

# **Taxonomy, ontology and PHSSR: What's in it for us?**

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# Overview

- Knowledge representation in general
- Taxonomy development in particular
- Results from data obtained using a taxonomy

# *Taxonomy*

**Science of naming, describing  
and classifying things**

- living organisms = alpha taxonomy
- more general use
  - *classification* of things
  - *principles* underlying classification

**Controlled vocabulary scheme--a way to  
organize knowledge for retrieval, re-use**

# Office of Personnel Management categories (OPM)

Enumeration 2000 taxonomy

## Equal Employment Opportunity categories (EEO-4)

Bureau of Health Professionals occupations (CHP/BHPr+)

### Administrative

#### **Officials and Administrators**

Health Administrator

### Professional

#### **Professionals**

Administrative/Business Professional  
Attorney/Hearing Officer  
Biostatistician  
Clinical, counseling, and School Psychologist  
Environmental Engineer  
Environmental Scientist & Specialist  
Epidemiologist  
Health Economist  
Health Planner/Researcher/Analyst  
Infection Control/Disease Investigator  
Licensure/Inspection/Regulatory Specialist  
Marriage and Family Therapist  
Medical & Public Health Social Worker  
Mental Health / Substance Abuse Social Worker  
Mental Health Counselor  
Occupation Safety & Health Specialist  
PH Dental Worker  
PH Educator  
PH Laboratory Professional  
PH Nurse  
PH Nutritionist  
PH Optometrist  
PH Pharmacist  
PH Physical Therapist

### Technical

#### **Technicians**

Computer Specialist  
Environmental Engineering Technician  
Environmental Science and Protection Technician  
Health Information Systems/Data Analyst  
Occupational Health and Safety Technician  
PH Laboratory Specialist  
Other Public Health Technician

#### **Protective Service Workers**

Investigations Specialist  
Other Protective Service Worker

#### **Paraprofessionals**

Community Outreach/Field Worker  
Other Paraprofessional

### Clerical/Support

#### **Administrative Support**

Administrative Business Staff  
Administrative Support Staff

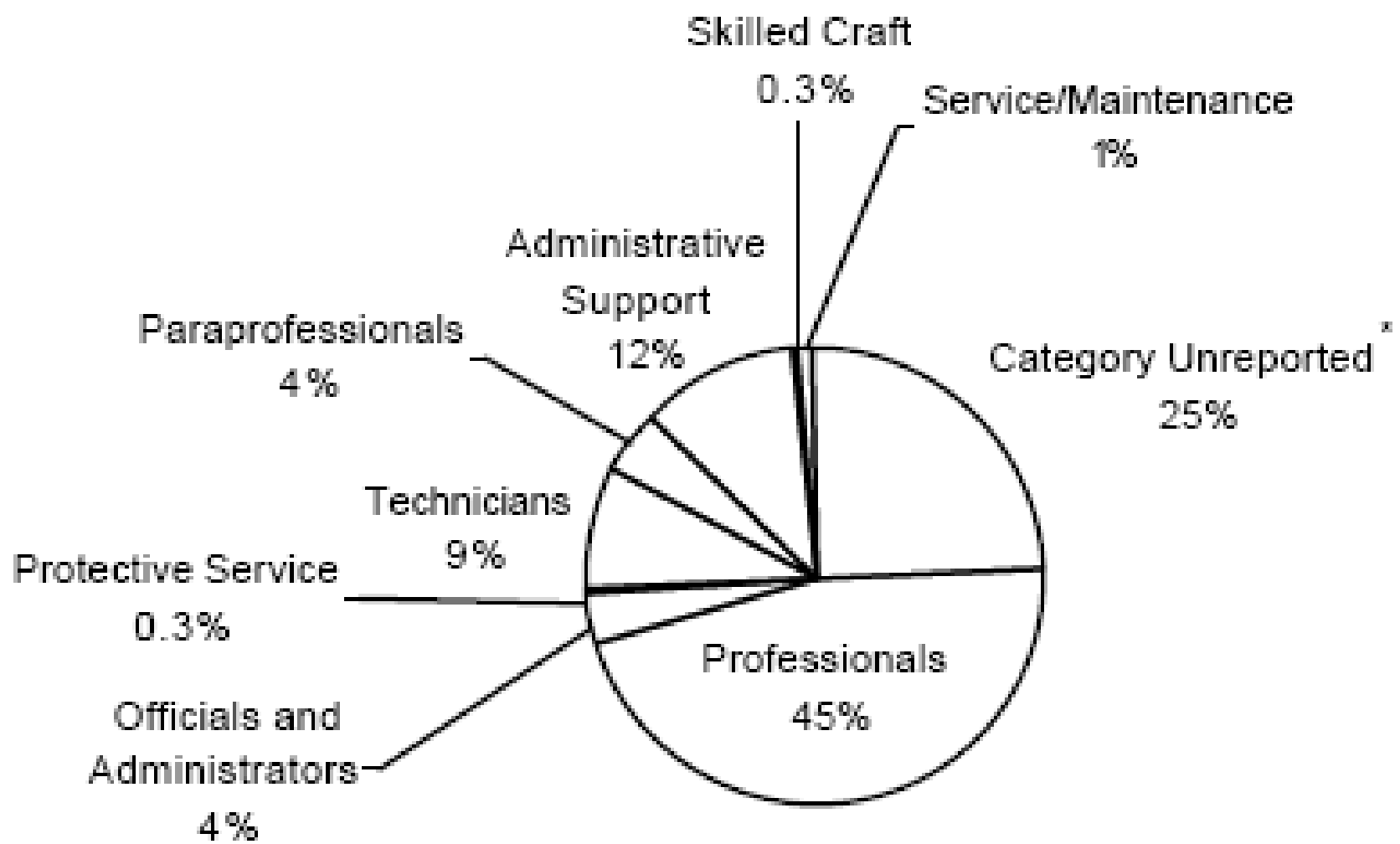
#### **Skilled Craft Workers**

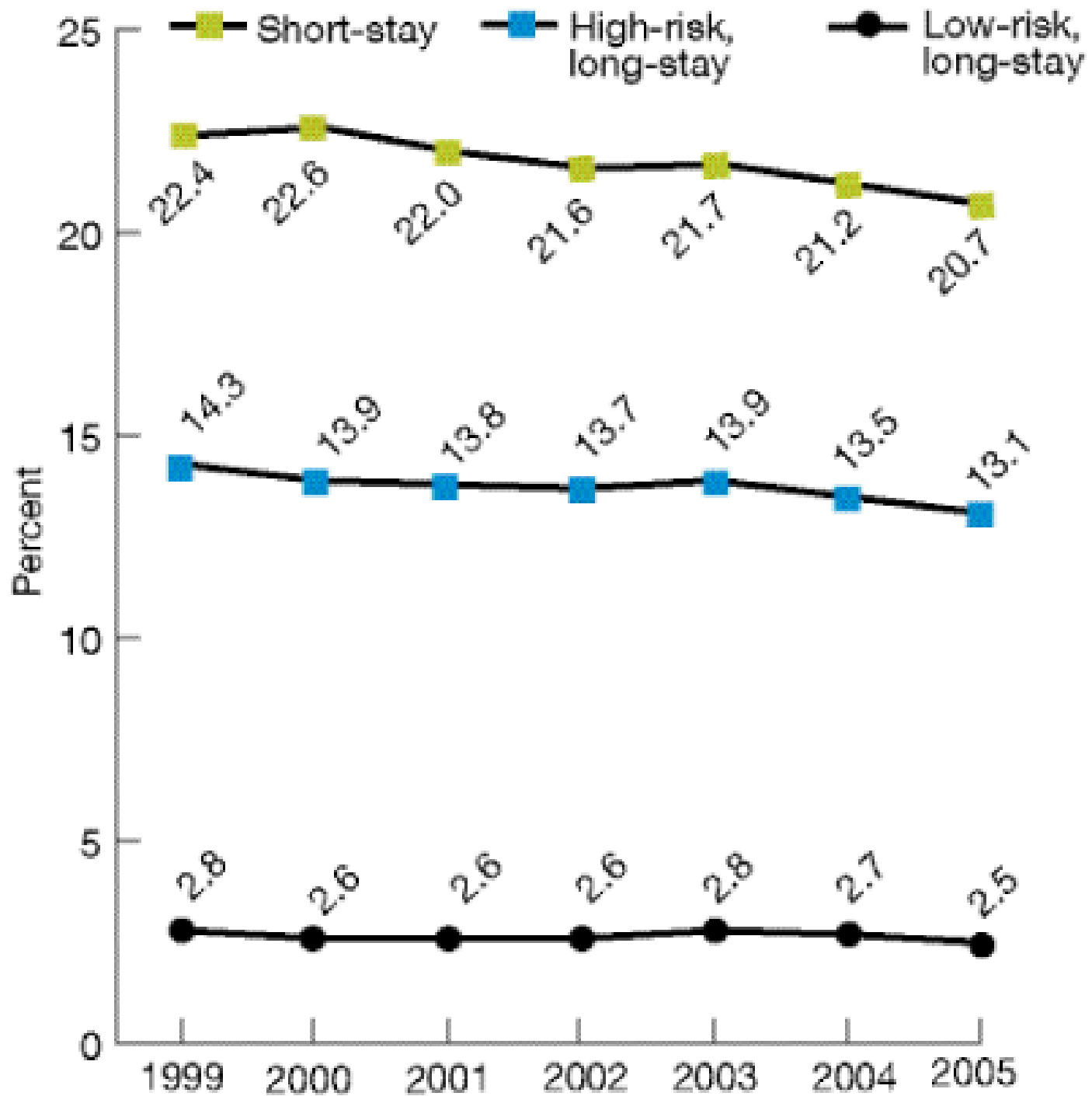
Skilled Craft Worker

#### **Service/Maintenance**

Food Services/Housekeeping  
Patient Services

# ESTIMATED PUBLIC HEALTH WORKERS BY EEO-4 OCCUPATIONAL CATEGORY: NATIONAL SUMMARY





# Standard data elements for classification

- **Part I - Classification (Names)**
  - Classifications are nothing more than lists of the correct names for taxonomic groups.
- **Part II- Nomenclature (Name documentation)**
  - Pre-defined, authorized, terms (or can gradually become fixed by use)
- **Part III- Data Structures**
  - inter-relationships among the data elements
    - **Ontology** formal representation of a set of concepts and the relationships between those concepts

# Continuum of ontological precision

tennis  
football  
game  
field game  
court game  
athletic game  
outdoor game

**GAME**  
**Athletic game**  
**Outdoor game**  
Court game  
Tennis  
Field game  
Football

$\text{game}(x) \rightarrow \text{activity}(x)$   
 $\text{athletic game}(x) \rightarrow \text{game}(x)$   
 $\text{court game}(x) \leftrightarrow \text{athletic game}(x) \wedge \exists y. \text{played\_in}(x,y) \wedge \text{court}(y)$   
 $\text{tennis}(x) \rightarrow \text{court game}(x)$   
 $\text{double fault}(x) \rightarrow \text{fault}(x) \wedge \exists y. \text{part\_of}(x,y) \wedge \text{tennis}(y)$

Taxonomy

game  
NT athletic game  
NT court game  
RT court  
NT tennis  
RT double fault

Database/  
Object  
Oriented  
scheme

Axiomatic  
theory

Glossary

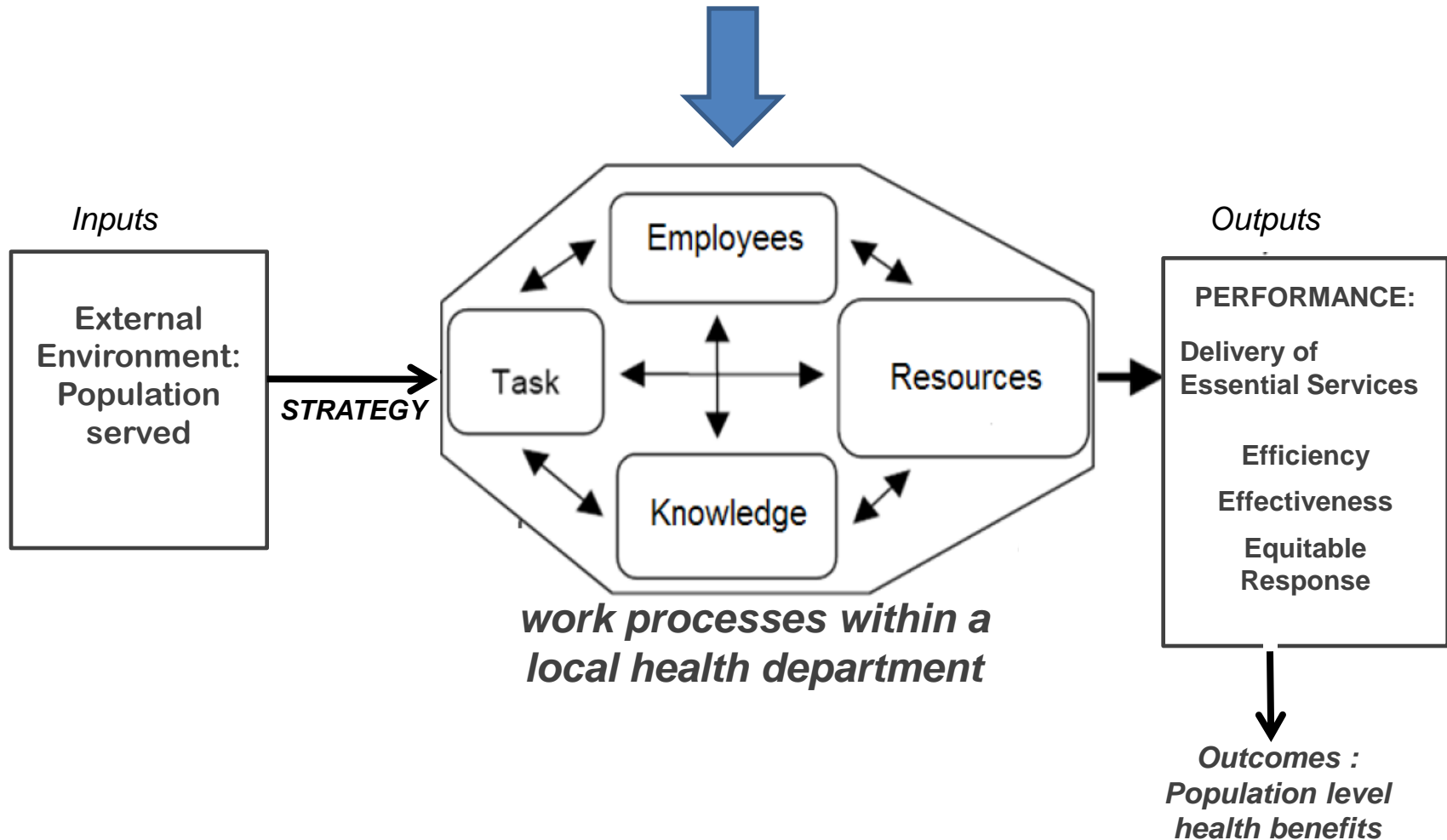
Thesaurus

Catalog

Ontological precision



# Operationalize a conceptual framework for a **taxonomy of PH work**



Congruence Model of an Organization

# Taxonomy of Public Health Work

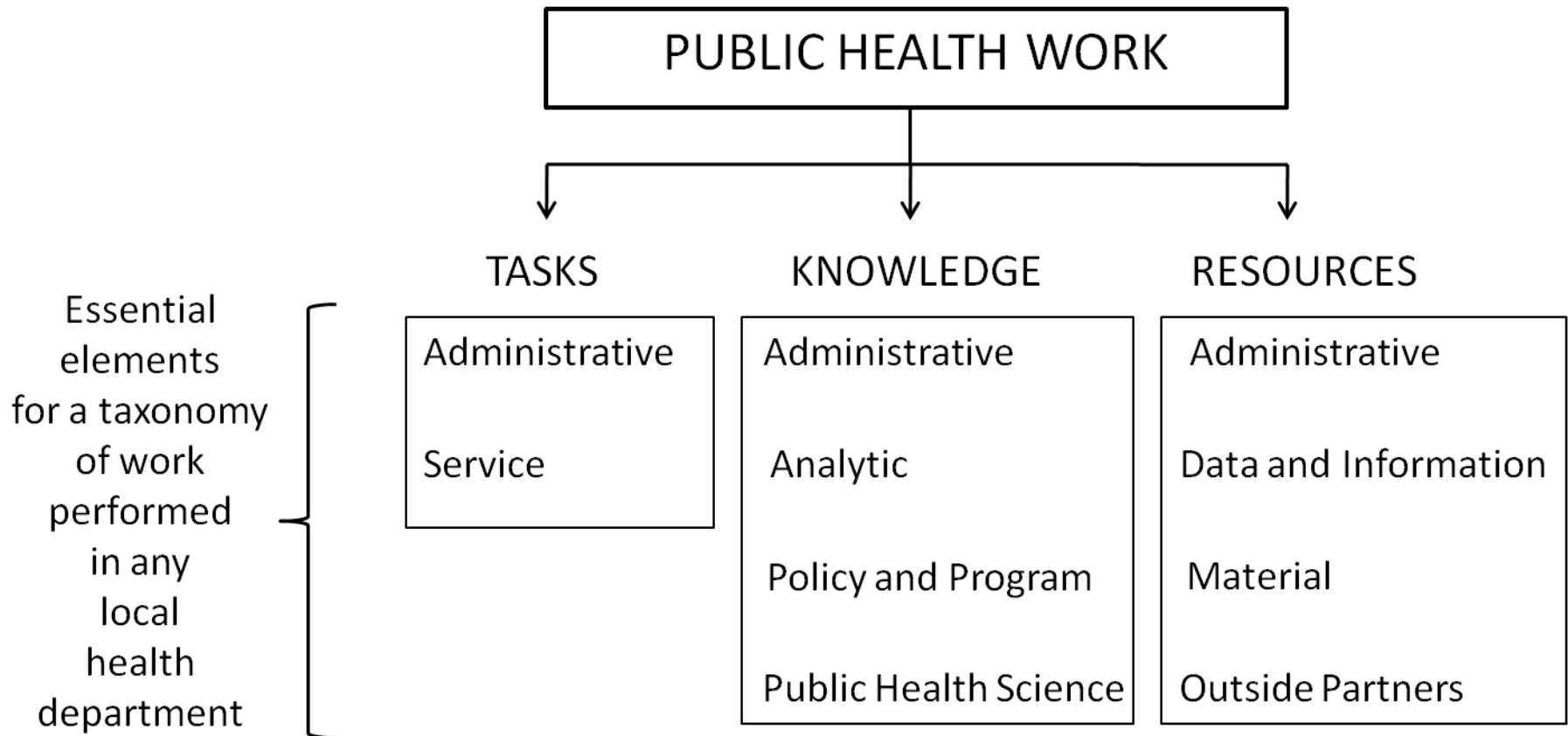
## Identification of terms

We used **Multi-step Rational Method** (consensus-based, iterative)

- relies on opinions: experts, knowledgeable practitioners
- *minimum* set of tasks, knowledge, resources
- least number of essential items--work done in *any* LHD

# Taxonomy of Public Health Work

## Hierarchical Schema



# Taxonomy for documenting the essential elements of public health work done in any local health department

1. TASKS	2. KNOWLEDGE	3. RESOURCES
<u>1.1 Administrative Tasks</u> Manage files, prepare reports and/or correspondence Phone communication with the public Use the internet to get information	<u>2.1 Administrative Knowledge</u> Workplace safety General office skills (filing, record keeping, writing reports, correspondence) Job descriptions (yours, those who work with you)	<u>3.1 Administrative Resources</u> Email access Internet access Personal computer workstation Desk space

## 3. Part 2 - Tasks you do for work

[Exit this survey >](#)



Indicate which tasks are

Online survey data collection

- part of your normal work
- **not** part of your normal work but you have the experience and knowledge required to **fill in** if necessary
- are not part of your normal work and you could not fill in

### 7. Administrative Tasks

	Part of your normal work	You could fill in if needed	Not part of your work/ could not fill in
Manage files, prepare reports and/or correspondence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Phone communication with the public	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use the internet to get information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

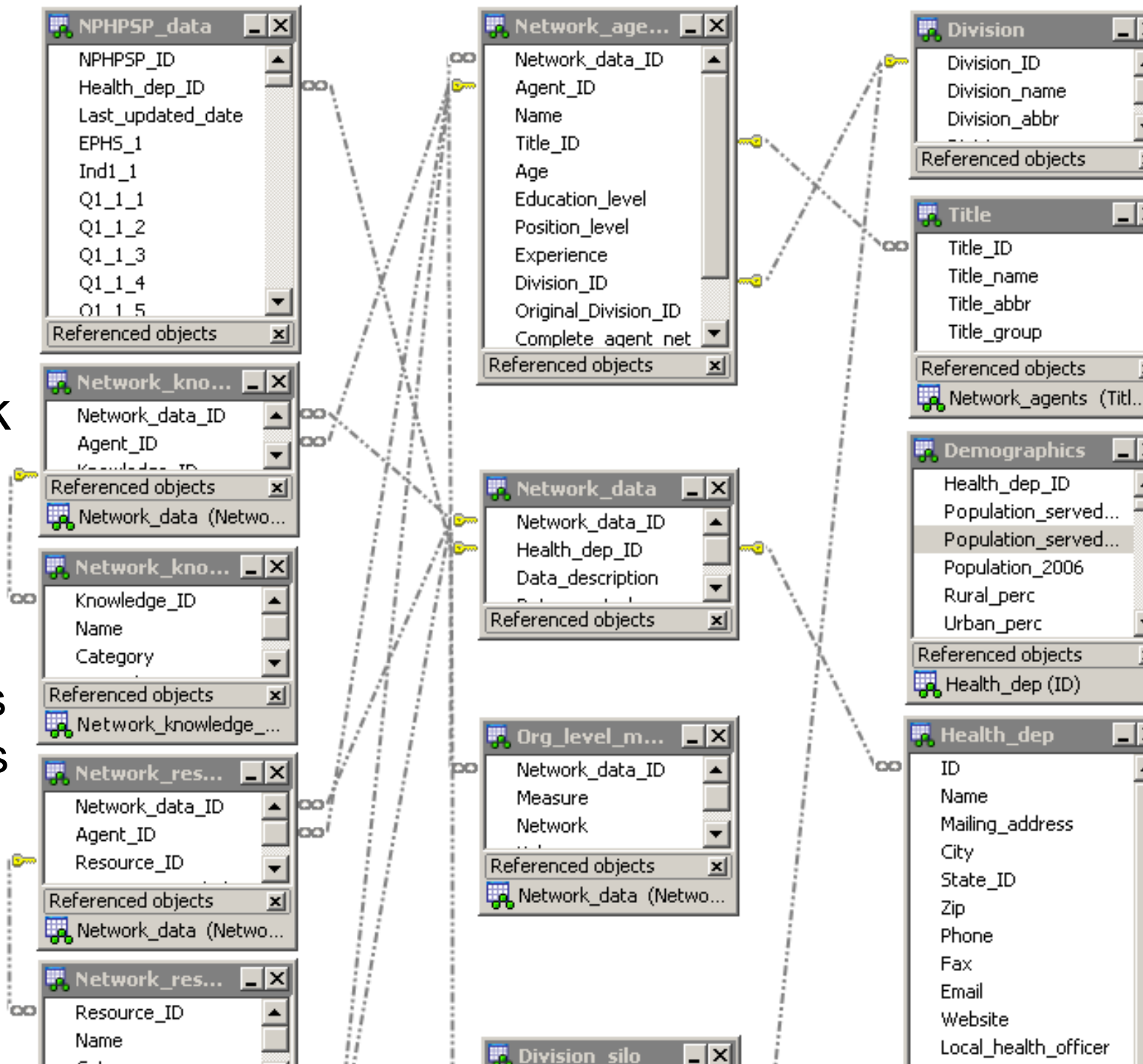
Review facility operational plans  
 Develop information and training materials  
 Provide education to the public  
 Conduct community assessments  
 Represent the department at community meetings  
 Interact with local or regional media

Community health improvement methods  
 Community channels for communicating information  
 Ecological model of population health  
 Emerging public health issues (for example, chronic diseases, bioterrorism)  
 Local policy makers and leaders  
 Utilization of health dept. services by the public

Up to date directory of community groups and organizations  
 Up to date directory of laboratories  
 Up to date staff directory  
 Time and activity schedules for staff  
 Consumer satisfaction assessment  
 Consumer complaint log  
 Staff development plan and training log

# Database Schema for network survey data

Allows comparisons across LHDs



# Taxonomy of Public Health Work **Applied**

11 LHDs, 84% response, 1062 workers

Governance	Size		LHD 1	LHD 2	LHD 3	LHD 4	LHD 5	LHD 6	LHD 7	LHD 8	LHD 9	LHD 10
Centralized**	35	LHD 1	-	-	-	-	-	-	-	-	-	-
	43	LHD 2	T	0.75	-	-	-	-	-	-	-	-
			K	0.76	-	-	-	-	-	-	-	-
R			0.69	-	-	-	-	-	-	-	-	
Centralized Hybrid†	121	LHD 3	T	0.73	0.74	-	-	-	-	-	-	-
			K	0.69	0.74	-	-	-	-	-	-	-
			R	0.53	0.64	-	-	-	-	-	-	-
	115	LHD 4	T	0.72	0.75	0.81	-	-	-	-	-	-
			K	0.72	0.74	0.83	-	-	-	-	-	-
			R	0.52	0.67	0.72	-	-	-	-	-	-
	187	LHD 5	T	0.76	0.85	0.8	0.81	-	-	-	-	-
			K	0.72	0.74	0.81	0.83	-	-	-	-	-
			R	0.59	0.73	0.71	0.74	-	-	-	-	-
Home Rule‡	139	LHD 6	T	0.68	0.64	0.7	0.73	0.69	-	-	-	-
			K	0.64	0.7	0.74	0.74	0.76	-	-	-	-
			R	0.57	0.69	0.65	0.59	0.61	-	-	-	-
Independent§	115	LHD 7	T	0.77	0.72	0.74	0.74	0.75	0.64	-	-	-
			K	0.69	0.72	0.76	0.8	0.82	0.75	-	-	-
			R	0.6	0.71	0.65	0.59	0.66	0.68	-	-	-
	144	LHD 8	T	0.64	0.72	0.72	0.74	0.76	0.7	0.75	-	-
			K	0.69	0.68	0.68	0.68	0.72	0.72	0.69	-	-
			R	0.6	0.73	0.7	0.66	0.75	0.7	0.67	-	-
	107	LHD 9	T	0.59	0.64	0.65	0.67	0.65	0.67	0.65	0.73	-
			K	0.61	0.69	0.7	0.72	0.76	0.82	0.77	0.68	-
			R	0.54	0.68	0.7	0.62	0.64	0.73	0.68	0.73	-
	118	LHD 10	T	0.72	0.68	0.69	0.75	0.75	0.73	0.79	0.78	0.7
			K	0.68	0.75	0.76	0.81	0.81	0.78	0.84	0.69	0.82
			R	0.52	0.63	0.54	0.58	0.61	0.62	0.61	0.6	0.64
	122	LHD 11	T	0.72	0.72	0.75	0.75	0.77	0.77	0.77	0.81	0.73
			K	0.71	0.79	0.72	0.76	0.77	0.79	0.77	0.74	0.81
			R	0.4	0.58	0.65	0.65	0.63	0.66	0.59	0.63	0.69

Limited correlations between LHDs on resources

Is lack of correlation on resources related primarily to funding variance?

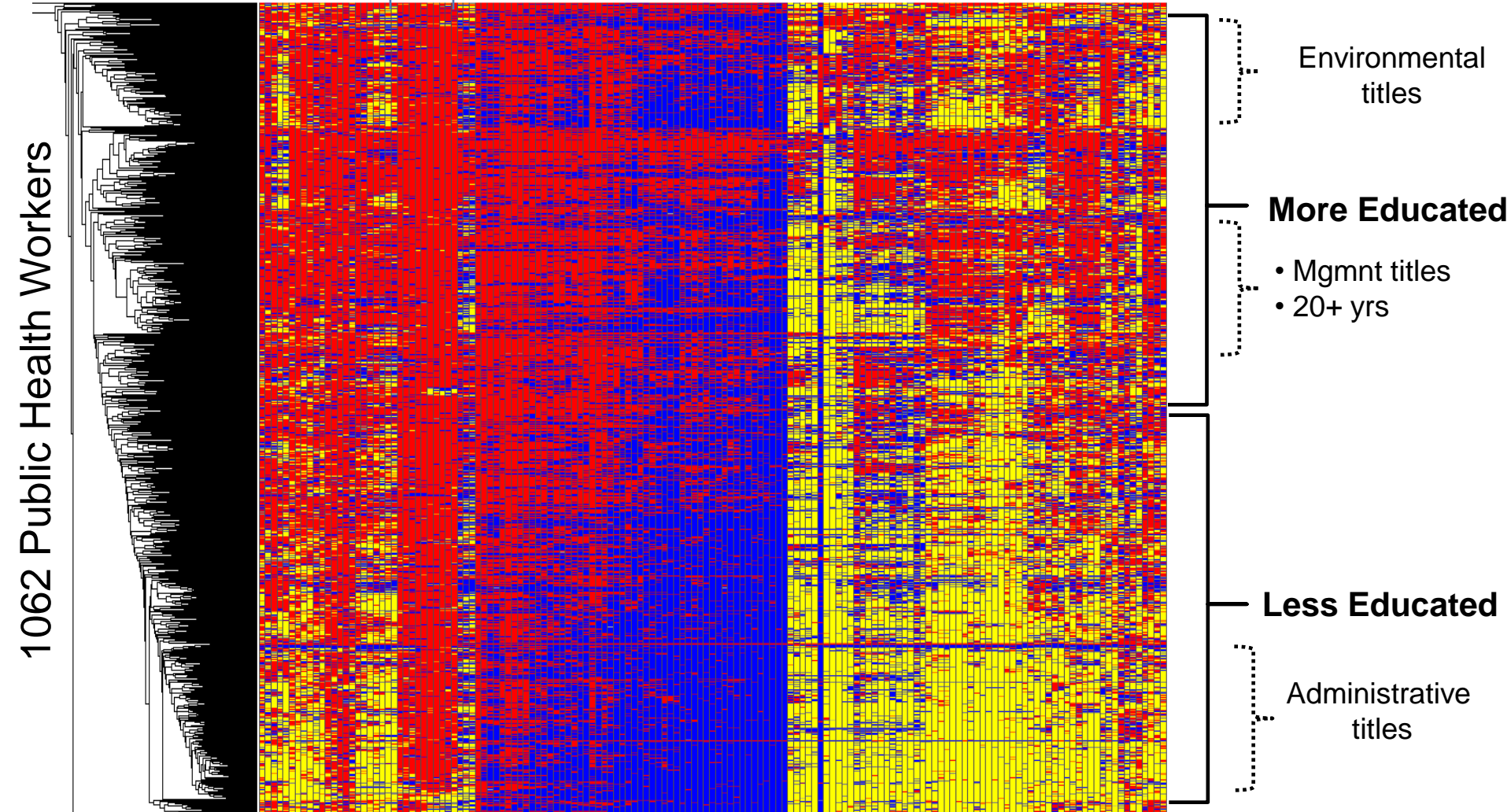
\*All correlations are significant at  $p \leq 0.05$

# Clustering of PH WORK by Employee Attributes

■ assigned      ■ above average  
                         ■ below average

Adm TASKS

KNOWLEDGE



### Cluster 1

Translator	Resources	Outside Partner
Translated info	Resources	Gen'l Resources
Provider Referrals	Resources	Data Resources
Review records	Task	Service Task
Register and enroll	Task	Service Task
Meet w/ clients	Task	Service Task
Educate public	Task	Service Task
Deliver hlth services	Task	Service Task

### Cluster 5

Problem solving	Knowledge	Analytic Knowledge
Assessment	Knowledge	Analytic Knowledge
Data collection	Knowledge	Analytic Knowledge
Data analysis	Knowledge	Analytic Knowledge
Case investigation	Knowledge	Analytic Knowledge
Biology	Knowledge	PH Science Knowledge
Env Health	Knowledge	PH Science Knowledge
Routine labs	Knowledge	PH Science Knowledge
Lab kits	Resources	General Resources
Manage files	Task	Admin Task
Phone	Task	Admin Task
Use internet	Task	Admin Task
Use email	Task	Admin Task
Process requests	Task	Admin Task
Schedule services	Task	Admin Task
Discuss fees	Task	Admin Task
Enforcement	Task	Admin Task
Conduct site visits	Task	Service Task
Perform screenings	Task	Service Task
Review plans	Task	Service Task
Investigation	Task	Service Task
Obtain specs	Task	Service Task
Report data	Task	Service Task
Vector control	Task	Service Task
Issue permits	Task	Service Task
Respond to emergencies	Task	Service Task

# K-means clustering of TKR

Maximum clusters set to 10, found 9

### Cluster 3

Mobile phone	Resources	General Resources
PDA	Resources	General Resources
Epi staff	Resources	General Resources
PPT	Resources	General Resources
GIS	Resources	General Resources
Transport	Resources	General Resources
CE	Resources	General Resources
Health code	Resources	Document Resources
Emergency response plan	Resources	Document Resources
County emergency plan	Resources	Document Resources
Other government agencies	Resources	Outside Partner

### Cluster 6

Office skills	Knowledge	Admin Knowledge
Job descriptions	Knowledge	Admin Knowledge
Chain of command	Knowledge	Admin Knowledge
Policy and procedures	Knowledge	Admin Knowledge
Mission	Knowledge	Admin Knowledge
Emergency response plan	Knowledge	Admin Knowledge
Human relations	Knowledge	Admin Knowledge
Team learning	Knowledge	Admin Knowledge
Community Resources	Knowledge	Policy
HIPAA regs	Knowledge	Policy
Diversity	Knowledge	Policy
Ethics	Knowledge	Policy
Authority to operate	Knowledge	Policy
Education & training	Knowledge	Policy
Community health risks	Knowledge	Policy
Utilization	Knowledge	Policy
Definition PH	Knowledge	Policy
Essential Services	Knowledge	Policy

### Cluster 7

Library of resources	Resources	Data Resources
Registries	Resources	Data Resources
HAN	Resources	Data Resources
HIN	Resources	Data Resources
Local surveillance	Resources	Data Resources
National/state surveillance	Resources	Data Resources
Data sharing agreements	Resources	Data Resources
PH websites	Resources	Data Resources
HP1010	Resources	Document
Community health plan	Resources	Document
Directory community groups	Resources	Document
Directory Labs	Resources	Document
Staff schedules	Resources	Document
Consumer satisfaction	Resources	Document
Consumer complaints	Resources	Document
Staff development plan	Resources	Document
Performance evaluations	Resources	Document
Surveys	Resources	Document
State consultant	Resources	Outside Partner
Community health advocate	Resources	Outside Partner
State epidemiologist	Resources	Outside Partner
Veterinarian	Resources	Outside Partner
State laboratory	Resources	Outside Partner
AHEC	Resources	Outside Partner
Medicare program staff	Resources	Outside Partner
Emergency planning committee	Resources	Outside Partner
Researchers	Resources	Outside Partner
Legal counsel	Resources	Outside Partner

# Conclusion

- PHSSR needs knowledge representation
- Classification of PH work is just one
  - basis for comparable information across PH systems
  - framework for further development
- Need common definitions, formal representation as ontology
  - prerequisite for interoperability among data sets

# Extra slide Vocabulary - Things sometimes called “Terminologies”

- Controlled vocabulary with identifiers (codes)
  - List of terms for some entities plus “codes” to identify them
    - Code - meaningless identifier independent of language
- Lexicon
  - The collection of linguistic entities - attached to a given controlled vocabulary, codes, or ontology
    - May include grammatical & other information; may be multilingual
- Classification (TAXONOMY)
  - An organization of entities into classes *for a specific purpose*, e.g. ICD and DRGs
- Thesaurus
  - A collection of entities/terms arranged for *human* navigation via broader-than/narrower-than and associative relations
- Ontology (sensu informatics)
  - A *logical* model of the *meanings of the* entities about which information is to be expressed for use in computers
- Knowledge Representation System
  - A *model* of the background knowledge assumed, expressed so as to be used in computer systems - including but not limited to the ontology