“The Initiative of Cardiovascular Service in the PHC Network of Lebanon”

Team Leader: Dr. Walid Ammar, MD, PhD

Principal Investigator: Rouham Yamout, MD, MPH

Contributors (By alphabetical order)

Dr. Salim Adib, MD, PhD

Dr. Mohammad-Samir Arnaout, MD

Mr. Moubadda Assi, MPH

Dr. Souha Fares, PhD

Ms. Alia Freidi, ParmD, MPH

Dr. Ghassan Hamadeh, MD

Randa Hamadeh, MPH, PhD Candidate

Ms. Fatima El-Masry, MPH

Mr. Joe Noun, MPH

Mr. Ali Roumani, BE

Dr. Mohammad Sandid, MD

Dr. Abla Mehio Sibai, PhD

"A main social target of governments, international organizations and the whole world community in the coming decades should be the attainment by all peoples of the world of a level of health that will permit them to lead a socially and economically productive life. ***Primary health care is the key to attaining this target as part of development in the spirit of social justice****".*

Article V of the Declaration of Alma-Ata. (1978). International conference on Primary Health Care, Alma-Ata, USSR, 6-12 September 1978. Available from http://www.paho.org/English/DD/PIN/alma-ata_declaration.htm

Table of Contents

Tables

Figures

Appendices

I- BACKGROUND

The situation of Cardiovascular Diseases in Lebanon

The prevalence of Non-communicable diseases (NCDs) are increasing in a secular trend worldwide including in low and middle-income countries that are experiencing epidemiological transition from communicable diseases towards NCDs. The burden is majorly attributed to cardiovascular diseases (CVD), which are the leading cause of mortality around the globe (WHO, 2011a). In Lebanon NCDs account for 84% of all deaths, of which 22-25% is premature occurring before the age of 60. It is estimated that 63% of all deaths and 45% of NCD mortality, are ascribed to CVD (WHO, 2011b), with age standardized mortality rate from CVD and diabetes reaching 404.4 per 100,000 in men and 262.7 per 100,000 in women (WHO, 2011a).

Aging of the population and lifestyle changes are driving forces towards higher figures of NCDs and CVDs in Lebanon. Tobacco smoking, sedentary lifestyle, surrender of traditional diet at the advantage of increased consumption of sugar and meat and increased daily calorie intake are considered among the top lifestyle factors that affect the burden of CVDs (Nasreddine at al., 2010).

Above all, CVD incidence is explained by the prevalence of CVD risk factors. In this regard, figures from Lebanon are among the most alarming in the region, (Nasredine et al, 2010; Motlagh et al, 2009). For example, 36.8% of the Lebanese people are smokers, 60% among youth, 47% have a sedentary lifestyle, and 27.4% are obese (Sibai el al., 2009; Saade et al., 2008). The stepwise survey, conducted in 2008 on a representative sample aged 25-64 showed that more than third surveyed (38.5%) smoke cigarettes, and 23.3 % smoke Narguileh (arguileh, water-pipe). The same survey found that almost half the surveyed reports low levels of physical activity, whereas the prevalence of obesity reaches 28.7% in men and 26.5% in women (Sibai and Hwallah 2010).

Similarly, the prevalence of hypertension and diabetes that are important risk factors for CVDs, is on the rise, with, in 2008, 13.8% (13.2% in men and 14.2% in women), and 5.9% (7.2% of men and 4.8% of women) of surveyed aged 25-64 self-reported having ever been diagnosed with hypertension and diabetes respectively (Sibai and Hwallah 2010). A study in 2008 reported a prevalence of self-reported hypertension in individuals 30 years and above as 23.1% of adult population (Tohme et al. 2005).

Another factor potentially explaining the gravity of CVD situation in Lebanon is the lack of active detection. The stepwise survey reported high proportions of surveyed aged 25-64 that never had blood sugar or blood pressure measurements: 29.6% and 16.1% respectively. Even among the advanced-age group (55-64) 29% and 4.6% never had blood sugar and blood pressure measurement (Sibai and Hwallah 2010).

Aspects of the Lebanese healthcare system

Governance and regulation of CVD

Lebanon has a reasonable quality of health services, fair access to high-tech clinical procedures in all domains guaranteed by public subsidy of hospitalization and expensive medical procedures within a system of supporting tertiary care for those not ensured with any public or private insurance scheme. However, the health system in the country is built around hospitals and specialists, and primary health care services remain marginalized (Ammar 2012; Jabbour 2011). Both patients and healthcare professionals tend to perceive the role of healthcare providers in curative terms (Sfeir, 2007). Relying primarily on expensive diagnostic and therapeutic measures rather than on preventive measures is common practice in Lebanon, encouraged by the availability and the accessibility of sophisticated care and not always discouraged by professional bodies in order to justify the over-supply of high-tech equipment (IGSPS, 2012). This practice is especially costly in what concerns CVD, whereby a major amount of public spending on health goes to subsidizing costly diagnostic and interventional actions, especially open -heart surgery (National Health Accounts 2000; Ammar, 2007). Lebanon has more cardiac surgery units per inhabitant than Germany but lacks sufficient programs tackling CVD to act at the community level (Ammar, 2003). Illustratively, in 2010 more than 4000 heart interventional procedures were funded by the Ministry of Public Health (MOPH) monopolizing the major share of public expenditure on health (Statistical Bulletin 2010, 2013).

Within the last two decades the MOPH has implemented, several measures and policies to improve preventive healthcare including in the domain of CVDs (Ammar, 2009). The ultimate expression of this political will was the development of Primary Health Care (PHC) network and the installation of the chronic medicines programs at its heart focusing on reinforcing and expanding preventive care based at the primary health care encounter relying mostly on the network of PHC centers with a special focus on NCDs (Khalil, 2013).

The Primary Health Care Network

The primary health care structure in Lebanon is represented by the PHC Network, governed by the PHC department at the MOPH. Nowadays, the Primary Health Care Network includes over 170 health centers distributed on the entire Lebanese territory. Those institutions are owned by the MOPH, the Ministry of Social Affairs, Municipalities, non-governmental and civil society organizations such as political and religious charity foundations. The PHC centers of the Network function under contract with the MOPH, to deliver a package of primary health care services including child immunization, general and specialized medical consultations, mother and child health monitoring services, and most of them run regularly awareness and health education activities. Centers address NCD through several programs and campaigns such as the yearly mammography campaign in some centers and Papanicolaou Smear Test to detect cervical cancer, or Prostate Specific Antigen to detect prostatic cancer in others. Some centers run campaigns of screening for blood glucose and lipid profile from time to time at the rhythm of donations.

The PHC-network is mandated by the MOPH to provide healthcare at reduced price for those with chronic diseases. In exchange, the Ministry is committed to secure the essential chronic drugs through the Program of Chronic Medicines, the so-called MOPH-YMCA program. This program is fully funded and supervised by MOPH, while it is operationalized – in terms of purchasing, storage, distribution of drugs and audit, by the Young Men Christian Association Lebanon- YMCA (Ammar, 2003). More than 75 generic and branded generic pharmaceutical preparations, covering the treatment of diabetes, hypertension, dyslipidemia, heart failure, respiratory diseases, musculoskeletal conditions, neurological and psychiatric diseases and other chronic conditions are distributed to the centers and dispensaries involved in the MOPH-YMCA Program to serve around 200,000 beneficiaries yearly (MOPH 2012; YMCA 2013). The procurement and distribution of essential medicines costs the country 4,000,000 USD per year.

Drugs are distributed to the centers following the need of the patients that are registered to benefit from the program. The PHC facilities should contract qualified physicians to follow up on the treatment of beneficiaries and should adhere to a number of operational and administrative requirements, including regular attendance of chronic patients to physician's consultations, timely reporting, and respect of inclusion criteria prioritizing the needy individuals and families, as assessed by an appointed social worker. In addition, the MOPH-YMCA program has a computerized medical records system to improve the accuracy and the quality of healthcare delivered to chronic patients (YMCA 2013). However, this database cannot yet inform the burden of those conditions, since it does not account for duplication and does not include diseased individuals who did not find their medications in the program.

In spite of the pitfalls, the installation of the MOPH-YMCA program had a positive impact on accessibility of chronic patients to healthcare and consequently improved an important indicator of NCDs – premature mortality. It is estimated that premature mortality from NCDs does not exceed 25% of all NCD mortality in Lebanon, compared to an average of 40% in the region (Ammar 2012). This result, among others, makes from the MOPH-YMCA program a success story in Lebanon.

Lately, 26 centers of the Network have undergone accreditation, based on indicators related to the quality and completeness of healthcare provision and on some criteria related to tangibles and structures available (MOPH 2013).

NCD prevention and control program for Lebanon

In response to the rising global burden of NCDs, the United Nations held a first-ever 'High-Level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases' in September 2011 in New York, USA (UN 2011). Since the beginning of 2012, and based on a situation analysis on NCD prepared for this purpose (Jabbour 2011), the WHO country office supported the MOPH in the development of a national program for the prevention and control of

non-communicable diseases (NCD-PCP) in collaboration with an ad-hoc advisory committee including ministerial officials, academicians and experts in the domain of NCDs. Appendix 1 exhibits the strategic objectives of the NCD-PCP. A National Consultation with more than 100 experts in NCDs was held in March 2012 and recommended to focus the NCD prevention action on CVD (WHO 2012) while capitalizing on the pre-existing resources within the philosophy and practices of PHC, in line with the Ministerial vision (Kronfol 2010). The initiative of integrating a cardiovascular preventive service at the PHC encounter is the first among a series of similar initiatives concerning primary and secondary prevention of NCDs at the clinical encounter.

II- DESCRIPTION OF THE INITIATVE

Rationale

The idea of including a comprehensive CVD service at the PHC level, is dictated by the particularity of the CVD pathogenesis; In individuals with genetic predisposition and adverse social conditions, behavioral risk factors such as tobacco use, poor weight control, and unhealthy diet boosted by age and male gender, facilitate the occurrence of metabolic diseases (dyslipidemia, hyperglycemia and hypertension) and physiologic diseases (obesity and central obesity). In turn those conditions/diseases enable the development of atherosclerotic vascular disease, the common pathogenic component of all CVD expressed clinically in coronary heart disease, cerebrovascular disease and peripheral artery disease (Mendis et al 2011). It is estimated that 75% of fatal and non-fatal cardiovascular events can be explained by the presence of modifiable cardiovascular risk factors (Mendis 2005) such as smoking and hypertension, therefore the modification of those risk factors on time can prevent CVD (Berger, 2010).

At the same time, addressing cardiovascular risk factors as separate entities, as was historically practiced in PHC facilities, may underestimate the gravity of the risk of occurrence of CVD in each individual, and therefore undermine management decisions (Mendis 2005; NCEP 2001). Several algorithms have been described to calculate total cardiovascular risk in individuals by stratifying their age, sex, with their behavioral, physiologic and metabolic risk status in order to optimize therapeutic measures aiming at preventing the occurrence of CVD in individual patients at risk. The effectiveness of such an approach has been well evidenced (WHO, 2013; Mendes et al., 2011; Berger, et al., 2010; D'Agostino, et al., 2008). Some researchers engaged in estimating the health gain from applying total cardiovascular risk approaches. For example, Yusuf and colleagues (2004) reported up to 90% reduction in the initial risk of acute Myocardial infarction (MI) by the application of treatment strategies dictated through the stratification of 9 easily measurable and potentially modifiable/controllable risk factors.

The adoption of total cardiovascular risk approach for detecting and modifying cardiovascular risk factors at the frontline encounter is an important public health action directed at reducing the national incidence of CVD by detecting latent high-risk individuals and modifying and controlling as soon as possible their underlying risky conditions. The initiative described herein is based on this approach as developed by the World Health Organization (WHO) and described in the "Package of Essential Non-communicable Disease interventions for primary health care" (WHO 2010). The service implemented in the PHC Network comprised massive opportunistic screening of asymptomatic individuals to detect simultaneously several CV risk factors and systematic calculation of total cardiovascular risk using an algorithm developed jointly by WHO and the International Hypertension Society (IHS) followed by active management of the cohort at higher risk, using a total cardiovascular risk approach.

Aim and Objectives

This initiative was designed following the idea of the MOPH Director General - Dr Walid Ammar who sought after a service able to democratize and standardize the detection of cardiovascular metabolic risk factors by tackling asymptomatic individuals in their usual PHC healthcare venue. This service was logically best hosted in the PHC network, involving the usual beneficiaries of the network, but also those residing in the centers' catchment areas but do not usually attend the PHC services, through outreach screening service delivered to individuals in their homes. At the same time, the screening service should be universally accessible, consequently free of charge, and the cheapest possible, to allow its sustainability. The MOPH and WHO technical team developed this initiative to become a PHC Network–based two-step detection of the main cardiovascular risk factors, and management of discovered metabolic impairments in the PHC facilities using a total cardiovascular risk approach. The objectives of this initiative were to

1- Detect people with undiagnosed cardiometabolic risk factors: diabetes, hypertension and dyslipidemia, as early as possible after the onset of those conditions.

2- Assess the cardiovascular risk profile of CVD free individuals.

3- Initiate risk lowering therapy of individual at risk through pharmaceutical and non-pharmaceutical management of discovered conditions at the general/family practice level when possible.

4- Customize the referral system and the quality of medical care offered to patients with cardiometabolic diseases at the PHC level.

5- Establish a reporting system allowing surveillance of CVD behavioral and metabolic risk factors that may grow in a cardiovascular risk factors registry.

In addition, the outreach component is expected to serve individuals who do not attend usually the PHC network by reaching to them in their homes or places of work, to reinforce the mission of the Network in delivering preventive healthcare within the centers' catchment areas.

The Protocol

A pilot of the cardiovascular service was implemented during 14 weeks in selected centers of the PHC Network. A graphic representation of the protocol is exhibited in appendix 2. To reduce the cost, the detection of CV risk factors procedure was split in two parts. A first screening step excluded the onerous procedures (medical consultation and lipid profile testing) and was performed under the supervision of non-physician health workers in health centers and outside them. This step played the role of triage. The second step, diagnostic, concerned those who screened positive in the first step, and was performed at the PHC facility under the supervision of a generalist MD. The diagnostic procedure aimed at completing the cardiometabolic profile of patients classified at probable cardiovascular risk through the screening procedure and confirming or discarding the preliminary diagnosis obtained through screening. The confirmed cases are then

taken in charge at the PHC center, by PHC doctors and other medical workers such as nurses and dieticians, supported by clinical protocols developed based on total cardiovascular risk approach and adapted to the needs of general practitioners. Those protocols combine pharmaceutical and non-pharmaceutical management of diabetes, hypertension, dyslipidemia, obesity and smoking cessation while prioritizing the prescription of medicines belonging to the MOPH-YMCA drug list when applicable. The entire procedure is accompanied with personalized health education at the paramedical and medical levels to promote healthy lifestyle and behavioral risk factors modification.

Venue and staff

The MOPH chose to subsidy the screening procedure in 26 accredited centers of the Network distributed in 7 Lebanese Regions (6 Mohafazats and Beirut Suburbs). See appendix 3 for the list of participating centers and their distribution by Lebanese Regions.

Eight field coordinators, employed at the PHC department of the Ministry, were trained and mandated to supervise the implementation of the pilot. The non-physician health workers employed in the selected centers assigned to implement the service were trained through a two-day training workshop. The MDs generalists, involved in the implementation of diagnostic and management steps underwent an orientation session on CV risk-lowering care. The screening step was offered free of charge to patients while the diagnostic and the management steps were charged the usual fees for services in place at the centers.

Seventy four non-physician health workers from 26 PHC centers implemented the service and recorded the results. From those only 43 health workers attended the training, the rest having been trained during field visits. See appendix 4 for the complete list of implementers. Similarly, 19 of the26 MDs involved in diagnostic step, attended the orientation session.

Recruitment of beneficiaries

The beneficiaries were included in the service by the method of purposive opportunistic recruitment, with focus on individuals aged 40 years and above, and free from chronic diseases. The participants were approached while attending the health center or outside the centers in their homes or places of work within the outreach component of the initiative. The paragraphs below details each step of the cardiovascular service piloted.

Conduct

The clinical conduct of the service included three consecutive steps summarized in table 1, while further details are displayed in the text below

Table 1: *Snapshot at the clinical conduct of the cardiovascular service*

Step	Eligibility	Output	Outcome
Screening	All	Suspected Metabolic Impairment/ CV risk	Referral to diagnostic step
Diagnostic	Referred to diagnostic step	Confirmed Metabolic Impairment	Eligible to management
Management	Confirmed cases	Treatment	Controlled cases

The screening step

The screening step was performed by non-physician health workers within two venues - in-facility and in outreach, between October 15th 2012 and January 31st 2013 and had four components:

1- *Questionnaire*: Health workers completed a questionnaire assessing *basic demographic and socio-economic information*, including gender, age, educational level, working status, residence and consanguinity of parents, and *health background information* related to CVD, including self-report of previously diagnosed diabetes mellitus, hypertension, dyslipidemia, full-blown CVD, and family history for premature cardiovascular events, along with detailed smoking history.

2- *Measurements*

- Anthropometric measurements included the measurement of waistline with a lent to retrieve Waist Circumference **(WC)**, and weight and height to calculate Body Mass Index **(BMI)** using the usual calibrated scales present in the centers and a manual BMI calculator.

- Systolic and diastolic blood pressure **(SBP** and **DBP)** was measured using a standardized digital sphygmomanometer. An initial elevated result yielded to the repetition of the measurement during the procedure with the lowest result retained as final.

- Random blood sugar **(RBS)** concentration in capillary whole blood was measured after the assessment of time of last meal using a standardized digital glucometer.

3- *Estimation of results and calculation of preliminary cardiovascular risk*

- According to the scores obtained from RBS measurement, beneficiaries with no reports of previously diagnosed diabetes were classified at impaired glucose metabolism when scored for RBS > 110 mg/dl in fasting condition (last meal taken at least 8 hours before the screening), RBS >125 mg/dl if the test was taken more than 2 hours after last meal, or RBS > 150 mg/dl if the teat was taken within 2 hours after last meal. Similarly, those previously diagnosed as diabetics and being under diabetic drugs were classified as presenting uncontrolled disease if their RBS score exceeded 130 mg/dl at least two hours after last meal or exceeded 160 mg/dl within two hours after last meal. Those cutoff values were drawn from compilation of recommendations by WHO and International Diabetes Federation (IDF) under the supervision of the National Diabetes Program of the MOPH,

after adjustment for the use of capillary whole blood within different delays after last meal (WHO and IDF 2006; WHO consultation 1999; WHO 2003; IDF 2006).

- According to the score of blood pressure **(BP)**, patient scoring ≥ 135 mmHg for SBP and /or ≥ 85 mmHg for DBP were classified at risk of hypertension according to the recommendation of the International Society of Hypertension (ISH).

- The presence of impaired sugar metabolism (suspected or previously diagnosed), smoking status, and SBP scores were compiled with age and gender on paper-based simplified WHO/IHS cardiovascular risk charts to calculate the preliminary 10-year total cardiovascular risk score (see reproduction of the chart in appendix 5).

- Men having a WC ≥ 99 cm and women having it at ≥ 92 cm were classified as having central (abdominal) obesity according to the optimal cutoff points to discriminate individuals with cardiometabolic risk retrieved from a previous study conducted among the same population (Yamout et al 2013), and those whose BMI ≥ 30 kg/m2 were classified as obese according to the WHO recommendations (WHO, 2000).

4- Assignment of risk groups and referral to follow-up steps

To recommend follow-up steps, the health workers classified their patients in 5 mutually exclusive levels of risk (see table 2).

1- Definite CV risk category included patients who reported a documented clinical expression of CVD regardless of their screening results, and those previously diagnosed with diabetes or/and hypertension and showed uncontrolled conditions during screening. Those were directed to their usual health care provider to follow-up on their status.

2- Probable risk category included patients who did not report CVD but showed impaired screening results for RBS or/and blood pressure or obtained a score of 10% and more for preliminary CV risk using the WHO/ISH simplified charts. Those were immediately referred to the diagnostic step. For those health workers established a "diagnostic sheet" previewing space for results of confirmatory testing, doctors' notes with final diagnosis, and information concerning health seeking options taken by patients, retrieved through phone interviews with patients who did not show up for diagnostic step.

3- Metabolic Syndrome risk group: included patients who got normal screening results, but have at least one component of the Metabolic Syndrome as defined by IDF [IDF 2008)- History of Diabetes, History of Hypertension, elevated waist circumference and any dyslipidemia. Those were advised to reinforce control over diagnosed conditions, and modify risk factors (smoking, obesity, central obesity) when applicable.

4-Genetic behavioral risk group: included subjects with no report of previously diagnosed metabolic impairment or CVD, and having obtained normal screening results but present any genetic or behavioral risk factor (smoking, obesity, family history of premature CVD). Those were delivered health education and directed to smoking cessation / dietetic services when applicable and advised to check their metabolic profile yearly.

5-The null risk group included patients with no CV risk factors. Those were encouraged to keep healthy life style and advised to repeat the screening step yearly.

Table 2: *Assignment of risk groups according to screening results*

Risk Definition	History of CV event	DM	AHT	TCVR ≥ 10%	RBS+	BP +	Elevated WC	History of DL	FH	Smoker	Obese
Null	No	No	No	No	No	No	No	No	No	No	No
Gen/Beh.	No	No	No	No	No	No	No	No	At least any of three		
Met-S	No	No or controlled		No	No	No	At least any of two				
Probable	No	No or controlled		At least any of three							
Definite	Yes	Any Uncontrolled									

Abbreviations: TCVR: total cardiovascular risk by WHO/ISH charts; DM previously diagnosed diabetes mellitus; AHT; previously diagnoses Arterial hypertension; RBS+: Impaired results for random blood sugar screening; BP+: impaired results for blood pressure screening; Elevated WC: elevated wait circumference (≥99 cm in men and ≥92 cm in women); DL: Dyslipidemia; FH: Family history of premature CVD

The diagnostic step

Patients going through further steps were charged the regular fees for laboratory analysis and doctors' consultations as adopted in the PHC centers. Those fees varied between 15,000 LBP ($10) and 50,000 LBP ($USD) for laboratory investigations and between 5,000 LBP ($3.5) and 15,000 LBP ($10) for the general doctor's consultation.

The MD generalists (general practitioners or family doctors) were mandated to supervise the diagnostic step in order to voice a final diagnosis based on medical examination, monitoring of blood pressure, additional laboratory investigations and final estimation of total cardiovascular risk using WHO/ISH with cholesterol, Framingham algorithms and Metabolic syndrome definition.

The diagnostic step included:

1- First consultation of the MD generalist: where the doctors verified the screening results and prescribed confirmatory and additional investigations.

2- Laboratory investigations including at minimum lipid profile (Cholesterol, triglycerides, LDL, HDL) in addition to Fasting Blood Sugar (FBS) with HbA1c for those suspected of sugar metabolism impairment. Additional laboratory tests could be prescribed as deemed necessary by the consulting doctor.

3- Second consultation of generalist MD where he/she evaluated the results of additional investigations to confirm or discard the preliminary results, calculated the final score of total cardiovascular risk, defined individuals with metabolic syndrome and decided on treatment strategy or referral to secondary care following sound guidelines.

Management of confirmed cases

The second consultation is the initiation of treatment of patients with newly diagnosed metabolic CV risk factors, following management guidelines produced by a scientific committee especially

to serve the beneficiaries of this service. The management sheet describes the recommended diagnostic and pharmaceutical and non-pharmaceutical therapeutic protocols within a total cardiovascular risk approach. In addition it contained nicotine replacement protocol and obesity management advices. A copy of the management sheet and the list of editors are shown in appendix 6.

Reporting and Monitoring

Health workers documented the answers and the results obtained from the screening step and entered the data on an appropriate IT application, sent monthly to the PHC department through intranet. When the patients showed up for follow-up, the health workers supervised the completion of the diagnostic sheets with the available results of investigations and doctors' recommendations. When a referred to diagnostic step patient did not show up within 1 month after taking the screening, the health workers phoned the referred patients to ask them about the fulfillment of their advices and the reason of their attrition if applicable and documented the information obtained. The data from diagnostic sheets and phone talks were then coded, entered and matched with the results obtained through the screening.

To monitor the right conduct of the service, each center was visited at least twice by field coordinators during the implementation of the service. During those visits the field coordinators supervised the conduct of the protocol and the data entry and delivered additional training on the site. A checklist was previewed to assess the quality of the work performed and record field observations and additional remarks. The material of checklists was compiled and analyzed to evaluate the implementation process.

Ethical clearance

At each step, subjects received clear information on the aims and objectives of the initiative and were asked unambiguously to give their informal consent to be screened. After the screening procedure, the beneficiaries were asked the permission to use their answers and results in aggregated anonymous form for data analysis aiming at improving the service in the future, and to be contacted further to follow-up of their cases if applicable. The consent was documented in the questionnaire.

III- METHODOLOGY

Framework

The information included in this report is based on secondary analysis of the records, field observations and completed diagnostic sheets produced during the pilot service, and on the findings of two qualitative studies conducted after the closure of the pilot service. The material collected was involved in development of several studies, already published or under publication. The present report gathers and synthetizes findings obtained from those studies to become the theoretical basis of guidelines for low-cost mass screening of the Lebanese population for cardiovascular risk and risk-lowering management of patients with detected metabolic impairments at the PHC centers under the supervision of PHC generalist doctors.

The background studies are listed below:

1- "SCREENING FOR CARDIOVASCULAR RISK IN ASYMPTOMATIC USERS OF THE PRIMARY HEALTH CARE NETWORK IN LEBANON: A PILOT PROJECT" (Yamout et al, 2013): This report described the preliminary screening results of 4198 asymptomatic beneficiaries.
2- "VALIDATION OF A MULTIFACTORIAL CARDIOVASCULAR SCREENER AGAINST FINAL DIAGNOSES**"** (Yamout et al 2014). This study used 541 follow-up records and 160 available secondary testing results to assess the compliance of patients with referral to the second step screening and validate the screeners used in the triage against confirmed diagnosis of metabolic impairments amenable to control.
3- "COMPARISON OF OBESITY INDICES TO PREDICT METABOLIC IMPAIRMENTS RELATED TO CVD IN LEBANON" (Yamout et al 2014), this study used a subsample 2178 beneficiaries of the screening service to define the optimal waist circumference cut-off points that best discriminate individuals with at least two cardiometabolic pathologies and/or documented CVD.
4- "ASSESSMENT OF THE NON-COMMUNICABLE DISEASES PROJECT INTEGRATED WITHIN THE PRIMARY HEALTH CARE NETWORK: PROPOSALS FOR SCALING UP" (Masry, 2013). This qualitative study explored the obstacles encountered and gathered suggestions for ameliorations, through in-depth interviews with PHC centers' directors involved in the implementation of the pilot.
5- "EXPLORING PATIENTS' FAILURE TO COMPLY WITH REFERRAL AFTER A CVD MULTIFACTORAL SCREENING INITIATIVE" (Noun 2013) This qualitative study explored the factors that influence non-compliance through in-depth interviews and focus group discussion conducted with beneficiaries who did not comply with their referral to the diagnostic step and with health workers involved in the implementation of the pilot service.

6- **“**DOCTORS’ COMPLIANCE BY CLINICAL GUIDELINES AND REFERRAL INSTRUCTIONS WITHIN A CARDIOVASCULAR SERVICE IN LEBANON”. This study explored and coded doctors’ notes from referral sheets to assess their compliance by the clinical guidelines and management instructions.

Sources of data and sampling

The present analysis involved data from several sources:

- The screening records of 5875 beneficiaries screened over a 14 weeks period between October 15th 2012 and January 31st 2013 were collected by 74 health workers in 26 accredited PHC centers within the MOPH network distributed over the entire Lebanese Territory.

- The follow-up records / phone interviews transcripts of 541 patients having been referred to the diagnostic step were gathered from 18 centers in February 2013.

- Field observations, informal conversations and meetings’ minutes with health workers, centers’ directors and doctors during the implementation of the pilot.

-Transcripts of in-depth interviews, focus group discussions and telephone interviews conducted with 9 centers’ directors, 6 health workers and 32 beneficiaries for two exploratory studies conducted after the closure of the pilot phase of the service.

Sampling

The 26 PHC centers out of more than 170 members of the Network functional in Lebanon were selected conveniently among centers having undergone accreditation process. Beneficiaries of the screening were recruited purposively, either while attending the PHC centers for any service not related to chronic diseases, or through outreach visits in households within the center’s catchment area. The health workers were requested to avoid approaching subjects less than 40 years, or subjects known to have diabetes, hypertension or having had a MI or stroke, without however refusing the service to any person expressing interest in taking it. This method triggered under-sampling of younger and those already diagnosed with chronic diseases or CVD from among the usual clientele of the PHC Network.

A subsample of 2178 screening records were involved in definition of optimal WC cut-off points against a cardiovascular outcome measure defined as the presence of two metabolic impairments (suspected or previously diagnosed) or history of undergone cardiovascular event.

A total of 160 records with available confirmatory testing results were matched with the screening data and involved in description of the predictive characteristics of screening tests against final diagnoses expressed in sensitivity and specificity.

The sample was used in totality to describe the results of the screening after having applied the definition of optimal cut-off points for waist circumference.

A weighted sample, including those aged 40 years and above only, was used for the projection of results on the Lebanese population.

A sub-sample of 541 records that had available follow-up data was involved in analysis to assess the degree of compliance of patients with health workers advices, along with reasons behind non-compliance.

Available around 500 doctors' diagnostic sheets were involved in the assessment of doctors' compliance with clinical guidelines in a quantitative data analysis.

The material of field observations, meeting minutes and centers' staff reports were compiled in a data-base and served to assess response rate, and other process indicators.

Exploratory studies

The study by Noun, a purposive sampling providing diversity of participants in terms of geographical area, age, education, and gender recruited conveniently 6 health workers, 4 centers' directors and 32 non-compliant patients from 4 health centers located in different areas in Beirut and one rural center in the South to participate in in-depth interviews, focus group discussion and phone interviews.

The study by Masry engaged in in-depth interviews with PHC centers' directors to explore the obstacles encountered during the implementation of the pilot, and assess the ways of amelioration.

Variables and themes

Process

The capacity of the Ministry and centers of the PHC Network to successfully implement this service has been evaluated through assessment of the proportion of delivered records out of those assigned (200 to 400 per center), the percentage of inaccurate conduct, the proportion of respondents recruited in outreach setting, the response rate, and timely delivery of records per center. Additional qualitative data explored additional features having hindered or favored the right conduct of the protocol.

Demographic and socio-economic characteristics

The questionnaire included basic demographic and socioeconomic information such as gender, self-reported age, education and working status, whereas residence in rural or urban areas and in different Lebanese regions was assimilated to the location of the PHC center. The regions were defined by the Lebanese Governorates (Mohafazat) with the exception of the Beirut suburb that was considered as a separate region. The three available socio-economic variables education, work status and residence were involved in development of a social deprivation scale to create a socio-economic gradient in this population thought to belong to the lowest socio-economic strata of the

country – the population generally attracted by the PHC network. Table 3 details the definition of the scale.

Table 3: *Definition of social deprivation scale (proxy)*

Variables	Deprivation Categories [coded ascending from least to most disadvantage]			
	Most advantageous	Intermediate		Most disadvantageous
Education	Secondary &+ [1]	Some schooling [2]		> Elementary [3]
Working status	Employed [1]	Not ILF [2]		Unemployed [3]
Residence	Urban [1]	--		Rural [3]
Levels SD	Lowest [3,4]	Low [5]	High [6]	Highest [7,8,9]
Level of social deprivation dichotomized		**Low [3,4,5]**		**High [6-9]**

Health Background variables

The health background of respondents in terms of CVD and cardiovascular risk factors included self-reported previously diagnosed diabetes, hypertension, dyslipidemia, or episodes of myocardial infarction or strokes or minor ischemic events leading to interventions, smoking status, nature and degree of smoking, and family history of premature CV events (indexed as having a first-degree relative having died or suffered from a CV event before the age of 60), along with anthropometric variables including WC and BMI.

Output variables

Output variables represented the screening outputs and the preliminary estimation of the screening results, namely the classification of beneficiaries in impaired or normal risk categories for sugar metabolism, BP, WC, BMI, smoking and family history along with the classification of patients in five risk groups in view of their referral to the diagnostic step or to risk factors modification.

CV-Risk profile variables

Three CV risk algorithms were used to assess the preliminary cardiovascular risk profile of the beneficiaries of the pilot service, one defined on the field, and two calculated by the investigator during data analysis.

- *WHO/ISH 10-year CV risk.* The classification of patients by five risk categories (<10% [low risk]; 10->20% [moderate risk]; 20-<30%; 30-<40%; ≥40% [levels of high risk]) was performed through plotting age, sex, smoking history, the presence of suspected or confirmed diabetes and the value of SBP on the simplified (without cholesterol) WHO/ISH charts (see appendix 5): The WHO/ISH risk score expresses the range of incidence of CVD among a group sharing the same characteristics. This score was calculated on the field by health workers according to the screening results and using paper-based charts, and recalculated by the investigators using a locally developed excel spreadsheet for accuracy.

- *The Framingham CV risk score with BMI* where BMI was used as a proxy of the Lipid profile. Age, sex, smoking status, values of systolic blood pressure, values of BMI, and the

presence of diabetes were plotted on an online calculator to retrieve the risk of three cardiovascular outcomes: the 10-year risk of Myocardial infarction (MI), the 10 year risk of stroke and the 10 year risk of general CVD.

- *ASSIGH risk equation*, allowing the calculation of life-long CVD risk attributed to smoking (number of cigarettes smoked per day) and to genetic predisposition (presence of family history for premature CVD), adjusted for age and gender.

Outcome variables

Outcome variables expressed the classification of beneficiaries by five risk groups defined by the service, their referral to follow-up steps and the compliance features, assessed through information included in the completed diagnostic sheets. The outcome variables included the prevalence of impaired result obtained through screening and variables expressing the attendance to diagnostic procedure, the coded reasons of attrition as retrieved from phone interviews with non-compliant patients, the results of follow up testing, final diagnosis of referred patients and doctors' diagnosis.

Health workers performance

The accuracy of non-physician health workers' performance is evaluated based on comparisons between the estimations of TCVR scores on paper-based charts, and decisions of referral as taken on the field with the same parameters retrieved by the investigator from corresponding variables. The compliance of health workers with the screening protocol, and their respect of informed consent statement and privacy requirements, was monitored on the field by the coordinators.

The evaluation of physicians' performance was conducted through analyzing physicians' notes on the completed diagnostic sheets in terms of compliance with the delivered guidelines.

Qualitative themes

The analysis of the qualitative data from field observations, meetings' minutes, informal conversations, in-depth interviews, phone interviews and focus group discussion assessed the ability and the willingness of health centers' staff to implement cardiovascular screening service, the obstacles hindering the sustainable addition of the service in the package of services offered at the PHC network, suggestions for ameliorations voiced by health workers and doctors, and explored the reasons of patients' attrition.

Quantitative data analysis

Quantitative data were analyzed using Statistical Package for Social Sciences (SPSS) for Windows version 20.

The receiver operator characteristic (ROC) curve was plotted between the continuous test variable Waist circumference (WC) in cm and the dichotomized state variable "cardiovascular outcome measure" to determine the optimal WC cut-off points. Logistic Models adjusted for socio-economic and health background factors compared the predictive characteristics of three obesity indices against five metabolic and cardiovascular outcomes.

The predictive characteristics of the screeners against final diagnoses of metabolic impairments and total cardiovascular risk estimation were represented by sensitivity and specificity and Youden Index. A kappa agreement was tested between preliminary and final results, with significance set at two-tailed p-value < 0.05.

To allow the projection of the results at the population level, data were manipulated through post-stratification weighing using the age distribution by gender reported in the statistical bulletin 2011 (Statistical Bulletin 2011).

Continuous variables were reported as means and standard deviations (SD), and comparisons across groups were carried out using the independent samples t test. The level of significance was set at Alpha = 0.05. Frequencies and cross tabulations were used to assess the distribution of the sample by demographic, socio-economic, health background variables and the prevalence of impaired screening results stratified by gender and selected covariates as needed. A chi-square test with significance set at Alpha = 0.05 was used to compare the prevalence of outcome variables across gender categories of other covariates when needed.

Simple frequencies examined the process indicators and the attendance of patients to consecutive steps of the procedure, and results were presented in counts and proportions.

To monitor the performance of health workers in directing patients by corresponding follow-up venues, kappa coefficient was used to compare the output produced in the field with an ideal output produced by hypothetical application of the screening protocol used.

Qualitative data analysis

The data compiled from field observations, meetings' minutes and informal conversations were compiled and analyzed by the method of thematic analysis. The transcripts of focus group discussions and phone interviews with patients were analyzed by the method of grounded theory, based on the participants' subjective perceptions and views. In depth interviews with general practitioners and health workers at selected centers served as triangulation to enrich the perception of the health workers about the reasons behind the beneficiaries' health seeking behavior.

IV- QUANTITATIVE RESULTS

Process indicators

Only eight from the 26 centers delivered the totality of records of their quota. The total of 6,353 reports were delivered, represented 80% of the expected reports set at 8000 initially, with a range from 37 to 100 % of the quota by center. Only 10 centers (40%) delivered reports on time. During data cleaning we deleted 8% of observations due to unfixable inaccuracy of data, and missing values for blood sugar measurement, blood pressure measurements, or time of last meal. At the end, 12.1% of retained observations contained missing values regarding information of secondary importance.

The overall number of beneficiaries served for the screening step within outreach was 2,320 respondents, or 39 % of all beneficiaries. The proportion of beneficiaries approached within outreach by center varied from 0% to 79% of all beneficiaries with only eight centers fulfilling the request of performing at least third of the screening service outside the facility and three centers not attending to outreach at all. Centers located in rural area were less active in outreach than those located in urban area (41% versus 38% respectively).

According to reports from the health workers, some 558 potential beneficiaries approached refused to accept the service, giving the study an overall response rate of 95%. Most of those who refused were men, and gave the reason of "not wanting to know" or not having time. A total of 119 beneficiaries refused to be contacted further, representing 2% of the screened sample. Most of the beneficiaries belonged to the population prioritized in the initiative.

Definition of optimal Waist Circumference cut-off points

The ROC curve was plotted for men and women separately to determine the discriminative values of WC that best predict a CV outcome measure defined by the presence of at least two metabolic impairments, suspected or confirmed, or history of CVD. The figure 1 shows the ROC curves.

The areas under the curve (AUC) showed fair worthiness for both sexes, slightly higher in men as compared to women (AUC= 0.685 and 0.669 respectively) (see figure 1). The closest data point to the upper left corner of the data plot corresponded to the cut-off points of 98.5 cm for men and 91.5 cm for women. Consequently, the optimal WC cut-offs for defining central obesity were $\geq$ 99 cm in men, and $\geq$ 92 cm in women. Those cut-off points yielded to a sensitivity of 62.5% and a specificity of 67.2% in men and to a sensitivity of 67.1% and a specificity of 60.8% in women to predict the CVD outcome measure selected (See figure 1). The table 4 shows the odds ratio and the 95% confidence intervals of the logistic models run between each of the obesity indices and each of the outcome variables, after adjustment for the remaining cardiovascular risk factors.

***Figure 1**: ROC curves plotting Waist circumference against cardiovascular outcome measure*

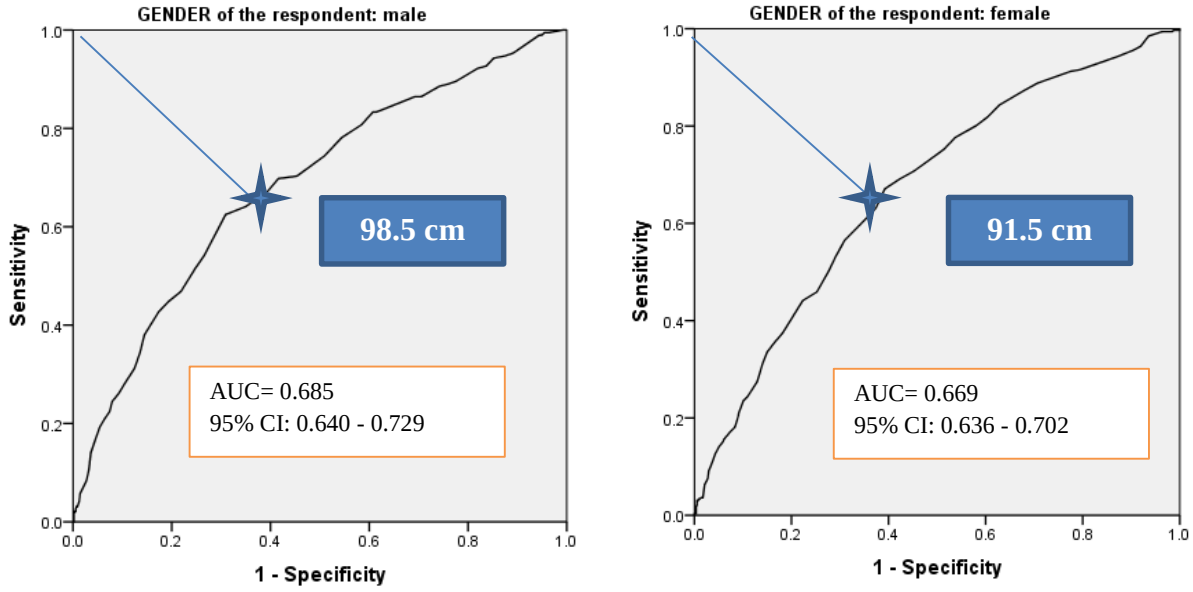


Table 4: *Comparison of predictive characteristics of obesity indices against 5 outcomes*

Clinical Manifestations	Abnormal obesity Indices – independent variables					
	Elevated BMI		Elevated WC		Elevated WHtR	
	OR	95% CI	OR	95% CI	OR	95% CI
MEN						
Raised FBS or DM	1.24	0.89 - 1.71	1.39	1.01 - 1.91	1.44	1.04 - 2.01
Raised BP or AHT	2.74	1.94 - 3.87	4.26	2.99 - 6.07	3.24	2.28 - 4.61
Dyslipidemia	3.11	1.69 - 5.69	3.84	2.04 - 7.23	3.88	2.10 - 7.18
History of CVD	2.18	0.93 - 5.12	2.80 a	1.19 - 6.59	1.49	0.64 - 3.47
CV outcome	3.10	2.20 - 4.65	4.02	2.69 - 6.00	3.25	2.20 - 4.80
WOMEN						
Raised FBS or DM	1.61	1.28 - 2.02	2.49 b	1.97 - 3.15	2.56	2.01 - 3.25
Raised BP or AHT	1.56	1.22 - 2.00	1.69 a	1.32 - 2.17	1.99	1.55 - 2.56
Dyslipidemia	1.47	0.99 - 2.20	2.26 a	1.50 - 3.39	2.52	1.67 - 3.80
History of CVD	0.87	0.32 - 2.34	3.21 a	1.11 - 9.29	1.66	0.60 - 4.60
CV outcome	2.20	2.20 - 4.65	2.80 b	2.06 - 3.80	2.92	2.15 - 3.96

Abbreviations: BMI Body Mass Index; WC: waist circumference; WHtR, waist to height ratio; FBS: Fasting blood sugar, DM: Diabetes Mellitus; BP: Blood Pressure, AHT: Arterial Hypertension.

Legend: Logistic models run between each of the five outcome variables (dependent variables) and each of the three obesity indices (independent variables), within multivariate logistic regressions models adjusted for age, education, working status, residence, smoking status, family history of premature CVD and stratified by gender. Obesity indices were classified according to the optimal cut-off points retrieved for the study population against cardiovascular outcome measure indexed as the presence of two metabolic impairment or history of CVD. BMI ≥ 28.6 / 27.1 kg/m2; WC ≥ 99/ 92 cm in men/women; WHtR≥ 0.59 / 0.58 in men/women.

Predictive characteristics of metabolic screeners against final diagnoses

A total of 160 referral sheets with available results of confirmatory testing were merged up with screening data of corresponding observations and used to assess the predictive characteristics of the different screeners against the confirmed diagnoses of corresponding pathologies and to define the best combination of parameters to predict Dyslipidemia (indexed as Cholesterol/ HDL fraction ≥ 5); Metabolic Syndrome and 10-years CVD risk score ≥ 10% as calculated by Framingham equation with BMI (see table 5).

The Random blood sugar (RBS) screener yielded to a sensitivity of 74% and a specificity of 82% against the final diagnosis of Diabetes defined as Fasting Plasma Glucose ≥ 110 mg/dl and/or HbA1c ≥ 6.5% in individuals with no reports of previously diagnosed diabetes. Similarly, in subjects with no history of hypertension, screening measurement could rightly indicate hypertensive disease, after ambulatory monitoring of blood pressure with a sensitivity of 97% and a specificity of 60%.

The presence of central obesity classified according to WC cutoffs locally defined did not significantly predict the presence of dyslipidemia but showed a sensitivity of 79% and a specificity of 48% in detecting metabolic syndrome. BMI ≥ 30 Kg/m2 failed to predict dyslipidemia and metabolic syndrome.

The WHO/ISH preliminary CV risk score defined using the paper-based WHO/ISH charts during the screening step, could predict raised Framingham risk of CV events (defined as the cumulative risk of MI and Stroke ≥ 10%) and Framingham general CVD risk ≥ 20% with a sensitivity of 61% and 62% respectively and a high specificity over 95%, whereas this same screener failed in predicting Metabolic Syndrome. When the TCVR was combined with central obesity and obesity, by upgrading the score by 10% whenever those measures were present, the sensitivity of the test against Framingham Risk scores and metabolic syndrome increased significantly. Dyslipidemia indexed as a cholesterol/ HDL ration ≥ 5 was best predicted, though insignificantly, by the combination of WHO/ISH risk score ≥ 10% and central obesity categorized following local WC cut-off points, with a sensitivity of 74% and a specificity of 18%.

Table 5: *Predictive characteristics of screeners against final estimations.*

SCREENER	FINAL DIAGNOSIS	N	Sensitivity	Specificity	J	Kappa	P-Value
Impaired RBS	Diabetes	147	74%	82%	0.57	0.57	0.00
Raised BP	Hypertension	115	97%	60%	0.58	0.46	0.00
Central Obesity	Chol/HDL ≥ 5	67	74%	28%	0.02	0.01	0.89
Obesity	Chol/HDL ≥ 5	67	59%	58%	0.17	0.16	0.18
TCVR	Chol/HDL ≥ 5	66	26%	77%	0.03	0.03	0.79
TCVR + WC	Chol/HDL ≥ 5	66	81%	18%	0.01	0.02	0.98
TCVR + BMI	Chol/HDL ≥ 5	66	74%	38%	0.13	0.114	0.29
TCVR	Risk of MI + Stroke	98	61%	94%	0.55	0.58	0.00
TCVR + WC	Risk of MI + Stroke	98	89%	19%	0.08	0.07	0.29

SCREENER	FINAL DIAGNOSIS	N	Sensitivity	Specificity	J	Kappa	P-Value
TCVR + BMI	Risk of MI + Stroke	98	83%	40%	0.24	0.20	0.02
TCVR	General CVD risk	98	62%	95%	0.57	0.61	0.00
TCVR + WC	General CVD risk	98	86%	18%	0.05	0.04	0.56
TCVR + BMI	General CVD risk	98	84%	41%	0.25	0.21	0.01
Central Obesity	Metabolic Syndrome	126	79%	48%	0.26	0.23	0.01
Obesity	Metabolic Syndrome	126	53%	61%	0.14	0.09	0.22
TCVR	Metabolic Syndrome	124	31%	83%	0.13	0.06	0.20
TCVR + WC	Metabolic Syndrome	124	88%	35%	0.23	0.24	0.01
TCVR + BMI	Metabolic Syndrome	124	73%	48%	0.21	0.17	0.05

Abbreviations and definitions: TCVR= T0tal Cardiovascular risk by WHO/ISH simplified charts ≥ 10%; Cent. Ob. Central obesity defined as Waist Circumference ≥ 99 cm in men and ≥ 92 cm in women; Obesity: defined as BMI ≥ 30 kg/m^2; Fram: risk score calculated to by Framingham Equation; RBS: Random Blood Sugar; BP: Blood Pressure; J: Youden Index defined as Sensitivity + Specificity -1.

Sample Characteristics

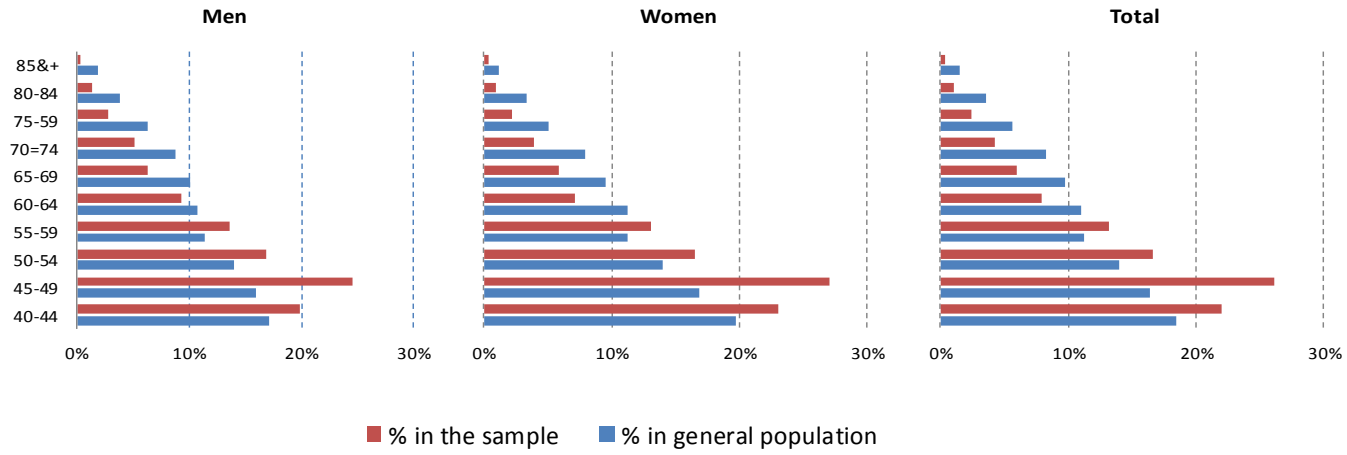
The totality of the sample was analyzed to describe the results of the screening. Women represented two third of the sample (n=3803; 64.7%), The proportion of women slightly drops among those approached in outreach setting to 62.1%. The over-representation of women in the screened population owes probably to the availability of women during the opening hours of the centers. This hypothesis is confirmed by the slight drop in the proportion of women in the group having been screened within the outreach component that was performed during the afternoons and evenings. This observation suggests that the service should be more responsive to the need of men, by making it available after working hours.

Rural dwellers represented 55% of the sample, and the distribution of the sample by Lebanese regions corresponded more or less to the distribution of the population over the Lebanese territory.

Only 185 (3%) beneficiaries were aged less than 40 years. The largest age group was 40-49, with a little less than half the respondents (56.6%), Almost two third went to school but did not exceed complementary level (61 %) with no significant difference between men and women. One in ten subjects was holder of university degree (11.3% of men and 9.8% of women). More than half the respondents (56.1%) were not in labor force, with 78.5% of women reported being housewives. Almost third the sample (31.2%) is issued from the union of relatives; 7.1 % from the union of first degree cousins, 16.4 % from the union of second degree cousins. The parents of 7.7% are relatives but not cousins, and the parents of 32.4% come from the same village, without being directly related (see table 6).

Figure 2 exhibits the comparison between age distribution of the sample aged at least 40 years at the moment of the screening, and the age distribution of the general population 40 years and above in Lebanon. Like shown in the figure, the sample is skewed towards more women and more individuals aged 50-60 probably due to the PHC network setting and opening hours.

Figure 2: *Age distribution of general and sample population*



The table 7 below summarizes the stratification of the demographic and socio-economic characteristics by Lebanese regions and residence. The results show significant difference in the distribution of demographic and socioeconomic parameters by regions: The least male/female ratio was in Beirut suburb and the greatest was in Mont Lebanon. The greatest proportions of employed full time and unemployed also were in Beirut, which has also the greatest proportion of subjects having reached university education, whereas almost third of the subjects surveyed in Nabatieh Mohafazat were illiterate. Consanguinity seems to be the most common in Mont Lebanon, and least common in Beirut suburb. The stratification by residence in terms of rural / urban showed significance in two parameters; the educational level of urban dwellers is significantly higher that this of rural dwellers and consanguineous unions seem to be more frequent in rural setting.

Table 6: *Demographic and socioeconomic characteristics of the sample*

VARIABLE	Men		Women		Total	
	N	%	n	%	n	%
Gender (N= 5875)	2072	35.3	3803	64.7	5875	100
Age-groups (N=5875)						
<40	81	3.9 $_a$	104	2.7 $_b$	185	3.1
40-49	885	42.7 $_b$	1854	48.8 $_b$	2739	46.6
50-59	605	29.2 $_a$	1092	28.7 $_a$	1697	28.9
60-69	312	15.1 $_b$	479	12.6 $_b$	791	13.5
70-79	155	7.5 $_a$	225	5.9 $_b$	380	6.5
80 &+	34	1.6 $_a$	49	1.3 $_a$	83	1.4
Work status (N=5831)						
Works fulltime	1352	65.9 $_a$	578	15.3 $_b$	1930	33.1
Works part-time	324	15.8 $_a$	199	5.3 $_b$	523	9
Not in labor force	304	14.8 $_a$	2965	78.5 $_b$	3269	56.1
Unemployed	73	3.6 $_a$	36	1.0 $_b$	109	1.9
Educational level N=5594)						
Illiterate	212	10.7 $_a$	560	15.5 $_b$	772	13.8
Up to Intermediate	1247	62.8 $_a$	2163	59.9 $_b$	3410	61
Secondary &+	526	26.5 $_a$	885	24.5 $_a$	1411	14.2
Consanguinity of parents (N=5642)						
1st degree cousins	143	7.2	255	7.0	398	7.1
2nd degree cousins	330	16.7	598	16.3	928	16.4
Parents relatives	155	7.8	280	7.6	435	7.7
From the same village	688	34.8	1138	31.1	1826	32.4
Not related at all	662	33.5	1393	38.0	2055	36.4
Ascending Degree of Socio-economic Index (N=5582)						
1 (advantaged)	660	33.3	606	16.8	1266	22.7
2 (rather advantaged)	347	17.5	1031	28.6	1378	24.7
3 (rather disadvantaged)	720	36.4	608	16.9	1328	23.8
4 (disadvantaged)	253	12.8	1357	37.7	1610	28.8

Each subscript letter denotes gender categories whose proportions do not differ significantly from each other at the 0.05 level.

Table 7: *Sample characteristics stratified by Mohafazat and location of the health center*

VARIABLES	Lebanese Regions (6 Mohafazat + Beirut Suburb)							Location	
	Beirut	Suburb	Mt Leb.	Nth Leb.	Sth. Leb.	Nab	Beqaa	Rural	Urban
Gender (N=5875)									
% Men	33.2 $_{a}$	27.5 $_{b}$	41.9 $_{c}$	39.3 $_{c}$	33.6 $_{a}$	34.5 $_{d}$	38.9 $_{d}$	36.2 $_{a}$	34.1 $_{a}$
% Women	66.8 $_{a}$	72.5 $_{b}$	58.1 $_{c}$	60.7 $_{c}$	66.4 $_{a}$	65.5 a, $_{d}$	61.1 c, $_{d}$	63.8 $_{a}$	65.9 $_{a}$
Age-groups (N= 5875)									
<40	4.9 $_{a}$	0.5 $_{b}$	4.8 $_{a}$	3.9 $_{a}$	2.4 $_{c}$	3.8 c	3.0 c	4.6 $_{a}$	1.4 $_{b}$
40-49	41.8 $_{a}$	42.0 $_{a}$	41.3 $_{a}$	45.4 $_{a}$	50.5 $_{b}$	44.5 $_{a}$	59.6 $_{c}$	49.3 $_{a}$	43.4 $_{b}$
50-59	28.0 $_{b}$	30.5 $_{b}$	29.8 $_{b}$	30.9 $_{b}$	29.1 $_{b}$	27.9 $_{b}$	23.0 $_{a}$	26.7 $_{a}$	31.6 $_{b}$
60-69	16.7 $_{a}$	16.5 $_{a}$	14.9 $_{a}$	13.8 $_{a}$	11.3 $_{c}$	13.2 $_{c}$	9.4 $_{b}$	11.8 $_{a}$	15.5 $_{b}$
70-79	6.8 $_{a,b,c,d}$	8.9 $_{d}$	6.0 $_{a, b, c, d}$	4.9 $_{c}$	6.2 a, b, $_{c}$	8.3 b, $_{d}$	4.6 a, $_{c}$	6.2 $_{a}$	6.8 $_{a}$
80 &+	1.8 $_{a}$	1.7 $_{a}$	3.4 $_{b}$	1.0 $_{c}$	0.6 $_{a}$	2.3 $_{b}$	0.4 $_{c}$	1.5 $_{a}$	1.3 $_{a}$
Work status (N=5831)									
works fulltime	43.7 $_{a}$	24.5 $_{b}$	40.0 a, c	32.8 d	33.5 $_{d}$	28.5 $_{b}$	35.9 $_{c, d}$	33.6 $_{a}$	32.5 $_{a}$
works part-time	6.1 $_{a}$	7.6 a, $_{b}$	15.0 c	9.3 b	6.8 $_{a}$	12.9 $_{c}$	7.3 $_{a, b}$	8.7 $_{a}$	9.3 $_{a}$
Not in labor force	46.6 $_{a}$	66.4 $_{b}$	43.2 a	57.0 c	57.5 $_{c}$	56.5 $_{c}$	55.2 $_{c}$	55.7 $_{a}$	56.5 $_{a}$
Unemployed	3.7 $_{a}$	1.6 $_{b, c}$	1.8 a, b, c	0.9 c	2.2 $_{a, b}$	2.1 $_{a, b}$	1.6b, $_{c}$	2.0 $_{a}$	1.7 $_{a}$
Educational level (N=5593)									
Illiterate	6.6 $_{a}$	9.1 $_{a}$	2.5 $_{b}$	14.6 $_{c}$	14.0 $_{c}$	29.2 $_{d}$	12.9 $_{c}$	16.1 $_{a}$	10.9 $_{b}$
Up to Complementary	42.5 $_{a}$	60.6 $_{b}$	63.6 $_{b}$	69.2 $_{c}$	64.7 $_{b}$	49.4 $_{d}$	64.8 $_{b, c}$	61.6 $_{a}$	60.2 $_{a}$
Secondary &+	50.9 $_{a}$	30.4 $_{b}$	33.9 $_{b}$	16.2 $_{c}$	21.2 $_{d}$	21.4 $_{d}$	22.3 $_{d}$	22.3 $_{a}$	28.8 $_{b}$
Consanguinity of parents (N=5642)									
Consanguineous union	26.0 $_{a}$	17.4 $_{b}$	55.3 $_{c}$	41.5 $_{d}$	28.0 $_{a}$	21.3 $_{b}$	34.2 $_{e}$	33.3$_{a}$	28.6 $_{b}$
Not consanguineous	74.0 $_{a}$	82.6 $_{b}$	44.7 $_{c}$	58.5 $_{d}$	72.0 $_{a}$	78.7 $_{b}$	65.8 $_{e}$	66.7$_{a}$	71.4 $_{b}$

Each subscript letter denotes a subset of Lebanese regions or residence categories whose proportions do not differ significantly from each other at the 0.05 level.

Health background

Table 8 summarizes the health background of the beneficiaries. The prevalence of smoking was 40.7%, 47.2 % of men and 37.2% of women. Among smokers 80.8% prefer cigarettes (82.8% of men smokers, and 79.4% of women smokers), 16.2% smoke arguileh (13.6% of men smokers and 17.9% of women smokers), and 2.1% of smokers smoke both cigarettes and arguileh.

Little less than 5% (4.3% - 4.1% of men, and 4.4% of women) reported having been diagnosed with diabetes, and were currently under treatment. Similarly, 778 subjects (13.3%) reported having been previously diagnosed with hypertension (13.1% of men and 13.4% of women) and 568 subjects (9.3%), reported having been diagnosed with any impairment in lipid metabolism, whereas 144 subjects (2.5 % of the sample) have already gone through MI or stroke or underwent intervention in relation with ischemic heart disease. A total of 977 beneficiaries (16.8%) reported having had a family history of premature cardiovascular events in first-degree relatives. Given the sampling methods, avoiding to recruit beneficiaries with known chronic diseases, those numbers do not represent the prevalence in the population.

Table 8: *Health background of beneficiaries*

Variables	MEN		WOMEN		BOTH GENDERS	
	N	%	N	%	N	%
SMOKING HISTORY (N= 5875)						
Never smoked	980	47.3 $_a$	2267	59.6 $_b$	3247	55.3
Former smokers	116	5.6 $_a$	119	3.1 $_b$	235	4.0
Smokers (% of the sample)	976	47.1 $_a$	1417	37.3 $_b$	2393	40.7
Currently smokes cigarettes (% of smokers)	809	85.1 $_a$	1125	81.4 $_b$	1934	82.9
Currently smokes arguileh (% of smokers)	133	15.8 $_a$	254	20.0 $_b$	387	18.3
CVD and CV metabolic risk factors						
Previously diagnosed with Diabetes (N= 5860)	85	4.1 $_a$	168	4.4 $_a$	253	4.3
Previously diagnosed with hypertension (N= 5861)	270	13.1 $_a$	508	13.4 $_a$	778	13.3
Previously diagnosed with dyslipidemia (N= 5810)	177	8.7 $_a$	361	9.6 $_a$	538	9.3
Had previously CVD (N= 5875)	81	3.9 $_a$	63	1.7 $_b$	144	2.5
Previously diagnosed with any Metabolic Risk Factors	459	22.4 $_a$	820	21.7 $_a$	1279	21.9
Family History of premature CV events (N=5567)	274	14.4 a	584	15.9 a	858	15.4
BMI (N= 5610)						
mean (standard deviation)	*27.86*	*(5.71)*	*28.38*	*(10.43)*	*28.2*	*(9.09)*
Overweight*	829	42.9 $_a$	1398	38.2 $_b$	2227	39.8
Obese**	546	28.3 $_a$	1136	31.0 $_b$	1682	30.1
Waist circumference (N=5808)						
mean and standard deviation	*98.19*	*11.6*	*93.26*	*12.28*	-	-
Elevated waist circumference ****	891	44 $_a$	1807	47.8 $_b$	2698	46.5

*BMI=25-29.9; ** BMI ≥30 ***≥94 cm men and ≥80 cm in women . **≥98 cm for men and ≥92 cm in women
Each subscript letter denotes gender categories whose proportions do not differ significantly from each other at the 0.05 level.

The mean BMI in the sample was 28.2, 27.86 in men and 28.38 in women. Almost 40% of the sample are overweight (BMI between 25 Kg/m^2 and 29.9 Kg/m^2) - 42.7% of men and 38% of women- , and 30.3% (28.4% of men and 31.3% of women) were obese (BMI ≥ 30 Kg/m^2).

Waist circumference showed a mean of 98.19 cm in men and 93.26 cm in women. When central obesity was defined according to WC cut-off points optimized for the sample population against cardiovascular outcome measure (WC ≥ 99 cm in men and ≥ 92 cm in women) the prevalence of central obesity was 43% in men and 47.5% of women.

To compare the prevalence of behavioral risk factors obtained through facility based assessment with the nationally representative figures reported in the stepwise survey, we assessed the prevalence of cigarette smoking and obesity among the group aged 45-64. The table 9 shows the results of this comparison, where it is seen that in general, the studied sample was more advantaged in regard to behavioral risk factor as compared to the status of participants of the step-wise survey.

Table 9: *Comparison with figures from stepwise survey*

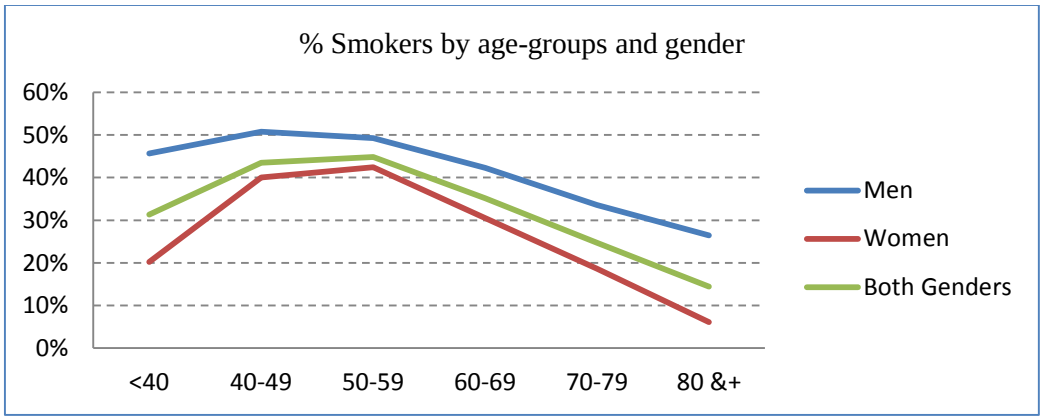
Risk Factors	Age: 45-54		Age: 55-64	
	Study	Stepwise*	Study	Stepwise*
MEN				
n men	*824*	*188*	*456*	*140*
% Cigarette smokers	45.4 %	55.3 %	40.4 %	45.7 %
% Obese (BMI ≥ 30 kg/m^2)	28.5 %	39.2 %	31.4 %	31.1 %
WOMEN				
n women	*1610*	*226*	*744*	*146*
% Cigarette smokers	35.7 %	45.6 %	34.0 %	44.5 %
% Obese (BMI ≥ 30 kg/m^2)	30.7 %	40.0 %	37.5 %	43.5 %
MEN & WOMEN				
n men & women	*2434*	*414*	*1200*	*286*
% cigarette smokers	38.9 %	50.0 %	36.4 %	45.1 %
% obese (BMI>=30 kg/m^2)	30.0 %	44.3 %	35.3 %	37.5 %

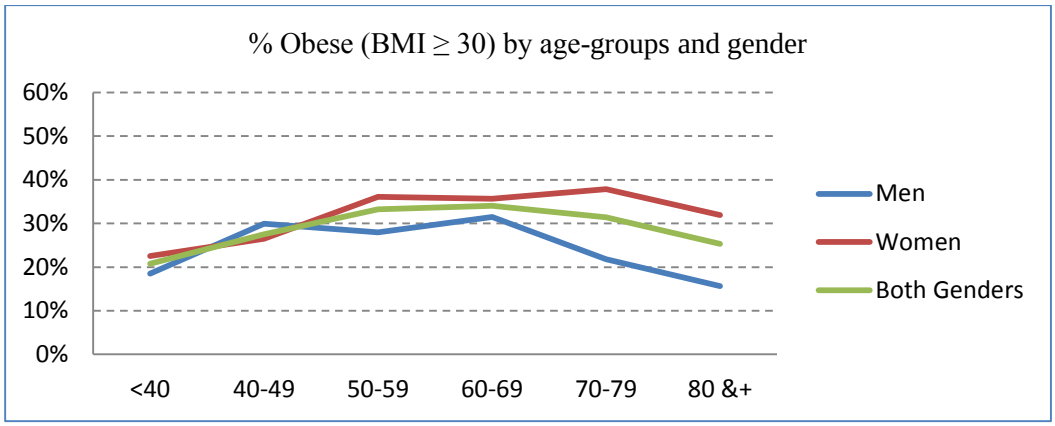
* Source: of the stepwise survey figures: Sibai and Hwallah 2010

The proportion of smokers and obese among the screened subjects seemed to be inferior to the one reported in the Step-wise survey for the same age group. The selection bias, having under-sampled subjects with chronic diseases may be the cause of under-representation of smokers and obese subjects among the beneficiaries of the pilot.

When the prevalence of smoking and obesity was assessed by age-groups and gender, the prevalence of both risk factors increased by age expect for the oldest age-group, where it marks a drop in men and women alike (see figure 3).

Figure 3: *Smoking and Obesity by age groups and gender*





The relative drop in the proportion of smokers and obese subjects in the oldest age group can be explained by the effect of those two risk factors on health. Hence, smokers and obese subjects are less likely to be the clients of PHC centers, because they may already have been subject of serious health complications related to their risk factors, treated at secondary and tertiary levels.

Screening results

Screening for Metabolic impairments

Means

The means and standard deviation of the screening results of sugar capillary blood concentration was calculated while stratified by time of last meal, and double stratified by gender. The mean blood sugar level was 101.3 mg/dl in fasting respondents, 110.8 mg/dl in those who ate before 6-8 hours and 124.6 mg/dl among those who had their last meal within two hours before taking the screening. In general the difference of means between men and women was not significant although slightly lower in women. The mean systolic blood pressure was 124.4 mmHg and the

mean diastolic blood pressure was 77 mmHg, significantly higher in men as compared to women (See table 10).

Table 10: *Preliminary estimation metabolic impairments stratified by gender*

Measurements	Men		Women		Both genders		p-value
MEANS AND ST DEVIATIONS	n	Mean ± st.dev	n	Mean ± st.dev	n	Mean ± st.dev	
Blood sugar							
Fasting blood sugar	762	101.6 ± 25.3	1361	100.1±22.9	2119	100.6 ± 23.8	0.18
Blood sugar 6-8 hours after meal	561	110.6 ± 25.8	958	109.3±29.5	1517	109.8 ± 28.2	0.41
Blood Sugar within 2 hrs after meal	749	128.7 ± 40.1	1484	124.4±36.8	2239	125.8 ± 38.0	0.01
Blood pressure							
Systolic blood pressure	2072	127.1 ± 16.5	3803	122.9 ± 16.3	5875	124.4 ± 16.5	0.00
Diastolic blood pressure	2072	78.5 ± 10.1	3803	76.2 ± 10.4	5875	77.0 ± 10.3	0.00
PREVALENCE	**n**	**%**	**n**	**%**	**n**	**%**	p-value
Impaired Glucose Metabolism							
All sample	303	14.6	445	11.7	748	12.7	<0.01
Previously Asymptomatic for diabetes	271	13.7	400	11.0	671	**12.0**	<0.01
Known Diabetes	31	36.5	45	26.8	76	30.0	0.08
Raised Systolic Blood Pressure (≥ 135 mm Hg)							
All sample	550	26.5	688	18.1	1238	21.1	<0.01
Previously Asymptomatic for Hypertension	407	22.7	446	13.6	853	**16.8**	<0.01
Known Hypertension	142	52.6	241	47.4	383	49.2	0.98
Raised Diastolic Blood Pressure (≥ 85 mm Hg)							
All sample	464	22.4	663	17.4	1127	19.2	<0.01
Previously Asymptomatic for Hypertension	364	20.3	496	15.1	860	16.9	<0.01
Known Hypertension	100	37.0	166	32.7	266	34.2	0.13
Raised Blood Pressure							
All sample	728	35.2	1008	26.6	1736	29.6	<0.01
Previously Asymptomatic for Hypertension	565	31.5	727	22.1	1292	25.4	0.10
Known Hypertension	163	60.4	281	55.3	444	57.1	<0.01

The p-value represents the significance of the difference between genders according to t-test for means, and Chi-square test for prevalence

A total of 671 subjects (12%) previously asymptomatic for diabetes showed impaired screening results for RBS (13.7% of men and 11% of women; p-value <0.01). Almost third subjects, who reported having been diagnosed previously with diabetes and were in principle under anti-diabetic treatment, were found to have rates of blood sugar above the norm without significant difference between men and women.

A little more than one in four from those who were unaware of hypertension was classified at increased risk of being hypertensive (31.5% of the men and 22.1% of women, p-value <0.01), with 17% of the sample showing elevated results for SBP and 17% of the sample showing elevated results for DBP. More than a half of men and women under antihypertensive treatment obtained suboptimal results of their blood pressure measurement suggesting uncontrolled condition during the screening without significant different between men and women.

The higher than accepted proportion of subjects under treatment for diabetes or hypertension who obtained impaired screening results suggests uncontrolled metabolic impairment, and triggers an action to review the existing management protocols and inclusion of non-pharmaceutical measures in the treatment protocols to combat chronic diseases.

Assessment of the association between metabolic impairments and covariates

The examination of the association between screening results and the available demographic and socio-economic variables showed that women were significantly less likely to screen positive for impaired RBS and blood pressure. Those involved in paid activity were significantly less likely to screen positive for RBS in men and women. Less educated women but not men were significantly less likely to screen positive for hypertension (table 11). Social deprivation showed significant association with both RBS and SBP impairment during screening, whereas the prevalence of metabolic impairments did not show significance by place of examination in-facility or in outreach (data not shown).

Impaired sugar metabolism was associated with age and obesity. Genetic predisposition for premature CV events was significantly associated with elevated systolic blood pressure, but not with elevated blood sugar, and exposure to smoking did not show significant effect on the screening results (see table 12).

Table 11: *Prevalence of impaired screening results by Socio-economic variables (N=5875)*

Socio-Economic Categories	Impaired blood glucose				Raised blood pressure			
	Detected		Uncontrolled		Detected		Uncontrolled	
	N	%*	n	%**	n	%*	n	%**
MEN (N= 2064)								
Work Status								
Employed	199	12.4	23	37.1	443	29.8	116	62.7
Unemployed	18	24.7#	-	-	21	36.8#	11	68.8
Not ILF	52	18.5	8	38.1	96	40.5#	34	52.3
Education								
Illiterate	69	13.6	9	47.4	62	35.2	22	64.7
Intermediate &-	151	12.6	15	31.9	348	31.9	93	60.4
Secondary &+	37	18.8#	4	33.3	128	27.8	40	60.6
Consanguinity of parents								
Related	87	14.4	5	22.7	158	28.4	39	55.7
Not related	174	13.6	26	42.6	369	31.8	118	63.8
Residence								
Rural	156	13.9	11	25.6	310	29.9	82	61.7
Urban	115	13.5	20	47.6#	255	33.6	81	59.1
Social deprivation								
Less deprivation	119	12.3	18	46.2	264	30.3	78	58.6
More deprivation	138	14.9	10	25.6	273	32.1	77	63.6
WOMEN (N= 3796)								
Work Status								
Employed	76	10.1	8	38.1	145	20.9	44	54.3
Unemployed	4	11.4	-	-	6	18.8	3	75.0
Not ILF	319	11.3	35	24.1	567	22.3	233	55.5
Education								
Illiterate	67	12.7#	15	45.5#	115	25.5#	54	49.5
Intermediate	244	11.8#	19	20.2	420	22.3#	159	58.5
Secondary &+	57	6.6	3	12.0	145	18.1	46	54.8
Consanguinity of parents								
Related	140	13.0	17	31.5	218	22.0	81	56.6
Not related	250	10.4	25	22.7	473	21.7	189	54.9
Residence								
Rural	238	12.1#	25	27.8	400	21.9	145	61.2#
Urban	162	9.8	20	25.6	327	22.3#	136	50.2
Social deprivation								
Less disadvantaged	131	8.4	13	18.1	286	20.5	125	52.7
More disadvantaged	237	12.6#	24	30.0	391	22.5	134	59.0

*defines the proportion of individuals with impaired screening from those previously free from the outcome; ** defines the proportion of individuals with uncontrolled outcome from those previously diagnosed with the outcome. defines # denotes the category of the Risk factor variable that has significantly higher prevalence of the outcome as compared to other categories at 0.5 level of significance of the z-test

Table 12: *Prevalence of impaired results by other CV risk factors (N=5875)*

Socio-Economic Categories	Impaired blood glucose				Raised blood pressure			
	Detected		Uncontrolled		Detected		Uncontrolled	
MEN (n= 2072)	N	%*	N	%**	n	%*	N	%**
Age-groups								
<40	12	15.2#	0	-	16	20.3	0	0
40-49	80	9.4	12	35.3	221	26.8	32	56.1
50-59	82	14.3#	11	36.7	177	34.2	52	60.5
60-69	57	19.0#	4	40.0	104	43.3	44	62.0
70-79	31	21.1#	4	57.1	42	37.2	24	58.5
80 &+	9	28.1#	0	0	6	28.6	11	84.6
Smoking status								
Not smoker	143	15.3#	13	31.7	268	32.0	75	54.0
Former Smoker	15	13.5	2	50.0	46	46.5#	14	87.5#
Smoker	113	12.1	16	40.0	251	29.2	74	64.3#
BMI Categories								
<25	59	11.1	7	28.0	108	21.6	33	58.9
25-29.9	103	13.0	8	22.9	215	29.5#	55	55.6
≥ 30	89	17.0*	11	57.9*	196	43.3#	62	67.4
Family History								
No FH	211	13.6	25	33.8	435	29.5	129	59.2
FH+	37	14.1	5	55.6	117	41.1#	33	68.8
WOMEN (N= 3803)								
Age-groups								
<40	16	15.5#	0	-	15	14.9	2	66.7
40-49	163	9.1	9	16.4	314	18.1	62	55.9
50-59	111	10.8	17	28.8	222	24.6	97	51.9
60-69	67	15.0#	12	36.4	107	29.7#	65	54.6
70-79	34	16.2#	4	26.7	58	36.9#	41	60.3
80 &+	9	20.5#	3	60.0*	11	37.9#	14	70.0
Smoking status								
Not smoker	243	11.2	27	29.0	422	21.6	171	54.8*
Former Smoker	17	15.0	0		29	30.9#	8	33.3
Smoker	140	10.4	18	25.7	276	22.3#	102	59.3*
BMI Categories								
<25	85	7.9	9	18.4	169	16.2	42	49.4
25-29.9	127	9.5	8	14.3	259	21.2#	104	59.4
≥ 30	172	16.0*	28	45.9*	279	30.4#	124	56.9
Family History								
No FH	327	11.1	32	25.4	587	21.5	219	55.2
FH+	63	11.6	12	30.0	134	26.0*	62	57.9

*defines the proportion of individuals with impaired screening from those previously free from the outcome; ** defines the proportion of individuals with uncontrolled outcome from those previously diagnosed with the outcome. defines # denotes the category of the Risk factor variable that has significantly higher prevalence of the outcome as compared to other categories at 0.5 level of significance of the z-test

Cardiovascular risk profile

WHO/ISH Scores

After having excluded from denominator the records of patients with CVD, from 5731 remaining, 765 (13.3%) scored 10% and above for the total cardiovascular risk (TCVR) calculated from the compilation of five parameters on the simplified WHO/ISH charts, 14.3% of men and 12.8% of women ($p<0.01$). The distribution of beneficiaries by TCVR according to the WHO/ISH equation is detailed in table 13.

Table 13: *Categories of total CV risk profile using the WHO/ISH simplified charts (N=5731)*

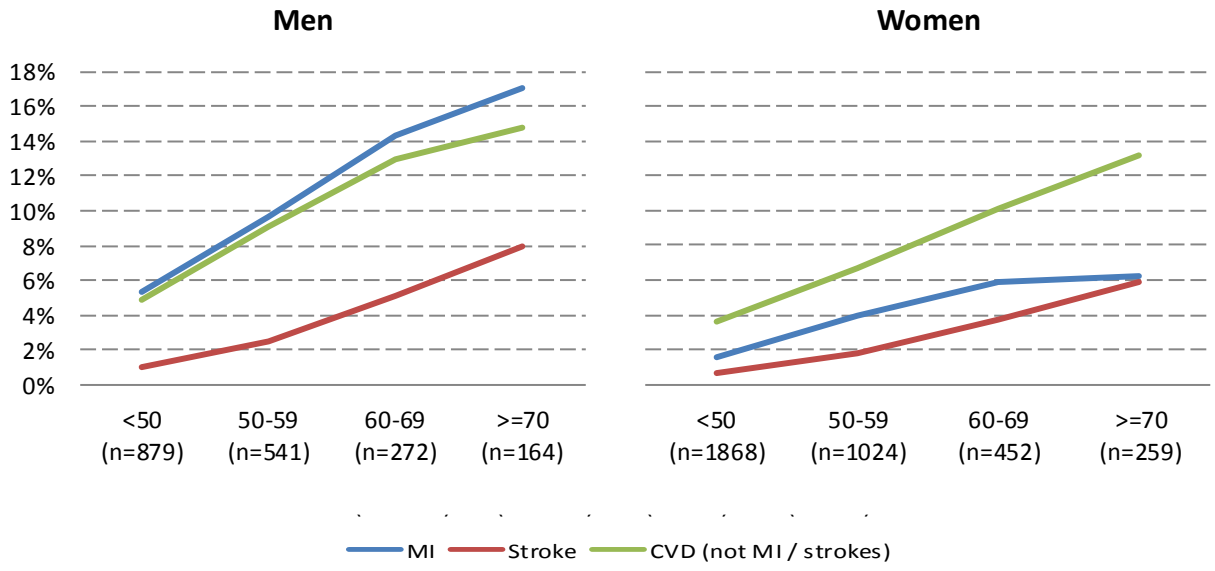
	Low CVR (<10%)		Moderate CVR (1 0-<20%)		High CVR (≥30%)	
Men	n	%	N	%	n	%
<50	942	99.4	2	0.2	4	0.4
50 -59	553	95.3	10	1.7	17	2.9
60 -69	204	70.1	55	18.9	32	11.0
>=70	55	32.0	71	41.3	46	26.7
total	1754	88.1	138	6.9	99	5.0
Women						
<50	1934	99.7	5	0.3	1	0.1
50 -59	1022	95.7	27	2.5	19	1.8
60 -69	341	72.9	99	21.2	28	6.0
>=70	147	55.7	63	23.9	54	20.5
total	3444	92.1	194	5.2	102	2.7
Men & Women						
<50	2876	99.6	7	0.2	5	0.2
50 -59	1575	95.6	37	2.2	36	2.2
60 -69	545	71.8	154	20.3	60	7.9
>=70	202	46.3	134	30.7	100	22.9
total	5198	90.7	332	5.8	201	3.5

Framingham risk scores

The Framingham 10-year Risk calculator using BMI as a proxy of lipid profile in a simplified model is available as excel spread sheet on the net (www.framinghamheartstudy.org/risk-functions/cardiovascular-disease/10-year-risk.php). Using this equation the Framingham risk scores was retrieved for different CVD clinical outcomes compiling together six predictor: sex, age (in continuous form 35 to 75 years) smoking status (smokers being defined as consuming at least one cigarette per day or one arguileh head per week) the presence of diabetes suspected from screening results or previously diagnosed and treated, the value of systolic blood pressure obtained during screening and the value of BMI.

The Framingham risk score represents by definition the risk of occurrence of a particular CVD in an individual presenting a set of predictors. Therefore, the mean score of a population free frp, CVD projects the incidence of the CVD outcomes for the next 10 years. The figure 3 exhibits the mean scores of three cardiovascular outcomes obtained through application of the Framingham equation on the screening records of the un-weighted sample. The t-test between the means risk scores of the three CV outcomes assessed show that the mean scores in women were significantly lower across all CV outcomes, and all age groups. In addition, men and women showed a different CVD profile projected according to Framingham estimations: Women seemed less threatened by MI as compared to minor CVD incidence, to the point that in the oldest age group in women the risk of heart attacks equals the risk of stroke. In opposition to men who showed mean MI risk score greater than the two other outcome across lifespan.

Figure 4: *Means of risk scores of three CVD using Framingham equation with BMI*



Observations included in the figure above concern only beneficiaries free from CVD, and with available data on BMI, N= 5459

ASSIGH risk scores

The ASSIGN CVD risk score calculator in excel spreadsheets is available from http://cvrisk.mvm.ed.ac.uk/calculator/excelcalc.htm and includes genetic predisposition among predictors. This ASSIGN spread sheet was used to retrieve lifelong risk of General CVD attributed to smoking and genetic predisposition separately, and adjusted for age and gender. The equation calculating the CV risk attributed to smoking involved the number of cigarette smoked per day. To adjust for Arguileh smoking, each smoked arguileh head per week was converted into 3 smoked

cigarettes per day. Table 14 shows the mean risk attributed to both risk factors among the screened sample stratified by age-group.

Table 14: *CV risk attributed to smoking and genetic predisposition among the screened population*

Age-groups	n	CV risk attributed to smoking		CV risk attributed to Genetic predisposition	
		Mean	Std dev	Mean	Std Dev
MEN					
<50	966	0.90	0.41	0.69	0.15
50-59	605	1.59	0.66	1.22	0.24
60-69	312	2.68	1.11	2.11	0.39
>=70	189	3.98	1.31	3.56	0.53
WOMEN					
<50	1958	0.94	0.57	0.78	0.24
50-59	1092	1.88	0.89	1.59	0.47
60-69	479	3.67	1.94	3.17	0.90
>=70	274	6.05	1.56	6.11	1.44

As seen from the table, according to the ASSIGN risk score, the compilation of the realistic smoking status and family history of the screened sample has yielded to higher risk of CVD attributed to smoking alone as compared to those attributed to genetic predisposition alone.

Screening Outcome

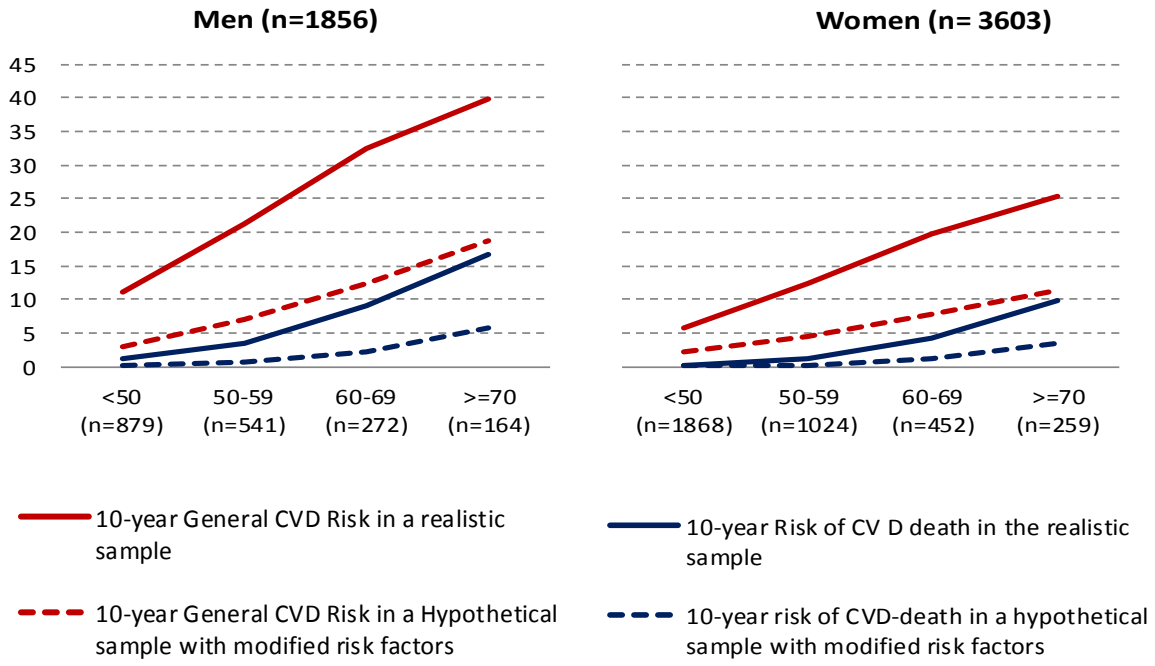
The distribution of the sample by the five risk-groups described before (table 2) is summarized in table 15. The general feature of the sample could be summarized as follows: from 10 subjects having taken the screening, one had already a CVD or an uncontrolled cardiometabolic condition. If we disregard those who already had a clinical expression of CVD, 60% of the screened population had one or more metabolic impairment - previously diagnosed or just detected through the screening. In the cohort of metabolically impaired subjects, more than half have been just detected through screening of RBS and BP, representing more than one in four of the beneficiaries of the service. At least 74% of the detected cases of sugar impairment, increased hypertension and elevated waist circumference, will be finally diagnosed with any metabolic impairment and would benefit from therapeutic action directed at controlling it. From the cohort of metabolically unimpaired, individuals, half are smokers and/or obese and would benefit from engaging in risk factor modification. Consequently, only a minority of the population screened, less than one in five (16.9%), could be classified as free from any CV risk factor and had nothing to do except keeping on and reinforcing healthy life style.

Table 15: *Distribution of the sample by risk groups assigned according to screening*

Assigned risk group	Men		Women		Men & Women	
	N	%	n	%	n	%
Definite	244	11.8%	353	9.3%	597	10.2%
Probable	706	34.1%	949	25.0%	1655	**28.2%**
Met-S	467	22.5%	1187	31.2%	1654	28.2%
Genetic/Behavioral	371	17.9%	608	16.0%	979	16.7%
Null Risk	284	13.7%	706	18.6%	990	**16.9%**

To concretize the load of modifiable risk factors in generating CV risk, we assessed the mean estimated scores for two CVD outcomes: the 10-year General CV risk and CVD death according to the Framingham equation with BMI. A first estimation was realized through plotting the realistic health characteristics of the screened population to retrieve the corresponding means risk scores, a second estimation was performed by plotting healthier risk profile, assuming that the smokers in the population screened quitted smoking, hypertensive individuals had controlled their hypertension (SPB =110 mmHg) and a normal lipid profile, exemplified by BMI= 20 kg/m^2. The presence of confirmed or suspected diabetes was kept in the hypothetical model. The figure 5 shows this comparison.

Figure 5: *The load of modifiable risk factors in generating CV risk*

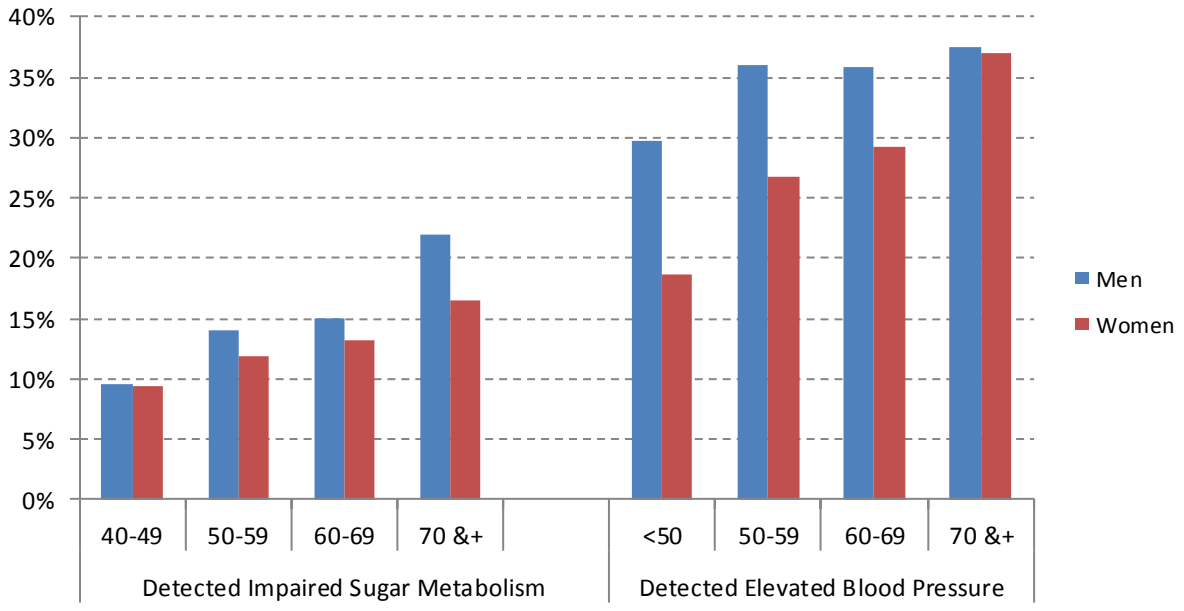


Projections at population level

If this same service was conducted among a sample aged 40 years and more and having the national age and gender distribution, the screening would have detected impaired blood sugar in 11.6% of individuals screened (12.7% of men and 10.9% of women; p-value= 0.04) and hypertension in 26.8% (33.5% of men and 23% of women; p-value <0.01). If the subsample of beneficiaries aged 35-64 included a proportion of diabetics similar to that encountered in Lebanon according to the stepwise survey (Sibai and Hwallah, 2010), we would have 4.5% of the sample with previously diagnosed diabetes instead of the obtained 4.2%. Reporting this new prevalence on screening results of this same age group, we obtained the proportion of 66% latent diabetics among the diabetic population aged 35-64.

In a weighted sample accounting for the general distribution of the Lebanese population by age groups, the prevalence of suspected impairments stratified by age groups, in subjects free from any known underlying metabolic condition, is shown in figure 6. Men and women showed a different figure. Women were less likely to be detected for impaired blood sugar, in proportion increasing steadily with age while men showed a sharp increase in the oldest age group. For detected elevated blood pressure, women were generally less likely to show impaired screening results, in proportion increasing steadily and regularly with age, while men initially showing higher proportions of elevated blood pressure, had a slower increase with age, or even a drop starting at the age of 60.

Figure 6: *Prevalence of Impaired screening results by age-groups and gender (weighted data)*



The proportion of those who had impaired screening results increased with age, which is a normal feature expressing the influence of age in the pathogenesis of diabetes and hypertension. However, this trend was not identical for men and women: the proportion of those with impaired blood pressure scores dropped slightly in men after the age 60, while continued its ascension in women. Gender differential in the adverse effects of hypertension on cardiovascular health and health in general could be an explanation of this figure.

The expected incidence of CVD within 10 years, as estimated using the Framingham equation, and projected at population level, was 14% in men and 11% in women

Health workers' performance

In the received reports, there were some inaccuracies in classification of patients by impaired categories, but they were minimal, and have been dealt with during registration of results and data cleaning, with contacting the false negative cases and propose to them to undergo diagnostic step. We will limit the statistical evaluation of health workers' performance to the variables involving their calculations and decisions. Those are mainly the variable expressing the classification of be beneficiaries by total cardiovascular risk (TCVR) using the paper-based WHO/ISH charts and consequent referral decisions. For this purpose, we assessed the degree of agreement Kappa, between those variables as defined by the health workers following their judgment, and similar variables obtained through objective retrieval of the two measures from corresponding variables (see table 16).

Table 16: *Kappa agreement to assess the performance of health workers*

Calculated by the investigators	Defined on the field by non-physician health workers							
	All health workers			Attended the training			Did not attend training	
	TCVR	REF		TCVR	REF		TCVR	REF
TCVR	0.348			0.406			0.267	
REF		0.196			0.228			0.149

TCVR= Classification of patients by total cardiovascular risk on paper-based WHO/ISH charts; REF= decision on referring the patient to the health canter or to risk factor modification service

Kappa agreement between the two groups of variables barely reached moderate level, with slightly better agreement among health workers who attended the training. The tendency was to under-refer patients to diagnostic step; from 5379 observations with available data of health workers' decision of referral either to diagnostic step or to risk factor modification, 42% were rightly referred; 49% were under-referred, and 8.6% were over-referred. Those proportions appeared as 44.9%, 45.7% and 9.4% respectively in beneficiaries having been served by formally trained health workers, and 37.7%, 54.8% and 7.5% in beneficiaries having been served by health workers who had only a trivial training.

Physicians' performance

This initiative did not preview clinical audit, but the clinical performance of the physicians involved in this initiative could be retrieved from their notes on the referral sheets. A preliminary analysis of the doctors' notes showed a pervasive non-compliance of doctors by the clinical instructions. MDs did not systematically prescribe laboratory investigations, the voiced diagnosis was often imprecise, inconclusive, and sometimes simply missing. The life style recommendations were seldom mentioned, and only one doctor bothered to calculate the final cardiovascular risk score by Framingham and recorded her estimation of the metabolic risk profile of patients seen by her during the diagnostic step.

Patients' Compliance

Table 17 represents the counts and proportion of respondents having attended each following step of the three-step architecture of the service- screening, diagnostic, and management. We had 541 follow-up reports available out of around 2000 expected. From those, 280 (51.7%) patients showed up at the first medical consultation and from them 264 were prescribed additional testing. From the 264 patients who had to take confirmatory and diagnostic laboratory testing, 149 (58.9%) got the tests in facility from which 106 (71%) attended to second medical consultation for final evaluation. Eleven subjects had lab test outside the center and reported the results, and 104 (41.4%) although attended the physician's consultation did not take prescribed testing at all. The reason of attrition were financial in 22% of cases, and "fear of knowing the results" in 44 % of cases, the rest being distributed between several other reasons by patients' reports through phone interviews. In conclusion, out of 10 patients having been referred from the screening stage, five attended the health center to follow-up on their condition, but only one had taken all the additional tests required. The table 15 details the available information retrieved

Table 17: *Patients' Compliance from 541 available follow-up reports*

Step	n	%
1st Medical Visit (*Total with available data on first medical visit)*	541	100
Ignored the referral	134	24.8
Attended to medical consultation inside the center	280	51.7
Sought for healthcare outside the center	127	23.5
Laboratory investigations (*Total having been prescribed tests)*	264	100
Performed the lab tests in facility	149	58.9
Performed lab tests outside the center	11	4.3
Showed up for 1st visit but not for laboratory testing	104	41.1
2nd medical consultation (*Total having undergone testing in facility)*	*149*	*100*
Attended to the diagnostic 2nd medical visit	106	71.1
Showed up for laboratory testing but not for 2nd medical visit	43	28.9
Total sought healthcare outside the center	*127*	*100*
Performed 2nd medical visit in the center	10	7.8
Cause of Attrition (*Total not showing up with available data on reasons)*	*94*	*100.0*

Step	n	%
Financial issues	21	22.3
"fear" of the consequences of additional testing	38	40.4
Others reasons (Lives far, got sick meanwhile)	35	37.2
Cause of addressing healthcare outside *(total having had private consultation)*	*98*	100.0
Has already a private doctor that follows on him/her	86	87.8
Lacks trust in center for dealing with "serious" health issues	7	7.1
Other reasons (lives far, had other plans, etc)	5	5.8

V- QUALITATIVE RESULTS

Field observations, meetings' minutes and informal conversations

According to the field observation, the degree of abidance of the health workers by the screening protocol was excellent and the respect of privacy was fair. However, the majority of health workers needed additional clarification for the calculation of cardiovascular risk scores and assigning the patients by different risk groups. The health workers had a tendency to under-refer patients, often justifying their referral decision with their patients' unwillingness to follow-up on their status". Health workers neglected follow-up on referred patients, especially when those did not show up at the facility. The performance of the health workers in terms of referral improved at the end of the pilot period, but for the majority of centers it remained suboptimal.

The comprehensiveness of this procedure allied the health workers and motivated them to pay additional effort and volunteer time to fulfill the requirement of the implementation, however, the field coordinators reported on several factors having hindered the exact agreement between the protocol and the realistic conduct of its the implementation.

- As shown from the process evaluation, only a minority of centers could deal with their engagement in due time. The health workers justified the delays by the load of work, long-lasting protocols, and competing responsibilities. It is worthy to note that only two centers officially recruited additional health workers or volunteers to help in the implementation of the pilot initiative. Towards the end of the pilot, a competing program was launched by the MOPH concerning healthcare to Syrian refugees, which was an additional factor interfering with the timely achievement of the allocated quotas of beneficiaries.
- Most, but not all, health workers involved in the implementation of the pilot were trained nurses, while half of the implementers did not attend the training sessions. Overall, the health workers encountered difficulties in BMI calculation using a manual calculator, in total risk calculation on charts and in deciding on the referral of patients to further steps.
- Entering the records triggered a pervasive complaint, due to deficient hardware in centers, insufficient internet connection, imperfections in the application, lack of time and difficulties in dealing with the program or with IT operations in general. Some centers allocated the data entry to an IT person, which compromised the quality of the data, and made its cleaning more difficult. IT problems were evoked as the main cause of delays in delivery of records.
- The measurement of waistline was a delicate procedure in several centers, whereby religious/cultural requirements in some areas forbade female providers to attend to this measurement in men.
- The referral to general practitioners was not well understood, and some health workers took the initiative of directing those eligible for diagnostic step to the specialists directly, cardiologist or endocrinologist, as they used to do before the introduction of this initiative.

Discussions and persuasions were used to change this practice, with equivocal results. Additionally health workers reported resistance from the patients, who did not always understand why they should address the generalist for a problem related to their blood sugar metabolism or blood pressure.

- Health workers deplored that some patients rushed to private doctors and laboratories as soon as they were informed that they may have a health problem needing follow-up and that others refused to take the referral sheet, because "were not convinced" by the preliminary diagnosis voiced by the nurses.
- The centers' directors and health workers reported at every occasion that patients from their usual clientele cannot afford the fees of consultation and additional investigations required within the diagnostic step, which triggered their concern about the usefulness of such a service, if not sustained by systematic diagnostic procedure of all suspected cases.
- Only half health workers willingly attended to outreach screening, while expressing their dislike of this exercise. The remaining health workers refused to visit people in their homes, even for proposed overtime. In some centers, the outreach component was banished from the practice, for reasons related to cultural awkwardness about "sending young ladies to strangers' homes".
- In most centers, we could not find the management protocols we delivered to doctors to be kept at hand, and we had to redistribute them. In opposition, one center had the management sheet photocopied and distributed in all examination rooms of the center, even in the gynecological cabinet. Some attending doctors expressed enthusiasm in implementing and improving this initiative and others expressed their skepticism about its usefulness, claiming that the Ministry "never sustains decisions" or that the patients lack knowledge and resources to pursue the needed medical attention, and would better wait to have an attack before paying attention to their cardiovascular health. Some doctors expressed reservation about the treatment protocol adopted by the ministry and declared they are using different protocols, and different approaches to deal with metabolically impaired patients.
- Although some doctors involved in this pilot service showed high proficiencies, excellent knowledge of the clinical material, and real motivation to improve community health through such an action, the majority of doctors met seemed demotivated and considered this work ungrateful in the current circumstances of employment in the PHC centers, "a waste of time, because the majority of patients use the center as a drug dispensary and don't listen to doctors" claimed an experienced doctor working many years in one of the health centers. A minority of doctors showed serious lack of knowledge, while another minority seemed tenaciously unwilling to change anything in their PHC practice, giving the impression that their interest in PHC practice is limited to acquisition of experience and connections that would help them in their private practice.
- Most physician and non-physician health workers expressed their reticence to send the suspected cases to general practitioners. This tendency is worth to address to not transform

this service in an opportunity for specialists to maximize, not always well-indicated investigations and medical procedures.

In a meeting with the staff of some centers, the attendees called to the decision makers to study the possibility of subsidizing the entire procedure, screening and diagnostic steps, because only such a decision could guarantee the sustainability of the service and maximize its positive impact on community health.

Obstacles and ways of Amelioration

An exploratory study following the closure of the pilot service explored additional features having hindered or favored the right conduct of the protocol. Six PHC centers' directors have participated in in-depth interview, and were asked to relay the difficulties encountered and voice their recommendations to ameliorate the service.

The obstacles listed by PHC centers directors through the exploratory study undertook after the closure of the pilot corresponded to the field observations and are summarized below.

- Financial limitation was the most cited obstacle in the way of unfailing the implementation of the pilot. The lack of financial resources hindered hiring additional health-workers to implement the screening as should have been given the work load on usual employees of those health centers. All centers' directors interviewed deplored the impossibility of covering the diagnostic step, the financial burden of which had, in their opinion, prevented patients to follow-up on the conditions and diseases detected during the screening. The financial limitations touched as well transportation fees to conduct home visits, and would have needed, by PHC centers' directors words, additional resources to be properly implemented, including additional fees to health workers, that were supposed to work overtime.
- Limitation in the human resources was also cited among the obstacles. The PHC centers staff members do not always have appropriate training, and the appointed nurses are often responsible of the implementation of several heath programs, therefore could not find enough time for implementing the service. In addition, health workers encountered difficulties in understanding and applying the clinical aspects of the project and IT component.
- Technical gaps were also cited as important obstacles, whereby the IT technology is a recurrent problem in the PHC centers. One health center's director said that in spite of the efforts paid by the Ministry, for many years now, the intranet communication with the Ministry was still not 100% functional. Some health PHC directors complained of mis-communication with the ministry, and delays of the latter in attending to the IT difficulties encountered,

- The health workers pointed on several gaps concerning the design and the equipment of the service: the digital sphygmomanometers were suspected to over-estimate blood pressure, and consequently overestimate the prevalence of detected hypertension. In addition, the questionnaires were suspected of including questions needed for studies and not related to patients' health status, such as consanguinity of parents, education and work status. In addition, the PHC centers' directors relayed difficulties in conducting the protocol, especially the component requiring calculations of total CV risk with charts. The training of implementers was in the opinion of several of them not sufficient.

The centers' directors interviewed, voiced precise recommendations to ameliorate the project and sustain its provision. We retained the recommendations that were most relevant.

- The Ministry should establish a system of monitoring, that would not only serve to assess the cardiovascular risk profile of the PHC Network clientele, but also evaluate the process and the outcomes of the service.
- The service cannot reach responsiveness of the population without involvement of Media, to inform the population about the need of taking cardiovascular risk screening and improve knowledge about latent metabolic risk factors, and their influence on cardiovascular health.
- The Ministry should be more involved in subsidy, encompassing the coverage of diagnostic step, providing medications at lower price, appointing health workers having a paramedical training especially to conduct the service.
- More appropriate training and continuous training of health workers should be established, coupled with more efficient monitoring of their work.

Reasons of non-compliance of patients

According to health workers and physicians, the main drive behind the high motivation of beneficiaries to participate in the free component and their pervasive non-compliance with attending the paid service component was financial, whatever would be the reasons given by non-compliant patients. To confirm this hypothesis, some health workers compared the patients' turn-out in free and charged health services offered at their centers, within the CVD screening initiative or other programs, and noted that free services always attract more patients and result in higher compliance rates than paid services, even if the payment is symbolic.

According to focus group discussion and phone interviews with non-compliant beneficiaries, the financial reason was the one most cited, but not the only. A variety of other reasons were stated by patients to justify their non-compliance by the directives given by health workers during the screening step. From the narratives, it seems that the culture of investing in detection tests is not well established in this social environment. Although some beneficiaries, showed poor recognition of the importance of detection and early treatment of chronic diseases, and did not link late diagnosis with worse prognosis, the majority of respondents agreed that detection services are

important and can tremendously improve the prognosis of latent diseases if they are present. However the two groups of respondents still link the decision to seek health attention with emerging health complaints. The concept of “healthy patient” was not deeply understood by both patients and health workers. The narratives indicated a reticence to invest money for nothing, such as addressing a doctor and not be proscribed medicines, or taking laboratory tests yielding to normal results. A minority even asserted that medications are harmful and addictive, and that one should not be eager to start any treatment if not “really sick”.

VI- CONCLUDING REMARKS

By tackling latent cardiometabolic risk factors, the service of cardiovascular risk screening and management of cardiometabolic impairments in patients free from CVD, subscribes to the secondary prevention of cardiometabolic risk factors, and primary prevention of CVD. This service does not prevent cardiometabolic risk factors, but only detects already existing but still latent conditions in order to install cardiovascular risk-lowering therapy and prevent the occurrence of CVD in those detected patients. This initiative has the potential to widen its scope, from secondary to primary prevention of cardiometabolic risk factors, by including the definition of pre-diabetes and pre-hypertension, in order to install therapeutic actions aiming at preventing, or at least delaying, the occurrence of full-blown diabetes and hypertension, coupled with active management of central obesity, obesity and smoking before morphologic changes in vessels occur.

Many detection programs tackling cardiometabolic risk factors have been taking place at the PHC Network, encompassing screening for diabetes and lipid investigations. The added value of this initiative is the concomitant assessment of several risk factors in one procedure, and their estimation in relation to each other, This approach optimizes the estimation of the risk each pathology can cause, whereby a accumulation of several cardiovascular risk factors even in mild expression is more predictive of CVD than the presence of one risk factor even in severe expression (Mendis, 2005). This approach also highlights the multifactoral nature of CVD, a message that was not always conveyed during campaigns tackling early detection of metabolic risk factors.

The usefulness of the screening was unequivocal. From six patients screened, one was detected for impaired blood sugar, or elevated blood pressure. If we disregard those who already underwent CVD, more than one in two beneficiaries had one or more metabolic impairment including known or suspected impaired sugar metabolism and elevated blood pressure or dyslipidemia, putting them at increased risk of CVD. Projections of the screening data at population level showed that two third of the metabolically impaired population were unaware of the risk before taking the screening, which alone justifies the inclusion of this service at the PHC level in Lebanon.

The choice of implementing total cardiovascular risk assessment at screening level had an important awareness mission as well, increasing the knowledge of health workers and beneficiaries about risk stratification in the pathogenesis of CVD. However, the systematic calculation of total cardiovascular risk was wrongly realized, and it did not really add to the accuracy of referral to diagnostic step. Consequently, the calculation of total cardiovascular risk score at the first contact can be withdrawn from the screening protocol, but kept as an essential element in the diagnostic step and in guiding the management strategy of confirmed cases. The introduction of health workers to the total cardiovascular approach during trainings is primordial to convey the concept of this service that remains that of multifactorial CV risk screening of asymptomatic subjects, even if the calculation per se is banished from the screening protocol.

The rates of impaired screening results for RBS and BP are comparable to those obtained during similar programs in the Gulf countries. Of special interest is a similar initiative held in Oman and that showed similar prevalence of detected cases. If this finding shows something, it is that Lebanon has achieved its epidemiologic transition, and exhibits prevalence of metabolic risk factors comparable to the champion countries of the region, and should therefore pay special attention to the prevention and control of NCD in the country.

The rather successful implementation of the screening service in 26 PHC centers, along with thorough reporting of the records generated from it, the quality of the work delivered on the field by ministerial field coordinators, and the responsiveness of centers' directors and most health workers to the initiative proved that the PHC-Network and the PHC department have the capacity of providing the screening step of this service in spite of some pitfalls that can be alleviated through better addressing the training part and through simplifying the protocol, without shrinking its predictive and preventive powers.

However, not all the components of the service provided during the pilot could be qualified as successful. Whereas, the screening part could be qualified as acceptable, and triggered an exemplary response form the beneficiaries and the health workers, the non-responsiveness of patients referred to diagnostic step, and the non-compliance of doctors with the management protocols had dramatic impact of the efficacy and efficiency of the service. At the end, nine from ten detected patients did not get the needed medical attention, either because he or she ignored the medical advices and refrained from attending to the consequent steps of the initiative, or because they were inaccurately taken in charge by the medical doctors assigned to this mission. Those circumstances reduced the chances of fulfillment of the ultimate objective of this initiative aiming at reducing the incidence of CVD by detecting and managing CVD risk factors.

The doctors constituted the most surprising weakness in the succession of steps constituting the service. Although some doctors showed the expected from PHC doctors motivation, high professionalism and concern about population health, those were a minority. The ambient impression was that of demotivation and skepticism resulting in deliberate negligence in abiding by guidelines and delivering clinical service, unfortunately often below the acceptable.

Another unexpected obstacle was the tenacious resistance of the Health System, notably, the PHC network, to a crucial element of the initiative: the management of detected cases at the generalist clinic. It seems that the centralization of the system around hospitals and specialist care has gained all the healthcare personnel in the country, even the generalists themselves, and anticipates the enormity of the work that should be done to produce a change in the culture of health provision in the country among patients and healthcare personnel alike.

VII- LIMITATIONS

The analysis of the screening records encountered many limitations due to the nature of sampling and the composition of the PHC Network clientele.

1- This is a facility based sample, which implied that the pathological profile of the screened population may be different from the health profile of the general population in Lebanon, even if asymptomatic patients were recruited.
2- The clientele of the PHC Network are thought to belong to the lowest socio-economic strata in Lebanon, since the better-off individuals would logically prefer to attend the private health care sector. The higher proportion of less affluent individuals as compared to the general population may have biased the screening estimations towards over-estimation for two reasons. First social deprivation is a risk factor for CVD as it has been demonstrated in many scholarly articles; therefore the prevalence of pathologies related to CVD is likely to be higher among less affluent individuals as compared to their richer counterparts. Second, people with more resources have better accessibility to detection services because more knowledgeable about the need of screening for metabolic profile regularly after a certain age. In addition many employers and private insurance schemes, require cardiometabolic profile before recruiting.
3- Although we attempted to project the results at population level, accounting for the distribution of the general Lebanese population by age and gender, we could not account for all health and demographic details characterizing the study population, which forbids the inference of our results on a population level.

VIII- SOME POLICY RECOMMENDATIONS

1- The PHC Network showed it has the human resources, and technical capacity to implement this service. The non-physician health workers showed high proficiency in taking clinical decisions, an exercise that was not among their mandate at the PHC Network before the introduction of this exercise. However, the protocol should be simplified, and the management sheet should be updated and upgraded in real management guidelines adopting the total cardiovascular risk approach, concerning the three metabolic risk factors, adapted to the needs of the generalist physicians exerting at the PHC network. In addition, more serious and appropriate training of health workers should take place, coupled with more rigorous process monitoring in the first period of implementation of the service.
2- The prevalence of detected impairment showed that such a service is relevant and should be integrated in the package of services offered at the PHC. However, the relevancy of such a service is neutralized if the subsidy covers only the screening part. Moreover, this action may have a controversial effect, aggravating the prognosis of latent diseases, pushing detected patients who could not afford medical services to use

surrogates to medical care, that may be more harmful than the condition itself. Consequently, there is a real need to find resources to subsidize the totality of the service, in order to safely recommend it as a systematic service.

3- Similarly, clinical audit should be installed to guarantee the abidance of doctors by the clinical protocols, in order to obtain a standardized end-product, able to assess the middle term and long term impact of such a service.

4- The concept of concentrating this service at the generalist clinic of the PHC network needs serious advocacy among the health professionals and the beneficiaries. Observations from the pilot showed that the reflex of asking for specialist care as soon as the least anomaly is detected is very tenacious even among the Ministerial employees. The empowerment of non-physician health workers and generalist doctors, and the rise of their capacities to attend to cardiovascular risk-lowering management are crucial not only for the cost-effectiveness of this measure but also for its impact on population health. The current trend directing detected patients to specialists bewilders the same meaning of this intervention whereby the reflex of any specialist would be to prescribe onerous diagnostic and therapeutic measures often not indicated at earliest stages of detection when control over risky conditions can prevent the occurrence of morphologic changes in vessels.

5- Only 15% to 25% as best estimates are among the clientele of the PHC Network, undermining the universality of the benefic effect of such a service on CVD morbidity and mortality in the country if it stays limited at the PHC-Network. Therefore, a formula should be found to involve all doctors from all specialties in both private and public practice, in detecting latent metabolic impairments in their patients aged 40 years and above by performing once per year at least, the screening for RBS, BP and waist circumference and referring those with any impairment to general practitioners or specialists.

6- The health awareness component was expedited during the pilot due to logistic restrictions. A full blown health awareness component should accompany the entire procedures at the level of patients and health professionals.

7- And last, to monitor the trend, and draw final evaluation of the service, the successful reporting system can and should be ameliorated and upgraded.

ACKNOWLEDGEMENTS

This document was developed by a mandate from the MOPH Director General in the goal of producing evidence for introducing the CVD screening and management protocol in the package of services offered at the PHC Network and equipping the centers with evidence-based guidelines driven from the results obtained through the pilot service.

The following persons participated in the conceptualization, elaboration and implementation of the pilot initiative

- From the WHO country office technical team: Drs. Hassan El Bushra, Alissar Rady, Ziad Mansour, Mr Houssam Chamma, and Ms Samar Hammoud
- From the WHO regional office: Drs Samer Jabbour, Ibtihal Fadhil and Sameen Siddiqi,
- Dr. Rima Afifi (AUB), and Mr Nabil Tabbal (MOSA).
- The PHC department staff: Ramia Assaad, Zeinab Berry, Rabha Charafeddine, Safaa Hajj Sleiman, Jaafar Jabak, Wafaa Kanaan, Faten Moustafa and Fadi Wehbe.
- The healthcare centers directors, physicians and staff, medical and administrative.

IX- References

Ammar W (2003) *Health System and Reform in Lebanon*, charter 3: Financing the Health System, WHO EMRO

Ammar W (2009) Health Beyond Politics, . World Health Organization Eastern Mediterranean Regional Office- Cairo

Ammar W (2012) opening remark at the Lebanese Epidemiological Association Annual Conference, 16 November 2012, Beirut, Lebanon

Ammar, W (2003) Health System Reform in Lebanon. World Health Organization Eastern Mediterranean Regional Office- Cairo

Ammar, W (2011) Health Beyond Politics, WHO EMRO

Ammar, W (2011) Health Beyond Politics, WHO EMRO

Berger, J. S., Jordan, C. O., Lloyd-Jones, D., & Blumenthal, R. S. (2010). Screening for cardiovascular risk in asymptomatic patients. *Journal of the American College of Cardiology*, *55*(12), 1169-1177.

D'Agostino, R. B., Vasan, R. S., Pencina, M. J., Wolf, P. A., Cobain, M., Massaro, J. M., & Kannel, W. B. (2008). General cardiovascular risk profile for use in primary care the Framingham Heart Study. *Circulation*, *117*(6), 743-753.

Khalil, A.,H. (2013), the speech of the Minister of Public Health in Lebanon H.E. Ali Hassan Khalil, at the PHC conference in UNESCO Palace in Beirut, 18 January 2013, Beirut, Lebanon

IDF International Diabetes Federation (2006) Diabetes Atlas -Updated guidelines for the definition, diagnosis and classification of diabetes, Press conference, 19th World Diabetes Congress, Cape Town, South Africa, International Diabetes

Institute of Health Management and Social Protection (IGSPS) at Saint-Joseph University (2012), National Health Statistics Report in Lebanon available from http://www.igsps.usj.edu.lb/docs/recherche/recueil12en.pdf

Jabbour S (2011) NCD in Lebanon – a situation analysis, World Health Organization, Beirut Country Office, Beirut, 2011.
Kronfol N (2009) "Health beyond Politics" A review, available from http://www.syndicateofhospitals.org.lb/magazine/jan2010/23%20a%2026%20opinion.pdf

Mendis, S., Lindholm, L. H., Anderson, S. G., Alwan, A., Koju, R., Onwubere, B. J. and al. (2011). Total cardiovascular risk approach to improve efficiency of cardiovascular prevention in resource constrain settings. *Journal of clinical epidemiology*, *64*(12), 1451-1462.

Mendis S (2005) Cardiovascular Risk Assessment and Management in Developing Countries, Vascular Health Risk Management v.1(1), http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1993930/

Motlagh, B., O'Donnell, M., & Yusuf, S. (2009). Prevalence of cardiovascular risk factors in the Middle East: a systematic review. *European Journal of Cardiovascular Prevention & Rehabilitation*, *16*(3), 268-280.

Nasreddine, L., Mokdad, A. H., Adra, N., Tabet, M., & Hwalla, N. (2010). Nutrition transition and cardiovascular disease risk factors in Middle East and North Africa countries: reviewing the evidence. *Annals of Nutrition and Metabolism*, *57*(3-4), 193-203.

NCEP- National Cholesterol Education Program (2001) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Executive summary of the third report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). *JAMA*. 285:2486-2497.

MOPH-Lebanon (2012) Ministry of Public Health Lebanon, internal document

MOPH- Lebanon (2012), The list of chronic Medicines 2012, internal document

MOPH, Website, PHC available from moph.gov.lb/Prevention/PHC/Pages/HealthCentersAccreditation.aspx

National Health Accounts, Lebanon, 2000, Prepared by Walid Ammar; Hisham Fakha; Osmat Azzam; Rita Freiha Khoury; Charbel Mattar; Maher Halabi; Doried Aoudat; Khaled Srour; A.K. Nandakumar, available from www.who.int/nha/docs/en/Lebanon_NHA_report_english.pdf, [accessed September 2013]

Political declaration of the International Conference on Healthy Lifestyles and Non-communicable diseases in the Arab World and the Middle East held in Ryadh, KSA, in Sepmtember 2012 available from emro.who.int/images/stories/ncd/documents/Riyadh_Declaration.Final_bilingual.pdf [accessed September 2013]

Saade, G., Abou Jaoude, S., Afifi, R., Warren, C. W., & Jones, N. R. (2008). Patterns of tobacco use: results from the 2005 Global Youth Tobacco Survey in Lebanon. *East Mediterr Health J*, *14*(6), 1280-9.

Sfeir R (2007) Strategy for National Health Care Reform in Lebanon, http://www.fgm.usj.edu.lb/files/a62007.pdf

Sibai A and Hwallah N (2010),WHO steps Chronic Diseases Risk Factor surveillance. American University of Beirut. http://www.who.int/chp/steps/2008_STEPS_Lebanon.pdf

Sibai, A., Tohme, R.A., Mahfoud, Z. & Chaaya, M. (2009) Non-communicable Diseases and Behavioral Risk Factor Survey, Comparison of estimates based on cell phone interviews with face to face interviews, Final Report Submitted to *World Health Organization- Lebanon office, Beirut, Lebanon*

Statistical Bulletin Lebanon 2011 (2013), Annual Report prepared by Hild Harb, available from www.moph.gov.lb/Publications/Documents/Statistical%20Bulletin%202011.pdf [Assessed October 2013]

Tohme, R. A., Jurjus, A. R., & Estephan, A. (2005). The prevalence of hypertension and its association with other cardiovascular disease risk factors in a representative sample of the Lebanese population. *Journal of human hypertension*, *19*(11), 861-868.

UN Political declaration of the High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases, available from un.org/ga/search/view_doc.asp?symbol=A/66/L.1

Consultation, W. H. O. (2000). Obesity: preventing and managing the global epidemic. *World Health Organization technical report series*, *894*.

WHO- World Health Organization. (2003). Screening for type 2 diabetes: report of a World Health Organization and International Diabetes Federation meeting. WHO, Geneva, Sitzerland.

WHO -World Health Organization (2006). International Diabetes Federation. Definition and diagnosis of diabetes mellitus and intermediate hyperglycaemia: report of a WHO/IDF consultation. World Health Organization, 21.

WHO-World Health Organization (2009) The world health report 2008 : primary health care now more than ever, WHO, Geneva, SWITZERLAND

WHO -World Health Organization (2010) Package of essential non-communicable (PEN) disease interventions for primary health care in low-resource settings, WHO, Geneva, Switzerland

WHO -World Health Organization (2011) Global Status Report on Non communicable diseases 2010, WHO, EMRO

WHO -World Health Organization (2011) Global Status Report on Non communicable diseases 2010, WHO, EMRO

WHO -World Health Organization (2011), ***NCD Country Profiles***

WHO country office in Beirut, Lebanon, proceedings of the national consultation for the prevention and control of Non-communicable Diseases, held in Beirut, Lebanon, in March 2012

WHO/ISH Cardiovascular Risk Prediction Charts Strengths and Limitations http://www.who.int/cardiovascular_diseases/publications/cvd_qa.pdf

YMCA (2013), Medical Assistance program for the chronically ill, available from http://www.ymca-leb.org.lb/health.htm

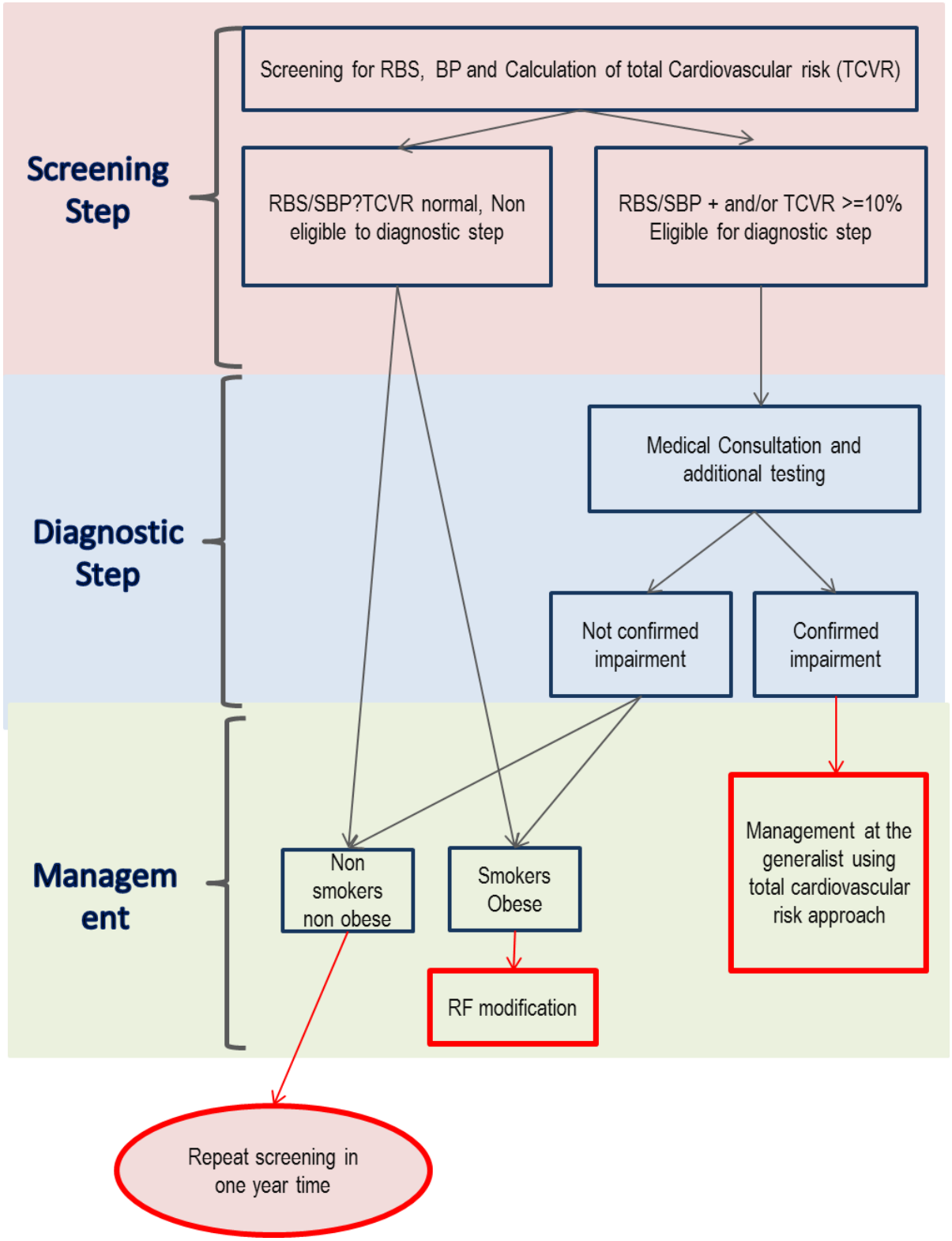
Yusuf S., Hawken S., Ounpuu S.; Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet*. 364 2004:937-952.

X- Appendices

Appendix 1: *The national NCD prevention and control program Strategic Objectives*

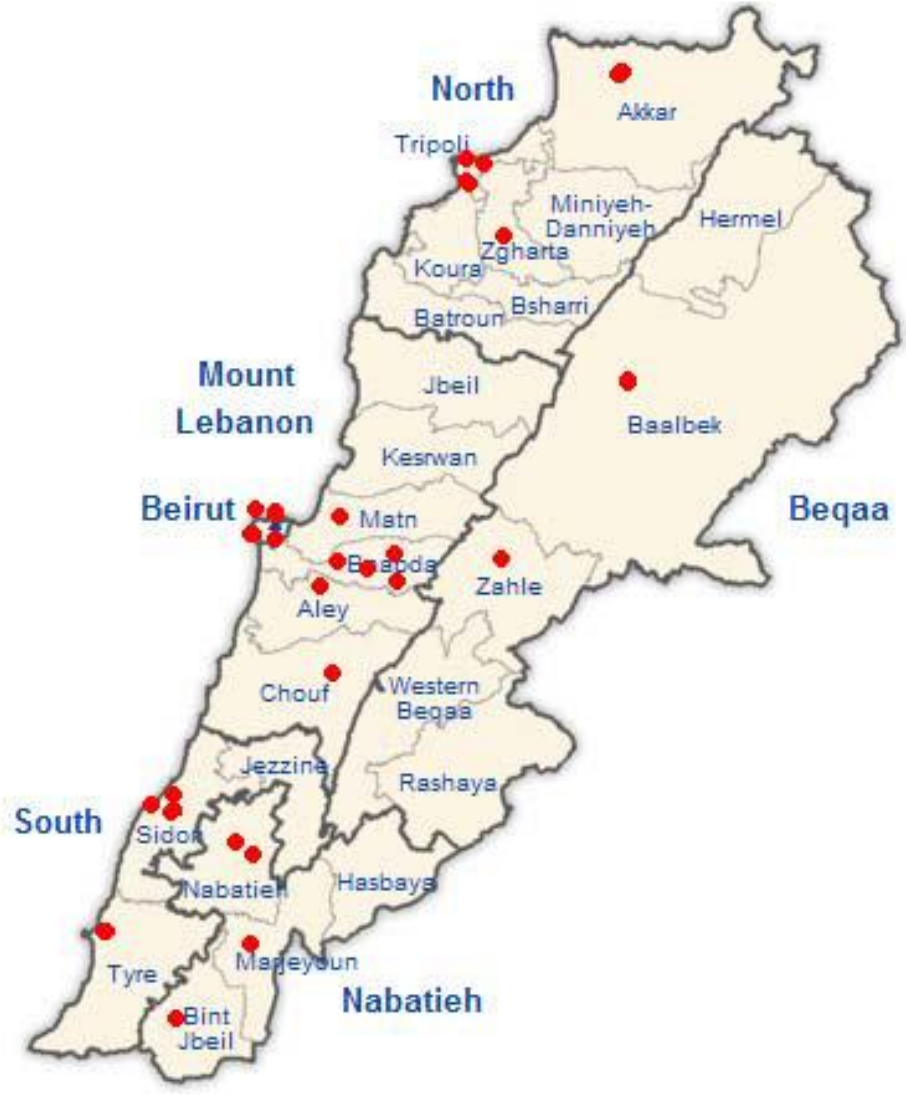
Strategic Objective	Interventions	Output
S.O.1 Develop policy framework and ensure political commitment	Establish an NCD unit at the MoPH	Functional Unit
	Advocate with the GOL to commit and secure funds	Funds secured
S.O.2 Strengthen the health system to respond more effectively to NCDs	Assess and strengthen the capacity of PHC centers	% PHC centres providing adequate care
	Capacity building of staff in MOPH PHC Network	
	Establish a PHC-based in-facility & outreach screening for Metabolic Syndrome and COPD	% Ignoring their condition
	Develop, adapt or update clinical practice guidelines and train healthcare providers on new guidelines	Produced Guidelines
S.O.3 Develop surveillance systems to monitor trends and impacts	Build on current routine data collection procedures to operationalize a health information system that will serve to report on NCDs and their risk factors	% centers reporting regularly
S.O.4 Reduce the exposure of population and individuals to shared modifiable risk factors	Implement existing laws and prepare new laws	Decrees
	Promote healthy lifestyles through mass media campaigns and targeted campaigns	Prevalence of smoking
	Implement regulations in & outside the health sector	Decrees

*Appendix 2: **Architecture of the service protocol***



Appendix 2: *Map with the list of the participating health centers*

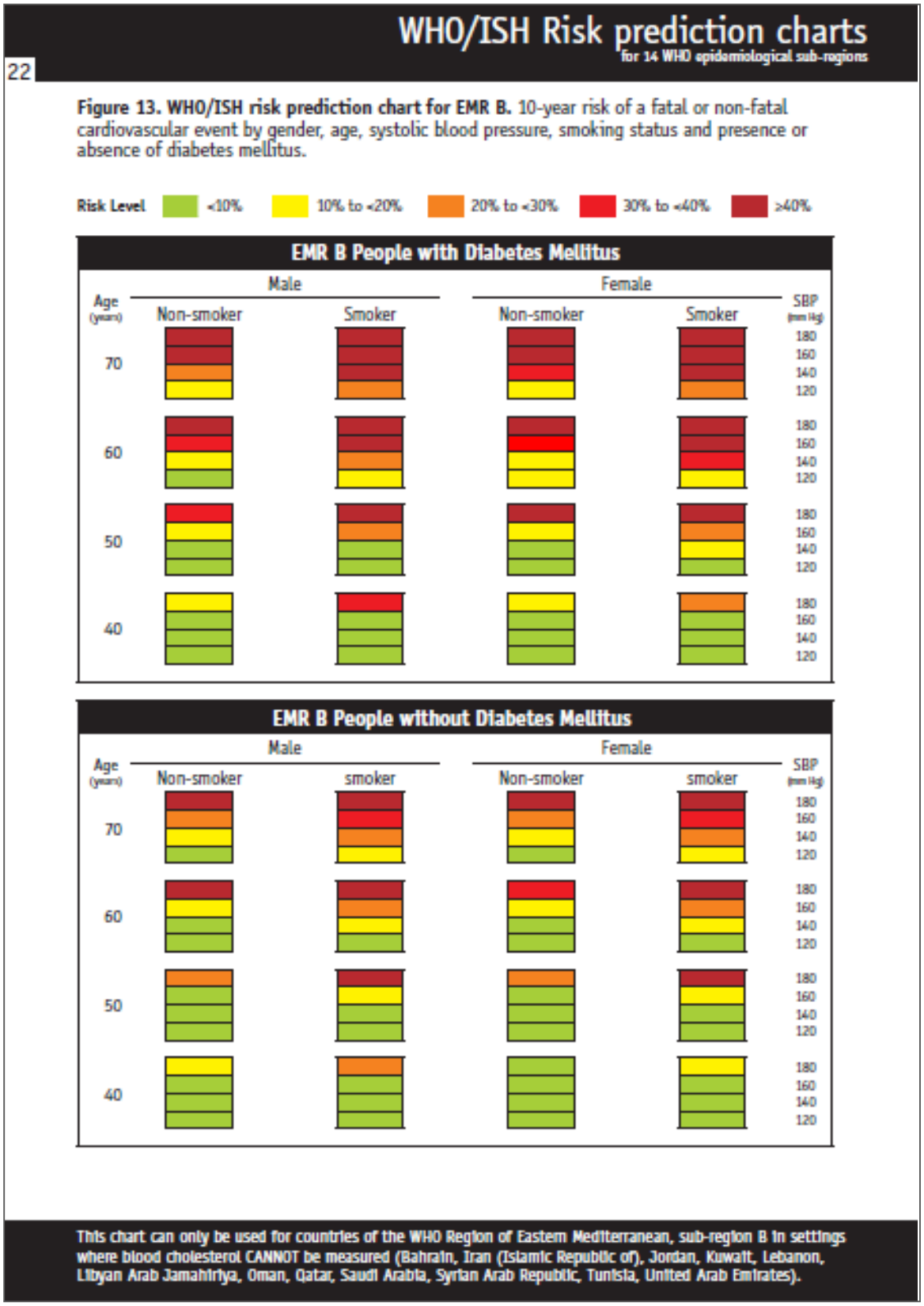
Beirut
El- Horj Centre/ Makassed
Dar El- Fatwa Health Centre
Ras El-Nabeh – Hariri Foundation
Saint Antoine Health Centre
Beirut Suburb
Bolghordjian Socio-Medical Centre
Haret Hreik PHC Centre
Dar El-Hawraa Centre
Ayn El Romaneh/ CDM
Ghbeiri Municipality Centre
Mount Lebanon
Chweifat Social Health Centre
Barouk Governmental Centre
North Lebanon
Khaldieh medico social Centre
Alkarameh charity Centre
Hariri Centre /Tripoli
Azm w Saade Centre
Wadi Khaled /Makassed
South Lebanon
Nabih Berri Rehabilitation Centre
Sribta Association
Imam Khomieni Health Centre
Almoasat association / Saida
Amel Health Centre/ Bazourieh
Nabatieh
Jbaa gov. health Centre
Kafar roman health Centre
Deir sirian health Centre
Beqaa
Kobelias Health Centre
Health Centre Nabi Sheet



Appendix 3: Coordinators and Health workers participating in implementation

Coordinators	Implementers
Jaafar Jabbak, MS candidate, Coordinator Beirut / Beirut Suburb	***Health Center Nabi Sheet*** Fayza Abdallah Zeinab Shokr
Wafaa Kanaan, Masters Health Management, Coordinator Mount Lebanon	***Khaldieh medico social center*** Marie Therese Zakri Miladia Hamati Soeur Dolly Azzi Souad Farchakh
Faten Moustapha, BS Nursing, MS, Coordinator South Lebanon	***Alkarameh Charity Center*** Abir Najwa Albaarini
Safaa Hajj Sleiman, BS nursing, MBA, Coordinator Beqaa	***Jbaa gov. health center*** Fatme Hassan
Ramia Assad, Nursing Diploma, Coordinator North Lebanon	***Nabih Berri Rehablitaton Cente*** Ali Noureldine Elham Hoballah Issaf Reda Mehdi Khayrallah
Rabha Charafeddine, Nursing Diploma, Coordinator Nabatieh	***Chweifat Social Center*** Abir Yehya Yolla Merhi
Ali Roumani, Maters CCE, IT developer and coordinator	***El- Horj Makassed Center*** Ali Machmouchi Christine Abou Jemaa Hadiya Itani Hussein Jamaleddin Ibrahim Abou Skini Ibtissam Abdallah Mahmoud Zabadawi Marwa Harb Souha Mneymneh Yassmine Mrad
Fadi Wehbe, BS, Data Manager	***Dar El- Fatwa Health Center*** Mariam Ghezawi
Zeinab Berry, MS candidate, data collection technical supervisor	***Wadi Khaled Health Center/Makassed*** Janette Hamid Nadia Al Khal Ramia Al Ali Wesal Sayed Widad Mohammad Ziad Alhaji
	Kobelias Health Center Darwich Khan Houwaida Chahine Mariam Al Hajj Wael Khan
	Sribta Association Hanane Assi Jamileh Manana
	Imam Khomieni Health Center Wafaa Hamoud
	Hariri center /Tripoli Darine Moghrabi Manal Chamtiyeh
	Ras El-Nabeh – Hariri Foundation Dania Demachkiyeh Rola Kanjo Salam Fayed
	Saint Antoine Health Center Lina Fahed Mira Andraos
	Barouk Governmental Health Center Rehab Mahmoud
	Bolghordjian Socio-Medical Center Chaghik Haboyan Virginie Khorshidian
	Dar El-hawraa Center Beer El Abed Zeinab Khalil
	Haret Hreik PHC Center Saja Al Assimi
	Socio-Medical Center –Ayn Romaneh Nahida Raaydeh
	Ghbeiri Municipality Center Ibtissam Nasrallah Mariam Mansour Nisrine Saadeh
	Azm w Saade center Darine Khaled Hana Bakir Khadija Lina Souzane
	Almoasat Association / Saida Doha Wehbi Iman Al Baba Khadija Fayed
	Kafar Roman Health Center Ayman Baalbaki Hanan Madi Maha Hotet Raoufeh Hotet Zahraa Ali Ahmad Zeinab Hamza
	Amel Health Center- Khyam/ Bazourieh Maysam Haidar Tagreed Aboud
	Deir Sirian Health Center Manal Yehya Nohad Serhan Rania Souly

Appendix 4: *WHO/ISH Risk prediction charts for the EMR B sub-region*



Appendix 5: The management sheet and member of the committee that has developed it

Estimation of Cardiovascular Risk

Assess History of Cardiovascular Events (MI, Stroke, CVA)
If the patient had a CV event, he/she is considered at highest CV risk without any further risk assessment.
Otherwise,
I- Gather information about gender, age, smoking history and family history of premature ischemic CV events(Father, mother, brothers, sisters or children that had MI, Strokes, CVA, or cardiac death below age 55),
II – Measure BMI, waist circumference, blood pressure, etc
III- Investigate FBS, Hb1AC, cholesterol, triglycerides, LDL, HDL etc

Calculate the total cardiovascular Risk by one of the 3 methods
1- Framingham Scales, downloadable from
http://hp2010.nhlbihin.net/atpiii/calculator.asp
2- WHO/ISH risk prediction sheets adapted for Lebanon enclosed
3- Metabolic syndrome criteria (below)

The metabolic syndrome score by AHA criteria (3/5 of the following)

Waist circumference	≥94 cm in men ≥80 cm in women
Triglycerides	≥150 mg/dl or on Drug treatment for elevated TG
HDL-C	<40 mg/dl in men/ <50 mg/dl in women or on Drug treatment for dyslipidaemia
BP	≥130 mm Hg / ≥85 mm Hg or Drug treatment for hypertension
Diabetes	Detected glucose intolerance or on Drug treatment for diabetes

Interpretation of the cardiovascular risk

CV Risk	By Framingham	By WHO/ISH charts	By Metabolic Syndrome
LOW <10%	Low	<10%	< 3/5
MEDIUM	Medium	10-20%	
HIGH	High	>20%	≥ 3/5
HIGHEST	Went through a major cardiovascular event (MI, Stroke, CVA)		

Non Pharmaceutical Management

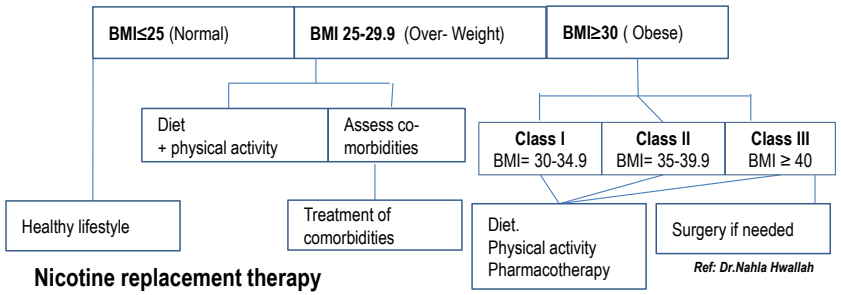
Hypertension
1.Weight reduction
2.Reduce salt intake to 1 teaspoon/day
3. Diet rich in fruits and vegetables low in dairy products and fats
4.Limit alcohol consumption
5.Regular exercise or walking for 30 min/day
6.Stop smoking
7.Limit caffeine consumption to 2 cups/day

Dyslipidemia
1.Stop smoking
2.Diet: reduce animal and industrial fat and substitute by raw vegetal oil.
3- Increase dietary fibers mostly the soluble ones
4.Regular exercise or fast walking for 30 min/day

Diabetes
1.Limit carbohydrates (sugar, bread, pasta, alcohol) & use non-nutritive sweeteners.
2- Quit smoking
3.Referal to dietician

Obesity management

BMI= Weight/ (Height)^2



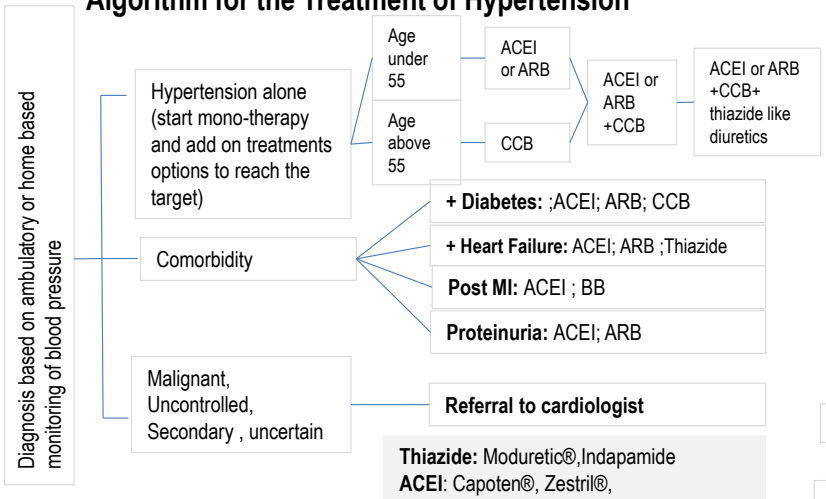
Nicotine replacement therapy

➢ **Patients should be warned of smoking while using Nicotine replacement therapy**

Type	Advise	Smoking Status	Dose & Timing
Nicotine gum	Chew one gum over 30 minutes when urge to smoke. stop smoking completely before using gum	<15 cigarettes/day	2mg gum Weeks1-6: 1 piece Q1-2h Weeks 7-9:1 pieceQ2-4h Weeks 10-12:1 piece Q4-8h
		>15 cigarettes /day	4mg gum Weeks1-6: 1 piece Q1-2h Weeks 7-9:1 pieceQ2-4h Weeks 10-12:1 piece Q4-8h
Nicotine Patch	Apply new patch daily to non-hairy skin upper torso or arm. Do not reuse skin sites for at least 1 week	If ≤10 cigarettes	Weeks1-6: 14mg patch Weeks 7-8:7mg patch
		If >10 cigarettes	Weeks1-6: 21mg patch Weeks 7-8:14mg patch Weeks 9-10:7 mg patch
Nicotine lozenge	Suck on the lozenge until it is fully dissolved, Do not bite or chew it lord swallow it.	Use<15 cigarettes per day :2 mg pastille Use >15 cigarettes per day:4 mg pastille	Weeks1-6: 1 piece Q1-2h Weeks 7-9:1 pieceQ2-4h Weeks 10-12:1 piece Q4-8h

Edited by Ammar W, Arnaout S, Hamadeh G, Hwallah N, Sandid M and Yamout R (2012)

Algorithm for the Treatment of Hypertension



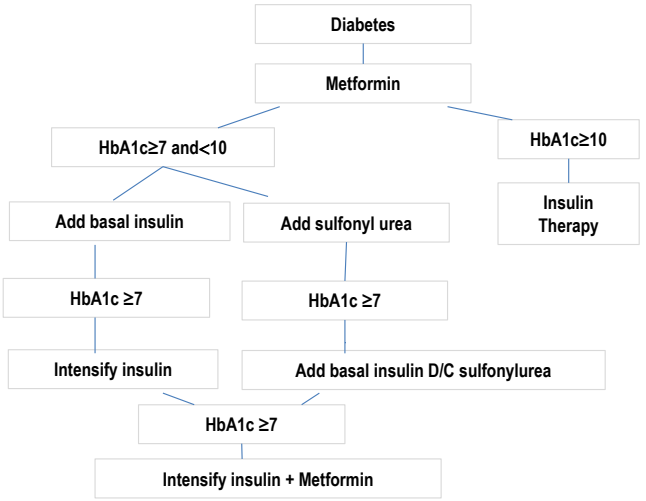
Thiazide: Moduretic®,Indapamide
ACEI: Capoten®, Zestril®,
CCB: Amlor®
BB: Concor®

Adapted from Hamadeh et al (2011) Primary Care Clinical Guide. Beirut, Lebanon: AUB

ASPIRIN: All those having had major CV event should be on 80 mg acetyl salicylic acid daily unless they have contraindications
All those having CV risk >30% should be given Aspirin after consultation with the cardiologist and r/o contraindications

Adapted from WHO (2007) Prevention of cardiovascular disease : pocket guidelines for assessment and management of cardiovascular risk

Algorithm for Treatment of Diabetes



Adapted from Hamadeh et al (2011) Primary Care Clinical Guide. Beirut, Lebanon: AUB

Algorithm for Treatment of Dyslipidemia

Lipid Profile	Treatment options	Diet
Mixed Elevation (high cholesterol and high triglycerides)	Statin or Fibrates	**Low fat diet** **+ Physical activity** **+ Smoking Cessation**
High Cholesterol (LDL high)	Statin if not managed Add Ezetimibe	**Low Fat Diet**
High Triglycerides (TG >150 mg/dl)	Fibrates	**Low carbohydrates** **Low alcohol consumption Low fat**

➢ **Statins are not equivalent regarding their potency in LDL reduction. Initiate treatment with simvastatin if target not achieved or/ and intolerance consider other statin or add on therapy**

Treatment goals based on the total CV risk

CV risk	LDL	TC/HDL	TG	BP	Hb1AC
High or MS >2/5	<77mg/dl	<4	<150	130-139/85-89 mmHg	Hb1AC Maintain in the range of 6.5-7%
Medium	<135mg/dl	<5	<150	140-159/90-99 mmHg	
Low	<193mg/dl	<6	<200	140-159/90-99 mmHg	

Conversion Factor: mg/dL cholesterol = mmol/L × 38.6 mg/dL triglycerides = mmol/L × 88.5

Adapted from European Heart Journal (2011) 32 (14): 1769111818.doi: 10.1093/eurheartj/ehr158

Edited by Ammar W, Arnaout S, Hamadeh G, Hwallah N, Sandid M and Yamout R (2012)

The Technical / Scientific Committee having gathered and edited the management sheet

Dr Walid Ammar	MoPH	MD, PhD	Director General, MOPH.
Dr Samir Arnaout,	AUBMC	MD, cardiologist	President, Lebanese society of Cardiology
Ms Alia Freidi	AUB	PharmD, MPH	Intern, American University of Beirut
Dr Ghassan Hamadeh,	AUBMC	MD, family practice	Chair, Family Medicine Department, AUBMC
Dr Nahla Hwallah,	AUB	PhD, Nutrition	Dean, Faculty of Agriculture and Food Sciences
Dr Mohammad Sandid,	MoPH	MD, endocrinologist	Manager, National Diabetes Program, MoPH
Dr Rouham Yamout	WHO	MD, MPH	NCD program coordinator