

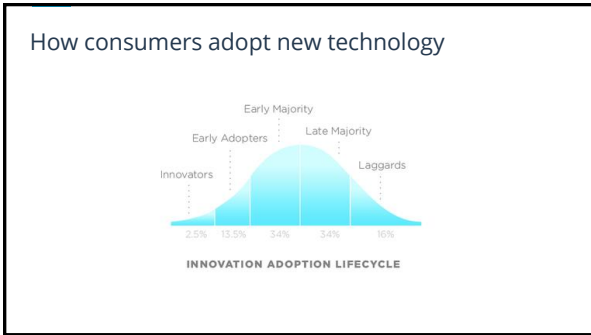
# The Future of Pharmacy

How to use new technology and advancements in existing technology to grow and succeed in the 21st century of healthcare

1

### Technology advancements in our lifetimes

2



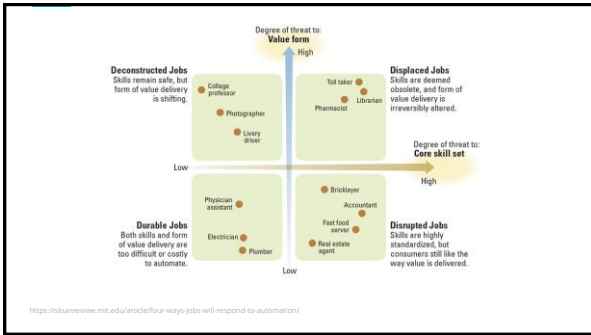
3

### Past impacts of technology on pharmacy

Then:

Today: **93%** of orders are auto-replenished through automated algorithms


4



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# The Future of Pharmacy

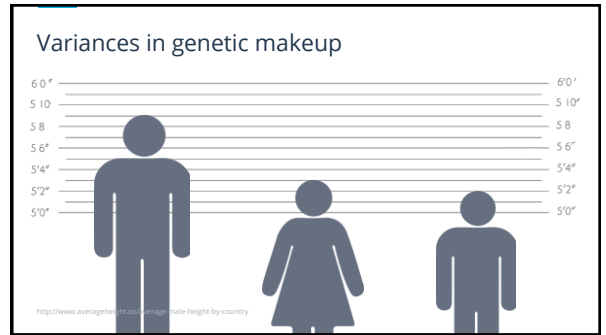
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## Pharmacogenomics

- The Need
- The History
- How it Works
- Regulatory Concerns
- Current Applications


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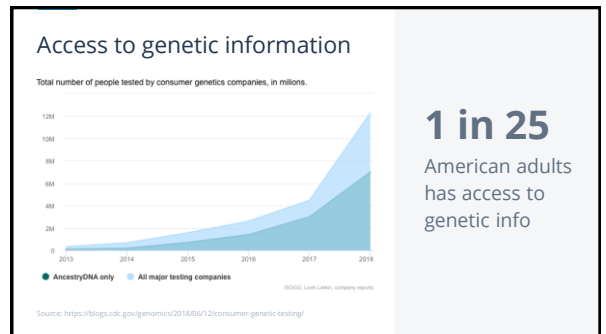
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### Pharmacogenomics historical timeline

- 510 BC Genetic differences first noticed by Pythagoras
- 1990 Start of Human Genome Project
- 2005 First pharmacogenetic testing for CYP2D6 and CYP2C19




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### Implications of codeine metabolizers



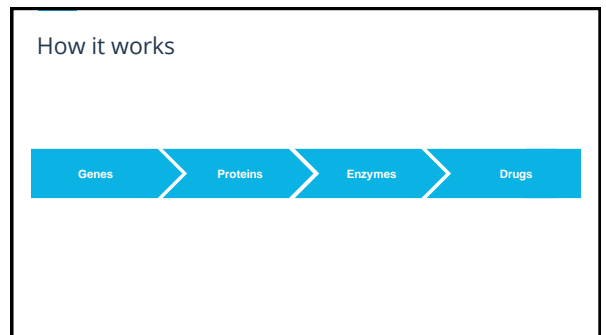
1 in 10 patients is not a normal metabolizer of Codeine

**1-2%**  
Ultrarapid metabolizer

**5-10%**  
Poor metabolizer

Source: <https://www.ncbi.nlm.nih.gov/books/NBK100662/>

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# 3D Drug Printing

- The Need
- The History
- How it Works
- Regulatory Concerns
- Current Applications

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## Need for better control and customization

**15%**  
Variation in drug dosage from the label claim considered to meet uniformity requirements

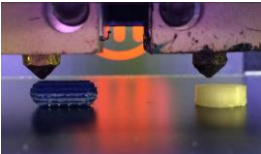


Source: [http://www.pharmacopela.cn/v252403ugg29v246d\\_095.html](http://www.pharmacopela.cn/v252403ugg29v246d_095.html)

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## 3D drug printing historical timeline

- 1981 3D printing first used to fabricate 3D plastic models
- 2014 FabRx was founded by two professors
- 2015 Spritam (levetiracetam): the first 3D printed FDA approved drug



Source: <http://medicalfuturist.com/future-3d-printing-drugs-pharmacies-closer-think/>

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## First 3D printed FDA approved drug



Spritam (Levetiracetam)

Source: <https://www.forbes.com/sites/jenniforhicks/2016/03/22/3d-printed-drug-available-in-the-us/#1d52bba666b>

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## Regulatory Concerns

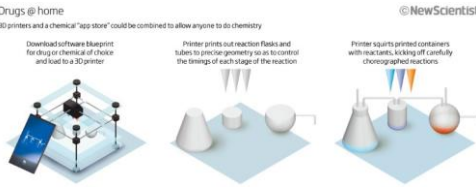
Drugs @ home

3D printers and a chemical "app store" could be combined to allow anyone to do chemistry

Download software blueprint for drug or chemical of choice and load to a 3D printer

Printer prints out reaction flasks and tubes to precise geometry so as to control the timing of each stage of the reaction

Printer squirts printed containers with reagents, kicking off carefully choreographed reactions

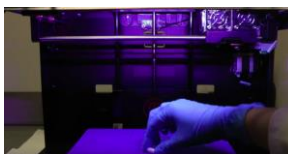


©NewScientist

Source: <https://www.scribd.com/doc/91487578/New-Scientist-21-April-2012>

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## 3D drug printing process



3D printing of Theophylline tablet

7x speed

Source: <http://medicalfuturist.com/future-3d-printing-drugs-pharmacies-closer-think/>

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## Tablet Recognition

- The Need
- The History
- How it Works
- Regulatory Concerns
- Current Applications

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### Pill identification calls to poison control

2016	137,880 calls
2015	195,955 calls
2014	287,038 calls
2013	408,711 calls
2012	558,117 calls



9 out of 10 patients 65+ can be prone to misidentifying

Source: <https://www.sandfonline.com/doi/abs/10.1080/15563650902754877?journalCode=icr120>

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### Tablet recognition historical timeline

- 1920s Supreme court ruled on Coco-Quinine
- 1950s Ruling on Pepto Bismol. Pink color provided therapeutic value and not protected under trade dress

**3,800+**  
Prescription products

**29,000+**  
Unique NDCs

Source: Ballimage


21

### Currently limited to Arizona, Idaho and Texas



22


### Companies automate pill counting and identification



Source: Cardinal Health Image Library

23

### How it works



24



## Personal Medication Assistant

- The Need
- The History
- How it Works
- Regulatory Concerns
- Current Applications

25

## Need for medication management

### 75 million

people using 3 or more drugs

### 38.6 million


people using 5 or more drugs

Source: <https://www.fda.gov/oc/ohrt/ohrt-report-2014-2015>

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## Personal medication assistant history

- 2014 Idea for Pillo
- 2017 First shipment of Pillo product to consumers
- 2017 InPower



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## More than just a pill organizer



Source: pillio.com

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## Protecting patient information



Source: Cardinal Health Image Library

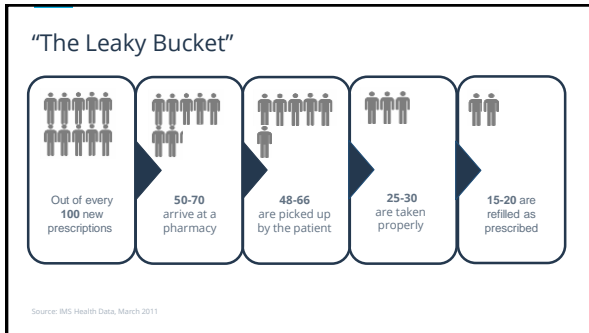
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## Drone Delivery

- The Need
- The History
- How it Works
- Regulatory Concerns
- Current Applications

30



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### Drone delivery historical timeline

- 2013 Drone delivered textbooks in Australia
- 2015 Three shipments of medical supplies in Virginia
- 2016 Medical supplies delivered from land to ship off the coast of New Jersey

Domino's pizza delivered in New Zealand

Source: <https://www.marketwatch.com/story/the-heavy-on-hype-light-on-substance-world-of-drone-delivery-2016-12-01>

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### First prescription delivery by drone

First Prescription Delivery by Aerial Drone

She removed her prescription and signed the delivery receipt

Source: <https://www.youtube.com/watch?v=9E8Ma4K03M>

33

### Taylor v FAA

SHOULD IT BE LEGAL TO SHOOT DOWN DRONES? Residents upset over government surveillance

Source: [https://www.youtube.com/watch?v=0Z5gTCL\\_n0](https://www.youtube.com/watch?v=0Z5gTCL_n0)

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### Drone delivery trials

Morning-after pill in Kent, England

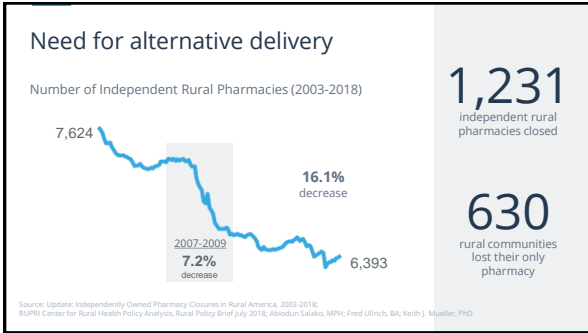
QuiQui of \$1, 24 hour delivery

35

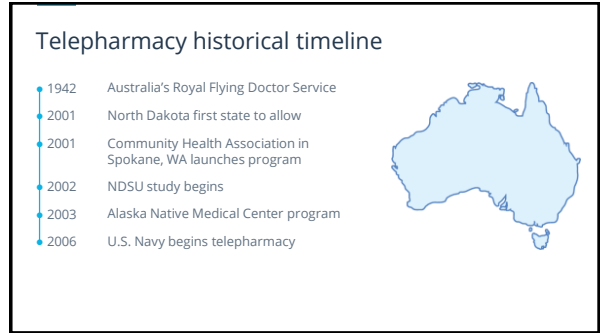
### Telepharmacy

- The Need
- The History
- How it Works
- Regulatory Concerns
- Current Applications

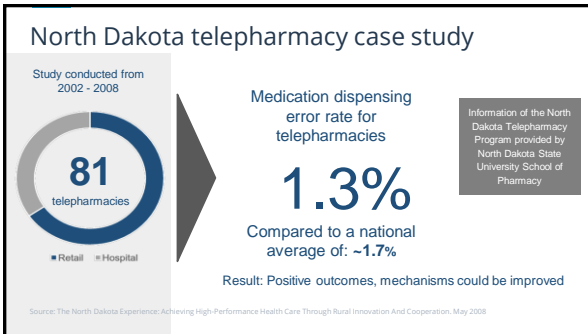
36



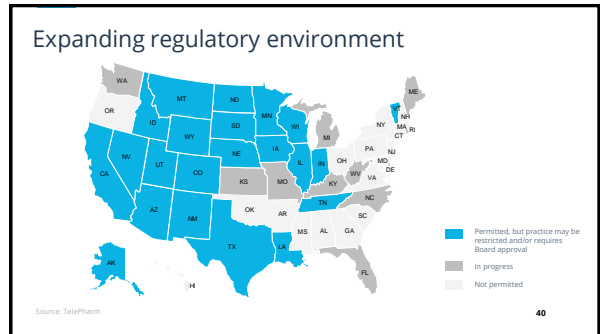
37



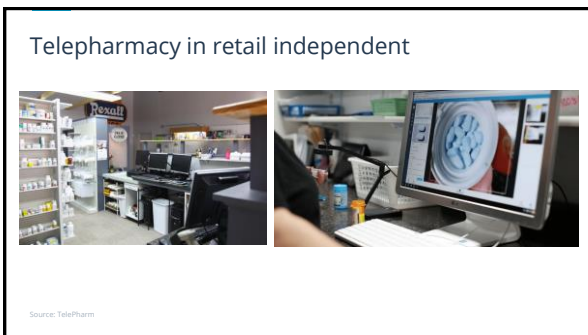
38



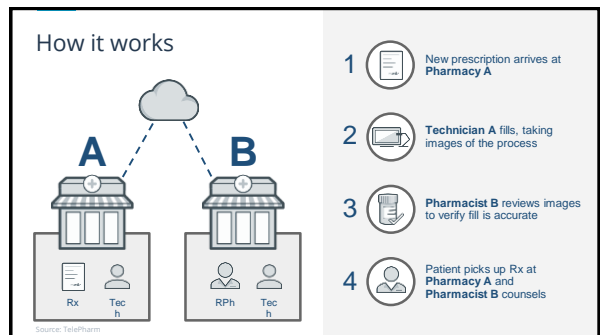
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**Medical Marijuana**

- The Need
- The History
- How it Works
- Regulatory Concerns
- Current Applications

43

**Need for pharmacist prescribing**

**2,254,782**  
Est. legal medical marijuana patients in 30 approved states

**States with Pharmacist dispensing**

State	Number of Patients
MN	6,384 patients
CT	23,960 patients
NY	43,975 patients

<https://www.mpp.org/issues/medical-marijuana/state-by-state-medical-marijuana-laws/medical-marijuana-patient-numbers/>

44

**Drug interactions with marijuana**

<b>93 Million</b> Annual Atorvastatin Rx	
<b>21 Million</b> Annual Clopidogrel Rx	

45

**Medical marijuana historical timeline**

- 1970 Controlled substances act - "No accepted medical use"
- 1996 California is the first state to legalize the use of medical Marijuana
- 2018 Currently 30 states have legalized the use of medical marijuana

[https://medicalmarijuana.procon.org/view\\_resource.php?resourceID=000881](https://medicalmarijuana.procon.org/view_resource.php?resourceID=000881)

46

**Legality concerns**

47

**Pharmacist prescribing in CT, MN, NY**

<https://www.pharmacist.com/article/pharmacists-take-medical-cannabis-dispensing-role-three-states>

48




**Rx**  
**Prescribing Authority**

- The Need
- The History
- How it Works
- Regulatory Concerns
- Current Applications

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**Illinois case study**

- 12,500 + RPh licensed in Illinois
- Residents lack access to pharmacist-provided services
  - Chronic disease management
  - Drug therapy management
  - Preventative screenings



Source: [http://www.ipha.org/assets/docs/AM17Presentations/gerrit%20reynoldsbillioe%20pharmacy%20law%20law%20update%2020170826.pdf](http://www.ipha.org/assets/docs/AM17Presentations/gerrit%20reynoldsbillioe%20pharmacy%20law%20update%2020170826.pdf)

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**Prescribing authority historical timeline**

**United States**

- 1960s Clinical pharmacy in ambulatory setting
- 1980s RPhs in federally funded primary care
- 2000s MTM
- 2009 37 states have language authorizing collaborative practice agreements
- 2018 Idaho

**Canada**

- Rph authority now involves selected medications from formularies
- No national initiative, left to provinces

51

**Regulations vary by state**




Source: Cardinal Health Image Library

52

**MTM impacts in Ohio**

**900,000**  
 Medicaid-eligible patients



<https://www.djgstorenews.com/article/pharmacys-battle-provider-status-reaches-erosion-to-state-federal-level/>

53

**How it works**

**Collaborative Prescribing** → **Independent Prescribing**

- Dependent (CPAs)
- Patient specific (most restrictive)
- Population specific

- Statewide protocol
- Unrestrictive


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\$  
Reimbursement of Services

- The Need
- The History
- How it Works
- Regulatory Concerns
- Current Applications


55

Costs of non-adherence



**\$290 billion**

Annually in mostly avoidable costs to treat adverse events from inappropriate medication use



**\$100 billion**


Medication non-adherence alone results in each year in excess hospitalizations.

<http://www.pharmacists.com/provider-status-what-pharmacists-need-know-now>

56


Reimbursement historical timeline

- 1980 Pharmacists in federally funded centers are recognized as providers
- 1997 Nurse practitioners and Physician Assistants obtain provider status through the balanced budget act of 1997



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Federal recognition of provider status



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Current application


CLIA Waived Test  
Albertsons in Idaho



Source: Cardinal Health Image Library


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Point of care testing



Source: Cardinal Health Image Library

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## Tech-check-tech

- The Need
- The History
- How it Works
- Regulatory Concerns
- Current Applications

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## RPh and technicians to practice at top of license

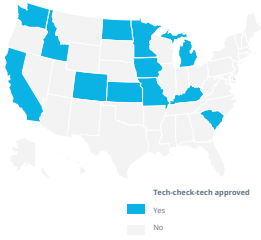


Source: Cardinal Health Image Library

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## Tech-check-tech historical timeline

- TCT was initially implemented for rural hospitals that could not afford pharmacists
- Now TCT has now been approved in 12 states



Tech-check-tech approved

- Yes
- No


Source: TelePharm

63

## Safety of tech-check-tech

**99.45% vs 99.73%**

Tech Accuracy same as pharmacist



Source: Frost, T, Adams, A. Tech-Check-Tech in Community Pharmacy Practice Settings. Journal of Pharmacy Technology, Vol 33, Issue 2, pp. 47 - 52. Published April 1, 2017. Accessed Jun 15, 2018. Doi: doi.org/10.1177/0895322316685519

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## Iowa tech-check-tech pilot study



[https://www.pharmacytoday.org/article/S1042-0991\(16\)31640-1/fulltext](https://www.pharmacytoday.org/article/S1042-0991(16)31640-1/fulltext)

65

## How it works



Source: Cardinal Health Image Library

66




## Technician Immunizations

- The Need
- The History
- How it Works
- Regulatory Concerns
- Current Applications

67

## RPh limited in time for clinical services

**Only 40.3%**  
of pharmacist's time is spent on value-added tasks (Clinical and patient interactions)



Source: <https://www.nabi.nlm.nih.gov/pmc/articles/PMC5043635/>

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## Tech immunizations historical timeline

- 2009 All 50 states allow pharmacist to immunize (varies by state)
- 2017 Idaho is the first state to approve technicians giving immunizations
- 2017 Washington State University develops first accredited training program for technicians



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## Proper training ensures safety




**953 vaccinations**  
administered by techs with no adverse events  
(Idaho: Dec 2016 - May 2017)

Source: <https://www.pharmacytimes.com/contributor/karen-berger/2018/03/vaccines-administered-by-certified-pharmacy-technicians-in-idaho>

70

## ID & RI are the only states to allow tech immunizations



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## Summary

- How can your pharmacy benefit from some of the current changes in technology to increase your bottom line and stay competitive?
- What are some changes your pharmacy business can make to implement new technologies that excite you?
- How can you be a thought leader, influencing the direction and form the way pharmacies provide services?

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## CE Question #1

What year was the first time a pharmacogenomic variance between humans was recorded?

- A.) 510 BC
- B.) 0
- C.) 1776
- D.) 1979

73

## CE Question #2

Artificial Intelligence exists that can recognize a tablet based on its shape and imprint through camera image recognition.

- A.) True
- B.) False
- C.) Answering this question is a slippery slope
- D.) I can neither confirm nor deny this

74

## CE Question #3

According to IMS, what percentage of patients never pick up their prescriptions?

- A.) 50-70
- B.) 30-50
- C.) 10-30
- D.) Trick Question. All patients pick up their medications and take them exactly as prescribed.

75

## CE Question #4

Which of the following are ways to increase pharmacist presence?

- A.) Telepharmacy in warfarin clinics
- B.) Telepharmacy to allow HIV medications at discharge
- C.) Telepharmacy to allow overnight coverage at rural hospitals/clinics

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## CE Question #5

According to the NIH, what percentage of a pharmacist's time is spent doing non-clinical tasks?

- A.) 20%
- B.) 40%
- C.) 60%
- D.) 80%

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## CE Question #6

In which state does a pharmacist have independent prescriptive authority?

- A.) Iowa
- B.) Ohio
- C.) Idaho
- D.) Idawahio

78

## CE Question #7

How many patients 65+ can be prone to misidentifying medications?

- A.) 1 out of 10
- B.) 5 out of 10
- C.) 9 out of 10
- D.) 10 out of 10

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## CE Question #8

True/False: 3D drug printing allows for more accurate dosage.

- A.) True
- B.) False

80

## CE Question #9

In what year did the Navy begin using telepharmacy?

- A.) 2006
- B.) 2016
- C.) 2012
- D.) 1998

81

## CE Question #10

According to the NDSU study, what is the medication error dispensing rate for telepharmacies?

*(Hint: the national average is 1.7%)*

- A.) 3%
- B.) 6%
- C.) 2%
- D.) 1.3%

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Thank you

Adam Chesler  
adam.chesler@cardinalhealth.com

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APPENDIX

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