Supplementary Table 1. Possible failure conditions and the corresponding solutions

	Failure conditions	Descriptions	Solutions
1	There is almost no liquid in the gut tract while sampling	Unable to sample	The pictures taken by the capsule can be used to monitor the gut tract. Sampling is not carried out until a certain amount of liquid is found
2	There is not enough liquid in the gut tract during sampling	Large amounts of gas may be collected	With the pictures taken by the capsule and an external magnetic control system, operator can adjust the attitude of the capsule making sure that the sampling ports are facing the liquid. Furthermore, with the attitude information obtained by the capsule's accelerate sensor, operator could make sure that the direction of the sampling ports is almost identical with gravitational acceleration, so that the sampling ports are immersed in the liquid. Then, keeping capsule's attitude with external magnetic control system during sampling
3	The sampling ports are clogged by food residue	Unable to sample	There is an anti-clogging ring inside the sampling ports, which can filter the chunks of food and other particles
4	The sampling ports are clogged by mucosa	Unable to sample	There are multiple (3) sampling ports along the capsule's cylindrical surface, and the liquid flow rate is so fast after the sampling starts that the probability of all sampling ports being clogged is considerably low
5	Insufficient vacuum in sampling chamber	Insufficient samples collected	After the capsule is activated, the real time pressure in the sampling chamber is monitored by a pressure sensor.

			Before the capsule is swallowed, the operator could check the pressure value in the sampling chamber to make sure that the capsule is capable of sampling.
6	Failure during sampling delay time	There are about 40 seconds between the receiving of sampling instruction and the beginning of sampling, which is called the sampling delay time. During this time, there is no video transmission. Large displacement or attitude change of the capsule may lead to the failure of the sampling	We are upgrading the capsule system now, and the sampling delay time may be reduced to less than 15 seconds.

Supplementary Table 2. A distance-based coefficient of determination R^2 [unweighted UniFrac and weighted UniFrac] was used to quantify the percentage of microbiota variability in different models (control group and antibiotic group), different regions (jejunum and ileum) and different methods (surgery and MSCE)

	Unweighted Unifrac		Weighted Unifrac	
	R^2	p	R^2	p
Model	0·157	0·001	0·139	0·009
Region	0·147	0·001	0·079	0·085
Method	0·023	0·695	0·014	0·711

Supplementary Table 3. Evaluation of technical reproducibility. P value between surgery and MSCE for microbiome metrics, including the abundance of four phyla, two alpha-diversity metrics (Chao1 and Shannon index), and three beta-diversity metrics (weighted PCoA1, weighted PCoA2 and weighted PCoA3)

t-text	Surgery vs. MSCE (p)			
Item	Con-J	Con-I	Anti-J	Anti-I
Actinobacteria	0·5715	0·4149	0·1323	0·358
Bacteroidetes	0·1437	0·4016	0·1534	0·3918
Firmicutes	0·1499	0·4828	0·1466	0·3563
Proteobacteria	0·1645	0·6025	0·1565	0·3579
Chao1	0·347	0·5282	0·3745	0·4989
Shannon	0·203	0·5374	0·1707	0·3902
Weighted PCoA1	0·6013	0·4752	0·3166	0·4257
Weighted PCoA2	0·7259	0·4844	0·443	0·4057
Weighted PCoA3	0·34	0·4533	0·1785	0·7928