

PEER EDUCATOR NETWORKS
FOR PEOPLE WITH
DIABETES MELLITUS OR
HIGH BLOOD PRESSURE
IN CAMBODIA

“HEALING A MARKET FOR HEALTH”

2005 – 2010

Table of Contents

ABBREVIATIONS	8
SUMMARY	9
INTRODUCTION	11
HOW IMPORTANT ARE DIABETES AND HIGH BLOOD PRESSURE IN CAMBODIA ?	12
PREVALENCE	12
ADDITIONAL ARGUMENTS.....	14
<i>Secondary prevention of chronic NCD: to do or not to do</i>	<i>14</i>
MAKING A START TO ADDRESS CHRONIC NCD	15
INTERNATIONAL LITERATURE REVIEW	17
METHODOLOGY OF THE REVIEW	17
RISING MAIN CHRONIC NCD INCLUDING DIABETES	18
RISING CHRONIC NCD COST	18
CHRONIC NCD IN DEVELOPING COUNTRIES: THE PARTICULAR CHALLENGES	19
<i>Commitment to effective primary prevention</i>	<i>19</i>
<i>Relatively very low awareness of diagnosis:.....</i>	<i>20</i>
<i>The poor have no or less access to health services :</i>	<i>20</i>
<i>Screening for Diabetes and High Blood Pressure</i>	<i>21</i>
<i>Indirect costs are a barrier</i>	<i>22</i>
<i>Lifestyle interventions and prevention</i>	<i>22</i>
SELF MANAGEMENT	23
<i>High income countries.....</i>	<i>23</i>
<i>Low- and Middle Income Countries.....</i>	<i>23</i>
<i>Involving the community: a mixed picture</i>	<i>24</i>
<i>Diagonal approach.....</i>	<i>24</i>
ACCESS TO MEDICINES THROUGH RDF IN DC.....	24
<i>An RDF for chronic patients ? Who knows.....</i>	<i>25</i>
THE INTERNATIONAL EXPERIENCE IN SUMMARY	26
<i>What we know from international experience:</i>	<i>26</i>
<i>What we do not know from international experience:</i>	<i>27</i>
INTRODUCING PEER EDUCATOR NETWORKS	28
INTERVENTION'S ROLE AND SCOPE.....	29
THE ORIGINAL MISSION	30
ADAPTING TO THE NEEDS AND CIRCUMSTANCES WITH ADDITIONAL ROLES	32
<i>Revolving Drug Fund - Medicine Supply</i>	<i>32</i>
<i>Medical Consultations.....</i>	<i>36</i>
<i>Laboratory Services.....</i>	<i>37</i>
<i>Eye care clinic</i>	<i>37</i>
TARGET GROUPS.....	38

<i>Focus on Poor</i>	38
<i>Expanding from only the poor to middle class</i>	38
<i>Expanding to High Blood Pressure Patients without DM</i>	38
<i>Primary Prevention</i>	39
<i>Equity fund and vouchers for the Poorest</i>	39
THE ROLE OF GOVERNMENT	40
<i>Working with health authorities and government health staff</i>	40
<i>Advocacy</i>	40
MANAGEMENT	41
ORGANIZATIONAL CHART	41
SETTING-UP A PEER EDUCATOR NETWORK	42
<i>Selection of candidates</i>	42
<i>Training</i>	43
<i>Peer Educator Kit</i>	44
<i>Active screening</i>	44
<i>Peer Educator Network structure</i>	46
DESCRIPTION OF THE CONTINUUM OF CARE	47
PEER EDUCATOR ROLES AND TASKS	50
<i>12 Peer Educator tasks are described in more detail</i>	50
<i>Primary Prevention</i>	55
MONITORING	56
RESPONSIBILITY	59
PROVIDER PAYMENT METHODS AND INCENTIVES	59
ASSESSMENT METHODOLOGY	64
DOCUMENTATION METHODS	64
CHALLENGES	64
RESULTS	66
OUTPUTS	66
PATIENTS PROFILE AT TIME OF REGISTRATION	66
HEALTH SERVICE UTILIZATION	83
<i>Medical Consultations</i>	83
<i>Laboratory services:</i>	84
<i>Access to routine medication</i>	88
OUTCOMES INCLUDING EFFECTS ON PATIENTS.....	90
<i>Early Diagnosis, detection, community-based self screening & costs</i>	90
<i>Knowledge</i>	95
<i>Body Mass Index and weight</i>	99
<i>Improved lifestyle</i>	100
<i>Self-Management</i>	102
<i>Health improvements</i>	104
<i>Lower health expenditure</i>	106
<i>Retention</i>	107
COSTS	111

FINANCING	116
GOVERNANCE	119
DISCUSSION AND CONCLUSIONS	120
EVIDENCE AND ITS QUALITY	121
FUTURE CHALLENGES	125
CONCLUSIONS	126

Annexes

Bibliography

FIGURES

Figure 1 Metabolic trauma.....	13
Figure 2 Levels of patient involvement in the PEN.....	30
Figure 3 Organisational Chart of MoPoTsyo	41
Figure 4 Urban Peer Educator Network.....	46
Figure 5 Main elements of the Continuum of Care	47
Figure 6 Rural DM women by age group	67
Figure 7 Percentage of rural Diabetic women in fertile age when they register as member in MoPoTsyo	68
Figure 8 Rural women with High Blood Pressure by age.....	68
Figure 9 Percentage of rural women with HBP in fertile age when they register as member in MoPoTsyo	68
Figure 10 Detecting the silent killer : Community based self-screening for DM in a rural district	69
Figure 11 DM Women & DM men as members of MoPoTsyo in first rural area.....	71
Figure 12 Year of diagnosis among female urban diabetic members.....	71
Figure 13 Levels of FBG at time of registration among rural females with DM	72
Figure 14 Levels of FBG among rural males with DM	73
Figure 15 Levels of PPBG at time of registration among rural females with DM	73
Figure 16 Levels of PPBG among rural males with DM.....	73
Figure 17 Blood Pressure in Rural DM by Sex	75
Figure 18 Waist circumference of rural women with DM or HBP	76
Figure 19 Waist circumference of rural men with DM or HBP	77
Figure 20 Comparing proportions waist circumference categories in rural females 370 DM & 400 HBP	78
Figure 21 Waist circumference categories in rural men with DM.....	78
Figure 22 Waist circumference categories in rural men with HBP	79
Figure 23 BMI of female rural membership with DM or HBP	79
Figure 24 BMI in 450 rural men with DM or HBP	80
Figure 25 BMI categories of rural male members of MoPoTsyo with DM & HBP	81
Figure 26 Comparing categories of BMI among rural females with DM & HBP	81

Figure 27 Consultation by sex and age	83
Figure 28 Use of laboratory services in 2010 by DM who are slum inhabitants	84
Figure 29 Use of laboratory services in 2010 by rural DM members	85
Figure 30 Access to laboratory services by sex	85
Figure 31 Access to insulin by sex for 132 members with DM in 4 provinces.....	90
Figure 32 Members registered from 2005 to 2010 in urban and rural areas.....	91
Figure 33 Knowledge about blood sugar levels urban network.....	96
Figure 34 Rural area knowledge of maximum Fasting Blood Glucose target.....	97
Figure 35 Physical activity by rural DM after being member of PEN for more than 6 months	100
Figure 36 Costs per patient 2005 – 2010 all Peer Educator Networks together	111
Figure 37 Decreasing cost to MoPoTsyo.....	112
Figure 38 Costs Per Patient in each in each Peer Educator Network.....	112
Figure 39 Registration of new members (patients).....	114
Figure 40 Percentage expenditure per cost category 2004 - 2010.....	115
Figure 41 Revolving Drug Fund Break Even.....	118

TABLES

Table 1 Peer Educator tasks.....	50
Table 2 Example of a 6-monthly assessment score	58
Table 3 Urban incentives overview	60
Table 4 Monthly urban incentives.....	62
Table 5 Monthly rural incentives new area	63
Table 6 Rural BP profile at time of registration until end of 2010.....	74
Table 7 Blood Pressure profile among rural Diabetics at their time of registration until October 2010	74
Table 8 Rural diabetic and non diabetic adults by sex and blood pressure	75
Table 9 Waist Circumference categories in rural females with DM & HBP.....	77
Table 10 BMI in rural Diabetic Males and Females members of MoPoTsyo.....	80

Table 11 Medical Consultation by sex, age.....	83
Table 12 Access to Medical Consultation by old patients.....	84
Table 13 Proportions and absolute numbers by sex and age of access to laboratory tests	86
Table 14 Average age of rural users of laboratory tests by age in 2010	86
Table 15 Age of Rural Female DM members using laboratory services between Oct 2010 and May 2011	86
Table 16 Laboratory results by % and number by Sex in rural area (October 2010 to May 2011).....	87
Table 17 Effect of self-screening for DM organized by a rural PEN	92
Table 18 Re-assessment on "knowledge"	95
Table 19 Knowledge about DM (members in Urban slums)	98
Table 20 Knowledge about DM rural area	99
Table 21 Rural BMI among diabetic members	100
Table 22 Health improvements in 5 urban slums.....	104
Table 23 Health Improvement among 8 x 19 randomly selected DM patients in rural area	104
Table 24 Snapshot of a rural diabetic membership (July 2010)	105
Table 25 Rural fasting blood glucose	105
Table 26 Blood pressure in rural area Ang Roka OD in Takeo province.....	106
Table 27 Comparing Health Expenditure before and after joining the PEN.....	106
Table 28 Reported Health Expenditure in the month preceding the interview (rural area)	107
Table 29 Urban retention of DM patients and reasons for drop out.....	108
Table 30 Reasons for drop out in 3 slum areas	109
Table 31 Urban loss of DM patients 2006 to 2011	109
Table 32 Costs per Patient of Peer Educator Networks.....	113
Table 33 Expenditure per destination category 2004 until 2010	114
Table 34 Revenue from health services provision to members	117
Table 35 Urban slum DM using laboratory	133
Table 36 Rural area DM using laboratory	133

ABBREVIATIONS

AOP	-	Annual Operational Plan
BG	-	Blood glucose
BMI	-	Body Mass Index (kg / height in m ²)
BP	-	Blood Pressure
CMDG	-	Cambodian Millennium Development Goals
CoC	-	Continuum of Care
CVD	-	Cardiovascular Disease
DM	-	Diabetes Mellitus
DPA	-	Diabetes Program Assistant
DPM	-	Diabetes Program Manager
FBG	-	Fasting Blood Glucose
GI	-	Glycemic Index
HC	-	Health Center
HSP2	-	Health Sector Strategic Plan 2
ID	-	Identification number
MDG	-	Millennium Development Goals
MiCaDO	-	Mission Care Development (NGO)]
MoA	-	Memorandum of Agreement
MoH	-	Ministry of Health
MSFB	-	Médecins sans Frontières Belgium
MSH	-	Management Sciences for Health (USA company)
NCD	-	Noncommunicable Diseases
NGO	-	Nongovernmental Organisation
OD	-	Operational District
ODO	-	Operational District Office
PEN	-	Peer Educator Network
PPBG	-	Postprandial Blood Glucose
RDF	-	Revolving Drug Fund
RH	-	Referral Hospital
VHBPG	-	Village High Blood Pressure Group
WHO	-	World Health Organisation

SUMMARY

The purpose of this report is to document the rationale for Peer Educator Networks (PEN) as part of the country's response to Chronic Noncommunicable Diseases, in particular with regards to Diabetes Mellitus (DM) and its associated disorders.

There are 8 PEN of which 2 are older (2005) and more mature than the other and more recent 6. Peer Educators are themselves trained DM patients. PEN consist of patients with DM who have been trained by Peer Educators to self-manage these diseases, and who are followed up by their Peer Educators. Peer Educators organise the detection of these diseases among people in their own community and share the self-management knowledge and skills that they have acquired with the other patients in their area.

This documentation is produced by the organiser of the PEN, a Cambodian NGO, using mostly internal data produced by the PEN itself as part of its normal reporting procedures. Also findings are used that were produced by independent studies and surveys and which help to create a population wide perspective for the results of this innovative strategy.

First the report reviews the international experience with regards to implementing the different policy options from which countries can choose as well as the standard health policy recommendations for low income countries. The international literature has been selected so that it becomes possible to situate the PEN, its role, activities and outcomes into a broad perspective of current and future challenges resulting from these chronic NCD.

Then, it describes the creation of *Peer Educator Networks* (PEN) in Cambodia and documents the functioning and effects in urban and rural settings in Cambodia for people who have *Diabetes Mellitus* (DM) with or without *High Blood Pressure* (HBP) and for those with HBP but without DM. The report documents how the PEN are set up and how they function. This includes a detailed description of the tasks and responsibilities of Peer Educators and of how they are being rewarded. The chapter on provider payment system should be read after the earlier paragraph on monitoring because the payment mechanisms are linked to the monitoring results.

The report describes why and how the PEN gradually became more involved in the organisation of health service delivery to its own members. In doing so, it has not just addressed a weak spot in the health system of this Low Income Country but it has also identified a source of revenue that may provide it with financial sustainability. The report then attempts to make an objective assessment of the care model that is driven by these PEN, providing it with an evidence base aims to justify its existence and also its gradual expansion with a view on the future of the country's health system.

The results of PEN described in the report are its effects on the DM patients among the population in the first rural district where the PEN was set up, starting in the middle of the year 2007. It assumes that the 6 other rural PEN follow the same path in screening, awareness raising and self-management training of the patients who become member of the NGO's PEN.

The results show that the great majority of these DM patients had been unaware of their condition until the PEN brought them diagnosis. The report then describes the biometric profile of this first rural membership to compare it with the national STEP Survey of 2010, showing that its membership provides a representative snapshot without signs of socio-economic bias, and that women with diabetes take up membership in larger numbers and proportions than men with diabetes.

The membership data and service utilisation data show that women, elderly, and socio economic disadvantaged do benefit significantly and proportionately from the PEN activities and health services.

The cost data show that with economies of scale and time the costs related to the functioning of PEN have gone down. The last sharp reductions of costs per member in rural areas is due to a sudden *recent* influx of a large number of HBP patients, but the effects on that category of patients have not yet been assessed. More time, investments and local coordination are needed to be able to show similar results for registered members with HBP as for DM.

Taken together the outputs and outcomes present a strong case for the possibility of cost effective long term secondary prevention in the Cambodian primary care setting. There appears to be a good basis for sustainability of the intervention mechanism itself, the PEN, in much of its current form but that would still leave many of the poorer socio economic groups without sufficient access to the right routine medication prescribed to them. The financing and other mechanisms of the PEN have been arranged in such a way, that subsidy or health equity fund targeting the most vulnerable members of the PEN will not just provide these patients more equitable access to this medication but also help sustain their effective Continuum of Care (CoC).

In spite of positive contributions the study highlights important caveats, describing risks and challenges which require adequate governance, stewardship and health policy regulation to keep this innovative and cost effective grass roots institution from unnecessarily running aground and from running off track. Instead the report recommends that this free floating institution becomes carefully integrated into Cambodia's primary care system in a way that preserves its strengths and helps it to address its weaknesses.

HOW IMPORTANT ARE DIABETES AND HIGH BLOOD PRESSURE IN CAMBODIA ?

PREVALENCE

The first published diabetes (DM) and high blood pressure (HBP) surveys ever carried out inside Cambodia, *The Lancet* (H King et al., 2005) took place in 2004 with technical assistance from one of the most experienced and renowned epidemiologists in this type of survey, Hilary King. He had been invited by WHO and the Cambodian Diabetes Association to help design and advise on implementation. Unfortunately the survey was carried out without strong involvement from the Ministry of Health' Department of Preventive Medicine. The epidemiological results give snapshots of glucose (in)tolerance among Cambodian adults of 25 years and older in a selected rural and a semi-urban area. It provides prevalence figures not just of diabetes, but also of pre-diabetes, high blood pressure, pre-hypertension, and results with regards to BMI, weight, height, waist, smoking and physical activity by sex and age group. Five years onwards, again with support from WHO but this time through the MoH Preventive Medicine Department, a new survey, so called STEP survey, was done not to assess risk factors for chronic NCD, which includes elevated blood sugar. It did not measure glucose (in)tolerance but Fasting Blood Glucose to determine diabetes prevalence. Also, people older than 65 have been excluded. These differences must produce different results (UHS&MoH&WHO, 2010). The results of the latest survey put DM prevalence at half of the first survey, and HBP at among 1 in 10 Cambodian adults. Although each of the surveys has a slightly different focus, both study mostly the same issues using different questionnaires to assess behavior and nutritional habits.

In neither of the 2 surveys dyslipidemia's were studied although these are important risk factors contributing to CVD and are frequently occurring disorders associated with DM.

The difference in diabetes prevalence that was found in the 2 surveys is puzzling and also relevant: If we would extrapolate the published 2004 survey results and generalize them to the Cambodian population – something which is not scientifically warranted – we would have in 2010 as many as one million Cambodians with diabetes and or high blood pressure among the total Cambodian population of 13.5 million. However if use the STEPS results, this figure amounts to 700.000 people with DM or HBP, still an enormous number. On page 78 of the STEPS report there are several reasons given to help explain the differences in numbers. Whatever the real number of DM and HBP, any figure between 700000 and 1000000 remains surprisingly high given the "leanness" of the Cambodian people, and it does not augur well for the future when the population will increase its body weight. What is worrying is the speed of the rates' increase in Cambodia's neighboring countries (Le, Kusama, & Yamamoto, 2006) (Wichai, 2007) and in Asia in general (W. Yang & J. Lu, 2010) (A. Ramachandran, 2008) making it a priority to try to slow down the rate of these increases through effective primary prevention measures. With very good reason therefore the STEPS recommends to repeat this survey every 3 to 5 years.

The first surveys in rural areas in 2004 found among Cambodian adults of 25 years and older that 5% had Diabetes Mellitus (DM) and 10% with High Blood Pressure (HBP). (H King et al., 2005). The second survey organized by the Ministry of Health (MOH&WHO, 2010) is a so called STEP survey. It found similar results in rural areas for HBP (10%

of adults in the age group 25 to 65 years old) but only 2.3% DM, so just half of the DM prevalence. Several factors can explain part of the difference: another type of BG test was used: Oral Glucose Tolerance Test (OGTT) in the first survey (measuring venous plasma glucose at 2 hours after intake of 75 gram glucose) but Fasting Blood Glucose (capillary blood) in the STEP survey. People older than 65 years were included in the first survey but excluded in the STEP survey. Possibly also some bias had sneaked into the sampling of the first surveys resulting from pressure from people who wanted to get tested and learn their diagnosis. Perhaps that explains the rest of the difference. Even if the lower proportions of DM are closest to the true prevalence the numbers are still worrying because they reflect a predisposition among Cambodians to develop metabolic complications at a significantly lower Body Mass Index (BMI) than expected.

Figure 1 Metabolic trauma

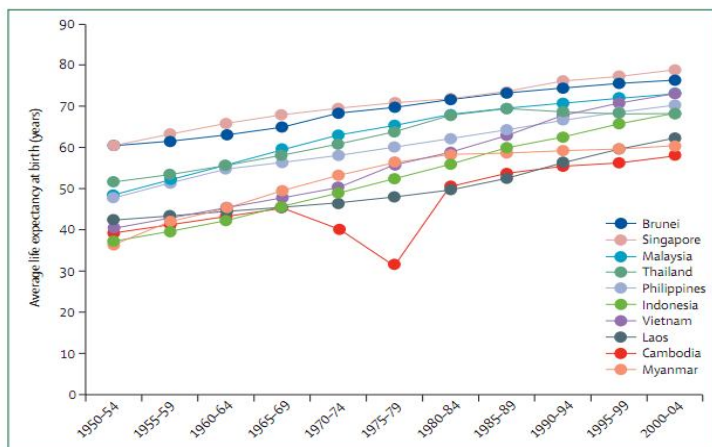


Figure 2: Average life expectancy at birth in southeast Asia, 1950–2010
Data are for both sexes combined, from reference 16.

It is unknown to what extent the relatively long period of extreme starvation suffered by the Cambodian people between 1975 and 1979 has affected pre-natal children born during 1975-1979. The surviving children are as adults probably more likely to develop DM later in life. There is evidence that poor nutrition *in utero* may lead to permanent changes in insulin glucose metabolism: The association between famine and impaired glucose intolerance later in life was clearly demonstrated as part of the Dutch Famine Birth Cohort Study (Ravelli et al., 1998) (S R de Rooij et al., 2006) in The Netherlands. That analysis could be made from records resulting from the 5 months famine that had occurred towards the end of the Second World War in the so called “Hunger Winter of 1944 and 1945”. Further scientific analysis showed that the impaired glucose intolerance is in those cases caused by an insulin secretion defect (Susanne R de Rooij et al., 2006). Therefore it is very well possible that the effects of the much longer “metabolic trauma” of 44 months and 20 days between 1975 and 1979 during the Khmer Rouge years, indirectly illustrated by the dip in life expectancy in the figure above (Chongsuvivatwong et al., 2011) are lying in wait to appear significantly in 10 to 15 years as part of the DM problem in Cambodia. This adds a special reason to get Cambodia ready with a proper continuum of care.

ADDITIONAL ARGUMENTS

Besides the large prevalence of DM or HBP there are 3 main arguments that add to the urgency of the needs and the relevance of appropriate action:

The *first* is related to the ability of uncontrolled DM to compromise a person's natural defense mechanism against infectious disease. It lowers the immune system and make her or him more vulnerable to infection. In India DM was found to be responsible for 1 in 5 cases of Pulmonary Tuberculosis (Jeon & M. Murray, 2008)(Stevenson et al., 2007). Perhaps the same mechanism is causing 1 in 5 Cambodians to become infected with Tuberculosis in Cambodia.

The *second* is related to gestational diabetes. A substantial proportion of women is in the fertile age group: 40% and is more at risk of complications during pregnancy and around delivery. The yearly numbers of such pregnancies in Cambodia are unknown, which is typical in itself as there is no organized response to these special needs.

The *third* argument is related to the demonstrated ability of chronic NCD to impact negatively on a person, or a household's socio economic status, including on a country's ability to attain the MDG (Stuckler, Basu, & McKee, 2010) and equitable economic growth. In similar tone we find (Fuster & Voûte, 2005). There is qualitative and quantitative evidence of how DM and other chronic NCD can wreak havoc on Cambodian households (Ir et al., 2010). This third argument is discussed in the paragraph below as it creates a dilemma.

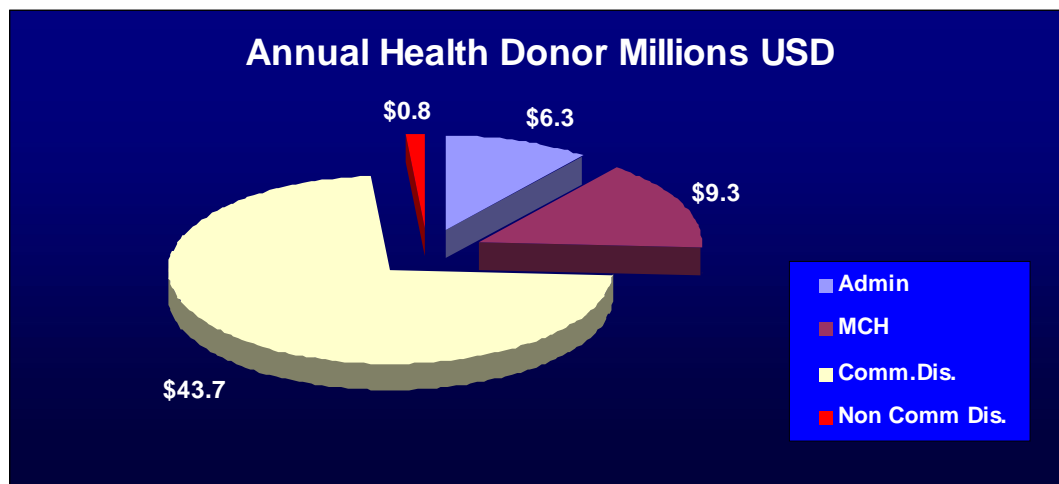
SECONDARY PREVENTION OF CHRONIC NCD: TO DO OR NOT TO DO

A particularly nasty dilemma is created for low- and lower/middle income countries with regards to the challenge posed by secondary prevention: Whereas in Cambodia the challenge is the complete absence of a *delivery system of basic chronic care* for these patients, the main problem in most other Low Income Countries (perhaps even in all) and in some LMIC in Asia where secondary prevention is indeed being offered, lies in the negative effects through impoverishment of the households with an affected member (S. Ding, Y. Chen, Feng, & Z. Li, 2008). In summary the dilemma that emerges is: Damned if you do and damned if you don't (provide care).

Cambodia has had recent history of decades of war and conflict, during which its social and human capital was almost destroyed. In 1993, when the time for rehabilitation came, international assistance and resources were allocated for an widely agreed health sector master plan. It was based on a common vision of a public health system delivering what would now be called horizontal primary care. In 1996, the Council of Ministers officially approved the Health Coverage Plan mapping the country into "Operational Districts", with a health center as first point of contact delivering a Minimum Package of Activities by trained health staff, complemented by a Referral Hospital, meant to serve the health needs of 100.000 to 200.000 people. Because of the need for quick results and the inability of the Ministry of Health during the early nineties to manage successfully the enormous budgets that donors were ready to commit to make inroads into infectious diseases, the same donors financed the creation of vertical programs for TB and for HIV/AIDS. These programs had their own systems, independent from the rest of the Ministry of Health, for vertical supply, staffing, management and accounting and leadership, and were receiving inputs from large numbers of foreign consultants.

Explained by the country's recent history, Cambodia's public health services are only supposed to deliver acute care, i.e. "cures" and "one-off" treatments. Health maintenance, the type of chronic care that is needed for patients with chronic NCD was never included into the publicly provided primary care package, funded by the international donor community.

The exclusion of these services from the publicly provided package legitimized for almost two decades donor financing preferences that were strongly biased towards Communicable Diseases as exemplified by the pie in the graph below showing donor contributions averaged over 3 years 2007, 2008 and 2009.



Donors have so far been shying away altogether from the challenge posed by NCD, so they have not dealt with the question whether and how to invest in secondary prevention and how to balance donor preferences between attention for primary prevention and secondary prevention.

MAKING A START TO ADDRESS CHRONIC NCD

At the end of 2007, Cambodia launched its first National Strategy for the Prevention and Control of Noncommunicable Diseases 2007 - 2010, (Ministry of Health, 2009) developed with the technical assistance from a - temporarily hired by WHO - qualified volunteering Australian Endocrinologist, Dr Sally Duke, someone with extensive practical medical experience in urban and in rural settings in Cambodia. It is by every standard a useful policy document providing a first broad framework that outlines priorities for action, mostly for stewardship by the MoH to create institutional capacity for effective *primary prevention* by pursuing 3 main goals and, lastly a 4th goal: to work out a health financing strategy for an appropriate care model for chronic NCD. The 4th goal is about meeting the challenge of working out an appropriate and affordable model for *secondary prevention*, which does not have the disadvantages of causing health related poverty among chronic patients seen in other Asian economies but which does provide access to appropriate care for people diagnosed with chronic disease. The word "affordable" means here affordable for the government, as a co-payer and affordable for the users, its patients.

In the strategy there is an important role reserved for people with chronic disease as self-managers and also for peer education :

On page 4:

Health services in Cambodia remain almost totally orientated towards treating acute illness and disease, with very little provision for managing chronic diseases. This relates to areas such as human resources, essential medicines and data management. In particular, there is currently no framework or concept for outpatient care of NCDs at referral hospital level. People with diabetes, complicated hypertension, chronic renal and liver disease, rheumatic diseases and hematological conditions have extremely limited options for health care. If they can afford it, most will seek care from private doctors where there is no standardization of care and costs can be high.

As in other low income countries⁸, Cambodia could explore the opportunities to reduce the costs related to secondary prevention by promoting self-management and adapting continuum-of-care models to the local context. In Cambodia, this could involve peer-educators, which in addition to reducing service costs, also has the potential to lead to better health outcomes⁹.

The 2 quoted paragraphs above from of the National Strategy refer to evidence published in WHO Bulletin in 2003 (D. Fu et al., 2003) about the feasibility of self-management in a typical Asian urban setting. In fact, there is much additional literature and evidence available about self-management, expert patients, task shifting and peer education as will be described further down.

In 2009, after almost two decades, and encouraged by some of its donors and technical agencies, Cambodia's Ministry of Health relabeled the boxes of its health system. In an attempt to redress some of the huge imbalances between needs and resources, a special programme for NCD was created, as one of 3 major programs. the other 2 being continuations of what had been started earlier: a programme on infectious diseases (Communicable Diseases), and a programme on Maternal- and Child health that includes a special focus on neonatal care, framed within the wider issue of reproductive health. The new box implied that this brand new NCD programme had to be conceptualized and developed so that donor investments can be absorbed and handled as effectively as possible. Technical assistance commensurate with the new program's relevance & challenges has not been forthcoming though.

One problem that results from current labeling is that it is designed to accommodate for donor preferences instead of helping to steer donor commitments towards structured responses to the country's modern health needs. If the boxes would have been labeled acute care and chronic care, then the funds could have been used to create a more comprehensive approach to health care and better adapted to the current needs. But then also the Ministry of Health would have required some restructuring.

As any other country Cambodia has to find a way to deal with the tremendous challenge from chronic NCD, in particular Diabetes Mellitus (DM) and its associated disorders such as High Blood Pressure (HBP) and dyslipidemias in order to prevent its citizens from becoming affected by – not just DM – but the 4 main chronic NCD and to mitigate negative impact and slow down progress towards complications among those who are already affected.

MoPoTsyo, member and vice chair of MEDICAM¹'s NCD Task Force, did a literature review to prepare a policy brief for the Ministry of Health and its Development Partners on how to deal with the challenge in reaching Goal number 4 of the National Strategy but with a focus on Diabetes and its associated disorders.

¹ Established in July 1989, MEDICAM is health sector's coordination platform for NGO's working in the health sector in Cambodia.

INTERNATIONAL LITERATURE REVIEW

This literature review aims to create a snapshot of what is already known about ***International experiences in low income countries aiming at Improving Access of patients with Diabetes and High Blood Pressure to chronic care including their essential routine medication***. There are 2 main reasons why it would be wrong to limit the scope of this review to international experiences related to patients with DM and HBP who have already been diagnosed:

The *first* argument is that by doing so we would exclude more than 70% of people with DM and more than half of those with (HBP). Both surveys (H King et al., 2005), (UHS&MoH&WHO, 2010) suggest high percentages of undiagnosed patients compared to Asian countries with a well functioning health care system where the percentage of undiagnosed diabetes can be as low as 30%.(Wareham, 2001). Therefore, we can argue that perhaps as many as 40% of undiagnosed Cambodian diabetics are not only in need of access to routine medication like the minority who has been officially declared “patients” but most of all is this group of undiagnosed individuals in need of being informed of their chronic NCD and on what to do about it. A patient is a person with the medical needs of a patient, independent of whether diagnosis by a doctor has occurred or not. The issue of screening is discussed further below.

The *second* argument is based on the need to change our approach in dealing with chronic NCD altogether, see The Lancet (Editorial, 2010). It says: “There is a glaring absence: no research on lifestyle interventions to prevent or reverse DM. Medicine might be winning the battle of glucose control but losing the war against DM”. If we want to deal with this epidemic, we have to open our eyes to the problem in all its aspects and not just trying to supply medicines to those who turn to the system for care. The importance of lifestyle changes as part of a continuum of care can hardly be overestimated (evidence listed further below).

For this review, we must therefore look not just at how other countries have so far been dealing with the whole formidable challenge of prevention of chronic NCD through better risk factor control (*primary prevention*), but also at ensuring that all their people with Diabetes and High Blood Pressure, whether they are aware of their needs or not, have access to appropriate care (effective lifestyle advice, control and their routine medication (*secondary prevention*)). We will see that there are more failures than successes, in particular where it comes to vulnerable groups, ethnic minorities or uninsured groups. We summarize main lessons for the different options that exist for Cambodia itself to address the enormous and rapidly growing challenges posed by chronic NCD to the health and development of the Cambodian people. It is not the right moment to stick our heads into the sand.

METHODOLOGY OF THE REVIEW

The databases searched were: HINARI, Cochrane, Google Scholar, PubMed

The key words used (grouped by category):

- Primary Prevention; Secondary Prevention, Chronic Care Model;
- Diabetes, Hypertension, High Blood Pressure, CVD, Chronic NCD; Major illness
- Health Related Poverty, Iatrogenic Poverty, Catastrophic Health Expenditure,

- Low Income Countries, Low Resource Settings, Developing Countries,
- Access to Medicines, Essential Drugs, Revolving Drug Fund,
- Self Management, Expert Patient, Peer Education, Community Health Worker, Lay Health Worker, Task Shifting, Patient Empowerment;

RISING MAIN CHRONIC NCD INCLUDING DIABETES

For a few decades already the main chronic NCD and the resulting mortality have been on the rise almost in every country (Zimmet, 2000) (A. Lopez, 2006) (Farmer et al., 2010) affecting nearly all populations: in rich countries as well as in developing countries including in Africa (Maher, Smeeth, & Sekajugo, 2010). The notable exception is Finland which even reversed the chronic NCD trends. Countries that keep the NCD monster manageable are typically countries where the government provided political support and fostered a strong involvement of communities in public health goals, interventions involving all stake-holding sectors. Most effective policies are supported with enforced legislation, based on community action and are well adapted to the local context (Pekka, Pirjo, & Ulla, 2002). However, this kind of success has so far been extremely rare.

As one of the main chronic NCD, Diabetes is striking some ethnical groups particularly hard and others much less (Diamond, 2003). This generates scientific debates on which factors precisely cause this sudden rise and how much they each contribute (Miranda, Kinra, Casas, Davey Smith, & S Ebrahim, 2008) and in particular in Asia (Chan et al., 2009)(A. Ramachandran, Wan Ma, & Snehalatha, 2010). Is it nature or nurture, in other words are specific genes the culprit or are environmental factors mostly responsible for the rapid but unequal rises that we can observe everywhere. It is likely that both genetic and environmental factors play a role, including factors “in utero” as babies with low birth weight are more likely to develop type 2 diabetes later in life (Zimmet, 2000) referring to a study in the UK. The prospective evaluation based on a 10 year follow-up in the USA among 75,521 women aged 38 to 63 years old shows convincing evidence that substituting whole for refined grain products may reduce the risk of type 2 DM (S Liu et al., 2000). We can therefore speculate that in Cambodia the recent but rapid nationwide switch from eating hand-husked rice to perfectly white machine-polished rice, may be a significant factor increasing the risk of Type 2 DM as well. The resulting 3 times daily sharp glucose peaks from highly glycemic Cambodian rice (Seng Serey et al, 2007) may be a factor that is contributing significantly to the DM epidemic in this country. After some initial controversies, the therapeutic relevance of lower GI food has been clinically proven.(Wolever, D. J. Jenkins, a L. Jenkins, & Josse, 1991). Another but related issue: A reduction of cardiovascular events may be the result if obese persons reduce the percentage carbohydrates of total energy intake to sharply lower levels (20%) than commonly recommended (55%) in the USA (Jörgen V Nielsen & Joensson, 2008). There is conflicting evidence on the benefits of lowering carbohydrates for people with DM. (Accurso et al., 2008). For this aspect too more research is needed.

RISING CHRONIC NCD COST

In 2007 the WorldBank published a comprehensive report on the public policy challenge for governments from “Middle Income Countries or “Low Income Countries” (Adeyi, 2007). The havoc that NCD is wreaking almost everywhere is impressive: in many industrialized countries it is the chronic NCD that are responsible for the spiraling out of control of health costs, (Yach, Stuckler, & Brownell, 2006) (WHO, 2008) (Suhrcke, 2006)

(Clarke et al., 2010) notably in the USA where the political system has allowed short term commercial interests prevail over larger and long term public interests of the American people as a whole but which it seems unable to grasp and come to terms with. Only lowering the price of prescription drugs is not enough. (Choudhry & Shrank, 2010). But with regards to chronic NCD, on the individual household level the same thing is happening also in countries like China and India. Many if not all developing countries leave the population exposed to the economic costs of disease and chronic disease in particular (Kruk, Goldmann, & Galea, 2009) (A Kapur, 2007) (Kawabata, Xu, & Carrin, 2002) (A. Ramachandran et al., 2007) (S. Ding, Y. Chen, Feng, & Z. Li, 2008) (B Meessen & Criel, 2008) (Falkingham, 2004). The fact that a health professional can abuse his position by standing between the patient and his recovery in order to exploit the individual is rarely described (Dussault, 2008).

We can count on the fingers of one hand the number of nations which have invested in timely and effective primary prevention measures (Pekka et al., 2002) combined with effective secondary prevention, (Uusitalo, 1996) See for an example on the latter reduction of complications due to diabetes in the UK (Currie et al., 2005). The early example of Gambia where the DM patients are only 0.03% of the patients presenting themselves but consume 3.6% of the government health budget and overload the health system is described in (Rolfe, Tang, R. W. Walker, Bassey, & George, 1992); The danger of funding tertiary care at the expense of proper investments in primary care is highlighted in (WHO, 2008) . Related is the call from many authors for a revival of the principles of Alma Ata to help address the needs resulting from the rising epidemic from chronic NCD (Miranda, Kinra, Casas, Davey Smith, & S Ebrahim, 2008) but these calls remain mostly theoretical (Lawn et al., 2008) and lack proportionate material responses. This literature review was written at a time when most countries experience an economic crisis.

CHRONIC NCD IN DEVELOPING COUNTRIES: THE PARTICULAR CHALLENGES

COMMITMENT TO EFFECTIVE PRIMARY PREVENTION

There are only very few examples where governments of low income countries were strong enough to push through the required legal changes and create the inter sectoral alliances that are necessary to make primary prevention of chronic diseases effective as it involves multiple sectors including enforcement of legislation and regulation. In most Low Income Countries regulation of this kind is simply not effective. For a discussion about this particular aspect, see the example of India in (Peters & Muraleedharan 2008) For a world map in 2007 of country situations see (Koh, 2007) with Bhutan extraordinarily as developing country that booked success. It is also worth mentioning the case of Mauritius as an example of successful lowering of blood serum cholesterol thanks to a change from palm oil, which is high in saturated fat, to soya bean oil resulting in a better lipid profile among its population see (Uusitalo, 1996). It raises the question to what extent low income countries are becoming a victim of globalization that urges them to open up their markets for commodities from western industries that are rich in trans fats or with refined sugars and which are marketed aggressively targeting young people with smart campaigns to make them change to “modern lifestyles” that are in fact unhealthy when they become the “default” of these children’s behavior. It is difficult for low income countries’ governments who have to balance the short term economic interests related to foreign investments with the long term interests related to the health of their citizens. It is an opportunity for western food industries to shift attention away from strictly regulated western markets where governments have begun to protect their people to the free-for-all environment of low income countries where such protection measures do not exist. But there is *no* call for the kind of effective measures that

are technically possible and which would be effective as primary prevention to protect the next generation in developing countries mentioned in the WDR 2007 called Development & the Next Generation (World Development Report (WDR), 2007).

RELATIVELY VERY LOW AWARENESS OF DIAGNOSIS:

Awareness of hypertension found in Ghana and Cameroon in Africa (Agyemang, Bruijnzeels, & Owusu-Dabo, 2006) (Kamadjeu et al., 2006) were both lower (34% and 23%) than found by the survey in 2005 in Cambodia where about half of those with hypertension were aware of their condition. That figure is much higher than found in the STEP survey conducted in 2010 (UHS&MoH&WHO, 2010), which found that only 23% of those with HBP aware of their condition. It is not clear how it can be so different.

The first survey found that more than 70% of people with DM in the rural area in Cambodia where the first survey took place were unaware of their condition (H King et al., 2005). The recently conducted STEPS survey does not provide a figure for those diagnosed with DM by the survey but previously unaware that they have DM, so we cannot compare it with the earlier survey (UHS&MoH&WHO, 2010) as far as that would have been possible anyway given the different screening methodologies used by these 2 prevalence surveys. Similarly low awareness despite an even higher prevalence (9%) was found for example in an ethnic minority community in North Eastern India (R Debarma, 2005), more than 13% among a more representative rural Indian community (Andra Pradesh) where about half of DM cases found was diagnosed and half undiagnosed. The most recent figures representative for China show that among people with DM there, the rate of undiagnosed diabetes is 61% and that 10% of adults have diabetes. (W. Yang & J. Lu, 2010) ; Earlier trends in prevalence figures in China were obtained regarding from Qingdao province comparing 2006 with 2001 (W. G. Gao et al., 2009); Also in Thailand, where the government's scheme has substantially lowered the access to care for all patients, including chronic patients, the awareness of diagnosis of DM and HBP remain very low: more than half of people with DM are unaware (Wichai, 2007). A seven country comparison of 3 developed countries and 4 developing countries (but no Low Income Country) also showed low awareness and a relationship between socio economic status and awareness of diagnosis in Thailand, in particular among men (Gakidou et al., 2011).

THE POOR HAVE NO OR LESS ACCESS TO HEALTH SERVICES :

Low literacy is correlated with low knowledge of DM and HBP, even in industrialized countries (M. V. Williams, Baker, Parker, & Nurss, 1998). There is evidence from many developing countries showing that in particular lower income groups there do not use health services for what they perceive as minor illnesses. They have no trust in the health service and worry about the high costs that using the professional services may bring. They hope that their illness will go away and only if it gets worse, they will go to see a doctor. (Chuma, Gilson, & Molyneux, 2007). Poverty related barrier problems delay care seeking in a chronic disease such as cancer in most developing countries with exceptions in Mexico and Colombia where specific health policies have included cancer treatments for poor people into insurance programmes (Farmer et al., 2010). A universal scheme such as in Thailand above lowers the threshold for poor people to have access to basic care and medication: 91% of those diagnosed has access to anti-glycemic drug agents and more than 70% had received lifestyle advice (Wichai, 2007) but the socio economic gradient nevertheless continues to hamper access to care (Gakidou et al., 2011). The Figure 2 of the survey also gives insight into the effectiveness of the care. Blood Pressure control among those diagnosed with diabetes always remains a big challenge everywhere, but the proportion of those effectively controlled is very low. Also with regards to glucose control and cholesterol the proportion of those treated but not controlled is always

larger than those under control. The picture that emerges is that the Thai care system for diabetics is accessible but not pro-active.

The Andra Pradesh study from India, in a country where medicines are cheap, showed that 67% of rural diagnosed diabetics (Chow, 2006) were taking glucose lowering oral medication, with only 3% on insulin. Cambodia's DHS consistently show that access problem affects the health seeking behavior of the poor. The 2010 Cambodian STEP survey provides useful data into the low degree of schooling among those affected by DM and HBP, specified by sex. (UHS&MoH&WHO, 2010);

There is literature from several countries indicating that the prices that Insulin Dependent Diabetes Mellitus patients (IDDM = type 1 who need at least 50 units a day) or Insulin Requiring DM patients (IRDM = type 2 who must use insulin daily too but less units as their pancreas still produces insulin but not enough or it reacts too late to rapid raises in blood sugar levels) must pay high prices for their insulin and often face tremendous barriers to obtain regular supply (J. Yudkin, 2000)(Beran, J. S. Yudkin, & de Courten, 2005) (Beran & J. Yudkin, 2006)(Beran, McCabe, & J. Yudkin, 2008)(Balabanova, McKee, Koroleva, & Chikovani, 2009) (H King et al., 2005). In Cambodia there are somewhere between 156,600 (UHS&MoH&WHO, 2010) and 250,000 patients with DM (H King et al., 2005). Both Cambodian surveys show low access to diagnosis of DM and HBP is in Cambodia. When the Cambodian surveys are interpreted, one has to take into account that the public service currently does not dispense routine medication for more than 3 to 5 days for chronic NCD and that buying regular prescription medication is usually not affordable. It is safe to assume that less than 20% of the chronic NCD patients receive care, an estimation based on available human resources and facilities able to treat and provide this type of care within the country.

SCREENING FOR DIABETES AND HIGH BLOOD PRESSURE

No literature was found with regards to cost benefit or cost effectiveness of screening for Diabetes in Developing Countries. Screening has been done in most countries to determine or monitor trends in prevalence in the form of surveys but not to actively find cases and add these to the already overburdened workload of the public services. In Developing countries public services struggle to provide care for the patients who present themselves, many of whom cannot afford the cost. Based on experience with Tuberculosis, one group of authors declares that active detection is not feasible and that any service should limit itself to patients who present themselves for treatment (A. Harries, A Jahn, R Zachariah, & D. Enarson, 2008). This opinion is not based on a study into cost effectiveness in low income contexts. And even if it were, findings from cost effectiveness studies cannot be simply applied from one particular context into another. Besides the ability of the health system to cope with increased case load, it matters if large proportions and large numbers of patients are undetected among the general population, or only a small proportion and a small number. In industrialized countries, such as the UK, with high trust in the health services and high rates of awareness there may be insufficient reason to screen for Diabetes (Wareham, 2001) because the people will seek a professional service provider as soon as they perceive something is wrong with their health as they have no reason to delay seeking health care. The health system can deal with the problems presented by the patient as they are still minor. Also, it matters which screening method is used and the type of human resources involved. Diabetes screening can be costly if it involves professional health staff in industrialized countries and sophisticated methods and equipment following the agreed standards of WHO.

Only the "awareness of chronic disease" is by itself of course not enough, but there is literature suggesting that awareness of their chronic disease, by itself does matter and may already have a positive effect on health outcome, for example among diabetics in India (A Kapur, 2007). A better diagnosis is welfare improving, in particular for the poor. Of particular importance in this respect is the India Study reported in annex 3 of the World

Bank report, quoted earlier (Adeyi, 2007) which suggests that early diagnosis can help the poor adapt their behavior so they can cope better with their disease. Relevant is here that drugs are in general cheap in India.

INDIRECT COSTS ARE A BARRIER

For an extensive overview of the types of barriers encountered by people with DM in a developing country (Tunisia) see for example (Alberti, Boudriga, & Nabli, 2007). Even if health services and medicines are free, like in Sri Lanka, coping with the indirect costs of chronic disease, such as diabetes, presents an enormous barrier for the poor. (Russel & Gilson, 2006) and this causes them to forego the “free” medical care. Distance and transport costs are also important barriers. In Sri Lanka, only one third of people with DM is undiagnosed (Katulanda et al., 2008) compared to more than 70% in Cambodia. Similarly in Cambodia these indirect costs were found a problem for poor people, in the form of food costs and transport costs (Hardeman et al., 2004) but this study did not look at chronic patients. This is also likely to have played a role in the large drop out, after the first visit to the MSF Belgium clinic in Takeo for DM and HBP patients, where the medicines were given out for free. The transport costs can easily exceed the costs of the medicines. AIDS patients were received financial support to come to collect their medicines, but the DM and HBP patients were not. (P Isaakidis et al., 2010)

LIFESTYLE INTERVENTIONS AND PREVENTION

As mentioned in the introduction, there is almost no evidence about the effect of life style interventions to prevent chronic NCD in Developing Countries, although this is of enormous relevance in reducing the burden of disease, the more so in low resource settings. An improvement in lifestyle, provides opportunities not just to improve health, prevent or reverse diabetes and but also reduce dependence on medication (Ishine, 2008) as observed among a vulnerable group in Laos. There is more evidence available about the effect of lifestyle interventions to prevent diabetes in Middle Income Countries, and about the experience in China (Pan, 1997), and for example among male factory workers in Korea (Kang et al., 2010). For industrialized countries a review of the evidence with regards to smokers (weak but significant reduction) versus non-smokers (larger reduction), see (Narayan & Williamson, 2010) and also see (Knowler et al., 2002); Inability of health facilities to promote effective lifestyle changes due to work overload and health system stress are often mentioned. (Rolfe et al., 1992)(Neuhann, Warter-Neuhann, Lyaruu, & Msuya, 2002)(P Isaakidis et al., 2010)

SELF MANAGEMENT

There is different terminology that is being used once healing is no longer the exclusive realm of the physician. The problem is that the different terminology has different meanings in different health system contexts and partly overlaps. Terms such as expert patient, self-management, peer education, and task shifting are used in contexts of developing countries too, but the role the not professional health workers or patients play may be very different in the contexts of low income countries.

HIGH INCOME COUNTRIES

The standards for self-management in Diabetes are given for the US context, see (Funnell et al., 2010). The experience with expert patients and self management is certainly not limited to Diabetes but extends to wide range of noncommunicable conditions, see for example (Cleland & Ekman, 2010) on the role of expert patients in “heart failure”, not just as self-managers but also in helping other patients to adapt their lifestyles successfully.

Diabetes is a self-managed illness in which the decisions most affecting the health and the well being of patients are made by the patients themselves. Effective diabetes care requires patients and health care professionals to collaborate in the development of self-management plans that integrate the clinical expertise of the health care professionals with the concerns, priorities and resources of the patient. Collaborative diabetes requires a new “empowerment paradigm” (Anderson & Funnell, 2005).

On the involvement of lay health workers in the delivery of health services in high income countries there is a substantial amount of literature indicating it has modest positive effects and that they are at least as good as professionals (Baksi et al., 2008) but also among American Indians with native peer facilitators (Struthers, Hodge, De Cora, & Geishirt-Cantrell, 2003). Interventions in community settings with regards to Education on Self Management for Type 2 DM were found to be efficient and effective based on data on improved glycemic control gathered through a review of the available literature (Norris et al., 2002).

Two scientific reviews were found critical of the quality of evidence (Warsi, P. S. Wang, LaValley, Avorn, & Solomon, 2004). It found improvements in HbA1c but not in Fasting Blood Glucose. It found improvements in Systolic Blood Pressure but not in Diastolic Blood Pressure. So it is a mixed result.

LOW- AND MIDDLE INCOME COUNTRIES

There is a lack of good evidence on how trained lay health workers (Peer Education) can help in secondary prevention of NCD (Beaglehole et al., 2008). He points to system wide problems: What is needed is not just self-management support, but also “decision support” to back up lay health worker, and “delivery system design” which can become very challenging when people suffer from multiple conditions.

Middle Income Countries in Asia must make a choice on which workforce to choose to address the rising problem. This can mean an expanded role for nurses, see for example Taiwan (K.-Y. Lu, P.-L. Lin, Tzeng, Huang, & Chang, 2006), but also an expanded role for the patients themselves. (D. Fu et al., 2003). For developing countries, there is literature on the opportunities of task shifting of professional tasks to lay health workers, very relevant also in developing countries with shortages of qualified professionals (Abegunde, 2007) and (McPake & Mensah, 2008) showing that, if properly trained, they are just as good in obtaining results as health professionals. It is unclear if “task shifting” leads necessarily to a loss of quality or how far we can go with task shifting in order to meet shortages in human resources. (Bärnighausen, E. Bloom, & Humair, 2010)

INVOLVING THE COMMUNITY: A MIXED PICTURE

Community health workers have been used in many different types of settings and in different levels of involvement (Standing & Chowdhury, 2008). In LIC it can be helpful to get things done through comprehensive action involving communities.

There is a lot of literature that already suggests that the involvement of communities in the care delivery can improve the quality of the service and coverage in developing countries (Amazigo M. Noma B. A. Boatin D. E., 1998). Specifically with regards to involving communities themselves in improving the performance of pharmacists, as they have many conflicts of interests, there is the description of Ghana (Smith, 2004) where the failures of proper incentives and their consequences are described with regards to community pharmacies.

The forceful argument “that there is no other option” has to be carefully explored. In Africa, with shortage of trained medical staff the options for scale up in HIV AIDS care are analysed in different scenarios with their consequences for the health system, see (Wim Van Damme, Kober, & Kegels, 2008); The writers argue that the delivery system has to be adapted and can be adapted because of the disastrous shortages in highly trained doctors and nurses as the only available human resources working in health care delivery. The experience of involving expert patients in delivery of care so far is still promising. An important lesson which has so far been learned is that community health workers have to be adequately remunerated. Just as importantly however, there remains a serious risk of neglect of quality of care due to lack of proper supervision (Hermann et al., 2009) and also (R Zachariah et al., 2009).

DIAGONAL APPROACH

An alternative direction is called the diagonal approach (Coovadia & Bland, 2008) and similarly (B. Janssens, W. V. Damme, et al., 2007) where a vertical response to an acute problem, in this case infectious disease programs is suggested as vehicle to be expanded to the new challenges and needs presented by the chronic NCD in a form of decentralized primary care management that integrates both and moves away from acute care to chronic care.

The TB DOTS is also a candidate strategy that is being eyed by some experts (A. D. Harries, Rony Zachariah, Anil Kapur, Andreas Jahn, & D. a Enarson, 2009) for expansion of scope to cover Diabetes.

ACCESS TO MEDICINES THROUGH RDF IN DC

The history of Revolving Drug Funds in DC goes back to the Bamako initiative of 1987 of UNICEF in Mali, as part of a comprehensive strategy to decentralize primary health care ensuring an adequate supply of essential drugs, later replicated to several other developing countries. Vietnam was an often quoted successful example. UNICEF has been advocating for increasing government support in the form of financing and subsidies, and reduce government dependency on NGO's for continuous supplies. (Umenai, 1996)(Umenai, 1998)(Mohamed Ali, 2009). However, these RDF's were mainly designed to meet health needs resulting from acute disease episodes, not maintenance treatments as required for chronic illnesses. With the rise of chronic NCD, the mismatch between what is offered and what is needed, grows proportionately, forcing people to seek alternative sources of care, including for routine medication.

Access to medicines for chronic NCD patients is problematic in most developing countries for many reasons, among which the high prices that patients must pay at the pharmacy outlet (van Mourik, Cameron, Ewen, & Laing, 2010).

There is a set of recommendations to improve access to medicines for patients in general (Laing, Hogerzeil, & Ross-Degnan, 2001). It does not have a separate set of recommendations for chronic patients compared to acute patients. All the recommendations, except the 8th aim to improve the situation through the supply side itself, the providers of health services. The 8th recommendation is to encourage active involvement by consumer organizations in public education about drugs, and devote government resources to support these efforts. Irrational use of medicines is often blamed on patients and consumer demand, in particular if the collection of data is organized via the regular professional health staff, for example in Laos (H. Murakami, Phommasack, Oula, & Sinxomphou, 2001), when the sale of the medicines benefits them as stakeholders.

Indeed, most RDF are owned by the health facilities. Many serve also to finance the facility running the health services (Fang & G Bloom, 2008). This is simultaneously hailed as a characteristic of financial success of “the” primary care facility in modern China while it is also seen to lie at the origin of catastrophic health expenditure among households with a person with a chronic NCD as patient-users of the same health care model (S. Ding, Y. Chen, Feng, & Z. Li, 2008). Particularly in Sudan and in China revenue from medicine sales in the public sector is used to finance other parts of the health system. (van Mourik, Cameron, Ewen, & Laing, 2010), termed as “*excessive mark-up*” there. One month of treatment of high blood pressure costs on average 1.8 day wage of the lowest paid government staff, the outcome measure developed in order to compare affordability among different countries. Prices that are loaded with other items than the cost of the medicines and their distribution can be expected to lead to interruptions in adherence to treatment because they create financial barriers for struggling chronic patients. Indeed there should be concern if vulnerable chronic patients are forced to pay a higher price for the cost of their prescription drugs in order to finance costs of maintaining a health facility ready for other patients with acute health care problems who are not insured and have not been pre-paying a contribution for that purpose.

An article that analyses the balancing of prices of the drug prices and defends the necessity of these mark-ups in order to maintain sustainability of these RDF, in absence of government funding or subsidies, takes Kyrgyzstan as example studying several pharmacies there (Waning, Maddix, & Soucy, 2010), also (Waning et al., 2009) on how competition can influence local markets.

A discouraging example of a facility owned RDF in a Developing Country (Gambia) for outpatients with DM is the one funded by WorldBank in early 90ies (Rolfe et al., 1992).

AN RDF FOR CHRONIC PATIENTS ? WHO KNOWS

As seen in practice most RDF serve both categories of patients (acute plus chronic). The chronic patients form a rather defenseless and vulnerable minority whose regular and predictable “contributions” can be tapped to finance running costs of a general health facility. By cross subsidies their financing can enable the facility to provide at more competitive prices a set of acute services to a large numbers of acute care patients who use the system only once or rarely because they are not chronic. If this happens, and the evidence from China seems to suggest that it does (S. Ding, Y. Chen, Feng, & Z. Li, 2008), this is not equitable although the facility may well appear to thrive (Fang & G Bloom, 2008).

The idea to design a special RDF for the chronic patients is not new. Intuitively it makes sense to integrate it with other chronic diseases. See for a theoretical example for Epilepsy (Coleman, Lopy, & G. Walraven, 2002) in Gambia.

But no literature was found how best to ensure adequate affordable supply of medicines for diabetes or high blood pressure. There is a painful shortage of evidence on best practices on how essential drugs for chronic patients can best be delivered. More attention should be given to the possible contribution of JPPI's (Joint Public Private Initiatives) in meeting the knowledge gap. It is a challenge to delimit the respective roles of government and private sector in this regard. (Irwin & Ombaka, 2004)

THE INTERNATIONAL EXPERIENCE IN SUMMARY

WHAT WE KNOW FROM INTERNATIONAL EXPERIENCE:

- Diabetes and high blood pressure and all main chronic NCD are rising due to a combination of genetic and environmental factors.
- By neglecting these diseases completely, development towards MDG is slower than necessary; chronic disease can cause poverty and vice versa.
- A substantial part of the burden of Communicable Disease (TB) would not exist if Noncommunicable Disease (DM) would have been properly taken care of;
- Part of Cambodian Maternal Mortality and Neonatal Mortality is due to uncontrolled DM & HBP;
- If people start to eat healthier, become more physically active and stop smoking as much as 80% of main chronic NCD is preventable. Primary prevention is not organized specifically for diabetes or high blood pressure but for the main chronic diseases;
- Effective primary prevention is possible, also in developing countries, provided there is strong governmental commitment and support, backed up by legislation and comprehensive action involving communities.
- Task shifting from professional health workers to lay health workers has been successfully applied in a wide variety of contexts and health programs, including in low- and middle income countries and in high income countries, including in diabetes education; It can be successfully applied where is a shortage of professional human resources. There is some criticism on the quality of the evidence in high income countries where health professionals may have strong reasons to feel threatened by the implications of task shifting for future allocations of resources; There are concerns about neglect of quality of care as a result of task shifting without proper organization.
- The health service delivery system must be adapted so that it can accommodate lay health workers who take on more tasks;
- Community involvement often works well to improve service delivery and increase coverage of services in developing countries;
- Peer Education is often more effective or just as effective in diabetes as education by health professionals;
- Lifestyle interventions are more effective than treatment only by medication;
- An intensive lifestyle course has positive effects that last for many years after the course has ended;
- Distance is a serious barrier for people with chronic disease in developing countries;

WHAT WE DO NOT KNOW FROM INTERNATIONAL EXPERIENCE:

There are 3 domains of great unknowns:

- Service delivery systems for chronic care in LIC: For effective secondary prevention there are currently no replicable models from other Developing Countries for diabetes nor for high blood pressure, which appear suitable to create sustainable models in the Cambodia, at least not in the short term. The problem is that the existing models are either too expensive for the majority of the population including the average Cambodian chronic patient, and they can cause impoverishment among many of those who do attend or they not sustainable and replicable if they are clinic based. For patient-centered models another problem rises: Obviously patients cannot do everything. So the question is: How to strike the right balance between “TASK SHIFTING” and “PROFESSIONALISATION” of medical services and care in environment of decentralized primary care for a developing country such as Cambodia?
- Performance and sustainability of RDF for DM and HBP with an adequate degree of ownership by (governing) communities of chronic patients in developing countries;
- Cost effective strategies to increase earlier awareness of diagnosis in diabetes and high blood pressure in developing countries, promoting earlier diagnosis linking with access to a continuum of care;

The field work of MoPoTsyo Patient Information Centre in Cambodia since 2005 is a useful beginning to generate data that are needed to analyze in order to get answers to some of the questions above.

In the following chapters this experience will be described.

Introducing Peer Educator Networks

The purpose of the following chapter is to document as objectively as possible the mechanism and effects of the PEN for people with DM and people with High Blood Pressure (HBP), to discuss the evidence and to draw conclusions from the 5-year old experiences originating from within the national context

It first describes briefly the background of the situation and then in detail how the intervention is organized and what everyone involved in the intervention is supposed to do, describing also how the intervention has evolved over time with implications for the role and scope of the PEN.

The public health services in Cambodia's OD's do not provide a continuum-of-care (CoC) for any of the so-called chronic NCD although they represent an unmeasured but undoubtedly large, share of Cambodia's Burden of Disease. Also it is unknown if they are the greatest cause of mortality or not yet. Also the extent to which they cause premature deaths is unknown because reliable data do not exist, but given the low quality of health services it is possible to argue that the proportion of premature deaths is unnecessarily high. There are multiple reasons for this: The health services and generic prescription medicines for chronic NCD care are yet not included in MPA and CPA, Cambodia's basic public service packages. There is not yet a comprehensive package to train medical staff in delivering chronic care. The planning for the organization and delivery of chronic care has not received the technical support that such a major topic requires. The Health Center (HC), which is the first point of contact, does provide symptomatic treatment of HBP with 3 days oral medication. Also the Referral Hospital (RH) only treats acute episodes experienced by these uncontrolled patients. Often treatment stops once they are discharged, often without prescription or "patient education". If there is prescription, the act is often influenced by economic incentives to medical doctors provided by pharmaceutical companies. In turn this results in unnecessary high monthly health expenditure for the patient. The human resources needed to deal with the chronic NCD cases are not planned as part of the Cambodian Health Workforce in the future. Serious market failures dominate most aspects of the provision of health care by many health service providers driving up high costs of chronic illness for people with DM and HBP. Economic incentives are typically related to provision of services and not designed to keep good control. The STEP survey 2010 shows that the market is unable to satisfy the health needs of 8 out 10 people with HBP. With most of them and more than 70% of DM undiagnosed, their needs unmet, the Cambodian market for health itself appears not healthy.

Market failure prevents poor patients to work their way out of poverty and on the other hand it is plunging the non-poor patient and the household into poverty, overall slowing down Cambodia's progress towards CMDG's. For many understandable reasons health worker attitudes towards chronic patients remain top down. This keeps these patients unnecessarily dependent. Privatization, decentralization and other health system reforms that are making public health facilities more autonomous in their financing will make it even more difficult to provide adequate social health protection to chronic patients. Chronic patients are on the line to become the latest source of government health financing just waiting to be tapped into, often after having been exploited by private health service providers. There is a need for an institution to defend the interests of these citizens in their emerging conflict with the interests of public health service financing to help inform decision making.

Cambodia's latest Health Strategic Plan 2008-2015 (HSP2) specifically includes NCD as its 3rd priority. Its overall goal is to prevent and control the rapidly growing burden of NCD and address the effects it has on individuals, families and society through the implementation of the National Strategy for Prevention and Control of NCD. Goal 4 of that National NCD Prevention Strategy is to strengthen and equip health delivery systems to provide

affordable, equitable and quality management of NCD. It has as stated Objective 4.4 : *Provide a comprehensive continuum of care for patients with NCD initially focusing on diabetes (DM) by improving the self-management skills of those with DM through patient education and by developing peer education models and use this to provide model for other chronic diseases* (p.32 of National Strategy NCD 2007-2010).

Faced with these daunting challenges to their health and livelihood, but in line with Goal 4 and Objective 4.4 of the National Strategy, these vulnerable chronic patients, including poor(est), with DM have begun to organize themselves into a chronic patient membership-organisation in order to improve the prospects of their interests, in other words “own survival”. They do this under the umbrella of a Cambodian NGO (MoPoTsyo). The NGO (<http://www.mopotsyo.org>) trains DM Patients to become Peer Educator in their own community. Groups of community-based Peer Educators form a structured network per OD, taking on a range of tasks as far they have become able to. By training other patients they share their skills in protecting themselves against catastrophic health expenditure, in regaining their health and productivity. They cooperate with health authorities, based on Memorandum of Agreements (MoA) with the MoH and local sub-agreements. Task shifting to patients themselves creates degrees of demand-side participation that vary per patient. The poor(est) are meant to be included and some succeed in not just becoming self-managers but also in becoming peer educator.

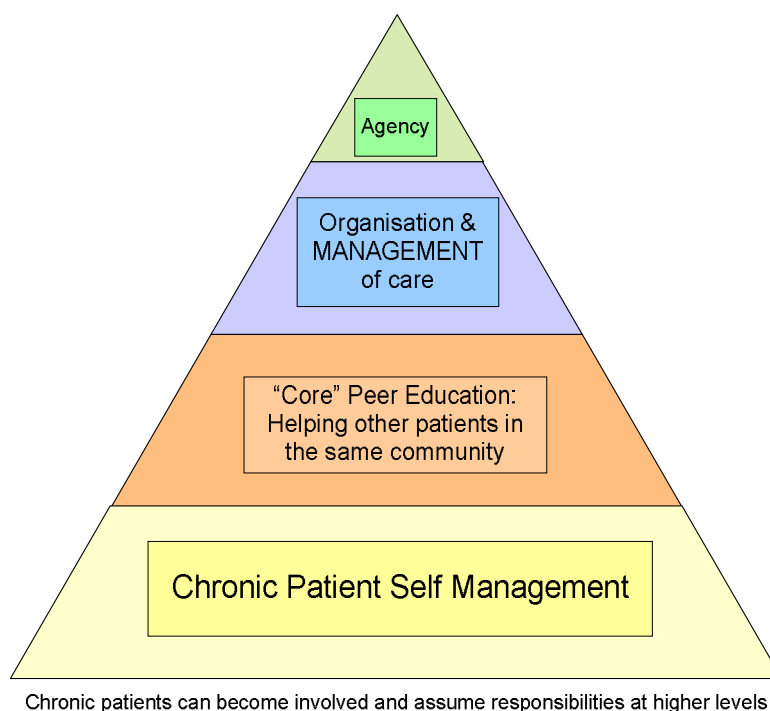
In early 2011, the MoH revised the wordings of its Annual Operational Plan 2012 in such a way that health authorities from provinces and districts may include the activities by partner-organizations with regards to risk factor control. This includes the set-up and management of PENs.

INTERVENTION'S ROLE AND SCOPE

The NGO, MoPoTsyo, provides the members the legal organization and functional structure for these activities to be undertaken and organized. Originally the NGO had only intended to provide better opportunities to patients to help them learn how to self-manage their chronic disease. Gradually responsibilities started to include some that are traditionally located on the “supply side of the health system”. As a result the traditional division between “demand side” and “supply side” that applies on most open health markets is no longer applicable or useful to understand the different type of market for long term health. The innovation aims to capture a very large segment of the traditional demand side with unmet health needs trying to supply it with long term health which is normally in rather short supply. Below is explained how and why these changes in roles and mixing of supply and demand came about.

Patients with DM can become involved at 4 different levels of responsibility of the PEN if they are member. These levels are represented in the figure below:

Figure 2 Levels of patient involvement in the PEN



THE ORIGINAL MISSION

The Cambodian NGO MoPoTsyo was created with the mission to improve access to information for Cambodian people with chronic disease, including poor people. Experts in health care, five Cambodians and one Dutch person gathered on August 8th, 2004 in Phnom Penh to form the NGO's Board. They chose the name MoPoTsyo as the Khmer pronunciation of its acronym. After they had decided on their respective board functions, as well as the articles of association, the registration process was completed on July 25th, 2005. During the registration process, NGO staff members conducted a situation analysis. Actual project activity such as "providing information to diabetes patients" was not started until July 2005. Nyemo Cambodia made office space available for free. The first two years all work was done by unpaid volunteers.

DM was selected by MoPoTsyo's board as the first chronic disease to focus on. A situation analysis was done to find out if there was sufficient interest among DM patients in learning self-management and in getting more information. The situation analysis was carried out by interviewing the staff working in the Chronic Disease Care clinic of the Center of Hope and by interviewing DM patients after their medical consultation (exit interviews), and by interviewing patients in Sras Chak, the slum area around the Boeungkak Lake in Phnom Penh, which lies relatively close this Chronic Disease Care clinic. At that time this clinic provided free care and medication to a rapidly growing number of chronic patients including people with DM. An early morning lottery system was used to let fate decide which of the chronic patients would be accepted into the CoC managed by the NGO. As a result of this system living close to the clinic could join into the lottery more often.

The situation analysis showed a great ‘thirst’ for information among DM patients. There was a mismatch between what patients wanted to know and what they were allowed to ask and to get in terms of information. The need was greatest among clients of private service providers but also among patients of NGO clinics.

Together with patients, MoPoTsyo developed practical educational materials in Khmer language. The original idea was that they should be used by paid diabetic health workers to conduct DM education sessions for groups of DM patients in MoPoTsyo’s training centre located under its office space in Boeng Keng Kong area. This idea was abandoned because:

- 1) the DM patients living in the slum area would not spend money for transportation to get DM education at our office;
- 2) although patients were often in quite desperate need they had not yet sufficient confidence in what the NGO was offering them in terms of “immaterial” advice;

To overcome this barrier 2 trained diabetics, one a health worker and one a trained DM patient, each were assigned to one slum area in order to get to know the patients and give them information and share knowledge about how to self-manage their disease.

Although many DM patients expressed that they wanted to be able to self-manage, many could not read and write. This makes it more difficult for the DM patient and the peer educator to keep track. MoPoTsyo started to supply every patient with the first version of its self-management book. This book contains information and is suitable for self-recording of urine glucose (Ruhnau, Faber, Borch-johnsen, & Thorsteinsson, 1997) , blood glucose results, blood pressure results, weight and other relevant information. Patient who cannot read well are afraid to use the wrong column or the wrong month to record their result, because that provokes a reaction from the Peer Educator. So often the information is actually recorded by the Peer Educator and based on the oral information provided by the patient to the peer educator. Complete self-management remains an ideal but it applies mostly to “choosing the right food items”, doing enough exercise, taking the medicines every day, and doing the urine glucose tests including the 24-hour urine test correctly. The details of this training are discussed in detail in the chapter on the Peer Educator role below.

The first community-based project activities complemented a NGO project to set up DM Consultations including biochemistry laboratory tests at Kossamak National Hospital, by the French NGO MiCaDO funded by World Diabetes Foundation (WDF). MiCaDO trained Cambodian medical doctors in examination and treatment of DM patients and helped organize a Diabetes clinic inside this National Hospital. Most Doctors and health workers employed at the National Hospitals have a private practice in order to supplement their meager government salaries and income. Among the health staff there is competition to recruit the wealthier patients for their private practice. The French NGO’s presence at the National Hospital helped to improve capacity, create clear roles and tasks, keep the prices transparent and reasonably low so they could be afforded by many of the regular DM patients. The French NGO supplied the medicines during the period of the project, the sale of which was used to provide incentives to the staff. It was not used to recover the cost of the medicines, as it was assumed that the government could and would assume the supply once there was an established need. It was not to be, unfortunately. Perhaps it could have worked over a much longer period than had been foreseen in the project.

The complementarity of the 2 interventions did not last very long. Towards the end of the WDF project at Kossamak National Hospital, the prices became more “variable” and “individually negotiable” and started to rise. As the government budget did not supply the medicines, nor finance the medical consultations and laboratory activity, and external donor funding was going to dry up, price rises of services were introduced to keep the

medical staff sufficiently motivated. However the price rises and their inconsistencies rapidly discouraged service utilization by the persons who have to pay, namely the patients. The wealthier patients were recruited for private practice and the poor who continued to attend were unpleasantly surprised with increasingly unaffordable medical bills for control visits.

ADAPTING TO THE NEEDS AND CIRCUMSTANCES WITH ADDITIONAL ROLES

REVOLVING DRUG FUND - MEDICINE SUPPLY

When the existing medicine supply began to present new barriers and without a good solution on the horizon, the point was reached where MoPoTsyo decided that it would attempt to meet a need where the free and unregulated market failed: create a RDF for its members.

At first, MoPoTsyo agreed with two private pharmacies to sell to MoPoTsyo's members certain generic prescription medicines, at a fixed price per tablet. One pharmacy is located one downtown and one in a re-settlement area. With the contracts signed, MoPoTsyo encouraged its members to buy at these pharmacies instead of somewhere else. The medicines had been selected by MoPoTsyo as most cost-effective among a wide range available on the local market sold by Cambodian wholesalers. In the downtown pharmacy MoPoTsyo was not involved in the procurement, which was left to the pharmacy and the whole sale importer. That pharmacy was able to set its own profit margin.

However, in the supply of the "pharmacy" in the resettlement area (slum) on the outskirts of Phnom Penh, MoPoTsyo took an active role from the start, as that pharmacy had not been licensed, had little knowledge and no money. MoPoTsyo staff bought the generics medicines from the whole sale company downtown, had them tested at the Ministry of Health' National Laboratory for Quality Control, and then transported them and sold them at the purchase price to that unlicensed but conveniently located pharmacy. This system made it possible for the pharmacy to sell them to MoPoTsyo's members, most of them very poor DM patients, at the fixed and published prices. These published prices included a margin of 15% for the private pharmacy.

Because MoPoTsyo charged the same price to the 2nd pharmacy as what it had paid to purchase the medicines from the wholesaler, MoPoTsyo incurred higher costs than it was able to recover through this activity. Pharmacies only want to pay after they have sold the medicines to the members, not when they receive the medicines from the wholesaler.

The same costly but vital supply system was also used at the start of the first rural project in Ang Roka OD in Takeo in June 2007. There one pharmacy was chosen located opposite the Referral Hospital and contracted with permission from the local Operational District Office (ODO). This was necessary because many patients, although they could receive their medicines free from MSF Belgium in the provincial capital, they still preferred to pay by purchasing the prescription medicines closer to home, as it saved them the costs of transportation and time. When MSF Belgium ended its presence in Cambodia in July 2009, it gave a last six months supply to its patients, after which the paid supply organized by MoPoTsyo became the cheapest available alternative that these people had.

After one year of losing money with this system, MoPoTsyo was able to analyze the consumption pattern of its members and make a reliable estimation for the coming year. That was the right moment to switch to international procurement. When MoPoTsyo switched to international procurement of its medicines the real costs of its RDF intervention could start to be partially recovered. At the end of December 2010, MoPoTsyo supplies 17 contracted pharmacies, of which 8 are fully licensed. All 17 were selected jointly with the OD. In these decisions

the geographical location is very important to reduce the cost of travel for the members. Another factor in the selection is the trust and reputation of the person in charge. After the contract with a pharmacy is signed, MoPoTsyo supplies them the 19 items prescribed to its members during the medical consultations.

1. Glibenclamide 5mg
2. Metformin 500 mg
3. Hydrochlorothiazide 25 mg
4. Furosemide 40 mg
5. Atenolol 50 mg
6. Propranolol 40 mg
7. Aspirin 300 mg
8. Captopril 25 mg
9. Enalapril 10 mg
10. Amitriptyline 25 mg
11. Amlodipine 10 mg
12. Simvastatin 20 mg
13. Gemfibrozil 600mg
14. Thiamine 250 mg
15. Multivitamines
16. Insulin fast acting (rapid) 3ml
17. Insulin glargine (24 hour-long acting) 3 ml
18. Insulin mix 30/70 3ml
19. Insulin intermediate acting (protaphane) 3ml

Insulin

Most of the 132 insulin requiring DM patients who are member of MoPoTsyo use 2 types of insulin.

USE OF INSULIN		name of the province or municipality				1 month = 30days, 1ML = 100 Unit		
	per April 2011	daily units	daily units	daily units	daily units	total daily units	units month	ml per month
	Type of Insulin	Phnom Penh	Takeo	Banteay meanchey	Kampong Speu			
1	Glargine	758	403	116	22	1,299	38,970	390
2	30/70 premixed	672	263	90	65	1,090	32,700	327
3	fast acting	215	106	10	74	405	12,150	122
4	Intermediate acting	82	374	129	20	605	18,150	182
	Total units	1,727	1,146	345	181	3,399	101,970	1,020

Municipality / Province	Phnom Penh	Takeo	Banteay Meanchey	Kampong Speu	
Total number of patients	74	41	14	3	132

Insulin has so far been obtained through Insulin for Life Australia² and partly through Insulin For Life The Netherlands which was established in 2010. Both these organisations belong to a growing not-for-profit movement whose founder and Director is a former Vice President of the International Diabetes Foundation. These organisations help to secure a steady supply of insulin to developing countries including Cambodia. These supplies are originating from overstocks in developed countries and include 3ml pens and user friendly high tech delivery devices for 3ml vials which are very fancy and easy to use but will be too costly for the Cambodian health system of the future. Insulin for Life will not be able to meet the whole Cambodian, currently hidden, demand in the future. After a deal with the insulin industry can be reached that makes insulin and its delivery mechanism affordable and accessible, MoPoTsyo's membership will have to switch to 10 ml vials and simple 1ml = 100 Units of Insulin syringes.

Since 2009 every member with DM who requires insulin can buy a package consisting of a 3 ml insulin pen with 5 pen-needles OR insulin vial with 5 syringes for 11,000 riels (1 USD = 4,000 riels) at the pharmacy in their district. The numbers of insulin units prescribed by the Medical Doctor to the DM patients are registered in the central database in Phnom Penh. The insulin use per patient per month is 7.7 ml which is about 26 units per day on average. Only 4 patients among the 132 have been prescribed more than 50 units per day. The great majority of the insulin using patients are DM type 2 patients. When possible insulin patients are also prescribed metformin tablets.

The supply of syringes or pen needles packaged together with the insulin is important because certain types of cheap syringes are for sale in Cambodia but those are based on 40 insulin units per ml instead of the standard 100 units per ml. So if a DM thinks he strikes a good bargain buying a stock of those cheap syringes, he injects 2.5 times the required dose which results in medical emergencies.

Based on a second separate contract the contracted pharmacy can borrow a fridge from MoPoTsyo for the duration of the contract. The cost of electricity is paid by the pharmacy. MoPoTsyo donates a special cupboard to keep the RDF medicines separate from the other medicines. In 2011 every tablet container is stamped with the logo of MoPoTsyo to avoid that the medicines can get mixed with non RDF medicines. Replenishment is normally *every month*: MoPoTsyo supplies small quantities of RDF medicines to each contracted pharmacy in order to meet the demand of the patients to ensure that there is always enough to dispense to the members. In case of expiry or a quality issue, MoPoTsyo will collect those medicines back.

² <http://www.insulinforlife.org/>

Revenue collection:

So far revenue collection has been done two monthly but this is being re-organised so that it happens monthly : MoPoTsyo's Peer Educator, in charge of this responsibility, collects the money from contracted pharmacy once a month according to the total amount mentioned in the medicines reception slip that the pharmacy received when the medicines were delivered.

MoPoTsyo is not a bank:

Per 31 December 2010 the outstanding debt (94,151,800 riels) of 17 pharmacies divided by the revenue (153,500,350) received from the 17 pharmacies was 61.4%. The debt ratio varies greatly per pharmacy. If a pharmacy is not paying on time, MoPoTsyo cannot simply refuse to continue to supply, because then its own members cannot get their routine medication. Clearly, some of the pharmacies were using MoPoTsyo as a cheap source of credit. To reduce the problem of slow payments of the bad apples and of their rising outstanding debt, the contracts had to be renegotiated so that interest can be charged at the market rate of 2.5% per month for invoices that are outstanding for more than 100 days. This system is not to make money but to avoid that pharmacies use MoPoTsyo as a bank. The new system kicks in for most pharmacies in May 2011. This new source of revenue will be accounted for in the books and helps to recover the intervention's cost. The renegotiation by itself sent a useful signal. Per March 2011, the debt to revenue ratio had been reduced to 55%. It was a necessary step.

Automation:

There are 2 software systems that MoPoTsyo uses to manage the RDF: Intuit QuickBooks Enterprise Solutions - Accountant Edition 10.0 is used for the management of the stock of the unsold drugs and sold drugs. This is linked to the Accounting & Financing of MoPoTsyo. When revenue is collected from the two RDF accounts, these amounts are entered too. It is producing the automatic monthly report on sales, revenue and inventory record as far as inside the stock of MoPoTsyo itself. The balance of this report must be compared with the balance from the second software.

The second software is Ms EXCEL for keeping track of the small supplies of medicines which are in the 17 pharmacies and which are sold to members. The EXCEL software is based on "verbal" information from the pharmacists reported to the peer educator who reports to MoPoTsyo. It is this rapidly daily changing system that keeps the pharmacies continuously supplied with small but sufficient amounts.

Procurement:

The 19 items are imported from abroad, sold by a handful of competing well-established companies that are implicitly recommended by Management Sciences for Health and WHO. Their regular clients are UN agencies and large international NGO's such as Médecins sans Frontières, and many governments.

The prices are close to the international world market reference prices (MSH&WHO, 2009). The margin between MoPoTsyo's payments to these suppliers and the prices at which the NGO sells to the pharmacies it contracts in the neighborhood of its patient communities, makes it possible to recover part of its expenses as importer and distributor.

For chronic patients precisely because of their own strong interests in long term healthy outcomes, if they associate themselves constructively, this may be an essential part of a natural solution to the range of problems that are otherwise almost impossible to solve as documented and evidenced by the dire situation of chronic

patients in all developing countries. Development Organisations contemplating how they can support a response to chronic NCD should consider supporting the patients in their efforts and play a role in helping to forge responsible partnerships in those contexts. The justification to let the affected groups assume more agency is perhaps strongest in low resource settings with excessive out of pocket expenses and market failure. In particular there it is difficult to argue convincingly why the ultimate victims should not be given more opportunities to solve their own problems.

The average difference between the world market reference price (MSH&WHO, 2009) and the price at which MoPoTsyo's members buy their prescription medication at the contracted pharmacy is +100%, the percentage varying greatly among items. The more expensive items have a small margin, whereas the cheaper items have larger margins. This was done to reduce the stimulation of the sale of more expensive items to the members of the network as the NGO wants the pharmacist to feel *financially* neutral with regards to the choice of molecule.

MEDICAL CONSULTATIONS

The lack of availability of medical consultation services in Ang Roka OD and the increasing prices at Kossamak (understandably), made it necessary for the NGO to take more action "on the supply side" of the health system. The NGO arranged with the Referral Hospital of OD's to organize medical consultations for its membership. There exists since 2006 a limited number of 15 to 30 Cambodian Medical Doctors who have received a 2-year additional training in Diabetology, an initiative of the French Governments development cooperation. In addition, specialised medical international NGO's such as Center of Hope, Médecins sans Frontières Belgium and MiCaDO, have trained on-the-job several Cambodian Medical Doctors in basics of Diabetology, examination and treatment. Also the World Diabetes Foundation has, besides supporting Peer Educator Networks, also supported initiatives to strengthen the capacities of Cambodia's medical doctors in Diabetology. Thanks to the capacity building in these projects, most of which have ended, MoPoTsyo is and will be able to recruit from a pool of relatively experienced Cambodian professionals to organise medical consultation for its membership. Some of them operate a private clinic and continue to treat DM expanding their professional experience. MoPoTsyo hires 4 experienced Medical Doctors as "consultant" to train the local hospital Doctor on-the-job in how to examine patients and provide treatments including prescription of routine medication. On average there is twice per month, sometimes three times per month a medical consultation session in an OD. These sessions are mostly in weekends, so the hospital is quiet and the extra membership-activity does not interfere with the normal busy hospital in- and outpatient activity. The doctor will see on normal days between 30 to 40 members during the session. There is no break. The doctor spends about 8 to 10 minutes per patient until the last patient is gone. A session normally takes up one whole morning from around 7.30 AM to about 12.30 PM. There is a hearing distance between the conversation of the doctor and the patient and the peer educator who is calling in the next patient. There is more transparency than privacy.

The trained Peer Educators play an active role in crowd control, registration, blood pressure taking, blood glucose measurement, weighing and other functions that are normally done by nurses. The shifting of tasks from nurses to Peer Educators helps not only to reduce the costs of this part of the continuum-of-care but also to build trust. The patients see their own peer educator involved in hospital activity in a relaxed atmosphere and with normal friendly and respectful conversation with the doctor. The same doctors are sent to the same areas so they can get to know their patients. The same formula was used for Ang Roka Referral Hospital, where consultations were organized in the MMM building. MMM is short for the Cambodian abbreviation of the Center for Mutual Support Groups of the National HIV/AIDS program. The building belongs to the NCHADS (National AIDS Program), a vertical mostly external donor funded programme. There, registered AIDS patients receive specialized medical services and groups

of AIDS patients or HIV positive people come together to share experiences. The fact that these different types of patients have been using the same building together for 4 years for different services and activities appears not to have posed any big problem but this has never been investigated. MSF Belgium also mixed the chronic patients in its Chronic Disease Care clinics in Takeo and Siem Reap province.

The Hospital Director appoints the Doctor who is “willing” to learn from the visiting consultant to make sure that the medical consultations can continue once the NGO stops to pay for the visiting hired consultant. At one such occasion this was a doctor with uncontrolled DM himself. At the end of 2010, MoPoTsyo is organizing medical consultations in 8 Referral Hospitals in 8 OD's. In 7 out of 8 OD's this is a new activity which did not exist before, so training is essential. The experience shows that the “self-help group” is able to exert a constructive pressure on the availability of public health services.

LABORATORY SERVICES

When the DM services were made available at Kossamak National Hospital with support from the French NGO MiCaDO, they included the provision of biochemistry tests at fixed affordable prices. When MoPoTsyo recommended its members to go for medical consultation at the Referral Hospitals where it was organizing the training-visits from the paid medical consultant, there was no or only expensive biochemistry testing available. It is much more difficult and impractical to do the medical consultations without the supporting information on levels of creatinin, protein- and/or (micro-)albuminuria, cholesterol and other biochemistry data. Updated and reliable results are tools that are appreciated by the treating physicians as they provide support for their clinical decision making. In early 2010, MoPoTsyo developed its own capacity to carry out laboratory tests. The prices charged to the membership lie at less than half of the average prices of public hospitals. Besides, the blood sample collection is organized twice per year in the community, so the patients do not have to travel to a referral hospital, which saves opportunity cost and travel expenses for them. Although the prices are low, the revenue from these laboratory services also helps to recover some of the costs of the PEN. The Peer Educators play an active role in delivering this health service to the membership and they use it themselves. Their involvement helps reduce the overall costs.

EYE CARE CLINIC

After 3 years of “information” and recommending DM patients to get their eyes checked. It proved to be not enough. At least once a year is indicated for those who have had DM for more than 5 years. The patients did not follow the advice. To try something different, at the end of 2010, the Takeo Eye Clinic (CARITAS) and MoPoTsyo decided to experiment with group transports per health center coverage area, once every two weeks. In addition, CARITAS promised that those who needed treatment would get this free of charge.

TARGET GROUPS

FOCUS ON POOR

When the intervention first started in the urban slums it was able to reach and help poor people thanks to the systematic outreach and frequent home visits. The peer educators went from home to home in the slum offering people information about DM, its symptoms and how to use a urine strip within two hours after the lunch and to watch carefully if the color changed. Poor people appreciated the information that was made available for them by the peer educators. Peer Educators would include any person with DM that was interested to receive information, not just poor people. In practice most were poor or near poor. Middle class and certainly most rich people were in general less interested than poor people because they can afford to pay for health services from a real doctor. A real doctor's advice is usually considered superior to peer educator advice.

There are many poor people living in the slum areas, with non-poor households living among them, some of them relatively quite wealthy from flourishing local business including providing financial services to poor people in need of cash. The slum areas are anything but homogenous. For this particular health program, it is convenient that people live so close together. The poorest people can watch and hear a peer educator working shack by shack and alley by alley and know more or less when it is their turn to be visited and what this diabetic peer educator wants from them. This helped to shape the intervention and get it established in the slums. The intervention initially did not provide financial assistance to the poor besides information about DM and how to control it, skills in self-management and urine glucose strips. The visiting Peer Educator carried a handheld Blood Glucose meter and Blood Pressure meter to facilitate the self-management. Working with the population in the slums led to the development of effective DM education materials that the peer educators could use and self-management materials that the patients could use to keep track of their own progress.

EXPANDING FROM ONLY THE POOR TO MIDDLE CLASS

When the intervention was first replicated to the rural area Ang Roka OD, it immediately caught on with a better educated societal class, such as teachers, village chiefs etc. Also in the rural areas, poor people are included in the screening, the training and group sessions but there is a difference with the class to which the majority of peer educators themselves belong.

EXPANDING TO HIGH BLOOD PRESSURE PATIENTS WITHOUT DM

Only in 2009 were the first attempts made to include into the intervention people with HBP but without DM. This is a big challenge because it is not common for health workers to advise patients to take their medication every day. Most people only take it when they feel unwell. It is very difficult to improve adherence to daily prescription.

PRIMARY PREVENTION

When screening in Ang Roka OD had been completed, some of the peer educators who are teachers proposed to carry out risk factor awareness sessions among their colleagues in the schools as health promotion to prevent onset of chronic NCD among healthy adults. This activity will be discussed in a separate paragraph below.

EQUITY FUND AND VOUCHERS FOR THE POOREST

As people have to pay for their routine medication according to their prescription, and because the price of the medicines has been loaded with the cost of the PEN, many patients need financial support to help them pay their routine medication. As long as the NGO itself is involved in the price-setting, the service delivery and organization of the supply network, it may not be advisable, at least not in the long term, to give it in addition the role of “medicine purchaser on behalf of the poor” because that combination of roles may hold a potential conflict of interests. Possibly, risk can be sufficiently contained through independent monitoring by a 3rd party. The NGO has always been rather reluctant to create dependencies from poor DM patients on middle class DM patients. It kept the number of health equity fund beneficiaries to a minimum, using different percentages of support varying from 50% to 100% of prescription drug costs, most often for users of insulin as they often face the highest costs. As long as there is no design of an adequate system, it is not the time to scale up but to experiment in order to get it right.

In order to get practical experience with the design of a mechanism for such support, MoPoTsyo has started to provide health equity funding on a small scale in the urban slums and for selected patients in Takeo province. In order to qualify for support, the patient has to meet 4 conditions:

1. be registered member of MoPoTsyo:
2. be too poor to be able to afford the cost related to illness
3. have a “costly prescription”
4. contribute a part of the cost

The 4th condition implies a barrier for the ones that are most needy. On the other hand, it reduces waste as it helps to select only patients who want to take the medicines benefit from the assistance. Later the funding agency of the assistance may have a say in the decision about which proportion of the pharmacy invoice of the poor will be funded by a social health protection scheme. The disadvantages of the current system are that there is co-payment, money for the poor travels via the service providing NGO staff and peer educators to the patient who is in a dependent position. There could be some kind of conflict of interest as the NGO is organizing the sale of drugs but also organizing the purchase of these drugs by helping patients to buy these drugs and driving up sales means larger revenue for the NGO.

A voucher management system is being designed to reduce the problems of circulating cash but this is not ready yet. Conflicts of interest between a service providing NGO and the decision making on the use of subsidies to finance these services can exist in this model. It requires external monitoring and governance.

THE ROLE OF GOVERNMENT

WORKING WITH HEALTH AUTHORITIES AND GOVERNMENT HEALTH STAFF

The intervention in the slum had not been designed to be carried out involving government health staff, not even professional health staff, but only trained DM patients themselves. The slum projects were carried out with permission from the Municipal Health Department, but not through their active involvement. The first rural project was based on a convention with the local Operational District (OD) authority but they were also not involved in the management of the intervention or of the PEN, nor in the 6-monthly assessments, nor in the primary prevention activities. The PEN reports to the OD health authority during monthly meetings about progress and constraints. The OD Director receives monthly information about the amounts of incentives received by every one of the Peer Educators in the OD. The OD Director is involved in the selection of pharmacies. In 2011, the Ministry discussed with MoPoTsyo about the possibility to organize the sale of its medicines through the public health centers instead of through private pharmacies. Practical arrangements are currently under discussion and implementation. From 2011 onwards all activities of NGO's planned in the OD's must be described and included into the Annual Operational Planning. In 2012 the wording of the AOP has been adapted so it will allow for MoPoTsyo's activities to be included.

ADVOCACY

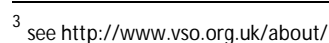
The information needs among people with chronic disease such as DM remain tremendous. With its intervention, MoPoTsyo is able to meet some of those needs in places where the community based networks are set up. However, in reality the challenge is larger in scope. The service needs cannot be met by addressing the "need for information" alone. It was never obvious how this enormous gap in services can and should be filled. After all, there are few international resources available for this issue and more troubling: none of the DM care clinics that were created in Cambodia have so far been able to, on one hand create for themselves a financially sustainable basis while on the other hand offering an affordable package of services to the common Cambodian person with DM or HBP. As long as there was no design or a care model that could meet the requirements of sustainability, effectiveness and affordability, a large and nationwide disbursement of funding is not what is needed. The NGO has deliberately not "advocated" for the establishment of more care clinics. The health system need - if we can call it this way - was for expertise and adapted technology rather than for large amounts of funds or resources to finance some type of foreign text book solution. As long as there was no proper solution, it also did not make sense to denounce the lack of care and cry out loud for more resources to respond to the medical needs. Without a suitable comprehensive model, the NGO had in fact no other choice than to allow itself to evolve from an information and skill sharing NGO with its mandate exclusively on the demand side for health services, to an organizer of a suitable and affordable CoC. The advocacy, as far as it was done, has been limited to efforts to obtain adequate funding from a variety of sources in order to conduct innovative small scale pilots. The other aspect of the advocacy has been directed towards the local health authorities: The NGO also had to advocate for permissions in order to undertake activities which are normally not reserved for patients, such as population screenings, care provision for other patients, laboratory services, a RDF and even the practical organization of medical consultations.

The consequence of the changing role, certainly uneasy in the longer term, is that by doing this the NGO can be seen as taking on full responsibility for the lack of the care for its members. While this was necessary in order to preserve sufficient flexibility during the innovative phase, over time when the activity takes a more definitive shape, the advocacy can target a resumption of more natural roles by the different stakeholders.

The core role of the NGO has therefore evolved from an information providing NGO for chronic patients, which has been by itself innovative through its use of patients as peer educators to help other patients, into a cost-effective vehicle for National NCD strategy development to respond to the challenges presented by the epidemic of chronic Non Communicable Diseases.

At the end of 2010, there are 8 PENs managed by the NGO MoPoTsyo with more than 5000 patients registered as member. At the end of 2010, there are 23 salaried staff members and 56 Peer Educators who are not salaried but paid small incentives according to performance. In February 2011, the NGO subjected itself (voluntarily) to a management review during one week. It was carried out by a Hospital Manager experienced in the UK and Cambodian context, financed by VSO UK³. It resulted in useful recommendations for the years to come.

Figure 3 Organisational Chart of MoPoTsyo



There is a supervisory board, which is not included in this organizational structure. It convenes about once or twice a year. It consists of the same 6 people who founded the NGO on August 8th, 2004 in Phnom Penh. They are not involved in daily management but have played an important role in choosing major strategic directions. The board members are not paid nor do they get their costs reimbursed.

In 2011, the General Peer Program Manager was seconded by an administrative assistant to help him prepare the reporting by the PENs in order to receive its finances from the administration. This became necessary as a result of lack of administrative skills in the PENs on one hand and on the other hand the administrative requirements.

The NGO consists of a CEO heading 3 departments:

- Finance & Admin
- Peer Educator Network Programs
- Access to Medical Services

The department most on the right of the Organizational Chart, “Access to Medical Services”, is relatively new. It was only created in 2009 to ensure coherence in management of activities which had become necessary over time: the NGO had been adapting its role to the circumstances in order to make sure that its members continued to have access to basic health services (see chapter above): RDF, Medical Consultations and Laboratory Services.

The Departments have been set up in such a way that they have to work together in order to function. They do not have their own budgets. For example, for every purchase the Peer Educator Network Program has to make a request to the Finance & Administration. All revenue from the RDF, which is under Access to Medical Services, goes directly into a special bank account which is controlled by the Finance & Admin, but the management of the collection of the revenue is under Access to Medical Services, because the revenue is collected from the 14 contracted Pharmacies who sell the NGO’s medicines to the members.

Per April 2011 one third of the NGO’s 25 salaried staff members is chronic patient (9 out of 10 of these chronic patients have DM with or without HBP). Peer Educators are not counted as salaried staff members but as volunteers. Per April 2011 there were 63 peer educators. Their updated number and patients registered to be followed up can be accessed at <http://www.mopotsyo.org/diabeticsnetwork.html> . All peer educators have DM.

SETTING-UP A PEER EDUCATOR NETWORK

- selection of candidates
- training & exam
- equipment & kit
- active screening
- network structure

SELECTION OF CANDIDATES

This is normally done by peer educators. Over time lessons have been learned in selecting candidates:

- they must have DM
- they must be able to read and write
- they must be respected citizens
- they must not be alcoholic, or show they can stop;
- they must be non smokers, or show they can stop;
- they must not mix politics in their work
- they must not be “middle class”, not very poor and not rich;
- they must be good listeners and communicators

Candidates are presented to the General Peer Program Managers before they can be accepted. As DM and HBP are more or less showing the same prevalence rates among men and women the NGO aims to balance the representation of the sexes among the peer educators. However this was so far not successful. Only 30% of peer educators are women and 70% are men. If this continues the interests of the female diabetics are therefore not well represented by the PENs. The problem of gender representation in Cambodia is widespread and well known and found on all levels including at political levels. It may be partly related to the fact that some husbands do not want their spouses to take on this type of work. There is no evidence however that women's access to the services is compromised because of their lack of representation.

TRAINING

This is done in Phnom Penh in MoPoTsyo's training centre, located at the headquarters. There, groups of 2 to 4 candidates receive theoretical training during one week before they are being sent to practice with an accredited peer educator in the field. There, the practical training takes about 2 – 3 weeks. During this period the candidates also review the theory lessons. This period is followed by another period of theoretical training and skills training at the training centre in order to prepare them for the exam.

The result of this exam determines if they are invited to continue training or go for the exam. Sometimes it becomes clear during the training that a candidate is unsuitable because he cannot master all the theory. Then the candidate enter do the exam too but it is usually not very long before it becomes clear that he/she cannot pass. Some candidates are given the chance to try again in a couple of months when they have become more familiar with the theory. Some candidates are allowed to start to practice, although they have not yet passed the exam. This is allowed if the peer educator needs more time to practice and is expected to learn by doing After the peer educator has passed the exam, he/she travels back to the village with a Peer Educator Kit.

Training Curriculum: The first version of the training curriculum had been written by one of the Medical Doctors with extra training in Diabetology. Based on the first curriculum a revision was started using contributions from many involved in the training: supervisors, peer educators, Medical Doctors, pharmacist and the Peer Educator Trainer. It is entirely in Khmer language. The revision is already being used with candidate peer educators but still requires more work. All existing peer educators will be re-trained based on the new curriculum starting in 2011. The new curriculum is more practical than the first curriculum, but it still does not have specific counseling skills or theory. It is focused on knowledge and understanding of DM and HBP and how to bring and keep it under control,

rather than on techniques and skills on how to engage effectively with people so they improve behavior. When the candidates are ready for the exam, they are subjected to a trial exam by the trainers.

PEER EDUCATOR KIT

It contains all the equipment and materials for the peer educator to start to organize screenings for DM and HBP in the health center coverage area and help the patients bring their disease under control. Peer Educators use materials and report on activities. Based on these reports they can refill their stocks. Typical consumable materials are non medical materials, such as the patient self-management book, the peer educator book, and administrative forms for screening, contracts for Village High Blood Pressure groups etc. but also medical materials such as urine glucose strips, blood glucose strips, BG meters and automatic Blood Pressure meters, posters, urine containers, boric acid sachets to avoid that bacteria in urine eat the glucose during the 24 hour it is being collected etc., filaments to detect numbness on extremities, mainly the feet and lower legs of diabetic patients etc. Peer Educators are not taught to prescribe medicines. In fact they are told NOT to prescribe medicines but to leave this always to the trained physician.

ACTIVE SCREENING

Screening in a new area is meant to create a community of patients where there is none. This is because the great majority of DM patients is unaware. Also most HBP patients are unaware of their condition. MoPoTsyo has not yet “re-screened” an area as new patients come when they learn they have DM or HBP. This is normal practice. It is not clear after how many years there is a new need for DM screening or HBP screening so this can be done again in a cost effective way. Perhaps this moment happens earlier in urban slums where migration is rapid and frequent.

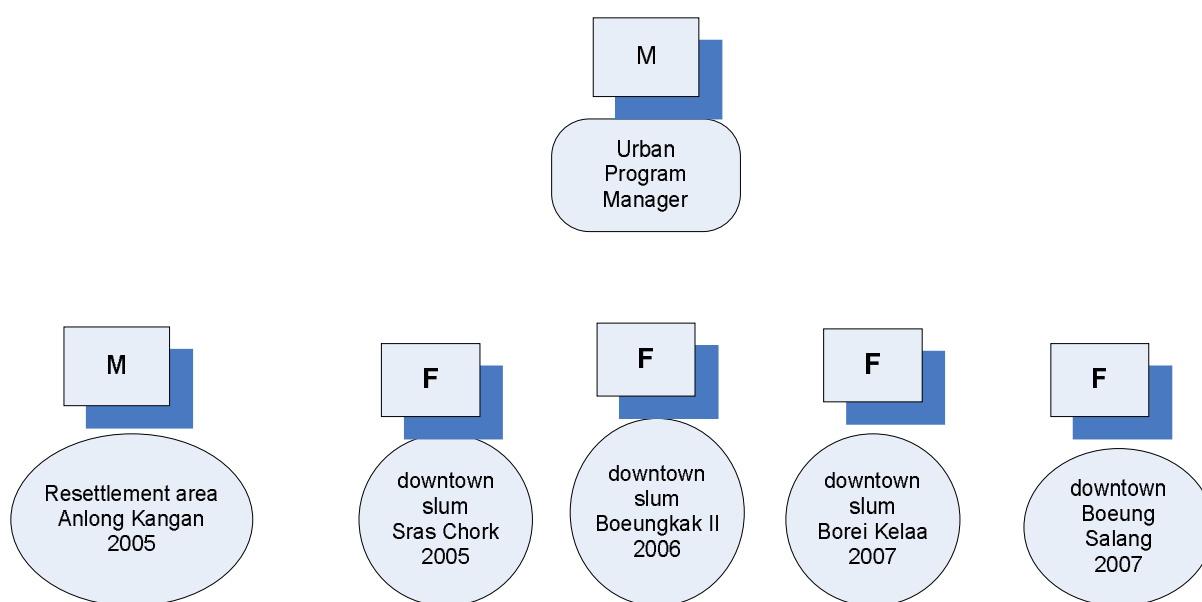
DM screening is done by distributing urine glucose strips for all adults and pregnant women of any age. The Peer Educator explains the village chief, the group leader and the household representative how to use the urine glucose strip: dip into the urine within 2 hours after meal. If it colors, it means that there is strong suspicion of DM and it needs to be confirmed with a blood glucose test by the Peer Educator. Some cases with elevated renal threshold are missed by this rather insensitive method. A few adults present with urine glucose but do not have DM. Despite these disadvantages it is a very effective strategy to rapidly create a community of DM patients among a population with low awareness. In Cambodia only 1 in 3 people with DM is aware. The PEN can increase this proportion to 60% in a relatively short period using the urine glucose test self-screening, followed by blood glucose confirmation. Among those detected with DM almost half has BMI lower than 23. In Cambodia DM is prevalent among many people with low BMI compared to other countries, so focusing screening activity on people with large waist circumference is not appropriate. To use a Blood Glucose test on the whole population may be too costly. The combination of urine glucose as a first filter and combining it with Blood Glucose test if urine glucose is positive appears to be the most cost effective approach. It has been done before in Taiwan among school children(J.-N. Wei et al., 2003) and the idea has been advocated by others in particular for low resource settings (van der Sande et al., 1999).

The HBP screening reaches less adults than the urine glucose because the urine glucose strip is handed to the head of the household, one for every adult for when they return from work. But the Blood Pressure meter is not left behind in the village at night by the Peer Educator. This was tried, but it did not translate into sufficient recruitment of active membership to be able to declare the system effective. If the meter is left overnight in the village, the result is a list with names of many people who have been found to have elevated or HBP but too many of the people on the list cannot be met in the days after or are reluctant to meet the peer educator for proper registration. For HBP detection the peer educator needs to be present when the measurement takes place in order to counsel the patient on the spot. Once there is group of at least 3 people with HBP in a village a Village High Blood Pressure Group can be set up that has its own meter. From that moment onwards any adult in the village can in principle check blood pressure as long as the machine has not broken down and batteries are replaced by the Group's Leader. The purpose of starting the screening for urine glucose and for HBP is to create groups of people who are aware of these risk factors and have the skills and tools to measure them. It is not to take over each individual's own responsibility to keep eye on their risk factors.

PEER EDUCATOR NETWORK STRUCTURE

In Phnom Penh the first PENH was created with peer educators in 5 urban slums. One peer educator covers one slum. The PEN is run by 6 diabetic patients, 2 men and 4 women. The PEN is managed by the Urban Program Manager who has office in the NGO's HQ. He is salaried. The Peer Educators are not salaried. They use their own home for the once weekly gathering of patients. This happens always early morning on the same day of the week.

Figure 4 Urban Peer Educator Network



The Urban Program Manager used to work as Peer Educator in Sras Chork. He handed over his role to a female diabetic patient after he helped train her and after she had passed the peer educator exam. He is the manager of the urban PEN and also counselor for “walk-in” diabetic patients who want to become member. He is also trainer of candidate peer educators who come from the province to study in Phnom Penh. He teaches certain skills and part of the theory and helps to organize the study program in the slum where these candidates accompany the Peer Educator on her outreach visits to patients at home. Twice a year, the strongest peer educators travel as “assessor” to rural areas to assess the performance of the rural PEN.

In rural provinces, every peer educator covers at least one health center coverage area. In one case, in Takeo province, one Peer Educator covers 2 health center areas because the area used to be one coverage area but it was split into two. He did not want to lose his patients so he continues as before. Cambodia is divided according to the Health Coverage Plan into 77 ODs. Each OD is divided into HC coverage areas for about 10,000 to 15,000 inhabitants each. A PEN follows the Health Coverage Plan, with one peer educator for each HC coverage area. The complete network of peer educators is represented by a Diabetes Program Manager (DPM), assisted by a Diabetes Program Administrator (DPA). The DPM and DPA are salaried. The rural PEN is meant fit with the Operational District. The idea is to report to the Operational District Director as part of the primary care system. The OD Director should be involved in the monitoring of the PEN and incorporate the PEN activities into the planning and reviews. There should be appropriate indicators and targets. MoPoTsyo has developed a monthly report that is submitted regularly to the OD director by the PEN leader.

The PEN submits the reports summarized as a group. Some individual Peer Educators continue to make mistakes in the reports. When these mistakes are discovered this leads to delays in payments and the supplies of the materials for the whole group that their PEN needs for their activities.

At the end of 2010, there are only 2 complete PENs. In one province there can be several OD's. However, it may not be necessary to have one DPM and DPA for every OD. The exact staffing of the provincial unit has not been decided as there is no complete provincial unit so far. In every village, where HBP screening has been done, there is a Village High Blood Pressure group leader. The Peer Educator visits this group monthly to collect data resulting from self-measurements of blood pressure of the people with HBP in that village. Once every three months, the Peer Educator conducts a self-management training for people with HBP in the village at the home of the VHBP Group leader. The VHBP Group Leader provides a permanent presence of someone who belongs to the PEN, but he has not been intensively trained like the Peer Educators have.

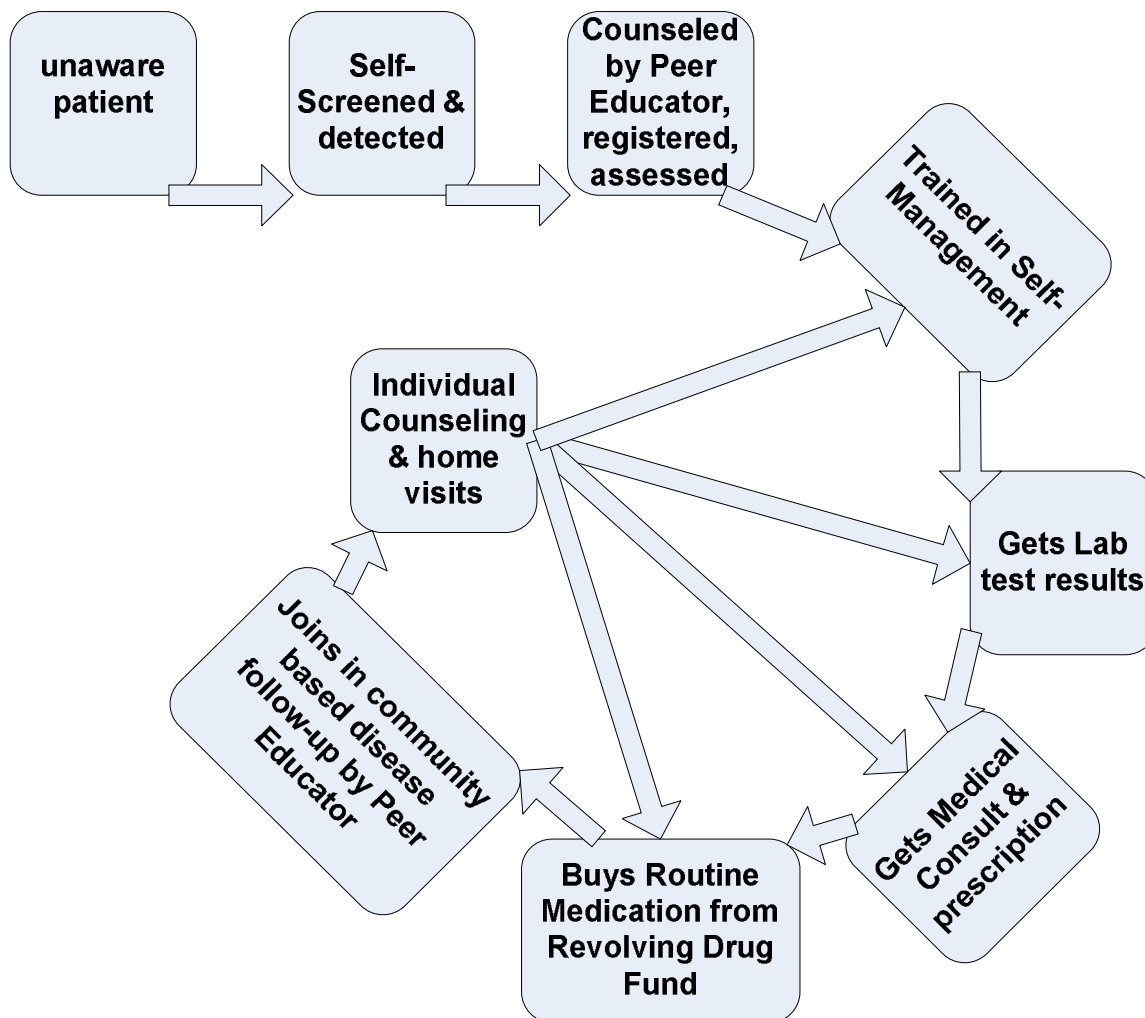
DESCRIPTION OF THE CONTINUUM OF CARE

A continuum of care (CoC) consists of different components of care for the patient to use at the right moment. The Peer Educator can become a key person to make sure that the drifting individual knows where to go and makes the right decisions. An important aspect of the Peer Educator's role is to poke the non-successful self-managing patient to take appropriate action.

If patients do no longer show up for follow-up by their Peer Educator, this Peer Educator will reach out and try to meet the person, at home if necessary, and try to get the person back into the system by advising the most relevant item for the individual. If patients indicate that they no longer want to be the object of the attention from the Peer Educator, or no longer want to receive the "services" from the network they can drop out of the system. Some drop out reluctantly because they have to travel for work or move out of the area to another area where the network does not exist. People die also of course. Some patients have a child who is studying medicine or nursing and "who wants to take care" of the parent instead of the Peer Educator.

Below is graphic representation of the CoC but without the tertiary care or other care provided during hospitalization. The CoC involves more actors and institutions than contained in the figure, such as Social Health Protection schemes and the Eye care provider.

Figure 5 Main elements of the Continuum of Care



Laboratory Services: The following range of biochemistry tests are made available to the members.

- Blood sugar
- Creatinin
- Total cholesterol
- HDL
- Triglycerides
- Potassium
- Transaminase (SGPT & SGOT)

Testing for albuminuria or proteinuria has not yet been introduced, let alone testing for micro-albumin levels.

The prices that members have to pay for the tests mentioned above are on average at just 32% of what they have to pay if would purchase these services at some of the better laboratories in the capital: Pasteur Institute, Center

of Hope and National Pediatric Hospital. The price levels for the same tests at other laboratories of the public hospitals are usually not much different. If patients would travel to one of those laboratories in town, they would spend a lot of time, pay more, and perhaps not get the full explanations of what the results mean. Also they would miss the opportunity of interacting with other patients from their own area at this twice yearly community-based event.

Among the tests offered to the members, there is not the HbA1c. This test was *not* yet available in Cambodia in 2004 and 2005 when implementation started. In those days at the Phnom Penh Pasteur Institute only the glycation of overall hemoglobin could be measured not the A1c. The result of this test is an indicator of the average blood glucose levels over the past 3 months, with the blood glucose levels in the recent weeks (just before the test) weighing relatively much heavier in the test result than the first weeks of the 3 months period. It has a well established international reputation as a tool - for those who can afford its cost - to measure quarterly the quality of a DM patient's blood glucose control. In 2011, it is available at several laboratories in Phnom Penh with prices varying from USD 5 to USD 11 for patients. There are three drawbacks to consider before deciding to give it a prominent role in Cambodia and encouraging patients to pay for it:

1. It is more expensive compared with locally available alternatives (FBG plus PPBG/urine glucose strip). The HbA1c often comes at no less USD 5,- roughly 20 times more expensive than a BG test and 150 more expensive than the urine glucose strip.
2. An unknown proportion of the Cambodian people have a different composition of hemoglobin (A, E & F hemoglobins) which in some of them raises the result of and in others lowers the result of their HbA1c test significantly which can create confusion about their glucose control (Weatherall & Clegg, 2001).

HbA1c does not always show the presence of daily but brief but damaging postprandial peaks, whereas these can be shown by post prandial blood glucose measurements and perhaps also urine glucose strips. Cambodian insulin resistant DM patients with an HbA1c of less than 7.0 but daily PPBG of 250-300 mg/dl have been encountered in clinical practice.

There are in the Cambodian context good arguments in favor of promoting first of all the correct and regular use of FBG & PPBG and urine glucose strip for frequent self-control at home (not at the hospital or an outpatient clinic) (Ruhnau et al., 1997). Other evidence regarding the precise correlations between plasma and urine glucose in diabetes assessed in the clinic for patients who visit as outpatients (so not for self-monitoring at home!) (Morris, 1981) may well have shown that the quantities of urine glucose detected by the urine strip underestimate the plasma glucose levels but that is not what home monitoring is about! At home DM use the urine glucose strip as an affordable and cost effective surveillance tool to alert them on presence of urine glucose and which helps them quickly adapt in order to keep their urine free from glucose presence that they can observe themselves and reflect on what may have caused it to appear and take action themselves to deal with it or contact their peer educator for advice. For all insulin using patients the blood glucose monitoring is imperative to help them avoid hypoglycemia but also for them the urine glucose strips are useful to monitor hyperglycemia after eating.

HbA1c results provide additional information which cannot replace the self-control tools. There remains always the factor of uncertainty caused by a deviating hemoglobin profile. Of course that can be assessed too, including in Cambodia, but that implies additional laboratory cost and the tests are not widely available in the provinces.

Eye Clinics

MoPoTsyo recommends its peer educators to inform the patients who are member of MoPoTsyo and who have a history of more than 5 years, to have their eyes checked. After an earlier entirely fruitless attempt to motivate DM patients to use the excellent facilities at the Takeo Eye Care clinic, run by CARITAS as a long term project with charity funds, CARITAS and MoPoTsyo decided to try and organize group trips per health center coverage area. The initiative took off at the end of 2010. . The patients have to pay for registration but if they are found to have diabetic retinopathy, the laser treatment at the clinic is free as part of this pilot. 4 out of the first 65 patients required laser treatment. The pilot will be reviewed after some time to see how effective it is. Possibly the service will be available for patients from Kampong Speu, where the AUSAID funded intervention is running.

PEER EDUCATOR ROLES AND TASKS

The Peer Educator functions as a member of a PEN that covers the whole OD. In that district, the network organizes a CoC for detected patients. A PEN has a structure with a leader and representative and administrator. The list of tasks below gives the main responsibilities (1 until 11) that occupy most peer educators. Not every peer educator is active in task 12, the Primary Prevention which is reserved for the higher educated ones.

Table 1 Peer Educator tasks

1	Do counseling & registering of new patients
2	Do training in self-management of DM Patients
3	Do training of Village High Blood Pressure Group Leaders
4	Do follow-up and collect data of registered members
5	Help organize access to laboratory tests
6	Help organize access to medical consultation
7	Help organize and monitor the RDF
8	Help organize access to Eye Care clinic
9	Help organize the 6 monthly assessments
10	Help facilitate access for poor patients with equity fund
11	Organize screening & self-screening
12	Take part of Primary Prevention in schools and for target groups

In addition, there are specific tasks which can be entrusted to individual peer educators on behalf of the whole network, such as:

- collecting the revenue from the Pharmacy in order to transfer it by bank transfer to Phnom Penh;
- certain acts to prepare the blood sample for transportation to the laboratory;
- creative contributions for special events
- administrative responsibilities
- representation in large regular local meetings

12 PEER EDUCATOR TASKS ARE DESCRIBED IN MORE DETAIL

1) The counseling of new patients and their registration:

In the rural areas, where most of the members live, more than half of patients are unaware of their diagnosis until the Peer Educator informs them of it. If this happens as a result of screening, there is a chance that the patient was not feeling particularly sick or unhealthy. In those situations the news of the diagnosis can be rather unwelcome. Some patients find it difficult to accept and take months in order to accept the diagnosis and come to terms with the disease. Especially DM carries an aura of being dreadful. The diagnosis is frightening news for most people because they must have seen the consequences of uncontrolled and untreated DM among people in their village. It is therefore even more important that a Peer Educator with the same disease can reveal this unpleasant news and provide the comfort of welcoming the new member "to the club". The Peer Educator invites the new member to come to the weekly session at his house where the new member can meet other people with DM. The Peer Educator explains to the new patient the benefits of registering. He/she gives the newly registering DM patient a self-management book with printed information in Khmer about how to self-manage and self-record. The Peer educator also gives plastic container and boric acid and urine glucose strips to measure urine glucose concentrations. The Peer Educator explains how to collect 24 hour urine. The Peer Educator gives a Poster with a Food Pyramid which is based on glycemic index (GI) and which helps DM patients reduce their relatively high intake of hyperglycemic white rice (Seng Serey et al, 2007) and replace it with healthier alternatives(Sun et al., 2010) (K. Murakami et al., 2006)(Villegas et al., 2007). The Peer Educator fills out an assessment form with biomarkers and other relevant information about the patient. He writes a number patient ID on the cover of the self-management book which is the ID number with which all follow-up data are kept in the data-base. New HBP patients also are assessed by the Peer Educator but they are encouraged to come regularly to the house of the Village High Blood Pressure Group leader in their own village in order to self-measure blood pressure with the automated blood pressure machine. The peer educators note down and teach the members to use the full precise figures of both systole and diastole. Systole is better remembered in Cambodia than diastole value which is sometimes neglected. The newly registered HBP patients receive another type of Poster, with advice on how to live with and control HBP. DM Patients who also have HBP receive only the DM Poster. The peer educators are not particularly skilled in counseling. As part of their training, they have learned a body of knowledge but their pedagogic skills or their abilities to influence behavior change are not yet a topic of their training.

2. Train DM Patients in self-management : The Peer Educator teaches a series of 6 lessons to DM patients. The content of the teaching is based on a Peer educator curriculum that was revised over 2009 and 2010. The six lessons are given again and again allowing patients to join in as often as they want. They deal with the following topics:

- a. Biology
- b. Diabetes Mellitus
- c. The need to keep a balance between food intake, physical activities and medication
- d. Food types
- e. Medicines
- f. Self-measuring methods and laboratory tests

Every lesson takes about half an hour. The teaching method is “old fashioned” in the sense the peer educator stands in front of a group of patients who listen to a school teacher. Often she or he uses a black board. Often during the lesson there are discussions and questions. It depends on the style of the Peer Educator. The Peer Educators have not received a special training in how to conduct self help group sessions and how to encourage everyone to speak. The focus of the teaching and the group sessions is very much on the knowledge and skill transfer to new patients. The NGO's has started to encourage Peer educators to let other, more experienced patients “teach” as well. It is not clear yet if this works satisfactorily.

However, there is still a lot of sharing and informal talk before and after the lessons. Some people becoming regulars because they enjoy the gatherings. The atmosphere during these sessions is in general relaxed and in particular the blood glucose and blood pressure measurement is a group and social event that compels the participants to share and explain. It has never been investigated if the lack of privacy inside the groups also discourages individuals from joining but so far there are no signs that this is the case.

3. *Train Village High Blood Pressure Group Leaders:* Whereas DM patients go to the Peer Educator's house in order to attend group sessions with other diabetics where they learn about DM disease, the HBP patients are trained in their own village. There are many HBP patients compared to DM patients so it is almost always possible to form groups at the village level around a person with DM who also has HBP. That Diabetic person has been exposed to the 6 lessons and is selected because he or she is showing good adherence to treatment and can serve as example to the others in the village, who have “only” HBP. The selected Diabetic with HBP can be the elected HBP Group Leader, chosen by the other HBP members from the village. As sign of their agreement, they thumbprint a document detailing the functioning of the group and which applies for the automated blood pressure machine to be donated to the group and placed the home of the Leader, accessible to all of those who want to measure. The price for using the automated BP machine is 200 riels (in 2011: 1USD = 4000 riels) which is supposed to be kept by the Leader. It is supposed to be used to buy new batteries and to replace the machine when it will be broken. Batteries are changed using the revenue. But if a new machine will be bought when the existing one breaks down, remains to be seen... The Group Leader keeps a register with the names and ID's and Blood Pressure results of people who have come to measure. The visiting Peer Educator checks these results and can make an appointment for someone with HBP for a medical consultation in order to get a prescription or a change in prescription. The patients with HBP receive a special poster. It has instructions on how to control HBP and on lifestyle. The content of the poster was based on information and main messages agreed with the Ministry of Health's Preventive Medicine Department. Targets for Blood Pressure among Diabetics are below 130/80 mm Hg whereas for HBP patients (without DM) they are 140/90 mm Hg.
4. *Follow-up and collect data of registered members:* Peer Educators are encouraged to meet with the diabetic members who live in their health center coverage area at least once a month to perform a Blood Glucose check using their handheld glucometer. The patient must pay 1,300 riels, of which the Peer Educator keeps 500. (S)he remits the remaining 800 to the NGO to buy replacements for the used lancet and blood glucose strip. The Blood Glucose result is written down and sent to the NGO. For the moment those results are not yet entered into database. The Peer Educator is supposed to obtain at least 3 FBG results for 1 PPBG result, but in practice it is irregular. Once every 3 months the test is free to lower the financial threshold for poor patients and to make sure there are follow up results of every member. If someone does not want to cooperate, he or she is considered “a drop out”. Other reasons for dropping out are that people move out of the area, or that they die. A small minority of members has moved in and

out of the program, at a rate of about 10% annually. Other data collected during follow-up are the Blood Pressure and the weight (kg) and pulse. For HBP patients the follow-up system, like the teaching, is much Group once every 3 months, to conduct a session with the HBP patients and to re-explain the poster with instructions and provide answers, identify patients who need medical consultation and provide other relevant information such as the dates when the Laboratory Team plans to descend on the area. It is part of follow-up by the Peer Educator to collect the pharmacy invoices from the patient. Patients are encouraged to ask for the invoice when the pharmacy dispenses their medicines.

5. Help organize access to laboratory tests: In 2009, the laboratory service was set up. The Peer Educators encourage the members living in their area to use the 2 yearly venue of the laboratory team to their area to provide an early morning fasting venous blood sample in order to check or re-check parameters with regards to a set of biochemistry tests. The members pay at the moment they give their blood sample. The Laboratory Team consists of Peer Educators reinforced with a qualified nurse from the Hospital, appointed by the Hospital Director for this task. The only role of the nurse is to draw venous blood from the members with DM and HBP who present themselves for the blood test. All the rest is done by Peer educators trained for their additional tasks: registration, explaining, spinning the blood in a power driven centrifuge for sufficiently long time to separate the serum from the blood, using a pipette to take sufficient serum and put into the labeled tubes for transportation, prepare the tubes with the right labels, put the serum on ice and organize the speedy transport of the samples to the laboratory of the NGO where the tubes are spun again to determine and record presence of blood in the serum sample before they are further processed. When the results are available, usually about two days later, the Peer Educator has to explain the interpretation to the members and as far as possible the implications. This helps motivate the patient to get a medical consultation. The peer educator has to make sure that the laboratory results are effectively available for the Medical Doctor during consultation with the member.
6. Help organize access to medical consultation: In every OD, the NGO organizes on average twice per month a medical consultation for its members. The Peer Educator Network representative discusses the schedule with the OD and Hospital Director. The Peer Educators know the schedule and advise the members who should use the service. They encourage members to use the laboratory service first, so that the Doctor has the lab results at his disposal during the consultation. Peer Educators encourage consultation by members with HBP or BG that is not controlled. People with BP which is higher than 160/100 mm/Hg are urged not to wait. The Peer Educators are supposed to check if the member adheres to the prescription when they decide to encourage the member to seek medical consultation. The Peer Educators act as gatekeepers in the sense that they promote the use of the service by those who need it most and discourage it for those who have their risk factors under control. The Peer Educators also have a role after the medical consultation in explaining and clarifying the Doctor's advice to the patient. The Peer Educators can also bridge the communication problems between patients and some doctors who have shown impatience with some members but are otherwise much appreciated for their competency in DM patient examination and treatment. Peer Educators play an important role in providing feedback about how the members feel about the services. As they work on both sides (demand and supply) they learn to see and appreciate the challenges from both perspectives. That is useful for the local trust building and it makes their voice as brokers particularly important in judgments about the local health system performance.
7. Help organize and monitor the RDF : Every patient so also every peer educator has a role in monitoring of the performance of the RDF. This includes a check if:

- a. The pharmacy fills out the preprinted invoice when it sells medicines to the patient
- b. The pharmacy only sells to members of the NGO
- c. Patients adheres to the prescription

Some peer educators have been contracted to collect revenue from the pharmacies or to help resupply or check inventory. All peer educators are supposed to collect the invoices back from the patients who have bought medicines at the contracted pharmacies.

The Peer Educators themselves benefit from a 50% discount when they buy medicines from the RDF.

8. Help organize access to Eye Care clinic: Peer Educators advise the members with DM who have a history of more than 5 years to go screen for diabetic retinopathy. For transport from their district to the provincial town where the clinic is located, the members can use a “remorque⁴” that leaves from a specific location in their area, and which is organized by MoPoTsyo but paid for by CARITAS. The Peer Educators have to explain the system to their members and join them on the trip. The result is yet to be evaluated before it is going to be replicated to other OD’s.
9. Help organize the 6 monthly assessments: More or less every six months, every PEN is assessed by selected members of another PEN. The best performing Peer Educators in a PEN are selected and paid to function as assessors. Every assessor does part of the assessment of every patient. For example one assessor checks all the feet of the whole sample for foot sores, while another assessor studies the self-management records of the sampled patients. They travel as a team to the area and interview members of the PEN to measure their knowledge and understanding of DM disease and check a number of other indicators such as bodyweight, the presence of foot ulcers etc. It is the role of every peer educator to facilitate the process by informing the members in advance and by convincing the members to collaborate with the assessment. The results of the assessment are important for every peer educator because they determine the height of a reward.
10. Help facilitate access for poor patients with equity fund: Peer Educators can identify a poor person with DM who cannot afford the medication and needs assistance. At the end of 2010, some 50 patients benefit from this system in the urban slum areas and a similar small number in the provinces. The funding for health equity fund should be as much as possible external and not be perceived as cost to the Peer educator intervention itself. The system has not yet been satisfactorily worked out in detail for scale up. It requires more design and piloting.
11. Organize screening & self screening: Peer Educators distribute urine glucose strips among adults and show them how to use these, within two hours after lunch, to test their urine for presence of glucose. If the urine-glucose-strip changes color, the adult tells the peer educator and then the Peer educator gives this person a free BG test, normally a FBG to confirm “diagnosis”. The Peer Educator should only register people as diabetics who really have DM (FBG>126 mg/dl or PPBG>180 mg/dl). Patients are not registered as diabetic based on the urine test alone. The Peer Educator has to make a proper assessment of the new diabetic by filling out a form, which has to be completed for entry into the NGO’s database. When the village is ready with DM screening, the Peer Educator organizes HBP screening. Various methods have been tried to do this. The urine glucose testing is done, often without the Peer Educator present, when the

⁴ a 2-wheel lorry with up to 30 (!) passengers pulled by a motorbike. It is the cheapest form of local transport.

adult comes home from work. This is not a problem because of the use of BG test as confirmation. The Peer Educators have to explain the urine strip users that a negative urine glucose test does not necessarily mean that the adult does not have DM, since the urine tests are not very sensitive. This is part of their training. The Peer Educators record the screening process and the numbers of people self screening for urine glucose. The number of people self-screening for HBP is not recorded accurately. However, also for HBP, the Peer Educator measures the BP herself/himself before registering a patient as someone with HBP.

12. Take part of Primary Prevention in schools and for target groups: Among Peer educators some are school teachers and others have leadership positions in their community. Those patients, once most of the screening activity is done, can make time free for primary prevention activities. MoPoTsyo trains them how to do this. The activity takes a few hours early morning and consists of a large gathering of some 50 adults, for example all the teachers of a school, or all the leaders of a commune. It is an important side activity for the PEN, explained in more in detail in the next paragraph.

PRIMARY PREVENTION

When there is community based secondary prevention (targeting patients), this creates a good basis for primary prevention. This type of activity targets members of the population who are not sick yet and aims to prevent them from becoming sick with chronic NCD. It resorts under the General Peer Program. It starts when the PEN is mature and screening is completed. It consists mainly health promotion in which peer educators play an active role. These peer educators are DM patients who do not only talk about DM but about the main categories of chronic NCD's (CVD, cancer, chronic lung diseases, DM) that can be prevented as a result of healthier behavior (no smoking, healthy food, physical activity). It was first experimented in schools in 2009 and first in communes in 2010. No OD has so far been covered completely. 2 types of audiences are directly targeted: School Teachers and Commune Leaders. They are exposed while in a gathering of some 50 adults, for example all the teachers of a school, or all the leaders of a commune. Sometimes the group is so big, that it needs to be split in two over two days. A team of 4 to 5 Peer Educators trains these people in awareness of Risk Factors for Chronic NCD. Through a series of activities and informative talks, the adults are exposed to information about their own risk factors (overweight, blood pressure, FBG) and learn how they can improve themselves their prospects of developing chronic NCD by taking some action with regards to smoking, healthier nutrition and physical activity. MoPoTsyo has developed special materials to help convey the key messages:

1. A flip chart for use in the schools was approved by the Ministry of Health and the Ministry of Education's School Health Department. It details the daily life of twins separated from each other as babies, one growing up in the village and the other one in the city. The drawings allow the school teacher to talk about differences and the consequences. It is also used during the sessions with commune leaders.
2. A primary prevention poster, containing key messages about risk factors, levels of blood sugar, blood pressure, cholesterol, BMI etc. and how to keep them under control to reduce the chance of chronic NCD.
3. Primary prevention song with key messages on healthy behavior and what to avoid;

Any person who during the primary prevention sessions is detected as patient is counseled and offered membership. There is strikingly low number of new DM cases resulting from FBG because most people have already been screened using the urine glucose test. The indirect target audience is the school children, but it is not clear and sure that this group is effectively reached through the exposed teachers. The teachers consider the action only relevant for themselves and are reluctant to integrate it into the formal curriculum. There is perhaps a

possibility to integrate the subject into “Biology” or into “Khmer society” in the future. The effects of the primary prevention activity are measured through the pre-test and post-test. When the first OD, Ang Roka, will be completed, the effect can be measured and compared with the cost. The only effects that are measured are the increases in knowledge, not the behavioral aspects. However, by repeating the same action among the same groups of beneficiaries a year or two years later, health outcome changes can be measured.

It is not clear how the primary prevention influences the secondary prevention and vice versa but it is safe to assume that these activities mutually reinforce each other. It would be difficult to separate the effects of the different components of the intervention on the overall results of the PENs.

MONITORING

Monitoring has different dimensions which are discussed in this paragraph:

1. Self monitoring of disease as part of self-management by Patients
 2. Monitoring of self-management by their Peer Educator
 3. Monitoring of Peer Educators by the Local Diabetes Program Manager and by the administrative Diabetes Program Assistant (rapporteur)
 4. Monitoring of DPM by HQ General Peer Program Manager
- 1) DM patients are given the opportunity to learn from Peer educators how to self-manage. This self-management includes the monitoring of their urine glucose levels. Their self-management book was designed for these patients to record results of self-monitoring but also to record the results of BG tests, BP measurements, pulse, waist circumference, HbA1c results if they are available, weight, and height and other relevant biometrics.
- HBP patients use the same biometric indicators but except that their glucose is not monthly controlled.
- 2) The Peer Educator has one patient follow-up book for all the patients he or she is following up. In the past the peer educator had 2 follow-up books: one for DM patients and another book for HBP patients without DM. The reason for using 2 different books was that DM patients require a different type of follow-up for which the peer educator is rewarded and supported differently than for HBP patients. Over time, this created confusion and it even resulted occasionally in patients having the same number.
- 3) The DPM monitors the Peer Educators based on their monthly reports.
- 4) The PEN itself (DPM, Peer Educators and registered Patients) is monitored based on these monthly reports plus a system of 6-monthly assessments. Reported data and assessment data are entered into the organisation's computerized database, centralized in Phnom Penh.

This data base was developed in ACCESS by NGO staff. In the middle of 2010, MoPoTsyo ordered a new data base to be developed for it by a software developer which was supposed to be ready before the end of 2010 but the development experienced delays. The new database, once it functions, is an important management tool.

Monthly:

The following documents are the main reports in the rural project to be filled by the Peer Educator:

1. Activity Report Rural (daily hours worked, activity done, where they went and kilometers traveled, to fill at the end of each day: purpose is to be able to spot check)
2. Overview of Patient Presence (name, number of patients present during trainings, date of training; purpose is to be able to spot check)
3. Assessment form for new HBP Patients (two pages with 35 entries to register new case; purpose is for data entry)
4. Assessment form for new DM Patients (two pages with 45 entries to register new case; purpose is for data entry)
5. Monthly Report for quantifying results of activities (Households and adults reached for screening, patients detected; purpose is for spot check and management monitoring of progress, etc)
6. Blood Glucose Measurement Report (ID, result of BG test, purpose is for management of patients and of supplies and for automated follow-up by local management unit with software but no software yet so no data entry yet!)
7. Chronic Disease report for screening (questions to ask during screening about chronic disease related health expenditure in households, for management, for accountability and for research into needs that are unmet, not for data entry);

6-monthly re-assessments:

Twice per year normally, the NGO supervisors select a random sample of 19 DM patients among the patients that are being followed up by the Peer Educator to re-assess them. For this special tools have been developed in Khmer language. The re-assessment compares how the individual patients are doing with how they were doing at the time they registered with the NGO according to the database. The number of 19 is based on Lot Quality Assessment Sampling (LQAS) and gives information for the management to get a picture of the situation in each district area and even in health center coverage area. These patients are invited to join in the “re-assessment”. This re-assessment is carried out in practice by members from another PEN in another province or Municipality. The re-assessment consists of a series of biological measurements (weight, length, BMI, circumference of waist and hip, blood pressure and Fasting venous Blood sample, foot inspection) and making copies of the self-management book. These are typically results that indicate “outcomes”. Then the patients are asked a series of questions to assess their knowledge of lifestyle issues like nutrition, exercise habits, and their knowledge of their figures related to DM and blood pressure, kilograms, the risks of uncontrolled DM, and how to improve their lifestyle, but also how much they spend and if they take their medication regularly or not and whether they appreciate the peer support. The result of there-assessment translates into points and a score per peer educator that indicates the quality of his peer education compared with his colleagues. After this, the score is multiplied by the number of patients under his/her follow-up/divided by the average number of peer educators followed up in his/her OD. That is the final score that reflects both quality and workload. This score is translated into a financial reward that varies between USD 10 and about USD 200 depending on the number of points a peer educator manages to get compared with the colleagues. Thanks to this system, there is an incentive for peer educators to achieve good control among as many patients as possible they are following up. The better the health outcomes of the patients, the more financial reward and honor the peer educator receives as a result of this assessment. A

recent example of a network score per peer educator in the urban area with the amount of the reward (in USD) as final score for outcomes is given below:

Table 2 Example of a 6-monthly assessment score

AREA	Nr. Patient in Follow Up	Total Score	Rank	workload factor	Final score	Winner
AK	114	83	5	1.45	120.69	1
BB	80	110	1	1.02	112.24	3
BK	93	97	2	1.19	115.06	2
BR	67	86	4	0.85	73.49	4
BS	38	95	3	0.48	46.05	5

The system is in fact a bit unfair as it assumes that populations are the same, while in fact some areas are remote and poorer with more illiterate rural people, who are doing perhaps more manual labor compared with areas that have small towns with a market and many relatively more wealthy residents who are also less physically active and more often overweight. Also a baseline assessment of patients when they register during the planting season may give a much better result than one carried out when it is party time in the Cambodian countryside with not much else to do. There are also statistical issues that must be considered. The sample of 19 per peer educator is rather small and has only 10% power. Another drawback of the small sample size of 19 means that, if a peer educator has many patients, some patients may never get independently re-assessed. On the other hand, participation of the patients in these 6 monthly re-assessments is excellent. Although they are busy, patients rarely refuse, also because the re-assessment means that the patient gets all the tests for free and the general atmosphere is social and very pleasant, almost like a reunion of people who used to have been in the same situation. Some poor patients are disappointed because they are never lucky whereas some wealthy patients have been solicited to join more than once. The fact that it is randomized makes it more representative for the patients under the care of the peer educator. The variation in the score is large. The score is first based on quality of the outcomes. But the workload of peer educators varies also and must be accounted for. Some peer educators follow up large numbers of patients and others are quite happy with a small number. The Peer Educator is a key factor in obtaining both quality and quantity outcomes. The low level of the rewards for which patients, once trained as peer educators, are ready in the Cambodian context to follow-up other patients in their community creates opportunities for a financially sustainable DM care model. The payment for Peer Educator performance is discussed below in the chapter on provider payments.

The assessment results are also meant to be used by the local supervisor and the management to address weaknesses which are local, individual or structural. So far the health authorities are not involved in this process, but this is definitively among the possibilities in the future.

For clarity: at the time of the assessment there is therefore a randomized lot of 19 patients of each peer educator who is tested for free, but all the other patients under the follow-up of that peer educator are offered to join in the testing but they pay for the tests. Their financial participation helps to recover the cost of the assessment. The Peer Educators recommend their members to do the tests at least once per year. There is no HbA1c among the tests yet.

Only in 2011 will the NGO for the first time re-assess HBP patients who are not diabetic. Covering the HBP patients among non-diabetics is relatively new and they are reached mainly through the Village High Blood Pressure Group Leader and there are problematic policy issues that should be resolved before good results can be expected.

RESPONSIBILITY

The NGO MoPoTsyo trains its peer educators to explain to the patients who register that they and the NGO are not taking responsibility for the health of the patients. Responsibility must remain with the patients themselves. Understandably, the Peer Educators are reluctant and afraid to assume responsibility for patients and their health. Both the NGO and the Peer educators are ill-equipped to deal with any emergencies or sudden episodes of illness. The NGO's role as well as the role of the Peer Educators was originally limited to provision of information for "secondary prevention" of long term complications. In its original role the NGO recommends the Peer Educators to provide opportunities to patients to use reliable information, but not to give patients the impression that they take over responsibility. The issue of responsibility remains tricky because of the attached accountability. Some patients would like to transfer it to a care provider and the NGO has become more involved in the organization of the care that its members need.

Because NGO is involved in the organization and supply and because they are the NGO's only sources of sustainable revenue, there are 2 parts of the care provision for which the NGO has to take responsibility and cannot escape accountability: the medicines and the diagnostic (laboratory) tests. The NGO does not want to take responsibility for the quality of medical consultation because it is done by a hired consultant and it takes place inside the setting of public service Referral Hospital. Health care providers are occasionally sued in Cambodia and have to pay damages to patients. These new dynamics create an upward pressure on costs to provide the best quality and equipment to support the medical services provided to the patients but the same patients exert a downward pressure on MoPoTsyo to keep the costs of the inputs as low as possible to help them afford the cost. Ultimately the Cambodian courts will decide if ever patients would sue the organization and the arguments could easily end up in ideological debates.

PROVIDER PAYMENT METHODS AND INCENTIVES

People who provide health services to registered patients and must be rewarded or reimbursed are the following types of providers:

1. DM and HBP patients themselves
2. Peer Educators
3. Pharmacists/Drug sellers
4. Medical Doctors
5. Hospital Nurse
6. Laboratory technician

1. DM and HBP patients themselves:

In fact, trained DM patients provide health services to themselves. The incentive to provide these services regularly and correctly originates in and is fed by risk aversion and a desire for control over health. There is immaterial reward in the form of restored health and reduced need for hospitalisation. There is material reward in the form of reduced health expenditure. Patients learn that they themselves play a large role in determining the level of these rewards. Although they are meant to become the main actors to self-manage, many patients prefer to rely on their peer educator for things they could do themselves. Over time, and if they join the lessons provided by the Peer Educators, and join the group sessions, they stabilize with better control and they will become more familiar with the different aspects of self-management.

2. Peer Educators:

The incentive environment created for the Peer Educators is meant to stimulate them to get on one hand good patient health outcomes and on the other hand reward the Peer Educators for providing service outputs and carry out procedures. There are trade offs among these in terms of efficiency. Through the assessments that take place two times per year, there is an opportunity to spot weaknesses. The way they are being incentivized is discussed in detail below.

3. Pharmacist/Drug Seller:

The pharmacist keeps approximately 15% of the difference between the price that patients pay for the medicines they buy at the pharmacy and the price that the pharmacy has to pay to MoPoTsyo for the supply.

4. Medical Doctor:

The Medical Doctor received between USD 31 and USD 34 for a full morning of consultation. They choose their own type of transport to travel from Penh to the rural area and are reimbursed accordingly. For example it cost MoPoTsyo USD 95 in early 2010 (this rose to USD 115 later in 2011) to pay for the Medical Doctor to travel from Phnom Penh to Sisophon plus a second taxi to Thmar Pouk, the hotel costs, and food, all expenses necessary to be present for one morning consultations in Thmar Pouk OD, and train 2 medical doctors of the Referral Hospital there.

5. Hospital Nurse:

The OD Director chooses a nurse from the Referral Hospital to draw blood in the community early morning starting at 06.30 according to the laboratory schedule that covers the area twice per year. This nurse receives 20, 000 Riels for one morning.

6. Laboratory technician/manager:

This person belongs to Headquarter staff and has a salary which is fixed and not related to the number of tests.

Below is the incentive system for Peer Educators more in detail:

The urban incentive policy for example looks like this with an exchange rate of 1 USD = 4050 Riels:

Table 3 Urban incentives overview

Policy for reimbursement for Peer Educators (Phnom Penh)		4050
1	8,000 Riel to find a new Diabetes patient	\$ 1.98
2	2,000 Riel to do the first assessment of a new Diabetes patient	\$ 0.49
3	50 Riel per screened adult for Diabetes	\$ 0.01
4	- 4,500 Riel to come to office for BB, BK, BR, BS, and	\$ 1.11
	- 9,000 Riel to come to office for AK	\$ 2.22
5	200 Riel for measuring level of glucose in blood (1 time per 3 months)	\$ 0.05
6	800 Riel maximum for 5 result of urine test every month	\$ 0.20
7	8,000 Riel for sending patients to hospital	\$ 1.98
8	8,000 Riel to train Diabetes patients in group	\$ 1.98
9	- 12,000 Riel to get vehicle repaired for BB, BK, BR, BS, and	\$ 2.96
	- 40,000 Riel to get vehicle repaired for AK	\$ 9.88
10	1,000 Riel for vehicle parking fee at hospital	\$ 0.25
11	500 Riel to collect a pharmacy invoice from the patient (Diabetes or High Blood Pressure)	\$ 0.12
12	500 Riel for test of glucose in blood, 100 Riel for measuring blood pressure	\$ 0.12
13	100 Riel for weight, measuring hip and waist (1 time per 3 months)	\$ 0.02
14	1,000 Riel to find a new High Blood Pressure patient	\$ 0.25
15	2,000 Riel to do the first assessment of a new High Blood Pressure patient	\$ 0.49
16	4,000 Riel to meet the Village High Blood Pressure Chief	\$ 0.99
17	4,000 Riel to train the Village High Blood Pressure Group Leader	\$ 0.99
18	4,000 Riel to collect the data every month from the register of the Village HBP Group Leader	\$ 0.99
19	4,000 Riel to train the Village High Blood Pressure Group Leader (1 time per 3 months)	\$ 0.99
20	- 10,000 Riel to send patients to Pochentong Hospital for BB, BK, BR, BS, and	\$ 2.47
	- 32,000 Riel to send patients to Pochentong Hospital for AK	\$ 7.90
	1. Peer 12,000 Riel	\$ 2.96
	2. Patient 20,000 Riel	\$ 4.94

The rural incentive policy is similar but has a complex kilometer reimbursement system which must ensure that the peer educator actually travels to the distant villages as often as to the nearby villages. This is a weak point in many existing rural health programs which do have not refined their incentive system. Peer Educators receive money, equipment and materials to find patients and help patients and report on their activities. In this chapter this is being described.

The incentive system is designed to encourage diabetic control through the use of both Blood Glucose measurement for hypoglycemia and Urine Glucose measurement for hyperglycemia, but it is extremely challenging to get it right by balancing the incentives with appropriate monitoring. The approach is only moderately successful so far: If there is too much financial incentive for a written record, It becomes tempting for peer educators to “help a patient record a result” even if the patient is not so sure it ever existed. This issue surfaced when the results of urine glucose self-tests exceeded the supply of urine strips to a peer educator. On the other hand, If the peer educator would not be allowed to help the patient record urine glucose results in the self management book, there would be no results recorded for many illiterate patients because they can’t do it without someone helping them. When we proposed that peer educators use a red pen, to be able to observe the difference of a recording by the patient and by the peer educator, this led to more and other practical problems. Also, the quality of the stock of urine glucose strips degraded too quickly. Still the use of the urine glucose strip is considered so worthwhile in the Cambodian context and in particular among poor diabetics that the recommendations are not dropped as part of the control strategy and remain a main policy objective of diabetic control. The struggle is uphill though.

Below is an example of a monthly payment of Incentives approved for payment to the Peer Educators in the urban slum areas where the network is relatively mature. The information on the amounts and names is submitted by the local network to the Operational District Director with a copy to the Provincial Health Department Director.

Table 4 Monthly urban incentives

N°	Name	Function	Diabetes		Hypertension		Total
			Screening	Follow up	Screening	Follow up	
1. Phnom Penh							
01	Meach Lina	Peer Educator-BK	\$0.00	\$94.15	\$0.00	\$0.00	\$94.15
02	Sreng San	Peer Educator-AK	\$0.00	\$113.80	\$0.00	\$5.93	\$119.73
03	Tet Touch	Peer Educator-BB	\$0.00	\$78.72	\$0.00	\$0.00	\$78.72
04	Lao Sothea	Peer Educator-BS	\$0.00	\$61.19	\$0.00	\$0.00	\$61.19
05	Hay Chantha	Peer Educator-BR	\$0.00	\$67.85	\$0.00	\$0.00	\$67.85
Total (1):			\$0.00	\$415.71	\$0.00	\$5.93	\$421.64

There is no screening by peer educators in the urban slum areas because that was completed for DM in 2007 and 2008. So far there has only been a pilot HBP screening in Slum number 2 as a result of which the Peer Educator in AK (Anlong Kangan) is following up the HBP patients there.

In a new OD, such as in Kampong Speu province, where the network is being set up with new peer educators being trained and added one by one to complete the network until there are 19 in total, one for each Health Center coverage area. Screening is being done in every area with a new peer educator in the OD Kong Pisey, the incentive amounts look like this. The amounts paid out for follow up are much lower because there are few patients registered.

Active screening is necessary in any new area because most patients are unaware of their diagnosis. Communities of patients cannot be created as long as people do not know that they have the same disease. Also if patients do not know what kind of disease they have, they cannot come forward for care provision. The screening purpose is the creation of a community of chronic patients, who have access to care from and through the Peer Educator who is based in their area. Without the Peer Educator there would be no screening, no patient and no CoC.

Table 5 Monthly rural incentives new area

N°	Name	Function	Diabetes		Hypertension		Total
			Screening	Follow up	Screening	Follow up	
4. Kampong Speu							
01	Houy Sreng	Peer Educator-DKC	\$22.51	\$10.20	\$0.99	\$0.00	\$33.70
02	Chhoeung Sinoeun	Peer Educator-DKD	\$19.75	\$14.36	\$1.98	\$0.00	\$36.09
03	Dourng Sameth	Peer Educator-DKG	\$29.72	\$14.94	\$0.99	\$0.00	\$45.65
04	Neak Noeun	Peer Educator-DKH	\$9.88	\$9.98	\$0.00	\$0.00	\$19.86
05	Test Sameoun	Peer Educator-DKI	\$17.28	\$9.80	\$0.49	\$0.00	\$27.57
06	Prak Lun	Peer Educator-DKJ	\$15.80	\$12.49	\$2.96	\$0.00	\$31.25
07	Phay Saroeun	Peer Educator-DKL	\$15.71	\$20.51	\$2.96	\$0.00	\$39.18
08	Long Lath	Peer Educator-DKM	\$5.56	\$18.15	\$0.49	\$0.00	\$24.20
09	Heam Sophal	Peer Educator-DKN	\$2.47	\$23.82	\$0.49	\$0.00	\$26.78
10	Vit Sothon	Peer Educator-DKQ	\$2.08	\$26.43	\$0.00	\$0.00	\$28.51
11	Sou Meach	Peer Educator-DKR	\$11.81	\$32.99	\$0.49	\$0.00	\$45.29
12	Mas Tourn	Peer Educator-DKS	\$15.46	\$14.98	\$0.00	\$0.00	\$30.44
Total (4):			\$168.03	\$208.65	\$11.84	\$0.00	\$388.52

The incentive policies for the urban slums and for the rural areas are different, because the rural peer educators must travel often many kilometers to reach patients and villages in their area. There is km reimbursement schedule based on the distance between the home of the Peer Educator and every village in the coverage area and the distance to the Referral Hospital.

The incentives above are for to reimburse and reward peer educators for activities and for performing tasks. However, unless these tasks lead to real benefits, it is all quite useless. That is why there is an important incentive as a result of the twice yearly assessment, when outcomes are measured and compared among peer educators. To measure outcomes is not easy. This part of the incentive system has been discussed above under 6-monthly assessments in the chapter on Monitoring.

No survey was done to ask trained health staff about it because it is obvious that professional Cambodian health staff, if they were given the same level of rewards, would be less inclined to perform the same tasks. This is because those health staff have incentives to perform a different set of activities (injections, IV fluids, medicating), which they normally perform for other patients with disease (diarrhea, fatigue, typhoid fever) and which are much more financially rewarding and which conflict with the tasks that the peer educators routinely perform (providing information on self-management and understanding of disease).

ASSESSMENT METHODOLOGY

DOCUMENTATION METHODS

The chosen method to demonstrate that the intervention has effects on health and on health expenditure is through comparing “before and after”: a comparison of relevant aspects of the profile of the membership at the moment they register with these aspects at later moments through assessments of random samples of the membership. These assessments are normally carried out every six months by selecting among all DM patients followed up by a (diabetic) peer educator a random sample of 19 DM patients. For example, if in an operational district (OD), there are 5 peer educators, then this requires a cluster of 5 random samples, totaling 95 DM patients re-assessed among the total of several hundred in follow-up. The actual patient interviews and physical re-assessments are carried out by peer educators belonging to a different Peer Educator Network from another province. The Peer Educators who do the assessments receive a small reimbursement for travel and time spent. The Peer educators whose patients are being re-assessed are rewarded according to the outcomes of their own patients as they result from these re-assessments. Peer Educators whose patients are doing relatively less well receive smaller financial rewards than peer educators whose patients are in better shape and show better self-management skills and knowledge. In the example, the re-assessment data of these 95 patients are compared with the data of the same individuals recorded in the assessment at time of their registration, in order to measure some of the outcomes that are being assessed. These individual patient comparisons generate routine data which are collected as part of normal management and supervision.

This monitoring and assessment system has not yet been developed for HBP patients who do not have DM and therefore there are no results to present related to assessments of those HBP patients. The Blood Pressure (BP) data in this report are related to BP levels of DM patients.

The chosen method to demonstrate effects on the broader health system is the analysis of official and NGO documents, including reports. These effects can be deduced from the emergence of health services and their utilization in OD's where these services did not exist before the start of the intervention. These health services are essential to treat people with DM and HBP: medical consultations, laboratory services and prescription medications. None of this had been formally planned in terms of public health work force and public resources, which is unsurprising as health policy to frame these activities as part of public health services does not exist. Yet as a result of demand side initiatives they came into being but only as a result of a remix of the inputs and roles on both demand and supply sides of the health system, involving the peer educators in active roles, as will be described.

The chosen method to measure to what extent the intervention is able to uncover the health needs which are for their greatest part hidden in the society, is to compare the NGO records on the members who have registered as persons with DM living in a particular rural area where the network has been created and the estimated DM prevalence numbers in rural areas based on the STEP survey 2010 (MOH&WHO, 2010).

CHALLENGES

There are important methodological issues related to the investigation of the intervention's various types of effects: the effects on people's health and on their socio-economic situation but also the effects on the wider health system, including health service delivery. This type of long term comprehensive community based intervention is unsuitable to be tested in randomized control trials (RCT). There is not much that comes close to

what could count as a “counterfactual”. We can make informed guesses but we cannot know what would have happened to the same beneficiaries of the intervention if the intervention had not been there. In such cases a combination of qualitative and quantitative data from random samples among beneficiaries may be convincing. Systematically random samples beneficiaries have been asked whether they appreciate the peer educator, whether they consider the peer educator helpful, and if they spend more than before their registration. Registered members certainly voice an opinion about these issues, but the answers that are available can never be as convincing in an RCT. Data from qualitative surveys may or may not be representative for all beneficiaries. There are no results of people with DM in the same community who did not benefit from the intervention because the same kind of routine data as we have of the ones who joined do not exist of the ones who did not join. It would be wrong to compare the results of those who benefited from the intervention, with people with DM attending a public- or private diabetes care clinic where they get medical services. The people seeking care at a diabetes clinic are a different population, socio-economically and psychologically in the degree to which they have accepted their diagnosis, and their need for medical care than the slum dwellers or villagers who have been detected by a Peer educator who knocks on the door one morning and informs a bit later that they suspect them to have DM.

A second series of methodological challenges are a consequence of the fact that the intervention is not just complex but also changing. It has evolved during a period of more than five years. As operators, we are trying to document and even measure what is essentially a “moving target”. Both words “moving” and “target” must be understood in multiple ways: The populations are changing, with people becoming member and dropping out, with changes in peer educators, changes in incentive levels and changes in prices charged to patients, but also the content of the services have changed. The method of intervening itself has been regularly modified and adapted to improve the ways needs can be met. As will become clear from the next chapter on Role and Scope, adaptation is not always a matter of free choice: for example it becomes necessary as a result of an abrupt end to the provision of health services that were available at the time the intervention started in the urban slums (National Hospital Kossamak had affordable Diabetes services in 2005 for the urban slum diabetics) and in a rural area (Takeo province, where MSF Belgium had been operating a Diabetes Clinic until June 2009). The ability to adapt to such developments may be an interesting feature of this particular intervention, but it remains unclear to what extent this characteristic is an essential part of the intervention itself. Perhaps the ability to adapt was just needed as part of the development of the prototype. On the other hand, adaptability, if it can be built into an intervention, helps meet future challenges when these come up.

RESULTS

OUTPUTS

There are 2 PENs that can be considered complete in terms of DM: One in Phnom Penh (urban) and one in Ang Roka OD in Takeo province (rural). There are 6 PEN's still incomplete in terms of DM and screening for DM. These are the ones in the 4 remaining OD's in Takeo, 1 in Thmar Pouk OD in Banteay Meanchey province and 1 in Kong Pisey OD in Kompong Speu province. All 8 PEN's should be considered incomplete in terms of HBP and screening for HBP but once policy is unified and clear this can be addressed.

PATIENTS PROFILE AT TIME OF REGISTRATION

To appreciate correctly the intervention's effects on patients in a given area it is necessary to consider the people who have the chronic disease whether they are aware of it or not. Most DM clinic based interventions will only look at the effects on the DM patients who attend their clinics so that is different type of population in terms of their receptiveness for medical messages and also socio economic background. The challenge that PENs are setting for themselves is of a different nature. It aims to deal with the backlog of care for DM patients who aware and unaware of their diagnosis and all living in a particular area. If the STEP survey of 2010 will be repeated every 5 years (2010) it will be possible to estimate and monitor the proportions of people with DM and HBP are receiving care in a particular area.

The urban members are not just detected and registered based on screening activity by peer educators in the 5 slum areas (2005, 2006 and 2007). This membership is since then changing naturally with people joining who have found out that they have DM and want to become member. Some of them have had DM for years and others just became diabetic. The urban membership is older than the rural membership but its membership has more access to diagnostics, to care from NGO's, and to financial resources, so this population which no longer only slum inhabitants, is getting less and less representative for Cambodia's real needs. They are supervised by the Urban Diabetes Program Manager. He is a diabetic man from one of the slum areas. Since 2010 he also acts as counselor for urban DM patients from outside the slum area if they want to enroll. The inclusion of motivated patients from outside the slum area into the program is helps to strengthen the regular revenue basis generating income through the RDF and through the laboratory activities. This is very much necessary because in the urban slums many of the poorest slum residents have difficulty to afford their medication. It opens the possibility of a cross subsidy from urban wealthy diabetics to urban poorest diabetics. This sort of cross subsidy is not part of the NGO's financing strategy for the rural areas.

To see how a new PENs impacts a the health needs of the diabetic population in a typical Cambodian rural area, the first rural OD where this intervention took place , Ang Roka OD, in Takeo merits a closer look.

The first rural operational district with a Peer Educator Network

The STEP Survey of 2010 (MOH&WHO, 2010) found that 2.3% of adults over 25 years old but not older than 65 years has DM. In Ang Roka OD there is in February 2011 an estimated population of 140,150 residents. The proportion of people aged 25 to 65 years is about 40% of total population in Cambodia, so 56,060 adults. If 2.3% is correct, then 1,289 among them should have DM. Per February 2010, the Peer Educators had registered 749 adults with DM, which is 58% of the estimated prevalence. Normally, in Cambodia's rural areas only one third of patients know they have DM(Hilary King et al., 2005). Almost 80% of DM patients in Ang Roka found out they are

diabetic at the time of the screening by the Peer Educators. The PEN's activities in a time span of 3 to 4 years more than double the proportion of people who are aware of DM from 28% to 58%.

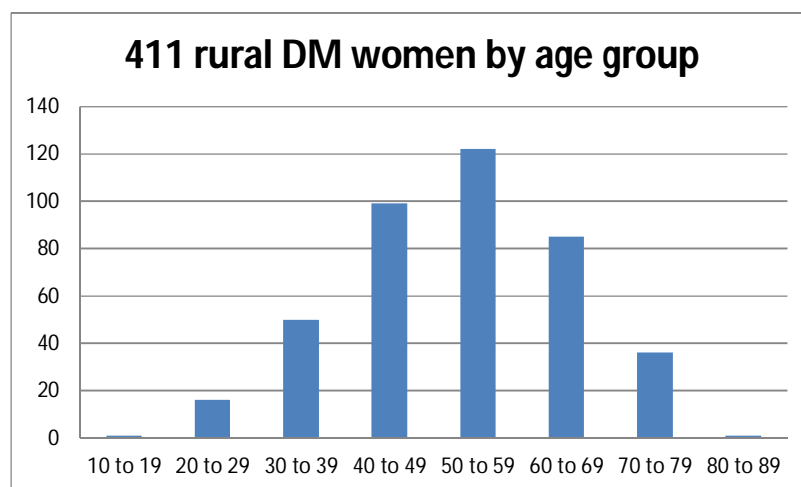
Ang Roka OD may have been not entirely representative for normal districts in Cambodia because there was a DM clinic in the provincial capital Takeo province, where the Chronic Disease Care clinic operated by Médecins Sans Frontières Belgium (MSFB) had been operating since 2002, offering free care and free prescription medication to DM and HBP patients. This clinic and another similar clinic in Siem Reap provincial capital closed in mid 2009. The effectiveness of these clinics based programs have been analysed and published (B. Janssens, W. van Damme, et al., 2007) (Marie-Eve Raguenaud et al., 2009)(P Isaakidis et al., 2010) but the analyses did not include data from the DM patients who came only once or twice to the seek care. Their number could be as high as a third of the DM patients. Among them are probably many diabetics who decide that they cannot afford the cost of attending the clinic regularly. This issue and follow-up will be discussed under “retention” in the chapter on Health Outcomes below because follow-up figures of a clinic clientèle and of a community based program must not simply be compared.

The 2010 STEP survey also shows that there is little difference in prevalence among women and men in impaired glucose tolerance, DM and in access to medication. Comparing how the sexes are represented in the intervention shows that rural women benefit in larger numbers from this intervention than the rural men.

The analyses that follow below were done at different moments when the numbers of registered DM patients and HBP patients were smaller, namely 655 Diabetics. Among them, in Ang Roka OD, in Takeo province, 439 adult women with DM registered as member with MoPoTsyo, usually after being detected by the Peer educator as a result of screening by urine glucose strip, (if positive) followed by a FBG or a PPBG in the days after.

At the moment of registration the first 411 women with DM in Ang Roka OD reported their age.

Figure 6 Rural DM women by age group



Between mid 2007 and the end of 2010, there were 166 of these 411 rural DM women who were in the fertile age group of 15 to 49 years old. That is slightly more than 40% at the moment of their registration as member of the NGO.

Their DM puts these women at increased risk during pregnancy. The early diagnosis of DM as a result of the screening creates opportunities to organize and target the extra protection that both these future mothers and unborn children need but which was hidden until the screening organized by the peer educators.

Figure 7 Percentage of rural Diabetic women in fertile age when they register as member in MoPoTsyo

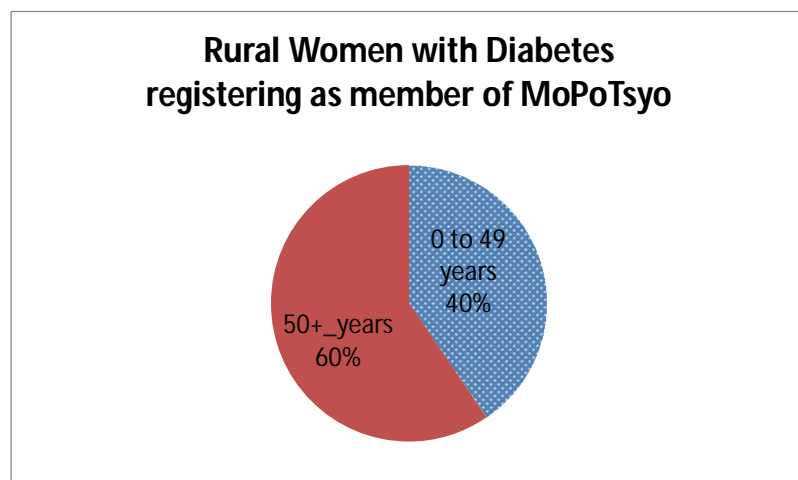
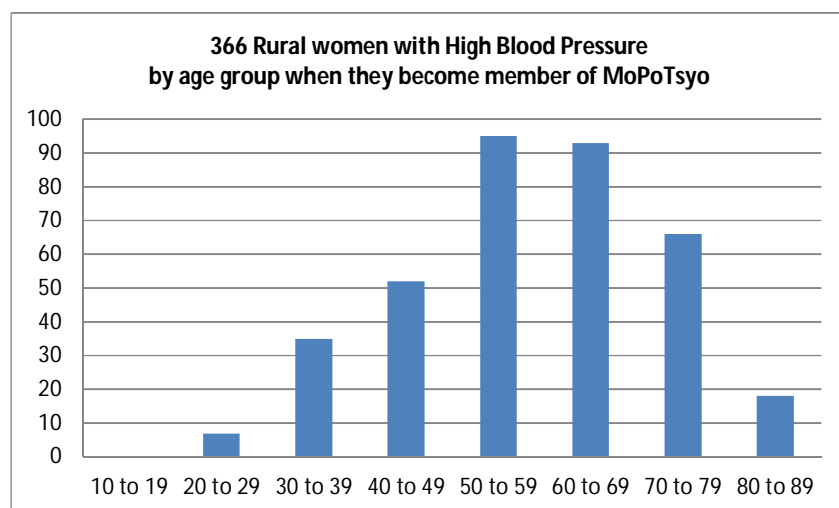


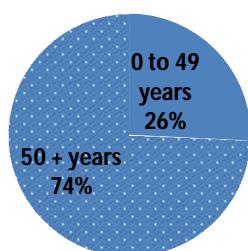
Figure 8 Rural women with High Blood Pressure by age



A quarter of these new rural female members is in fertile age between 15 and 49 years old.

Figure 9 Percentage of rural women with HBP in fertile age when they register as member in MoPoTsyo

26% of Rural women with HBP who register is in fertile age

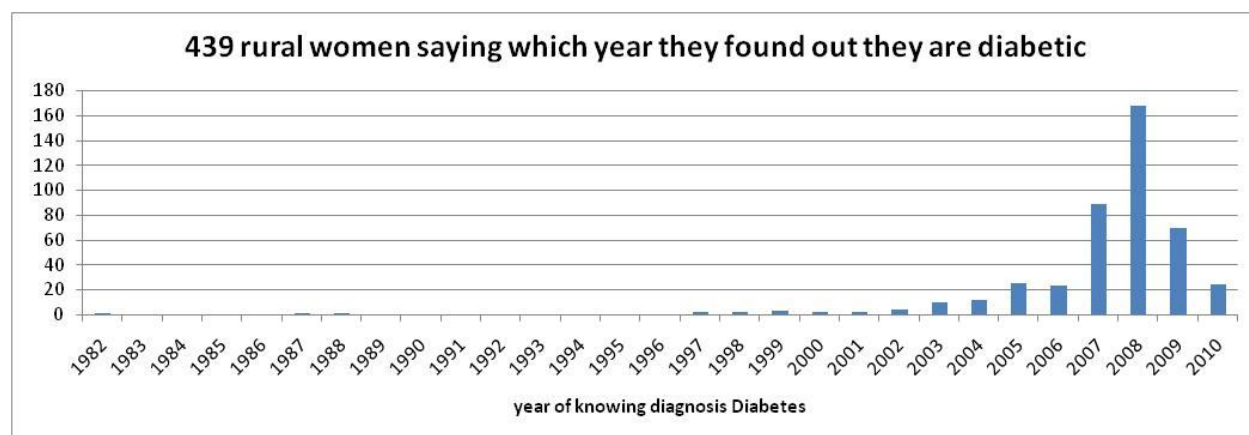


When patients register as member, the Peer Educator asks the diabetic persons in which year they found out that they are diabetic. The figure below shows the impact of community based self-screening in this rural district. The self-screening started in the middle of 2007 and was completed by the end of 2009, resulting in a community of DM patients, which did not exist before.

Before the screening was completed most of the problem had been hidden. As far as people were aware of their diagnosis, they consisted of dispersed individuals unable to help themselves and each other. From a well functioning health system one may expect that it deals immediately and effectively with the incidence of new cases of DM. In Cambodia, the PEN screening seems to have functioned as a measure to remove a backlog of unmet needs. In 2010 there was no more active screening in that district. Much of the backlog must have been dealt with, so one may expect that mostly incidence, so relatively new cases, are registered. This has not been studied yet so it has to be confirmed. It would explain why in 2010 the numbers have dropped back to the level of 2006 when the MSFB clinic was still functioning in the province.

It remains to be seen whether the PEN will be able to meet the needs in 2011 and onwards. Perhaps a community based self-screening is a cost effective operation to conduct every so many years to remove any backlogs if they would re-appear to exist from surveys.

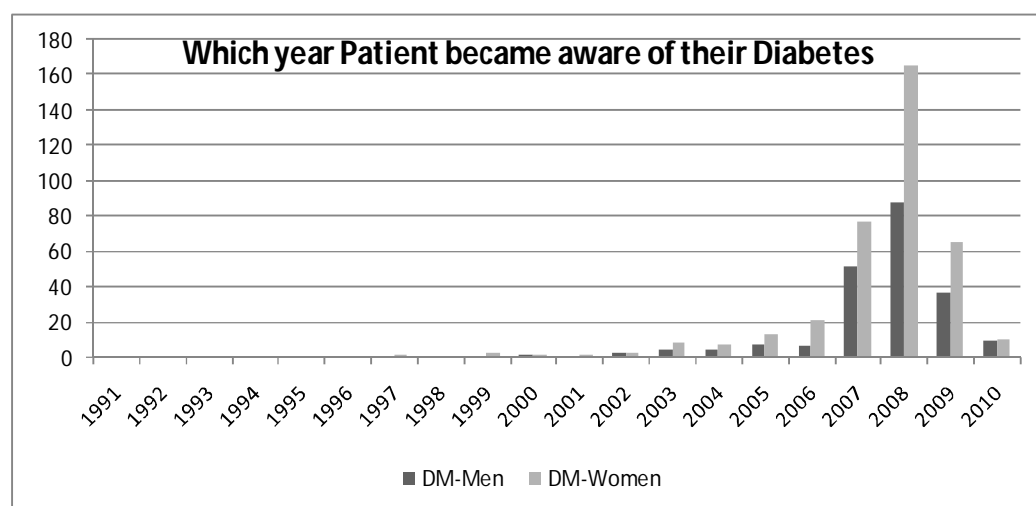
Figure 10 Detecting the silent killer : Community based self-screening for DM in a rural district



Compared with men, more women appear to grasp the opportunity of the self-screening (mid 2007 until 2009) offered by the predominantly male peer educators. They are perhaps more risk averse. If we realize that the

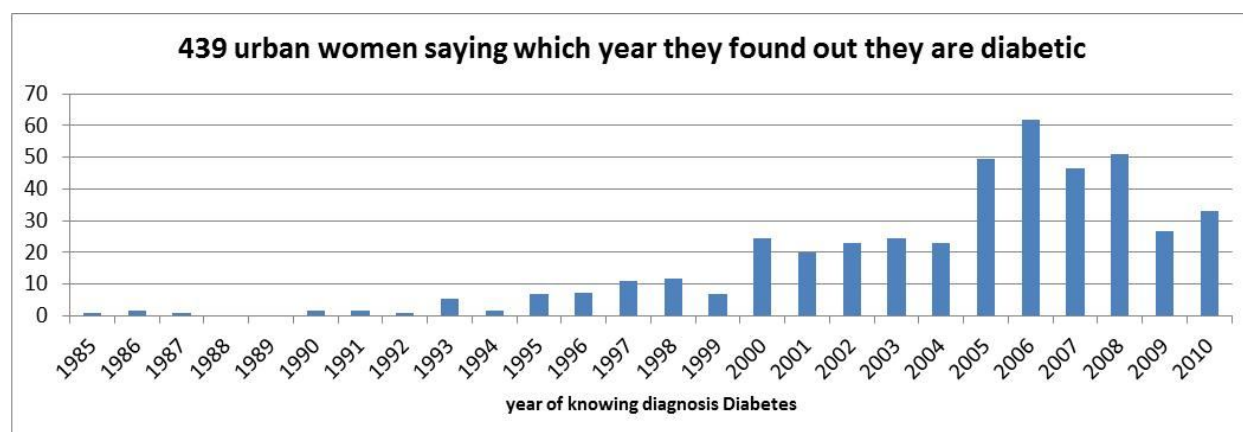
prevalence in rural area among men and women is not very different, then the figure below shows that rural women want to get informed and if they are find positive urine glucose, they take action by joining in the membership. It is possible that men are more often away when the peer educator comes to their house to explain how to use the strip, or maybe the men do not listen to their spouse when she explains how to use it or he is afraid to use it or if he uses it and it changes color, he gets so scared of the positive result that he denies it. Or the strip has become useless by the time he comes home because too many fingers have touched it.

Figure 11 DM Women & DM men as members of MoPoTsyo in first rural area



Another difference shows when comparing rural with urban settings: The urban access to diagnosis and perhaps also survival comes to mind when we compare with the same number of urban female members with DM when they say which year they became diabetic. The size of the difference cannot be simply estimated on the basis of these two graphs because the urban membership is not the result of deliberate screening activity among the defined population in a defined area.

Figure 12 Year of diagnosis among female urban diabetic members



The actual number of female with DM registered as member of the PEN in the urban area is greater but to be able to compare their profile in terms of DM history with the rural district the graph above was made on the basis of just 439 among these urban women. The urban diabetic women when they registered were at average age of almost 55 years old. Among the ones of which the age (N=550) at registration is in the records 162 women (29%) were in fertile age (15 – 49 years old) and 4 were pregnant when they registered and 175 (=32%) of urban registering females is older than 60 years and 5 were even older than 80 when they registered!

Still it is revealing that when a relatively systematic screening is organized in a rural OD with a relatively good public health service in a province with a DM clinic in its provincial capital providing free routine prescription medication, that only so few people with a DM history of more than ten years were found alive. It is unlikely that they were alive in that rural area but did not want to become member of MoPoTsyo but it is a theoretical

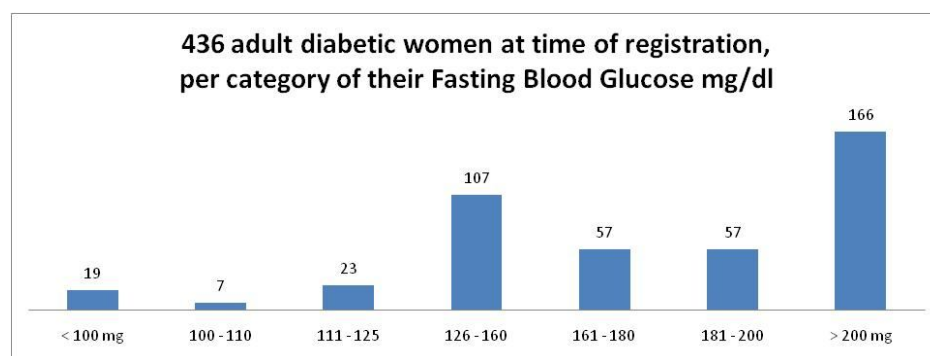
possibility. It is in fact normal that there are more of such people in Phnom Penh because it is a much larger area and they may have been flocking there over time from all over the country to increase their chances of survival with the disease. This means also that the figures found by the STEP survey (MOH&WHO, 2010) have to be interpreted with care: the prevalence of DM in rural Cambodia is much lower than it should be because they have been dying in just a few years.

In order to judge an intervention's effectiveness we must also take into account its population impact. People who regularly attend a clinic are not representative for the total population with the same health needs especially if they reside outside the district where the clinic is located. The challenge for any model be it a clinic based model or a community based model is to restore patient health and maintain risk factors under control in order to allow people with the disease to lead healthy productive lives as long as possible. This issue is discussed under retention, as part of health outcomes further below.

Blood Glucose at time of registration:

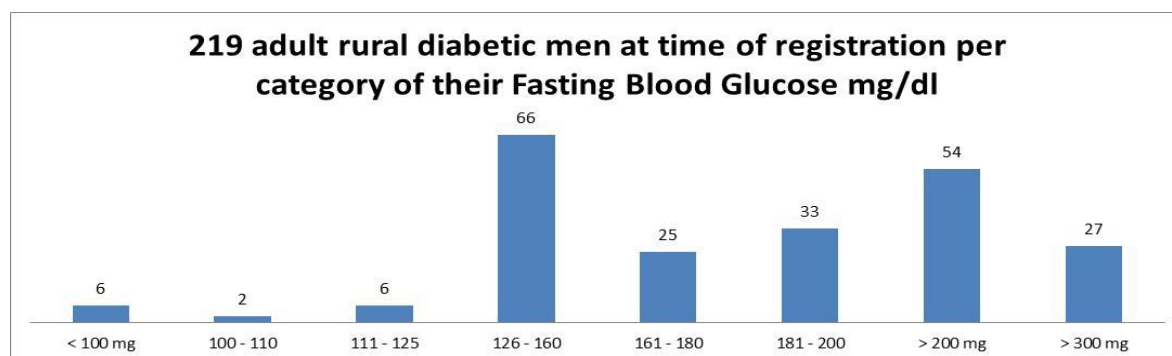
Although the medical needs were hidden from the official figures, the levels of FBG and PPBG these women were experiencing at the moment of their registration as members of the network suggest human suffering. These BG levels are shown in the 2 figures below. The first figure below shows the distribution over categories of FBG of adult women in Ang Roka OD, a rural district in Takeo province, at the time they registered as member of MoPoTsyo. The average FBG level of the diabetic women at the time they registered is 201 mg/dl (compared with 204 mg/dl in men). According to the STEP survey the mean FBG of rural Cambodian adults over 25 years old is 3.9 mmol, which is 70 mg/dl. It is important to note that $19+7+23 = 49$ (11%) among the 439 did not have FBG > 126 mg but nevertheless registered. They were either taking anti-diabetic medication, or had a PPBG glucose of > 180mg/dl to be able to register.

Figure 13 Levels of FBG at time of registration among rural females with DM



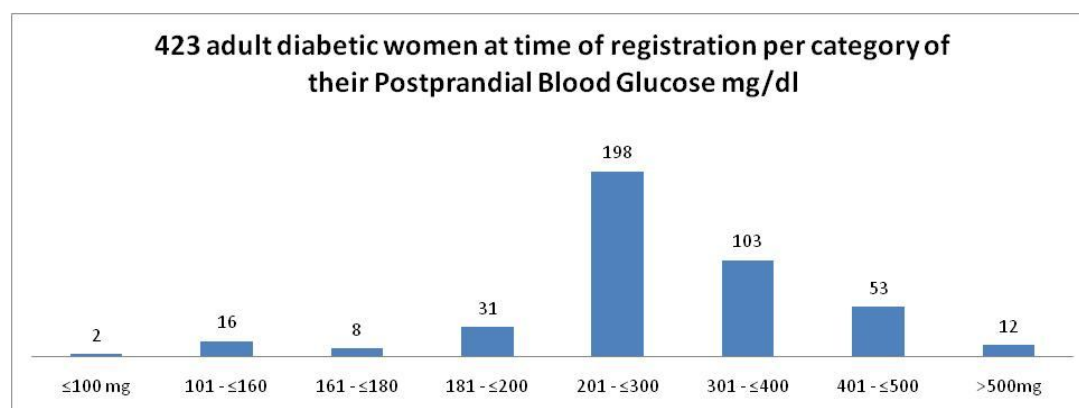
For men in the same age group, the results are not very different.

Figure 14 Levels of FBG among rural males with DM



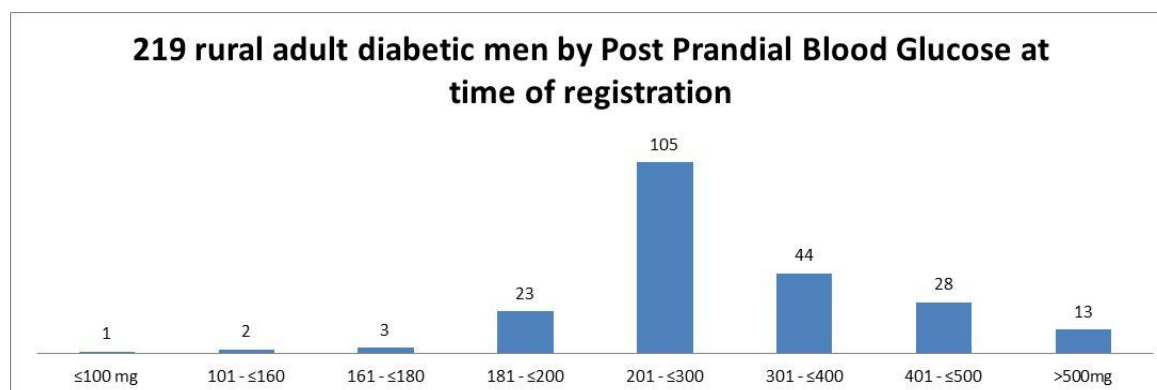
The figure below shows the roughly the same group of women but now by quantity of BG “after eating” also at time they registered as member of MoPoTsyo. The female average PPBG level is 290 mg/dl (compared with 297 mg/dl in men).

Figure 15 Levels of PPBG at time of registration among rural females with DM



For rural men, it is not much different.

Figure 16 Levels of PPBG among rural males with DM



Type 2 patients with FBG over 200 mg and or PPBG of almost 300 mg do not feel well, do not sleep well and cannot function well. The high glucose levels and the pattern of “explosive registration” as soon as screening takes place, suggest that there was a large unmet need for care by an undiagnosed ill population. In the Cambodian context

this may be explained by lack of trust in the health system and its lack of capacity, both private and public, to meet health needs related to chronic NCD of the adult Female and Male rural population.

Table 6 Rural BP profile at time of registration until end of 2010

Blood Pressure levels in mm/HG among Ang Roka OD members					
Systolic Blood Pressure	<130	from 130 - 140	>140	>160	Total members
Diastolic Blood Pressure	<80	from 80 - 90	>90	>100	
Diabetic Members	246	188	242		676
<i>Percentage</i>	36%	28%	36%		46%
Hypertensive Members			286	514	800
<i>Percentage</i>			36%	64%	54%
					1476

The table above gives the profile of membership In terms of BP. It is the first rural membership 3 years after the start (middle of 2007) of the project to create the PEN in a rural OD with 133,000 inhabitants when the intervention started and with 140,150 inhabitants on January 1, 2011. The BP levels are the levels recorded at the moment they register as member at different times and moments after middle of 2007 until the end of 2010.

The table shows that among 64% of DM (28% + 36%) at time of registration their blood pressure is too high, while only 36% has no problem with blood pressure. More detailed analyses have been carried out on an earlier subset of the same population, see below:

Among 618 Diabetics who registered, there were 396 Diabetic Females (64%) +222 Diabetic Males (36%) .

Table 7 Blood Pressure profile among rural Diabetics at their time of registration until October 2010

assessments done from May 2007 until October 2010 (rural female + male)					
Syst BP	<130	from 130 - 140	>140	>160	
Diast BP	<80	from 80 - 90	>90	>100	Totals
Diabetic	228	167	223		618
Not DM but HBP			358	382	581
					1199

Rural women in general but in particular when she has DM seem to have more severe problems with blood pressure than men as can be seen from the figure and tables below. When we test the significance with the proportions, $p = 0.240488$ so not significant yet (see annex), but when there are more mature networks it may become a significant difference. That is a matter of time.

Figure 17 Blood Pressure in Rural DM by Sex

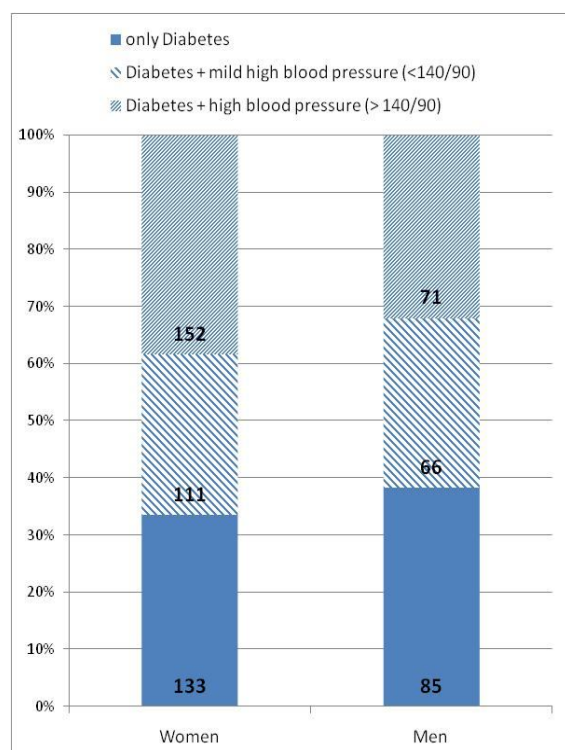


Table 8 Rural diabetic and non diabetic adults by sex and blood pressure

FEMALE Blood Pressure assessments done from May 2007 until October 2010					
Syst BP	<130mm Hg	from 130 - 140	>140	>160 mm Hg	
Diast BP	<80 mm Hg	from 80 - 90	>90	>100 mm Hg	Totals
Diabetic	34%	28%	38%		100%
Not Diabetic but hypertensive			35%	65%	100%
MALE Blood Pressure assessments done from May 2007 until October 2010					
Syst BP	<130mm Hg	from 130 - 140	>140	>160 mm Hg	
Diast BP	<80 mm Hg	from 80 - 90	>90	>100 mm Hg	Totals
Diabetic	38%	30%	32%		100%
Not Diabetic but hypertensive			33%	67%	100%

Of these women 85% report to be farmer. Only 20% of these women or households reportedly can be contacted by telephone. Their average household size is 5.1 persons. The average age of the membership in this rural district is almost 56 years old, but the women with DM are on average almost 7 years younger than the women with HBP at the time of registration. But as we saw, two thirds of those women with DM have too HBP as well.

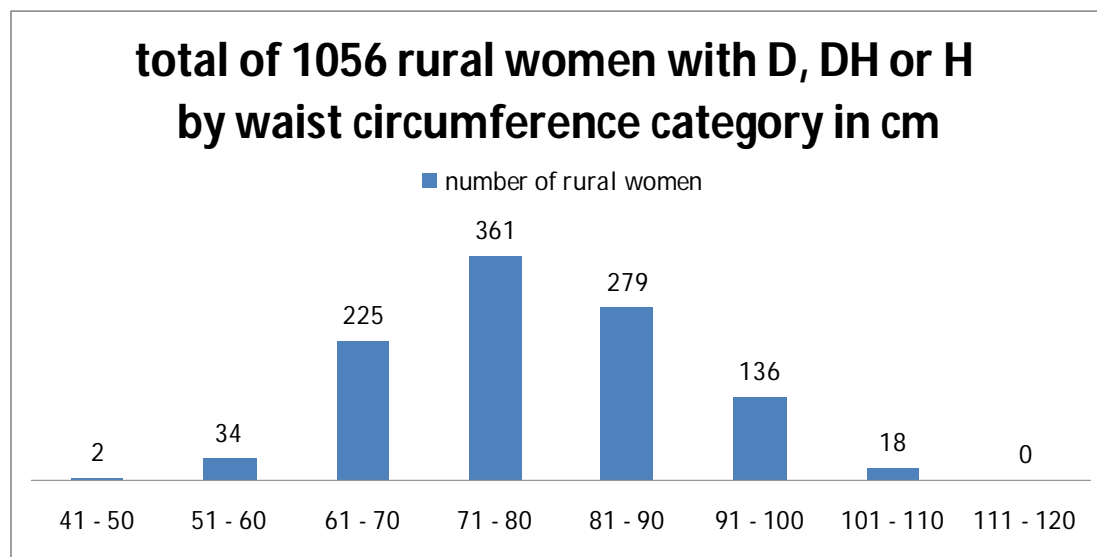
Waist circumference

In many countries waist circumference is used to identify people at risk in particular for DM while BMI is used to identify people at risk for other chronic diseases including HBP.

Below follows first a discussion of Waist Circumference and then BMI using the profile of the rural adults registering as a result of community based self screening for DM and HBP.

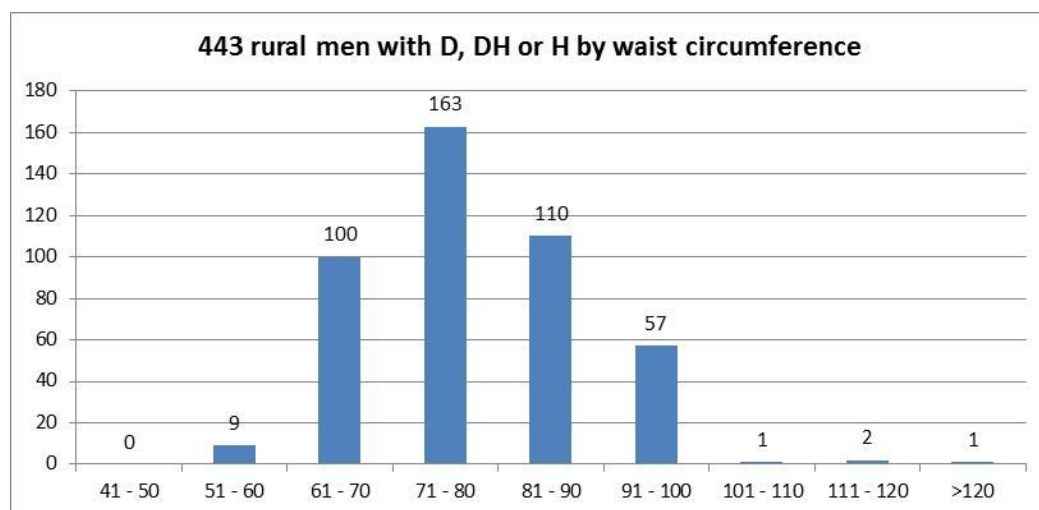
Internationally, often a waist of more than 90 cm or even of more than 100 cm is used as cut off point. In Asia often 85cm is recommended as cut-off point for determining who is more at risk for men, and 80cm for women. Some Cambodian health education materials promote the use of 95cm for men and 80cm for women, which is a large difference in waist size between the 2 sexes. In low income countries, such as Cambodia, patients with the larger waists are often the relatively wealthy ones, so this screening tool can function in the day to day reality as a socio-economic filter that discards the poor but captures the more wealthy patients. Its utility as screening tool depends on the objectives of the user. The strength of the correlation between waist circumference and socio economic status in the rural areas in Cambodia has not studied so no official data exist but it is likely positive.

Figure 18 Waist circumference of rural women with DM or HBP



On the X-axis the waist circumference is given in centimeters. The largest column is a group of women (361) with DM and or HBP who have a waist circumference of 71 to 80 centimeters, which is equivalent to 28 - 31.5 inches. The majority of Rural Cambodian women with DM and or HBP have a small waist.

Figure 19 Waist circumference of rural men with DM or HBP



And, as the figure above shows, for men it is the same. In the rural areas, the majority of men with DM or HBP have a waist circumference that is smaller than 81cm, so targeting men with a larger waist let alone a waist of more than 95cm misses most patients.

If we split the cases in 370 rural DM and 400 HBP females, we see the same phenomenon.

Table 9 Waist Circumference categories in rural females with DM & HBP

female waist in cm	HBP	DM
41 - 50	1	2
51 - 60	17	6
61 - 70	106	52
71 - 80	140	120
81 - 90	83	127
91 - 100	19	82
101 - 110	3	10
111 - 120	1	1
total # women	370	400

When these numbers are translated into proportions, we see that the proportion of women with DM with a waist that is smaller than 81 cm is huge. Using 80cm as criteria above which to target women and screen for DM, is not appropriate also because the women with a waist smaller than 81cm are probably the poorer ones and they need to be made aware of their DM to protect themselves.

Figure 20 Comparing proportions waist circumference categories in rural females 370 DM & 400 HBP

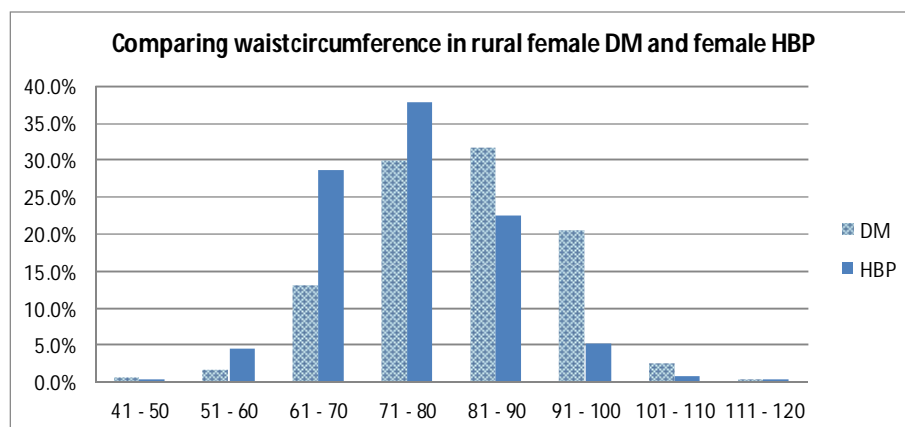
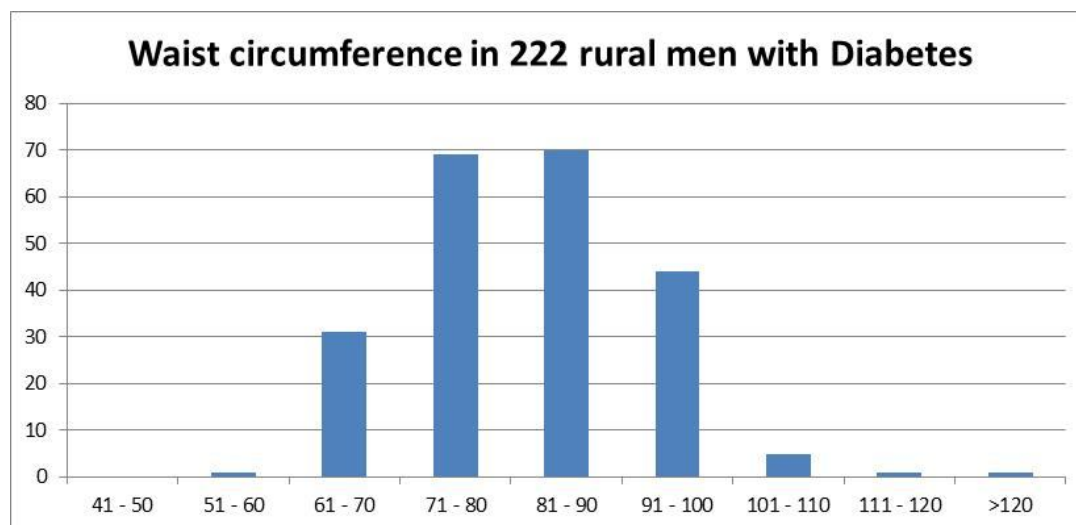


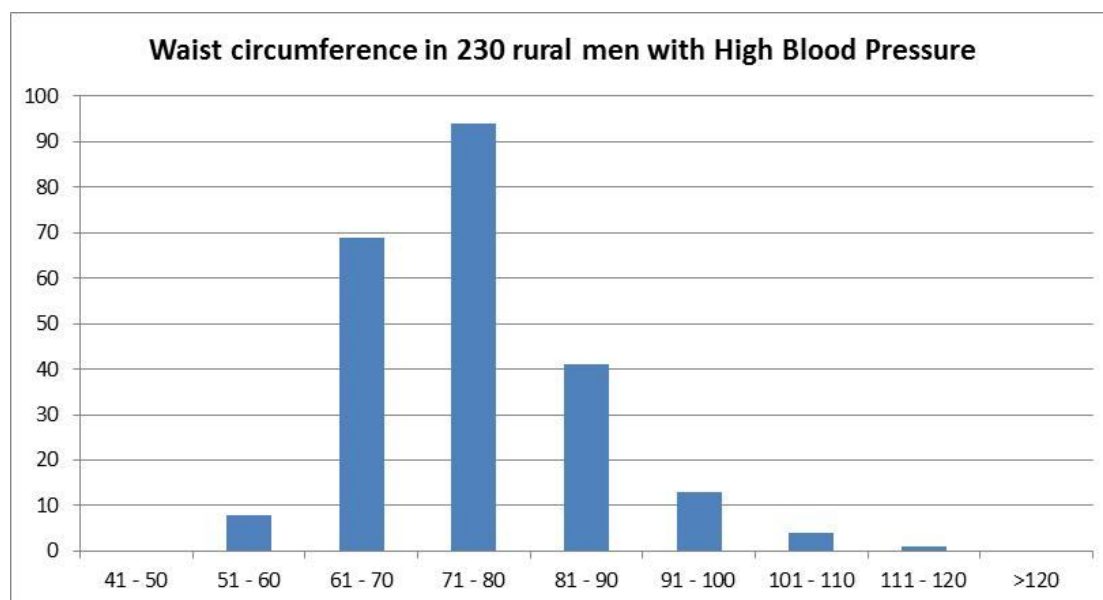
Figure 21 Waist circumference categories in rural men with DM



While it is true, that in rural Diabetic men, there are more with a large waist than in rural non-Diabetic men, the sometimes suggested cut-off point for waists in Cambodian men at 95 cm is inappropriate to be used for targeting risk groups in screening because there are so many Diabetic men with a much smaller waist than that. They are more likely to be poor than the men with a waist of more than 95cm. Even targeting men with a waist of more than 80 cm as risk group for DM screening appears not to be right for the purpose.

To detect HBP (over 140/90) in rural men, it is of no use either to target men with a large waist.

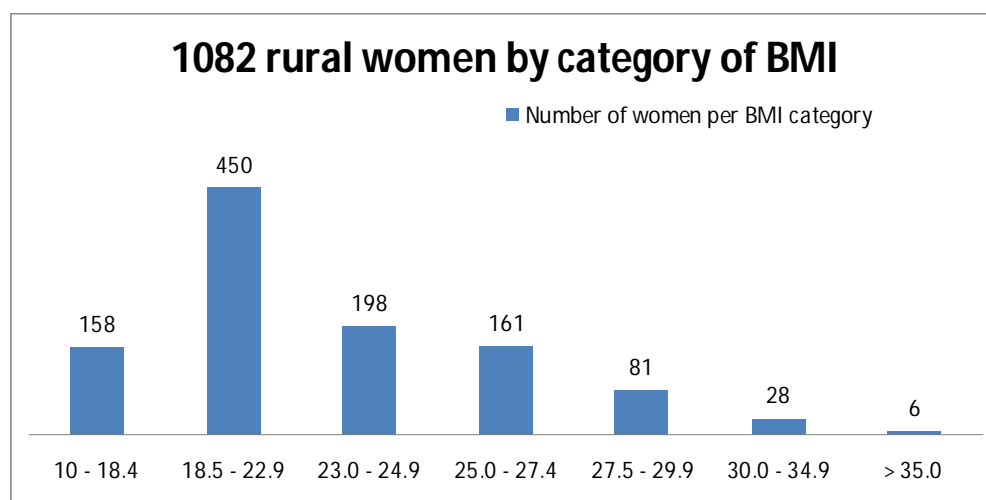
Figure 22 Waist circumference categories in rural men with HBP



Body Mass Index

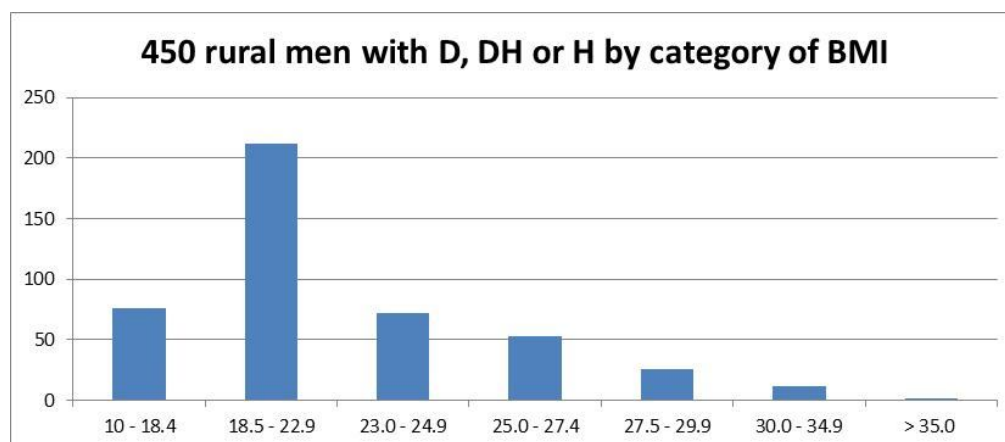
Also the BMI of women with DM, HBP or both that have become member is relatively low when compared to BMI's in developed countries.

Figure 23 BMI of female rural membership with DM or HBP



The data show that most rural female patients with DM and or HBP are found in the category with BMI lower than 23.0. For men it is the same, as seen in the figure below.

Figure 24 BMI in 450 rural men with DM or HBP



It reinforces the argument that was made above regarding the waist circumference: it is unfit for purpose in Cambodian society to focus too much on heavy adults with a bit larger waist and high BMI as the ones at risk of DM and HBP and suggest that they should be targeted for screening activities excluding the ones with smaller waists and normal BMI. The heavier adults are proportionately more at risk than the slim ones, but their numbers are small when compared to the needs of the population. The downside of this targeting of people with a large waist and higher BMI is that it sends the wrong message to many Cambodian adults with normal BMI and normal waist who in fact need to be alerted. It excludes most of the poor adults because they are usually not heavy with a big waist. BMI in rural Diabetic Men and Women shows that the proportion of overweight is larger in women than in men: 50% of women have a BMI >23.0 compared with only 42% of men. It is striking how many rural adults without overweight have DM. There is a likely positive correlation between BMI and socio economic status in the rural areas, but the strength of the correlation is not known. The lower BMI are more likely to be poor, not well nourished but affected by what is sometimes incorrectly called “disease of affluence”.

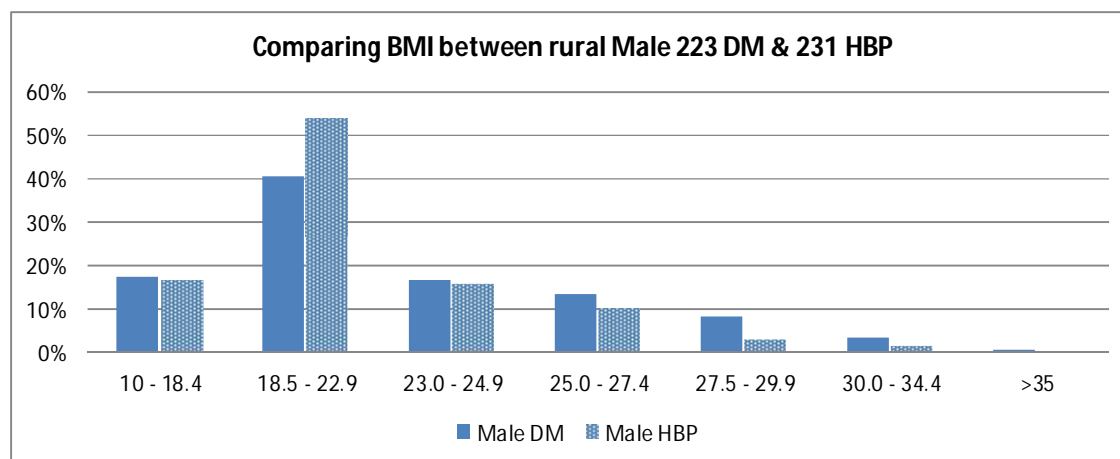
Table 10 BMI in rural Diabetic Males and Females members of MoPoTsyo

BMI	Rural Diabetics at Registration	
	Male DM	Female DM
10 - 18.4	39	54
18.5 - 22.9	90	151
23.0 - 24.9	37	81
25.0 - 27.4	30	75
27.5 - 29.9	18	29
30.0 - 34.4	8	14
>35	1	2
Total number N	223	406
10 - 18.4	17%	13%
18.5 - 22.9	40%	37%
23.0 - 24.9	17%	20%
25.0 - 27.4	13%	18%
27.5 - 29.9	8%	7%
30.0 - 34.4	4%	3%
>35	0.4%	0.5%

BMI < 23.0	58%	50%
------------	-----	-----

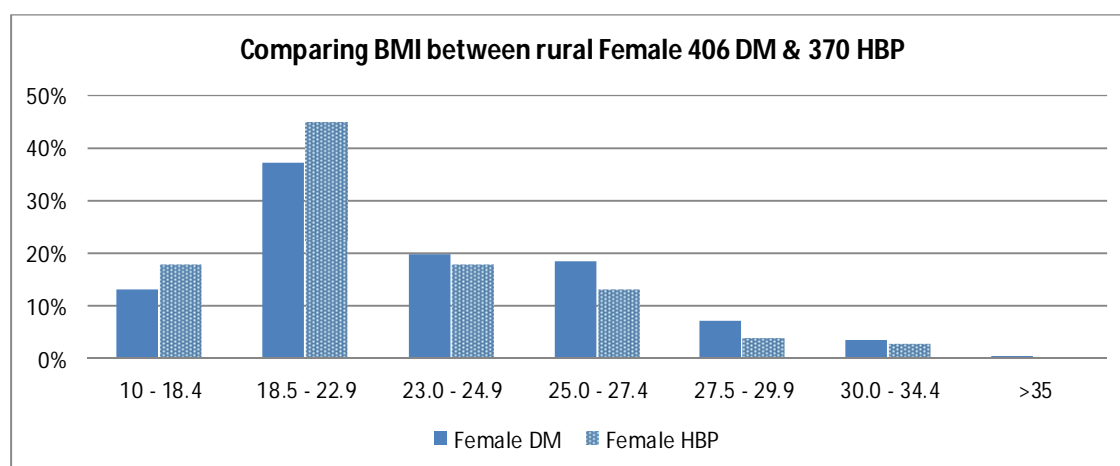
Average BMI	22.4	22.8
-------------	------	------

Figure 25 BMI categories of rural male members of MoPoTsy with DM & HBP



For rural women with DM or and women with HBP the same phenomena appear: large proportions of women who are registering for DM have a low BMI and even larger proportions of women registering with HBP have low BMI values in the rural areas. They are registering as a result of active community based self-screening organized by peer educators. Targeting only women with higher BMI as risk groups is not appropriate and can send the wrong signal to those with a relatively low BMI but who are unaware they are affected.

Figure 26 Comparing categories of BMI among rural females with DM & HBP



In summary:

DM screening: Community-based self-screening organized by peer educators is not technically perfect but it helps to unhide two thirds of a hidden problem. For DM the most commonly shared risk factor that can be observed at low cost and without having to do a BG test is the positive urine glucose that many people have who are unaware of their DM. BG testing may be too costly to detect the DM patients among the Cambodian population. Other risk factors that are used in developed countries to select risk groups (overweight, large waist) are not equitable and not fit for purpose in Cambodian society. The cost will be described in the chapter on cost.

Blood pressure screening: There is also no reason to limit screening to adults with observable risk factors other than a certain age. As the screening is organized as part of awareness promotion the younger adults are when they take notice of their blood pressure and understand its value the better. Once the Village High Blood Pressure groups are in place there the cost of self-screening for elevated blood pressure in any adult has become negligible.

Physical exercise at time of registration among rural members is reported by them as follows:

exercise	295
no exercise	311
	606

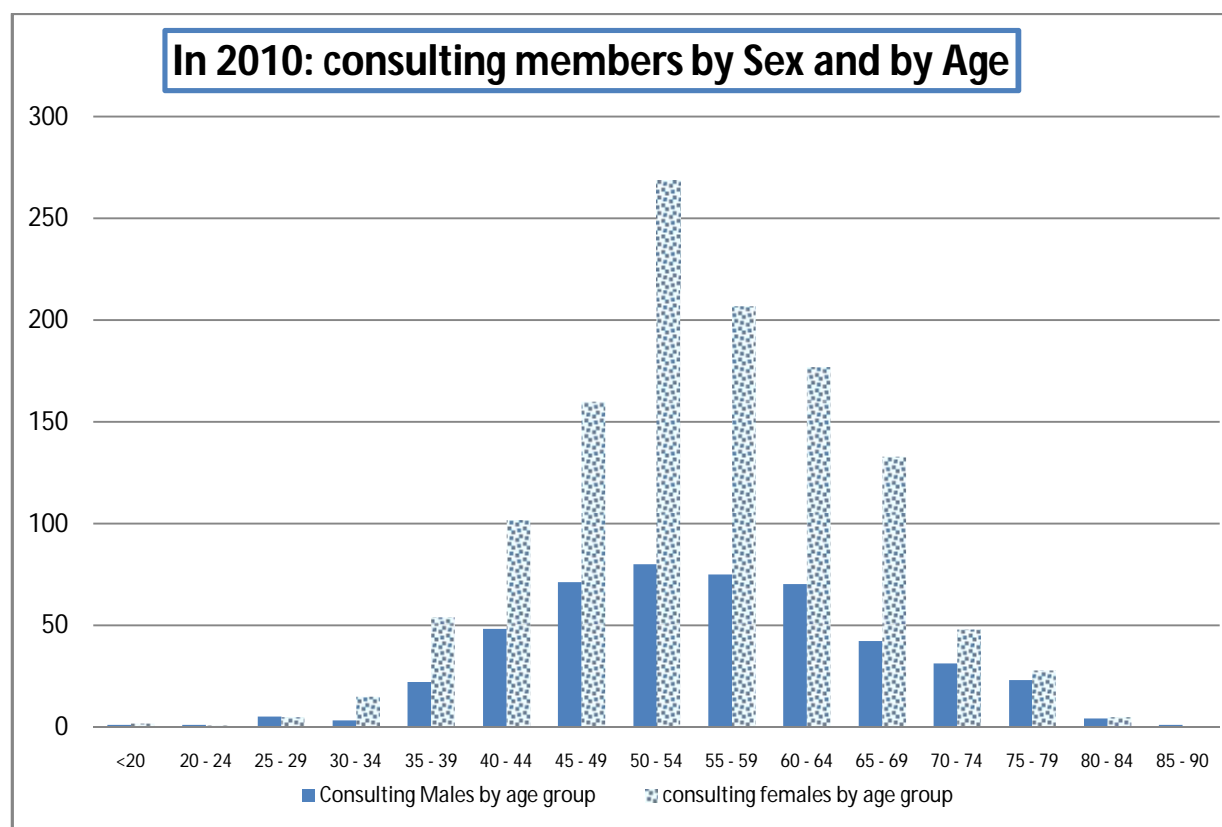
The person who interviews the new patient is using in the question the khmer words for “exercise” (hatpraan) and “physical labor” (polekam) so both types of physical activity are covered when the patient answers. At time of registration, only 209 out of 606 members with DM said that they do heavy physical activity or exercise during half an hour or more (34%) per day, whereas 49% said that they were doing “some exercise”. Together they calculate how many minutes this is per day in an average week.

HEALTH SERVICE UTILIZATION

MEDICAL CONSULTATIONS

Women are disadvantaged in many aspects of Cambodian society. They are however able to make good use of the PEN as long as they are productive and not too old. Women do not just constitute an overwhelming majority of the membership, they also make more use of the available medical consultations. In 2010, there were 1683 medical consultations organized at local Referral Hospitals by the predominantly male Peer Educators on special days, about twice a month, with a male visiting medical specialist in DM.

Figure 27 Consultation by sex and age



72% of consultations were for female members, and only 28% for males suggesting that women benefit not just by becoming member (64% female members and 36% male members) and receiving the counseling services and trainings in self-management, but also that they are slightly crowding out the men from the medical consultations that are organized for them. Their utilization appears to be more than proportionate overall, but we have to look at this in more detail.

Table 11 Medical Consultation by sex, age

male consultations	477	28%
female consultations	1206	72%
total consultations	1683	100%

The average ages of the consulting females and males are almost the same, with the women on average just about five months younger than the men.

average age of consulting male	55.4
average age of consulting female	54.9

However, as they get older, women gradually lose their comparative advantage in service access, so there may be a gender issue, a women's inequality issue, lurking behind these figures that affects older women's access to medical consultations. It is impressive to see in the figure above how above 70 years of age women's utilization abruptly collapses.

Table 12 Access to Medical Consultation by old patients

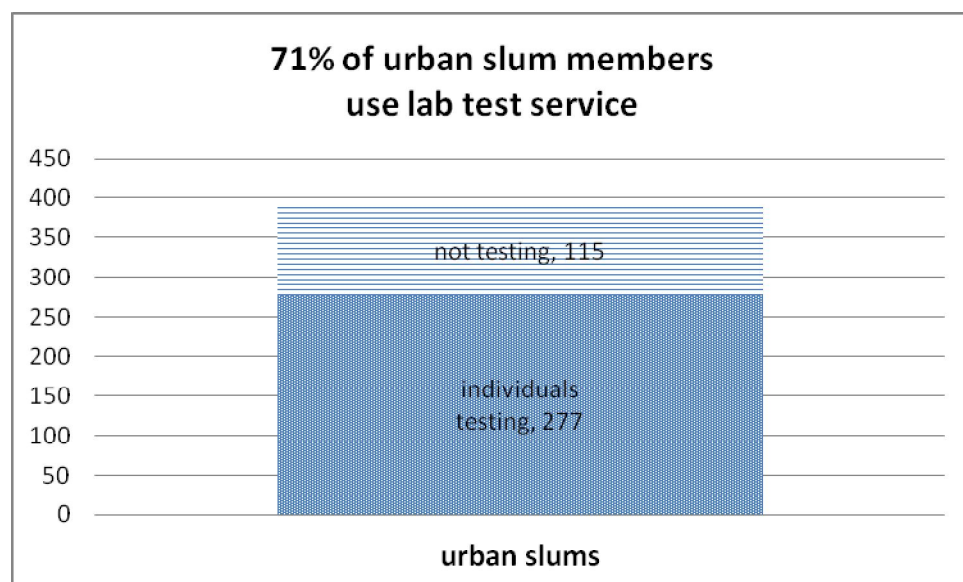
among consulting males	36%	is > 60 years
among consulting females	32%	is > 60 years

among consulting males	1.05%	is > 80 years
among consulting females	0.41%	is > 80 years

LABORATORY SERVICES:

The laboratory services were introduced in early 2010. By the end of the year 71% of the members living in the urban slums had used the service, 30% had used it twice and the 29% had not used the service. The reason for not using has not been investigated, but probably poverty and availability are main reasons. However, in the first six months of 2010 there was no charge to the patients for the laboratory services.

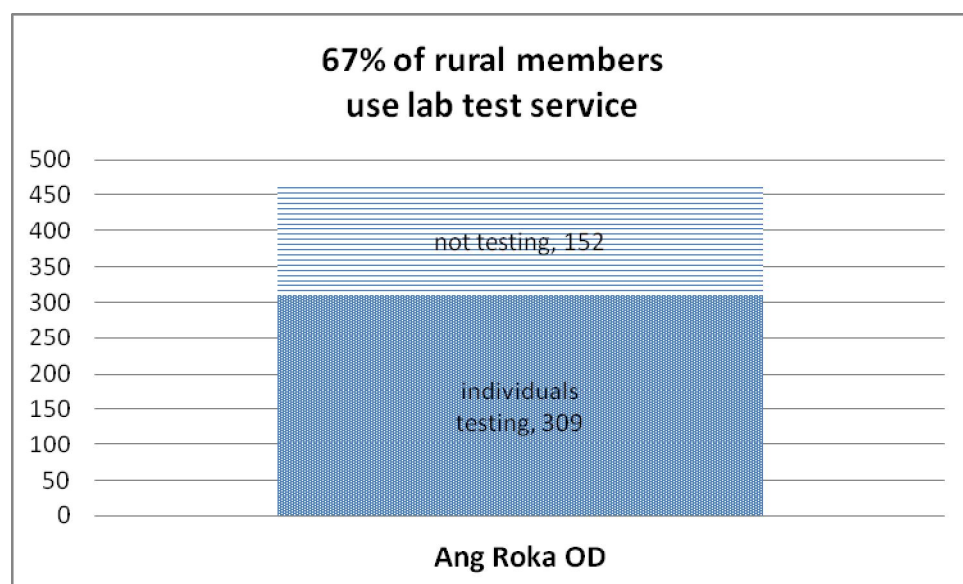
Figure 28 Use of laboratory services in 2010 by DM who are slum inhabitants



In Ang Roka OD, the rural district, the emerging picture at the end of the year was quite similar: two thirds of the rural members used the service, so one third did not. But 34% of the lab users in the rural area used the service

twice. The main reason for using the service twice is probably that people who had already used it were selected as part of the random sample for the mid 2010 assessment. For them using the service is free of charge.

Figure 29 Use of laboratory services in 2010 by rural DM members



In the NGO's database the laboratory results are linked to the patient ID, so over time with once yearly testing it will be possible to track progress or deterioration of the kidney function in order to take the necessary steps.

By sex and age:

In the same rural area, the use of laboratory services by the NGO's members was analyzed by sex over a period of 14 months (January 2010 until February 2011) to determine if men and women have equal opportunity of access to the laboratory services. There are 64% female and 36% male members.

Figure 30 Access to laboratory services by sex

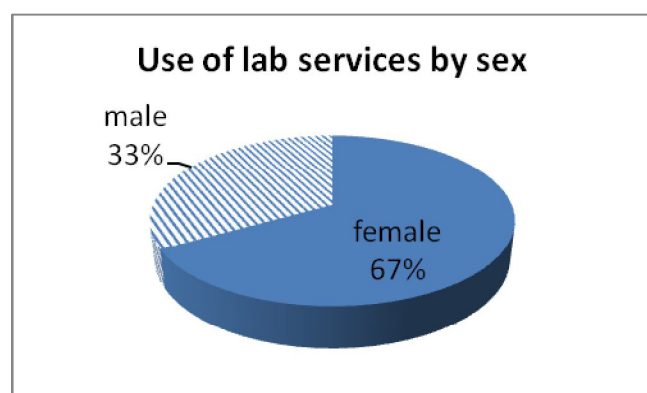


Table 13 Proportions and absolute numbers by sex and age of access to laboratory tests

Females	Males	Age of the member with DM	Nr Females	Nr Males
23%	29%	>60 years of age	59	38
0.4%	1.6%	>80 years of age	1	2

It is of course not correct to use in the table above percentages to indicate proportions of these very small numbers of people over 80 years old, but over time it will be interesting to monitor how this indicator develops when we will aggregate the results from all districts. With aggregation we will be able to see if indeed with progress of age women lose their good and equal access to laboratory services and if we can solve the problem.

The women are on average almost 3 years younger than the male users of the laboratory services. It is interesting to see that the average age of female users of the laboratory tests is more than 3 years younger than average age (54.9) of female users of consultation services, whereas in male users the difference is only 1 year and 6 months (average ages 54.4 compared with 55.9). The lower average age of female users of laboratory services could be the result of women being or feeling more affected or more risk averse and more willing to spend on preserving their health than men.

Table 14 Average age of rural users of laboratory tests by age in 2010

Average Age		Nr
51.5	Female	260
54.4	Male	129

Table 15 Age of Rural Female DM members using laboratory services between Oct 2010 and May 2011

average age	55 years old	In total of 647 Women
15 - 49 years	198	31%
> 60 years	186	29%
> 80 years	1	0.15%

Almost a third of the diabetic women in the rural areas who are member of MoPoTsyo and who have used the biochemistry laboratory services are in the fertile age group. Diabetic women who become pregnant require special follow-up and advice during their pregnancy. Normally, they must switch to insulin treatment for the duration of the pregnancy. In theory this is possible, but there is no special record in the database of female diabetic members who become pregnant and the resulting changes in medical treatment. If blood glucose lowering medication is required, the women can receive the training on how to use the insulin during their pregnancy through the Peer Educator Network. The Peer Educator and the network can perhaps become more focused on these and other important maternal health issues but for this the role of peer educator needs to be well integrated into the primary care system.

The table below shows laboratory results of men and women who are member of the NGO and have DM. Some of these differences between the sexes must be mainly attributed to biological differences such as muscle mass in the case of creatinin results. The high triglyceride results are often seen among Diabetics and can be the result of

intake of large quantities of white rice and of alcohol. The rate of alcoholic diabetics has not been measured, but alcohol is a problem among the general population as shown in the STEP survey, including occasionally for some peer educators including for some female peer educators. The laboratory results below are not representative for membership as a whole because the users are patients who have come forward themselves for whatever reason, or have been encouraged by the peer educators to do the test before they will see the doctor. The table below is also not representative of the average laboratory value of the general population nor the members registered with DM. It is a mixture of new and old members wanting to pay for the laboratory results and those who have been randomized at time of 6-monthly assessment of the performance of the PENs.

Table 16 Laboratory results by % and number by Sex in rural area (October 2010 to May 2011)

Rural female members with Diabetes

Creatinin	Number tested 640	
	average	0.99
	>1.1	30%
	>1.3	6.3%
	>1.5	2.5%

HDL	number tested 566	
	average	48
	<50	59%
	<40	26.1%
	<30	5.1%

Total Cholesterol	number tested 537	
	average	210
	>250	20%
	>300	5.6%
	>400	0.9%

Potassium	number tested 411	
	average	4.1
	<3.5	18%
	>5.0	6.6%
	>6.0	1.7%

Triglycerides	number tested 591	
	average	288
	>150	79%
	>300	33%
	>400	17%

Blood Glucose	Number tested 442	
	average	157
	>110	62%
	>126	48%
	>180	27%

Rural male members with Diabetes

Creatinin	Number tested 299	
	average	1.19
	>1.5	9%
	>1.8	5%
	>2.0	2.3%

HDL	number tested 252	
	average	44
	<50	71%
	<40	40%
	<30	6.7%

Total Cholesterol	number tested 247	
	average	201
	>250	11%
	>300	5.7%
	>400	0.8%

Potassium	number tested 214	
	average	4.3
	<3.5	14%
	>5.0	8.4%
	>6.0	0.9%

Triglycerides	number tested 277	
	average	279
	>150	75%
	>300	31%
	>400	18%

Blood Glucose	Number tested 225	
	average	163
	>110	62%
	>126	50%
	>180	30%

ACCESS TO ROUTINE MEDICATION

From the routine data in first half of 2010, the available invoices and the randomly selected DM patient interviews in July 2010, and a small survey carried out in September 2010 and a second period of six months (October 2010 until March 2011), it becomes clear that as may be expected many patients do not purchase medication monthly. But what is much more important is that the comparison shows some progress.

	First six months in 2010 01-01-2010 until 30-06-2010			A later period of six months 01-10-2010 until 31-03-2011		
	DM	HBP	Total	DM	HBP	Total
Ang Roka OD in Takeo province						
Number of members with a prescription	340	11	351	402	103	505
Number of members who bought	161	15	176	238	65	303
Total number of monthly invoices			382			998
How many bought one time			97			135
How many bought ≥ two times			179			168
Average nr of invoices per patient			2.2			3.3
Average cost of invoice in riels			19,040			15,015

Total of patients registered	672	704	1376	747	1098	1845
Percentage of members with a prescription	51%	2%		54%	9%	
Percentage of members with a prescription who bought	47%	136%		59%	63%	

The DM program started in this rural district in July 2007. In 2010 a large number of people with HBP registered as member as part of the expansion of the scope of the intervention. This explains part of why the proportion of people with DM and a prescription who actually buys their medicines is much higher than the proportion of people with HBP who do not have DM. There are more reasons discussed below.

For this rural area the low proportion of diabetics with a prescription is also no surprise, because many diabetics were early diagnosed as a result of screening and lifestyle changes have had positive effects. Many do “not yet” want to get a prescription but are aware of the prospect. They are trying to ward off the moment. The DM patients with a prescription give several reasons for not adhering to a routine prescription in Cambodia:

1. It costs money: on average between USD 3 and USD 5 per month for every DM patient. (In the first half of 2010 the exchange rate still stood at 1 USD = 4250, whereas in 2011 it is 1 USD = 4000 riels).
2. The symptoms that were annoying the patient at the time the patient received the prescription are no longer there. The patient feels better than before as a result of the combination of lifestyle changes and medication which have given patients a feeling of control over their disease;
3. Side effects of medications, difficulty because of the size of the tablet, fear of hypoglycemia, etc.
4. No time or means of transport to travel to the pharmacy to buy the medication.

There is no quantitative survey done to find out which reasons are really the most important ones. Peer Educators have no financial advantage from the sale of medicines but they are aware that financial sustainability of the

intervention hinges on the use of the RDF by the members. The Peer Educators receive 500 riels (USD 0.12) for each original invoice that they collect from the patients and return to the NGO for monitoring of adherence. The NGO compares these original invoices with copies it collects from the pharmacies. Peer Educators will encourage patients with abnormal values to buy medication but if patients cannot afford the medication their advice cannot be followed by the patient. The affordability of the routine medication depends on 3 factors:

1. The monthly cost of the prescription medication
2. The socio-economic situation status of the patients
3. Distance between home and dispensing point

There are non-poor patients who face a problem because of factor 1 and there are officially pre-identified poor patients who should experience difficulty because of factor 2 but who do not have a problem with factor 1. Factor 3 can be a problem for poor patients and for non poor patients, for example older patients who depend on others to purchase the medication.

There are more barriers: In particular with regards to HBP the overall attitude with regards to adherence to routine medication to control HBP needs to change. Here the problem is not just the patients, but also the private and government health staff at all levels of the health system. Cambodian health staff has been trained to treat HBP as an acute problem instead of as chronic disease. A patient who presents herself for treatment receives 3 days anti-hypertensive medicine from health staff. This as part of the MoH policy instructed to health center staff. The patient is told to come back in the future in case she feels unwell again. Many health staff themselves also only “occasionally” take some anti-hypertensive medicines when they feel they have HBP and stop again when they do no longer experience certain symptoms. It is very difficult for trained peer educators to begin to contradict this advice.

Another reason why the adherence by HBP patients is worse than the adherence by diabetic patients is that diabetic patients are directly trained and educated by peer educators and directly followed-up every month. The large number of HBP patients makes that they must be followed in groups per village through the newly formed Village High Blood Pressure Group with its leader and register. This is a relatively new system only created in 2010. For HBP patients at the village level it is confusing to get these different messages about having to take medicines every day or not every day for the rest of their life. The easiest way for these people at village level is to believe the health center staff and take 3 days of free medication once in a while when symptoms appear. It will time and coordination in order to solve this issue.

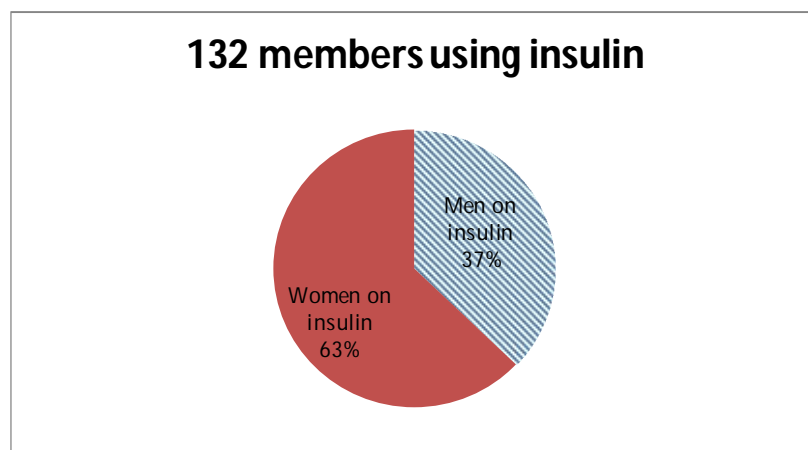
In DM care, there is no such a local alternative health policy, so the peer educators are able to fill the vacuum with what they have learned on the importance of taking daily medication.

Reason number 2 above can be perfectly valid for DM patients who stop taking their medication. If a patient no longer has high blood sugars the patient must not only reduce the intake of medication, she can even stop as long the blood sugars remain within the normal ranges. Self management includes the skill and practice of self-monitoring of urine glucose presence and regular FBG values and post prandial glucose values to determine if this is the case. It is in the community based program at the moment impossible to say how reason 1 and reason 2 in DM care get mixed up. There must be many DM patients who in fact should be taking medication but they feel much better already so they don't buy or have financial difficulty to buy. We cannot simply say that these adherence problems will disappear if the price of medication will be lowered or even if the medication would be available for free. It is very easy for someone to say that he or she cannot afford the medication if in fact the other

reasons also play an important part on the non-adherence. If that is the case then throwing money or pills at the problem will only make the situation worse because the medication will be perceived as of little or no value by the patient. It is important to create and foster a desire for the right kind of medication. Peer Educators do not have to report on what the problem is of each individual patient so the weight of each of the 4 reasons above is unknown.

Gender: The access to medication for diabetics including insulin for men and women is proportionate with the men and women among the membership. Below is the example of access to insulin.

Figure 31 Access to insulin by sex for 132 members with DM in 4 provinces



OUTCOMES INCLUDING EFFECTS ON PATIENTS

1. early detection, community based-self screening and its costs;
2. knowledge
3. improved lifestyle
4. self-management
5. Health improvements (Health outcomes)
6. Lower health expenditure
7. Retention

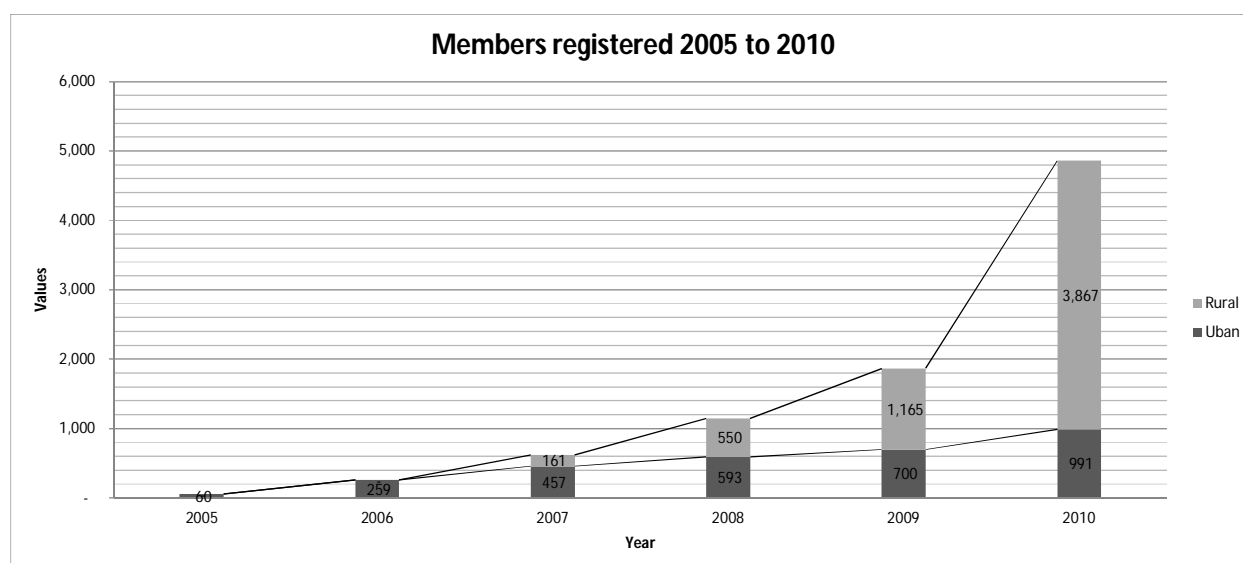
EARLY DIAGNOSIS, DETECTION, COMMUNITY-BASED SELF SCREENING & COSTS

The STEP Survey of 2010 found that 2.3% of adults over 25 years old but not older than 65 years has DM. In Ang Roka OD there is in February 2011 an estimated population of 140,150 residents. The proportion of people aged 25 to 65 years is about 40% of total population in Cambodia, so 56,060 adults. If 2.3% is correct, then 1289 among

them should have DM. Per February 2010, the Peer Educators had registered 749 adults with DM, which amounts to 58% of the estimated prevalence.

The 2010 STEP survey showed that 8 out of 10 people with HBP were unaware of their condition until the survey diagnosed them with HBP (82.4%) in the rural areas. The report does not give the proportion of newly diagnosed DM but the 2004 survey (H King et al., 2005) puts this proportion at two thirds of the DM, higher in men than in women and higher in Slem Reap (rural) than in Kompong Cham (semi-rural). MoPoTsyo screening experience in rural Ang Roka showed that only 28% of patients know they have DM, so the PEN's activities in a time span of 3 to 4 years more than double the proportion of people who are aware of DM bringing it from 28% to 58%. For HBP the peer educators have stopped the screening activity to allow the health system to find an appropriate solution for the treatment of the ones that have been detected so far. According to the STEP survey the rate of HBP among adults over 25 years old in rural areas is about 4 times that of people with DM. This is also what has been found in practice by the peer educators in the rural areas. The detection of HBP patients is easier and less costly than of DM patients using the PEN as the organizer. Because of the unresolved issues around HBP and its treatment with routine medication, the priority is not to detect large numbers of HBP patients but to focus on solving this issue and the functional integration of PEN and their patients within the government's primary health care system.

Figure 32 Members registered from 2005 to 2010 in urban and rural areas



STRENGTHS AND WEAKNESSES OF COMMUNITY-BASED SELF-SCREENING FOR DM

The table below shows the year that men and women with DM who become member of MoPoTsyo report to be the year that they have become diabetic. These data only regard the members residing in the OD of Ang Roka in Takeo province. The higher numbers in 2007, 2008 and 2009 are likely the result of self-screening for DM by the adult population. This community based self-screening is facilitated by the Peer Educator Network. From the middle of 2007 until late in 2009, the Peer Educator Network distributed one urine glucose strip for every adult in the operational district, household by household, village by village.

Table 17 Effect of self-screening for DM organized by a rural PEN

Assessment by Peer Educator: Since which year do you have Diabetes ?			
	11	2010	10
end urine glucose screening	66	2009	37
urine glucose screening	165	2008	88
start urine glucose screening	77	2007	52
	22	2006	7
	14	2005	8
	8	2004	5
	9	2003	3
	3	2002	3
	2	2001	1
	2	2000	2
	3	1999	0
	1	1998	1
	2	1997	1
	0	1996	0
	0	1995	1
	0	1994	0
	0	1993	0
	0	1992	0
	0	1991	1
	5	unknown	1
	390	Total	221
	Women	DIABETIC	Men
	79%	611	80%

The data suggest that running a diabetes clinic at provincial level (2002 until 2009) providing free care is by itself not enough and that active screening is needed to uncover hidden needs. The data show that active screening is possible in rural areas, that it helps women in particular, and that is affordable if done by the PEN as described below.

The urine glucose strips that were used for this activity came from Vietnam but when supply from there stopped, they were replaced with an ACON® strip called Mission™ Urinalysis Reagent Strip. Before distributing the strips the Peer Educator provides information about diabetes and about symptoms of diabetes, the advantages of early diagnosis. He or she explains the household representative how to use this urine glucose strip to detect the presence of glucose in the urine after a normal meal and leaves one strip for every adult in the household including for every pregnant woman. On the next day or days the Peer Educator is again available in that village visiting the same households in order to provide counseling about the results, in particular for those whose urine glucose strip has changed colour. With them, the Peer Educator makes an appointment in order to carry out a confirmation BG test using a handheld BG-meter. That test is free. It is preferably an FBG but it may be a PPBG test. All peer educators use the same type of BG meter and BG strips. The standard BG meter that they used from the first activities in the urban slum in July 2005 until completing the screening in 2009 in Ang Roka OD was Accucheck® of Hoffman-La Roche. However, in 2010, MoPoTsyo changed and provided all Peer Educators with an On Call® Plus from Acon® REF G113-111 for testing whole blood for self-testing and professional use.

This screening method is far from perfect because of several reasons and circumstances:

- Urine glucose tests are not very sensitive in the lower BG values. This causes DM cases to be missed. Those DM patients miss the opportunity to find out that they are in fact DM and continue unaware;
- DM patients with elevated renal threshold are also missed although their BG values may be well over 200mg/dl;
- Adults may manipulate the urine strip incorrectly so there is no correct result;
- Adults may fail to spot the change in color if the change is only observable for trained users;
- Also, it has been established that screening using FBG to find DM yields another diabetic population than using PPBG. If the urine strip is used correctly, the positive urine glucose strip signals in its own imperfect way that at some moment between the last meal and the urine test two hours later a sufficiently high level (diabetic level) of PPBG glucose has occurred. It is not entirely logic then that the screening system used by the PEN seeks confirmation with Fasting Blood Glucose, because it combines the two criteria on one patient instead of using them complementary to find as many patients as possible. However, not to do it this way is impractical for other reasons including management. In the example from Taiwan where school children were routinely screened for diabetes using a urine glucose test, but on morning urine, also the urine glucose strip functioned as a first filter and blood glucose test as confirmation.(J.-N. Wei et al., 2003)

Peer Educators are trained to know and are supposed to explain to the adults who they talk with that a negative result does not mean that the person does not have DM and that a positive result means that the person has DM. However, there is little guarantee that this information always reaches the self-testing person at the moment it is needed in the privacy of their home. The advantages of using the method have to be balanced against the disadvantages. The disadvantages can be reduced by strengthening the provision of accurate information and by repeating the self-screening regularly. Having the activity organized by an existing PEN lowers the cost, increasing the chance for it to be regularly repeated if from repeated prevalence surveys it can be deducted that there must again be a sufficiently large hidden diabetic population. The decision to repeat the screening can be based on comparing the numbers of registered DM with the estimated prevalence. However, at such occasions and with the PEN fully in place and equipped, it will be more cost effective and more appropriate to offer the opportunity to get a proper BG test together with other risk factor tests including Blood Pressure and raising awareness on how to control or improve these risk factors.

CALCULATING DM PREVALENCE IS COMPLICATED

A precise calculation is complicated: the MoH STEP 2010 survey found a prevalence of 2.3 % of DM in the rural areas using another cut off point for DM, namely 6.1 mmol which is equivalent to 110 mg/dl (page 71 of the STEP survey report) instead of 126 mg/dl (7 mmol) which is more common and which is used by the PEN as definition of DM in FBG, together with 10 mmol (180 mg/dl) in PPBG and which is also used normally by the WHO itself following recommendation number 7 on page 3 of the 2006 consultation between WHO and IDF. (WHO-IDF, 2006) Also, the age group that was surveyed in the STEP survey is smaller: 25 years until 65 years, whereas MoPoTsyo's peer educators teach self-screening to all adults and pregnant women of any age. The prevalence among the older persons in the survey is as high as 6% as people tend to develop DM the older they get. According to the STEP survey there should be 2.3% of adults over 25 years old with "DM" (40% of the total population) using the larger

definition of DM, whereas the community based self screening finds 1 in 100 adults based on the normal definition of DM ($\geq 126\text{mg/dl}$) among 50% of the population including pregnant women. It is probably not possible to extricate this messy comparison, but what can be said is that although certainly DM cases are missed out most are captured which makes this still a highly cost effective and empowering screening method of MoPoTsyo. Sometimes more can be achieved in a messy way than by focusing on technical perfection, and this could be an example. Let's not make the perfect the enemy of the good. These complexities must be borne into mind, when PENs are being given targets for detection based on the STEP survey in the future.

There are several other methods as well to determine Diabetes and each method has its own strength and weaknesses but they are all more costly than the used combination of two steps, which is far from perfect but which helps to increase early diagnosis substantially and quite systematically at relatively low cost.

COSTS OF SCREENING FOR DM

With the PEN in place in Ang Roka OD, the DM screening can be repeated there among the 50% adults in a rural population of 140,000 people over a period of one to two years for an estimated cost of USD

This amount would be spent mainly on materials such as urine strips, seizing the opportunity to equip all peer educators with a new BG meter and BP meter, and on reimbursements to the peer educators for their activities including the carrying out of Blood Glucose confirmation tests, and assessments of new patients based on a result of 700 new DM patients. The total amount is to be used over a period of two years.

Health Centers = Peer Educators :	10
adults screening :	70,000
target diabetics :	700
CATEGORY	Costs
SCREENING Diabetes	
1. Incentives for Screening Diabetes	\$ 3,500
2. Transportation for Screening Diabetes	\$ 1,200
3. Strips for BG-meter	\$ 280
4. Needles for BG-meter	\$ 35
5. Urine Strips	\$ 1,750
6. Boric Acid (not used)	\$ -
7. Screening Materials for Diabetes	\$ 960
8. Equipment for Screening Diabetes (BP & BG-meters)	\$ 570
<i>total SCREENING for Diabetes</i>	<i>\$ 8,295</i>

With the PEN in place, the costs of the counseling, training, patient education, the diagnostic tests, medical consultations and medication are financed through the existing membership. There is no intention to charge an entry fee for membership in order to create no new barriers. This means that, if a new round screening would turn up another 700 new DM cases over one to two years, these 700 new DM are absorbed into the existing Continuum of Care which is for a large part self-financing.

KNOWLEDGE

Every six months a random sample of 19 patients is being interviewed to ask them the questions in the table below to assess their knowledge. The questions were formulated in 2006 and have remained mostly the same since then. The basis for these questions was the confusion or lack of knowledge that persisted among DM with regards to these issues. The baseline that was created showed that most of the time DM patients did not know the answers to any of these questions or gave the wrong answer. In 2005 and 2006 these questions were part of the patient assessment carried out by the peer educator for the registration of the patient. By including these questions again into the re-assessment it became possible to “measure” the progress. After some time seeing that the DM patients normally did not know the answers the baseline questions and peer educators asked to reduce the long list of assessment questions, these were considered as not essential and were therefore removed from the original assessments for registration. It is possible that nowadays new patients already know a bit more than back in 2005 and 2006. The results on the knowledge show therefore what patients know but there is less certainty about what they did already know if they registered in recent times.

The knowledge is (re-) assessed with the following standard questions :

Table 18 Re-assessment on "knowledge"

If you eat fish, does the blood sugar level rise ?.....	yes	no	don't know	
If you eat eggs, does the blood sugar level rise ?.....	yes	no	don't know	
If you eat trakoun, does the blood sugar level rise ?.....	yes	no	don't know	
If you eat watermelon, does the blood sugar level rise ?.....	yes	no	don't know	
If you eat grilled bread (=Toast), does the blood sugar level rise ?.....	yes	no	don't know	
If you eat white rice, does the blood sugar level rise ?.....	yes	no	don't know	
How high should the maximum blood sugar be in the morning if you have not yet eaten anything ?	don't know	Know :		
How high should the maximum blood sugar be AFTER you have eaten ?.....	don't know	Know :		
If your urinetest shows color, what does it mean for your blood sugar ?.....	it IS too high	it IS too low	I don't know	
How do you collect 24 hour urine ?.....	know :	don't know	don't know	
How high was your last Fasting Blood Glucose ?.....	know :	don't know		
How high was your last Blood Pressure Systolic ?.....	know :	don't know		
How high was your last Blood Pressure Diastolic ?.....	know :	don't know		
How high do you want your Blood Pressure to be ?.....	know :	don't know		
Which organs in your body make your blood sugar go up or go down?.....	Patient know s both:	Patient know s one	Patient does not know	
How do you keep your blood sugar at the right level ?.....	Patients know s 3 factors	Patient know s 2 factors	Patient know : 1 factor	Patient does not know
What is the name of your diabetes medicine ?.....	don't know	know w hat:		
What are the major risks if you have diabetes ?.....	1. small blood vessels			
	2. large blood vessels			
	3. heart			
	4. kidneys			
	5. eyes			
	6. nerve problems			
	7. extremities			
	8. wounds/infections			

Nature's more complex reality has had to been reduced to a straightforward “yes” or “no”. The questions are relevant in the Cambodian context. In all aspects of knowledge measured among the DM patients the older the program in the urban area beats the rural program in Ang Roka. There may be several reasons for this: the peer educators in the rural area have been somewhat distracted with setting up the HBP program, which is only happening in one slum area: AK and that is also the area where quality dipped in many aspects. Previous samples showed better knowledge scores among samples of patients in the same rural area. It may be that knowledge has

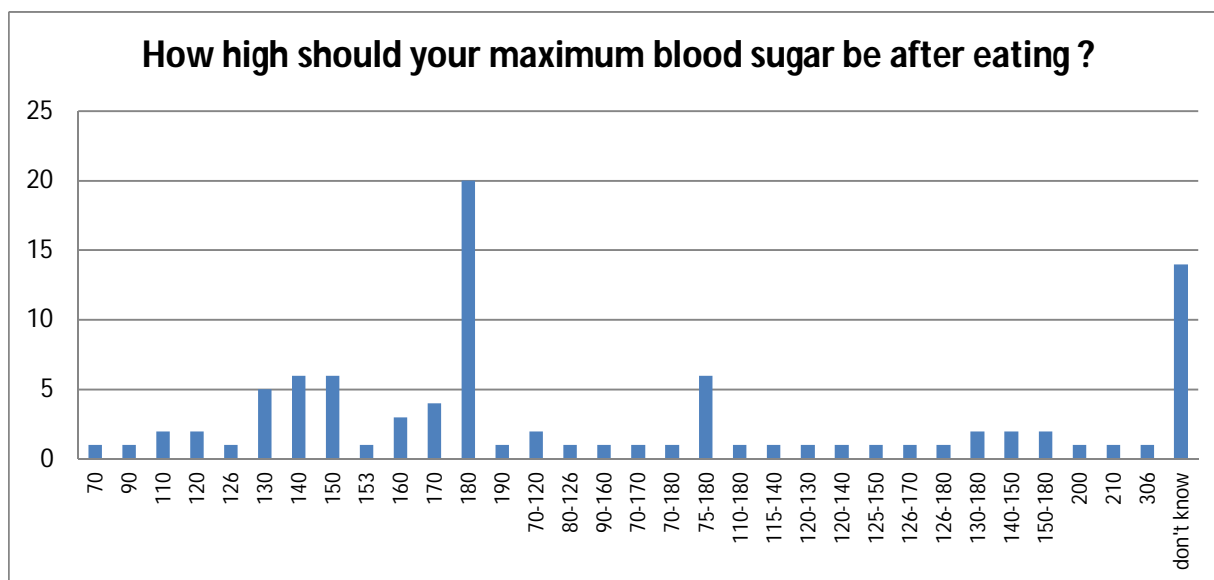
been forgotten. The knowledge levels that were the result of the re-assessments in the middle of 2010 showed the two samples were close together.

In the table below "*Total valid answers*" means "*total answers*".

Rural area July 2010					
Does your sugar level rise....	correct	don't know	wrong	Total valid answers	
If you eat fish	134	7	3	144	93%
if you eat eggs	99	10	32	141	70%
If you eat morning glory	124	8	11	143	87%
Ir you eat water melon	133	6	4	143	93%
If you eat grilled bread	125	4	14	143	87%
If you eat white rice	125	2	26	153	82%
	740			867	85%
Urban area August 2010					
Does your sugar level rise...	correct	don't know	wrong	Total valid answers	
If you eat fish	91	3	1	95	96%
if you eat eggs	66	7	22	95	69%
If you eat morning glory	88	2	5	95	93%
Ir you eat water melon	92	1	1	94	98%
If you eat grilled bread	86	1	8	95	91%
If you eat white rice	91	1	3	95	96%
	514			569	90%

There are several versions of a good answer in the case of "how high do you want your blood pressure to be". Some patients say "12" instead of less than 130/80 mm Hg because that is (short for any value from 120 to 125 or perhaps even to 129 mm Hg, a relic of French medical custom in Cambodia. Similar interpretation is applied to judge correctness of answers with regards to the blood sugars: the BG after eating must be higher than the fasting blood sugar figure that the patient has given and then any figure in the range of 150 to 200 would be approved as a good answer.

Figure 33 Knowledge about blood sugar levels urban network

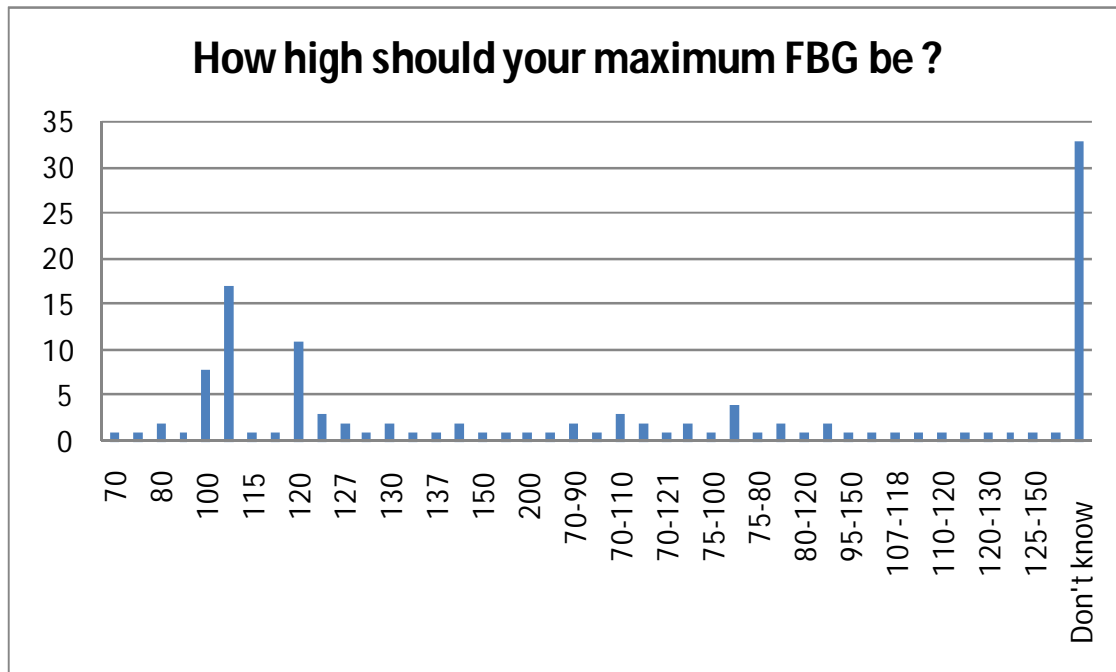


An objective of the patient education is that patients are aware what their own result is and where their personal target is. If a patient was registered with FBG of over 300 mg per dl this patient will try to get below 140 or 150 mg and try to keep this PPBG under 200 mg whereas an initially pre-diabetic member is aiming to get back below 110 or even 100 mg per dl for FBG and perhaps 150 PPBG after eating. In other words, there is an individual aspect to these targets and one shoe simply does not fit all. When the results come in the registration data of each patient are available with which are compared. Below is an example of the types of results in the re-assessment in the urban slums in the middle of 2010 when 95 people with DM were randomly selected (out of 392 diabetic members at that time followed-up by 5 peer educators so 19 per urban peer educator). All answers are in mg per dl as is the custom in Cambodia (for mmol divide by 18). It shows that some answer with a precise figure in mind whereas others think of it as a range although the word maximum is used in the question.

In the urban area the results of this answer were not used to reward the peer educators there. The rewarding system gives the possibility to select indicators that show weaknesses in the program. The management can announce that it is going to pay more attention to certain types of indicators if it notices such weaknesses are structural.

In the rural area in the same period in a sample of 124 randomly selected DM patients 51% gave the correct answer, 31% did not know and 17% gave the wrong answer (see the figure below). There the overall picture emerges that about half of the patients with DM have learned what their blood sugar should be, even though most people express their knowledge with slightly different figures and ranges. The 51% appear to have internalized their target. Most of these patients had been unaware of their diabetes before the intervention started.

Figure 34 Rural area knowledge of maximum Fasting Blood Glucose target



In the Y-axis the number of DM patients giving the answers about Fasting Blood Glucose in mg/dl mentioned on the horizontal X-axis. For mmol divide by 18.

Peer Educators have not yet been trained or given special tools to “refresh” old knowledge but many Peer Educators in the rural areas are professional teachers whereas none of the peer educators in the urban intervention is a professional educator. From the baseline assessments it is known that new patients do not have the knowledge that is being measured. The re-assessments show that the knowledge of patients has increased. It is reasonable to assume that a large part of this increase in knowledge and skills can be attributed to the Peer Educator intervention. Below are the two tables with the indicators that were used to reward peer educators in urban and rural areas. The fractions are scores per area. So if area AK scores 0.37 this means that 7 out of 19 patients answered correctly how to keep BG (blood glucose) at the right level. Average score for the first question is 0.46. This reflects the fact that 44 out 95 (5 times 19 per area) patients gave the right answer to that question.

Table 19 Knowledge about DM (members in Urban slums)

How to keep BG at right level	Knows Kidney damage	Knows Heart damage	knows name diabetes Medicine	BG rises if eat white rice	feel better than before	Area
0.37	0.58	0.47	0.37	0.89	0.84	AK
0.68	0.68	0.63	0.58	0.89	0.89	BB
0.63	1.00	0.68	0.53	1	0.89	BK
0.26	0.42	0.47	0.21	1	0.95	BR
0.37	0.58	0.58	0.21	0.89	0.89	BS
0.46	0.65	0.57	0.38	0.94	0.89	average

The knowledge of this question was disappointing in the rural area. The average proportion of rural DM patients that can remember the name of their routine medication is much lower than in the urban area, respectively 8% versus 38% . In the urban area and rural area respectively 89% and 81% feels better than before registration.

Table 20 Knowledge about DM rural area

	HowkeepBGrig htlevel	Knows Kidney damage	Knows Heart damage	knows name diabetes Medicine	BG rises if eat white rice	feel better than before
ARA	0.26	0.37	0.37	0.11	0.84	0.89
ARF	0.00	0.11	0.11	0.05	0.53	0.63
ARD	0.32	0.79	0.68	0.16	1	0.84
ARG	0.05	0.37	0.42	0.05	0.84	0.84
ARE	0.37	0.47	0.42	0.21	0.68	0.84
ARB	0.11	0.47	0.26	0.00	0.68	0.74
ARH	0.21	0.32	0.32	0.05	0.63	0.79
ARI	0.16	0.47	0.37	0.00	0.79	0.89
Average Ang Roka	0.18	0.42	0.37	0.08	0.75	0.81

BODY MASS INDEX AND WEIGHT

In Cambodia abdominal obesity is seen as a sign of wealth. Among experts there is no consensus yet on what the Cambodian standard for BMI (kg / m²) should be, in particular where overweight begins and ends and where obesity begins. It is widely accepted that a BMI of 18.5 is where underweight stops and normal weight begins. MoPoTsyo has been using 23.0 as the cut off point where overweight begins. There is little doubt inside the Peer Educator Network that glucose control improves if Cambodians with DM and a BMI of more than 23.0 lose some weight arrive back at a level of 23.0. The Peer Educators help people to calculate their target weight. There is substantial proportion (20% of people with DM in the rural area who are underweight with too low BMI (18.5). So the health education for people with DM is not one standard message about losing weight: some have to gain weight while others have to reduce and many are just fine the way they are.

During the July 2010 re-assessment 37% had normal BMI (18.5 to 23.0), out of 139 diabetic members. This was an improvement from 33% with normal BMI at time of assessment. However the improvement was thanks to those who were underweight at time of their registration and had moved into the normal BMI range while being a member. The proportion of those overweight remained the same in the rural area.

It is still an improvement and likely it is related to the intervention but it is a relatively easy one to obtain. Losing weight is proving more difficult than gaining weight as a result of proper treatment. The desire to lose weight is often not supported by the direct environment of the DM patient. Many uninformed people consider weight loss as a negative effect of disease. 1 in 4 of people with DM in the rural area and with a BMI of more than 23.0 say during the assessment that they do not want to lose weight. There is no baseline to compare this figure with, so it is not possible to say if this is a relative improvement. 3 out of 4 who are too heavy say that they want to lose

weight. The 17 who are too heavy but not wanting to lose weight are mostly people who want to stay as they are. There was only 1 person with a BMI more than 23.0 who wanted to gain weight. There were 15 who wanted to gain weight but according to their BMI that would not be problem.

Table 21 Rural BMI among diabetic members

# total assessed	139	
# too heavy (BMI >23.0)	65	
# too heavy wanting to lose weight	48	
# too heavy(>23.0)but NOT wanting to lose weight		17

IMPROVED LIFESTYLE

All members are encouraged to be physically active for at least 30 minutes per day and to eat healthy. These two topics are discussed here:

Exercise

Peer Educators inform patients that heavy physical activity also counts as “exercise”. In the rural areas, exercise comes still more often as part of routine daily activity. At the time of their registration, 17% of DM in rural area is doing no exercise, 49% of rural diabetics say that they do some exercise and 34% does half an hour or more.

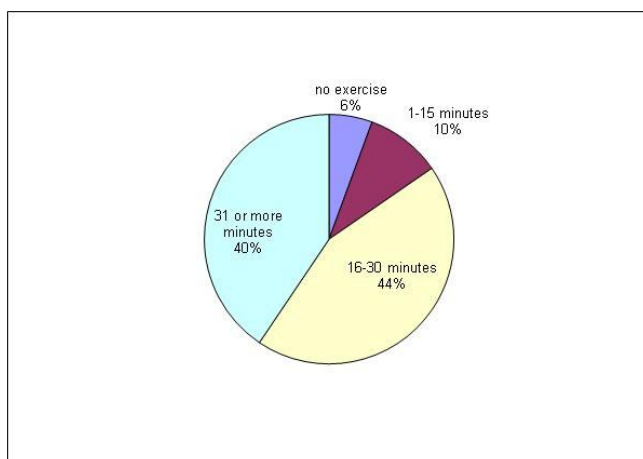
In the rural area the interviewer takes into account that people do not exercise as in the cities and uses the Cambodian words that are appropriate to include heavy physical labor to determine the level of physical activity. The question is asked for yesterday’s physical activity and then again for weekly physical activity.

When they are re-assessed having been a member for at least six months they report changes to their level of physical activity as follows:

5%	does less exercise now
23%	same as before
73%	more than before

The figure below shows the answers from diabetics who have been asked about how much physical activity they did “yesterday”, so the day before the interview took place.

Figure 35 Physical activity by rural DM after being member of PEN for more than 6 months



In urban areas when a random sample of diabetics were assessed (N=95) in August 2010 the proportion that does half an hour or more has become 38%. Those who do no exercise had been reduced to 7%. The remainder, 55%, do some exercise but less than half an hour per day. 65% of urban diabetics say that are doing more exercise since they have registered.

Nutrition

With almost 1 in 5 under-nourished, about half not overweight, and about half overweight, not every DM patients should receive the same simplified message. Upon entering membership every DM patient has received a nutritional pyramid based on the locally available food items. When randomly assessed almost all patients report that they attempt to follow the nutritional advice contained in this pyramid. The great majority of assessed patients report to have reduced the proportion of white rice as part of their daily energy intake. Their pyramid helps to guide the patients in the choices of food items. They learn that they should try to vary and eat with the season. The concept of calories has not yet been introduced nor a Khmer word for “protein”. The word “sugar” is used for “glucose”. The patients learn which items contain mostly good fats and bad fats. If they eat normally more than 80% of energy comes from highly glycemic white rice (Seng Serey et al, 2007). Besides taking in a large proportion of their energy from white rice, they also eat it in very large quantities. That increases the risk for diabetes significantly further (Villegas et al., 2007). Growing numbers of diabetic members have switched, in particular in the rural areas from machine polished white rice to eat whole rice or “less polished rice”. In urban areas 41% of members with DM at least occasionally eat whole rice instead of white rice. In rural areas it is even 64% (92 out of 142 diabetic members). There is also a growing trend among the rural members to switch to rice and other products that have not been treated with chemicals and pesticides. All patients with HBP, including DM with HBP learn that they should reduce the intake of salt.

Switching to whole rice: The whole rice is not always available and in the urban slum areas if it is available at all it costs more than the white rice. Many residents in the slum areas have a connection with relatives in the countryside so over time they can succeed in assuring a special supply of for them from their own homeland. For the rich patients with DM Cambodian whole rice is for sale in all supermarkets in excellent qualities and luxury packaging creating new dynamics for its promotion in Cambodian society. As a result of these developments the status of whole rice has radically improved over the past few years from being seen as despised prisoner food to something that has special healthy advantages and that only wealthy intellectuals can afford to eat on a daily basis. It is very likely that the machines husking the rice making it much more polished, lose its bran and protective vitamins, making highly glycemic (Seng Serey et al, 2007)

must take part of the responsibility for the incidence of insulin resistance(Radhika, Van Dam, Sudha, Ganesan, & Mohan, 2009) (Björck, Granfeldt, & Asp, 1994). Switching diabetes patients to low glycemic foods is a major strategy to help hyperglycemic DM patients bring their blood sugar levels down. Alternatives are a great variety of beans but Cambodians normally eat these with sugar as a sweet desert. Through the peer educators and other patients they learn they can eat these beans as replacement of white rice. Many mix the beans through the whole rice.

The improvements in glucose levels cannot be solely attributed to changes in nutrition as patients also report to be more active and many have access to routine medication.

SELF-MANAGEMENT

A Peer Educator is a patient who has been trained to self-manage diabetes disease and to teach others how to do the same thing. Naturally, many Peer Educators like to help the patient where ideally the patient should be self-managing. In the groups experienced patients like to help other patients. Some patients prefer to be helped instead of wanting to self-manage. The word “kruu” is often heard among patients who address a Peer Educator. Kruu is more like “teacher” than the “older fellow” concept suggested by “peer”. These tendencies to help each other, instead of individually self-manage, are reinforced because time for interaction is short: Early morning, everyone is busy and has other priorities than waiting and watching a half or illiterate patient struggle with a pen and his self-management book to record the automatic reading of the one blood pressure machine around which everybody is crowding in the peer educator home inside the slum. There, the members also weigh themselves or each other if they can't read the result. Most patients handle themselves multiple times the automatic blood pressure machine helped by the Peer Educator, the Village High Blood Pressure Group leader and other patients with HBP, giving them multiple chances to find out over time how it works. In general, patients are taught their targets for blood pressure, blood sugar and body weight. In fact they can also learn how they can calculate weight targets, but many just memorize these targets. The handheld Blood Glucose meter is only used by the Peer Educator to measures the patient's capillary blood instead of letting the patient use it him/her self. This is because every patient must use a new lancet after removing the used one and disposing it in an appropriate container, the use of the strip is expensive and the Peer Educator gets money for doing the test. Over time, more DM patients are buying a handheld blood glucose meter so they can use it themselves at home.

The concept of self-help can therefore be understood to apply on the whole community of patients, structured in the form of the PEN with patients registered as members. The structure works according an agreed set of policies that allows the community as a whole to help itself, with Peer Educators being paid for certain important acts. The degree of self-help varies in each individual patient according to motivation, dependency and general capacity.

As part of self-management, DM patients learn from the peer educator that they can influence their blood glucose levels: through physical activity and through the choice of their food items and later, after medical consultation prescription, through their medication. The self-management book contains pages for recording of the results of urine glucose, blood pressure and pulse (recorded as “heart rate”) by the patients. There are 4 months over 2 pages in the book. If there are recordings every month, this allows the doctor to follow the development since registration. When the book is full, the new book must be attached to the old book, but this has not always happened. Every month, the patient receives one free urine glucose test strip to use. Regular, preferably monthly meetings with the Peer Educator, help to keep track of Blood Pressure and Blood glucose, kg and pulse, which are recorded in the self-management book. Every three months, the patient can

receive one free blood glucose measurement. Patients are encouraged to use and buy more urine-glucose tests to keep track of hyperglycemia and try to reduce it when it appears. As long as patients do not have an elevated renal threshold home control with urine glucose strips is just as good as with blood glucose strips (Ruhnau et al., 1997). Just as European studies have shown patients prefer the Blood Glucose monitoring although combining this with urine glucose monitoring presents many advantages in particular in the low resource setting (A. P. Rotchford, K. M. Rotchford, Machattie, & Gill, 2002) For this to work patients need to understand how these different tools can best be used complementary. This remains a challenge but it works for a proportion of patients.

In the urban area in August 2010, where the intervention in slum areas, 95 DM registered patients were randomly selected among the ones in follow-up by the peer educators to be assessed by peer educators from another non-urban area. 63 DM (66%) of the assessed were able to explain correctly how to collect, preserve and test their own 24-hour urine for presence of glucose. 85 (89%) responded correctly that if the urine strip changes color the blood glucose level is (too) high. The assessed population in the sample had on average 1.1 strip left but 59 DM (62%) among them said they are without a strip at the moment of assessment. 10 (11%) report that they do not like to use the strip. In their self-management book 73 (77%) patients had urine strip results recorded in the 2nd month, 82 (86%) in the 1st month preceding the assessment.

In the rural area in July 2010, only 16 (11%) out of 142 randomly assessed DM patients were able to give the correct explanation about the collection and self-testing of the 24-hour urine. But 125 (88%) responded correctly that a changing color implies a high blood glucose level. The assessed population in the sample had on average 1.9 strip left but 89 DM (63%) among them answered that they are without a strip at the moment of assessment. 5 (3.5%) report that they do not like to use the strip. In their self-management book 83 (62%) patients had urine strip results recorded in the 2nd month, 82 (62%) in the 1st month preceding the assessment. Qualitative data suggest that stakeholders are not unanimously enthusiastic about the use of urine glucose strips for self-monitoring of glucose.

HEALTH IMPROVEMENTS

In the table below are the results of the re-assessments of 19 randomly selected DM patients in each of the 5 slum areas (AK, BB, BK, BR and BS). When the 19 patients in AK were re-assessed, their Fasting Blood Glucose (FBG) was on average 62 mg lower than at the moments of assessment when they registered as member of MoPoTsyo. In the other columns are similar indicators: the average change in systolic blood pressure among this group was not a reduction but an actual raise of 5 points and the diastolic had not changed in this particular group of 95 DM patients. On average 14% (0.14) of the sample of 95 DM had a pulse (heart rate) over more than 100 per minute, 37% a BMI between 18.5 and 23.0, compared to 36% at the time of registration. 53% presented an FBG of less than 126 mg/dl and the percentages of DM with controlled Systole and Diastole were 44% and 52%. In this overview the results of Systole and Diastole are presented separately, the Peer Educator rewards are calculated based on the proportion of patients who have "both Systole and Diastole" under control (less than 130/80mm Hg) .

Table 22 Health improvements in 5 urban slums

Area	Changed FBG	Changed Syst	Changed Diast	Heart Rate>100	BMI normal	BMI before	BMI compared	BMI change	Normal FBG	normal Systole	normal Diastole	normal heart rate	no foot ulcer
AK	-62	-1	1	0.21	0.21	0.26	-0.05	2.50	0.42	0.53	0.39	0.68	0.89
BB	-119	7	-1	0.00	0.63	0.53	0.11	0.18	0.53	0.42	0.58	1	1
BK	-89	20	3	0.32	0.53	0.32	0.21	1.44	0.63	0.24	0.45	0.68	1
BR	-43	-1	-2	0.11	0.21	0.26	-0.05	0.60	0.58	0.34	0.39	0.92	1
BS	-3	0	-2	0.05	0.26	0.42	-0.16	0.59	0.47	0.66	0.76	0.97	1
average	-63	5	0	0.14	0.37	0.36	0.01	1.06	0.53	0.44	0.52	0.85	0.98

Only one area (AK) had DM members with a foot ulcer, namely 2 out of 19 randomized DM patients there (0.89). The others had no ulcers and this quite remarkable because many have had foot ulcers in the past often before they joined as members or it happens while they are member.

Below are the July 2010 re-assessment results of 8 random samples of 19 DM patients, one from every Health Center area in Ang Roka OD with a Peer Educator.

The re-assessment results are compared with the assessment data, i.e. the data of the same patients at the moment they register as member of MoPoTsyo. On average FBG has gone down. Blood pressure improvements (Systole -10 and Diastole -8) are more impressive than the blood sugar results in this assessment (last row). Only 9% has a pulse of more than 100 when at rest.

Table 23 Health Improvement among 8 x 19 randomly selected DM patients in rural area

	Changed FBG	Changed Syst	Changed Diast	Heart Rate>100
ARA	-74	-3	-14	0.11
ARF	-35	-28	-19	0.11
ARD	-32	-6	-7	0.16
ARG	-16	-8	1	0.21
ARE	-92	8	-3	0.05

ARB	19	-5	0	0.00
ARH	-20	-7	-4	0.05
ARI	30	-27	-19	0.05
average Ang Roka	-28	-10	-8	0.09

The table above reflects the changes compared to the moment of registration, whereas the table below reflect the outcomes by themselves. 49% of the members with normal FBG etc.

Even if these measurements are not always technically performed, and even if these results show that half of the patients is not “treated to target” , what matters most of all is that a large group of rural and often disadvantaged chronic patients is aware of the figures and their targets and is trying to keep these risk factors under control.

Table 24 Snapshot of a rural diabetic membership (July 2010)

	Normal FBG	normal Systole	normal Diastole	normal heart rate	no foot ulcer
ARA	0.58	0.63	0.89	0.82	0.95
ARF	0.89	0.55	0.45	0.74	0.79
ARD	0.47	0.55	0.50	0.84	0.95
ARG	0.26	0.53	0.63	0.76	0.89
ARE	0.58	0.42	0.45	0.92	0.95
ARB	0.47	0.32	0.34	0.79	0.74
ARH	0.32	0.61	0.58	0.79	0.84
ARI	0.37	0.47	0.34	0.66	0.74
average Ang Roka	0.49	0.51	0.52	0.79	0.86

Consistently over the past five years, the random samples show that on average slightly more than half the members with DM have normal FBG. That is an FBG <126 mg/dl.

As seen in the profile, both diabetic men and diabetic women have on average an FBG of about 200 mg/dl and a PPBG of about 300 mg/dl when they register. This is the same in rural and in urban areas. The last urban assessment (August 2010) showed that among the randomly selected 95 registered diabetics the average FBG was 136 mg with only 6 diabetics still having an FBG of > 180 mg/dl. This suggests a strong improvement of blood glucose levels among the urban diabetics registered as member of the network.

With regards to the rural diabetics, the last assessment in Ang Roka OD of 130 randomly selected diabetic members showed that their average FBG was a bit higher than in the urban area at 145 mg/dl but still a relative improvement compared to their baseline.

Table 25 Rural fasting blood glucose

Rural area Ang Roka OD	July-10
Total Last Recorded FBG	18,819
# last recorded FBG	130 records
average Last FBG	145 mg/dl
% FBG>130	51%

Blood Pressure

Normal Systole in DM means ≤ 130 mm/Hg and normal Diastole means ≤ 80 mm/Hg. The results above are also more or less the same as what is always observed during these 6-monthly assessments. The proportion of DM with both Systole and Diastole under control rises from about one third at the time of registration to about half during the assessments. The last assessment in Ang Roka reconfirms this:

Table 26 Blood pressure in rural area Ang Roka OD in Takeo province

	Registration	re-assessment
DM patients	143	137
Number of DM with BP under 130/80 mm Hg	54	67
Number of DM patients with HBP	89	70
% of DM with HBP	62%	51%
% DM has BP under control	38%	49%

There are 6 blood pressure measurements missing in the re-assessment data. If those would be all HBP, it will still be a relative improvement.

There prevailing opinion of those involved is that the role of the peer educator is of great importance in determining the variation among the areas. As long as incentive levels are low, compared to other health programs supported by the Ministry of Health policies and often donor funded it may not be possible to get much better health outcomes than this although more involvement of the health authorities in supervision may be an effective strategy.

LOWER HEALTH EXPENDITURE

The evidence on the effects of the PEN on health expenditure among DM patients who register as member of the PEN comes from different sources and point into the same direction: downward. During six monthly assessments patients are interviewed by Peer Educators from outside the area and asked whether they are spending now more the same or less than when they register. In new areas about 80% of respondents say that they are spending less on their health than before. After a few years the memory of the good old days appears to fade:

Table 27 Comparing Health Expenditure before and after joining the PEN

Compare If You Spend More On Health Care than Before Registered With MoPoTsyo		
ANG ROKA OD JULY 2010	Members	%
less than before	90	64%
same as before or no spend	37	26%
more than before	14	10%
Total	141	100%

The average cost of routine medication according to the prescription and according to the invoices filled at the contracted pharmacy where the members buy their DM medication hovers usually around USD 4 for a monthly

prescription for people with DM. Below is example per health center coverage area in Ang Roka, where the 143 randomly selected members with DM live who were interviewed about their health expenditure.

Table 28 Reported Health Expenditure in the month preceding the interview (rural area)

How much did you spend in previous month on your health?									
ANG ROKA OD JULY 2010	ARA	ARB	ARD	ARE	ARF	ARG	ARH	ARI	143
average amount in riels among	13,321	23,478	22,775	23,931	19,000	19,631	12,375	19,000	1,915,900
converted to USD	\$ 3.13	\$ 5.52	\$ 5.36	\$ 5.63	\$ 4.47	\$ 4.62	\$ 2.91	\$ 4.47	\$ 4.42
non-spenders	5	5	3	6	12	3	4	3	41

The cost is still not affordable for many patients: In the table above, 29% of the interviewees report that they do not spend anything. Perhaps it is not necessary but perhaps it is but they can't afford it. Members may have to travel to the pharmacy to buy their medication, to the hospital for their consultation and spend time to meet with their peer educator. Those costs are likely not (well) counted. An important advantage for the members is that unlike before the medicines and other medical services are now made available inside their own district whereas in previous years, when there was no PEN, they had to travel to the provincial capital or even to the capital Phnom Penh for their medication. While people report that they spend less the costs may still be too high for many of them to adhere to the routine medication as they should.

The study by Center for Advanced Studies as part of the Thmar Pouk Partnership Project in Banteay Meanchey province (done by medical anthropologist Chean Men) into the effects on health expenditure on the DM patients in Thmar Pouk shows a reduction by factor 3 of their health expenditure as well as a reduced need for hospitalization (C Men, 2011). This study is mainly intended as a baseline study in a district where the PEN is in its first year of operations. The first 100 patients have been interviewed to create a baseline for a later impact study but it already measures the immediate term effect of the intervention on the disease related costs as reported by these first 100 interviewees. The true economic savings remain hidden in this factor 3: regained productivity, avoided or delayed stroke, kidney failure, blindness and foot ulcers. If a person is controlled by the disease instead of the person controlling the disease, the lifetime cost picture must be different thanks to avoiding consecutive "acute disease-episodes" which involve emergency care which is often much more costly and steady maintenance treatment.

RETENTION

In order to create the conditions in Cambodia for "healthy ageing" interventions must not aim for quick effects on blood sugar, lipids, and blood pressure although that can be an attractive and profitable activity. *Instead* the priority should be to focus on getting better cardiovascular outcomes, preservation of the kidneys and the eyesight by trying to reduce *long term* damage to the microvascular -, the macrovascular and the nervous system. It is more important for people with DM to be able to maintain levels of blood glucose, blood pressure and lipids close to the normal ranges over many years than to make them reach those levels quickly and declare victory. Treatment to target in Cambodia is an indicator that has to be put into this local perspective. The importance of long term retention into any DM or HBP programme can hardly be overestimated. The retention period presented here is from the start of the intervention in July 2005 until May 2011, so almost six years. It is still too short to draw definitive conclusions but these 5 year data are already much longer than the earlier available data which

were based on 24 months periods for the diabetics (B. Janssens, W. van Damme, et al., 2007)(Marie-Eve Raguenaud et al., 2009) (P Isaakidis et al., 2010)

The other issue to bear in mind is that the literature referred to above describes a clinic based program. The patients who attended just once or twice were excluded from analysis on retention data. The profile of the excluded people and their reasons for not continuing to use the free services of the provincial clinics remain unknown. But based on the studies of the people who dropped out of the care, we can speculate that also for the excluded the costs of travel and time related to receiving care from the clinic must have played a large role as a barrier because there are not that many alternatives to choose from that also offer free care and free medicines. The patients of described DM clinics consist almost exclusively of people who already know that they have DM when they first go there. They actively seek treatment for their health problem from that clinic. On the other hand, more than 70% of the members of MoPoTsyo who register as diabetics was previously unaware of their DM. They have to be convinced by the peer educator to accept the diagnosis and care. This can be difficult if people do not yet experience symptoms, if people do not trust the peer educator's advice and if people are not familiar with western medicine but rely on traditional medicine. To get people to register for free is a step, but since registration is free and comes with material benefits, such as a poster, a self-management book, a 24-hour urine container, urine glucose strips, boric acid, free counseling and advice, opportunities to learn and meet others in the same situation, people are usually attracted. From then onwards to actually retain people in a community based primary care program poses challenges of a very different nature than a clinic based program faces.

In order to look at the capacity of the intervention to retain its members, the first group of urban diabetics who became member of MoPoTsyo in 2005 and 2006 are being looked at. They are (or were) residents of 3 slum areas in Phnom Penh. One slum (Anlong Kangan) is a resettlement area on the remotest outskirts of Phnom Penh at 16 km from the Tonle Bassac slum area, the place from where these people had been evicted before the intervention started. The second and third slum areas lie both downtown in the capital around the Boeungkak lake from where many patients and their households have been evicted during the period of the intervention. They were resettled in another area on the remote outskirts of the municipality where there is no community based DM peer educator. Many of the patients were poor residents of the slums so their DM makes them extra vulnerable. The figures after 5 to 6 years related to the first group of 170 diabetics who registered are as follows:

Table 29 Urban retention of DM patients and reasons for drop out

The 1st group of urban slum diabetics July 2005 until May 2011		
Died	18	11%
Still Follow Up (not moved out)	64	38%
Still Follow Up (moved out)	9	5%
Stopped follow Up (Moved out)	64	38%
Stopped follow up (Not Moved out)	15	9%
	170	100%

There may have been more deaths among the 64 who have moved out and stopped follow-up. After almost 6 years only 43% of the first group of 170 is still in follow up by the 3 peer educators in the 3 slum areas. This means an average annual loss of 13%. The annual loss was only 10% in the earlier years before the evictions started but many poor patients, once they had moved out, lived so far away that they could no longer be followed up.

Only 9% among the 170 patients has decided over a period of 6 years that their peer educator is not useful for them and that they do not need or want the use the peer educator's services. That is only 1.5% per year. All the

other loss is involuntary loss through death or by moving out. This figure shows that the retention capacity of the peer educator intervention over a long time is very high. This is conform the data that emerge when randomly selected patients are independently interviewed twice per year. Only rarely are patients not satisfied with the opportunities provided to them by the peer educators.

It is possible to look at the situation in each slum area to see if there is a difference between the slum on the outskirts of Phnom Penh with very poor people who had been evicted to (Anlong Kangan) and the 2 slums downtown from where a number of members were evicted or moved out during the six year period. If we compare how the 3 memberships evolve over time in the 3 slums, the following table can be made:

Table 30 Reasons for drop out in 3 slum areas

			Not moved Out	MOVED OUT	MOVED OUT	Not Moved Out
		DIED	Follow UP	Follow Up	Not Follow Up	Not Follow Up
	Total	A	B	C	D	E
Anlong Kangan	64	8	32	5	19	0
SrasChork	54	5	12	4	29	4
Boeungkak	52	5	20	0	16	11
total in 3 slums	170	18	64	9	64	15

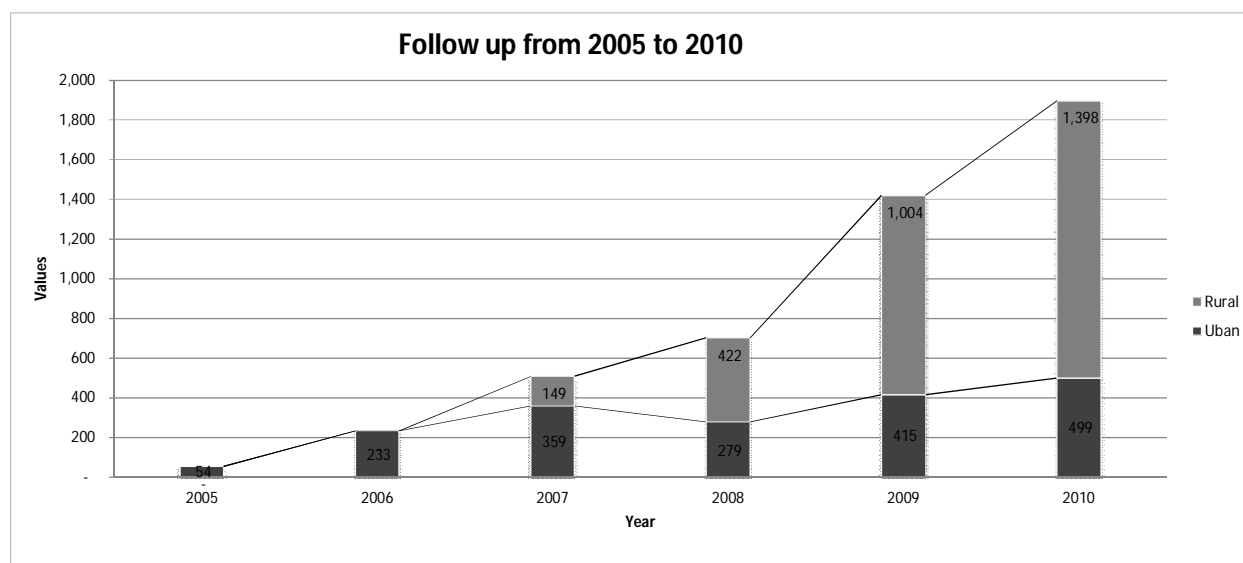
The Peer Educator and her family moved out of Boeungkak slum but keeps visiting regularly. The fact that she no longer lives inside the slum could be a reason for the relatively larger number (11) of slum residents out of 52 who still live there but do no longer want to part of the program there.

Table 31 Urban loss of DM patients 2006 to 2011

year	DM	13% loss
2006	170	22
2007	148	19
2008	129	17
2009	112	15
2010	97	13
2011	85	11

The rural program only started in mid 2007 with DM patients in Ang Roka. The retention is 10% annually and follows a similar pattern. In 2009 a first group of people with HBP but not DM were registered and in 2010 a very large group of more than 2000 people in a relatively short time. The management of these new patients presents a new and different challenge for the same peer educators as they have to be managed through the Village High Blood Pressure groups.

The rural overall picture looks as follows:



	Urban		Rural	
year	Registered	FollowUp	Registered	FollowUp
2005	60	54	-	-
2006	259	233	-	-
2007	457	359	161	149
2008	593	279	550	422
2009	700	415	1,165	1,004
2010	991	499	3,867	1,398

The rural figure of 2009 follow up as proportion of registered is high but suddenly low in 2010. That is because the proportions in 2009 are diabetics whereas in 2010 a large group of new members with HBP (without DM) has been added to the membership. The rural Peer Educators do not yet count them in the follow-up because they do not "feel" in charge of active follow-up of these members. The figure 991 registered in the urban area in 2010 also hides 140 new patients with HBP but without DM. So the follow up figures only reflect DM patients in these figures.

There are practical reasons for ending the labeling by the peer educators of their patients:

1. The data base into which the assessment data have been entered shows who at time of registration is diabetic and or has HBP so a baseline is available to measure the changing situation afterwards.
2. These BP and BG values change dramatically over time with hypertensive members becoming diabetic and by diabetic people becoming not diabetic in the strict sense of the definitions if they no longer take BG lowering medication and succeed in keeping BG in the normal ranges;
3. Everyone who is registered remains always at risk of all the risk factors that the peer educators following up. If peer educators put all their patients in separate boxes with separate numbers and separate follow up systems and separate incentive systems it becomes a vertical bureaucracy of silo's that make it difficult

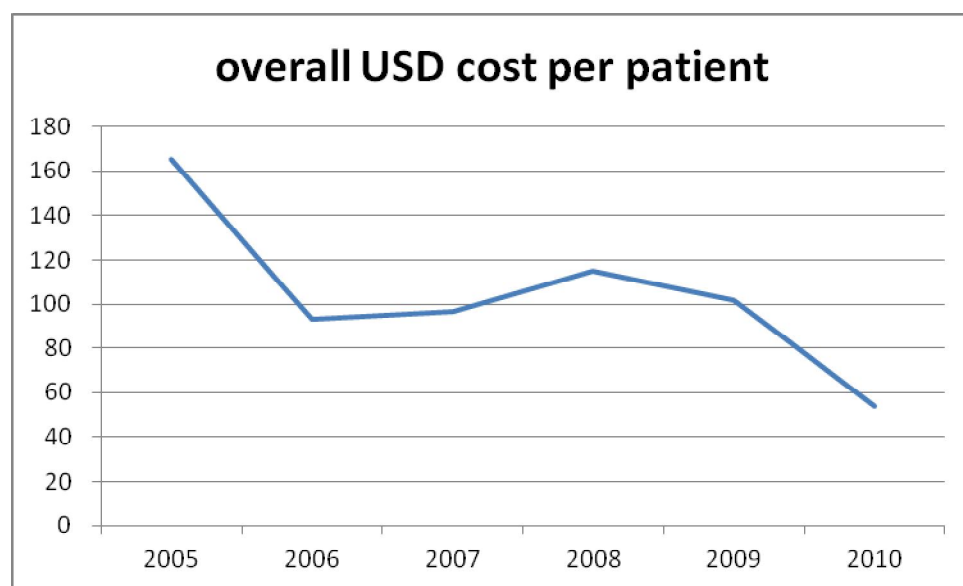
for the members to cross over from one silo into the other in particular now that the lipid profiles are being added to the data.

This integration at the grass roots is in process and requires hands on management to get the best results. The large number of added HBP patients can only be managed successfully if the Village High Blood Pressure Groups function and if the public health staff supports the CoC.

COSTS

The overall costs per patient to the NGO of setting up and maintaining the PENs have decreased since the organization began operations in July 2005 with 2 urban slums and a small number of DM patients, later expanding to rural areas and including HBP patients (without DM). These are the costs to the NGO of managing the PENs including all the screening, the services the NGO organizes for its members, the supervision, the headquarter, administration etc. etc.

Figure 36 Costs per patient 2005 – 2010 all Peer Educator Networks together



The costs represented above are not the same as “costs related to illness” because they do not include what the patients pay themselves out-of-pocket in order to receive specific services, such as the laboratory tests, the routine medication they buy at the contracted pharmacies, the medical consultation fees that the patients must pay at the Referral Hospital, the costs of their travel to and from the facilities, the peer educator home, the costs of changes to their diet. It is those costs that determine whether a patient can afford to adhere to the CoC that is made available. But it is the costs in the graph which determine if the CoC can be set up and maintained by patient’s adherence to treatment, **unless** there is going to be sustainable outside support in the form of government subsidy that helps poor patients buy their medication, adhere to treatment and finance through their adherence this CoC. In the cost above is included also the cost of a small number of equity fund patients, less than a 100 individuals who receive financial assistance that helps them purchase 50% of their medication. If that cost were removed too, the cost to the NGO would be even slightly lower.

So both aspects of affordability are equally important and must be kept in balance when the CoC is being designed or when decisions are made about including a specific service that represents an additional cost. If a particular

service is made available, there is always a risk that patients are unable to make the best informed choice, foregoing the service if they should use, or using it if they don't need to. The incentive environment of peer educators must be so that they give the best advice!

When a new PEN is being set up, there are investment costs that are necessary to train and equip peer educators, screen the whole adult population, buy a stock of medicines and materials large enough to cover pipeline time for re-supply.

In Phnom Penh the natural stabilization can be observed. From 2008 onwards costs were shifted towards the patients leading to further reductions in costs (and angry patients of course and angry peer educators as well as they operate side by side with other organizations who care for chronic patients, mostly providing free services. This creates tensions because peer educators suddenly had to charge for services that used to be given free. This happened at the same time as fuel prices and food prices started to rise. In the urban slum areas it happened at the time evictions took place, and many members were forced to relocate to places outside the city where there was no peer educator or a pharmacy.

Figure 37 Decreasing cost to MoPoTsyo

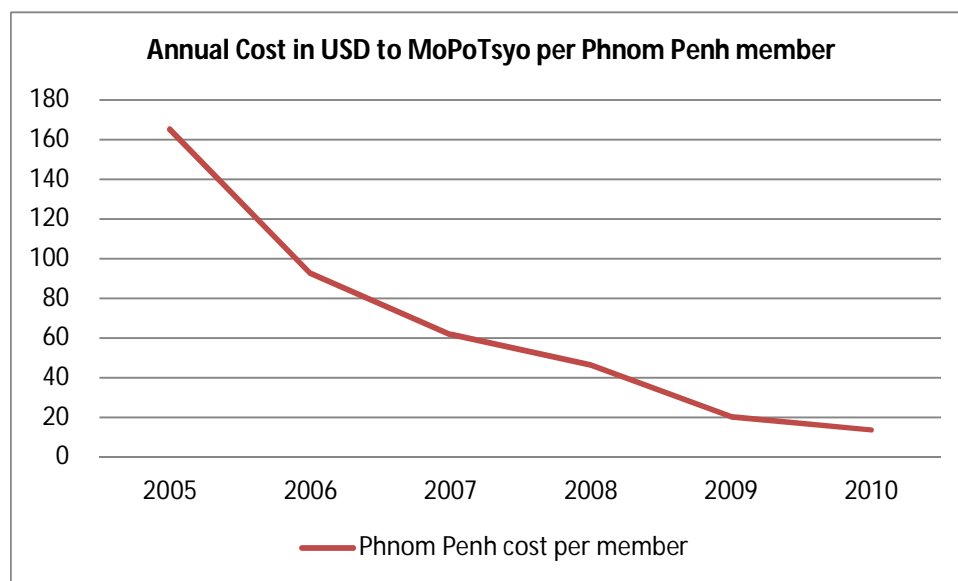
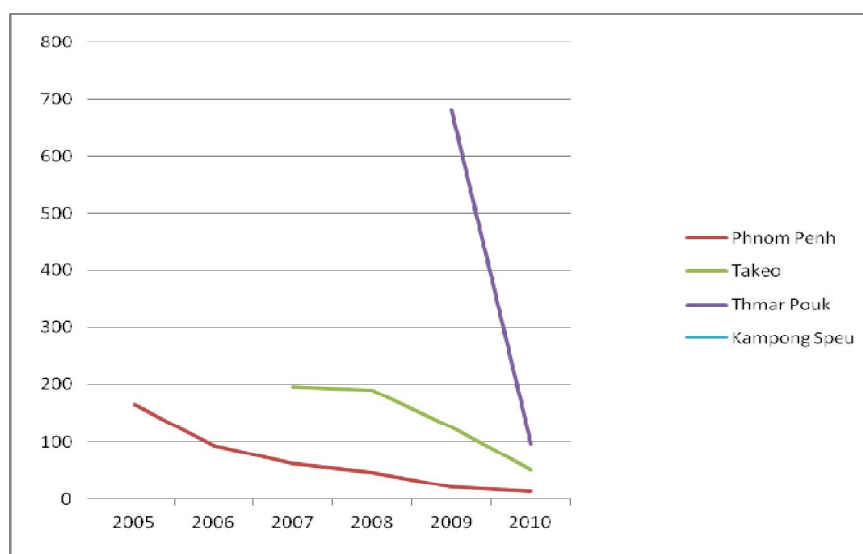


Figure 38 Costs Per Patient in each in each Peer Educator Network



The cost reduction from 2009 to 2010 is mostly due to the rapid inclusion of patients with HBP, who do not have DM. Over time the costs per patient appear converge towards the same levels in every project as is shown in the figure below. If a network is set up at the end of calendar year in a new project with only a few patients, the cost per patient gets distorted. That's the explanation of the high cost per patient in Banteay Meanchey province (=Thmar Pouk). The costs per patient in the table below incurred from the middle of 2005 until 2009 are only for DM patients. Banteay Meanchey is the name of the province with the OD Thmar Pouk, where financial investments began late in the year 2009 with few patients. If the project would have started on January 1, 2009 the costs would have been at levels like in Takeo, somewhere between USD 150 and USD 200 in that year.

The figures above are based on the table below with the exact amounts per year since MoPoTsyo began operations.

Table 32 Costs per Patient of Peer Educator Networks

	per (DM+HBP) patient					
	2010	2009	2008	2007	2006	2005
overall cost	\$54	\$102	\$115	\$97	\$93	\$165
Phnom Penh	\$14	\$20	\$46	\$62	\$93	\$165
Takeo	\$50	\$126	\$189	\$196	-	-
Banteay Meanchey	\$97	\$681	-	-	-	-
Kampong Speu	\$107	-	-	-	-	-

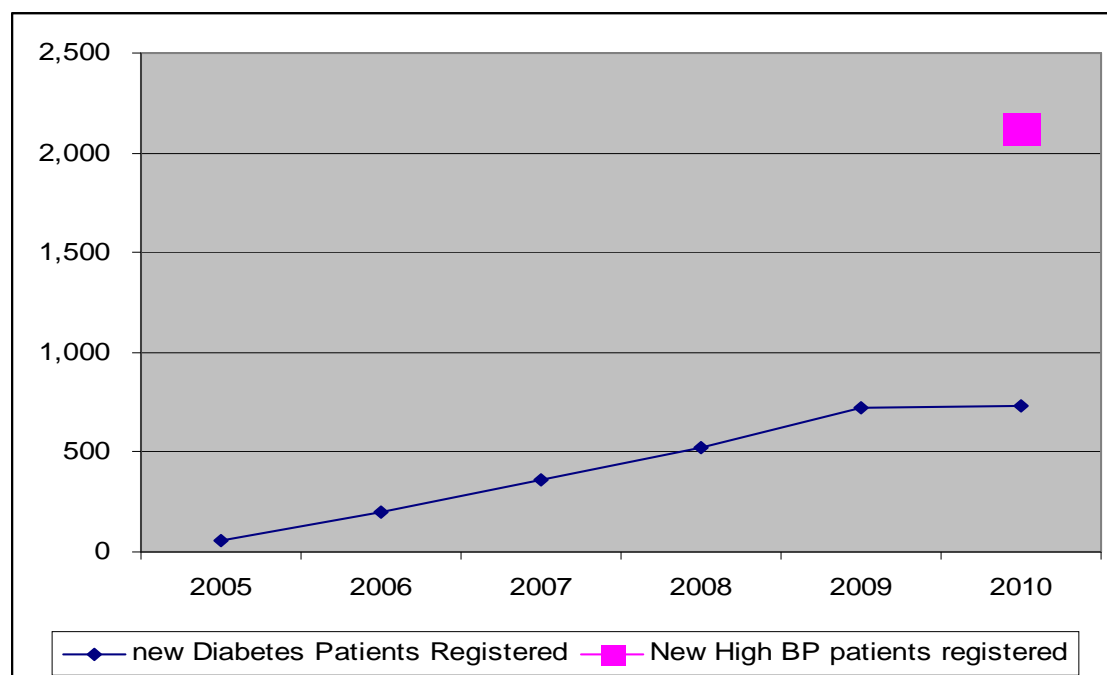
The steady cost reductions are a result of stabilizing networks (no more screening), Economies of scale, shifting costs onto patients, but the last cost reduction (from 2009 to 2010) must be understood in the light of the intervention's (explosive) expansion to cover HBP patients which began in 2010.

It typically takes about 2 years to 3 years to complete a PEN. We suspect that primary prevention activities help the secondary prevention and vice versa as the risk factor awareness are relevant for the whole target population.

With a PEN firmly in place it is easy and extremely cheap to organize the screening (see figure below). But screening for HBP alone is of course not enough. The true costs that this expansion entails are not yet known

because “the add-on intervention” is not finished, it has not been evaluated and as it is now it is probably not yet as effective as the DM intervention already is.

Figure 39 Registration of new members (patients)



The costs of setting up a PEN therefore cannot yet be precisely calculated, as the HBP intervention is not as it should be and the primary prevention activities are in full swing in the first rural district where they are being undertaken. The costs of running the urban PEN are fairly represented in the figure of USD 14 per patient in 2009. The urban network is able to take in new patients and stabilize them. There is no active screening or self-screening in these costs. It is financially quite sustainable at this level for any government to pay for at this modest level. The most interesting feature to add would be health equity fund support for the poorest, to help them pay for their monthly medication because buy paying for medication the patients also pay for their secondary prevention follow-up by the Peer Educators. A voucher system will be tested in 2011. The expenditures are booked into categories used to keep track of the cost of the outputs. The system has not changed much since the beginning of its operations in 2005. They are booked per destination or per ultimate beneficiary. That means the following categories:

Table 33 Expenditure per destination category 2004 until 2010

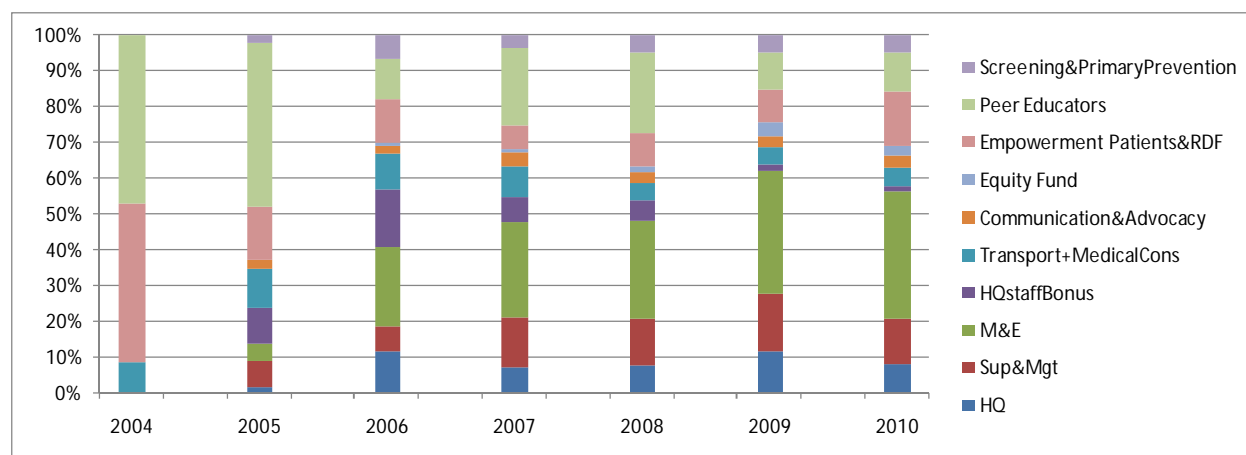
YEARS	2004	2005	2006	2007	2008	2009	2010	Total	
EXPENSES:									
1 Population Beneficiaries	0	179	2,796	4,497	10,278	21,925	21,673	61,348	9%
2 Investing in Peer Educators	0	705	1,737	8,372	17,390	30,990	33,148	92,343	14%
3 Empowerment of Patients	0	500	5,323	15,814	35,993	64,708	92,559	214,897	31%
4 Equity Fund	0	1,002	3,808	4,037	7,481	3,933	3,185	23,446	3%
5 Communication and Advocacy	633	1,072	2,390	5,262	6,358	9,189	13,185	38,089	6%
6 Transport of HQ Staff to / from Field	0	248	566	2,300	4,093	5,529	9,798	22,535	3%
7 Fringe Benefits for HQ Staff	0	0	201	474	1,782	6,947	7,021	16,426	2%
8 Advice, QI, M & E, Audits	3,267	1,469	2,898	4,054	12,347	17,924	39,192	81,151	12%
9 Supervision and Management	3,461	4,522	2,768	12,986	29,502	19,667	28,305	101,211	15%
10 HQ Facility	0	220	1,563	2,013	6,500	8,961	12,379	31,635	5%
TOTAL EXPENSES	\$7,361	\$9,917	\$24,049	\$59,808	\$131,725	\$189,773	\$260,446	\$683,080	100%

1. Population beneficiaries is the general population that benefits from primary prevention in the form of the self-screenings organized by the peer educators. The adult population learns how to self-screen for diabetes using a urine glucose strip and how to measure blood pressure. Community leaders are exposed to a session run by peer educators during which they are made aware of their own risk factors and how to bring these under control.
2. Investing in Peer Educators is the training and equipment of Peer Educators
3. Empowerment of Patients is the training of patients by peer educators and their follow up. Also it is the costs related to the RDF
4. Equity Fund is the expenditure to help poor patients help meet part of their health care costs.
5. Web site and internet related costs and some advocacy costs;
6. In 2010, around 60% of this expense is for Medical Doctors who travel from Phnom Penh to the OD once or twice a month to conduct medical consultation for the membership;
7. HQ staff receiving Khmer New year bonus
8. All costs of internal monitoring and evaluation, surveys, 6 monthly assessments, audits, and also external evaluation costs;
9. Management related costs such as salaries
10. Facility rent and utilities and other costs related to the building in Phnom Penh;

The costs of the community based self screening are discussed in the paragraph “Early Diagnosis, detection, community-based self screening & costs” above.

The evolution of expenditures per cost category over the years 2004 until 2010 can be visualized as in the figure below.

Figure 40 Percentage expenditure per cost category 2004 - 2010



FINANCING

From the start of the NGO in August 2004 the NGO and its projects have been financed by external donors.

Fortunately, small donors for the first interventions could be identified in Europe. They sympathized with the project objectives and although success was unproven at that stage, were ready to give it a try: a consumer rights organization in The Netherlands, a charity foundation who normally does not fund health projects and a civil society organization that helps Dutch organizations get funding for development projects in developing countries. Although the NGO has gradually become more involved in service provision, negotiation and organization, it was originally not designed to be, as was described in the chapter about the role of the NGO.

The first 2 urban slum projects started in July 2005 based on donor commitments for Euro 40,000. Local Embassy projects financed further local urban expansions. Based on that experience it was possible to show to interested donors that that something could be done about the problem. The first rural project Ang Roka OD in Takeo was financed by combining funding from the World Diabetes Foundation, the French Embassy and the Swiss Red Cross. When it became clear that the mechanism appears to work, it became possible to attract other donors to replicate adapted rural versions of the project. The Government's Development Partners in the Health Sector have so far been focused on other main priorities, such as communicable diseases and Mother- and Child Health.

At the start the "hope" for financial future sustainability was vested in 3 sources:

1. Government: subsidy for the functioning of PENs if they are proven to be cost-effective;
2. Donors: Equity Fund to finance the care provided by Peer Education as they help poor patients meet a lower cost of disease (in addition to equity fund for medical consultation costs, diagnostic test costs, and most importantly the costs of routine medication);
3. Health Insurance organizations, for the same reason as Equity Funds, making savings as a result of better health of chronic patients and less cost of disease;

The arguments for these potential sources of financing remain perfectly valid six years onward. However, none of them have so far materialized. This is perhaps partly related to the fact that nor the Cambodian health system and nor its social health protection system are appropriate for chronic care. Both were designed to meet acute needs only. It is dangerous to expand these existing systems simply to include also chronic care because at least the lifestyle related diseases requiring chronic care have to be dealt differently with involving individuals and communities themselves as part of the response.

Realizing the delays in stakeholder awareness of the need for appropriate design and therefore also of sustainable financing, but also seeing how important and effective its own intervention is for the health and livelihood of its members, the NGO had to act quickly. It developed its own financial sustainability plan by shifting costs to stabilized patients and by organizing generation of revenue through service provision "by and for" its members. It began to ask its peer educators to charge the patients in 2007 experimenting with different fees.

As "cost recovery", the NGO collected the revenue from the following services and supplies in 2009 and 2010 as in the table here below:

Table 34 Revenue from health services provision to members

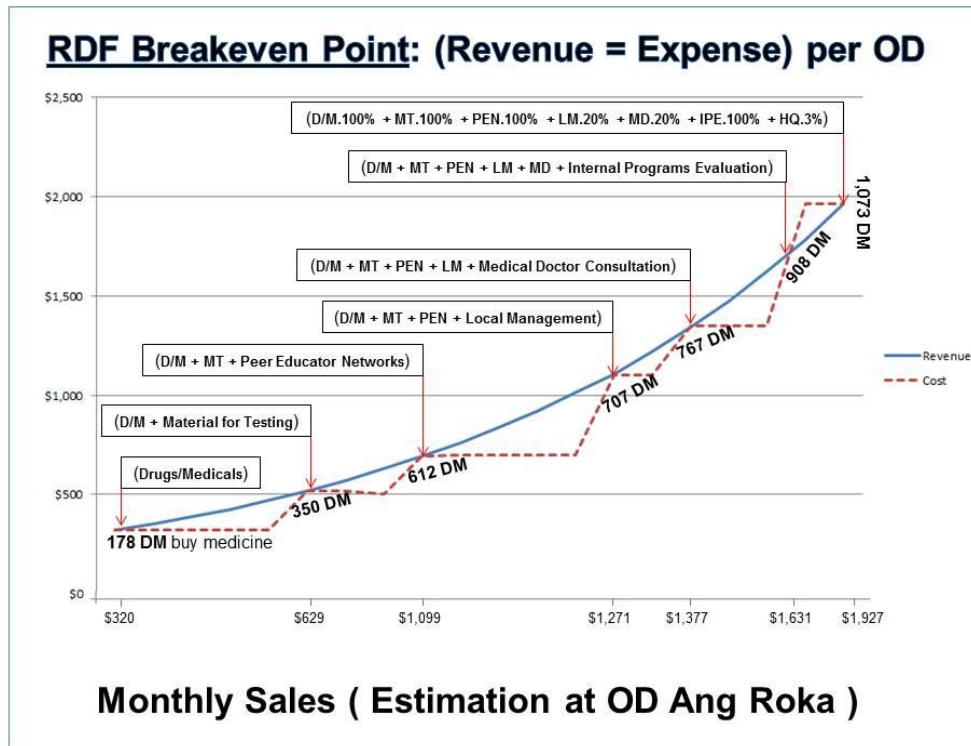
	Revenue from NGO Services&Supplies	2008	2009	2010	
1	medicine		\$ 11,070	\$ 22,720	64%
2	laboratory			\$ 4,303	12%
3	BP meters		\$ 390	\$ 788	2%
4	BG meters		\$ 378	\$ 2,395	7%
5	Strips for BG meters		\$ 2,007	\$ 3,532	10%
6	Needles for BG Meters		\$ 243	\$ 311	1%
7	Urine strips		\$ 1,247	\$ 550	2%
8	Syringes			\$ 20	0%
9	bank interest		\$ 430	\$ 429	1%
10	Agencies Prevention of NCD among NGO staff		\$ -	\$ 316	1%
	total per year		\$ 15,764	\$ 35,364	100%

The main items are discussed In more detail below:

1. RDF Medicines: These figures represent the annual value of the wholesales by the NGO to 14 contracted pharmacies who act as retailers and sell these prescription drugs to the members of the NGO who pay for these medicines mostly Out Of Pocket. These retail sales were never a cost that used to be borne by MoPoTsyo. A large number of patients used to receive these drugs for free from international charity organizations who stopped the free provision or who withdrew altogether from Cambodia. So the cost of medication was not shifted onto the patient by MoPoTsyo but by the failure of other agencies to establish a sustainable drug supply system. These revenue are revenues from private pharmacies and constitute 64% of the NGO's revenue, meant to contribute to making the whole CoC sustainable, not just the medicine flow. It is important to note that only a minority of registered members are buying their prescription medicines every month, for different reasons. So this figure has a strong growth potential. The price level is kept at competitive level with other suppliers.
2. Laboratory Services: This is a new activity, only started in early 2010, and which proves to be popular. The price level of the service has been set at a level that is far below (at only 30%) the prices of the competition. One has to bear in mind that – besides being cheaper – the provided service also saves the patient who uses the service any costs of lost time and of travel to and from a laboratory if he/she would choose to go to a laboratory. The NGO has capacity to increase quantity of services but the members may not much need more than they are currently using per individual member. About one third of the members does not yet use the service, maybe because of poverty. There seems to be some but not as much growth potential in this figure as in the RDF, unless we consider growth of the membership itself. Also, most of the HBP patients did not make use of the service yet.
3. Blood Pressure Meters: This is revenue from automatic Blood Pressure meters sold to the members with HBP and to donors who finance the establishment of Village High Blood Pressure groups. The plan is to set up one such a group per village. This is an investment normally paid for by donors. Most Cambodians cannot afford to buy this meter. It can become a sustainable sales item for the membership but it will not be sold in large numbers. It is sold at well below the prices demanded by the competition.
4. Blood Glucose Meters: The blood glucose meter being used is a standard meter, produced by ACON. It comes at relatively lower cost than the others including the strips.

5. Strips for Blood Glucose meters: These ACON strips, with 3 electrodes, are the cheapest ones currently available on the Cambodian market. Most companies manufacture their products in China.

Figure 41 Revolving Drug Fund Break Even



Abbreviations used in the figure above:

DM is people with Diabetes with a prescription.

PEN is Peer educator Network (paid by NGO)

LM Local Programme Manager (DPM and DPA paid by NGO)

MD is Medical Doctor (who comes to consult at the local hospital, but paid by NGO)

IPE is International Programme Evaluation is the cost of the 6 monthly assessments of the PEN performance

HQ is the NGO's Headquarter in Phnom Penh which is managing the intervention. If the NGO would have a network in every OD in Cambodia and charges 1.3% of its management costs onto every one of these, then the NGO is financially sustainable because $77 \times 1.3\% = 100\%$. However, this is not MoPoTsyo's plan.

In theory PEN can replicate from the current 8 to more districts. There is concrete planning to scale up to 15 districts, but none of these districts should be charged more than their fair share. As a working figure the NGO uses 3% on charge per OD for its HQ cost. This means that the NGO would become financially sustainable when 33 OD's are covered with a PEN.

The above figure is based on current practice of members with DM buying their medicines. This means that if the current members buy their medicines more often, the break-even shifts to the left. Also nowadays very few members with HBP buy their routine medication. If that changes, the break-even point will also shift to the left.

If poor people with DM or HBP receive financial assistance to purchase their medication every month, the break even will shift to the left.

The cost of the visiting Medical Doctor should not fall 100% on the shoulders of the patients but at least partly be at the cost of the Ministry of Health.

GOVERNANCE

When MoPoTsyo was established in 2004, there was no law governing Cambodian NGO's, although they were made to register with the Ministry of Interior as a formal requirement in order to be allowed to operate. The broad right to associate is guaranteed in the Constitution (1993) but the details had not been worked out either. In 2011 a new law on NGO's and Associations was in final stages, it seems, for approval by the government.

Once the law is approved, it will be possible for MoPoTsyo to divide up its role into different parts. An often attempted division is the one between a lean implementation vehicle and a broad lively governing conscience of that vehicle. There are risks involved: tension can rise between the two units. Imagine just what would happen if for example the governing conscience were politically hijacked, commercially captured. Other risks are that is technically incompetent, about to take sub-optimal or even dangerous decisions, too late in its understanding of what is happening, it may become manipulated by salaried staff members who unionize the board members in order to interfere in the daily management, be detached from the field reality, too romantic and unrealistic and optimistic with its view of the future, or too risk averse and too conservative, unable to modernize, ideological, old-fashioned and impractical. So given these risks, why bother to create two units? The main reason is that the above weaknesses can of course also occur inside the implementation vehicle itself, the NGO. The idea behind the split between an implementation vehicle and its governing conscience is to have checks and balances not just bottom up and top down, but also sideways at all levels of the hierarchy so that (often uneasy) diagonal communication can take place.

Such a control-body only fulfills its tasks well if its members have the resources to do so, in terms of time, information, wisdom, competence, courage and motivation. The role of the board is one of ultimate responsibility and accountability, policeman, inspector or controller. The risk is that it becomes itself uncontrollable, so its powers must be limited enforcing accountability and respect for standards and principles along which the NGO is known and supposed to operate. So its power is ex post and not a priori. The Association is not a driver of change and it must allow adaptations and modernizations, but not if that compromises long term interests of its members. Its creation requires careful preparation and great wisdom. It is better to have no such a thing than one which derails the NGO.

Possible an adequately financed association can fulfill this role basing its operations on certain principles, which keep it functioning within the right limits and focused on what it has to do. It is clear that in this body expert chronic patients and unsalaried peer educators must have an important vote, including on the appointment of the NGO Director, deciding on contract renewal of Heads of Departments of the NGO staff, choice of the audit firm etc.

Social Health Protection Framework

With poor members facing high monthly prescription costs, there exists an opportunity to target financial assistance to this group and help it finance its own CoC by helping them to pay for their routine medication. The NGO is designing a voucher system to be piloted. The costs related to treatments received during hospitalization can be paid as usual by the existing Health Equity Fund schemes and Community Based Health Insurance and by other Health Insurance.

Providing financial assistance to the patients with unaffordable prescription costs will help them maintain their health and avoid acute episodes of disease that are very costly too. If they can adhere to a CoC it will help to reduce the costs to the existing schemes have they are covering the costs of acute disease episodes.

Strategic Partnerships

PENs can engage in partnerships with other organizations for mutual benefit:

- The Operational District Office
- Health Equity Fund agencies
- Community Based Organisations implementing social health protection schemes such as health insurance

The PENs offer primary prevention activities and secondary prevention activities in exchange for various types and levels of support that they can get from their strategic partners. As usual NGO's can facilitate the creation of such alliances and bring them under the umbrella of the local health authority.

DISCUSSION AND CONCLUSIONS

The key question that must have sprung to mind multiple times when reading the preceding chapters is which findings in this report may be considered reliable enough to be used for supporting policy decisions.

This report of course does not claim to have produced gold standard evidence but the report wants to inform policy makers. As explained in the introduction there was never a double blind cross over randomized control trial subjecting samples of districts and populations for limited periods of time to the PENs and it is unlikely that there is going to be such a trial.

So the normal answer that sound academic practice must give for reports of this type is “nothing”. But the quality standard for evidenced based policy making mentioned above was invented to decide on clinical issues in ideal settings but not for the type of interventions in low resource settings described in this report.

The reasons not to open the door to research findings resulting from methods that do not meet the highest academic standards may sound attractive. However if there is no gold standard evidence available about what works in the specific low resource context there are other good reasons to consider everything which is available from those contexts which appears relevant as long the agenda's driving the data and interpretation remain transparent. As every practitioner working in developing countries learns sooner or later there is more danger in applying on low resource settings the conclusions that were reached and based on gold standard evidence produced in high income settings than in accepting conclusions that result logically from comprehensive documentation based on real and still ongoing activity produced in those low resource contexts themselves.

Another possible source of bias is the following: Most of the documentation is produced by the implementing agency itself, the NGO, with salaries and emotional attachments to the success of their own intervention. Would these be forces resulting in bias and exaggeration of the intervention's positive effects? The NGO has been open about its own shortcomings. At this point, after 5 years of implementation, the NGO is already beyond having to prove to its future paymasters that its intervention works. To exaggerate the positive effects would simply be not strategic as it could result in demands of development partners to reduce the NGO's costs and obtain better results with even less money than now. The opposite then...? Perhaps, but then the reader would have to accept that in this report the NGO underreports on its achievements. That is also very unlikely. The conclusion must be that with this report the NGO has no incentive to exaggerate and also no incentive to underreport.

Because the data to make the comparison are not available, there is no scientific evidence that peer educators in Cambodia - as trained patients helping other patients - are performing better, equal or worse than professional health staff would do. Peer Educators are now delivering services to a defined group of people, who would normally for multiple reasons not be receiving those services in the Cambodian context. That is why what is in the preceding chapters of the report should be sufficient evidence that they have positive effects on the availability of health services. Also, the records show that there is sufficient evidence that these health services improve patient health. The independent study has shown that they reduce DM patient's health expenditure. The documentation shows that treatment to target reaches likely about half of the registered DM patients in terms of blood sugar and blood pressure, while for the others the health improvements are in varying degrees that are less than optimal or negligible.

To attempt to answer the key question, the level of reliability of the findings the evidence has been graded from relatively high to low.

EVIDENCE AND ITS QUALITY

The evidence on the intervention's "Positive Effects on the health system including health care availability".

The data may have been collected and written up by biased observers but it is difficult to find theoretical or practical arguments that support the opposite namely that the PEN had negative effects or no effects on the local health system or on the availability of local health services without sounding ridiculous. Sometimes it is hard to prove the obvious. The requests for the PEN's expansion to other areas from OD's in Takeo are further signs that the observations are shared and close to the truth. If anything the creation of PEN has brought populations closer to using service facilities that they were reluctant to use before they became member of the networks. There is no doubt that creating and adding PEN has improved the capacity of the OD health systems (public and private) to respond to health needs of its population. The evidence is as strong as it can possibly be.

Early awareness and diagnosis of DM : The percentage of people with DM who are detected with the method but who are not interested to become member is unknown but this is reportedly a rare event in the rural areas. The purpose of conducting the first screening for urine glucose and for HBP is double: a) to create sufficient groups of people who are aware of these risk factors and have the skills and tools to measure them. b) to raise awareness and promote individual's own responsibility to keep an eye on the easily measurable risk factors. The quality of the data that result from these amateur screening activities can still generate some useful findings and should be used as context specific evidence to inform local health policy.

The evidence that the organization of self-screening for DM has increased early awareness and diagnosis in the rural areas is relatively strong because the 2010 STEP survey allows to make a comparison between prevalence of DM and the effect of this type of screening to help uncover the hidden needs. The only rural district where the screening was completed (Ang Roka OD) now has almost 60% of all resident adults with DM registered as member of the PEN more than double of what is normal the awareness rate. There is reason to suspect that cases are missed (elevated renal threshold) and those with relatively lower postprandial values as the sensitivity of the urine glucose strips is not good. Besides some people whose urine glucose strip changes color will “deny” the problem and not tell the peer educator. Also some people will use the strip in the wrong way. In spite of these problems there are clear positive results in the form of detected new cases. The screening method is effective in the local context and affordable. Perhaps it is the optimal method for Cambodia. More cases may be detected but only by using more expensive methods.

Waist, BMI and Socio Economic Status: The report has given special attention to waist circumference and to BMI among the members. Many of these measurements may have been done in an unskilled way and with inferior scales and tailor’s centimeters but errors were not systematic and were not the result of any particular bias. One may expect that the errors have leveled each other out. The data had to be presented in order show that:

1) the intervention is able to reach large proportions of the population with small waist and with low BMI ; There has been no independent study done in Cambodia relating socio-economic status with BMI and waist circumference but they are likely to be positively correlated as in all other low income countries. This suggests that BMI and waist circumference can be used in rural Cambodia as proxies for socio-economic status of *large groups* of adults. This could mean that about half of the current members with DM and HBP are belonging to lower socio-economic quintiles in Cambodia. They would normally remain hidden in the rice fields instead of traveling regularly to town to attend diabetic clinics.

2) it is important in Cambodia not to focus only on overweight adults and people with a relatively large waist but on all adults is justified because people with DM do not share one simple biometric risk factor such as a large waist or an overweight body. Positive urine glucose is probably the risk factor that comes closest to what all diabetics in Cambodia have in common.

Another sign that the intervention has so far been effectively reaching the lower socio economic groups in the rural areas may be that only 20% of the female members can be reached through a telephone number at the time of their registration.

Once the Village High Blood Pressure Groups are in place the barriers to diagnosis of HBP are lowered but it is not clear yet how this will affect the rate of awareness of HBP in Cambodian adults. These rates can again be measured and compared with a future STEP survey in 2015. The planning of the STEP survey in 2015 should take the existence of these PEN into account because it can distort the results.

Retention :

The findings of 90% retention annually with only 10% loss to follow-up in rural area and only 13% in urban slums, only exist for people with DM, not for HBP patients without DM. The data on the urban retention of the first 170 members with DM are complete, re-checked and correct. That evidence on the ability of the PEN in the urban slums and rural networks to retain its members is based on the NGO’s own records. There can be unintended errors in the data because of competencies and literacy levels but also because people move in and out a lot. Also mistakes have been made and recording systems have changed, documents got lost or become unreadable.

Another factor determining the retention was the peer educators' fluctuating motivation in Takeo as a result of the changing levels of incentives provided by the NGO. In other provinces the incentive levels have remained constant.

A definition of retention was only introduced in 2008: More than 3 months no record of a contact between Peer Educator and DM patient means that the person (registered patient) is no longer being followed-up so lost to follow-up. People are always allowed back in if they had disappeared from follow-up by peer educator. The Peer Educators report every month on the results of their contact with the DM patient. In 2009 HBP patients were added to records in Ang Roka OD but kept as a separate group. In 2010 more non diabetic HBP members were added as a separate group but in 2011 they were administratively integrated to avoid bureaucratization and undesirable consequences at the actual implementation level. It is theoretically possible that peer educators report that there has been a contact while in fact there has been no contact but there is no evidence that this has happened. It has happened that a patient and a peer educator have contact by telephone in order to transmit the results to the peer educator so the peer educator can report this as part of the activity results for which the peer educator is reimbursed.

In the second half of 2009, due to lack of funding, the level of payments to peer educators was reduced and this resulted in less patients being in follow-up. Also the quality of the reporting in general by peer educators went down as more people were becoming member. It could be that the loss to follow-up in 2010 was in fact 5% higher so 15% instead of 10% but not much more. In 2010 peer educator incentives resumed and reporting modalities were strengthened. As a result, the quality of the data generated in second half of 2010 and 2011 is better than the data at the end of 2009 and early half of 2010.

Lifestyle improvements

The members who are interviewed during the six monthly assessments are randomly selected. The interviewers are peer educators from other areas who have no conflict of interest in reporting the true answers to the interviews. The patients are requested to say the truth even if it is not a nice answer to give to the interviewer. The results seem realistic and seem to reflect the reality. The quality of the evidence related to this seems to be good.

Health Expenditure

Patients who are interviewed as part of the six monthly assessments have no reason to over estimate or underestimate their health expenditure. The amounts they report are related to their expenses for medicines but do not always include transportation costs. The independent study carried out by Chean Men of the effects on health expenditure among the first 100 DM patients in Thmar Pouk OD gives the strongest evidence. The data from the different sources seem to confirm the same finding namely that the health expenditure among DM patients is reduced as a result of this intervention. The evidence is strong.

Health outcomes

The patient's awareness of diagnosis can also be considered a health outcome. More than 70% of DM patients in the rural area are made aware of their diagnosis as a result of the Peer Educator Intervention.

Consistently, during 5 years, the great majority (>80%) of DM patients randomly selected to be interviewed by outsiders report that they feel better since registering with the NGO. If "report to feel better" is accepted as a health outcome, the evidence is strong. The data do not yet exist for HBP patients without DM.

Blood Glucose: The main finding that BG levels are significantly reduced as a result of entering the program is based on good evidence but the extent to which this reduction takes place on average for everybody or in every

registered individual is almost impossible to assess. There exists no hard evidence supporting that a majority of DM patients are “treated to target” in terms of BG if we take as target 126mg/dl or would have an HbA1c <7% if this blood test would be used to assess their BG control. The evidence that half of the patients has a FBG result of 126mg/dl is not based on BG results that were obtained from the biochemistry laboratory services but from the ones that were recorded in the patient self-management book copied by the NGO during the six monthly assessment. Those BG values are produced by handheld BG-meters used by the Peer Educators during the follow-up. The BG values that are recorded at the time of registration are also produced by these handheld BG meters. When the program in Ang Roka started in 2007 a different BG meter was in use (ROCHE) than during the re-assessment in July 2010 (ACON). Both meters are supposed to convert the results of capillary (whole) blood to plasma results applying a conversion formula but it was not checked if both meters use the same formula. The reason that the bio-chemistry laboratory results were not used is that by mid 2010 the biochemistry laboratory was not yet ready to play its role when the last random assessment was taking place.

The quality of the evidence surrounding the urine glucose strip use for self management is also shaky because the urine strip use has been part of the items for which peer educators were rewarded so there was an incentive to report their use. However a comparison with the supply line showed the peer educators were reporting more use of urine strips than they had taken from the stock. This shows that peer educators are routinely capable of producing data about their patients on forms which are not based on reality if there is a “perverse” incentive encouraging them to do so. This was a lesson but it also cast a shadow over the quality of the patient records in general and that must include the recorded blood glucose results in the patient book on which the last random assessment was based. There is no evidence of cheating with those results however. With the 6 months assessments itself no such practices were ever discovered so these results give a better view of the reality and that is why they exist and what they are meant to do.

Blood Pressure: There are few issues related to blood pressure measurements: it may have been done sometimes too much in a hurry leading to higher results. Another issue is that there have been different machines used over time among which the most recent type tends to produce slightly higher results than the earlier automated machines. When averaged the 6-monthly assessment results do not show important differences with the results recorded in the patient book. There may have been the so called “white coat effect” where the 6 monthly assessment results were obtained in the hospital because randomly assessed patients were called to join in the assessment although they had never been there. So they were more nervous than when their blood pressure was measured in their home community. The overall evidence that the intervention significantly lowers blood pressure is strong but also the extent to which it does it is very difficult to ascertain.

There may also be an effect on the health outcomes resulting from the fact that some of the DM in Ang Roka OD (Takeo province) when they registered were still receiving free medication from Médecins sans Frontières Belgium who was running a DM clinic in the provincial hospital in Takeo province. Some DM patients registered with the PEN while they were receiving their free medication from MSF B. However when in July 2009 the clinic closed the patients received several months free supply and had to start to purchase their medicines from the RDF. Their ability to make the transition smoothly may also have affected the health outcomes assessed in July 2010 among diabetics especially among the poor patients who cannot afford the medication made available through MoPoTsyo's RDF. It is possible that these poor people had good control when they registered and presented with poor control during the July 2010 assessment.

FUTURE CHALLENGES

The Cambodian government will have to decide to what extent it wants chronic patients to be used as a new source of health financing for the public and or private services and how to intervene. With the introduction of task shifting to chronic patients themselves the government has a new policy instrument at its disposal to increase the value for the money it spends on health care inputs. In addition it can and must decide what kind of protection, if any, it wants to provide all or certain categories of patients. If nothing is done, chronic patients are the new cash cows for the public health facilities.

The future poses 5 types of major strategic challenges for which different options are open in how to proceed in terms of investment, focus, organization and choice of partners.

These 5 challenges are:

1. How to Decentralize

We have to decide whether we decentralize to ourselves, in other words deconcentrate, or devolve by giving a new and larger role to, for example the OD Health authority, in management of parts of the intervention. We also have to decide what we decentralize and what we retain at central level. Things to retain at central level are standards and protocols, policies on remuneration, training and retraining, monitoring and evaluation, supply of consumables, financing, whereas things to decentralize to provincial level units could items such as Management, reporting, paying incentives, monitoring, and possibly laboratory services.

2. To focus more on Supply of Services or on Demand for Services

Cambodia currently does not offer adequate services, as part of a CoC, to patients. Services are missing or of low quality. Although it appears odd that a patient organisation is taking on this challenge, the results show that by doing it, the activities fills an important gaps and meet health care needs that deserve to be met. There is no supplier induced demand for services and the utilization is not frivolous or excessive or wasteful. The NGO is organising health services as far as there is voluminous demand for these services from its own members. There may be potential to do more in terms of the range of services the NGO provides. On the other hand, patients often express an uninformed demand for health services. Peer Educators do not have a lot of tools at their disposal to communicate effectively with patients who are struggling with their lifestyle and adherence. Counseling techniques may be weak.

3. To invest more in reaching the Poor and protecting the Vulnerable

Many poor and near poor still struggle to adhere to treatment because of the costs involved in their individual treatment program. Some poor patients have prescription costs that are high for them. What can the NGO do to facilitate their access to their care. How to organize the payment on behalf of poor patients to an NGO who is also service provider ? Perhaps there can rise some conflict of interest which requires extra monitoring ?

4. To widen the Scope of diseases or to specialize further in DM and HBP

Heart diseases, arthritis and stomach problems are examples of diseases which the intervention could maybe help society to cope with. On the other hand the results that are produced currently are by no means perfect. How to deal with this question ?

5. How to organize the governance

With the privatization and decentralization of the responsibilities for financing in the form of autonomy of health districts and hospitals, the chronic patients risk becoming the modern age cash cows. This has already happened in many Asian societies including China. To reduce the damage to society, the proper interests of chronic patients need to be propped up regularly and safeguarded. Commercial interests of suppliers combine into silent but powerful lobbies that sway public policies to capitalize on the NCD epidemic but to the detriment of patients who pay the price instead of receiving the protection and care that they need. It is difficult to create institutions that are able to permanently and optimally safeguard the interests of chronic patients as a homogenous group. Perhaps an association of only patients, with special powers can be a solution.

CONCLUSIONS

The issue currently at stake in Cambodia with PENs for DM and HBP is not to prove that in comparison with professional health staff they perform better. That debate belongs for the time being in the developed world where professional services for patients exist and are or should be paid for. There is political tension with regards to the answer to this question for situations in developed countries where the health services are not reaching specific often marginalized populations. The evidence indicates that it does and that it does not. Whatever the right answer is, it is probably ill advised and impractical to decide what to do in Cambodia based mainly on that type of evidence but it must not be completely ignored just because it related to developed countries.

The experience with HIV-AIDS in developing countries in Africa has shown that if only extra funding is made available or only extra pharmaceuticals without the needed human resources workforce to handle these extra resources, Peer Educators and lay health workers may also be part of the solution but they need adequate management, and supervision and training as part of health systems strengthening.

In Cambodia the stage onto which the PENs made their entry was different from both situations described above: Although Cambodia is a developing country there were never substantial donor resources flows destined to reach people suffering from chronic NCD. So the PEN model has evolved as result of nurturing an attempt to get organized and structure a self-help group or “community”. This has now become what seems a still growing and living organism of mixed demand and supply forces attempting to feed on itself while it attaches itself to the public health system for governance and more resources. As the perfect parasite does not kill its master, it aims for symbiosis.

The way it is functioning does not make it a “quasi market” or another form of “internal market” because those types of markets create an artificial split between a provider and a purchaser in order to squeeze more efficiency out of existing budgets. Saving money and creating more efficiency was not the issue nor did it create a split between provider and purchaser. If anything it brings them closer improving communication through intermediaries who belong to both sides.

Market Healer: What this intervention model seems to be able to do is to *heal a health market* that would otherwise be dysfunctional and if left abandoned fails about 8 out of 10 of its demand side clients. It uses financial incentives to stimulate health service providers to promote better health outcomes creating more favorable conditions for *healthy ageing* of the adult population despite the low resource context.

With less than 2% of members annually during more than 5 years voluntarily dropping out the model creates a basis for long term health outcome improvements which may be expected as a result of the relative improvements in risk factor control of the membership as long as they are followed up by the Peer educators.

The fact that many of those health service providers are themselves users of the same services and its organizers may be a key element in the model. It opens, improves and optimises a market where demand and supply did not meet and that even did not seem to exist. The realization that the model appears to be cost effective comes at a time when the Ministry of Health is reflecting on its own formulation of an appropriate response to chronic NCD in the wake of the 2011 Moscow Declaration.

The findings suggest that the PENs have positive effects on health system bringing universal coverage closer by improving:

- Population trust in the right type of health services
 - Diabetic Peer Educators are unique brokers having learned to see the perspective of the service providers and of the users; they have no reason to lie or conflicts of interest;
- Health service availability and utilization
 - PEN helps to organize 4 types of services: screening for DM and HBP, laboratory services, medical consultations, and its RDF. Essential services that would not be available in Cambodia without their involvement; Besides, PEN educates and counsels patients in self-management;
- Improving access to disadvantaged groups such as older people, women and poorer socio-economic quintiles
 - As prevalence rates of DM and HBP among older people increase it is impossible to say if an adequate number of older people benefits of the services. It can be said that some do. Women benefit strongly from all aspects of the intervention. If small waist and lower BMI and lack of telephone are correlating with socio economic status in rural Cambodia, then the intervention is pro-poor (screening, registration, education) but poor people must have much more difficulty in paying for their prescription routine medication. Small waist and BMI cannot be used as proxy indicators in individual cases;
- Quality of care
 - Shared ownership of registered patients, peer educators, treating physicians, health authorities and the NGO appears to bring out the best that is available for the moment in the society at this level of cost.
- Health outcome (including earlier diagnosis)

- In rural areas the proportion of people made aware of DM more than doubles as a result of the intervention; knowledge of the risk factors increases, lifestyle adapts and health outcomes improve in terms of blood sugar, blood pressure and body weight with women benefiting more from the different aspects of the intervention than men except from being peer educator; Targeting & screening activities in Cambodia should not be limited to adults with large waist or with a BMI above a certain level. Organizing self-screening helps increase awareness of risk factors as a community awareness activity.
- Reducing catastrophic health expenditure
 - health expenditure among those with DM showed to be reduced by factor 3 in the months after registration;

Gender: It should be properly researched why after five years the women remain consistently underrepresented among the Peer Educators (30%) but overrepresented among the beneficiaries (70%) and proportionately (as registered members) represented in utilization of medical consultations and laboratory services. Access to medication is proportionate to the sexes among the membership. The fact that women are under represented among peer educators is probably a reflection of gender issues in the Cambodian society, perhaps the same reasons underlying the fact that they are under represented in the elected commune council. For example women have lower literacy rates and they are too busy keeping the house. Also, often the husband objects that their spouse starts to be less present around the house for an activity that brings in very little extra money and only honor for her which does not imply direct benefits for him. If Peer Educators are supposed to represent people with DM and HBP in their local community then the sexes need to be balanced in the representation. It is easier said than done!

Ways have to be found to improve the representation of women among peer educators. Gestational DM is only appearing as a result of the population wide screening. For this reason gestational DM is not being picked up as a result of the current intervention itself although many diabetic women who are member are in the fertile age groups. More research is needed into these aspects of the intervention and how the intervention can link better with M&CNH care initiatives that exist as part of the Ministry's program. There is for example no information on what the diabetic women who are member of MoPoTsyo and who are in the fertile age group think of becoming pregnant. Also there is no information about what trained midwives who are working in the area where there is a male peer educator active about opportunities of their diabetic female clients to get counseling.

Likewise there are opportunities to explore with regards to AIDS patients who become insulin resistant and even diabetic over time but who have not been able so far to obtain the integrated care and medication that they need through the national program.

Three key factors, which are relevant in the low resource context, make the involvement of peer educator networks as human resources an attractive option, when compared to professional health staff: 1) proximity to the targeted population, 2) low cost and 3) the provider payment methods. If these 3 key factors are not present, it is not clear if PEN still have a function in the Cambodian society.

- 1) As members of the targeted population who appear to have themselves recovered from serious illness, people can easily identify with them. They have the local population's trust.
- 2) The relatively low cost of their involvement in the delivery of health services helps to bring down an important element in the overall cost of care they not just help to provide but also use.

- 3) The third factor could in theory also be organised for professional health staff : a special incentive environment elaborated to frame optimally everything health service providers are supposed to do and achieve and which helps them to continue to behave. In practice however, it may be too costly to improve the incentive environment for professional health staff because they almost always are subjected to conflicts of interests in the form of more profitable alternative offers to choose from. This problem may not change any time soon.

If there are links going to be created with other types of programs, the same 3 factors may help frame how the relationship can be best constructed. That ensures that the peer educator involvement remains *limited* to where they have comparative advantage.

Until professional health staff will be sufficiently paid and in an incentive environment that is conducive to maintaining chronic patient health, peer educators in the Cambodian context are likely to continue to be able to play a role. That moment is not yet on the planning horizon. When it appears, the performance of peer educators can start to be compared with professional health staff. For the time being, the low resource context and the long term health and economic interests of the patients require that professionally trained health staff only perform tasks that peer educators cannot do while peer educators try to do as much as possible but only that what patients cannot do themselves. For the moment, it remains highly unlikely that the primary care health services needed by people with DM and HBP and in the organization & delivery of which the peer educators play such a pro-active role (1. self-screenings 2. counseling 3. assessments & registrations 4. DM patient education 5. medical consultation, 6. laboratory services and 7. the RDF) can produce the same or better results without their involvement, at least not at the same low cost levels.

For planning purposes one has to take into account that Cambodia's health system in the coming years does not just face a challenge to deal with the large backlog of undiagnosed and untreated patients with DM and HBP who are sick but who cannot access care but also with new cases that will appear every year. To this group must be added that with better access to care many people with DM and HBP are going to live longer requiring more complex care that will exceed the capacity of Peer Educators.

As Peer Educators start to deal with the case load they have an important additional job to take care of: those who are pre-diabetic and pre-hypertensive and whose onset of disease can be delayed or avoided through better risk factor control and through better awareness at community level. Peer educators come from different sectors in the society so this puts them in a favorable position in the mobilisation of broad support and in inter-sectoral action. The effectiveness and impact of those primary prevention activities have not yet been convincingly demonstrated but that they may be more a matter of time than of the way they go about it.

The experience so far in urban slums and rural areas shows that it is not necessary to strengthen capacity of existing clinics and professional health staff as a precondition or preparation before being able to reach DM and HBP patients with effective care. More experiments and pilots are necessary that build on empowerment of people with the disease at the core of the intervention and use them as fund holders.

PENs can only function if the actors are and of course remain adequately trained, paid, supervised and managed.

The experiences with PENs 2005 to 2010 demonstrate that the moment to address the population's health needs with regards to chronic NCD is overdue. Although no formal cost benefit study of the PEN was carried out, the costs and benefits (results) as reported in this research report show that investing US 2 per capita to set up PENs yields much larger long term economic benefits.

Health maintenance and life expectancy of at least one million Cambodians depend on whether the Ministry of Health prioritises long term population health over short term financial revenue for the health services. The trade-off is precarious and not suited for “win-win” solutions that allow public services to charge high prices or to pull chronic patients to use unnecessary services.

New and different indicators: As in the Tuberculosis program and the NCHADS program, separate indicators are needed. Some of the existing public service indicators may have to be reviewed to make sure that hospitalization rates and contact rates are not artificially inflated with chronic care patients as users of these services. Most of the existing public service performance indicators are geared towards “increasing service utilization” whereas in chronic care lower utilization and lower hospitalization may be signs of success in the form of control. Monitoring of the provision of acute care and chronic care must be separated in order to understand how the health facility is fulfilling its two almost opposite roles.

As privatization and internal contracting increasingly force health authorities, Hospital Managers and Clinic Managers to look for local sources of financing, it is necessary to provide chronic patients with the tools to protect themselves against catastrophic health expenditure. There are not only vulnerable chronic patients among the pre-identified poor but also among the non-poor who risk becoming poor due to disease related expenses. The PENs are suitable mechanisms to “help” target the most vulnerable patients for support including financial support.

Disadvantaged Groups: Non poor chronic patients should not be expected to shoulder the cost of care for poor chronic patients. This issue requires a political decision by Cambodian leaders once the social health protection system has been designed and adapted for to support care for chronic disease. Special external support systems are required to finance equity for the poor so they can use services like the non-poor. The height of monthly prescription costs is an indicator that can be used to weigh in the decision to provide special social health protection.

The PENs show that an affordable CoC can be organized for and by Cambodian patients with DM and HBP. Similar potential may be available among patients affected by other chronic diseases. The interests of Cambodian people with chronic NCD deserve to be better taken into account in decision making, health policy making and in institutional governance. The strategy of task shifting to chronic patients creates important opportunities for low income countries, where there international wisdom had assumed that there were none at all. Task shifting to chronic patients, combined with payment for performance, in fact opens access to effective care for large not wealthy population groups with DM and perhaps also HBP.

NGO's remain suitable vehicles in the Cambodian context for piloting new strategies, flexible as they are, but they cannot be expected to govern and own the actual response to a population health need as important as DM and HBP. Once the innovation will be sufficiently fine-tuned, considered acceptable, effective, financially sustainable, the Cambodian government should take on a major institutional role in the governance of its scale-up by throwing its weight and finances behind it. The adapted wordings of the Annual Operational Planning allow this to happen from 2012 onwards.

With decentralization much of the care burden can be devolved to lower levels at the risk that advantages may again be lost, unless central government takes up a stronger position in the defense of chronic patient long term interests and facilitates the institutionalization of their empowerment as important stakeholders in the country's future health system.

Annexes

List of Outputs/materials

There are different kinds of outputs that result from the PEN activities:

- The intervention model itself with the tools that have been developed
- The health care that has been provided to the patients by others than patients themselves (peer educators organizing screening, providing counseling to new patients and teaching them how to self manage,
- The health care made available from the specific health services (biochemistry laboratory tests, medical consultations, RDF;

The PEN networks try to deliver these outputs as part of a coordinated system to themselves and the people that they have registered as members.

Practical tools in Khmer language and which can be used by DM patients and HBP patients for self-management record keeping.

For the patients:

- Patient self-management book for DM (suitable for 4 years)
- Patient self-management book for HBP
- A nutritional pyramid for uncontrolled DM to help bring down hyperglycemia
- A nutritional pyramid for people HBP patients
- A nutritional food pyramid to prevent chronic disease
- Instruction leaflets for use of urine glucose strips
- Explanations of relevance of particular laboratory tests;
- Explanations of the use of certain medicines including insulin and how to administer this;

For the Peer Educators:

- Peer Educator follow-up book
- A training curriculum
- Materials that Peer Educators can use during group trainings of patients

- Activity report formats for key activities: screening, for assessment of new patients, for follow-up, for stop or resumption of follow-up, for training activities, for claiming travel costs, for requesting supplies such as urine strips, blood glucose strips and lancets, for re-assessing patients, for recommending patients for medical consultation or for laboratory tests;
- Material for primary prevention (promotion risk factor control awareness) for use in schools and in communities;

For a district based Diabetes Program Manager

- Forms and Summary Reports on the Peer Educator activities
- Local Stock keeping reports

In addition there is series of contracts that regulate the relationships with the different actors, such as the private Pharmacies, the OD, the NGO and its employees, etc. The issue of “governance” remains open and will be explored more in detail towards the end of this report.

The NGO’s database is centralized and was specifically developed for managing the intervention. It contains the assessment data of all registered patients, their re-assessments, their laboratory results, prescriptions and pharmacy invoice data.

Tables on use of laboratory by the urban and rural members in 2010

Table 35 Urban slum DM using laboratory

Use of laboratory service by urban members with DM					
slum area	members in follow up	2010 all tests	unique patients	second tests	participation rate
AK	114	85	64	21	0.56
BK	93	72	59	13	0.63
BB	80	81	63	18	0.79
BR	67	52	42	10	0.63
BS	38	69	49	20	1.29
totals	392	359	277	82	71%

30%

Table 36 Rural area DM using laboratory

Use of laboratory service by Ang Roka OD members with DM					
Health Center	members in follow up	2010 all tests	unique patients	second tests	participation rate
ARA	33	36	26	10	0.79
ARB	66	42	31	11	0.47
ARC	24	10	10	0	0.42
ARD	44	48	35	13	0.80
ARE	83	54	44	10	0.53
ARF	27	34	25	9	0.93
AFG	40	48	34	14	0.85
ARH	68	56	43	13	0.63
ARI	32	43	29	14	0.91
ARJ	44	43	32	11	0.73
totals	461	414	309	105	67%

34%

Two by two table analysis

Row1: 133; 263

Row2: 85; 137

CI: 95%

z for 95% CI= 1.96

Total cases in table 618

Smallest cell contains 85 cases

Chi squares

(all with 1 degree of freedom):

Pearson's= 1.378 (p=0.240488) *

Likelihood Ratio= 1.371 (p=0.24167)

Yate's= 1.179 (p=0.27746)

Mantel Haenszel= 1.376 (p=0.24087)

Measures of Association for 2X2 table:

Measures based on alpha:

Risk Ratio

first column against row totals

p1=133/396; p2=85/222

p1/p2: 0.8772 (invers p2/p1: 1.14)

Wald 95% CI: 0.706 >0.877> 1.09

first row against column totals

p1=133/218; p2=263/400

p1/p2: 0.9279 (invers p2/p1: 1.0777)

Wald 95% CI: 0.817 >0.928> 1.054

Odds Ratio:

Odds1=133/263; Odds2=85/137; or

Odds1=133/85; Odds2=263/137

O.R.=Odds1/Odds2=0.81507

Approx. S.E. O.R.: 0.1421

Wald 95% CI: 0.579 >0.815> 1.147

O.R.=Odds2/Odds1=1.22688

~SE= 0.2139

Wald 95% CI: 0.872 >1.227> 1.727

Measures based on Odds-ratio:

Log-odds: -0.2045; s.e.= 0.1743

Yules-Q: -0.101883; s.e.= 0.0863

Yules-Y: -0.051074; s.e.= 0.0435

Measures based on Chi-square:

Phi-sq: 0.0022

Pearsons R: 0.0472 (p= 0.240488)

Miscellaneous Tests:

kappa agreement measure: -0.04

Variance: 0.00116; S.E.: 0.0341

95% CI: -0.107 <-0.04> 0.027

McNemar Change Tests:

Pearson chi2: 91.046 (p= 0)

Yates chi2: 90.026; (p= 0)

Binomial (P>=85|N=348)= 1

Bibliography

- Abegunde, D. (2007). Can non-physician health-care workers assess and manage cardiovascular risk in primary care? *Bulletin of the World Health Organization*, 85(6), 432-440. doi: 10.2471/BLT.06.032177.
- Accurso, A., Bernstein, R. K., Dahlqvist, A., Draznin, B., Feinman, R. D., Fine, E. J., et al. (2008). Dietary carbohydrate restriction in type 2 diabetes mellitus and metabolic syndrome: time for a critical appraisal. *Nutrition & metabolism*, 5, 9. doi: 10.1186/1743-7075-5-9.
- Adeyi, O. (2007). *Public Policy and the Challenge of Chronic Noncommunicable Diseases. WORLD BANK Directions in Development* (p. 218). doi: 10.1093/ije/dym222.
- Agyemang, C., Bruijnzeels, M. a, & Owusu-Dabo, E. (2006). Factors associated with hypertension awareness, treatment, and control in Ghana, West Africa. *Journal of human hypertension*, 20(1), 67-71. doi: 10.1038/sj.jhh.1001923.
- Alberti, H., Boudriga, N., & Nabli, M. (2007). Primary care management of diabetes in a low/middle income country: a multi-method, qualitative study of barriers and facilitators to care. *BMC family practice*, 8, 63. doi: 10.1186/1471-2296-8-63.
- Amazigo M. Noma B. A. Boatin D. E., U. (1998). Delivery systems and cost Mectizan treatment for onchocerciasis recovery in. *Annals of Tropical Medicine And Parasitology*, 92(Supplement 1), 23-31. doi: 10.1080/00034989859528.
- Anderson, R., & Funnell, M. (2005). Patient empowerment: reflections on the challenge of fostering the adoption of a new paradigm. *Patient education and counseling*, 57(2), 153-7. doi: 10.1016/j.pec.2004.05.008.
- Baksi, a K., Al-Mrayat, M., Hogan, D., Whittingstall, E., Wilson, P., & Wex, J. (2008). Peer advisers compared with specialist health professionals in delivering a training programme on self-management to people with diabetes: a randomized controlled trial. *Diabetic Medicine*, 25(9), 1076-82. doi: 10.1111/j.1464-5491.2008.02542.x.
- Balabanova, D., McKee, M., Koroleva, N., & Chikovani, I. (2009). Navigating the health system: diabetes care in Georgia. *Health policy and planning*, 24(1), 46-54. doi: 10.1093/heapol/czn041.
- Beaglehole, R., Epping-jordan, J., Patel, V., Chopra, M., Ebrahim, Shah, Kidd, M., et al. (2008). Alma-Ata : Rebirth and Revision 3 Improving the prevention and management of chronic disease in low-income and middle-income countries : a priority for primary health care. *The Lancet*, 372, 940-949.

- Beran, D., McCabe, A., & Yudkin, J. (2008). Access to medicines versus access to treatment: the case of type 1 diabetes. *Bulletin of the World Health Organization*, 86(8), 648-649. doi: 10.2471/BLT.07.048710.
- Beran, D., & Yudkin, J. (2006). Diabetes care in sub-Saharan Africa. *The Lancet*, 368(9548), 1689-95. doi: 10.1016/S0140-6736(06)69704-3.
- Beran, D., Yudkin, J. S., & Courten, M. de. (2005). Access to care for patients with insulin-requiring diabetes in developing countries. *Diabetes Care*, 28(9), 2136.
- Björck, I., Granfeldt, Y., & Asp, N.-georg. (1994). Food properties affecting the digestion and absorption of carbohydrates. *American Journal of Clinical Nutrition*, 59(3), 699S-705S (Supplement).
- Bärnighausen, T., Bloom, E., & Humair, S. (2010). Universal antiretroviral treatment : the challenge of human resources. *Bulletin of the World Health Organisation*, 88, 951-952. doi: 10.2471/BLT.09.073890.
- Chan, J. C. N., Malik, V., Jia, W., Kadowaki, T., Yajnik, C. S., Yoon, K.-H., et al. (2009). Diabetes in Asia: epidemiology, risk factors, and pathophysiology. *JAMA : the journal of the American Medical Association*, 301(20), 2129-40. doi: 10.1001/jama.2009.726.
- Chongsuvivatwong, V., Phua, K. H., Yap, M. T., Pocock, N. S., Hashim, J. H., Chhem, R., et al. (2011). Health and health-care systems in southeast Asia: diversity and transitions. *The Lancet*, 377(9763), 429-437. Elsevier Ltd. doi: 10.1016/S0140-6736(10)61507-3.
- Choudhry, N. K., & Shrank, W. H. (2010). Four-dollar generics - increased accessibility, impaired quality assurance. *The New England journal of medicine*, 363(20), 1885-7. doi: 10.1056/NEJMp1006189.
- Chow, C. (2006). The Prevalence and Management of Diabetes in Rural India. *Diabetes care*, 29(7), 1717-1718. doi: 10.2337/dc06-0781.
- Chuma, J., Gilson, L., & Molyneux, C. (2007). Treatment-seeking behaviour, cost burdens and coping strategies among rural and urban households in Coastal Kenya: an equity analysis. *Tropical medicine & international health : TM & IH*, 12(5), 673-86. doi: 10.1111/j.1365-3156.2007.01825.x.
- Clarke, P., Glasziou, P., Patel, A., Chalmers, J., Woodward, M., Harrap, S. B., et al. (2010). Event rates, hospital utilization, and costs associated with major complications of diabetes: a multicountry comparative analysis. *PLoS medicine*, 7(2), e1000236. doi: 10.1371/journal.pmed.1000236.
- Cleland, J. G. F., & Ekman, I. (2010). Enlisting the help of the largest health care workforce--patients. *JAMA : the journal of the American Medical Association*, 304(12), 1383-4. doi: 10.1001/jama.2010.1387.

- Coleman, R., Lopy, L., & Walraven, G. (2002). The treatment gap and primary health care for people with epilepsy in rural Gambia. *Bulletin of the World Health Organization*, 80(5), 378–383.
- Coovadia, H., & Bland, R. (2008). From Alma-Ata to Agincourt: primary health care in AIDS. *The Lancet*, 372(9642), 866-8. doi: 10.1016/S0140-6736(08)61373-2.
- Currie, C. J., Morgan, C. L., Dixon, S., McEwan, P., Marchant, N., Bearne, A., et al. (2005). The financial costs of hospital care for people with diabetes who have single and multiple macrovascular complications. *Diabetes research and clinical practice*, 67(2), 144-51. doi: 10.1016/j.diabres.2004.01.002.
- Diamond, J. (2003). The double puzzle of diabetes. *Nature*, 423(6940), 599-602. doi: 10.1038/423599a.
- Ding, S., Chen, Y., Feng, L., & Li, Z. (2008). Prevalence of Illness and Household Ill-Health risk Coping Strategies in Rural China A Chinese literature review. In Bruno Meessen (Ed.), *Health and social protection: experiences from Cambodia, China and Lao PDR in SHSO&P 23* (pp. 55-82). ITGPRESS.
- Dussault, G. (2008). The health professions and the performance of future health systems in low-income countries: support or obstacle? *Social science & medicine*, 66(10), 2088-95. doi: 10.1016/j.socscimed.2008.01.035.
- Editorial. (2010). Type 2 diabetes—time to change our approach. *The Lancet*, 375(9733), 2193. Elsevier Ltd. doi: 10.1016/S0140-6736(10)61011-2.
- Falkingham, J. (2004). Poverty, out-of-pocket payments and access to health care: evidence from Tajikistan. *Social Science & Medicine*, 58(2), 247-258. doi: 10.1016/S0277-9536(03)00008-X.
- Fang, L., & Bloom, G. (2008). Between Profit and Legitimacy, A Case Study of Two Successful Township Health Centers in Rural China. In Bruno Meessen (Ed.), *Health and social protection: experiences from Cambodia, China and Lao PDR, in SHSO&P 23* (pp. 107-122). ITGPRESS.
- Farmer, P., Frenk, J., Knaul, F., Shulman, L. N., Alleyne, G., Armstrong, L., et al. (2010). Expansion of cancer care and control in countries of low and middle income: a call to action. *The Lancet*, 376, 1186-1193. doi: 10.1016/S0140-6736(10)61152-X.
- Fu, D., Fu, H., McGowan, P., Shen, Y.-e, Zhu, L., Yang, H., et al. (2003). Implementation and quantitative evaluation of chronic disease self-management programme in Shanghai, China: randomized controlled trial. *Bulletin of the World Health Organization*, 81(3), 174-82. Retrieved from <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2572423&tool=pmcentrez&rendertype=abstract>.

- Funnell, M., Brown, T., Childs, B., Haas, L. B., Hosey, G. M., Jensen, B., et al. (2010). National standards for diabetes self-management education. *Diabetes care*, 33 Suppl 1, S89-96. doi: 10.2337/dc10-S089.
- Fuster, V., & Voûte, J. (2005). MDGs: chronic diseases are not on the agenda. *The Lancet*, 366(9496), 1512-4. doi: 10.1016/S0140-6736(05)67610-6.
- Gakidou, E., Mallinger, L., Abbott-Klafter, J., Guerrero, R., Villalpando, S., Ridaura, R. L., et al. (2011). Management of diabetes and associated cardiovascular risk factors in seven countries: a comparison of data from national health examination surveys. *Bulletin of the World Health Organization*, 89(3), 172-83. doi: 10.2471/BLT.10.080820.
- Gao, W. G., Dong, Y. H., Pang, Z. C., Nan, H. R., Zhang, L., Wang, S. J., et al. (2009). Increasing trend in the prevalence of Type 2 diabetes and pre-diabetes in the Chinese rural and urban population in Qingdao, China. *Diabetic medicine*, 26(12), 1220-7. doi: 10.1111/j.1464-5491.2009.02832.x.
- Hardeman, W., Van Damme, W., Pelt, M. van, Por, I., Heng, K., & Meessen, Bruno. (2004). Access to health care for all? User fees plus a Health Equity Fund in Sotnikum, Cambodia. *Health Policy and Planning*, 19(1), 22-32. doi: 10.1093/heapol/czh003.
- Harries, A., Jahn, A., Zachariah, R., & Enarson, D. (2008). Adapting the DOTS framework for tuberculosis control to the management of non-communicable diseases in sub-Saharan Africa. *PLoS medicine*, 5(6), e124. doi: 10.1371/journal.pmed.0050124.
- Harries, A. D., Zachariah, Rony, Kapur, Anil, Jahn, Andreas, & Enarson, D. a. (2009). The vital signs of chronic disease management. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 103(6), 537-40. doi: 10.1016/j.trstmh.2008.12.008.
- Hermann, K., Van Damme, Wim, Pariyo, G. W., Schouten, E., Assefa, Y., Cirera, A., et al. (2009). Community health workers for ART in sub-Saharan Africa: learning from experience--capitalizing on new opportunities. *Human resources for health*, 7, 31. doi: 10.1186/1478-4491-7-31.
- Ir, P., Men, Chean, Lucas, H., Meessen, Bruno, Decoster, K., Bloom, Gerald, et al. (2010). Self-reported serious illnesses in rural Cambodia: a cross-sectional survey. (P. H. M. van Baal, Ed.) *PloS one*, 5(6), e10930. Public Library of Science. doi: 10.1371/journal.pone.0010930.
- Irwin, A., & Ombaka, E. (2004). Millennium Project, Background Paper of the Task Force on Major Diseases and Access to Medicine , Subgroup on Access to Essential Medicines. *UN Secretary General*, 85.
- Isaakidis, P., Raguenaud, M-E, Say, C., De Clerck, H., Khim, C., Pottier, R., et al. (2010). Treatment of hypertension in rural Cambodia: results from a 6-year programme. *Journal of human hypertension*, 1-9. Nature Publishing Group. doi: 10.1038/jhh.2010.49.

- Isaakidis, P., Raguenaud, M-E, Say, C., De Clerck, H., Khim, C., Pottier, R., et al. (2010). Treatment of hypertension in rural Cambodia: results from a 6-year programme. *Journal of human hypertension*, 1-9. Nature Publishing Group. doi: 10.1038/jhh.2010.49.
- Ishine, M. (2008). Improvement in obesity and glucose tolerance in elderly people after lifestyle changes 1 year after an OGTT in a rural area in Lao PDR. *Journal American Geriatric Society*, 56(8), 1582-1583.
- Janssens, B., Damme, W. V., Raleigh, B., Gupta, J., Khem, S., Ty, K. S., et al. (2007). Offering integrated care for HIV / AIDS , diabetes and hypertension within chronic disease clinics in Cambodia. *Bulletin of the World Health Organization*, 85, 880-885. doi: 10.2471/BLT.06.036574.
- Janssens, B., Damme, W. van, Raleigh, B., Gupta, J., Khem, S., Ty, K. S., et al. (2007). Offering integrated care for HIV / AIDS , diabetes and hypertension within chronic disease clinics in Cambodia. *Bulletin of the World Health Organization*, 85(11), 880-885. doi: 10.2471/BLT.06.036574.
- Jeon, C., & Murray, M. (2008). Diabetes mellitus increases the risk of active tuberculosis: a systematic review of 13 observational studies. *PLoS medicine*, 5(7), e152. doi: 10.1371/journal.pmed.0050152.
- Kamadjeu, R. M., Edwards, R., Atanga, J. S., Unwin, N, Kiawi, E. C., & Mbanya, J.-C. (2006). Prevalence, awareness and management of hypertension in Cameroon: findings of the 2003 Cameroon Burden of Diabetes Baseline Survey. *Journal of human hypertension*, 20(1), 91-2. doi: 10.1038/sj.jhh.1001936.
- Kang, J. Y., Cho, S. W., Sung, S. H., Park, Y. K., Paek, Y. M., & Choi, T. I. (2010). Effect of a continuous diabetes lifestyle intervention program on male workers in Korea. *Diabetes research and clinical practice*, 90(1), 26-33. Elsevier Ireland Ltd. doi: 10.1016/j.diabres.2010.06.006.
- Kapur, A. (2007). Economic analysis of diabetes care. *The Indian journal of medical research*, 125(3), 473-82. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/17496369>.
- Katulanda, P., Constantine, G. R., Mahesh, J. G., Sheriff, R., Seneviratne, R. D. A., Wijeratne, S., et al. (2008). Prevalence and projections of diabetes and pre-diabetes in adults in Sri Lanka--Sri Lanka Diabetes, Cardiovascular Study (SLDCS). *Diabetic medicine*, 25(9), 1062-9. doi: 10.1111/j.1464-5491.2008.02523.x.
- Kawabata, K., Xu, K., & Carrin, G. (2002). Preventing impoverishment through protection against catastrophic health expenditure. *Bulletin of the World Health Organization*, 80(8), 612. Retrieved from <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2567587&tool=pmcentrez&rendertype=abstract>.

- King, H, Keuky, L, Seng, S, Khun, T., Roglic, Gojka, & Pinget, M. (2005). Diabetes and associated disorders in Cambodia: two epidemiological surveys. *The Lancet*, 366, 1633-9. doi: 10.1016/S0140-6736(05)67662-3.
- King, Hilary, Keuky, Lim, Seng, Serey, Khun, T., Roglic, Gojka, & Pinget, M. (2005). Diabetes and associated disorders in Cambodia: two epidemiological surveys. *Lancet*, 366(9497), 1633-9. doi: 10.1016/S0140-6736(05)67662-3.
- Knowler, W. C., Barrett-Connor, E., Fowler, S. E., Hamman, R. F., Lachin, J. M., Walker, E. a, et al. (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *The New England journal of medicine*, 346(6), 393-403. doi: 10.1056/NEJMoa012512.
- Koh, H. K. (2007). Making smoking history worldwide. *The New England journal of medicine*, 356(15), 1496-8. doi: 10.1056/NEJMp068279.
- Kruk, M. E., Goldmann, E., & Galea, S. (2009). Borrowing and selling to pay for health care in low-and middle-income countries. *Health Affairs*, 28(4), 1056 - 1066.
- Laing, R., Hogerzeil, H., & Ross-Degnan, D. (2001). Ten recommendations to improve use of medicines in developing countries. *Health policy and planning*, 16(1), 13-20. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/11238425>.
- Lawn, J., Rohde, J., Rifkin, S., Were, M., Paul, V., & Chopra, M. (2008). Alma-Ata : Rebirth and Revision 1, Alma-Ata 30 years on : revolutionary , relevant , and time to revitalise. *The Lancet*, 372, 917-927.
- Le, D. S. N. T., Kusama, K., & Yamamoto, S. (2006). A community-based picture of type 2 diabetes mellitus in Vietnam. *Journal of atherosclerosis and thrombosis*, 13(1), 16-20. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/16505587>.
- Liu, S, Manson, J. E., Stampfer, M. J., Hu, F B, Giovannucci, E., Colditz, G. a, et al. (2000). A prospective study of whole-grain intake and risk of type 2 diabetes mellitus in US women. *American journal of public health*, 90(9), 1409-15. Retrieved from <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1447620&tool=pmcentrez&rendertype=abstract>.
- Lopez, A. (2006). *Global Burden of Disease and Risk Factors. IBRD/WB* (p. 506). Oxford University Press, New York.
- Lu, K.-Y., Lin, P.-L., Tzeng, L.-C., Huang, K.-Y., & Chang, L.-C. (2006). Effectiveness of case management for community elderly with hypertension, diabetes mellitus, and hypercholesterolemia in Taiwan: a record review. *International journal of nursing studies*, 43(8), 1001-10. doi: 10.1016/j.ijnurstu.2005.11.013.

- Maher, D., Smeeth, L., & Sekajugo, J. (2010). Health transition in Africa : practical policy proposals for primary care. *Bulletin of World Health Organisation*, 88, 943-948. doi: 10.2471/BLT.10.077891.
- McPake, B., & Mensah, K. (2008). Task shifting in health care in resource-poor countries. *The Lancet*, 372, 870-1. doi: 10.1016/S0140-6736(08)61375-6.
- Meessen, B., & Criel, B. (2008). Health and social protection in Transitional Asia: challenges and ways forward. *Health and social protection: experiences from Cambodia, China and Lao PDR*, in SHSO&P 23 (pp. 15-26).
- Men, C. (2011). *Peer Educator Network in Thmar Pouk Cambodia: An intervention to Reduce Health Care Costs and Improve Health Outcomes of Patients with Diabetes and Hypertension*; (p. 27). Retrieved from [http://www.mopotsyo.org/Highlight2010_Dec_2011_Feb/Narrative report on mopotsyo patients _final.pdf](http://www.mopotsyo.org/Highlight2010_Dec_2011_Feb/Narrative%20report%20on%20mopotsyo%20patients_final.pdf).
- Ministry of Health. (2009). *NATIONAL STRATEGY FOR THE PREVENTION AND CONTROL OF NONCOMMUNICABLE DISEASE. Cambodia* (p. 35).
- Miranda, J. J., Kinra, S., Casas, J. P., Davey Smith, G., & Ebrahim, S. (2008). Non-communicable diseases in low- and middle-income countries: context, determinants and health policy. *Tropical medicine & international health : TM & IH*, 13(10), 1225-34. doi: 10.1111/j.1365-3156.2008.02116.x.
- MOH&WHO. (2010). *STEP Survey on PREVALENCE OF NON - COMMUNICABLE DISEASE RISK FACTORS IN CAMBODIA. Preventive Medicine* (p. 192 pages).
- Mohamed Ali, G. (2009). How to establish a successful revolving drug fund: the experience of Khartoum state in the Sudan. *Bulletin of the World Health Organization*, 87(2), 139-142. doi: 10.2471/BLT.07.048561.
- Morris, L. (1981). Correlation between Plasma and Urine Glucose in Diabetes. *Annals of Internal Medicine*, 94(Part 1), 469-471.
- Mourik, M. van, Cameron, A., Ewen, M., & Laing, R. (2010). Availability, price and affordability of cardiovascular medicines: A comparison across 36 countries using WHO/HAI data. *BMC Cardiovascular Disorders*, 10(1), 25.
- MSH&WHO. (2009). *International Drug Price Indicator Guide* (p. 323).
- Murakami, H., Phommasack, B., Oula, R., & Sinxomphou, S. (2001). Revolving drug funds at front-line health facilities in Vientiane, Lao PDR. *Health policy and planning*, 16(1), 98-106. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/11238436>.

- Murakami, K., Sasaki, S., Takahashi, Y., Okubo, H., Hosoi, Y., Horiguchi, H., et al. (2006). Dietary glycemic index and load in relation to metabolic risk factors in Japanese female farmers with traditional dietary habits. *The American journal of clinical nutrition*, 83(5), 1161-9. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/16685061>.
- Narayan, K. M. V., & Williamson, D. F. (2010). Prevention of type 2 diabetes: risk status, clinic, and community. *Journal of general internal medicine*, 25(2), 154-7. doi: 10.1007/s11606-009-1148-9.
- Neuhann, H. F., Warter-Neuhann, C., Lyaruu, I., & Msuya, L. (2002). Diabetes care in Kilimanjaro region: clinical presentation and problems of patients of the diabetes clinic at the regional referral hospital-an inventory before structured intervention. *Diabetic medicine*, 19(6), 509-13. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/12060064>.
- Nielsen, Jörgen V, & Joensson, E. a. (2008). Low-carbohydrate diet in type 2 diabetes: stable improvement of bodyweight and glycemic control during 44 months follow-up. *Nutrition & metabolism*, 5, 14. doi: 10.1186/1743-7075-5-14.
- Norris, S. L., Nichols, P. J., Caspersen, C. J., Glasgow, R. E., Engelgau, M. M., Jr, L. J., et al. (2002). Increasing Diabetes Self-Management Education A Systematic Review. *American Journal of Preventive Medicine*, 22(02).
- Pan, X. (1997). Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance. *Diabetes Care*, 20, 537-544.
- Pekka, P., Pirjo, P., & Ulla, U. (2002). Part III. Can we turn back the clock or modify the adverse dynamics? Programme and policy issues. *Public Health Nutrition*, 5(1a), 245-251. doi: 10.1079/PHN2001300.
- Peters, D., & Muraleedharan, V. R. (2008). Regulating India's health services: to what end? What future? *Social science & medicine*, 66(10), 2133-44. doi: 10.1016/j.socscimed.2008.01.037.
- R Debarma. (2005). Healthcare Planning in North-East India: A Survey on Diabetes Awareness, Risk Factors and Health Attitudes in a Rural Community. *Journal of Physicians of India*, 57.
- Radhika, G., Van Dam, R. M., Sudha, V., Ganesan, A., & Mohan, V. (2009). Refined grain consumption and the metabolic syndrome in urban Asian Indians (Chennai Urban Rural Epidemiology Study 57). *Metabolism: clinical and experimental*, 58(5), 675-81. Elsevier Inc. doi: 10.1016/j.metabol.2009.01.008.
- Raguenaud, Marie-Eve, Isaakidis, Petros, Reid, Tony, Chy, S., Keuky, Lim, Arellano, G., et al. (2009). Treating 4,000 diabetic patients in Cambodia, a high-prevalence but resource-limited setting: a 5-year study. *BMC medicine*, 7, 33. doi: 10.1186/1741-7015-7-33.

- Ramachandran, A. (2008). High Prevalence of Diabetes and Cardiovascular Risk Factors Associated with Urbanization in India. *Diabetes Care*, 31(5), 893-898. doi: 10.2337/dc07-1207.Abbreviations.
- Ramachandran, A., Ramachandran, S., Snehalatha, C., Augustine, C., Murugesan, N., Viswanathan, V., et al. (2007). Increasing expenditure on health care incurred by diabetic subjects in a developing country: a study from India. *Diabetes care*, 30(2), 252-6. doi: 10.2337/dc06-0144.
- Ramachandran, A., Wan Ma, R., & Snehalatha, C. (2010). Diabetes in Asia. *The Lancet*, 375(9712), 408-418. Elsevier Ltd. doi: 10.1016/S0140-6736(09)60937-5.
- Ravelli, a C., Meulen, J. H. van der, Michels, R. P., Osmond, C, Barker, D. J., Hales, C. N., et al. (1998). Glucose tolerance in adults after prenatal exposure to famine. *Lancet*, 351(9097), 173-7. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/9449872>.
- Rolfe, M., Tang, C. M., Walker, R. W., Bassey, E., & George, M. (1992). Diabetes mellitus in the Gambia, West Africa. *Diabetic Medicine*, 9(5), 484-488.
- Rooij, S R de, Painter, R C, Roseboom, T J, Phillips, D I W, Osmond, C, Barker, D. J. P., et al. (2006). Glucose tolerance at age 58 and the decline of glucose tolerance in comparison with age 50 in people prenatally exposed to the Dutch famine. *Diabetologia*, 49(4), 637-43. doi: 10.1007/s00125-005-0136-9.
- Rooij, Susanne R de, Painter, Rebecca C, Phillips, David I W, Osmond, Clive, Michels, Robert P J, Godsland, I. F., et al. (2006). Impaired insulin secretion after prenatal exposure to the Dutch famine. *Diabetes care*, 29(8), 1897-901. doi: 10.2337/dc06-0460.
- Rotchford, A. P., Rotchford, K. M., Machattie, T., & Gill, G. V. (2002). Assessing diabetic control--reliability of methods available in resource poor settings. *Diabetic medicine : a journal of the British Diabetic Association*, 19(3), 195-200. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/11918621>.
- Ruhnau, B., Faber, O. K., Borch-johnsen, K., & Thorsteinsson, B. (1997). Renal threshold for glucose in non-insulin-dependent diabetic patients. *Diabetes research and clinical practice*, 36, 27-33.
- Russel, S., & Gilson, L. (2006). Are health services protecting the livelihoods the urban poor in Sri Lanka? Findings from two low-income areas of Colombo. *Social Science & Medicine*, 63(7), 1732-44. doi: 10.1016/j.socscimed.2006.04.017.
- Sande, M. a van der, Walraven, G. E., Bailey, R., Rowley, J. T., Banya, W. a, Nyan, O. a, et al. (1999). Is there a role for glycosuria testing in sub-Saharan Africa? *Tropical medicine & international health : TM & IH*, 4(7), 506-13. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/10470343>.

- Seng Serey et al. (2007). Studying changes in glycemic index of white rice according to how it is prepared. *unpublished*, 1-10. Retrieved from <http://www.mopotsyo.org/20070730GI-final.pdf>.
- Smith, F. (2004). Community pharmacy in Ghana: enhancing the contribution to primary health care. *Health Policy and Planning*, 19(4), 234-241. doi: 10.1093/heapol/czh028.
- Standing, H., & Chowdhury, A. M. R. (2008). Producing effective knowledge agents in a pluralistic environment: what future for community health workers? *Social Science & Medicine*, 66(10), 2096-107. doi: 10.1016/j.socscimed.2008.01.046.
- Stevenson, C., Forouhi, N., Roglic, G., Williams, B., Lauer, J., Dye, C., et al. (2007). Diabetes and tuberculosis: the impact of the diabetes epidemic on tuberculosis incidence. *BMC public health*, 7, 234. doi: 10.1186/1471-2458-7-234.
- Struthers, R., Hodge, F. S., De Cora, L., & Geishirt-Cantrell, B. (2003). The experience of native peer facilitators in the campaign against type 2 diabetes. *The Journal of Rural Health*, 19(2), 174-180.
- Stuckler, D., Basu, S., & McKee, M. (2010). Drivers of inequality in Millennium Development Goal progress: a statistical analysis. *PLoS medicine*, 7(3), e1000241. doi: 10.1371/journal.pmed.1000241.
- Suhrcke, M. (2006). *Chronic disease: an economic perspective* (p. 60). London.
- Sun, Q., Spiegelman, D., Dam, R. M. van, Holmes, M. D., Malik, V. S., Willett, Walter C, et al. (2010). White rice, brown rice, and risk of type 2 diabetes in US men and women. *Archives of internal medicine*, 170(11), 961-9. doi: 10.1001/archinternmed.2010.109.
- UHS&MoH&WHO. (2010). Prevalence of Non-communicable Disease Risk Factors in Cambodia, STEPS Survey Country report. *Cambodia*, 192.
- Umenai, T. (1996). Revolving drug funds in Asia and Latin America. *The Lancet*, 347, 1698-1699.
- Umenai, T. (1998). Revolving drug funds and district community health system development. *The Lancet*, 351, 297-298.
- Uusitalo, U. E. A. (1996). Fall in total cholesterol concentration over five years in association with changes in fatty acid composition of cooking oil in Mauritius: cross sectional survey. *BMJ*, 313, 1044-1046.
- Van Damme, Wim, Kober, K., & Kegels, G. (2008). Scaling-up antiretroviral treatment in Southern African countries with human resource shortage: how will health systems adapt? *Social science & medicine* (1982), 66(10), 2108-21. doi: 10.1016/j.socscimed.2008.01.043.

- Villegas, R., Liu, Simin, Gao, Y.-T., Yang, G., Li, H., Zheng, W., et al. (2007). Prospective study of dietary carbohydrates, glycemic index, glycemic load, and incidence of type 2 diabetes mellitus in middle-aged Chinese women. *Archives of internal medicine*, 167(21), 2310-6. doi: 10.1001/archinte.167.21.2310.
- Waning, B., Maddix, J., & Soucy, L. (2010). Balancing medicine prices and business sustainability: analyses of pharmacy costs, revenues and profit shed light on retail medicine mark-ups in rural Kyrgyzstan. *BMC health services research*, 10, 205. doi: 10.1186/1472-6963-10-205.
- Waning, B., Maddix, J., Tripodis, Y., Laing, R., Leufkens, H. G. M., & Gokhale, M. (2009). Towards equitable access to medicines for the rural poor: analyses of insurance claims reveal rural pharmacy initiative triggers price competition in Kyrgyzstan. *International Journal for Equity in Health*, 8(1), 43.
- Wareham, N. J. (2001). Should we screen for type 2 diabetes? Evaluation against National Screening Committee criteria. *Bmj*, 322(7292), 986-988. doi: 10.1136/bmj.322.7292.986.
- Warsi, A., Wang, P. S., LaValley, M. P., Avorn, J., & Solomon, D. H. (2004). Self-management education programs in chronic disease: a systematic review and methodological critique of the literature. *Archives of Internal Medicine*, 164(15), 1641.
- Weatherall, D. J., & Clegg, J. B. (2001). Inherited haemoglobin disorders : an increasing global health problem. *Bulletin of the World Health Organisation*, 79(1), 704-712.
- Wei, J.-N., Sung, F.-C., Lin, C.-C., Lin, R.-S., Chiang, C.-C., & Chuang, L.-M. (2003). National surveillance for type 2 diabetes mellitus in Taiwanese children. *JAMA*, 290(10), 1345-50. doi: 10.1001/jama.290.10.1345.
- WHO. (2008). *The World Health Report 2008 Primary Health Care Now More Than Ever* (p. 148).
- WHO-IDF. (2006). *Definition and diagnosis of Diabetes Mellitus and intermediate hyperglycemia* (p. 50). Geneva.
- Wichai, A. (2007). Prevalence and Management of Diabetes and Associated Risk Factors by Regions of Third National Health Examination Survey 2004. *Diabetes Care*, 30(8), 2007-2012. doi: 10.2337/dc06-2319. Abbreviations.
- Williams, M. V., Baker, D. W., Parker, R. M., & Nurss, J. R. (1998). Relationship of functional health literacy to patients' knowledge of their chronic disease. A study of patients with hypertension and diabetes. *Archives of internal medicine*, 158(2), 166-72. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/9448555>.

- Wolever, T. M., Jenkins, D. J., Jenkins, a L., & Josse, R. G. (1991). The glycemic index: methodology and clinical implications. *The American journal of clinical nutrition*, 54(5), 846-54. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/1951155>.
- World Development Report (WDR). (2007). *WDR2007: Development and the next generation*. WB (p. 336). Washington.
- Yach, D., Stuckler, D., & Brownell, K. (2006). Epidemiologic and economic consequences of the global epidemics of obesity and diabetes. *Nature medicine*, 12(1), 62-6. doi: 10.1038/nm0106-62.
- Yang, W., & Lu, J. (2010). Prevalence of diabetes among men and women in China. *The New England journal of medicine*, 362(25), 2425-6; author reply 2426. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/20578276>.
- Yudkin, J. (2000). Public health Insulin for the world ' s poorest countries. *The Lancet*, 355(March 11), 919-921.
- Zachariah, R, Ford, N., Philips, M., Lynch, S., Massaquoi, M., Janssens, V., et al. (2009). Task shifting in HIV/AIDS: opportunities, challenges and proposed actions for sub-Saharan Africa. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 103(6), 549-58. doi: 10.1016/j.trstmh.2008.09.019.
- Zimmet, P. (2000). Globalization, coca-colonization and the chronic disease epidemic: can the Domsday scenario be averted? *Journal of internal medicine*, 247(3), 301-10. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/10762445>.