Introduction:
- Enteral nutrition (EN) is required by many critically ill patients
- While nutrition formula provision is generally automated, water flushing is mostly manual
- Hospital staff follow rigid and time consuming manual flushing schedules to help prevent:
  - Feeding tube clogging (TC)
  - Patient dehydration
- Feed and flush technology (FFT) (Figure 1) automates both feeding and water flushing. It may help to reduce TC, dehydration, and hospital staff time
- While studies of FFT support a reduction in TC, dehydration9 and hospital staff workload, the economic impact remains largely unaddressed
- This study AIMS to fill this information gap by investigating the expected costs of a full transition to FFT in the French, German, Italian and US settings through dedicated budget impact models

Figure 1
Feed and flush pump & feeding bags

Methods:
- A structured literature review of EMBASE and PubMed was performed to identify relevant cost and outcome data for EN
- A cohort Markov model was developed (following good practice guidelines8), which started in critical care as either malnourished or healthy (Figure 2)
- Major efficacy endpoints:
  - Malnutrition
  - Dehydration
- Care quality endpoints:
  - Length of stay
  - Days on enteral nutrition
  - Readmissions to hospital
  - Acute kidney injury (AKI)
- The major safety endpoint was tube clogging. As it implies higher risk of dehydration or malnutrition and entails a cost of either removing the obstruction or replacing the tube
- In the model every 3 days 100 patients were assessed over a duration of 1 year
- The model was adapted to different settings by using local incidence and cost data (Table 1)
- Probabilistic sensitivity analysis (PSA) was utilized to determine the significance (95% level) of results over 500 evaluations

Table 1 Key local costs

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Results:
- The structured literature review revealed a plethora of data on malnutrition
- Dehydration data, on the other hand, were scarce
- Utilizing the data identified, the model revealed that a transition to FFT for EN would potentially be cost saving in France, Italy, Germany and the US (Table 2)

Conclusions:
- Feed and flush technology likely has advantages for patient safety and resource usage
- Cost savings were found in all settings, with significant advantages for France, Germany and the US
- Patient benefits of reduced tube clogging and readmission rates, as well as reduced burden on hospital staff, likely makes the transition to feed and flush technology desirable
- To estimate the full potential of automated water flushing more data on dehydration and its consequences is required

Figure 2 Markov model flow

Figure 4 Readmissions per 100 patient-years on HEN

Figure 5 Cost drivers

Disclosure of Interest:
R. Torrejon Torres Consultant for: Cardinal Health and other medical device manufacturers. Other: Employee of Coreva Scientific. W. Nadeau Other: Emperior of Cardinal Health, the sponsor of the study. R. Saunders Consultant for: Cardinal Health and other medical device manufacturers. Other: Owner of Coreva Scientific, which received consultation fees from Cardinal Health

Reference:
1. National, B. et al. (2017)
2. Condurulli, A. et al. EJNMMI (2016)
5. Gershengorn, B. et al. JAMA (2015)