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Editorial

Global health has definitions of varying levels of complexity, but in essence, it can be summarized as a framework of methods aimed at improving population health. Through both observation and intervention, global health researchers can monitor diseases and employ interventions to prevent adverse health outcomes by reducing their incidence. Given the large variability in the human population, public health and medical research investigations require rigorous methods and analytics in order to evaluate and to determine the validity of conclusions. Moreover, these standardized research methods are critical for comparison of findings across geographic boundaries, ethnic groups, and time periods. However, a lack of skills in the areas of research methods and statistical evaluation is a common limitation among researchers globally, especially in developing countries where research productivity is lower compared to developed countries[1-3]. This debilitating condition, which is found worldwide and has a far-reaching impact on publications and tenure, is known as “Stataphobia”.

Stataphobia is a phrase which describes the ‘abnormal fear of research design and statistics’[4]. The fear of statistics, or not having access to a statistician for help, is a major problem for many scientists, as a lack of properly performed methods dooms submissions to rejection for articles, grants, and other scientific communications. It can affect multiple layers of global health, as major policy decisions based on inaccurate, incomplete, or old statistics can waste resources without positively impacting the health issue. The rejection of publications based on poor statistical methods can have a profound impact on the number of scientific publications and the competitiveness of research coming out of many countries, especially those that are non-Western countries.

Publication statistics from the country of Kazakhstan highlight the disparities present in global health research productivity. Adambekov et al. discusses how health research contributes to only 7% of the overall number of publications coming from Kazakhstan, a trend shared by other Central Asian countries[5]. Even when compared with other countries of a similar population size or GDP, the publication rates are indeed low[6]. In fact, despite the low number of publications coming from this country, Kazakhstan is in the highest output of

medical publications in Central Asia, highlighting the need for regional improvement[6-8] (see Figure 1). We suggest that Stataphobia plays an important role in this phenomenon, as without proper research methods and publication output, not only is scientific progress impeded in these countries, but health research—and public health policy as a whole—suffers.

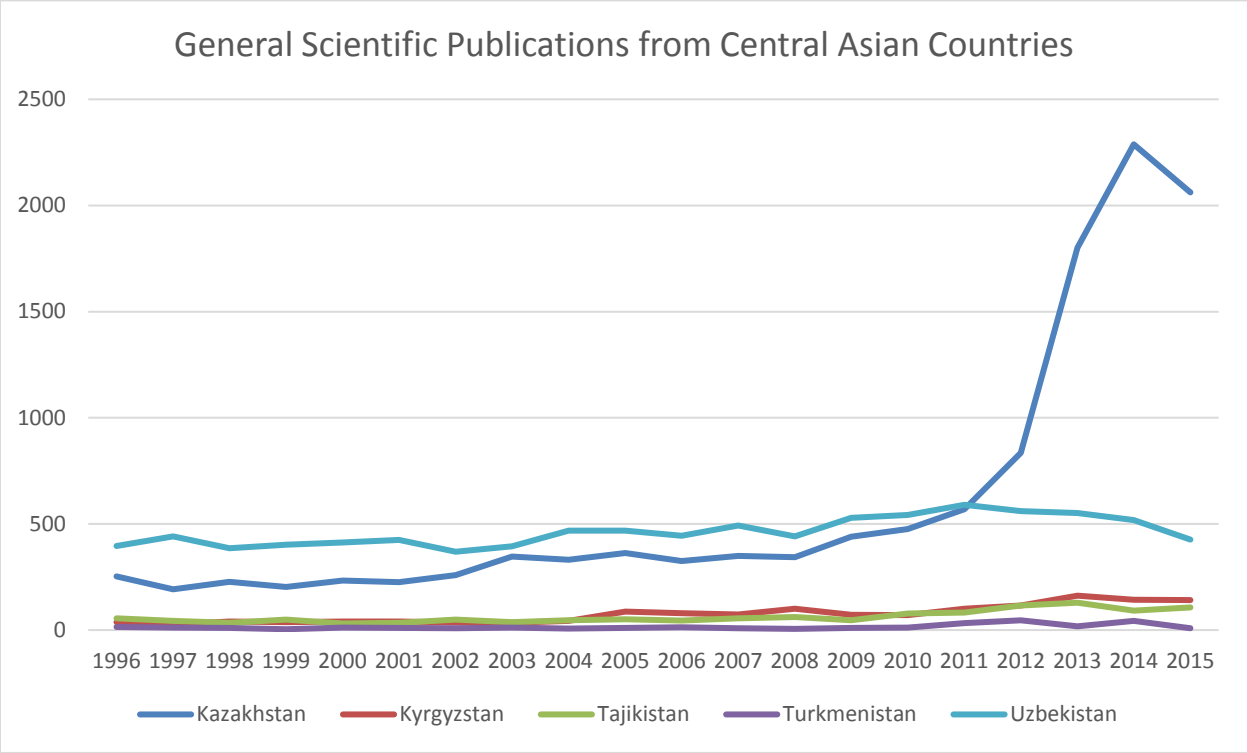

Figure 1: General scientific publication trends of Central Asian countries for 1996-2015

It is believed that the increase in publications from Kazakhstan starting in 2012 are likely from the addition of a policy that PhD candidates must submit at least one article to a journal with an impact factor greater than 0[9].

The basic understanding of statistics usually comes in the higher education settings. Students in health, especially those who are medical and nursing students, require an understanding of statistics to perform clinical research. Without an understanding of research publications, it is most difficult to improve clinical performance. Even medical students not planning to perform research must be able to understand statistics in order to comprehend clinical research and to understand how it may apply to their patients. In other areas of national and international work, a lack of understanding of statistical concepts can cause even larger issues. For example, a lack of understanding of statistics would make it impossible to accurately interpret and evaluate global health trends and their applications to public health programs. This has had an impact on policies

regarding immigration, where statistics have recently been found to be lacking and inaccurate[10]. Improper statistical training can also result in developing countries becoming exporters of "raw" research data to developed countries because they are unable to properly analyze and publish that data. This has the effect of furthering the establishment of "scientific banana republics" in developing nations, where the economic benefit and the directions of health research are ultimately under the control and influence of already developed countries[11].

Thus, an intervention on a global scale is required to reduce the impact of Stataphobia on research, especially in developing countries. This can lead to improved health and can aid in establishing evidence-based programs. One area to intervene on is in the initial teaching of statistical methods and in the access to those teachings. Often, students find statistics difficult and boring. Stataphobia can take hold in the classroom, where some learners of statistics become frightened by the non-intuitive concepts they most need to learn in order to produce the best research possible. Students enter the classroom coming from a variety of backgrounds, from math majors to philosophy majors, thus having marked differences in existing knowledge and interest in statistics. Furthermore, students may just learn certain topics best from different approaches than the approach the professor is using, and these 'best approaches' may differ from student to student as well as from topic to topic. Is it possible to intervene on the classroom, influencing learning through multiple approaches on the same topic? Moreover, can this be done in countries facing language barriers to international publications and/or face limitations in teaching resources? Cue: The Euclid Statistical Matrix.

Through the Research Methods Library at the Library of Alexandria (RMLA), Egypt, we have constructed a free, malleable, and multilingual tool designed to help learners of basic statistical methods[12]. The Euclid Statistical Matrix is a compilation of some of the most popular YouTube videos which teach statistics. In the Euclid Matrix, the columns of the matrix serve to house content for a particular YouTube channel, and the rows contain various statistical topics or lessons (Figure 2).

Matrix link:
http://www.pitt.edu/~super1/ResearchMethods/StatisticsMatrix.htm

Using this format, if one wanted to learn about variance, they may move down to the "Variance" row, and then choose from a Khan Academy video, a Brandon Foltz lecture, a Statslectures video, etc., providing multiple presentation approaches to a similar topic.

This approach has many strengths. The most important strength is that the Statistical Matrix is easily accessible. The use of YouTube videos as a primary educational source provides a format that is freely accessible by all and allows for multiple visual representations of and approaches to a topic. Two, it allows the professor to integrate their own lectures into the matrix, making it an adaptable tool for the classroom. By allowing multiple presentation formats (video, PowerPoint, online books, etc.), a student can utilize several matrix resources to understand the difficult topic.

Three, it utilizes much of the high quality statistical open access content that currently exists on the Internet. Four, the Euclid Matrix has the ability to be a living matrix. As more quality videos are found or created, the Matrix may be updated to better reflect the needs of statistics learners. Finally, the concept of the matrix is easy to implement in other languages. Statistics is already hard enough to learn, and if your native language is not English, then learning statistics will be even more difficult. By re-creating the Euclid Statistics Matrix using educational materials developed in the other languages, we remove this language barrier issue while also utilizing the resources available in non-English languages and empowering the global researcher/lecturer communities. To this point, we have developed the Euclid Statistical Matrix in several languages, including Russian, which is the language that many Central Asian scientists speak.

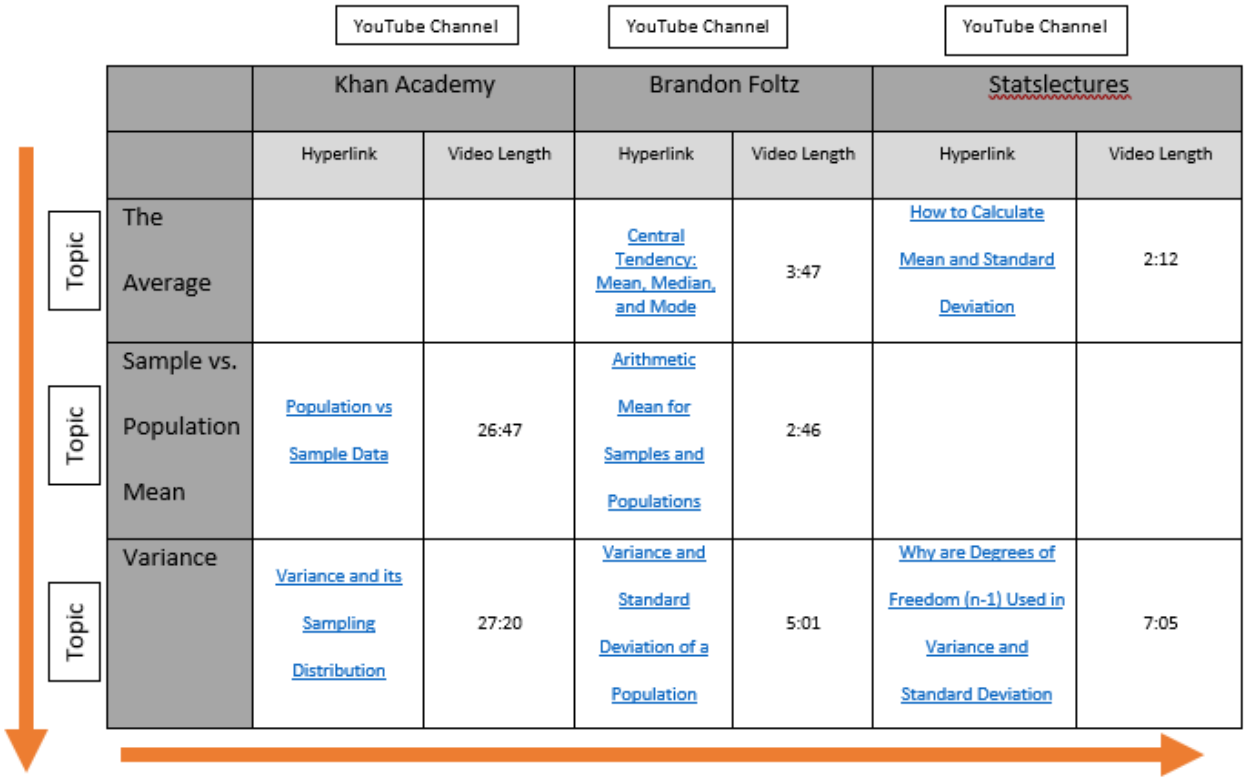

Figure 2: Schematic of the Euclid Statistical Matrix

We disseminated our Matrices using a large e-mail network generated as a part of the Global Health Network Supercourse project[13]. As a part of this project we obtained e-mails from top universities in the countries/regions of focus and developed region based teams of interest. Individuals from the teams of each region then developed a message on their matrix and distributed it to their local and global colleagues. By

having team-developed messages, we are better able to facilitate international collaboration while also promoting these resources from within the regions. Using our Iranian team as an example, we distributed the information on the Farsi Statistical Matrix to a network of over 10,000 Iranian faculty members from top universities in Iran. Additionally, we have collaborated with an Iranian-American Student Association in the US[14], where we shared this information among a few thousand Farsi-speaking students.

Increasing the distribution of information on research methods will require multiple tools. In addition to the Euclid Statistical Matrices, we are also developing matrices with other research methods content, such as matrices with focuses on agricultural statistics, epidemiology, and big data. Another future project includes the development of a Golden Lecture of Statistics. The Golden Lecture concept is to provide very small PowerPoint presentations of a particular topic so that it may be adopted for lectures in any subject. A Golden Lecture for "Health" has already been developed so that if, for example, a history professor needs a resource to discuss what health is but does not have the background to do so, they may utilize the Health Golden Lecture slides[15]. In similar spirit, we also plan to develop a Golden Lecture for Statistics.

The Euclid Statistical Matrices are currently housed within the University of Pittsburgh Supercourse repository, an online collection of health lectures which has previously been used to establish scientific social networks[16]. This network reaches to many regions, including the Central Asian region where the network is over 1,300 individuals[17]. Further spread of the Statistical Matrix concepts can also occur at the meetings of large statistical organizations, where current efforts are ongoing to collect and ship statistical textbooks to the Library of Alexandria in Egypt[18].

The Euclid Statistical Matrices will be most beneficial for developing countries in Central Asia, as the language barriers and lack of research methods specialists are crippling health sciences in this region. With a majority of the research intuitions having access to the Internet and increasing coverage of the general population, the Statistical Matrices are the perfect tool to improve knowledge on research methods in Central Asia. An important next step in the Central Asian region will be to get support from the universities, public health schools, and healthcare and education ministries of Kazakhstan, Uzbekistan, Tajikistan, Turkmenistan, and Kyrgyzstan, due to the strong centralized structure of the education system in these countries.

We suggest that the Matrix model can be a useful tool not only for statistics and research methods, but also for virtually any course or age group. This may be of benefit in the teaching of Science, Technology, Engineering, and Mathematics (STEM) courses for youth. The Matrices also are quite versatile and can be easily adapted. Matrices have the potential to be layered into levels, such that a basic course is the foundational level, followed by levels of more advanced courses. Various additions could be added onto a Matrix, such as the incorporation of questions to test how well a learner

mastered the topic, or a help desk where a student may post questions that can be answered by other students or the professor.

Scientific progress should not be halted because of a fear of statistics. Research methods can be learned, and with enough comfort to produce better science. When bright and passionate individuals place their minds and energies together, we can address and mitigate problems like Stataphobia. With multilingual tools that utilize already-created internet resources such as the Euclid Statistical Matrix, we can begin to eliminate the issue of Stataphobia worldwide, leading to increased and better-quality research as well as global improvements in health.

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