The Challenge of Chronic Disease: Opportunities for Nurses in Africa

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Nursing opportunities to decrease the global burden of cardiovascular disease

Deborah Chyun PhD, RN, FAHA, FAAN

Maurice, 2013, Lancet, 382:1085-6
Is this possible? How?

- Population demographics
- Importance of chronic disease
  - Cardiovascular disease
- Risk factors
- Prevention strategies
Population demographics
World Population Growth Through History

Billions

Growth in More, Less Developed Countries

Billions

Demographic Transition

- World population in midst of transformation from high mortality and high fertility to one of low mortality and fertility
- Responsible for rapid and accelerating growth, slowing and changes in age distribution
  - Stage 1:
    - Reduction in mortality → longer survival
    - Proportion of children increases

*The diversity of changing population age structures in the world, Population Division, Dept of Economic and Social Affairs, UN Secretariat, 2005*
Demographic Transition - 2

- Stage 2:
  - Fertility declines as fewer children needed
  - Proportion of children declines while population ages
  - Sustained reduction slow growth and contribute to ageing

- Stage 3:
  - After lengthy periods of low fertility and mortality, proportion of children and adult of working age decline and only older adults rise
  - Ageing reinforced and growth of older persons greater than younger

The diversity of changing population age structures in the world, Population Division, Dept of Economic and Social Affairs, UN Secretariat, 2005
Age Distribution of the World’s Population

Population Structures by Age and Sex, 2005

Millions

Less Developed Regions

More Developed Regions

Age

Male

Female

80+
75-79
70-74
65-69
60-64
55-59
50-54
45-49
40-44
35-39
30-34
25-29
20-24
17-19
10-16
5-9
0-4

Trends in Life Expectancy, by Region

Life Expectancy at Birth, in Years

<table>
<thead>
<tr>
<th>Region</th>
<th>1965-1970</th>
<th>2000-2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>44</td>
<td>49</td>
</tr>
<tr>
<td>Asia</td>
<td>54</td>
<td>67</td>
</tr>
<tr>
<td>Latin America/Caribbean</td>
<td>59</td>
<td>70</td>
</tr>
<tr>
<td>More Developed Regions</td>
<td>71</td>
<td>76</td>
</tr>
<tr>
<td>World</td>
<td>56</td>
<td>65</td>
</tr>
</tbody>
</table>

Population of individuals 60 and over

Proportion of population (%)

0 5 10 15 20 25 30 35 40

1950 1975 2005 2025 2050

Africa
Asia
Latin Am/Carib
North Am
Europe
Oceania

World population prospects: The 2004 revision, United Nations, 2005
Women and Aging

Projected World Population, by Sex, at Specified Age Groups, 2025

Percent

<table>
<thead>
<tr>
<th></th>
<th>All Ages</th>
<th>Ages 60+</th>
<th>Ages 80+</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women</strong></td>
<td>50%</td>
<td>54%</td>
<td>63%</td>
</tr>
<tr>
<td><strong>Men</strong></td>
<td>50%</td>
<td>46%</td>
<td>37%</td>
</tr>
</tbody>
</table>

Trends in Urbanization, by Region

Urban Population

Percent

<table>
<thead>
<tr>
<th>Region</th>
<th>1950</th>
<th>2000</th>
<th>2030 (Projected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>29</td>
<td>47</td>
<td>61</td>
</tr>
<tr>
<td>Africa</td>
<td>15</td>
<td>37</td>
<td>54</td>
</tr>
<tr>
<td>Asia</td>
<td>17</td>
<td>37</td>
<td>55</td>
</tr>
<tr>
<td>Latin America/Caribbean</td>
<td>42</td>
<td>76</td>
<td>85</td>
</tr>
<tr>
<td>More Developed Regions</td>
<td>53</td>
<td>74</td>
<td>82</td>
</tr>
</tbody>
</table>

Chronic disease
Did you know??

35 000 000 people will die from chronic diseases in 2005

60% of all deaths are due to chronic diseases
64 million deaths in 2015
Death rates from non-communicable diseases per 100,000 adults aged 15-69 years in 23 high-burden countries.

47% of all NCD deaths
71% of deaths in people younger than 70 years globally

Figure 1
80% of chronic disease deaths in LMIC
Chronic diseases are concentrated among the poor
- Increased exposure to risks and decreased access to health services
- Poor and children have limited choices
80% of CVD and 40% cancer preventable
Chronic disease prevention and control is NOT expensive!

WHO, 2005
Estimated costs of five priority interventions for non-communicable disease (NCDs) in three countries.

<table>
<thead>
<tr>
<th>Interventions</th>
<th>Cost per person per year (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>China</td>
</tr>
<tr>
<td>1. Tobacco use</td>
<td></td>
</tr>
<tr>
<td>Accelerated implementation of the WHO Framework</td>
<td>0.14</td>
</tr>
<tr>
<td>Convention on Tobacco Control</td>
<td></td>
</tr>
<tr>
<td>2. Dietary salt</td>
<td></td>
</tr>
<tr>
<td>Mass-media campaigns and voluntary action by</td>
<td>0.05</td>
</tr>
<tr>
<td>food industry to reduce consumption</td>
<td></td>
</tr>
<tr>
<td>3. Obesity, unhealthy diet, and physical inactivity</td>
<td></td>
</tr>
<tr>
<td>Mass-media campaigns, food taxes, subsidies,</td>
<td>0.43</td>
</tr>
<tr>
<td>labelling, and marketing restrictions</td>
<td></td>
</tr>
<tr>
<td>4. Harmful alcohol intake</td>
<td></td>
</tr>
<tr>
<td>Tax increases, advertising bans, and restricted</td>
<td>0.07</td>
</tr>
<tr>
<td>access</td>
<td></td>
</tr>
<tr>
<td>5. Cardiovascular risk reduction</td>
<td></td>
</tr>
<tr>
<td>Combination of drugs for individuals at high risk</td>
<td>1.02</td>
</tr>
<tr>
<td>of NCDs</td>
<td></td>
</tr>
<tr>
<td>Total cost per person</td>
<td></td>
</tr>
<tr>
<td>*</td>
<td>1.72</td>
</tr>
</tbody>
</table>

Table 1 Cost for each case of RHD prevented in regions where RHD is highly endemic

<table>
<thead>
<tr>
<th>Population/outcome</th>
<th>n</th>
<th>Intervention</th>
<th>Unit cost (US$)</th>
<th>Total cost (US$)</th>
<th>DALY averted (US$; calculation$)</th>
<th>Cost per DALY averted (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy children*</td>
<td>10,000</td>
<td>Vaccine</td>
<td>3–10</td>
<td>30,000–100,000</td>
<td>218 (287.4×0.8×0.95)</td>
<td>137–458</td>
</tr>
<tr>
<td>Cases of pharyngitis</td>
<td>100,000</td>
<td>Primary prevention</td>
<td>10–15</td>
<td>1.0–1.5 million</td>
<td>45 (287.4×0.8×0.25)</td>
<td>22,075–33,113</td>
</tr>
<tr>
<td>Cases of RF</td>
<td>39</td>
<td>Secondary prevention</td>
<td>5,890–6,620</td>
<td>229,710–258,180</td>
<td>230 (287.4×0.8)</td>
<td>999–1,123</td>
</tr>
<tr>
<td>Deaths§</td>
<td>13.65</td>
<td>Surgery</td>
<td>13,949</td>
<td>320,966</td>
<td>172 (287.4×0.6)</td>
<td>1,861</td>
</tr>
</tbody>
</table>

*Hypothetical cohort of children aged 5–14 years observed for 10 years. $Calculations are based on the following assumptions: for vaccination, 80% efficacy with coverage of 95%. For primary prevention, 90% efficacy, 70% of patients being symptomatic, approximately 25% of whom might seek a medical consultation. For successful secondary prevention programmes, 100% coverage by the health sector, 100% provider performance, and 80% patient compliance. For surgery (valve replacement or repair), efficacy is assumed to be 60% after 10 years. These assumptions were used to calculate DALYs averted. §Hypothetical number of deaths extrapolated from speculative RF mortality of 35% over 10 years. Figure 29-8 from Michaud, C., Rammohan, R. & Narula, J. Cost-effectiveness analysis of intervention strategies for reduction of the burden of rheumatic heart disease. *Rheumatic Fever* (eds Narula, J., Virmani, R., Reddy, K. & Tandon, R), © American Registry of Pathology, 1999). Abbreviations: DALY, disability-adjusted life year; RF, rheumatic fever; RHD, rheumatic heart disease.


NCDs in sub-Saharan Africa: what we know now (Dalal et al., 2011, *Int J Epi*, 40:885-901)

- Disproportionate burden of infectious and chronic diseases – DOUBLE-BURDEN
- Few community-based studies
- South Africa over-represented
- Stroke: 0.07-0.3%
- Diabetes: 0-16%
- Hypertension: 6-48%
- Obesity: 0.4-43% (women)
- Smoking: 0.4-71% (men)
- Lack of vital statistics systems
- Studies needed for in-depth analysis risk factors
Projected global deaths (millions) for major chronic disease groups and other causes of death in 23 selected countries, 2005-2015

### Causes of chronic diseases

**UNDERLYING SOCIOECONOMIC, CULTURAL, POLITICAL AND ENVIRONMENTAL DETERMINANTS**
- Globalization
- Urbanization
- Population ageing

**COMMON MODIFIABLE RISK FACTORS**
- Unhealthy diet
- Physical inactivity
- Tobacco use

**NON-MODIFIABLE RISK FACTORS**
- Age
- Heredity

**INTERMEDIATE RISK FACTORS**
- Raised blood pressure
- Raised blood glucose
- Abnormal blood lipids
- Overweight/obesity

**MAIN CHRONIC DISEASES**
- Heart disease
- Stroke
- Cancer
- Chronic respiratory diseases
- Diabetes

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*Preventing CHRONIC DISEASES a vital investment*
Globalization

- The increasing interconnectedness of countries and the openness of borders to ideas, people, commerce and financial capital
- Positive aspects include availability of new technologies, such as information and communication technologies
- Negative effects include the trend known as the “nutrition transition” and less physically active lifestyles

WHO, 2005
So, globalization is making all regions of the world face similar health threats, thus demanding a unified response by nurses. It also provides us a unique opportunity to be innovative and work together with nurses across the globe.
Cardiovascular Disease (CVD)

- Coronary heart disease (CHD) [coronary artery disease (CAD), ischemic heart disease (IHD)] ✔
- Cerebrovascular disease (stroke) ✔
- Peripheral vascular disease
- Heart failure (HF)
- Hypertension (HTN)
- Rheumatic heart disease ✔
- Congenital heart disease
- Deep vein thrombosis and pulmonary embolism
Atherosclerosis: A Progressive Process

- Normal
- Fatty Streak
- Fibrous Plaque
- Occlusive Atherosclerotic Plaque
- Plaque Rupture/ Fissure & Thrombosis

- Unstable Angina
- MI
- Coronary Death
- Stroke
- Critical Leg Ischemia

Clinically Silent
Effort Angina Claudication
Increasing Age

Courtesy of P Ganz.
Age-standardised incidence of ischaemic stroke per 100,000 person-years for 1990 (A), 2005 (B), and 2010 ©

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Lancet Global Health, 1, e259-e281
Age-adjusted and sex-adjusted stroke mortality rates. Rates are highest in eastern Europe, north Asia, central Africa, and the south Pacific.

Johnston, Lancet Neurology, 8, 345-354
Copyright © 2009 Elsevier Ltd
## Ranking of 10 selected risk factor causes of death in world (WHO, 2009)

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Deaths (Millions)</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. High blood pressure</td>
<td>7.5</td>
<td>12.8</td>
</tr>
<tr>
<td>2. Tobacco use</td>
<td>5.1</td>
<td>8.7</td>
</tr>
<tr>
<td>3. High blood glucose</td>
<td>3.4</td>
<td>5.8</td>
</tr>
<tr>
<td>4. Physical inactivity</td>
<td>3.2</td>
<td>5.5</td>
</tr>
<tr>
<td>5. Overweight and obesity</td>
<td>2.8</td>
<td>4.8</td>
</tr>
<tr>
<td>6. High cholesterol</td>
<td>2.6</td>
<td>4.5</td>
</tr>
<tr>
<td>7. Unsafe sex</td>
<td>2.4</td>
<td>4.0</td>
</tr>
<tr>
<td>8. Alcohol use</td>
<td>2.3</td>
<td>3.8</td>
</tr>
<tr>
<td>9. Childhood underweight</td>
<td>2.2</td>
<td>3.8</td>
</tr>
<tr>
<td>10. Indoor smoke from solid fuels</td>
<td>2.0</td>
<td>3.3</td>
</tr>
</tbody>
</table>
### Causes of chronic diseases

<table>
<thead>
<tr>
<th>UNDERLYING SOCIOECONOMIC, CULTURAL, POLITICAL AND ENVIRONMENTAL DETERMINANTS</th>
<th>COMMON MODIFIABLE RISK FACTORS</th>
<th>INTERMEDIATE RISK FACTORS</th>
<th>MAIN CHRONIC DISEASES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Globalization</td>
<td>Unhealthy diet</td>
<td>Raised blood pressure</td>
<td>Heart disease</td>
</tr>
<tr>
<td>Urbanization</td>
<td>Physical inactivity</td>
<td>Raised blood glucose</td>
<td>Stroke</td>
</tr>
<tr>
<td>Population ageing</td>
<td>Tobacco use</td>
<td>Abnormal blood lipids</td>
<td>Cancer</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>Overweight/obesity</td>
<td>Chronic respiratory diseases</td>
</tr>
<tr>
<td></td>
<td>Heredity</td>
<td></td>
<td>Diabetes</td>
</tr>
</tbody>
</table>

**Environmental factors**

[World Health Organization](https://www.who.int) preventing chronic diseases: a vital investment.
Psychological Factors

Acute
Anger
Mental activity

Episodic
Depression
Exhaustion

Chronic
Hostility
Low SES

Background Factors
Adverse health behaviors
Environmental factors
Genetic predisposition

Physiological Response
Catecholamines \( \uparrow \)
HR and BP \( \uparrow \)
plasma volume \( \downarrow \)
coronary constriction
platelet activity \( \uparrow \)
coagulation \( \uparrow \)
inflammation \( \uparrow \)

Cardiac Effects
Electrical instability
Increased demand
Decreased supply

Pathological Result
Arrhythmia
Ischemia
Plaque rupture
Thrombus formation

Cardiac Event
Sudden Death
Myocardial Infarction

Severe coronary artery disease
Early coronary artery disease
Association of risk factors with acute myocardial infarction in men and women after adjustment for age, sex, and geographical region: INERHEART

Risk if acute myocardial infarction associated with exposure to multiple risk factors: INTERHEART

Figure 6. Risk of acute myocardial infarction associated with ApoB/ApoA1 ratio (top vs lowest quintile), overall and by region after adjustment for age, sex, and smoking PAR is for the top four quintiles versus the lowest quintile.


http://dx.doi.org/10.1016/S0140-6736(04)17018-9
Figure 7. Risk of acute myocardial infarction associated with self-reported hypertension, overall and by region after adjustment for age, sex, and smoking


http://dx.doi.org/10.1016/S0140-6736(04)17018-9
Figure 8. Risk of acute myocardial infarction associated with self-reported diabetes, overall and by region after adjusting for age, sex, and smoking


http://dx.doi.org/10.1016/S0140-6736(04)17018-9
Figure 9. Risk of acute myocardial infarction associated with abdominal obesity measured as waist/hip ratio (upper tertile vs lowest tertile), overall and by region after adjusting for age, sex, and smoking PARs are for top two tertiles vs lowest tertile.


http://dx.doi.org/10.1016/S0140-6736(04)17018-9
Figure 10. Risk of acute myocardial infarction associated with the composite psychosocial index, overall and by region


http://dx.doi.org/10.1016/S0140-6736(04)17018-9
Comparison of the population-attributable risk (99% CI) for common risk factors in the INTERSTROKE and INTERHEART studies

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>INTERSTROKE (all stroke; 3000 cases, 3000 controls)**</th>
<th>INTERHEART (acute myocardial infarction; 15 152 cases, 14 820 controls)††</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>34.6% (30.4–39.1)</td>
<td>17.9% (15.7–20.4)</td>
</tr>
<tr>
<td>Smoking</td>
<td>18.9% (15.3–23.1)</td>
<td>35.7% (32.5–39.1)</td>
</tr>
<tr>
<td>Waist-to-hip ratio (abdominal obesity)</td>
<td>26.5% (18.8–36.0)</td>
<td>20.1% (15.3–26.0)</td>
</tr>
<tr>
<td>Diet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diet risk score</td>
<td>18.8% (11.2–29.7)</td>
<td>..</td>
</tr>
<tr>
<td>Fruits and vegetables daily</td>
<td>..</td>
<td>13.7% (9.9–18.6)</td>
</tr>
<tr>
<td>Regular physical activity</td>
<td>28.5% (14.5–48.5)</td>
<td>12.2% (5.5–25.1)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>5.0% (2.6–9.5)</td>
<td>9.9% (8.5–11.5)</td>
</tr>
<tr>
<td>Alcohol intake</td>
<td>3.8% (0.9–14.4)</td>
<td>6.7% (2.0–20.2)</td>
</tr>
<tr>
<td>Psychosocial factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All psychosocial factors</td>
<td>..</td>
<td>32.5% (25.1–40.8)</td>
</tr>
<tr>
<td>Psychosocial stress</td>
<td>4.6% (2.1–9.6)</td>
<td>..</td>
</tr>
<tr>
<td>Depression</td>
<td>5.2% (2.7–9.8)</td>
<td>..</td>
</tr>
<tr>
<td>Cardiac causes</td>
<td>6.7% (4.8–9.1)</td>
<td>..</td>
</tr>
<tr>
<td>Ratio of apolipoproteins B to A1</td>
<td>24.9% (15.7–37.1)</td>
<td>49.2% (43.8–54.5)</td>
</tr>
</tbody>
</table>

90% men
94% women

“Rheumatic heart disease is a marker of inequity, of social injustice, and of neglect of vast populations living in poverty’…”

Srinath Reddy, President of the World Heart Federation

Pathogenetic pathway for ARF and RHD

Carapetis et al., 2005, 366, 155–168
Awareness and Education in Prevention and Control RHD

- Case detection of ARD and RHD – all members aware of presentation & diagnosis
  - Highest among HC workers
- Public education into RHD control strategies
  - Potential consequences
  - School and educational facilities
- Strategic design
  - Collaboratively designed, locally adapted, implemented on multiple levels, and comprehensively evaluated

Zuhlke et al., Global Heart, 2013; 8:235-9
Advocacy, Policy, Public Health and Government Engagement

- National level advocacy and notification policy
  - Surveillance data
  - Politicizing the issue
  - Leveraging millennium development goals
  - Aligning RHD with issues of child health, maternal morbidity/mortality and NCD agendas
  - Activate community – literacy
- Health workforce training
- Benzathine penicillin
  - Availability, quality and safety (anaphylaxis)
  - Dosing
  - Rx sore throat

Zühlke et al., *Global Heart*, 2013; 8:235-9
PREVENTION

RHD Africa

RHD Africa serves as a platform to bring together researchers, communities and resources to advance the combat against rheumatic heart disease on the continent. Africa continues to face unacceptably high rates of rheumatic fever (RF) and rheumatic heart disease (RHD), despite readily available and inexpensive preventive measures. However, in the past several years, key players from many African nations have come together to acknowledge the persistent health burden attributable to RF/RHD and have agreed to a pledge of action to reduce it. The plan of action is a comprehensive RF/RHD prevention and treatment programme known as the ASAP Programme.

The A.S.A.P. programme focuses on four areas of activity: (i) raising the awareness of the public and healthcare workers about RHD, (ii) determining the incidence and prevalence of RHD through epidemiological surveillance, (iii) improving advocacy to influence public policy for the prevention and treatment of RHD, and (iv) working towards the establishment of primary and secondary prevention programmes of RHD at the community level.
Principles of Risk Reduction

• Population versus individual
• Primary prevention focuses on individuals known to be at risk
  – Screen and treat
• Most events occur in individuals with only moderate elevation of numerous risk factors
  – Population-based strategies needed
  – Developmentally appropriate, culturally sensitive student-level school-based interventions WITH modifications of school food and physical activity
Strategies aimed at diet and physical activity of the population shift the blood pressure distribution of the whole population to the left.

High-risk strategy focuses on approximately 2.5% of the population.

Impact of a combination of population-wide prevention and targeting high-risk subjects on the effective control of blood pressure.

CVD Prevention Opportunities

Primordial
- Healthy eating
- Ideal weight

Primary
- Psycho-social factors
- Familial predisposition

Secondary
- Lipids
- Hypertension
- Smoking cessation
- Diabetes + Primordial

Secondary
- ASA
- ACE
- Rehabilitation
- Beta-blockers + Primary

Benjamin and Smith et al., JACC 2002;40:579-61
Concepts of Prevention

- The power of primordial prevention
- **CVD and risk factors develop early in life**
- Balance of population-level approaches for health promotion and disease prevention and individualized high-risk approaches

*Lloyd-Jones et al., Circulation, 2010;121:586-613*
FIGURE 6.1 Growing toward heart health: Influences and opportunities into adulthood.
Causal Pathway

Group A Streptococcal infection → Acute rheumatic fever → Rheumatic heart disease → Cardiac failure, Stroke, Death, Endocarditis

Preventive Measure

Primordial
Housing/hygiene

Primary
Sore throat Rx

Secondary
Secondary prophylaxis

Tertiary
HF meds, valve surgery, anticoagulation

Carapertis, NEJM, 2007, 357:429-42
Set of 9 voluntary global NCD targets for 2025

- Premature mortality from NCDs: 25% reduction
- Essential NCD medicines and technologies: 80% coverage
- Drug therapy and counseling: 50% coverage
- Diabetes/obesity: 0% increase
- Raised blood pressure: 25% reduction
- Tobacco use: 30% reduction
- Salt/sodium intake: 30% reduction
- Physical inactivity: 10% reduction
- Harmful use of alcohol: 10% reduction
World Heart Federation Vision

- Coalitions & partnerships across health disciplines, non- & medical organizations & governments for NCD control
- Develop reliable health-information systems to monitor mortality, morbidity & health behaviors
- Enforce tobacco control, implement HTN detection and control, & secondary prevention
- Develop efficient systems of integrated care with trained non-physician healthworkers for HTN, secondary prevention in uncomplicated and to counsel lifestyle modification

World Heart Federation Vision

- Improve access and affordability of proven drugs with facilitation of low-cost combination pills
- Develop expertise in knowledge translation and implementation
- Engage civil society and community organizations in CVD control
- Build partnerships between hi- and low-resource countries for CVD & control of NCD with use of transfer of expertise and modest funding
- Establish large population studies in different regions of the world (diet, PA, ETOH, tobacco)
10 Best Buys to combat heart disease, diabetes and stroke in Africa

1. Provide multidrug regimens and adopt absolute risk approach to prevent
2. Food control legislation with public education for reducing salt and saturated fat
3. Promotion of physical activity in schools, workplaces and built environment
4. Maintain and extend tobacco control activities especially in young, and encourage quitting (counseling, nicotine replacement)
5. Syndromic treatment of sore throat with penicillin in children to prevent RF

Mayosi, *Heart*, 2013,
6. Establish register-based secondary RF and RHD prevention
7. Needs-driven modular training of health professionals to meet needs of the population
8. Strengthen district-based primary health systems, and integration of care of communicable and NCD
9. Creation of regional centers of excellence for specialist medical and surgical care
10. Develop surveillance and quality assurance systems for CVD, DM, and stroke
Ensuring a strong nursing voice in all health and social system policy, development and planning dialogues

Shamian et al., Can J Nursing Leadership
thank you