Pyotr Dimitrievich EN'KO
b. 15 November 1844 - d. 6 March 1916 (o.s.)

Summary. En'ko was a Russian physician whose probabilistic modelling and data analysis of measles epidemics in the late 1880s anticipated the work of Reed and Frost in the 1920s.

In 1760, Daniel Bernoulli (q.v.) produced a model for the number of susceptibles in a cohort of individuals exposed to smallpox; this model did not involve what is now understood as the spread of infection by homogeneous mixing (mass action) in a susceptible population. Dietz (1988) has made an excellent case for Pyotr Dimitrievich En'ko's paper (1889) as the first to discuss the elements of a genuine epidemic model, namely the chain binomial; this was developed some forty years later by Reed and Frost in the USA (see Abbey, 1952 and Frost, 1976).

En'ko was born in St. Petersburg in 1844, the son of a member of the nobility in the Chernigov region, and a Saxon mother. In an autobiographical sketch (in Pushkin's Dom at the Vengerov Archives, St. Petersburg), En'ko mentions that the family rose in the 17th and 18th centuries to achieve wealth and social importance. He was first educated at the school attached to the Imperial Medical and Surgical Academy of St. Petersburg, where he was greatly influenced by his mathematics teacher, and by the school principal Bardovskiy. The best pupils were encouraged to pursue topics outside the school curriculum, and to read widely in the school's excellent library. He later studied medicine at the Academy itself, and graduated from it in 1867. He began his medical career as an intern at the Zagorodnaya Hospital in 1869, and in 1871 transferred to the St. Petersburg Alexander Institute, whose senior doctor he became in 1874. He worked as a physician among children, and in his book, Moshkovskiy (1950) mentions that he was concerned with "the clinical and epidemiological aspects of children's infections, physiology and the hygiene of schools".

En'ko organized the first institutional medical station in Lipetsk, south of Moscow in 1885, remaining at its head for several years. He then set up a similar station in Gapsal. In 1901 he was named Director of the Imperial School for Deaf-Mutes in St. Petersburg. He was decorated for his work, ending his career as an official of fairly high rank in the hierarchy of the imperial public service. He was married, with 3 daughters and two sons. He was a person clearly ahead of his times, and expressed disappointment

that his "natural method of education" for deaf-mutes found little support among his colleagues, despite its success with patients. He appears to have been equally unsuccessful in persuading participants at the all-Russian 1910 meeting on the education of deaf-mutes in Moscow, of the merits of his method.

While practising medicine in St Petersburg, En'ko continued his researches, and presented a dissertation on revaccination (published in Russian in 1873) for the Doctorate in Medicine of the Medical Faculty of the University of St. Petersburg. This was not accepted, but by accident he found out that Professor Minding of the Tsarist University of Dorpat (now Tartu in Estonia) was interested in probability, and arranged to consult him. Minding understood his approach to the problem and approved his original methods of analysis. In the autumn of 1874, he travelled to the University of Dorpat to take an examination in German, and was then awarded his Doctorate in Medicine by the Medical Faculty for the German version of his dissertation (1874).

Few further details are known about his later life; he continued to practise medicine, and between 1873 and 1913 authored some 71 works, not all of them on strictly scientific topics. Of his many scientific papers, most are in Russian, but some are in German and French. The topics were quite diverse: revaccination, the degeneration of vaccines, muscle contraction, the thorax, the brightness of light, respiratory organs, the artificial feeding of newborn babies, hygiene in daily life, vegetarianism, the teaching of deaf-mutes. His two main works on epidemic problems are his paper on susceptibility to measles and scarlatina (1887), and his famous contribution (1889) on the course of epidemics (see Dietz's English translation, 1989). He died in 1916 during the First World War, just before the Russian Revolution of 1917.

We give a brief description of En'ko's contribution to epidemic modelling. Consider the spread of an infection in a population of size N_t of whom C_t are infectives and S_t are susceptibles in discrete time $t > 0$. En'ko argued, on the assumption of homogeneous mixing, that a particular susceptible would have a chance

$$P_{C_t} = C_t/(N_t - 1)$$

of making contact with an infective. Thus, if A is the number of actual contacts of infectives with susceptibles, then the probability of making at least one contact is

$$a_t = 1 - [(N_t - 1 - C_t)/(N_t - 1)]^{A_t}.$$

Hence, assuming that new infectives occur according to the binomial distribution, the total number of new infectives will have a mean $a_t S_t$. In En'ko's model, A_t can vary depending on the propensity of individuals to gather in groups, or lead a solitary existence.

En'ko gathered daily data on several measles epidemics at the St Petersburg Alexander Institute and the Educational College for the Daughters of the Nobility, carefully recording the population size N_t and the initial number of cases C_0. He estimated the number of contacts A_t , varying the value until he obtained good fits of the data to the theory, and graphing the results. His work foreshadows the Reed-Frost chain binomial model of 1928, and entitles him to be considered as the first epidemic modeller in the modern sense of the word. En'ko's achievement is a vindication of the value of a broad education, resulting in the competent use of mathematical methods by medical doctors; it is also a reminder that original thinking can occur in very unsettled circumstances, such as those prevalent in Russia through much of En'ko's life.

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J. Gani