INTRODUCTION
Since 2003, Belgium obtained the official free status (<0.1% of infected herds) for bovine tuberculosis (bTB) by Commission Decision 2003/467/EC (EC, 2003; FASFC, 2010). EU Council Directive 64/432/CEE allows each MS which maintained the official free status for 5 consecutive years to review and adapt their national surveillance program (EEC, 1964).

In this context, a study has been carried out in order to evaluate different components of the current bTB surveillance program and to optimize this program. The main components of bTB surveillance are the following: i) slaughterhouse surveillance ii) testing at purchase surveillance iii) testing all imported animals surveillance and iv) tracing-on and tracing-back of outbreaks surveillance during the winter screening.

The main objective of this study was to propose an improved risk- and target-based surveillance for bTB in Belgium. To estimate the risk factors of bTB in Belgium, an extensive risk factor analysis was made in order to come up with empirical data to feed the model.

MATERIALS AND METHODS
Scenario tree design
Separate scenario trees were designed for each component of the surveillance program: i) slaughterhouse surveillance ii) testing at purchase surveillance iii) testing all imported animals surveillance and iv) tracing-on and tracing-back of outbreaks surveillance during the winter screening. Each scenario tree reassembled all steps from infection to detection. An expert opinion was carried out to estimate the main risk factors retained to be important in epidemiology of the disease in Belgium. Risk factors retained to be relevant were: geographic location, imports from countries at risk, bTB status of the past, movement rate, herd type, and herd size.

Parameter estimation
For each herd active in 2009, data regarding imports, purchases by national trade, herd structure and bTB status over the past 5 years (2005-2009) were collected from the Belgian animal identification system (SANITRACE). In total 158,810 herd records grouped all historical data from 2005 to 2009 for each of the 36,057 herds still active in 2009.
Separate univariate analysis, for each risk factor considered, enabled to partition the sampled and the whole population into categories according to a threshold value, which was the median value, above which the herd was considered at risk or not (SAS 9.2.).

For the estimation of the relative risk of each herd in the high risk category, a generalised linear mixed model was developed in SAS 9.2. to model the probability of a herd being bTB positive given the risk factor of interest. The low risk category was the reference value and fitted with a uniform distribution of 1. For the high risk category, a pert distribution (mean, minimum, maximum value) was fitted around the average value of the relative risk estimates obtained from the risk factor analysis. Literature review and bTB expert opinion were used to estimate the different diagnostic test sensitivities (Cousin and Florisson, 2005).
Model
All these parameter estimates were fitted into the scenario tree model. For each herd risk group, defined by each possible combination of risk factor, an effective probability of infection was obtained, followed by an infected probability of detection according to the methods described by martin et al. (2007). The combination of each effective probability of detection enabled to obtain the component sensitivities. Different stochastic simulations were carried out to measure the impact of modifications in one surveillance component relative to the other ones and also to determine the most optimal diagnostic test to be applied in each component. Simulations were carried out in ModelRisk 3.0. with 10000 iterations per simulation.

Sensitivity analysis
A sensitivity analysis was carried out for this scenario tree model to determine what input parameter was most influential on the output parameters component system sensitivity. In order to validate the output, a generalized estimating equation model was built in parallel to investigate the probability to detect a single positive animal given the component which enabled the detection of the case. For this purpose historical data regarding the detected bTB outbreaks during 2005-2009 were used (SAS 9.2).

RESULTS
The median (50% percentile) of the component sensitivities across 10,000 iterations was 0.83, 0.85, 0.99, 0.99 respectively for i) tracing-on and tracing-back of outbreaks surveillance during the winter screening ii) testing only imported cattle iii) testing only purchased cattle and iv) testing only all slaughtered cattle.

The sensitivity analysis showed that the most influential input parameter explaining the variability around the output came from the uncertainty distribution around the sensitivity of the diagnostic tests used within the bTB surveillance. Providing all animals are inspected and post mortem inspection is highly sensitive, slaughterhouse surveillance was the most effective surveillance component. If these conditions were not met the uncertainty around the mean sensitivity of this component was important. Purchase was not such an efficient component for detecting bTB in Belgium, when correct values, reflecting the Belgian situation, for the intra dermal skin test were used. Using an antibody ELISA at purchase and an interferon gamma test during winter screening and at import would increase greatly the sensitivity and the confidence level in Belgium’s freedom from bTB infection status. Targeting the surveillance on imported cattle would not provide sufficient level of guarantee of our freedom status. To date, since Belgium has obtained the official free status, the few positive cases detected were never related to imports.

DISCUSSION
In the past, scenario trees have proved to be useful tools to enable the quantification of sensitivity of such a targeted surveillance and guarantee a certain level of confidence (More et al., 2009; Welby et al., in press), providing that proper estimates of the main epidemiological parameters are available (Dohoo, 2009), such as for instance the risk factors. In other cases one might need to rely on assumptions which might bring bias to the results of such studies. Making use of the bTB surveillance data and population data over the last 5 years has enabled to come up with objective inputs regarding the current surveillance of bTB in Belgium. This study confirmed the current perception and revealed that more time and money should be allocated to certain populations at risk as well as certain components of the surveillance program.

Results of such models provide alternatives to policy makers to optimize the surveillance program, depending on the efficiency of detection, field work, and financial resources, such as required by the international standards.
REFERENCES