), they more easily incorporate a didactic and visual approach. Properly constructed videos have the power to educate medical trainees (DelSignore et al., 2016) and even patients and families (Jones et al., 2016). On YouTube, the most accessed online video platform in the world, popular medical education channels receive millions of views per month (Social Blade LLC, 2018).

Some of the medical genetics community's initial distance learning initiatives in the COVID-19 era have involved online video. Lectures and grand rounds are now streamed (Rose, 2020), the European Society of Human Genetics annual meeting is now virtual (European Society of Human Genetics, 2020), and a paywall for pre-recorded CME content hosted by the American College of Medical Genetics has been lifted (American College of Medical Genetics, 2020b). To equip educators to make additional, original content going forward, we believe it would be useful to describe the current landscape, implementation, and viewership of free, online videos for professional education about medical genetics – none of which has been reported previously.

We surveyed the current availability of free, online video education about medical genetics and genetic disorders. Videos beyond YouTube and similar hosting platforms (e.g. Vimeo) are limited (see Supplemental Methods and Data). Thus, we focused our analyses on YouTube. We first identified YouTube channels with multiple videos about Mendelian diseases or the practice of medical genetics. Only seven such channels exist (Table S1); however, the overall reach of

these channels was considerable (five have > 1M views; three have > 100K subscribers). To assess the availability and qualities of videos on specific topics across the Mendeliome, we identified individual videos on YouTube covering a sample of 26 disorders from GeneReviews, determining whether each was authored by a medical or scientific expert and whether it was didactic (intended to convey key features of the disorder) or not (Table S2). An expert-authored, didactic video existed for only half (13) of the disorders. Furthermore, among the top 10 search results for each disorder, on-topic videos were as frequently non-didactic (50 videos) as they were didactic (50 videos).

To provide information about the implementation and viewer demographics of a small-scale, *de novo* video initiative, we collected data about the Learn Medical Genetics YouTube channel (<https://bit.ly/2On0Wj3>). Thirty-two brief (mean 13m 42s) didactic videos were created and uploaded over a > 4-year period, and viewer engagement and demographics were analyzed (Supplemental Methods and Data). A workflow was established in which video scripts were drafted and illustrated by trainees, then reviewed by experts. Topics included individual disorders (e.g. Gorlin syndrome), families of disorders (e.g. disorders of galactose metabolism), and testing algorithms (e.g. the newborn screen) (Table S3). Videos were viewed 238,891 times, with an average viewer retention time of 4m 2s. Views originated in > 50 countries, the top 5 viewer origins being the United States, India, United Kingdom, Philippines, and Saudi Arabia. The vast majority of viewers were young adults < 35y. 57% of viewers were female and 43% male. The channel acquired 3526 subscribers, however the majority of watch time (96.4%) was by non-subscribers. Videos were viewed on multiple devices including computer (44.0%), mobile phone (42.5%), tablet (10.1%), TV (2.5%), and even game console (0.4%). Viewers found the videos predominately via YouTube, but also via external (internet) traffic (10.5% of views). 39.3% of watch time resulted from YouTube suggesting the content, versus 60.7% from users seeking the content themselves.

Finally, to assess the reach of videos about genetic conditions on an established platform, we collected data from the Osmosis YouTube channel, which has > 1.2M subscribers and an audience base as previously described (Tackett et al., 2018). Of the 618 Osmosis videos, 50 are devoted to Mendelian genetic conditions (Table S4). Over an average period of 1.28 years, these videos accrued > 3.3M views. On

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topics of rare disease, Osmosis paired with the National Organization of Rare Disease and disease-specific patient organizations (e.g. the National PKU alliance) to ensure accuracy and clinical relevance of content.

To summarize: The COVID-19 pandemic and the overall challenge of educating a genetics-literate healthcare workforce demand creative approaches. Free, online videos are a potential solution for learning at a distance. We assessed their current availability and features, with the intention of guiding medical genetics educators who may be interested in creating additional content going forward. We found that Mendelian disorders are inconsistently covered by existing online didactic videos. However, when videos do exist, viewership is substantial. Our analyses revealed that both a small-scale, *de novo* initiative (Learn Medical Genetics) and an established platform (Osmosis) can transmit medical genetics video content to large audiences around the globe, and demonstrate the potential of trainee-created content and of partnership with rare disease organizations. With appropriate scaling, the global body of free, online video tutorials about genetic disorders could become encyclopedic, with the power to help current and future clinicians diagnose and care for patients with genetic conditions. Furthermore, both the creation and consumption of such content provides a potential route to interest trainees in the field of medical genetics. We conclude that online video education about genetic disorders is an attractive but currently underexploited tool to educate the healthcare workforce about genetic disorders, both in the COVID-19 era and beyond. Further work will be needed to measure and optimize the impact of online educational videos on improving the clinical care of patients with genetic disease.

Declaration of competing interest

T.M. and R.D. are employees of (and P.M.B. was formerly a contractor for) Osmosis, L.L.C., a for-profit medical education company. Learn Medical Genetics is not a for-profit initiative.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ejmg.2020.103983>.

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