Example: Sensitivity, Specificity, PPV, NPV, and Bayes Theorem

The World Health Organization conducts surveys in countries to declare neonatal tetanus (NT) elimination[1]. To diagnose NT deaths in rural locations, women are interviewed using the oral autopsy method.

Notation:
D^+ - woman had a live infant who died of neonatal tetanus
D^- - woman had a live infant who did not die of NT
T^+ - the oral autopsy concluded that an NT death occurred
T^- - the oral autopsy concluded that an NT death did not occur

Using data from Kenya[2], the sensitivity of the oral autopsy method is 90%; the specificity was found to be 79%. Suppose 0.1% of the women surveyed had an infant die of neonatal tetanus.

a) What is the probability that the oral autopsy method declares a neonatal tetanus death when the woman had an infant die of neonatal tetanus?

b) What is the probability that the oral autopsy method does not declare a neonatal tetanus death when the woman did not have an infant die of neonatal tetanus? What is this value called?

For more information, see
[1] http://www.who.int/immunization_monitoring/diseases/MNTE_initiative/en/index.html
[2] Snow R, Armstrong J.R.M, Forster D. et al. Childhood deaths in Africa: Uses and limitations of verbal autopsies, *Lancet,* 1992,340:351-355.

c) What is the probability that a woman had an infant die of neonatal tetanus, given that the oral autopsy method declared a neonatal tetanus death? What is this value called?

d) What is the probability that a woman did not have an infant die of neonatal tetanus when the oral autopsy method does not declare a neonatal tetanus death? What is this value called?

e) What are the implications of parts (c) and (d) for the neonatal tetanus survey?