**Supplementary 1**

**S1. Statistical analysis details.**

**S1.1 Comparison of log10 mean bacterial concentration**

The log10 mean bacterial concentration for both *E. coli* and *Enterococcus* spp. was assessed according to

(1)

where is the concentration of *E. coli* or *Enterococcus* spp. (log10 cfu/g) at the *i*-th timefor the piglet *j* from the sow *k*. The fixed effects component are: ,is the log10 *E. coli* or *Enterococcus* spp. (log10 cfu/g) for the *i*-th sow; is a vector associated with the group level of the *j*-th piglet; and is a vector associated with the *i*-th time point observation for the *j-*th piglet and sow *k*. Coefficients for the fixed effects are: is a common intercept associated with the time=10 and group=G1, is the coefficient associated with the sow’s log10 cfu/g; is a vector of coefficients associated with the group level, is a vector of coefficients associated with the time point observationandis a vector of coefficients for the interaction between time and group. is the random effect of the *k*-th sow, and is the random effect of the *j*-th piglet nested within the *k*-th sow, and is the residual error, where .

**S1.2. Comparison of the frequency of antimicrobial resistance (AMR)**

For each bacteria (*E. coli* or *Enterococcus* spp.) the logodds of AMR () for the *i*-th phase, *j*-th piglet and *k*-th sow was assessed according to

(2)

where the fixed components are: is a vector associated to the group level of the *j*-th piglet; and is a variable associated with the *i*-th step for the *j-*th piglet and sow *k*. Coefficients for the fixed effects are: is a common intercept associated with the step=growing/finishing and group=G1; is a vector of coefficients associated with the group level, is a coefficient associated with the phaseandis a vector of coefficients for the interaction between phase and group. is the random effect of the *k*-th sow, and is the random effect of the *j*-th piglet nested within the *k*-th sow, and is the residual error, where , .

**S1.3 Effect of antimicrobial use on frequency of multi-drug resistance (MDR) and frequency of full susceptibility**

The logodds for MDR or full-susceptibility for the *i*-th phase, *j*-th piglet and *k*-th sow was modeled as

(3)

Where the fixed effects are: is the antimicrobial dose (mg/pig) for the *i*-th phase, *j*-th piglet and *k*-th sow, and is the phase (nursery of growing/finishing); is the intercept, is coefficient associated with the phase, and is the coefficient associated with the antimicrobial dose. is the random effect of the *k*-th sow, and is the random effect of the *j*-th piglet nested within the *k*-th sow, and is the residual error, where , .

**S1.4 Effect of colistin on the minimum inhibition concentration**

The logodds for bacterial growth inhibition for the *i*-th phase, *j*-th piglet and *k*-th sow ) was assessed according to

(4)

were the fixed effects are: is the colistin concentration (µg mL-1) for the *i*-th phase, *j*-th piglet and *k*-th sow. is a vector of the group for the *j*-th piglet, and is the variable for the phase (nursery or growing/finishing). is the intercept, is a vector of coefficients associated with the group, is the coefficient associated with the phase, and is the coefficient associated with the colistin concertation. is the random effect of the *k*-th sow, and is the random effect of the *j*-th piglet nested within the *k*-th sow, and is the residual error, where , .

Then, the minimum inhibitory concentration (MIC) of colistin for 50% and 90% of the tested strains (MIC50, and MIC90) was assessed by

(5)

were ,..., are the coefficients adjusted in the logistic regressions in (4), and *%* is 0.5 for MIC50

and 0.9 for MIC90. The marginal MIC90 assessed (per group and phase) is now an independent and identical distributed variable, and it was used as the outcome in linear regression (MIC90 vs. number of days of colistin use in each group and phase)