



An Exploration of Introducing a Chlamydia Screening Programme to the Democratic People's Republic of Korea

Gareth Mark Jones¹, Ye Jin Kang²

¹BSc (Hons) Sexual Health Studies, University of Central Lancashire, Manchester, UK

²Harvard Medical School, MA, USA

ABSTRACT Maternal and reproductive preventative and early health interventions can often lead to exponential cost-savings on long-term sequelae of complications related to this aspect of health. The DPRK occupies a region of the world which has a high rate of sexual and reproductive health issues, and with this in mind and the possible cost-savings could be a good candidate for preventative public health interventions. In particular, chlamydia, an STI that is asymptomatic in the majority of patients but can lead to expensive long-term sequelae as well as having high rates of partner co-infection, could be a good candidate to explore for a screening and treatment programme within the DPRK to prevent more costly long-term impacts such as pelvic inflammatory disease, as well as increased risks of miscarriage. This paper explores, through a literature review, the potential cost-effectiveness of a chlamydia screening programme in the DPRK through a lens which also considers the unique geopolitical space the country occupies.

KEY WORDS North Korea, DPRK, Chlamydia Screening

INTRODUCTION

Treating complications in pregnancy, miscarriage and delivery can have major economic consequences.¹ Within Southeast Asia only 38% of women who experience complications during pregnancy and delivery receive care for them and their baby.² This disparity between need for care versus care accessed and provided can lead to increased rates of maternal and infant mortality. In the Global South, economic burden to the health system as a result of such complications should also be considered as a secondary concern.³ Sexually Transmitted Infections (STIs) can be one contributing factor to increased risks of complications during pregnancy.⁴ With 20% of 357 million people globally diagnosed each year with an STI living in Southeast Asia,^{5,6} it is possible that these high rates are impacting rates of pregnancy complications. Especially in an area where a majority of women are not receiving the care required to deal with these complications, there is a potential for greater health and economic consequences of STIs.

131 million out of 357 million global STI cases are chlamydia,⁴ an STI that can lead to pelvic inflammatory disease, ectopic pregnancy, tubal infertility, endometritis, perihepatitis, sexually acquired reactive arthritis and can also facilitate greater risks of transmission of human immunodeficiency virus (HIV).⁷ 0.2-2.7% of women with chlamydia experience ectopic pregnancy, compared to 0.5 – 1.5% of all pregnancies,⁸ and up to 30% of women with chlamydia developed PID, and 0.1 - 6% developed tubal-factor infertility.⁹ Infertility and pregnancy complications have cost implications and economic development implications for countries and their health systems,¹⁰ including greater cost of treatment of such conditions than prevention, as well as reduction in quality-adjusted life years due to such sequelae.

©2021 GARETH AND KANG. This is an open access article distributed under the terms of the Creative Commons Attribution License (CC-BY 4.0), which permits the user to copy, distribute, and transmit the work provided that the original author(s) and source are credited.

Send correspondence to: GARETHMACSHEOIN@GMAIL.COM, YJNKNG88@GMAIL.COM

In the Democratic People's Republic of Korea (DPRK), situated in the WHO Southeast Asia region, there is also evidence of high rates of chlamydia.¹¹ The United Nations Fund for Population Activities (UNFPA) reported chlamydia in 9.6% of symptomatic women who presented for testing.¹¹ Considering that 70-95% of chlamydia infections are asymptomatic¹² and that chlamydia also has a high transmission frequency (up to 75% of partners of people diagnosed with chlamydia also have the infection),⁶ the possibility of a high number of infections in the DPRK, as well as the greater region of Southeast Asia, cannot be excluded. This analysis will focus on chlamydia in the DPRK, where the Ministry of Public Health (MOPH) and the UNFPA have committed to improving the quality of testing and treatment of STIs.¹³

Current infrastructure in Southeast Asia, including the DPRK, is not ideal for dealing with the possible scale of the issue,¹⁴ However, with the commitment of the current stakeholders (MOPH and the UNFPA) to improving testing and treatment as well as improvement in sexual and reproductive health (SRH) in general, there is a good base for both stakeholders to not only improve SRH, but also alleviate the economic burden on the health system of the long-term consequences of chlamydia in the population.

OPTIONS AND CONSIDERATIONS

Past evaluations show that such partnerships have been effective in strengthening the healthcare system in the DPRK.¹⁴ Based on previous experience of successful partnerships, it would be in the interest of current stakeholders to bolster this aspect of the health system with multi-agency collaboration; either through partnerships that are already established or the introduction of a new stakeholder that specializes in STI testing, diagnosis and treatment.

Due to the asymptomatic nature of chlamydia, a screening program similar to that run in the UK for 15 – 24-year-olds (who have the highest burden of new chlamydia incidence) is a viable option.¹⁵

Targeting other demographics or groups for screening is another option: such as testing members of the military, teenagers and young adults at school or university, workers in factories, or pregnant women at ante-natal clinics. During a screening session there would also be the opportunity to screen for other STIs such as gonorrhoea, syphilis and trichomoniasis vaginalis. This, however, would increase the cost per person screened. Due to the majority of chlamydia cases being asymptomatic,⁸ screening programs have a significant effect on addressing chlamydia prevalence and reducing the rates of expensive medical complications.¹⁶

Diagnosing Chlamydia

Chlamydia can be diagnosed with nucleic acid amplification tests (NAATs), and more recently polymerase chain reaction rapid diagnostic tests, a form of point-of-care test (POCT). POCTs are ideal for screening as they reduce the loss to follow up due to the ability to give results within the same consultation as the test is done.¹⁷

The aQcare Chlamydia TRF kit was the only POCT for chlamydia that was found to have comparable sensitivity and specificity to NAATs.¹⁸ NAATs has a >96% sensitivity for cervical swabs,⁷ and the aQcare Chlamydia TRF kit showed 93.8% sensitivity.¹⁸ The Cepheid GeneXpert also performed well with high sensitivity and specificity (97.6% sensitivity for female urine samples, and >99.4% specificity for all samples¹⁹). However, the cost per test and the need to have a constant electricity supply could be prohibitive when trying to reach areas where electricity supplies are not guaranteed. Other POCTs are available, however their sensitivity and specificity mean they are generally unsuitable as POCTs instead of using NAATs.¹⁸

Treating Chlamydia

Treatment for chlamydia is a relatively simple regime of antibiotics. Doxycycline or azithromycin are the first-line treatments for chlamydia; if a patient is unable to have either of these, amoxicillin, erythromycin and tetracycline can also be used.²⁰

Partner Notification

Partner notification as standard protocol for all positive results increases the effectiveness as well as reduces the cost per positive test of chlamydia screening programs.²¹ Partners can either also be tested for chlamydia or can simply be treated on the basis of being a contact due to the high concordance rates.⁶ Partner notification would need to be done on a voluntary basis, and could be either done by the index patient or by the care provider. This would need to be done in partnership with the index patient and with their consent and framed positively as something that will improve the health of the index patient and their partner. According to guidelines available from the Society of Sexual Health Advisors.²² Such guidelines could be produced in conjunction with the MOPH

in the DPRK as part of a screening program. Should the index patient not wish to notify their partner of the infection, such wishes should be observed by healthcare providers to maintain patient confidentiality. However, they should be made aware of the high chance of reinfection and the health impacts of this.

Test of Cure

Test of cure (TOC) for chlamydia infection is not routinely recommended. In pregnant women, TOC is recommended where poor medication compliance is suspected.⁷ Repeat testing, or testing for reinfection, is recommended, particularly for patients for whom partner notification was not completed. The British Association for Sexual Health and HIV recommends re-testing for under 25s at 3-6 months due to high prevalence. It could be suggested that a chlamydia POCT be done at every ante-natal appointment, however the minimum should be at the first ante-natal appointment and the last scheduled appointment before delivery, to reduce the risk of neonatal chlamydia infection.⁷

Sanctions

Any POCTs used in the DPRK as part of a screening program would need to be imported. How far they could have to be transported and the cost of this would depend on where they are sourced from. The aQcare Chlamydia TRF kit is made by a South Korean company, so the cost of importing would be less than a POCT made by a European or American company. Sanctions relief would also need to be sought in order to import tests and antibiotics for the program.

Aside from sanctions relief, no other extraordinary considerations need to be made in terms of importing kits into the DPRK, as other NGOs (such as Eugene Bell) have been exporting equipment from South Korea to the DPRK with appropriate sanctions relief with relative ease.²³ UNFPA is also regularly granted sanctions relief for importing reproductive health-related equipment into the country;²⁴ it is not expected that sanctions would cause any undue burden that is not already experienced by humanitarian healthcare programs currently operating within the DPRK.

DPRK Staff Capacity Strengthening

Training would also need to be provided for the implantation of a screening program. POCTs do not require highly trained staff, so the cost of training would be minimal.²⁵ This could be integrated into the current curriculum of training for health staff in two ways:

1. During initial training: doctors, nurses, and midwives could be trained in the use of POCTs during their initial clinical training; this then could be used in the future for the potential introduction of POCTs for other infections. Based on the UNFPA's success of introducing a standardized midwifery curriculum to the DPRK, with buy-in from the MOPH, previous experiences indicate this is practical and would ensure coverage and standards of training.
2. As part of the program introduction: at each clinic where the screening program is being rolled out, a number of training sessions run by both foreign project staff as well as local staff would ensure that all current working staff would have the requisite training and not result in a gap and waiting for current students to graduate and start working. This would necessitate not only training with staff in clinics on POCTs, but also require "Train the Trainer" sessions for medical staff in management and supervisory positions to ensure sustainability of the project long-term. Compared to the first option, this would mean that the training is going only to the specialized staff who require it for the initial pilot as well as any potential wider roll-out.

Based on timeframes, initially the second option would be selected for a potential project. Staff who took part in the training would receive a certificate of competency to utilize the POCTs upon completion of training from project partners.

EVALUATION

Evaluation of ante-natal chlamydia screening

The cost-effectiveness of a chlamydia screening program depends on the prevalence of the infection within the targeted population and the number of service-users screened; ante-natal chlamydia screening has been shown to be cost effective in high-prevalence areas (prevalence >16.9%) using NAATs.²⁶ The use of POCTs can further increase the cost-effectiveness of a screening program.²⁷

Considering cost-effectiveness of screening to reduce long term complications; a prevalence of 6% (less than the 9.6% reported in symptomatic women reported in the DPRK) with one annual chlamydia test leads to a decrease in the prevalence of PID and associated costs.²⁸

Table 1: Risks, QALY losses and cost-effectiveness results of complications following acute CT screening during pregnancy to detect 1000 positive women, showing antenatal CT screening is cost effective in terms of QALY gained.²⁷

Application to the DPRK

UNFPA reports that >90% of pregnant women attend at least four ante-natal appointments;¹¹ therefore, with the inclusion of mandatory partner treatment for positive cases, ante-natal screening could provide the best opportunity to test. Screening in an ante-natal clinic also means that staff there will already have a knowledge of SRH, and so not as much training may need to be done for staff working there to deliver effective counselling, testing and treatment, than staff at other potential testing sites such as schools or factories. Adding screening as a routine part of ante-natal appointments may offer the best chances of getting positive results and screening a population that would be at-risk.

RECOMMENDATION

Recommendation Overview

With Southeast Asia having a high STI burden and the DPRK sharing some of this, a screening program that takes place as a routine part of ante-natal appointments with automatic partner treatment seems to be the most viable, cost-effective, and high-priority step. This could maximize the number of relevant contacts who are sexually active and at risk of transmitting the infection, as well as prevent adverse effects in pregnancy for both the mother and baby.²⁹

As part of the screening program, pre-screening counseling would be done with each client, consisting of information on chlamydia, how to prevent it and partner notification and treatment. When a positive result is given, treatment and information on treatment would need to be given. Repeat testing is recommended during pregnancy to ensure the best outcomes for the mother and baby;³⁰ due to the high rates of access of ante-natal clinics during pregnancy, this would not be too difficult to implement. The implementation of this program would lead to an improvement in the reproductive health of women and men, as well as help to reduce the risks to babies during pregnancy caused by chlamydia infections.

Recommendation for pilot implementation

Implementation of regular chlamydia screening during ante-natal appointments should consider the following sequential steps:

1. Liaise with the UNFPA and the MOPH to ensure culturally appropriate implementation of the program and identifying appropriate clinics in which to pilot the program³¹
2. Identify all materials needed for the screening program and apply for sanctions relief as appropriate; based on situation analysis and cost, the aQcare chlamydia POCT would be most appropriate
3. Train current staff offering ante-natal appointments in pre-testing counseling, how to perform POCTs, delivering positive diagnoses, giving treatment as well as partner treatment, test of cure and record keeping
4. Initiate screening in clinics identified as appropriate for piloting the program
5. Monitor records for number of tests, number of positives, test of cures, etc. to determine the effectiveness of the program
6. Alter and scale up training and screening program as appropriate from the pilot
7. Review and explore the possibility of implementing the screening program for different demographics

CONCLUSION

A chlamydia screening program for the DPRK has the potential to improve the reproductive health of women, increase fertility, decrease pregnancy complications, as well as have economic benefits by reducing expensive medical complications caused by an infection that is relatively common but also easy to treat.

REFERENCES

1. Dalaba, M. A., Akweongo, P., Aborigo, R. A., Saronga, H. P., Williams, J., Aninanya, G. A., Sauerborn, R., and Loukanova, S. (2015). Cost to households in treating maternal complications in norther Ghana: a cross sectional study. *BMC Health Services Research*, 15(34).
2. Guttmacher Institute. (2017). *Adding It Up: Investing in Contraception and Maternal and Newborn Health in Asia*. Retrieved from: <https://www.guttmacher.org/fact-sheet/adding-it-up-contraception-mnh-2017-asia#fn0>
3. Holmes, K. K., Bertozzi, S., Bloom, B. R., and Jha, P. (2017). *Major Infectious Diseases*.
4. Zenilman, J., and Shahmanesh, M. (2012). *Sexually Transmitted Infections: Diagnosis, Management, and Treatment*. Jones and Bartlett Learning.
5. World Health Organisation. (2016). *Global Health Sector Strategy on Sexually Transmitted Infections 2016-2021*. Retrieved from: <https://apps.who.int/iris/bitstream/handle/10665/246296/WHO-RHR-16.09-eng.pdf?sequence=1>
6. Korenromp, E. L., Wi, T., Resch, S., Stover, J., and Broutet, N. (2017). Costing of National STI Program Implementation for the Global STI Control Strategy for the Health Sector, 2016-2021. *PLOS One*. 12(21).
7. Nwokolo, N. C., Dragovic, B., Patel, S., Tong, C. Y. W., Barker, G., and Radcliffe, K. (2016). 2015 UK national guidelines for the management of infection with Chlamydia trachomatis. *International Journal of STD & AIDS*, 27(4), 251-267.
8. Sultana, S., Asif, H. M., and Akhtar, N. (2015). Incidence rate and prevalence of major risk factors for ectopic pregnancy in the Pakistani population: mini-review. *Asian Pacific Journal of Tropical Disease*, 5(3), 246-250.
9. Hoenderboom, Bernice M, Van Benthem, Birgit H B, Van Bergen, Jan E A M, Dukers-Muijters, Nicole H T M, Götz, Hannelore M, Hoebe, Christian J P A, . . . Van den Broek, Ingrid V F. (2019). Relation between Chlamydia trachomatis infection and pelvic inflammatory disease, ectopic pregnancy and tubal factor infertility in a Dutch cohort of women previously tested for chlamydia in a chlamydia screening trial. *Sexually Transmitted Infections*, 95(4), 300-306.
10. OECD/WHO. (2018). *Health at a Glance: Asia/Pacific 2018: Measuring Progress towards Universal Health Coverage*. Retrieved from: https://www.oecd-ilibrary.org/docserver/health_glance_ap-2018-en.pdf?expires=1608555423&id=id&accname=guest&checksum=FC5FF45879C3FD8A03BE3F79DE9AD219
11. United Nations Fund for Population Activities. (2016). *Country programme document for the Democratic People's Republic of Korea*. Retrieved from: https://www.unfpa.org/sites/default/files/portal-document/DPRK_CPD_2017-2021.pdf
12. Lanjouw, E., Ouburg, S., de Vries, H. J., Stary, A., Radcliffe, K., and Unemo, M. (2015). 2015 European guidelines on the management of *Chlamydia trachomatis* infections. *International Journal of STD & AIDS*.
13. Ministry of Public Health. (2017). *Medium Term Strategic Plan for the Development of the Health Sector DPR Korea 2016-2020*. Retrieved from http://www.nationalplanningcycles.org/sites/default/files/planning_cycle_repository/democratic_peoples_republic_of_korea/dpr_korea_medium_term_strategic_plan_2016-20.pdf
14. Grundy, J., Biggs, B-A., and Hipgrave, D. B. (2015). Public Health and International Partnerships in the Democratic People's Republic of Korea. *PLOS Medicine*.
15. Public Health England. (2014). *Opportunistic Chlamydia Screening of Young Adults in England: An Evidence Summary*. Retrieved from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/740182/Opportunistic_Chlamydia_Screening_Evidence_Summary_April_2014.pdf
16. Aledort, J. E., Ronald, A., Rafael, M. E., Giroi, F., Vickerman, P., Landay, A., Holmes, K., Ridzon, R., Hellmann, N., Shea, M. V., and Peeling, R. W. (2006). Reducing the burden of sexually transmitted infections in resource-limited settings: the role of improved diagnostics. *Nature* 23(444), 59-72.
17. Meyer, T. (2016). Diagnostic Procedure to Detect Chlamydia trachomatis Infections. *Microorganisms*, 4(3), 25.

18. de Cortina, S. H., Bristow, C. C., Davey, D. J., and Klausner, J. D. (2016). A Systematic Review of Point of Care Testing for *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, and *Trichomonas vaginalis*. *Infectious Disease in Obstetrics and Gynecology*.
19. Gaydos, C. A, Van Der Pol, B, Jett-Goheen, M, Barnes, M, Quinn, N, Clark, C, . . . Hook, E. W. (2013). Performance of the Cepheid CT/NG Xpert Rapid PCR Test for Detection of Chlamydia trachomatis and Neisseria gonorrhoeae. *Journal of Clinical Microbiology*, 51(6), 1666-1672.
20. World Health Organisation. (2016). *WHO Guidelines for the Treatment of Chlamydia trachomatis*. Retrieved from: <https://apps.who.int/iris/bitstream/handle/10665/246165/9789241549714-eng.pdf?sequence=1>
21. Turner, K., Adams, E., Grant, A., Macleod, J., Bell, G., Clarke, J., and Horner, P. (2011). Costs and cost effectiveness of different strategies for chlamydia screening and partner notification: an economic and mathematical modelling study. *The BMJ*, 342.
22. Society of Sexual Health Advisers. (2015). *Guidance on Partner Notification*. Retrieved from: <https://ssha.info/wp-content/uploads/ssha-guidance-on-partner-notification-aug-2015.pdf>
23. Agoy, A. (2015). Treating tuberculosis in North Korea. The Experience of Eugene Bell Foundation. *Tiempo Devorado*, 2, 50-68.
24. United Nations Security Council. (2020). *Humanitarian Exemption Requests*. Retrieved from: <https://www.un.org/securitycouncil/sanctions/1718/exemptions-measures/humanitarian-exemption-requests>
25. Peeling, R. W., Holmes, K. K., Mabey D. (2016). Rapid tests for sexually transmitted infectious (STIs): the way forward. *BMJ Sexually Transmitted Infections*.
26. Rours, G. I. J. G., Smith-Norowitz, T. A., Ditkowsky, J., Hammerschlag, M R., Verkooyen, R. P., de Groot, R., Verbrugh, H. A., and Postma, M. J. (2016). Cost-effectiveness analysis of Chlamydia trachomatis screening in Dutch pregnant women. *Pathogens and Global Health* 110(7-8), 292-302.
27. Aledort, J. E., Ronald, A., Rafael, M. E., Girosi, F., Vickerman, P., Landay, A., Holmes, K., Ridzon, R., Hellmann, N., Shea, M. V., and Peeling, R. W. (2006). Reducing the burden of sexually transmitted infections in resource-limited settings: the role of improved diagnostics. *Nature* 23(444), 59-72.
28. Rours, G. I. J. G., Smith-Norowitz, T. A., Ditkowsky, J., Hammerschlag, M R., Verkooyen, R. P., de Groot, R., Verbrugh, H. A., and Postma, M. J. (2016). Cost-effectiveness analysis of Chlamydia trachomatis screening in Dutch pregnant women. *Pathogens and Global Health* 110(7-8), 292-302.
29. Adachi, K., Nielsen-Saines, K., and Klausner, J. D. (2016). *Chlamydia trachomatis* Infection in Pregnancy: The Global Challenge of Preventing Adverse Pregnancy and Infant Outcomes in Sub-Saharan Africa and Asia. *BioMed Research International*.
30. Lazenby, G. B., Korte, J. E., Tillman, S., Brown, F. K, and Soper, D. E. (2017). A recommendation for timing of repeat *Chlamydia trachomatis* test following infection and treatment in pregnant and nonpregnant women. *International Journal of STD & AIDS*, 28(9), 902-909.
31. Kadiri, K. K., Ahmad, M. K., and Mustafa, C. S. (2014). Cultural Sensitivity in Sexually Transmitted Infections (STIs) Preventive campaign in Nigeria. *Procedia – Social and Behavioral Sciences* 155(6), 331-336.