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Implementation of a package of essential noncommunicable (PEN) disease interventions in Kyrgyzstan:

evaluation of effects and costs in Bishkek after one year

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Implementation of a package of essential noncommunicable (PEN) disease interventions in Kyrgyzstan:

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By: Anna Kontsevaya and Jill Farrington

ABSTRACT

To achieve the global goal of a 25% reduction in premature mortality from the four main noncommunicable diseases (NCDs) by 2025, and the equivalent sustainable development goal of a 30% reduction by 2030, will require action in the prevention and management of these diseases. WHO has defined a minimum set of essential NCD interventions to be implemented in primary health care in low-resource settings in its package of essential noncommunicable (PEN) disease interventions. In Kyrgyzstan, cardiovascular diseases are responsible for half the number of deaths and are a major theme of the national health reform programme 2012–2016. The country has been operating the PEN protocols for one year, at the end of which WHO carried out an evaluation of their implementation. While it was possible to ascertain the costs incurred in implementation, it was not possible to demonstrate effectiveness. This may reflect the limitations of the evaluation and/or the implementation of the protocols. As scale-up and sustainability of the pilot project are being considered, this report is a timely opportunity for reflection and adjustment of the model as part of the quality improvement cycle.

Keywords

CARDIOVASCULAR DISEASES
CHRONIC DISEASE – prevention and control
DELIVERY OF HEALTH CARE
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Abbreviations

CI	confidence interval
FMC	family medical centres
LMIC	low- and middle-income countries
NCD	noncommunicable disease
PEN	package of essential noncommunicable disease interventions
SCORE	Systematic COronary Risk Evaluation

Introduction

There has been increasing global recognition of the health and economic impact of the four main noncommunicable diseases (NCDs) – cardiovascular diseases, chronic respiratory diseases, diabetes mellitus and cancer – in recent years *(1)*. To achieve the global goal of a 25% reduction in premature mortality from these four main NCDs by 2025, and the equivalent sustainable development goal of a 30% reduction by 2030, will require action in the prevention and management of diseases and the implementation of effective interventions at both the population and individual levels *(2)*. The WHO package of essential noncommunicable (PEN) disease interventions *(3)* is a conceptual framework for strengthening equity and efficiency in primary health care in low-resource settings. It defines a minimum set of essential interventions to be implemented and comprises four clinical practice protocols for early detection of NCDs and their diagnosis using inexpensive technologies, pharmacological and non-pharmacological approaches for modification of NCD risk factors, as well as affordable medications for the prevention and treatment of heart attacks and strokes, diabetes, cancer and asthma. Several countries in the WHO European Region have embarked on implementation of the WHO PEN package or equivalent in primary care, and others are interested in doing so.

Kyrgyzstan is one of the pioneer countries for implementation of the WHO PEN protocols in the Region. Initiated in 2015, and funded by WHO, this project is one of the most longstanding instances of a PEN implementation globally. An evaluation of this project not only holds lessons for application of the model in Kyrgyzstan, it can contribute to both an overall understanding of PEN implementation worldwide and research regarding implementation in general.

During the second half of 2016, WHO undertook a cost-effectiveness evaluation of the implementation of WHO PEN protocols in Kyrgyzstan using routine data. The initial results were presented to the PEN working group on 9 March 2017 and discussed in a technical workshop with the Ministry of Health and invited experts on 10 March 2017; both meetings were held in Bishkek, the capital city. The occasion also provided an opportunity to explore some of the issues highlighted during a visit to one of the family medicine centres participating in the project. The methodology, experience in Kyrgyzstan and broader issues for implementation were also discussed at the Workshop on Implementation of a Package of Essential Interventions for Noncommunicable Diseases (PEN) for Primary Health Care in Eastern Europe and Central Asia, organized by WHO in Helsinki, Finland on 24–25 March 2017, in which 14 countries, three WHO collaborating centres and the WHO Secretariat participated. The salient points from that consultation exercise have been incorporated into this report.

Background

Kyrgyzstan is classified as a lower-middle-income country (a low-income country until 2014) in central Asia and one of the first countries in the Region to implement the WHO PEN. With a health system in transition *(4)*, the leading causes of premature mortality in Kyrgyzstan are ischaemic heart disease and cerebrovascular disease *(5)*. Over a third of adults have three or more cardiovascular risk factors, and the probability of dying from an NCD between the ages of 30 to 70 years is 28% *(6)*. Significant gender differences exist for cardiovascular disease mortality, with rates higher in men than women by a factor of 2.5 in the group aged 0–64 years. The three risk factors that account for the greatest disease burden are dietary risk, high blood pressure and tobacco use. Around half (50.5%) of the men smoke and common foods are high in salt and trans fats. Over two fifths (42.9%) of adults aged 25–64 years have elevated blood pressure and a quarter (23.6%) have a raised total cholesterol level. Almost one in five (17.4%) adults were identified in 2013 as being at high cardiovascular risk, that is, the probability of a cardiovascular event or death in the next 10 years was 30% or more.

Primary health care is delivered by family medicine centres (FMC) which serve the population living in the specified area. There are 64 FMCs, 28 health care delivery centres, 696 family general practitioners (plus 17 independent GPs) and 1030 *feldsher* midwife points. FMCs are financed on a per capita basis. There is a national essential medicines list (2012, currently under review) and a reimbursement list (2015). All the essential medicines required for implementing the WHO PEN protocols are on the national essential medicines list but around a third are missing from the reimbursement list, importantly statins and medicines for treatment of diabetes. The latter are funded through a separate programme.

Barriers in the health system to achieving better NCD outcomes have been identified and significant progress has been made in recent decades in tackling issues such as financial barriers to accessing health services *(7,8)*. Nevertheless, almost half the population still finds it difficult to pay for health care. The lack of price regulation leads to considerable increases in out-of-pocket spending for medicines. Copayments for medicines prescribed and dispensed under the reimbursed drug package increased by 20% from 2013 to 2015 *(9)*.

There is a national strategy on NCDs 2013–2020, and the National Health Reform Programme (Den Sooluk) 2012–2016 (which has been extended) *(10)* prioritizes cardiovascular health as one of its main themes. The policy dialogue on primary health care strengthening includes a recently developed Primary Health Care Action Plan 2016–2018. Implementation of the WHO PEN protocols 1 (prevention of heart attacks, strokes and kidney disease through integrated management of diabetes and hypertension) and 2 (health education and counselling on healthy behaviours) began in Kyrgyzstan in June 2014 with the appointment of a national coordinator and PEN working group and the definition of FMCs to be included in the pilot project *(11)*.

Rationale for the evaluation

WHO first issued guidelines and risk prediction charts for the assessment and management of cardiovascular risk in 2007 *(12,13)*. Its first package of essential NCD interventions for primary health care in low-resource settings was issued in 2010 *(14)*, with a further iteration in 2012. A set of implementation tools, including a facility assessment questionnaire and a clinical information sheet, was published in 2013 *(3)*. Three countries in the Region are piloting the implementation of the WHO PEN protocols, and several other countries have used the concept to review their own national protocols for primary health care. Apart from the WHO/ International Society of Hypertension risk prediction charts, the European Society of Cardiology Systematic COronary Risk Evaluation (SCORE) charts are also frequently used in the Region *(15)*.

In the 2015 WHO global survey assessing national capacity for the prevention and control of NCDs *(16)*, 29 (55%) of the 53 countries in the Region reported that they had national guidelines/standards/protocols in place for all four main NCDs *(17)*. Twenty (38%) countries reported that cardiovascular risk stratification was present in more than 50% of primary health care facilities, and 38 (72%) countries reported that a list of essential NCD drugs was generally available. In the same study, Kyrgyzstan reported that cardiovascular risk stratification was present in fewer than 25% of primary health care facilities.

A review of published literature found few publications on PEN implementation in low- and middle-income countries (LMICs) (see Annex 1 for search strategy). In some cases, such as in the Philippines, only implementation indicators were accessed (such as staff training and availability of equipment) *(18)*. In the case of Bhutan, a PEN evaluation included an assessment of routinely collected health-care data in pilot PEN centres *(19)*. An evaluation was made of the performance indicators (such as blood pressure registration rates) and changes were made in some parameters of the group of patients who visited pilot PEN centres three times (cardiovascular risk assessment score levels, blood pressure and other risk factors). There were some positive trends, but this group was very small compared with the total population of the PEN centres and no attempts were made to assess the significance of these changes.

The authors of this report found two examples of the economic evaluation of the PEN protocols, both of which used models. In Bhutan, a modelling study focused mainly on the screening component (universal screening for hypertension and diabetes) of PEN *(20)*, where it was shown to be cost-effective. In Indonesia, a model was also used (cost-effectiveness of screening and treatment of hypertension and diabetes as a part of the PEN protocols). The study showed that implementation of the PEN protocols would be cost-effective in Indonesia and yield cost savings for the government and the possibility of reallocating resources to the country's priority health concerns, thus leading to better health outcomes *(21)*. No study was found of the economic assessment of the PEN protocols based on real data.

At present only a few economic models show the cost-effectiveness of implementing PEN, and these are based on the assumption that the PEN protocols will be fully implemented and will achieve the expected clinical effects. There is a clear lack of evidence that implementation of the PEN protocols in LMICs really has a significant clinical impact in terms of improving, for example, blood pressure control and other important clinical parameters. Implementation is an important issue.

The lack of evidence about the effects of implementing PEN may be partly due to the absence of an approved methodology which can be used in LMICs with limited resources, including research capacity. This lack of clear evidence may be a significant barrier to the broad implementation of the PEN in low-income countries.

Since there is a clear need to develop and gain approval for a methodology which will allow for the evaluation of the clinical and economic effects of PEN implementation in limited resource settings, the study took as its principal objective to develop and test a methodology which will allow for such an evaluation. More specifically, the study aimed to:

- compare the inputs, outputs and outcomes for PEN pilot sites versus non-PEN pilot sites in Bishkek city for 12 months;
- assess the possibility of and perspectives for developing an approach to the economic evaluation of PEN implementation in Kyrgyzstan that can be of value for other countries;
- inform the future development of PEN implementation in Kyrgyzstan.

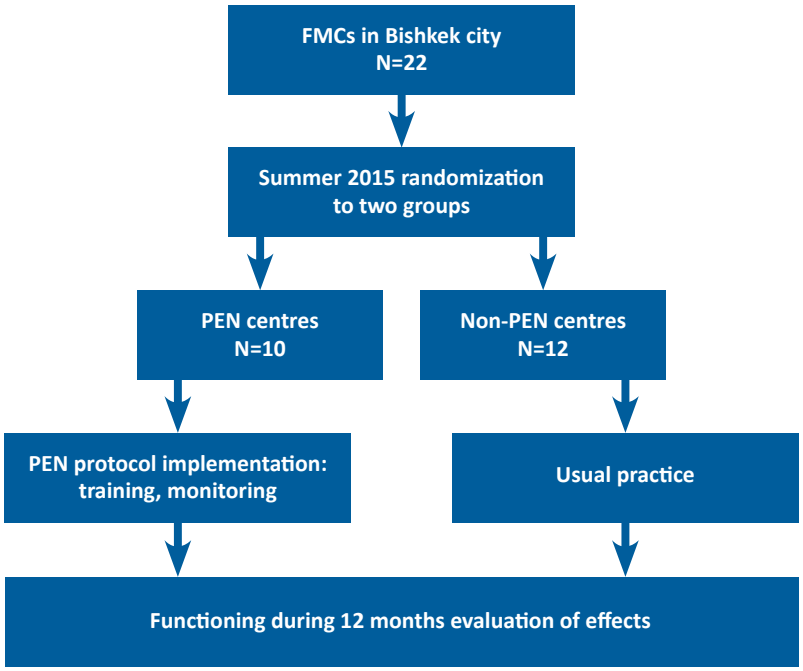
Methodology

Scope

In Kyrgyzstan, by the time of the evaluation (August to December 2016), piloting of PEN protocols 1 and 2 had been initiated in Bishkek city (population 1 200 000), Chuy (population 862 000), Issy Kul (population 436 000) and Batken (population 20 000).

The study focused its evaluation on Bishkek city because this was the most longstanding of the four pilot schemes and had been the most comprehensively implemented by the local team and through regular monitoring. Of the 22 FMC in Bishkek city, the PEN protocols had been randomly implemented in half (10) covering 40.1% of the population (481 213) (Fig. 1). No data were available describing the differences between PEN and non-PEN FMC as these exact data had not been collected. A simple randomization approach appears to have been used. Individual FMCs are not equal in population type (ethnicity – prevalence of Kyrgyz, Russian or other ethnic group), size or some other parameters (such as inner-city versus rural population at the edge of the city). The size of the population aged 18+ years covered by each FMC is shown in the Results section below.

Fig. 1. Implementation of PEN protocols 1 and 2 in FMCs in Bishkek



An important point is that before the implementation of the PEN project the Ministry of Health had introduced nurse-led preventive clinics in all FMC in Bishkek (Ministerial order No. 445, 05.08.2014), including both PEN (intervention) and non-PEN (control) clinics. These nurses have to offer consultations to all FMC visitors regarding their risk factor levels and lifestyle modification.

The implementation of the PEN protocols included the following steps.

i. Political support was gained at governmental level with an approved programme for the prevention and control of NCDs and an action plan for its implementation (Ministerial order No. 597, 13.11.2013).

ii. A national coordinator for NCDs was defined and the working group on implementation of the WHO PEN protocols was established (Ministerial order No. 352, 23.06.2014). Largely funded by WHO, the working group comprised a full-time NCD coordinator and five part-time staff. Its functions included adapting the PEN protocols to the specific circumstances of Kyrgyzstan, preparing training materials and carrying out training, and working with the FMCs on the implementation, monitoring and evaluation of the PEN protocols.

iii. The prevention/risk assessment clinics in the PEN centres were reorganized and staffed by nurses responsible for making a risk assessment for each visitor to the FMC. Clear algorithms of work for the nurses in the preventive clinics were introduced (see below).

iv. The infrastructure was assessed and the equipment available in the FMCs for the purposes of the PEN protocols was revised and recommendations made for the purchase of additional units (paid for by the FMCs).

v. New statistical forms were introduced in PEN centres, with sections on the risk prediction score (using the WHO/International Society of Hypertension charts) and risk factor assessment. These were distributed more widely than in the non-PEN centres. The data are transferred from the cards to an electronic format.

vi. A one-day training session on PEN protocols was held for all FMC staff. This was designed to be interactive and include skills practice and case studies, and was followed by separate sessions for physicians and nurses over two to three months (Annex 2).

vii. The implementation of the PEN protocols was monitored by members of the PEN working group, who were to visit PEN FMCs every two to three weeks and review medical records, consult the staff over any issues related to PEN and prevention and remain in the physician's or nurse's offices during preventive consultations.

viii. A new electronic registration system was developed and implemented for PEN centres using the ACCESS database, which differs from the system in non-PEN centres as regards information on risk factors and total risk.

In Bishkek, 90% of the doctors and nurses (97 people) working in the PEN pilot FMCs received initial training (Annex 2). A checklist (multiple choice questions) was used to test knowledge pre- and post-training. Average scores were 20–30% before the project, 70–80% post-project and 80–90% one year after the project, using the same checklist each time. The main differences between PEN and non-PEN FMC are summarized in Table 1.

Screening of all patients aged 18+ years for cardiovascular risk factors takes place on an opportunistic basis. Patients who attend an FMC for whatever reason are invited to visit the nurse clinic where their smoking status and blood pressure are measured. These visits are obligatory in the PEN centres but voluntary in the non-PEN centres. In the PEN FMCs only, clear algorithms with total cardiovascular risk are calculated using the WHO/International Society of Hypertension risk charts, and health workers have been taught to advise and manage patients according to PEN protocols 1 and 2. All patients assessed as being at high risk (that is, assessed as having a more than 30% risk of a cardiovascular event or death within 10 years) are referred to and managed by their family physician. Patients with no or low cardiovascular risk are managed by nurses and are given lifestyle recommendations and advice to visit the nurse again within three months.

In Bishkek city, the health worker fills in a record card during every patient's visit to an FMC. This contains information such as International Classification of Diseases code, smoking status, blood pressure levels and risk score level (if measured). At the end of each day, the data on these paper forms are transferred to electronic format and made available for analysis. They can then form the basis for monitoring and evaluation.

Table 1. Main differences between the PEN FMCs (intervention) and non-PEN FMCs (control)

PEN FMCs	Non-PEN FMCs
Clear algorithms of the work in the preventive clinic according to PEN protocols	No clear algorithms for work in the preventive clinics according to PEN protocols
Visit to preventive office is obligatory for any FMC visitor (adult): up to 60–70 visitors in preventive clinics per day	Visit to preventive office voluntary for any FMC patients (adult): 5–10 visitors in the preventive clinic per day
Staff in all FMCs trained by PEN implementation team	Absence of formal training
Regular monitoring of PEN/preventive activities (once in 2–3 weeks), staff consultations on PEN/preventive issues	No monitoring or consultations
Records made on special cards of the patient's visit, later transferred to electronic format including the section on smoking status and cardiovascular risk. Data on risk score levels and smoking status or FMC visitors are available.	Records made on special cards of the patient's visit, later transferred to electronic format, do not include the section on smoking status and cardiovascular risk. Data on risk factor levels and smoking status of FMC visitors are available.

Other information can be retrieved from the central database (hospitalizations, myocardial infarction and stroke cases, death). Such health/disease outcomes for patients are entered by the FMC administration on receipt of discharge information from the hospital contained in an extract from the hospital record which the patient brings to the FMC.

Resources for the implementation of PEN

Data on the additional resources needed to implement the PEN protocols during one year were collected (Table 2), including time spent by the central team on implementation and monitoring, training and printing materials. The average annual additional costs per PEN centre compared with non-PEN centres were calculated.

Table 2. Additional resources for each PEN FMC

Types of resource	Description
Preparatory work by the team	Meetings, lectures and development of materials; work with FMC leaders
Training of the medical staff	Numbers of: training hours, medical staff covered, lecturers involved and teaching hours per FMC
Monitoring	Number of visits per year and time spent in one centre
Printing materials	Number of all materials printed both at the implementation stage and later during one year
Additional equipment	Additional equipment bought for the FMC from any source
Additional computer program development	Money spent on program development

Evaluation of performance: quality and effectiveness indicators in PEN and non-PEN centres

In PEN and non-PEN centres (together as a group and separately in each centre), indicators were evaluated in two time periods: 12 months before PEN implementation and 12 months after PEN implementation (Table 3). This approach allowed for the changes in the PEN centres before and after the implementation of PEN to be evaluated and for the PEN and non-PEN centres to be compared over the same period and the possible impact of external factors eliminated.

Table 3. Timeframe for evaluation of indicators

10 PEN centres	12 non-PEN centres
12 months before PEN implementation (June 2014–June 2015)	12 months before PEN implementation (June 2014–June 2015)
12 months after PEN implementation (June 2015–June 2016)	12 months after PEN implementation (June 2015–June 2016)

The evaluation included performance/quality indicators and effectiveness indicators.

The following performance/quality indicators measure how FMCs detect and register diseases and risk factors:

- number of registered hypertension patients
- number of newly registered hypertension patients
- number of registered type 2 diabetes patients
- number of newly registered type 2 diabetes patients
- number of patients with a calculated SCORE
- number of patients with different SCORE levels
- number of patients with registered risk factors
- number of people who smoke.

With effective implementation of the PEN protocols, evidence could be expected of improvements in performance/quality.

The effectiveness indicators listed below can demonstrate the improved outcomes as being the results of improved performance/quality:

- number of visits to the clinic by hypertension patients with elevated blood pressure
- number of referrals to hospital
- number of ambulance calls
- number of stroke cases
- number of myocardial infarctions
- number of cardiovascular deaths.

One year may not be a long enough period in which to achieve significant changes in this type of indicator, but some of them, such as detection of risk factors, can change in that time and the tendency can be fixed which can later become significant. Enrolment in the study was rolling as patients were screened in the nurse clinics opportunistically so not all individuals were followed for one year.

The performance/quality indicators were assessed during the 12 months before and after the PEN evaluation (for example, the number of registered hypertension cases, the number of registered hypertension patients who visited a clinic at least twice and the number of patients visiting the intervention clinics for whom the risk score had been calculated) and expressed against the total populations covered by the FMCs.

The authors extracted data on the size of the population in each FMC for each time period and on the predefined performance and effectiveness of each centre. Statistical analysis was performed in Excel 10.0 to calculate the mean, the standard error and the 95% confidence interval (CI) for the groups of PEN centres and non-PEN centres.

Results

Tables 4 and 5 show the general characteristics of the populations aged 18+ years covered by the FMCs. These populations differ in size by up to two or three times, but the total populations served by the PEN and the non-PEN centres were similar (330 000 and 355 000 adults aged 18+ years, respectively). Depending on their size and performance, the FMCs have several thousand registered hypertension patients and several hundred (up to 1000) patients aged 18+ years with diabetes.

Table 4. PEN FMCs: general characteristics

FMC Before/ after implementation of PEN[a]	Population aged 18+ years	Registered hypertension patients	Newly diagnosed hypertension patients	Registered diabetes patients	Newly diagnosed diabetes patients	No. of visits (all)	No. of visits by people aged 40+ years	No. of visits where the risk factors were fixed	No. of visits by people aged 40+ years where the risk factors were fixed
FMC 2									
Before	54 594	2 145	164	625	118				
After	53 198	2 175	165	711	116	36 913	23 207	20 319	19 632
FMC 4									
Before	32 103	1 705	153	429	39				
After	30 613	1 961	154	568	51	23 745	15 831	10 824	9 642
FMC 7									
Before	34 791	1 113	164	225	13				
After	34 089	1 135	165	301	47	23 436	15 378	12 120	9 105
FMC 8									
Before	38 857	1 473	140	331	41				
After	39 771	2 972	142	417	71	36 291	21 650	12 034	10 894
FMC 10									
Before	22 291	752	56	233	41				
After	17 227	894	57	275	33	9 443	6 772	4 072	3 072
FMC 12									
Before	46 894	1 017	121	489	71				
After	46 326	1 102	121	587	54	29 423	13 062	12 033	10 796
FMC 14									
Before	51 348	1 198	97	376	11				
After	49 502	847	98	308	51	23 970	10 551	6 560	5 660
FMC 17									
Before	18 100	678	74	186	15				
After	18 100	832	75	189	14	11 526	7 120	10 525	6 507
FMC 19									
Before	28 616	2 475	152	500	61				
After	28 616	2 356	153	486	42	23 700	16 350	7 511	6 519
Railway clinic									
Before	13 908	932	90	117	19				
After	28 616	905	92	138	31	10 994	6 653	6 146	5 562
Total									
Before	341 502	13 488	1 211	3 511	429				
After	331 289	15 179	1 222	3 980	510	22 944	136 574	102 144	87 389

[a] Before=26 June 2014–25 June 2015; after=26 June 2015–25 June 2016.

Table 5. Non-PEN FMC: general characteristics

FMC	Before/after implementation of PEN[a]	Population aged 18+ years	Registered hypertension patients	Newly diagnosed hypertension patients	Registered diabetes patients	Newly diagnosed diabetes patients
FMC 1	Before	69 888	3 281	258	942	207
	After	66 029	6 245	241	1 012	189
FMC 3	Before	53 994	4 324	173	1 090	47
	After	51 823	2 638	154	1 169	63
FMC 5	Before	48 953	2 256	136	508	83
	After	48 225	2 458	134	535	65
FMC 6	Before	40 539	3 006	142	515	96
	After	40 153	3 185	137	515	59
FMC 9	Before	43 136	2 658	173	304	24
	After	40 909	2 607	115	342	17
FMC 11	Before	19 311	1 206	37	288	26
	After	17 602	1 180	56	257	7
FMC 13	Before	29 623	1 529	21	174	16
	After	26 090	1 718	29	196	8
FMC 15	Before	27 914	2 152	64	482	92
	After	26 643	2 066	76	533	107
FMC 16	Before	17 808	1 009	36	174	25
	After	14 972	1 121	38	283	24
FMC 18	Before	21 201	1 337	92	253	39
	After	21 678	1 254	104	222	40
Total	Before	353 056	21 552	1 132	4 730	655
	After	354 124	24 472	1 084	5 064	579

[a] Before=26 June 2014–25 June 2015; after=26 June 2015–25 June 2016.

Resources for implementation of PEN

Table 6 summarizes all the additional costs for the implementation and functioning of the PEN protocols during 12 months (see Annex 3 for more details on these costs).

Table 6. Additional costs of operation of 10 PEN centres in Bishkek for 12 months

Costs	Total US$	Payer
Staff payment (working group, preparatory, monitoring and other)	4324	WHO
Computer program	300	WHO
Printing materials	2540	Other sponsors
Equipment (per 3 FMCs)	1500	FMC
Total per 10 centres	8664	
Average cost per centre	866	

In general, additional costs per year per FMC, including the costs of preparation and implementation, were low (US$ 866). Only three FMCs needed to buy the additional equipment; the other seven had it already.

Performance/quality indicators

Table 7 shows the performance/quality indicators in PEN and non-PEN centres presented as a mean per 100 000 population with 95% CI, except smoking which is presented as a percentage (prevalence) with 95% CI. There is a non-statistically significant tendency towards increasing the detection rate of hypertension and diabetes in PEN centres, but almost the same is seen in non-PEN centres. Any difference is also likely to be overestimated because of clustering. The detection rate is still very low. For example, hypertension was diagnosed in 4.3% of patients of PEN centres before the implementation of PEN and had only improved to 5.0% in the 12 months after implementation (a non-statistically significant difference) . The detection rate for hypertension in PEN FMCs is much lower than the hypertension prevalence of 42.9% for adults aged 25–64 years in the general population, according to the WHO STEPS risk factor survey in 2013 *(6)*. Even taking into account the difference in age group between the STEPS survey and this evaluation, which covered a population aged 18+ years, the detection rate is still very low (almost 10 times lower than prevalence data). In non-PEN centres the hypertension detection rates were 6.2% and 6.8%, respectively, in the time periods before and after the implementation of PEN in PEN centres, which was slightly better.

Table 7. PEN evaluation: performance/quality indicators per 100 000 population aged 18+ years (mean and 95% CI)

Population aged 18+ years	PEN centres		Non-PEN centres	
	12 months before PEN	12 months of PEN	12 months before PEN	12 months of PEN
Hypertension, all (95% CI)	4320.1 (2295.8; 6344.5)	4994.1 (2823.4; 7164.9)	6197.7 (4986.5; 7408.8)	6826.5 (5459.7; 8193.4)
Hypertension, newly diagnosed cases (95% CI)	389.4 (245.4; 533.4)	405.8 (264.2; 547.3)	284.7 (172.7; 396.6)	301.0 (208.3; 393.8)
Type 2 diabetes, all (95% CI)	1041.6 (721.3; 1361.9)	1234.8 (844.8; 1624.8)	1235.5 (795.4; 1675.7)	1414.3 (905.3; 1923.2)
Type 2 diabetes, newly diagnosed cases (95% CI)	127.0 (59.6; 194.4)	156.0 (107.4; 204.7)	168.8 (73.6; 264.0)	154.8 (38.3; 271.3)
Smoking[a] (95% CI)	0.6 (0; 1.2)	1.8 (0.9; 2.8)		

[a] Smoking is presented in %.

The type 2 diabetes registration rate was also several times lower than the epidemiology data on diabetes prevalence given in the 2013 STEPS survey. In PEN centres, the diabetes registration rate before implementation of PEN was 1% of adults aged 18+ years; in the 12 months after implementation of PEN it was almost the same (1.2%). The STEPS survey gave a prevalence of diabetes (on the criteria of glucose level above 7 mmol/l or antidiabetic medications) of 5.1%. The same pattern was seen in the smoking registration rate (data only available for PEN centres). Before the implementation of PEN, the smoking registration rate was only 0.6%; after implementation it improved by three times (1.8%) but was still less than 2% and many times less than the smoking prevalence seen in the STEPS survey (average for males and females 25.7%). Detection of smoking would have been expected to increase early in the pilot if it was being assessed and recorded. The prevalence of current smoking in Kyrgyzstan is much lower for women (3.7%) than for men (50.5%). A failure to persuade men to have preventive checks might partly explain the lower levels, but unfortunately the data were not available by gender.

There was a considerable difference in the CI for all parameters, which suggests a wide variability in these parameters in both PEN and non-PEN centres. This can also be a question of accuracy of registration or variability of implementation and functioning.

In general, the registration of specific cardiovascular risk factors (hypertension, diabetes and smoking) did not improve significantly in the 12 months after implementation of the PEN protocols compared with the previous period, nor did registration in PEN centres improve significantly compared with non-PEN centres.

The number of visits to clinics by patients with blood pressure above 180/100 fell by 39% in PEN centres after the implementation of PEN compared with the previous period. In non-PEN centres there were no positive changes. Nevertheless, the wide and overlapping CI make these differences non-significant (Table 8).

Table 8. PEN evaluation: effectiveness indicators in PEN and non-PEN centres per 100 000 population aged 18+ years (mean and 95% CI)

Population aged 18+ years	PEN centres		Non-PEN centres	
	12 months before PEN	12 months of PEN	12 months before PEN	12 months of PEN
Visits to clinic with blood pressure above 180/100 (95% CI)	116.0 (14.4; 217.5)	70.4 (-15.7; 156.5)	151.2 (-10.6; 313.0)	161.7 (-24.9; 348.3)
Hospital admissions for hypertension (in form of transfers) (95% CI)	60.6 (8.5; 112.7)	37.4 (-0.8; 75.6)	72.5 (28.2; 116.7)	74.5 (24.5; 124.5)
Ambulance calls for hypertension (95% CI)	281.4 (77.4; 485.5)	207.2 (25.9; 388.5)	425.8 (166.5; 685.1)	440.7 (233.3; 648.0)
Myocardial infarction (95% CI)	23.5 (3.1; 44.0)	15.0 (2.9; 27.1)	32.3 (18.2; 46.5)	43.2 (25.4; 61.0)
Stroke (95% CI)	42.4 (10.9; 74.0)	47.1 (15.1; 79.0)	83.6 (36.3; 130.9)	103.0 (42.5; 163.5)

While some changes were suggested in hospital admission rates for hypertension (an apparent decrease of 38% in PEN centres compared with no change in non-PEN centres) and ambulance calls for hypertension (an apparent decrease of 24% in PEN centres compared with a slight increase in non-PEN centres), the overlapping CI for all parameters indicate that no statistically significant differences were detected between the PEN and non-PEN clinics. In the case of ambulance calls for hypertension, the differences between the intervention and control groups were consistent at baseline and follow-up.

At present there are no data on blood pressure levels. If they become available in future it will be possible to obtain stronger evidence as to whether blood pressure control has improved.
Some non-significant positive changes were seen in the myocardial infarction rate in PEN centres, but not in the non-PEN centres. The stroke rate had increased in both PEN and non-PEN centres. These results are difficult to interpret: if they were due to the impact of improved blood pressure control the positive changes should have been seen in both myocardial infarctions and strokes. A definite impact from improved blood pressure control on strokes and myocardial infarction can, however, be expected after 12 months of PEN implementation.

Attempts to evaluate some indicators related to blood pressure levels in PEN centres for the periods before and after implementation were inconclusive (Table 9).

For all indicators, the CI were overlapping, indicating no statistically significant difference over time. In PEN centres, during the 12 months after the implementation of the PEN protocols, the number of visits by patients with blood pressure both above and below the recommended thresholds per 100 000 population appeared to double compared with the period before implementation of PEN. Even if this were statistically significant, it would be difficult to interpret as it could reflect changes in detection through screening (probable) rather than changes in blood pressure control (possible).

Table 9. PEN evaluation: blood pressure control indicators in PEN centres per 100 000 population aged 18+ years (mean and 95% CI)

Population aged 18+ years	12 months before PEN	12 months of PEN
No. of visits by patients with blood pressure above 140/90, per 100 000 population (95% CI)	9 481.1 (664.6; 18297.5)	17 171.0 (6700.0; 27642.1)
No. of visits by patients with blood pressure above 140/90 per registered hypertension patient per 12 months (95% CI)	2.3 (0.4; 4.3)	3.6 (1.4; 5.8)
No. of visits by patients with blood pressure below 140/90 per 100 000 population (95% CI)	10 347.6 (-8301.9; 28 997.2)	18 447.1 (-817.4; 37 711.6)
No. of visits by patients with blood pressure below 140/90 per registered hypertension patient per 12 months (95% CI)	2.0 (-0.4; 4.3)	3.5 (0.6; 6.4)

Discussion

This analysis was performed with the main aim of developing and testing a methodology to evaluate the implementation of the PEN protocols in LMICs where there was a lack of data and imperfect registration systems. The methodology included the evaluation of the short-term clinical effect (12 months), calculation of the costs and whether there was evidence of clinical effects. Implementation is a big issue for LMICs that lack all types of resource: human, money and equipment. A demonstration of some clear short-term effect in LMICs is crucial for broader implementation of PEN protocols and for long-term economic calculations.

The evaluation of the short-term 12 months' effects in terms of changes in prespecified performance and effectiveness indicators in PEN centres did not show clear and significant evidence of a real impact resulting from the implementation of the PEN protocols on primary care, so there were no arguments for performing a long-term economic analysis of the combination of the effects and costs.

The additional costs of implementing and running the two PEN protocols in Bishkek FMCs over 12 months were on the low side (less than US$ 1000 per FMC per year). As it was not possible to demonstrate the effectiveness of the intervention, it is difficult to judge whether this was a sufficient amount or not. If an intervention is implemented ineffectively any cost is too much and demonstrates an opportunity cost in distracting from the implementation or optimization of effective interventions.

The detection of diseases and risk factors had not improved in PEN centres. The registration rates in primary care of hypertension, type 2 diabetes and smoking were far below the prevalence rates found in the 2013 STEPS survey and did not differ between PEN and non-PEN centres. These indicators might improve in the short term, although this was not yet apparent. There was also considerable variability in the indicators between FMCs, which could indicate different performances or problems with accuracy of registration.

There was some non-significant positive effect on the effectiveness indicators reflecting blood pressure control (number of ambulance calls for hypertension, number of hospital admissions for hypertension, visits to clinics by patients with extremely high blood pressure) in the PEN centres but not in the non-PEN centres. It could be that this format of PEN implementation did not affect the detection rate but did affect the medical care of hypertension patients who were already under supervision in the FMC. The large variability in the numbers in the indicators quoted above militates against finding a significant difference between PEN and non-PEN FMCs and makes the point about the definite improvement in blood pressure control in PEN centres compared with non-PEN centres.

The decrease in the myocardial infarction rate in the absence of a decrease in stroke can be an artefact or the result of influence by other factors such as confounding and unadjusted rates.

There can be various reasons for the lack of effect found in this study. The first option is that the implementation of the PEN protocols is effective in Kyrgyzstan; this analysis failed, however, to demonstrate a real difference between PEN and non-PEN centres, especially in terms of an observed tendency towards improved blood pressure control in PEN centres compared with non-PEN centres. This failure could be the result of several factors. The pilot study design could have been insufficiently powered to detect a true effect, if such existed. The methodology used may have not been completely appropriate considering the period of implementation and species of data collection. The real difference might in fact be small so that it would only be possible to demonstrate its significance on a big sample. In addition, the accuracy of data registration is an issue: the transfer of data to an electronic format from the paper record in the FMC and the discharge from hospitalization paper which the patient has to bring to the FMC can lead to loss or distortion of data.

The second important possibility is that the PEN protocols are ineffective over a period of 12 months (at least as regards increased detection and diagnosis of cardiovascular risk factors). In Bishkek the implementation was gradual and it is possible that the full effect might not be achieved in 12 months but could be seen later. Kyrgyzstan has also kept some features of the former Soviet health care system and health education so that it could be different/better than other lower-middle-income countries in terms of primary care and educational level of staff and the PEN protocols do not add as much as they can do in, for example, African countries. Also since the preventive clinics with the functions of risk factor evaluation and lifestyle counselling were introduced everywhere, the implementation of PEN in this format did not add much to the usual practice. Another issue could be poor implementation, so that the increased number of visitors to the preventive clinics do not really receive high quality preventive care and advice on lifestyle modification. It is not known for sure, for example, that the PEN protocols were used, risk scores were calculated correctly, decisions were made according to risk scores and health workers understand the meaning of risk.

The implementation of new primary care/chronic care models can come up against a significant number of barriers, such as the organizational culture and structural characteristics of the provider, networks and communication, the implementation climate and readiness, the presence of supportive leadership and providers' attitudes and beliefs. These barriers can have a serious impact on effectiveness and need to be studied and addressed during the implementation phase *(22).*

As regards the perspectives for the analysis, some more indicators are expected (mean blood pressure levels, some indicators among those who made at least two visits to FMCs) and whether there will be any significant changes that will yield the data for an economic analysis. It may also be possible to prolong the evaluation period for one more year to see what difference there might be in two years.

The results of the evaluation demonstrated the limitations of the initial design of the pilot project and the methodology used to evaluate the effects of the implementation of the PEN protocols in LMICs. Firstly, the initial randomization of clinics to PEN intervention or usual practice did not apparently account for clustering coefficients. This suggests that any effect demonstrated will be overestimated *(23)*. Furthermore, the lack of baseline data about the characteristics of the clinic population for the PEN and non-PEN FMCs means that it cannot be concluded that any observed differences are the result of the intervention or of baseline differences.

Finally, the electronic registration of some data on patients' visits does not constitute a full electronic record, so the possibilities for data analysis are limited. A huge variability in data raises the issues of variability of performance and accuracy of registration (for all parameters, including the population size).

Conclusions

This study is the retrospective evaluation of the implementation of the PEN protocols during 12 months in FMCs in Bishkek, using existing sources of data that are routinely collected. The evaluation included two periods (one year before PEN implementation and one year after it) and two randomly selected groups of FMCs (PEN and non-PEN). The detection rate of cardiovascular disease risk factors and diseases did not change in PEN centres compared with both the period before

implementation of PEN and with the non-PEN FMCs over both periods. There was some positive change in the effectiveness indicators reflecting blood pressure control (number of ambulance calls for hypertension, number of hospital admissions for hypertension, visits to clinics by patients with extremely high blood pressure) that were not seen in non-PEN centres, but it was not significant.

The study concludes that either the implementation of the PEN protocols in Kyrgyzstan is effective and the design of the pilot and evaluation and quality of data were unable to detect it, or that the current implementation model is ineffective.

Cardiovascular disease causes 50% of deaths in Kyrgyzstan and significant disability, health and social costs. The prevention and control of cardiovascular disease requires population-level prevention efforts, cardiometabolic risk assessment and management, effective acute care, secondary prevention and rehabilitation. The effective detection and management of cardiometabolic risk factors play important roles in prevention and in meeting the global and sustainable development goals for reducing premature mortality from NCDs. The set of nine global voluntary targets within the Global Monitoring Framework for NCD prevention and control *(24)* includes targets on reducing the prevalence of raised blood pressure, increasing access to essential medicines and basic technologies and management of cardiovascular risk. The forthcoming WHO STEPS and country capacity surveys will indicate whether Kyrgyzstan is making progress in meeting these targets and in increasing the coverage of risk stratification. Two concurrent WHO studies have evaluated the implementation of the NCD strategy in Kyrgyzstan, in particular prevention efforts at population and individual level and acute and rehabilitative care for heart attacks and strokes *(25,26)*. Among other things, these studies indicated that there were shortcomings in secondary prevention. Better management of risk factors in those already known to have cardiovascular disease would have a significant impact in preventing further heart attacks and strokes. As found in a survey of 24 European countries by the European Society of Cardiology, most coronary patients in Kyrgyzstan are also not meeting their lifestyle, therapeutic and risk factor targets after hospitalization *(27)*.

Implementation is a complex matter. Barriers to evidence-based practice relate to the innovation itself (in this case, the PEN protocols), the adopter (in this case, the primary health care workers), the beneficiary (in this case, the patient), and the context (social, organizational, economic and political) *(28–33)*. A systematic review of the model for PEN implementation in Kyrgyzstan which takes all of these factors into account would be both valuable and would indicate areas that need to be redesigned or strengthened. Quality improvement is a repeating cycle (plan, do, study, act). The implementation of the PEN protocols in Kyrgyzstan was planned, has been done for over a year and has been studied. The country is now at the point in the cycle when further exploration of the issues highlighted would inform action. Following any necessary adjustment, adaption or de-adoption of the model, the cycle would start again.

This is an important study for Europe and globally. It is the biggest and longest evaluation of PEN implementation in real life (from available literature) and it can contribute to overall understanding of the implementation issues of PEN worldwide. Evaluation is part of the implementation cycle for improvement of primary care in Kyrgyzstan. In implementation research, it is important to understand why an innovation is successfully implemented in one setting but not in another. The application of a theoretical framework to guide data collection, analysis and interpretation could help to identify the determinants of implementation that apply to a specific context and assist in achieving the goal of generalizing and building on findings across studies and contexts *(34)*. This evaluation hints at potential weaknesses which need to be explored further. Supplementing it with qualitative methods should bring a clearer understanding and guide adjustment of the model.

The implementation of PEN in Kyrgyzstan faces a challenge. Scaling up an intervention that is not effective or efficient would not be an appropriate use of limited and external resources. It is, therefore, important that time is taken to understand better the model for risk assessment and management in primary care in Kyrgyzstan, what works well and what does not, and to see how the model might be adjusted and improved, including in the light of learning from other countries. It is also useful to see how broader strengthening of health systems, such as work on quality improvement and access to medicines, can benefit the implementation of essential NCD interventions in primary health care.

This study is extremely timely. As Kyrgyzstan expands the pilot implementation of the PEN protocols, considers their scale-up and sustainability and introduces incentives for performance, it is a good time to reflect. How can Kyrgyzstan achieve

the global and sustainable development goals for NCD, and how can cardiometabolic risk be best identified and managed in primary health care?

Next steps

Suggestions for the next steps would include:

- to take stock of the past year's experience in addressing NCDs at the primary care level, hear back from other pilots and consider an appropriate model for scale up and sustainability;
- by June 2017, to supplement this evaluation with other methods (audits of case records, interviews and focus groups) so as to gain a better understanding of the model (what works well and what does not) as part of strengthening primary health care in a resource-limited setting, and adjust the model appropriately;
- by August 2017, to hold a workshop with the Ministry of Health, relevant national and international experts and development partners to:
  - consider how to improve blood pressure control;
  - strengthen cardiovascular prevention in primary health care (including aspects such as payment reforms and incentives, quality improvement and clinical guidelines, access and availability of affordable medicines, an intersectoral approach and addressing determinants); and
  - develop a roadmap for scale-up and sustainability that both: (i) builds on broader contributions from health systems so as to achieve this within the framework of the national health reform programme and a sector-wide approach; and (ii) informs other initiatives supported by domestic and external resources.

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Annex 1. Literature search strategy

Information sources

The following bibliographic databases were searched:

- MEDLINE/Pubmed (Ovid);
- Google Scholar;
- Cochrane Central Register of Controlled Trials (CENTRAL) in The Cochrane Library;
- ClinicalTrials.gov (www.ClinicalTrials.gov);
- WHO International Clinical Trials Registry Platform (ICTRP) Search Portal.[1]

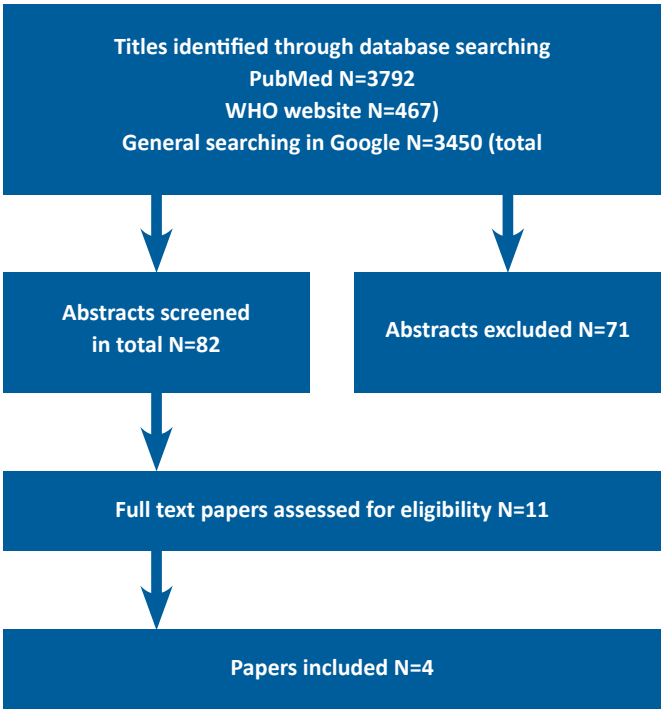
All searched were conducted in the period 1 October 2016 to 15 December 2016.

Search

The search formula for PubMed:

((PEN[Title/Abstract] OR PEN-protocol [Title/Abstract] OR WHO PEN [Title/Abstract] OR primary care PEN [Title/Abstract]) AND (effectiveness [Title/Abstract] OR effect [Title/Abstract] OR clinical [Title/Abstract] OR evaluation [Title/Abstract] OR economic [Title/Abstract] OR cost-effectiveness [Title/Abstract] OR cost-benefit [Title/Abstract] OR cost [Title/Abstract] OR modelling [Title/Abstract])

Fig.1.1. Flowchart for selection of the articles



[1] WHO International Clinical Trials Registry Platform Search Portal [online database]. Geneva: World Health Organization; 2017 (http://apps.who.int/trialsearch/, accessed 10 February 2017).

Selection of studies

Eligible studies were screened for assigned databases by titles.
Abstracts of selected papers were downloaded and reviewed and papers for full text downloading were selected.
Full papers downloaded from each database were combined and duplicates were excluded.
Full papers were reviewed for eligibility.

Annex 2. Content of teaching seminar

Teaching seminar programme

10.00–10.15	Introduction
10.15–10.25	NCDs: burden and STEPS surveys results
10.25–10.35	PEN protocols: description and practice of use
10.35–11.00	Physical examinations, blood analysis
11.00–11.10	Risk prediction score
11.10–11.20	Criteria for treatment of outpatients and inpatients during the visits
11. 20–11.40	Diabetes evaluation: recommendations for patients and family members
11.40–12.00	Nutrition counselling
12.00–12.20	Alcohol consumption counselling
12.20–12.40	Physical activity counselling
12.40–13.00	Smoking cessation counselling
13.00–14.00	Lunch
14.00–14.10	Counselling on hypertension treatment
14.10–14.20	Counselling on diabetes treatment
14.20 –16.00	Group work: recommendations based on the NCDs risk level. Group presentations
16.00–16.10	Repeat visits
16.10–16.20	Effectiveness indicators. Electronic statistics form
16.20–16.30	Work of the nurse clinic
16.30–17.00	Discussion. Closure of seminar

Teaching session included pre- and post-testing (12 questions)

Mean score before training 5.9
Mean score after training 10.9

Annex 3. Additional resources per PEN centre (preparation, training, monitoring)

Types of resource	Unit of resource (hours)	Price per unit (US$)	No. of units (hours)	Total (US$)	Comments
Preparatory work by the team	1	6.0	200	1200	Meetings, lectures and development of materials. Work with leaders.
Training of the medical staff	1	5.6	340	1904	Numbers of: training hours per FMC, medical staff covered, lecturers involved and teaching hours per FMC
Monitoring	1	6.3	150	945	Number of visits per FMC per year, time spent in 1 centre
Preparation of reports	1	5.4	51	275	
Total			741	4324	
Additional computer program development	1			300	Money spent on program development or working hours of IT person
Printing materials				2540	Per FMC, number of all printing materials (risk charts and other) at the implementation stage, and later during 1 year
Additional equipment				1500	Additional equipment for 3 FMCs

The WHO Regional Office for Europe
The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

Member States
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Andorra
Armenia
Austria
Azerbaijan
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