**Appendix**

* Mathematical compartmental models

One of the simplest forms of these models divides the population into three groups (compartments): susceptible to the disease (S), infected by the disease (I) and recovered/removed from the diseased (R) (Figure 6(a)). The number of people in each compartment fluctuates as the disease dynamic changes. People move from one compartment to another at different rates: the transmission rate is β—the rate of transitioning from the susceptible compartment to the infected compartment; the recovery rate is γ. This SIR system can be expressed by a set of ordinary differential equations:

$$\frac{dS}{dt}=-\frac{βIS}{N};$$

$$\frac{dI}{dt}=\frac{βIS}{N}-γI;$$

$$\frac{dR}{dt}=γI$$

In this system, S, I, R represent the number of people in each compartment and is a function of time t. N represents the total number of people in the population and is equal to the sum of S, I and R. The basic reproductive number is defined as R0=β/γ. A typical model for TB includes compartments “susceptible (S)”, “latently infected (L)”, “infectious (I)” and “recovered (R)” (Figure 6(b)). The additional compartment would require more parameters in the model for the rates between compartments, hence more differential equations are needed.

**Glossary**

**Mycobacterium tuberculosis (Mtb)** – the bacterium that causes tuberculosis.

**Latent tuberculosis infection (LTBI)** – a state of persistent immune response to stimulation by Mycobacterium tuberculosis antigens without evidence of clinically manifested active TB.

**Generation interval/time**– the time between the infection of a case and the time of infection of its infector; usually unobservable.

**Serial interval/distribution** – the time between disease symptom onset of a case and that of its infector; usually observable; can serve as a surrogate for the generation interval under certain conditions.

**Incubation period/time** – the time between infection and developing active disease.

**Reproductive/reproduction number/rate/ratio/value** – the average number of secondary cases a primary infectious case will produce.

**Net reproductive number** – an interchangeable term for the reproductive number.

**Basic reproductive number** – reproductive number in a totally susceptible population where everyone is at risk of infection.

**Effective reproductive number** – reproductive number in a population with both susceptible and non-susceptible persons.

**De novo infection** – an event of a new, recent infection.

**Reactivation** – the event of latent bacteria becoming active to cause disease; can occur when the immune system becomes weakened.

**Reinfection** – the event of infection with a bacterial strain different from the original strain.

**Restriction fragment length polymorphism (RFLP)** – a technique that exploits variations in homologous DNA sequences.

**Multi-drug-resistant tuberculosis (MDR-TB)** – a form of tuberculosis (TB) infection caused by bacteria resistant to treatment with at least two of the most powerful medications, isoniazid and rifampin.

**Contact tracing** – the identification and diagnosis of people who may have come into contact with an infected person.