

#### **3D printing: the perfect tool for personalized medicine**



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# Why 3D printing: Personalized pharmacotherapy

#### organ function



#### drug use





#### drug levels

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M



#### co-morbidity







#### drug interactions

# Why 3D printing?



Polypil

#### **Drug development and research (phase 1)**





Is Your Senior Loved One Taking Too Many Medications? -Bayshore HealthCare







# Techniques



Fused deposition modelling



**Binder jetting** 



#### Semi-solid extrusion



#### **Target populations: poly pharmacy**

- Poly-pill: current disadvantages:
  - Fixed combinations, inflexible



- 3D printed polypill:
  - Each individual dose can be adapted to the patient needs

Khaled SA, Burley JC, Alexander MR, Yang J, Roberts CJ. 3D printing of five-in-one dose combination polypill with defined immediate and sustained release profiles. J Control Release. 2015 Nov 10;217:308-14

Siyawamwaya M, du Toit LC, Kumar P, Choonara YE, Kondiah P, Pillay V. 3D printed, controlled release, tritherapeutic tablet matrix for advanced anti-HIV-1 drug delivery. European journal of pharmaceutics and biopharmaceutics : official journal of Arbeitsgemeinschaft fur Pharmazeutische Verfahrenstechnik eV. 2018

#### **Target population: children**





Available medication with market authorisation:

- Too big
- Wrong dosage

Liquid formulations (solutions or suspensions):

- Taste
- Excipients

Children prefer mini tablets<sup>1</sup>



<sup>1</sup>Van Riet-Nales DA, de Neef BJ, Schobben AFAM, Ferreira J, Egberts TCG, Rademaker CMA. Acceptability of different oral formulations in infants and preschool children. Arch Dis Child 2013 Sep;98(9):725-731

# **Current application in our hospital (LUMC)**



#### Semi-solid extrusion @ LUMC





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#### 2022: from prototype to commercial 3D medication printer



#### Products that can currently be printed



- Furosemide (2 mg; 10 mg)
- Sildenafil (4 mg; 7 mg; 10 mg)
- Pediatric use:
- Current formulations:
  - Liquid
  - Fixed high dose



# **3D printed tablets as good as commercial tablets? Research: Quality Control**



# **3D printed tablets as good as commercial tablets? Research: Quality Control**



'A randomized, open-label, single dose two-way cross-over pharmacokinetic study of 3D-printed sildenafil tablets compared to the originator sildenafil tablets in healthy adults'



## Next target population: Pharmacogenetics and 3D printing



## Future?

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dosermedical.com



# InnoGenerics



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