Ontology of a Cyberenvironment for Malaria Surveillance

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OBJECTIVE

This paper presents an ontology of a cyberenvironment [1] for malaria surveillance. The ontology encapsulates a comprehensive natural language enumeration of the requirements of the cyberenvironment using a structured terminology. It can be used to systematically analyze and prioritize the functions of the cyberenvironment. It will help the medical, individual, environmental, and strategic management of malaria.

BACKGROUND

Malaria control programs suffer from weak and fragmented surveillance of the wide range of information required to manage the disease effectively and efficiently [2]. A computational framework to manage, integrate, analyze, and visualize the data resources, a cyberenvironment, can improve the surveillance and the outcomes.

METHODS

The proposed ontology has been developed by parsing the concept of a cyberenvironment for malaria surveillance into four dimensions, each represented by a column in Figure 1 below. They are: (a) timing of the surveillance, (b) surveillance process, (c) information surveyed, and (d) malaria management. Each dimension is defined by a taxonomy derived from the literature. The categories in the four dimensions can be combined (with the conjunctive word/phrase between the columns) to form natural language statements of the cyberenvironment capability or requirement. Four illustrative capability statements are shown at the bottom of Figure 1. A total of 6*5*9*11=2970 such combinations are possible with the present ontology. They represent a closed description of the cyberenvironment for malaria management. Some meaningless or impractical combinations will have to be eliminated from consideration. One meaningless combination could be: Predictive collection of clinical management information for outcomes assessment. The dimensions and categories can be modified to provide a different perspective on the problem.

RESULTS

Consider the four illustrative capabilities below the ontology in Figure 1. Each may require a very different configuration of the cyberenvironment. By the same token, their impact on malaria management can vary. We can similarly analyze the other combinations to develop priorities for the cyberenvironment. Thus the ontology can be a structured tool for the design, development, and implementation of the cyberenvironment.

CONCLUSIONS

The ontology can be used to approach the design and development of a cyberenvironment with a logical, systematic, and transparent approach. It can also be generalized for surveillance of other diseases.

REFERENCES

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Timing	Surveillance		Information		Malaria Management
Ad hoc	Detection	[of]	Entomological	[information for]	Medical management
Post hoc	Collection		Parasitological		Treatment of active malaria cases
On-demand	Analysis		Socio-economic		Treatment of asymptomatic cases
Periodic	Interpretation		Clinical management		Prophylactic medication
Real-time	Application		Epidemiological		Personal protection
Predictive			Ecological		Use of insecticide treated bed nets
			Climate		Use of interior residential spraying
			Geographical		Use of insecticide treated clothing
			Financial		Mosquito (vector) control
					Mosquito source control
					Adult mosquito control
					Strategic management
					Resource allocation
					Education
					Outcomes assessment

Illustrative Cyberenvironment Capabilities

Ad hoc collection of entomological information for prophylactic medication.
On-demand interpretation of socio-economic information for resource allocation.
Periodic analysis of epidemiological information for mosquito source control.
Predictive application of climate information for use of interior residential spraying.

Figure 1: Ontology of a Cyberenvironment for Malaria Surveillance