ABSTRACT DISCREPANCY PRINCIPLE FOR THE ANALYSIS OF EPIDEMIOLOGY MODELS

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A new research on generalized discrepancy principle (DP) for linear ill-posed problems will be presented. The study has been motivated by a practically important parameter identification problem in avian influenza. Mild and unhazardous among wild birds, this virus has mutated to a highly pathogenic strain (HPAI) once transmitted to domestic poultry. The death rate for domestic birds from HPAI of subtype H5N1 reaches 90-100% within 48 hours. This coupled with nearly 60% in human mortality (384 deaths out of 648 reported cases as of December 2013) is the driving force for the investigation of HPAI models. Presently the virus is in a zoonotic state, but the cross-species infection creates the opportunity for an antigenic shift and the emergence as a human-to-human transmission pathogen.

One of the major challenges in the study of HPAI is to estimate the transmission rate accurately. In our analysis, a time dependent transmission rate is reconstructed by solving the underlying inverse problem given monthly data for human and poultry outbreaks. In solving this particular inverse problem, it turns out to be beneficial to apply a combination of regularization strategies, each requiring a reliable parameter selection scheme. In a large number of papers, various implementations of the DP are presented. In these papers, DP-style methods have been justified for special types of regularizers. However, our numerical simulations for the above problem indicate that applicability of the DP depends on the noise alone, while the structure of a particular regularizing operator is not relevant. Based on this observation, we formulate and justify what we call *the abstract discrepancy principle* that provides a unified approach to the implementation of the DP for an arbitrary family of regularizing strategies. In that respect, the new algorithm generalizes all prior results on the DP principle for linear irregular operator equations with noisy data.