Utilizing Death Certificate Data for Health Services Planning: An Example Using Parkinson's Disease

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Introduction

- Administrative data sources have been used extensively for research purposes
- Vital Statistics Death Certificate data are particularly useful as the registration of all deaths is required by law
  - Population-based
  - Ongoing collection
- Cause of death information helps give insight into an individual's health condition at the end of life

Epidemiology PD

- Usual onset between 50-70 years
  - infrequent before 30 years (Young onset)
- Male-to-Female ratio – 3:2
- Incidence 20/100,000
- Prevalence 160/100,000
- Incidence is similar in all countries where records are kept

Symptoms of PD

- Early stage
  - Loss of smell
  - Musculoskeletal Pain
  - Depression
- Motor symptoms
  - Tremor
  - Rigidity
  - Instability
- Later Manifestations
  - Freezing (causes falls)

PD Background

- Service requirements are particularly acute as death approaches as symptoms become difficult to control with medications
- PD is characterized by frequent occurrences of co-morbidities
- PD is a good example for examining disease interactions

Research Objectives

- To measure the association between PD and a broad range of conditions
- To measure the strength that association
- To compare results with previous research such as basic biomedical and prospective studies on PD to help gain insights into the validity of using death certificate information

Data and Study Population

- Nova Scotia Vital Statistics Death Certificate Data
- Residents of Nova Scotia who died between Jan 1, 1998 and Dec 31, 2005

- Total observations: 63,431

Methods

- All causes of death from death certificate utilized
  - Can be up to 13 causes of death listed
- Disease types were identified through ICD coding used on the death certificate
- Parkinson's disease was defined as ICD-10 codes G20-G21 (ICD-9 332) which includes secondary Parkinsonism
- Total observations with PD mentioned: 900

Methods

- 14 conditions were analyzed
- Analysis also included:
  - A single category of diseases defined as “external causes of death”
  - Sub-grouping, skin cancer
- Examine measures of diseases coexisting with PD on the death certificate

Methods

- Percentage of decedents with study diseases appearing together with PD

- Observed/expected
  - Measure of strength of association
  - Control for chance occurrence of diseases appearing together

Observed/Expected Ratio Calculation

$$\frac{\text{Observed number of deaths with both PD and comparator disease}}{\text{Expected number of deaths with both PD and comparator disease}}$$

Where expected number of deaths based on the assumption of independence is:

$$\frac{\text{(deaths with PD) x (deaths with comparator)}}{\text{Total deaths (all causes)}}$$

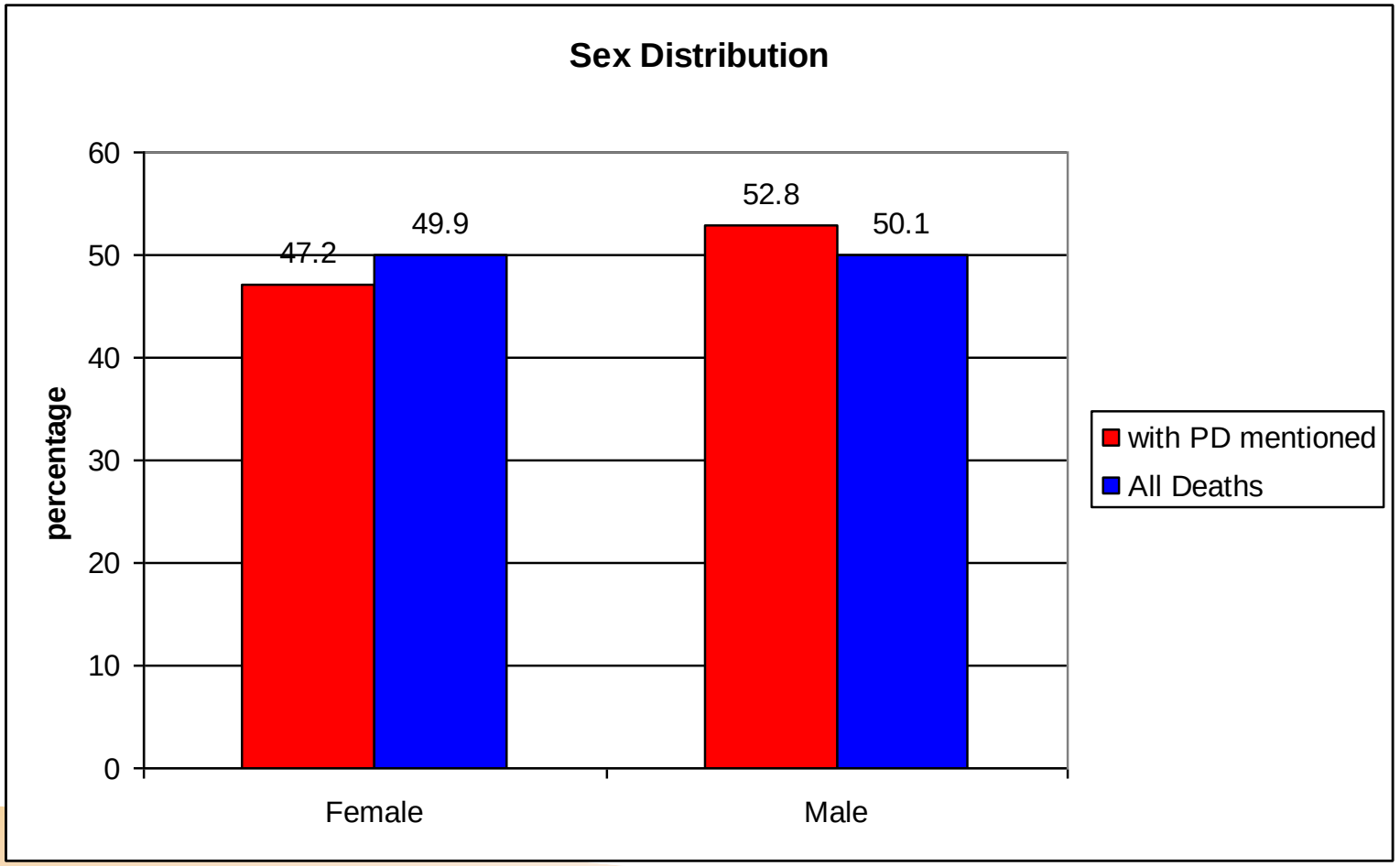
Observed/Expected Ratio Interpretation

- If ratio >1, then association is stronger than expected
- If Ratio is < 1 then association is less than expected
- Chi-squared calculation is calculated to test if causes are independent (95% confidence level)

Control Factors

- Age, Sex and Year of Death are potential confounding factors
  - e.g. certain diseases are more likely to be listed as a cause of death for older individuals so may occur together more often
- We constructed a cohort of matched to those with PD by age, sex and year of death

Sex Distribution



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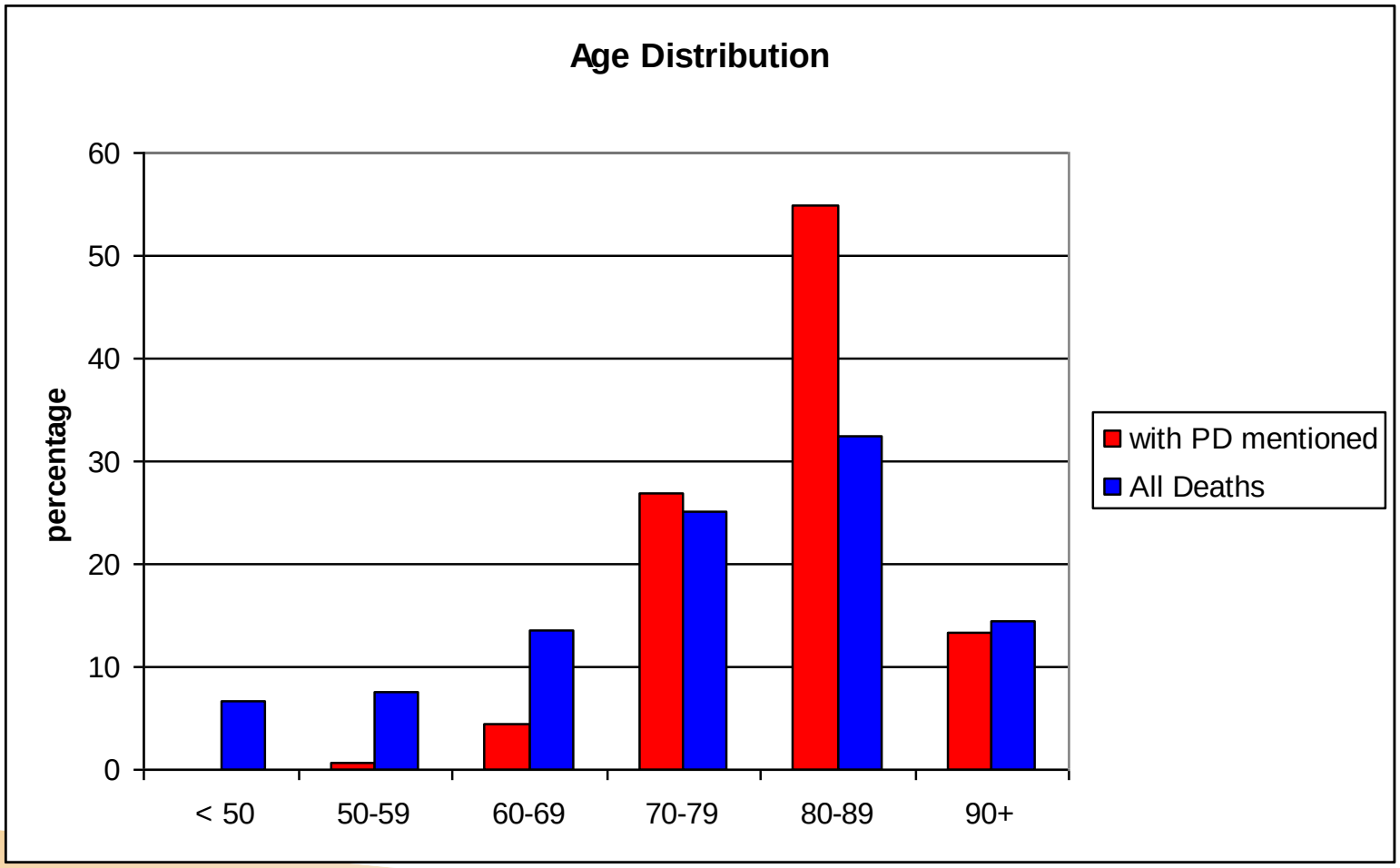
Age Distribution



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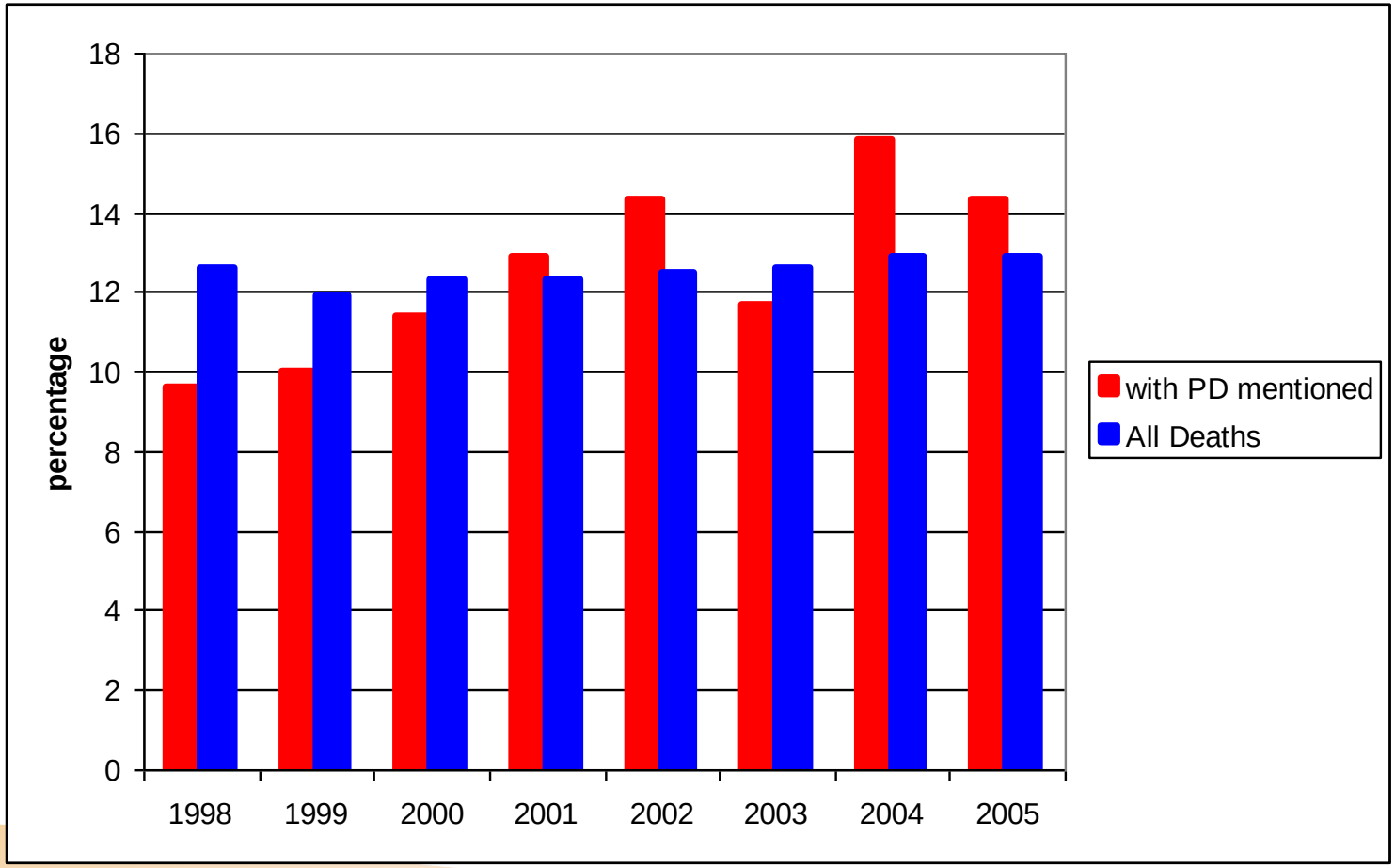
Distribution Across Study Years



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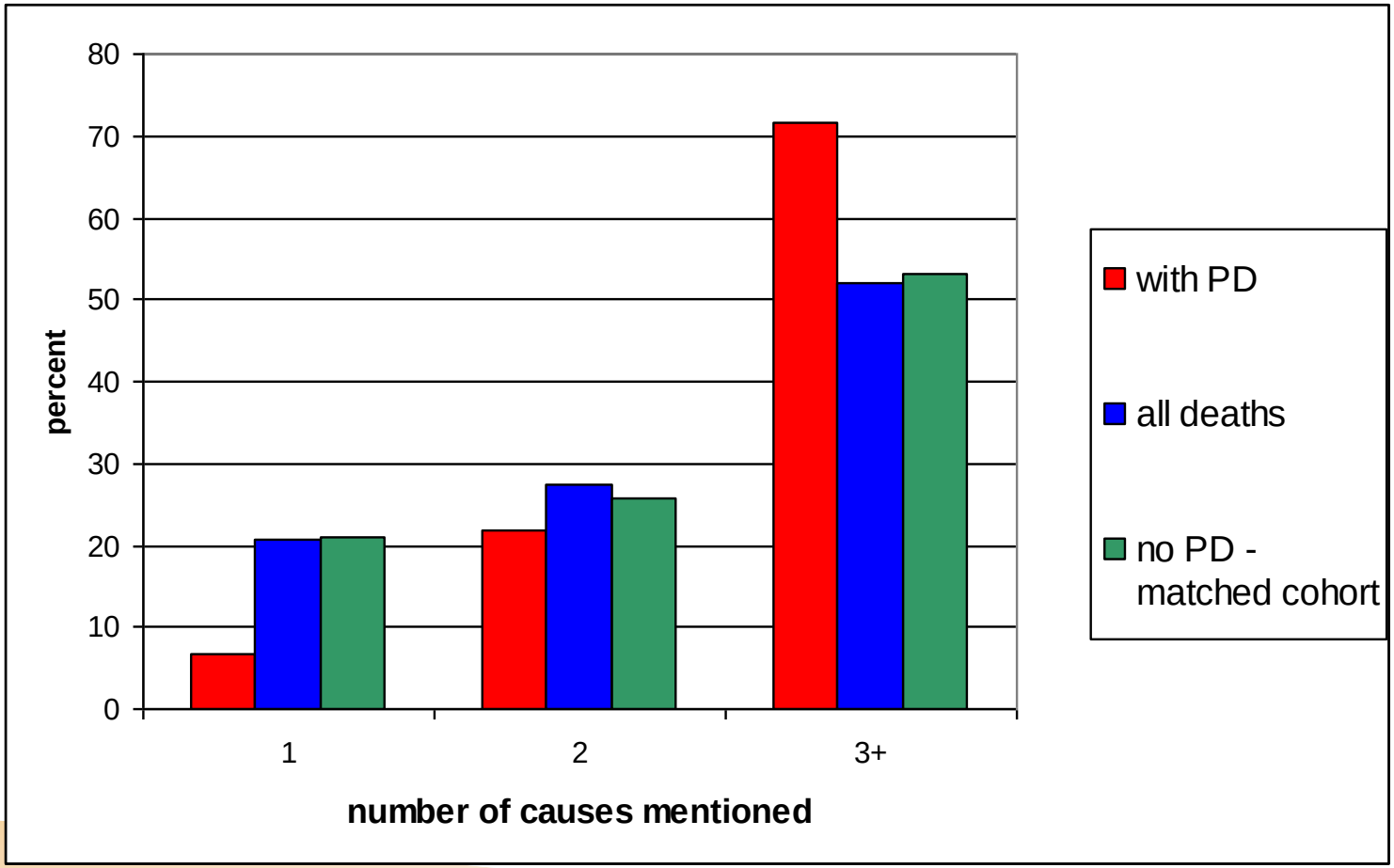
Number of Causes Mentioned



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Percentage Mentions on Death Certificate

	Decedents with Parkinson's mentioned	All Decedents	Matched Cohort of Decedents Parkinson's not mentioned
Alzheimer's disease / dementia	26.2% [ab] (23.3%-29.2%)	10.4% (10.1%-10.6%)	14.4% (12.1%-16.8%)
Pneumonia	22.3%[ab] (19.6%-25.1%)	12.2% (11.9%-12.4%)	12.8% (10.5%-15.0%)
Cerebrovascular disease (stroke)	14.2% (11.9%-16.6%)	12.1% (11.9%-12.4%)	11.4% (9.3%-13.6%)
Malignant neoplasms (cancer)	11.1%[ab] (9.0%-13.2%)	33.0% (32.6%-33.4%)	38.6% (35.3%-41.8%)
Congestive heart failure	8.1%[ab] (6.3%-10.0%)	11.3% (11.0%-11.5%)	12.2% (10.0%-14.4%)
Diabetes	8.0%[ab] (6.2%-9.8%)	10.9% (10.7%-11.1%)	12.7% (10.4%-14.9%)
observations	900	63,431	900

[a] statistically different from all deaths
[b] statistically different from those without Parkinson's

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Results

- Alzheimer's and Pneumonia are mentioned most frequently among those with PD
- Of note, only 11.1% of decedents with Parkinson's disease mentioned also has cancer mentioned
  - 33.3% for all
  - 38.6% for the matched cohort

Observed to Expected Ratios

Causes of Death Associated with Parkinson's	Ratio observed to expected deaths	
	Full Study Population	Matched Cohort
Alzheimer's disease / dementia	2.53*	1.29*
Pneumonia	1.83*	1.27*
Cerebrovascular disease (stroke)	1.17	1.11
Malignant neoplasms (cancer)	0.34*	0.45*
Congestive heart failure	0.72*	0.80*
Diabetes	0.73*	0.77*
observations	63,431	1800

*χ^2 test for independence significant at p=.05.

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Results

- Observed/expected ratios differ for the matched cohort compared with the full population
- This difference is particularly apparent for both Alzheimer's and pneumonia
  - Like PD, positively associated with age

Cancer

- Most frequently mentioned for all deaths
- Results suggest PD patients are less likely to have cancer
- Supported by biomedical studies
  - Genes predisposed to PD may be better protected from malignant growth
- Skin cancer is an exception
  - Small sample size here

Previous Evidence Other Associations

- Pneumonia
  - Very often become bed-ridden and prone to infections
- Alzheimer's Disease
  - Like PD, characterized by dying brain cells
- Fractures
  - Increased risk due to the motor complications of PD
- Stroke
  - Same areas of the brain that are affected by PD can be affected by strokes - Vascular Parkinsonism
  - No significant association in our study

Co-Morbidities and Health Services

- Clinical Practice Guidelines (CPGs) generally focus on single diseases
- Treatments can be affected by the presence of co-morbidities
- Patterns of functional decline can also be affected as they traditionally focus on a single condition

Limitations

- Death certificate doesn't capture all PD patients
- Difficulties determining cause of death
  - Including all causes of death helps to mitigate this limitation
- Limited number of variables available as controls
- No indication of date of disease occurrence

Future Work

- Link to other data bases
  - Validity
  - Understand current patterns of service provision, including palliative care
- Code external causes more precisely
  - Fractures due to falls known to be common among those with PD

Conclusions

- Examining cause of death information is an efficient, effective tool in understanding patterns of disease associations for those with PD
- As the population ages and co-morbidities increase, there's a shift away from a focus on individual diseases in patient care
- Supports a needs-based approach to Health Human Resource (HHR) planning