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<u>Research question 1:</u> Testing best epidemiological control according to budget possibilities according to national guidelines before 2018:

- The optimal preventive guidelines: cervical screening practice, targeted vaccination and sexual education
- Costs of HPV vaccination, screening, treatment and preventive program

<u>Research question 2:</u> Testing possible impact of new 'single' 2018 year project foudned mostly by extremal sources: - vaccines for cohort of girls born in 2007 ~600k EUR

- screening woman aged 25-61 (Romanowski ->Pap) ~700k EUR

# Optimal cervical cancer preventing strategies for Moldova according to new guidelines in 2018

#### Motivation 1&2

### **Objectives and Results 2**

Human papillomavirus, or HPV, is a sexually transmittable virus infection, **Moldova has modified since 2018 screening program almost the same as** which is necessary risk factor for developing cervical cancer, first most **we recommended** (with small difference in maximum age of screening common type of cancer in working age women in Moldova. We observe with 61 instead of 65 which could be an artefact of our age-cohorting both behavioral change (sexuality increase) and demographical change schema).

(population ageing and massive emigration, but still very young), which both corresponding to second demographic transition since Soviet Union collapse. Total yearly expenditure on health is limited to just 150EUR per capita and reliable data on cervical cancer is missing. Moreover, public health system in Moldova had no capacity to couple **with official screening** 



program till 2017 (women >20 every 2 years), where more than 700k test should be done yearly (currently it's around 200k unique ones and in many sitesit seems to be already overloaded). However, Moldovan cervical cancer perspective looks much better, than in central western Europe countries, because of relatively young society and increasing knowledge of STI.



Fig. 1 Incidence of new cancer case estimated for historical data (1998-2014) and possible projections till 2031. Graph inside represents screening frequencies changes. Mortality and incidence patterns comparison (2012)

#### **Results 1**

We propose optimal screening guidelines in woman in range 25-64 years old (with prevention cost 5-12k EUR per QALY), which could provide saving perspective in range 150-300k EUR yearly. We reopen re-open discussion about vaccination guidelines in low-income countries (as Moldova), where cost of wide action are too high. We found that vaccination of only 20% girls chosen by surveys, will already show big difference in cancer long terms perspectives, which it is even cheaper than vaccinating single cohorts as introuced in partly in 2015 and fully in 2018.



Fig. 2 Past and short term analysis of main interventions QALY and intervention costs

Fig. 4 Moldovan demographic patterns and projections of intervention costs

There is still **open question about cost effectiveness of point vaccinations**, because vaccinating single cohort had no satisfactory effects in other countries as Australia. The real scenarios assuming vaccinating 10 y.o. girls in 2018 was neglected by us, because the first effects would be visible in 2028. We verify single year vaccination of 14 y.o. girls in 2018.



Fig. 5 Comparison of QALY losses and total costs of HPV related issued (interventions, genital warts and cancer) with and without vaccination





Fig. 6 Effect of vaccination on sexual active men and young women in two nodes of sexuality

**Conclusions and recommendation** (whinin simulation limitation as compartment approach) **Point vaccination is both cost-beneficial** (total cost reduction balance intervention cost around 2040) and **cost-efficient** (with incremental impact in 20 years perspective on the level of 2200 EUR/QALY). The possible explanation of this nonintuitive behaviour is transitional situation in Moldova ( $R_0 \sim 1$ ), still small change of

Fig. 3 Long term cost-effectiveness analysis of main interventions. Variables (monetary and life) per year. Additionally, we underline 3 scenarios: our proposition (red indicator), official national program (orange indicator), realistic realization of national program (yellow indicator), realistic realization of national program (yellow indicator) while changing partners is still not so common as in other countries.

Technics and methods 1&2 We have run computer simulation to prepare cost/benefit analysis for different vaccination strategies, various screening programs and preventive programs (using condoms) for Moldova in low resource settings, based on its own demography and sexual behavior. We used data since 1998 to 2014 to adjust model parameter and we project till around 2030 (for vaccination till 2050) and data between 1998 to 2017 with projection till 2038. We built the model, that aggregated the most important paths of infection, cancer development and prevention scenarios (more than 100 equations and 200 parameters).